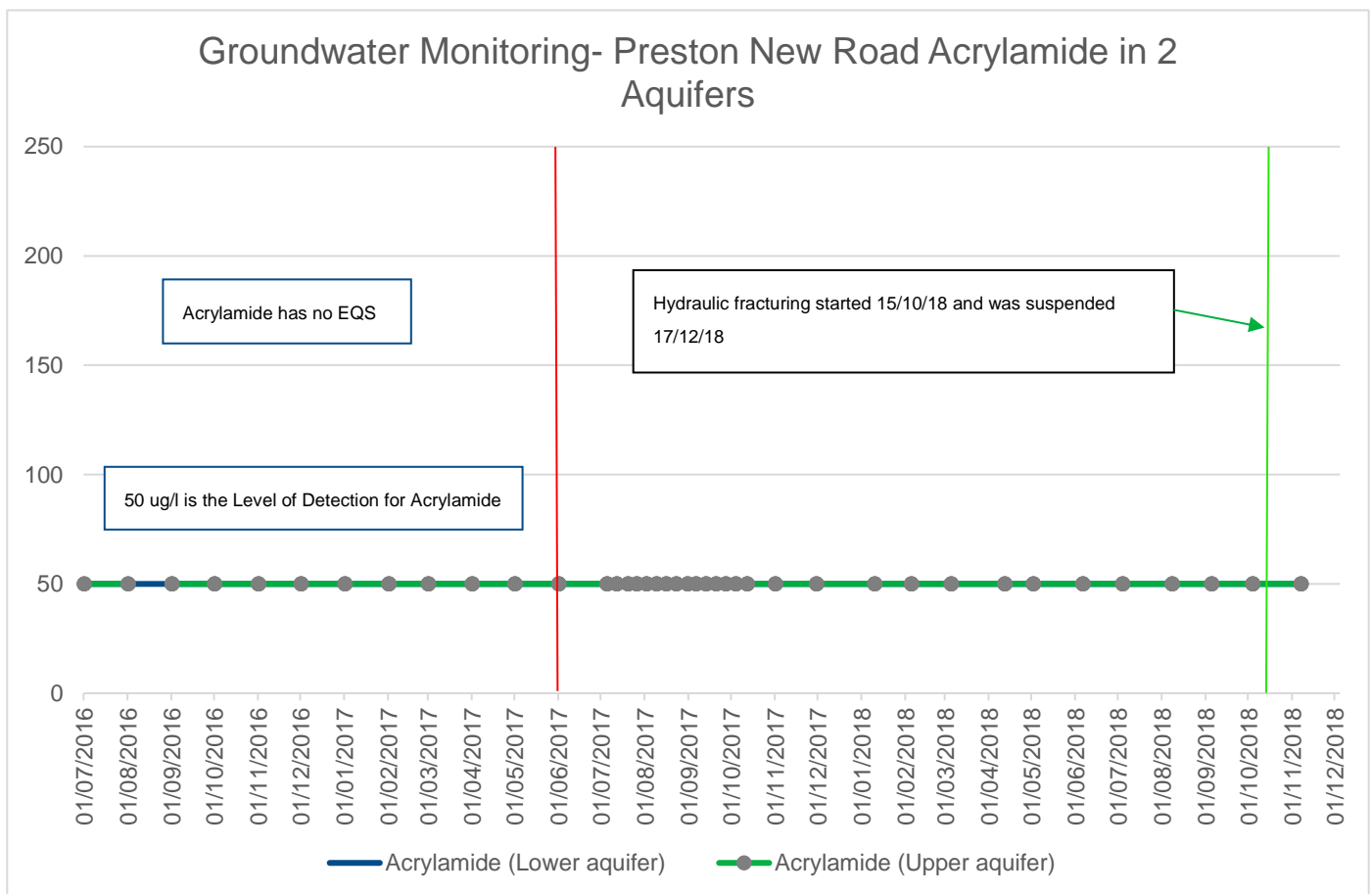


# Preston New Road Groundwater Monitoring Data Q4 2018

The following report includes Cuadrilla's quarterly groundwater monitoring data for Q4 2018 (October - December 2018).

## Acrylamide



Groundwater Monitoring Preston New Road Acrylamide in 2 aquifers

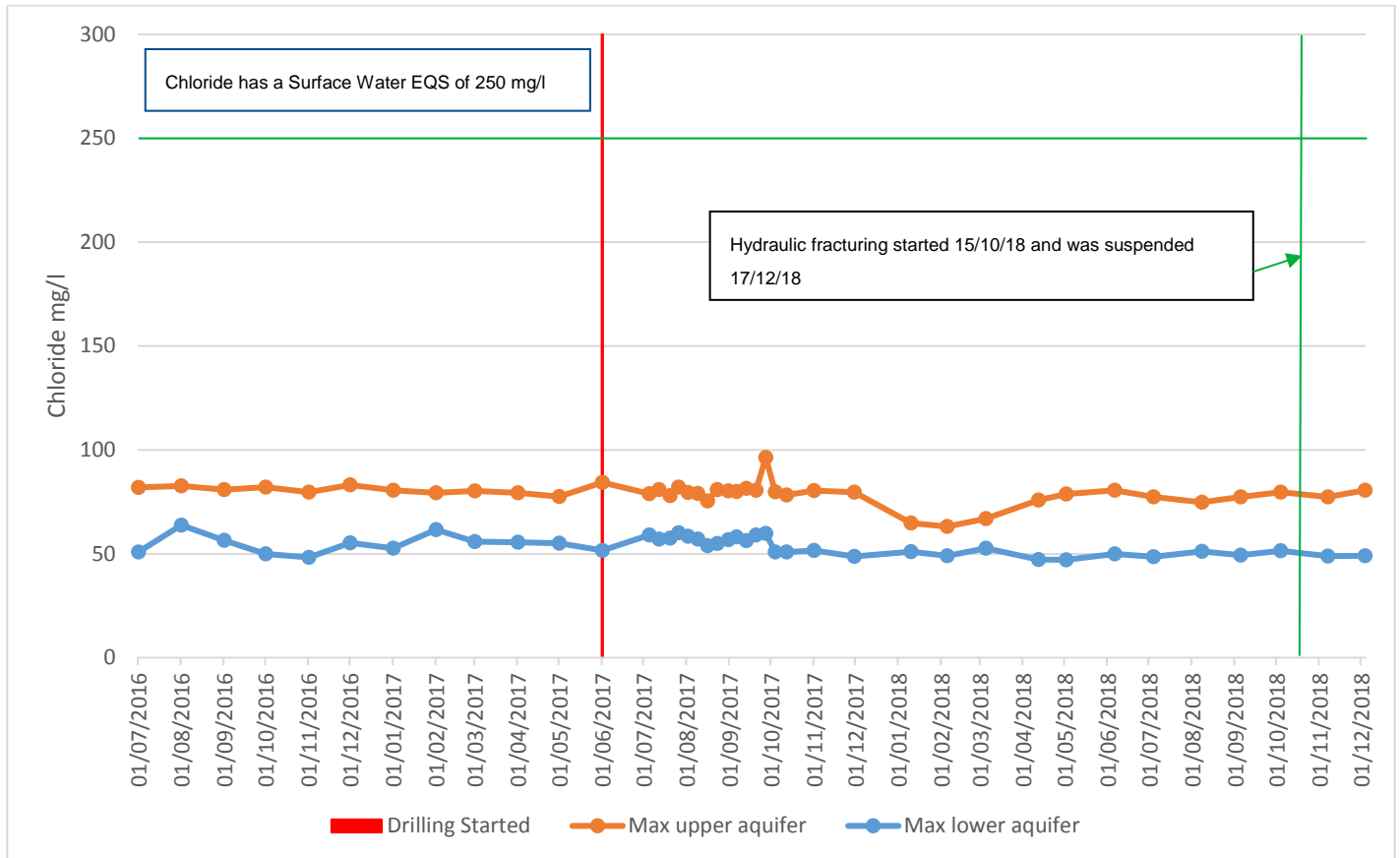
No results for acrylamide were received for December 2018. Please see CAR Form UP3431VF/0337394 for our investigation into this.

## Benzene



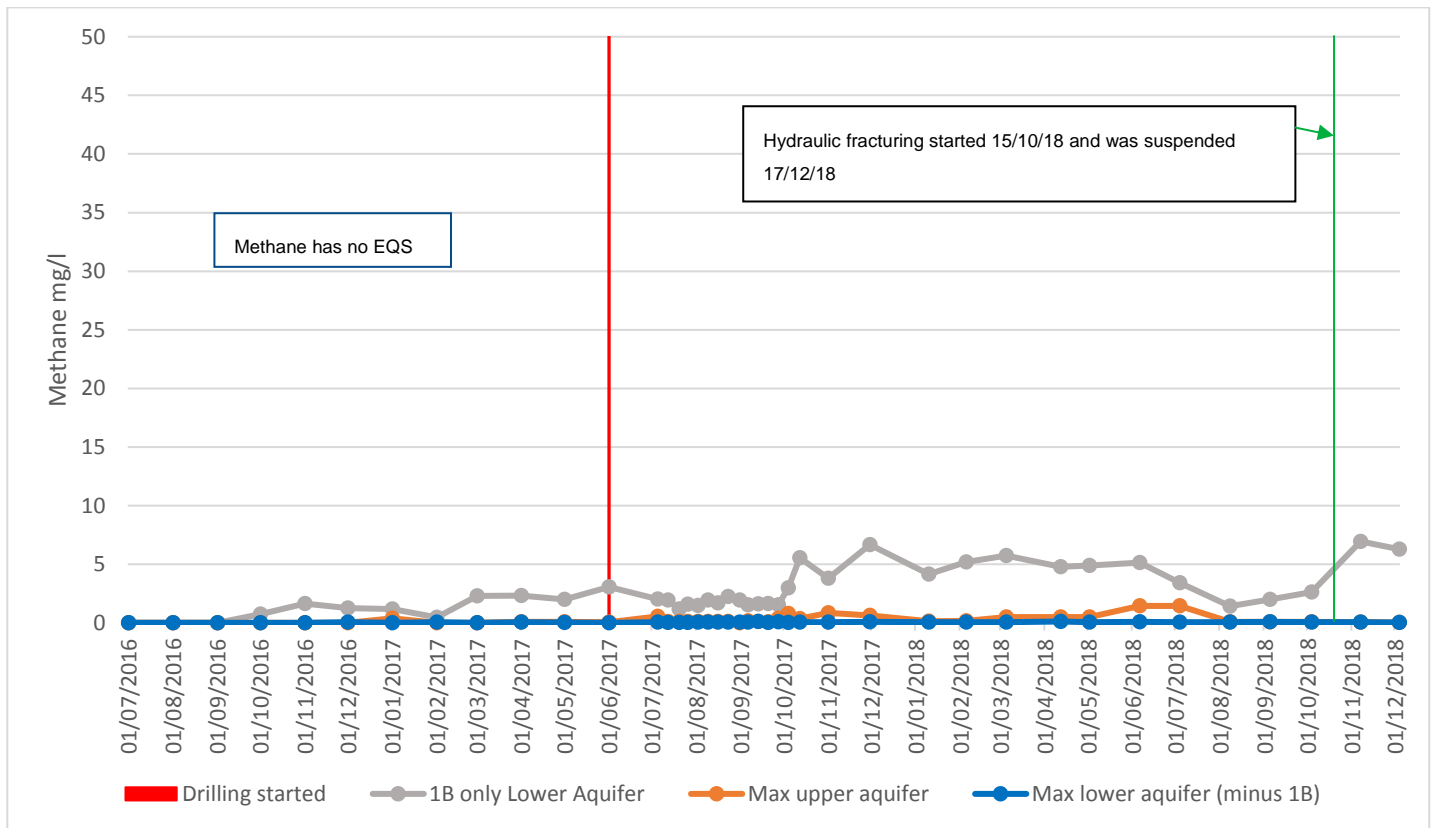
Groundwater Monitoring Preston New Road Benzene in 2 Aquifers (Maximum Values)

## Chloride



Groundwater Monitoring Preston New Road Chloride in 2 Aquifers (Maximum Values)

# Methane



Groundwater Monitoring Preston New Road Methane in 2 aquifers (Maximum Values)

### Cuadrilla Preston New Road Groundwater Quality Monitoring Q4 2018 - Upper Aquifer

Permit Number												
Facility	Preston New Road Upper Aquifer Groundwater monitoring data Q4 October - December 2018											
Substance/ Parameter	1A			2A			3A			4A		
	04-Oct-18	07-Nov-18	04-Dec-18	05-Oct-18	08-Nov-18	04-Dec-18	04-Oct-18	07-Nov-18	04-Dec-18	04-Oct-18	07-Nov-18	05-Dec-18
Dissolved Aluminium #	<20	<20	<10	<20	<20	<10	<20	<20	<10	<20	<20	<10
Dissolved Antimony #	<2	<2	<1	<2	<2	<1	<2	<2	<1	<2	<2	<1
Dissolved Arsenic #	<2.5	4.1	1.23	<2.5	3.2	1.3	<2.5	5.4	1.44	<2.5	4.5	<0.5
Dissolved Barium #	207	184	194	103	104	108	47	47	50.5	147	140	149
Dissolved Beryllium	<0.5	<0.5	<0.1	<0.5	<0.5	<0.1	<0.5	<0.5	<0.1	<0.5	<0.5	<0.1
Dissolved Boron	31	30	28.9	42	37	37.4	54	53	51.3	32	25	31.3
Dissolved Cadmium #	<0.5	<0.5	<0.08	<0.5	<0.5	<0.08	<0.5	<0.5	<0.08	<0.5	<0.5	<0.08
Dissolved Calcium #	129.2	130.2	126	127.5	123.8	125	129.4	126.5	126	135	126.6	128
Total Dissolved Chromium #	<1.5	<1.5	<1	<1.5	<1.5	<1	<1.5	<1.5	<1	<1.5	<1.5	<1
Dissolved Cobalt #	<2	<2	<0.5	<2	<2	<0.5	<2	<2	<0.5	<2	<2	<0.5
Dissolved Copper #	<7	<7	0.49	<7	<7	0.531	<7	<7	<0.3	<7	<7	<0.3
Total Dissolved Iron #	<20	<20	0.0382	<20	<20	0.067	<20	<20	<0.019	<20	<20	<0.019
Dissolved Lead #	<5	<5	<0.2	<5	<5	<0.2	<5	<5	<0.2	<5	<5	<0.2
Dissolved Lithium	10	8	8.44	13	10	11.1	16	15	14.6	8	12	9.4
Dissolved Magnesium #	37.7	34.7	37.3	36.8	33.6	36.5	35.8	33.2	35.1	38.1	33.8	38.6
Dissolved Mercury #	<1	<1	<0.01	<1	<1	<0.01	<1	<1	<0.01	<1	<1	<0.01
Dissolved Nickel #	<2	<2	0.637	<2	<2	0.555	<2	<2	1.19	<2	<2	0.436
Dissolved Potassium #	2.6	2.7	2.73	3.2	3.1	3.44	2.1	2	5.08	1.9	1.7	1.76
Dissolved Selenium #	<3	<3	<1	<3	<3	<1	<3	<3	<1	<3	<3	<1
Dissolved Silver	<5	<5	<0.5	<5	<5	<0.5	<5	<5	<0.5	<5	<5	<0.5
Dissolved Sodium #	34.1	30.8	31.9	28.9	26.8	27	34	31.6	32.2	45.2	40.1	43
Dissolved Strontium	237	237	243	292	298	306	538	556	571	222	217	215
Dissolved Vanadium #	<1.5	<1.5	<1	<1.5	<1.5	<1	1.6	<1.5	<1	<1.5	<1.5	<1
Dissolved Zinc #	<3	<3	2.06	<3	<3	3.26	7	9	9.13	<3	4	2.7
EPH (C8-C40) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
GRO (C4-C8) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
GRO (C8-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
GRO (C4-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MTBE #	<5	<5	<3	<5	<5	<3	<5	<5	<3	<5	<5	<3
Benzene #	<5	<5	<7	<5	<5	<7	<5	<5	<7	<5	<5	<7
Toluene #	<5	<5	<4	<5	<5	<4	<5	<5	<4	<5	<5	<4
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
m/p-Xylene #	<5	<5	<8	<5	<5	<8	<5	<5	<8	<5	<5	<8
o-Xylene #	<5	<5	<3	<5	<5	<3	<5	<5	<3	<5	<5	<3
Fluoride	<0.3	<0.3	-	<0.3	<0.3	-	<0.3	<0.3	-	<0.3	<0.3	-
Bromide	0.06	<0.05	0.188	0.08	0.06	0.147	0.08	0.09	0.156	0.07	<0.05	0.197
Chloride #	64.3	62.5	64.9	53.2	51.9	53.4	56.1	54.4	56.3	79.6	77.4	80.5
Nitrate as NO3 #	42.1	39.1	9.72	39.8	38.6	9.24	1.6	1	0.439	28.6	27.7	7.43
Nitrite as NO2 #	<0.02	<0.02	<0.0152	<0.02	<0.02	<0.0152	0.04	0.06	0.0317	<0.02	<0.02	<0.0152
Ammoniacal Nitrogen as NH4 #	<0.03	<0.03	<0.2	<0.03	<0.03	<0.2	<0.03	<0.03	<0.2	<0.03	<0.03	<0.2
Dissolved Ethene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Ethane #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Butane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Propane	<2	<2	<1	<2	<2	<1	<2	<2	<1	<2	<2	<1
Dissolved Methane	0.1	0.01	0.00421	<0.01	<0.0001	<0.00221	0.08	0.063	0.0451	<0.01	<0.001	0.00122
Dissolved Carbon Dioxide	45.1	75.544	39.8	42.5	64.915	29.6	32.9	57.225	24.2	45.3	79.274	29.1
δ13C - CH4	-	-	-	-	-	-	-	-	-	-	-	-
δ13C - CO2	-25.3	-23.7	-	-24.2	-21.7	-	-23.1	-20.6	-	-24.4	-22.5	-
Total Alkalinity as CaCO3 #	356	348	-	316	352	-	394	342	-	350	360	-
Acrylamide	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-
Laurylamine	<100	<100	-	<100	<100	-	<100	<100	-	<100	<100	-
Hydroxyethyl ethylene diamine	<100	<100	-	<100	<100	-	<100	<100	-	<100	<100	-
Myristyl dimethylamine	<1000	<1000	-	<1000	<1000	-	<1000	<1000	-	<1000	<1000	-
Octyldimethylamine	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-
para phenylene diamine	<500	<500	-	<500	<500	-	<500	<500	-	<500	<500	-
BOD (Settled) #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
COD (Settled) #	<7	11	14	<7	11	16.5	9	<7	7.88	<7	<7	7.92
pH #	7.68	7.83	7.48	7.72	7.81	7.56	7.7	7.91	7.7	7.71	7.92	7.59
Salinity	<0.1	<0.1	<2	<0.1	<0.1	<2	<0.1	<0.1	<2	<0.1	<0.1	<2
Total Dissolved Solids #	546	623	581	526	632	579	596	611	574	592	658	554
Total Suspended Solids #	19	17	4.65	<10	<10	<2	<10	<10	<2	<10	<10	<2

## Interpretation of Data

The data high-lighted in yellow show marginal increases over the background monitoring undertaken pre hydraulic fracturing, but are not considered to be statistically significant. Carbon Dioxide is seen to be high in November (in both upper & lower aquifer) this is considered to be a sampling anomaly, which has been referred back to Cuadrilla for comments.

Data was not received for the following substances in December:

Acrylamide, fluoride, total alkalinity,  $\delta^{13}\text{C-CH}_4$ ,  $\delta^{13}\text{C-CO}_2$  (isotopic analysis) and dissolved butane.

Our investigation into this missing data is reported in CAR Form UP3431VF/0337394

### Cuadrilla Preston New Road Groundwater Quality Monitoring Q4 2018 - Lower Aquifer

Permit Number	Preston New Road Lower Aquifer Groundwater monitoring data Q4											
Facility	October - December 2018											
Substance/ Parameter	1B			2B			3B			4B		
	04-Oct-18	07-Nov-18	04-Dec-18	05-Oct-18	08-Nov-18	04-Dec-18	04-Oct-18	07-Nov-18	04-Dec-18	04-Oct-18	07-Nov-18	05-Dec-18
Dissolved Aluminium #	<20	<20	<10	<20	<20	<10	<20	<20	<10	<20	<20	<10
Dissolved Antimony #	<2	<2	<1	<2	<2	<1	<2	<2	<1	<2	<2	<1
Dissolved Arsenic #	<2.5	<2.5	1.5	13.8	16.2	18.4	<2.5	22.4	2.31	12.5	16.6	12.8
Dissolved Barium #	126	112	116	70	68	77.5	61	58	63.8	66	62	67.6
Dissolved Beryllium	<0.5	<0.5	<0.1	<0.5	<0.5	<0.1	<0.5	<0.5	<0.1	<0.5	<0.5	<0.1
Dissolved Boron	43	27	41.1	45	42	43.4	52	45	46.1	45	41	47.2
Dissolved Cadmium #	<0.5	<0.5	<0.08	<0.5	<0.5	<0.08	<0.5	<0.5	<0.08	<0.5	<0.5	<0.08
Dissolved Calcium #	114.6	110.5	108	126.2	128.8	127	122.2	119.6	120	128.5	127.1	127
Total Dissolved Chromium #	<1.5	<1.5	<1	<1.5	<1.5	<1	<1.5	<1.5	<1	<1.5	<1.5	<1
Dissolved Cobalt #	<2	<2	<0.5	<2	<2	<0.5	<2	<2	<0.5	<2	<2	<0.5
Dissolved Copper #	<7	<7	0.371	<7	<7	<0.3	<7	<7	<0.3	<7	<7	<0.3
Total Dissolved Iron #	<20	<20	<0.019	619	550	0.605	532	484	0.545	722	659	0.651
Dissolved Lead #	<5	<5	<0.2	<5	<5	<0.2	<5	<5	<0.2	<5	<5	<0.2
Dissolved Lithium	11	14	12.3	16	15	13.5	16	15	13.1	15	15	13.7
Dissolved Magnesium #	38.3	38.9	38	35.4	33.8	35.8	33.9	31.6	34	36	33.4	37.8
Dissolved Mercury #	<1	<1	<0.01	<1	<1	<0.01	<1	<1	<0.01	<1	<1	<0.01
Dissolved Nickel #	<2	<2	1.06	<2	<2	<0.4	<2	<2	<0.4	<2	<2	<0.4
Dissolved Potassium #	2.1	1.9	4.6	2	1.9	2.14	2.1	2.1	2.17	2	2	1.94
Dissolved Selenium #	<3	<3	<1	<3	<3	<1	<3	<3	<1	<3	<3	<1
Dissolved Silver	<5	<5	<0.5	<5	<5	<0.5	<5	<5	<0.5	<5	<5	<0.5
Dissolved Sodium #	46	47	47.6	30.5	29.2	28.4	28.9	27	27.3	28.4	26.1	27.8
Dissolved Strontium	227	219	223	573	589	620	490	485	509	531	531	499
Dissolved Vanadium #	<1.5	<1.5	<1	<1.5	<1.5	<1	<1.5	<1.5	<1	<1.5	<1.5	<1
Dissolved Zinc #	4	4	3.86	<3	<3	1.64	<3	<3	5.09	<3	<3	2.36
EPH (C8-C40) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
GRO (C4-C8) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
GRO (C8-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
GRO (C4-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MTBE #	<5	<5	<3	<5	<5	<3	<5	<5	<3	<5	<5	<3
Benzene #	<5	<5	<7	<5	<5	<7	<5	<5	<7	<5	<5	<7
Toluene #	<5	<5	<4	<5	<5	<4	<5	<5	<4	<5	<5	<4
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
m/p-Xylene #	<5	<5	<8	<5	<5	<8	<5	<5	<8	<5	<5	<8
o-Xylene #	<5	<5	<3	<5	<5	<3	<5	<5	<3	<5	<5	<3
Fluoride	<0.3	<0.3	-	<0.3	<0.3	-	<0.3	<0.3	-	<0.3	<0.3	-
Bromide	0.08	<0.05	0.123	<0.05	0.07	0.278	<0.05	<0.05	0.143	0.07	<0.05	0.172
Chloride #	45.5	43.2	43.7	51.5	48.8	48.5	49.8	48	49	45.5	43.7	45.1
Nitrate as NO3 #	6.2	9.7	3.06	2.1	<0.2	<0.0677	0.4	<0.2	<0.0677	0.3	<0.2	<0.0677
Nitrite as NO2 #	0.11	0.09	0.0216	<0.02	<0.02	<0.0152	<0.02	<0.02	<0.0152	<0.02	<0.02	<0.0152
Ammoniacal Nitrogen as NH4 #	<0.03	<0.03	<0.2	0.04	0.04	<0.2	<0.03	<0.03	<0.2	0.06	0.08	<0.2
Dissolved Ethene #	<1	<1	<19.3	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Ethane #	<1	<1	<20.7	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Butane	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-
Dissolved Propane	<2	<2	<1	<2	<2	<1	<2	<2	<1	<2	<2	<1
Dissolved Methane	2.64	6.945	6.28	<0.01	<0.001	<0.00221	0.07	0.056	0.031	<0.01	0.003	0.00373
Dissolved Carbon Dioxide	44.3	79.452	32.4	33.5	64.702	25.7	28	51.663	21.7	37.6	68.52	26.7
δ13C - CH4	-56.3	-	-62.3	-	-	-	-	-	-	-	-	-
δ13C - CO2	-24.2	-23.5	-25.1	-23.3	-21.2	-	-23.3	-20.6	-	-23.5	-21.1	-
Total Alkalinity as CaCO3 #	372	382	-	402	366	-	332	334	-	348	352	-
Acrylamide	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-
Laurylamine	<100	<100	-	<100	<100	-	<100	<100	-	<100	<100	-
Hydroxyethyl ethylene diamine	<100	<100	-	<100	<100	-	<100	<100	-	<100	<100	-
Myristyl dimethylamine	<1000	<1000	-	<1000	<1000	-	<1000	<1000	-	<1000	<1000	-
Octyldimethylamine	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-
para phenylene diamine	<500	<500	-	<500	<500	-	<500	<500	-	<500	<500	-
BOD (Settled) #	5	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
COD (Settled) #	<7	<7	11.8	<7	<7	13.9	<7	<7	18.2	<7	<7	8.85
pH #	7.75	7.81	7.96	7.65	7.86	7.65	7.8	7.96	7.69	7.77	7.88	7.62
Salinity	<0.1	<0.1	<2	<0.1	<0.1	<2	<0.1	<0.1	<2	<0.1	<0.1	<2
Total Dissolved Solids #	539	556	522	602	581	568	566	562	533	591	581	546
Total Suspended Solids #	<10	<10	6.4	<10	<10	<2	<10	<10	3.55	10	10	<2

customer service line  
03708 506 506

incident hotline  
0800 80 70 60

floodline  
03459 88 11 88

## Interpretation of Data

The data high-lighted in yellow show marginal increases over the background monitoring undertaken pre hydraulic fracturing, but are not considered to be statistically significant. Dissolved Methane is seen to increase against the background maximum recorded within the 1st year in BH 1(B). The British Geological Survey have also detected Methane in other parts of the aquifer and stated that Methane (CH<sub>4</sub>) is also often detected, though rarely at high concentrations. The composition of CH<sub>4</sub>, where present, suggests that it has been produced in the superficial sediments by microbial reaction of organic matter. Carbon Dioxide is seen to have high values in November, and is probably an anomaly. This is being discussed with Cuadrilla.

Data was not received for the following substances in December:

Acrylamide, fluoride, total alkalinity,  $\delta^{13}\text{C-CH}_4$ ,  $\delta^{13}\text{C-CO}_2$  (isotopic analysis) and dissolved butane.

Our investigation into this missing data is reported in CAR Form UP3431VF/0337394