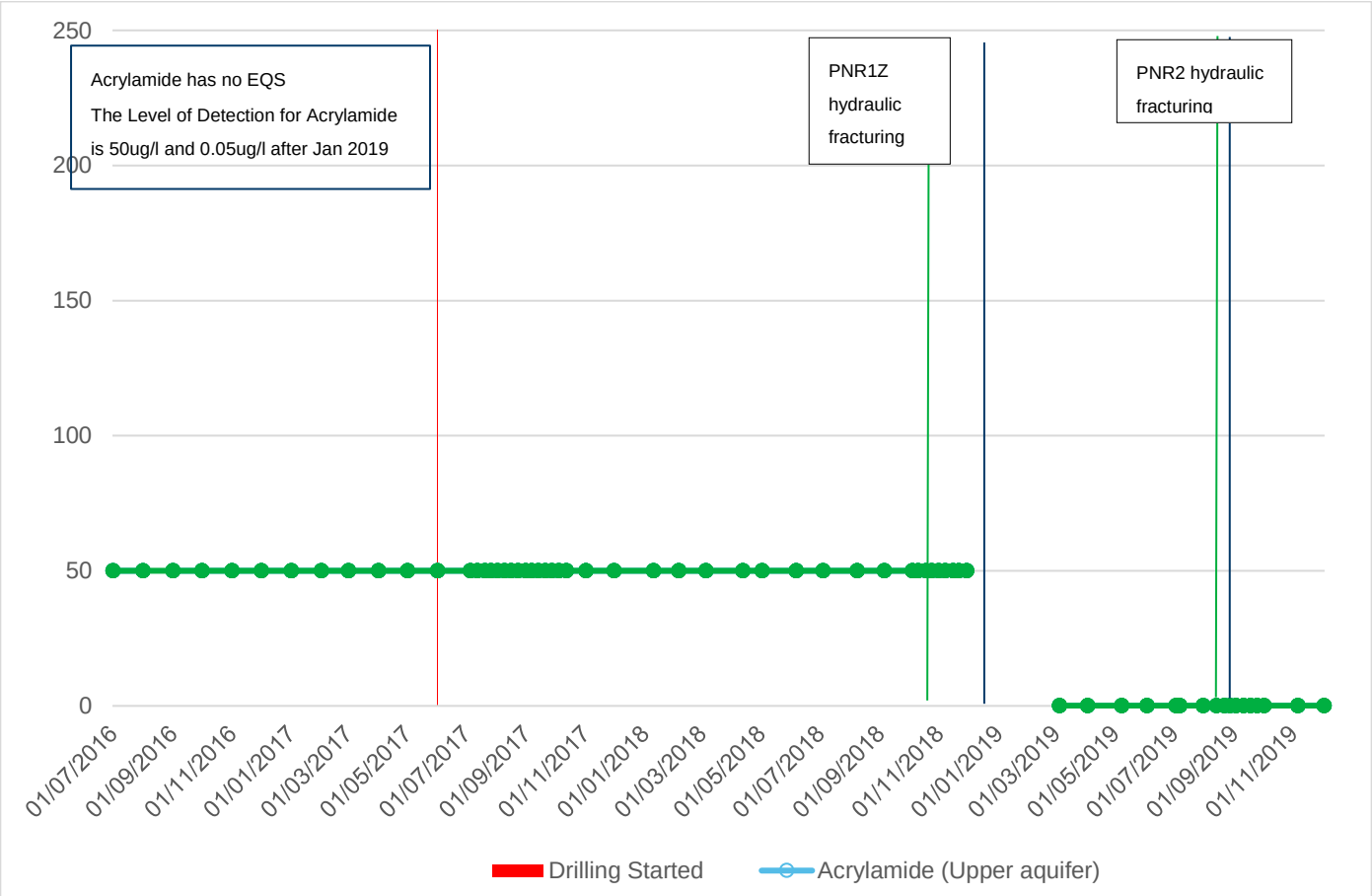
Preston New Road Groundwater Monitoring Data Q4 2019

The following report includes Cuadrilla's quarterly groundwater monitoring data for Quarter 4 2019 (October-December 2019). All weekly data is presented in the tables below. The data can be viewed by zooming in.

Please note that the next quarterly report (Q1 2020) will present data from the revised monitoring suite to reflect the change in operations at the site. Details of our approval of these changes can be found in CAR Form UP3431VF/0348127 on citizen space.

Acrylamide



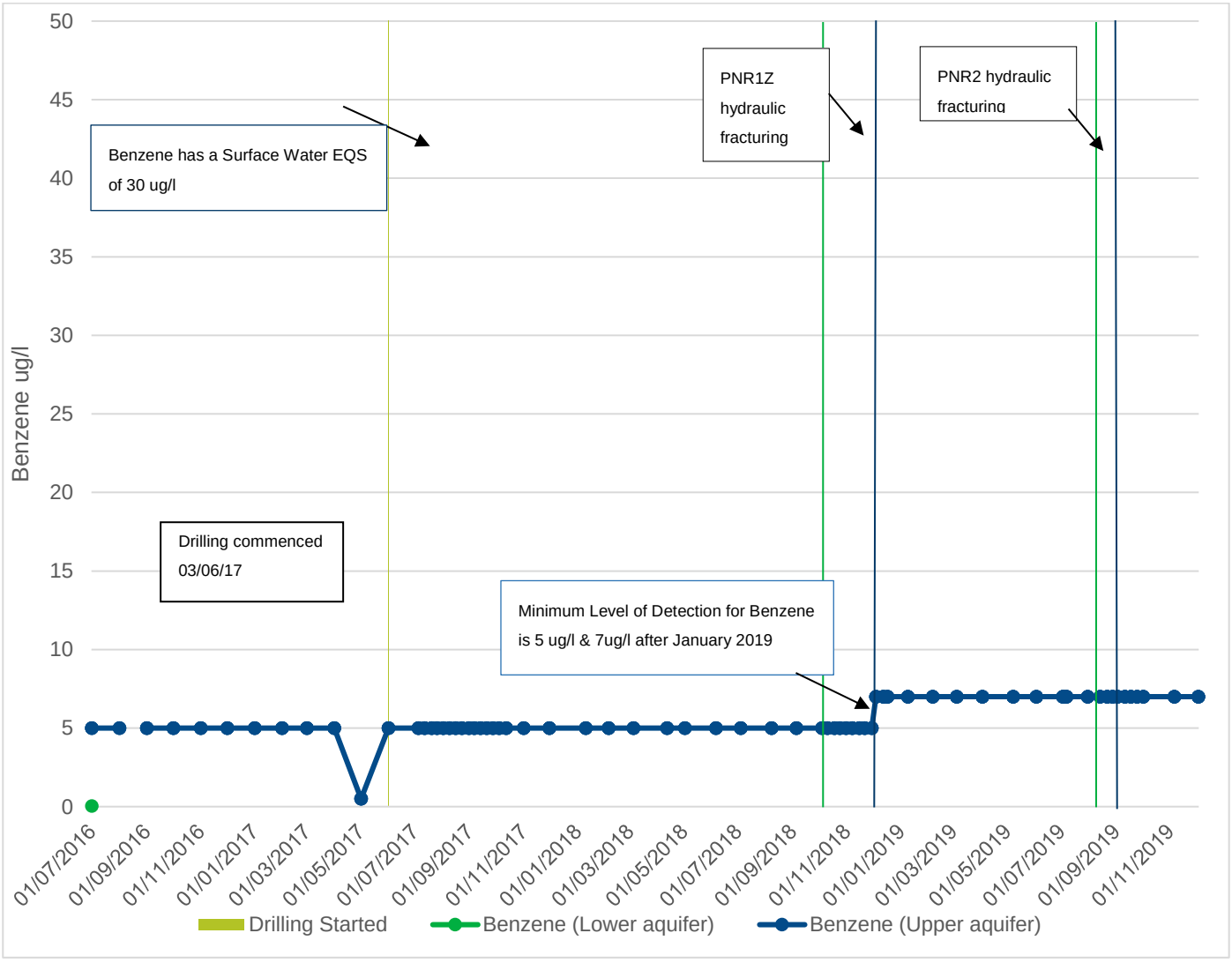
PNR1Z Hydraulic Fracturing commenced 15.10.2018 and stopped on 17.12.2018

PNR2 Hydraulic Fracturing commenced 13.08.2019 and stopped on 26.08.2019

No results for acrylamide were received for December 2018, January and February 2019. Please see CAR Form UP3431VF/0337394 for our investigation into this.

Benzene

Groundwater Monitoring Preston New Road Benzene in 2 Aquifers (Maximum Values) Quarter 4 2019

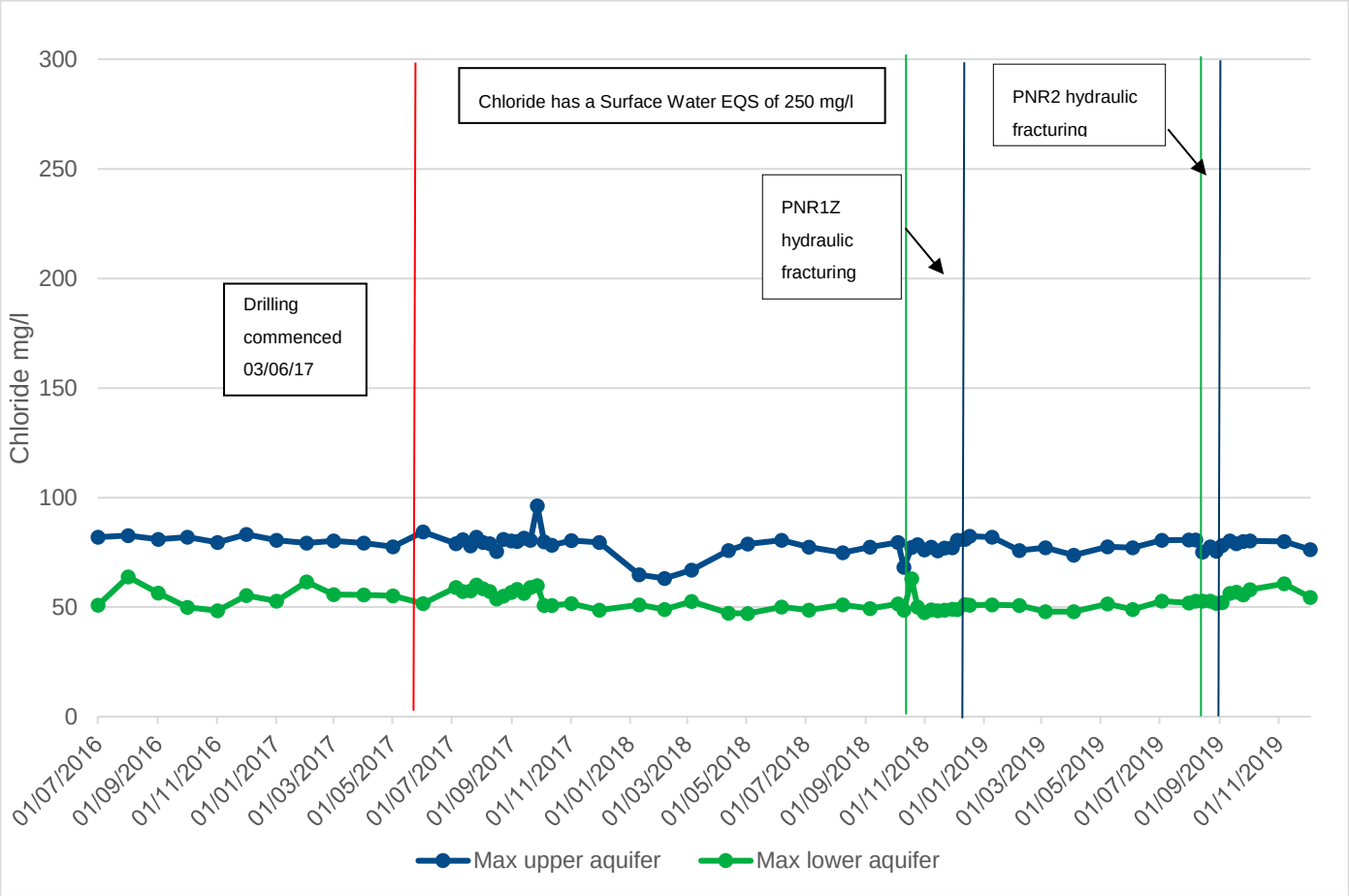


PNR1Z Hydraulic Fracturing commenced 15.10.2018 and stopped on 17.12.2018

PNR2 Hydraulic Fracturing commenced 13.08.2019 and stopped on 26.08.2019

Chloride

Groundwater Monitoring Preston New Road Chloride in 2 Aquifers (Maximum Values) Quarter 4 2019

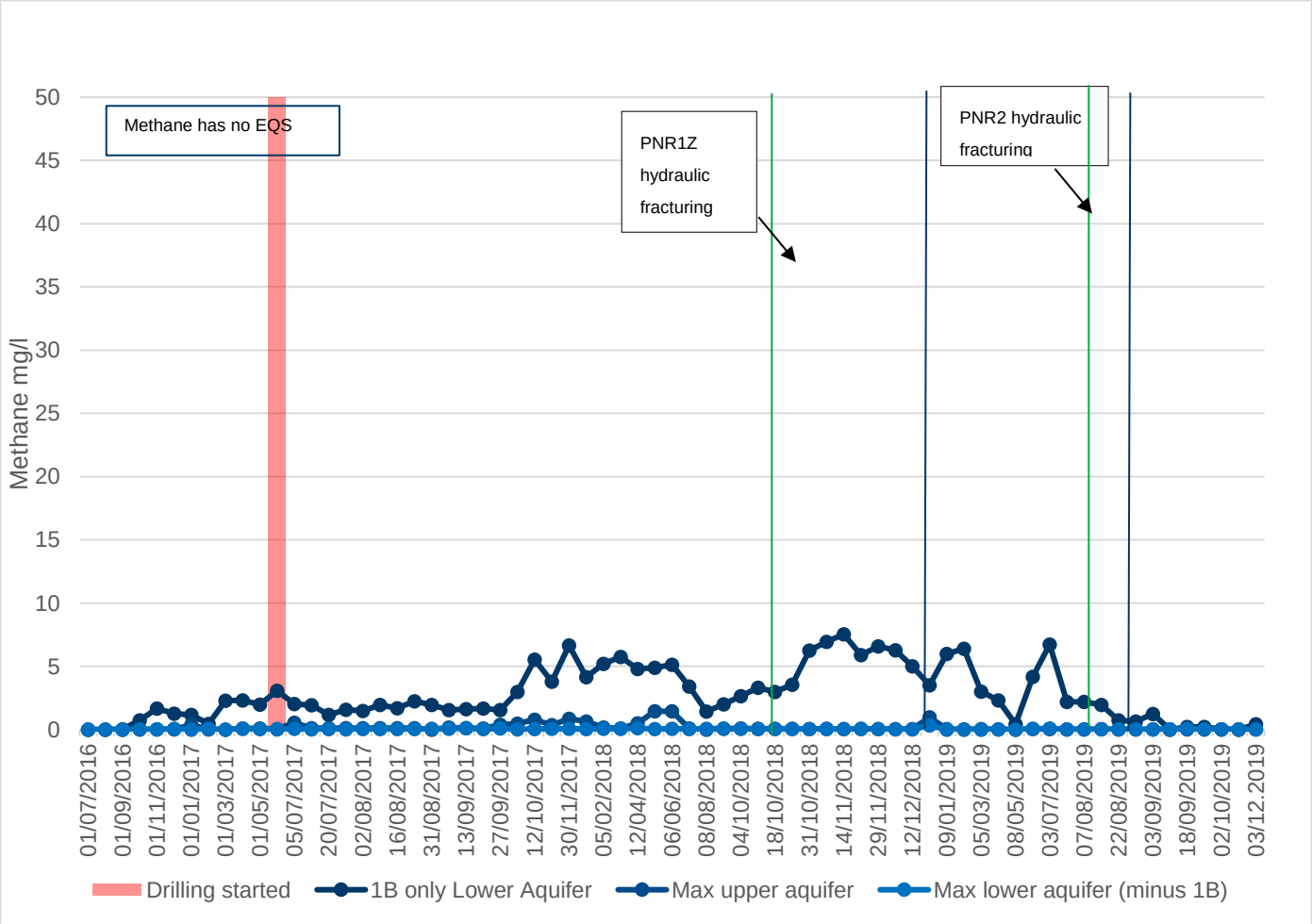


PNR1Z Hydraulic Fracturing commenced 15.10.2018 and stopped on 17.12.2018

PNR2 Hydraulic Fracturing commenced 13.08.2019 and stopped on 26.08.2019

Methane

Groundwater Monitoring Preston New Road Methane in 2 aquifers (Maximum Values) Quarter 4 2019



PNR1Z Hydraulic Fracturing commenced 15.10.2018 and stopped on 17.12.2018

PNR2 Hydraulic Fracturing commenced 13.08.2019 and stopped on 26.08.2019

Cuadrilla Preston New Road Groundwater Quality Monitoring Q4 2019 - Upper Aquifer

Substance/ Parameter	Q4 2019 Preston New Road Groundwater Analysis Upper Aquifer												Q4 Data		Pre Frack	
	BH 01 A			BH02 A			BH03 A			BH04 A			Aquifer A upper		Aquifer A upper	
	02-Oct-19	06-Nov-19	03-Dec-19	03-Oct-19	07-Nov-19	04-Dec-19	02-Oct-19	06-Nov-19	03-Dec-19	02-Oct-19	06-Nov-19	03-Dec-19	Min	Max	Min	Max
Dissolved Aluminium #	<10	<10	<10	<10	<10	<10	<10	<10	<10	102	<10	<10	<10	102.00	20	45
Dissolved Mercury #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1	1
Dissolved Antimony #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	3
Dissolved Arsenic #	<0.5	<0.5	<0.5	0.773	<0.5	0.678	0.852	0.553	1.49	0.522	<0.5	<0.5	<0.5	1.49	2.5	12.7
Dissolved Barium #	154	166	162	107	114	108	48.7	50.6	64.7	144	148	153	48.7	166	37	421
Dissolved Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	0.5
Dissolved Boron	23.7	35.8	23.5	38.5	35.8	33.2	46.8	65.8	44.8	23.9	33.6	29.5	23.7	65.8	12	60
Dissolved Cadmium #	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.5	0.5
Total Dissolved Chromium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.09	<1	1.07	1.5	6.8
Dissolved Cobalt #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2	2
Dissolved Copper #	0.567	0.308	1.21	0.736	0.72	0.586	1.4	<0.3	<0.3	0.451	<0.3	1.95	<0.3	1.95	7	8
Dissolved Lead #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.527	<0.2	0.527	5	5
Dissolved Lithium	8.47	10.1	8.1	11.5	11.6	11.3	14.3	15.6	13.5	9.21	10.1	8.84	8.1	15.6	5	48
Dissolved Nickel #	<0.4	<0.4	<0.4	<0.4	<0.4	0.465	0.78	0.732	<0.4	<0.4	<0.4	<0.4	<0.4	0.78	2	11
Dissolved Selenium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	10
Dissolved Strontium	234	251	250	299	311	297	549	588	538	225	227	241	225	588	202	649
Dissolved Vanadium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.5	2.3
Dissolved Zinc #	<1	7.29	1.97	2.21	1.68	2.39	5.53	5.86	1.3	<1	1.3	7.61	<1	7.61	0	33
Dissolved Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5	5
Dissolved Sodium #	32.4	30.2	31.6	26.1	26.4	25	32.5	30.1	28	41.9	37.3	40.2	25	41.9	24.1	42.3
Dissolved Magnesium #	37.9	35.9	37.4	35.9	36.5	36.3	36	34.3	34.5	37.4	33.7	36.2	33.7	37.9	32.1	39.7
Dissolved Potassium #	2.45	2.74	2.93	3.21	3.42	3.27	1.95	2.11	2.35	1.95	1.92	2.18	1.92	3.42	1.4	3.3
Dissolved Calcium #	118	126	121	119	125	122	116	121	116	120	119	119	116	126	101.9	138
Total Dissolved Iron #	<19	<19	<19	<19	<19	<19	<19	23.2	529	<19	<19	20.2	<19	529	20	2012
EPH (C8-C40) #	<10	<10	<10	<10	13	<10	<10	73	<10	<10	<10	<10	<10	73	10	620
GRO (C4-C8) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	87
GRO (C8-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	18
GRO (C4-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	101
MTBE #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	0.1	5
Benzene #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	0.5	5
Toluene #	<4	<4	<4	<4	10	<4	<4	<4	<4	<4	<4	<4	<4	<4	5	5
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	1	5
m/p-Xylene #	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	2	5
o-Xylene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	1	5
Fluoride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.03	0.4
Bromide	0.185	0.169	0.156	0.156	0.192	0.159	0.157	0.152	0.137	0.209	0.178	0.173	0.137	0.209	0.05	0.18
Chloride #	63.5	62.4	60.4	52.3	53.5	52	56.9	56.7	47.8	80.2	80	76.3	47.8	80.2	24.6	96.3
Nitrate as NO3 #	9.55	9.32	9.4	9.3	9.68	10	0.439	0.414	<0.0677	6.7	6.57	6.69	<0.0677	10	0.2	46.5
Nitrite as NO2 #	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	0.0247	0.0231	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	0.0247	0.02	0.7
Ammoniacal Nitrogen as NH4 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.03	0.66
Dissolved Ethene #	<1	<1	<1	<1	<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	<1	<1	1	1
Dissolved Butane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1	2
Dissolved Propane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1	<2	1	2
Dissolved Methane	0.013	0.023	0.019	<0.001	<0.001	<0.001	0.03	0.023	0.029	<0.001	<0.001	<0.001	<0.001	0.03	0.01	1.45
Dissolved Carbon Dioxide	28.5	27.7	23.8	31.9	23	28.9	23.5	20.4	16	30.2	25.7	31.4	16	31.9	17.4	63.2
δ13C - CH4	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	-	NDP	-74.6	28
δ13C - CO2	-22.7	-22.7	-23.7	-22.2	-22.5	-23.1	-22.8	-21.1	-21.3	-20.2	-22.7	-23.3	-20.2	-23.7	-63.9	29.16
Total Alkalinity as CaCO3 #	346	355	346	344	345	350	327	330	325	355	355	352	325	355	250	600
Acrylamide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50	50
Laurylamine															50	50
Hydroxyethyl ethylene diamine															50	50
Myristyl dimethlyamine															50	50
Octyldimethylamine															50	50
para phenylene diamine															50	50
BOD (Settled) #	<1	<1	<1	<1	1.04	<1	<1	<1	<1	<1	<1	<1	<1	1.04	1	32
COD (Settled) #	<7	26	<7	<7	8.73	11.1	<7	20	11.3	<7	21.3	13.1	<7	26	5	22
pH #	7.74	7.84	7.81	7.82	7.75	7.89	7.81	8	8.29	7.91	7.71	7.73	7.73	8.29	6.81	7.95
Salinity	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	0.1	11.2
Total Dissolved Solids #	631	555	406	605	745	590	610	545	695	619	567	532	406	745	384	2242
Total Suspended Solids #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2.5	<2	2.5	10	7669

Interpretation of Data

The data high-lighted in yellow show marginal increases over the background monitoring undertaken in the first year, but are not considered to be statistically significant. High COD in BH 1A is considered to be a function of silt samples. Borehole 4A 2nd October 2019 is seen to have an aluminium reading of 102 mg/l which is anomalous. This has been checked with the operator and their labs and it appears to be a one-off result, with no indication of groundwater contamination.

*"Q4 Data" columns are the minimum and maximum readings for each determinand for comparison against the pre-hydraulic fracturing background minimum and maximum results.

Cuadrilla Preston New Road Groundwater Quality Monitoring Q4 2019 - Lower Aquifer

Substance/ Parameter	Q4 2019 Preston New Road Groundwater Analysis Lower Aquifer												Q4 Assess		Pre Frack	
	BH 01 B			BH 02 B			BH 03 B			BH 04 B			Lower Aquifer		Background	
	02-Oct-19	06-Nov-19	03-Dec-19	03-Oct-19	07-Nov-19	04-Dec-19	02-Oct-19	06-Nov-19	03-Dec-19	02-Oct-19	06-Nov-19	03-Dec-19	Min	Max	Min	Max
Dissolved Aluminium #	<10	<10	<10	22.4	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	20	45
Dissolved Mercury #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1	1
Dissolved Antimony #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	4
Dissolved Arsenic #	0.819	<0.5	0.72	15.6	14.5	14.9	1.68	1.21	0.689	14.7	13.8	13.1	<0.5	15.6	2.5	21.2
Dissolved Barium #	144	147	148	74.7	73.3	69.1	60.3	62.6	46.7	65.8	72.6	62.4	60.3	148	49	397
Dissolved Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	0.6
Dissolved Boron	27.6	34.8	33.3	48	44.8	42.2	40.3	57.3	49.5	38.3	55.3	40.6	27.6	57.3	19	55
Dissolved Cadmium #	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.5	0.6
Total Dissolved Chromium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.32	1.5	6.6
Dissolved Cobalt #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2	2
Dissolved Copper #	0.536	0.394	2.04	<0.3	<0.3	<0.3	<0.3	<0.3	0.334	<0.3	<0.3	<0.3	<0.3	2.04	7	22
Dissolved Lead #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	5	6
Dissolved Lithium	9.49	9.4	10.1	13.7	13.8	13.6	13.8	14.6	14.1	13.4	15.7	13.5	9.4	15.7	5	55
Dissolved Nickel #	0.715	0.804	1.54	<0.4	<0.4	<0.4	<0.4	<0.4	0.672	<0.4	<0.4	<0.4	<0.4	1.54	2	20
Dissolved Selenium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	4
Dissolved Strontium	237	240	251	635	626	595	492	508	548	553	580	536	237	635	207	683
Dissolved Vanadium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.5	2.7
Dissolved Zinc #	2.64	2.69	20.6	1.54	1.15	3.66	<1	<1	7.51	1.15	1.37	4.72	<1	20.6	0	28
Dissolved Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5	5
Dissolved Sodium #	35.2	28.7	35.2	28	27.9	26.7	27.9	25.3	31.3	28	25.7	26	25.3	35.2	24.9	53.1
Dissolved Magnesium #	38.3	33.7	37.3	35	34.4	34.5	34.7	32.1	35.7	37.8	35.6	36	33.3	37.6	31.4	40
Dissolved Potassium #	2.42	2.42	2.98	1.91	1.99	1.95	1.99	2.05	2.11	1.94	2.05	1.94	1.94	2.98	1.6	3.7
Dissolved Calcium #	117	114	114	119	122	121	113	112	124	122	123	123	113	124	98.2	136
Total Dissolved Iron #	<19	<19	<19	507	568	601	482	482	<19	698	681	680	<19	698	20	3472
EPH (C8-C40) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	11
GRO (C4-C8) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	60
GRO (C8-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	51
GRO (C4-C12) #	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	97
MTBE #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	0.1	5
Benzene #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	0.5	5
Toluene #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	5	5
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	1	5
m/p-Xylene #	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	2	5
o-Xylene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	1	5
Fluoride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.3	1.1
Bromide	0.161	0.173	0.145	0.155	0.15	0.165	0.13	0.138	0.163	0.158	0.131	0.135	0.13	0.173	0.05	0.17
Chloride #	58	60.7	50.2	49.1	50.7	48	50.2	49.9	54.4	45.9	45.6	43.4	43.4	60.7	10	63.8
Nitrate as NO3 #	7.37	7.46	5.63	<0.0677	<0.0677	<0.0677	<0.0677	<0.0677	0.405	<0.0677	<0.0677	<0.0677	<0.0677	7.46	0.2	15.1
Nitrite as NO2 #	<0.0152	0.0916	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	0.0219	<0.0152	<0.0152	<0.0152	<0.0152	0.0916	0.02	0.24
Ammoniacal Nitrogen as NH4 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.03	0.41
Dissolved Ethene #	<1	<1	<1	<1	<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	<1	<1	1	1
Dissolved Butane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	2
Dissolved Propane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	2
Dissolved Methane	0.012	0.007	0.423	<0.001	<0.001	<0.001	0.024	0.024	0.025	0.004	0.004	<0.001	<0.001	0.423	0.01	6.66
Dissolved Carbon Dioxide	34.4	23.8	28.9	26.8	19.9	29.8	21.7	20.6	20.8	31.1	27.2	26.1	19.9	34.4	9.8	47.9
δ13C - CH4	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	-73.6	0
δ13C - CO2	-22.7	-22.9	-23.6	-21.2	-21.2	-21.9	-21.4	-21	-21.3	-20.4	-21.5	-21.8	-23.6	-20.4	-35.3	27.2
Total Alkalinity as CaCO3 #	353	355	358	344	350	335	322	320	327	343	345	340	320	358	262	510
Acrylamide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50	50
Laurylamine													-	-	50	50
Hydroxyethyl ethylene diamine													-	-	50	50
Myristyl dimethlyamine													-	-	50	50
Octyldimethylamine													-	-	50	50
para phenylene diamine													-	-	50	50
BOD (Settled) #	<1	1.03	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.03	1	15
COD (Settled) #	<7	8.7	<7	<7	9.52	8.11	<7	<7	<7	<7	<7	<7	<7	9.52	7	26
pH #	7.61	8.04	7.83	7.95	8.17	8.06	7.75	8.22	7.73	8.01	8.05	7.76	7.61	8.22	6.84	8.06
Salinity	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	0.1	10.2
Total Dissolved Solids #	635	562	461	551	549	574	571	520	537	581	555	822	461	822	393	901
Total Suspended Solids #	<2	<2	<2	<2	<2	2.45	<2	<2	<2	<2	2.75	2.9	<2	2.9	10	8891

Interpretation of Data

The data high-lighted in yellow show marginal increases over the background monitoring undertaken in the first year, 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 (CH4) is also often detected, though rarely at high concentrations. The composition of CH4, where present, suggests that it has been produced in the superficial sediments by microbial reaction of organic matter.

*"Q4 Assess" columns are the minimum and maximum readings for each determinand for comparison against the pre-hydraulic fracturing background minimum and maximum results.