STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N Monroe Street • Spokane, WA 99205-1295 • 509-329-3400

March 6, 2019

Mark Ioli
Vice President and General Manager
Echo Bay Minerals Company
363 Fish Hatchery Road
Republic, WA 99166

RE: Key Mill, Kettle River Operations Site Inspection
State Waste Discharge (SWD) Permit No. ST0008033

Dear Mark Ioli:

I've enclosed the inspection report for my site visit to the Key Mill on December 21, 2018.

I had one minor recommendation based on review of your discharge monitoring report (DMR) data. You reported higher than typical conductivity readings from the tailings impoundment drain system on January 17, 2017, (West Drain) and July 23, 2018 (East Drain). Please double check these values and make any corrections for the DMRs in the WQWebPortal, if needed.

As a reminder, the SWD permit requires an application for permit renewal by April 30, 2019. Please let me know if you need any assistance in completing the permit renewal application.

I wish to thank Jacquelyn Nutt and Gary Johnson for their assistance during the inspection. Please review the inspection report. If you have any questions, please contact me at (509) 329-3500 or phal461@ecy.wa.gov.

Sincerely,

Pat Hallinan
Water Quality Section

PH:red
Enclosures
cc/encl: Gary Johnson, Echo Bay Minerals Company
Jacquelyn Nutt, Echo Bay Minerals Company

WASHINGTON STATE DEPARTMENT OF ECOLOGY
WASTEWATER TREATMENT FACILITY
SITE VISIT REPORT

DEPARTMENT OF ECOLOGY
State of Washington

Name of Entity	Echo Bay Minerals Company – Kettle River Operations		
Permit No.:	ST0008033	Date of Visit:	December 21, 2018
City:	Republic	Entry Time:	10:30 am Exit Time: 2:30 pm
County:	Ferry	Ecology Rep. #1:	Patrick Hallinan
		Ecology Rep. #2:	Jake Cocke, Jenny Filipy (Air Quality)
Person Contacted:	Jacquelyn Nutt	Phone No.:	(509) 775-8575
Title:	Environmental Manager		
Responsible Official:	Mark Ioli	Phone No.:	(509) 775-3157
Title:	VP and General Manager		
Facility Type:	State to Ground	Discharges to:	Lined tailings impoundment and reclaim pond
Type of Visit:	Compliance Inspection-Without Sampling		

Operation Status: **S** = Satisfactory; **U** = Unsatisfactory; **M** = Marginal; **NA** = Non-Applicable; **N** = Not Evaluated

Permit on Site:	S	Laboratory:	N	Self-Monitoring Schedule:	S
Records/Reports:	S	Effluent/Receiving Water:	S	Operations & Maintenance:	S
Facility Site Review:	S	Pretreatment	NA	Sludge Disposal:	NA
Flow Measurement:	N	Compliance Schedule:	N	Other:	

Announced? Yes ☒ No ☐ On Ecology's Inspection Schedule? Yes ☒ No ☐

Inspectors Comments:

This was a joint site inspection between Ecology's Water Quality and Air Quality programs. Echo Bay's contact for this permit has changed from Jacquelyn Nutt to Gary Johnson, Environmental Superintendent. Mr. Johnson's phone number is (509) 775-8530.

Permit: Ecology issued State Waste Discharge Permit No. ST0008033 to Echo Bay Minerals in April 2015 with an expiration date of April 30, 2020. The permit requires an application for permit renewal by April 30, 2019. The permit regulates discharges associated with the disposal of mill tailings into a lined tailings impoundment and reclaim process water pond, and treatment of groundwater intercepted beneath the tailings impoundment (see attached Photolog).

Facility Site Review: The Kettle River Operations consist of a gold and silver mill and tailings disposal facility (Key Mill), and inactive mine sites (K2, Lamefoot, and Key Pits). Most recently, the mill processed ore mined at the Buckhorn Mine operated by Crown Resources Corporation. Mining at Buckhorn ended in May 2017, and the processing at the Key Mill ended in October 2017. Presently, Echo Bay keeps the mill on a care and maintenance basis.

A drain system intercepts groundwater beneath the lined portion of the tailings impoundment. The collected water flows into an underground tank located on the downstream edge of the tailings dam. Echo Bay continuously monitors the conductivity of the underdrain water. Since an increase in conductivity may indicate a possible liner leak, a process control system diverts the underdrain water into the tailings impoundment if conductivity levels rise above 750 µmhos/cm. During typical operations, Echo Bay treats the underdrain water in an above ground biological treatment system to reduce nitrate and sulfate. Echo Bay then re-infiltrates the treated water downgradient of the tailings impoundment. The Permittee plans to add an additional 15,000 gallon tank to equalize flows through the bio-treatment system.

Records/Reports: The attached file summarizes discharge monitoring report data from January 2016 through November 2018. During this time, the Permittee has met permit limitations for WAD cyanide concentrations in the tailings impoundment; conductivity in the tailings underdrain water; and nitrate, total dissolved solids (TDS), and sulfate concentrations in groundwater monitoring wells TP-1, TP-2, and TP-3. The permit requires routine monitoring of the tailings impoundment water, water collected in the double-lined portions of the tailings impoundment and reclaim pond, and influent and effluent from the tailings underdrain water treatment system, and the three groundwater wells.

(over)

Inspectors Signature: _____ 3/6/2019

Permit condition S7 sets a design criteria flowrate for the underdrain water treatment system at 14,400 gpd (monthly average). This condition does not apply when excess flows from spring runoff or high precipitation events cause an exceedance of the design criteria. The Permittee exceeded the design criteria during nine months from January 2016 through November 2018, all caused by wetter than normal conditions.

Inspectors Signature: _____ 3/6/2019

Water Quality Photolog **Facility: Echo Bay Minerals Company**

Location: Republic
Date Photos Taken: December 21, 2018

Permit No.: ST0008033
Photographer: Pat Hallinan

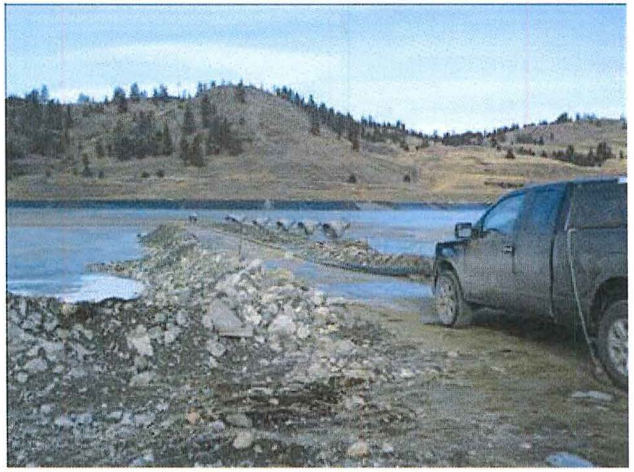

Photo 1: At downstream dike of tailings pond. The permittee had constructed a pad onto the tailings for the use of mechanical spray evaporators.

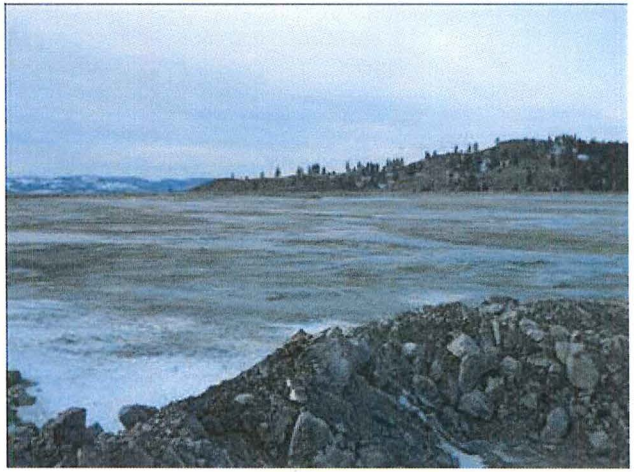

Photo 2: At downstream dike of tailings pond, looking northeast.

Photo 3: At downstream dike of tailings pond, looking northeast.

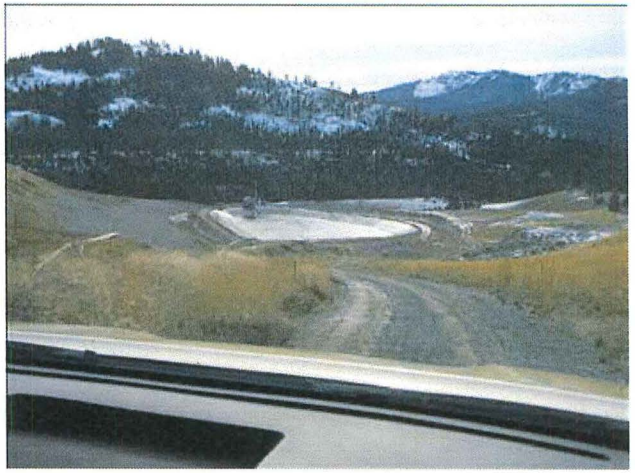

Photo 4: Reclaim water pond for tailings impoundment. When in operation, the water from this pond is re-used in the milling process.

Location: Republic
Date Photos Taken: December 21, 2018

Permit No.: ST0008033
Photographer: Pat Hallinan

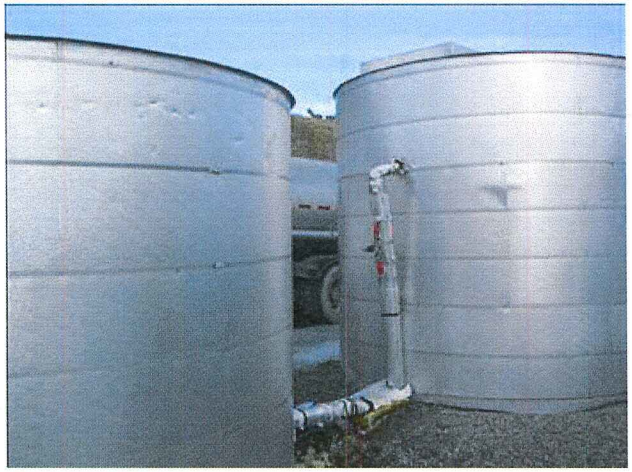

Photo 5: Tailings underdrain water treatment system tanks.

Photo 6: Insulated line running between treatment tanks at tailings underdrain water treatment system. The permittee is using a Hydroflow unit that reduces scale build-up in the treatment lines.

Tailings Impoundment

	WAD Cyanide (mg/L)		pH (su)	
Date	Avg	Max	Min	Max
Jan 2016	8.90	11.1	8.23	8.95
Feb 2016	12.51	16.2	7.38	9.03
Mar 2016	8.44	11	7.72	8.54
Apr 2016	8.70	10.2	8.08	8.61
May 2016	3.33	5.37	8.29	8.6
Jun 2016	2.48	4.3	8.17	8.55
Jul 2016	1.90	2.43	7.9	8.35
Aug 2016	1.83	2.42	7.92	8.34
Sep 2016	2.12	2.95	8.01	8.49
Oct 2016	2.93	3.91	8.22	8.67
Nov 2016	5.22	6.94	8.11	8.61
Dec 2016	4.57	8.01	8.19	9.64
Jan 2017	24.68	27.1	8.24	8.99
Feb 2017	17.84	25.4	8.01	8.95
Mar 2017	10.45	16	8.21	8.67
Apr 2017	11.62	15.2	8.26	8.63
May 2017	14.22	17	7.88	8.85
Jun 2017	12.17	17.4	7.82	8.46
Jul 2017	3.77	4.88	7.84	8.29
Aug 2017	3.46	4.19	7.51	8.27
Sep 2017	1.24	1.71	8.04	8.47
Oct 2017	1.56	2	7.6	8.56
Nov 2017	1.74	2.64	7.6	8.1
Dec 2017	1.33	1.56	7.46	8.03
Jan 2018	0.84	0.84	7.09	7.09
Feb 2018	0.94	0.936	8.04	8.04
Mar 2018	1.20	1.2	8.02	8.02
Apr 2018	1.66	1.66	6.83	7.95
May 2018	0.61	0.606	7.86	7.86
Jun 2018	0.35	0.348	8.37	8.37
Jul 2018	0.19	0.187	7.1	8.29
Aug 2018	0.13	0.129	8.16	8.16
Sep 2018	0.06	0.055	7.43	7.43
Oct 2018	0.26	0.258	8.12	8.12
Nov 2018	0.27	0.27	8.4	8.4

Min	0.055	0.055	6.83	7.09
Average	4.96	6.47	7.89	8.41
Median	2.12	2.95	8.01	8.46
95th %tile	15.3	19.8	8.3	9.0
Max	24.68	27.1	8.4	9.64

Limits	- / 40	- / -	- / -	- / -

East Tailings Impoundment Drain and LCRS

Date	Cond (umhos/cm)	Flow (gpm) Avg	Flow (gpm) Max	pH (su) Min	pH (su) Max
Jan 2016	13,160	14.8	18.8	7.02	7.3
Feb 2016	13,580	16.4	18.8	7.04	7.23
Mar 2016	13,650	17.3	25	6.94	7.11
Apr 2016	13,710	21.15	30	7.16	7.47
May 2016	13,760	14.16	20	7.08	7.13
Jun 2016	13,430	13	15	7.04	7.34
Jul 2016	13,550	13.2	15	7.1	7.24
Aug 2016	13,450	12.4	17	7	7.14
Sep 2016	13,710	9.83	13.6	6.98	7.14
Oct 2016	13,700	7.8	8.3	7.02	7.41
Nov 2016	13,260	10.88	12.8	6.75	7.05
Dec 2016	13,900	10.8	12.5	7.12	7.26
Jan 2017	13,750	8.44	10	7.2	7.33
Feb 2017	13,240	9.825	11.5	7.25	7.45
Mar 2017	13,080	10.025	12.5	7.2	7.45
Apr 2017	12,840	20.35	25	7.14	7.42
May 2017	13,610	23.2	25	7.18	7.47
Jun 2017	13,150	23.12	30	7.43	7.57
Jul 2017	12,480	17.5	18.8	6.88	7.61
Aug 2017	12,660	17.52	25	6.49	7.28
Sep 2017	13,140	13.6	15	6.88	7.08
Oct 2017	12,630	12	13.6	6.6	7.03
Nov 2017	13,020	11.425	12.5	7.01	7.29
Dec 2017	13,320	11.8	12.5	7	7.2
Jan 2018	13,610	12.26	15	7.03	7.22
Feb 2018	13,560	12.8	13.6	7.33	7.43
Mar 2018	13,740	16.45	18.8	7.32	7.39
Apr 2018	13,460	20.75	21.4	7.35	7.49
May 2018	12,820	20.88	21.4	7.41	7.47
Jun 2018	13,150	18.55	21.4	7.32	7.44
Jul 2018	130,220	16.78	18.8	6.95	7.3
Aug 2018	13,430	18.275	18.8	6.95	7.44
Sep 2018	13,620	16.275	16.7	6.87	7.18
Oct 2018	14,100	17.54	18.8	6.85	7.47
Nov 2018	14,090	17.325	18.8	7.01	7.43
Min	12,480	7.8	8.3	6.49	7.03
Average	16,731	15.10	17.76	7.05	7.32
Median	13,460	14.8	18.8	7.03	7.33
95th %tile	14,093	21.74	26.50	7.37	7.51
Max	130,220	23.2	30	7.43	7.61

West Tailings Impoundment Drain and LCRS

Cond (umhos/cm)	Flow (gpm) Avg	Flow (gpm) Max	pH (su) Min	pH (su) Max
13,910	14.3	15	7.13	7.2
14,180	15	15	7.11	7.11
13,960	16.8	18.8	6.92	7.05
14,100	16.45	18.8	6.99	7.3
14,210	15.3	28.3	7.02	7.16
13,880	14.1	16.7	7.03	7.49
13,510	14.275	16.7	7.06	7.13
13,480	16.56	25	7.01	7.24
13,710	18.4	30	6.96	7.06
13,640	16.225	16.7	7	7.18
13,660	21.08	30	6.91	7.11
13,710	21.4	21.4	7.05	7.1
132,000	3.12	15.6	7.06	7.16
13,370	0	0	7.13	7.5
13,730	4.7	18.8	7.15	7.26
13,890	18.8	21.4	7.11	7.24
14,200	21.6	30	7.15	7.43
14,150	18.92	23.1	7.25	7.43
14,240	18.1	18.8	6.9	7.28
14,640	16.44	18.8	6.87	7.17
14,700	13.4	16.7	6.91	7.01
14,280	10.58	12.5	6.59	7.02
14,780	9.425	10.7	6.96	6.99
15,260	9.8	11.5	7	7.1
15,450	10.52	12.5	6.93	7.19
15,450	8.675	10	7.22	7.3
15,570	9.025	9.4	7.22	7.29
15,400	10.725	11.5	7.3	7.44
15,280	11.74	12.5	7.31	7.49
15,670	10.475	12.5	7.25	7.34
15,860	9.8	11.5	6.93	7.25
15,730	8.975	10	6.87	7.22
15,450	8.5	9.4	6.74	7.02
15,770	9.02	10.7	6.77	7.15
15,900	8.275	9.4	6.96	7.09
13,370	0	0	6.59	6.99
17,906	12.87	16.28	7.02	7.21
14,240	13.4	15.6	7.01	7.19
15,872	21.18	30.00	7.27	7.49
132,000	21.6	30	7.31	7.5

Reclaim Pond LCRS

Date	Cond (umhos/cm)	Flow (gpm)		pH (su)	
		Avg	Max	Min	Max
Feb 2016	10920	0	1	7.25	7.25
Mar 2016	10090	1	1	6.79	7.13
Apr 2016	10150	1	1	7.02	7.5
May 2016	9880	1	1	6.77	7.32
Jun 2016	10490	1	1	7.07	7.66
Jul 2016	9370	1	1	6.78	7.2
Aug 2016	9340	<1	<1	6.35	6.94
Sep 2016	9170	1	1	6.44	6.7
Oct 2016	9110	1	1	6.78	6.95
Nov 2016	-	1	1	-	-
Dec 2016	-	1	1	-	-
Jan 2017	-	1	1	-	-
Feb 2017	-	1	1	-	-
Mar 2017	-	1	1	-	-
Apr 2017	-	1	1	-	-
May 2017	-	1	1	-	-
Jun 2017	-	1	1	-	-
Jul 2017	916	8.57	8.57	6.96	6.96
Aug 2017	-	1	1	-	-
Sep 2017	-	1	1	-	-
Oct 2017	-	1	1	-	-
Nov 2017	-	1	1	-	-
Dec 2017	-	1	1	-	-
Jan 2018	-	1	1	-	-
Feb 2018	-	1	1	-	-
Mar 2018	-	1	1	-	-
Apr 2018	-	1	1	-	-
May 2018	-	1	1	-	-
Jun 2018	-	1	1	-	-
Jul 2018	-	1	1	-	-
Aug 2018	-	<1	<1	-	-
Sep 2018	-	<1	<1	-	-
Oct 2018	-	<1	<1	-	-
Nov 2018	-	<1	<1	-	-

Min	916	0	1	6.35	6.7
Average	8,944	1.23	1.26	6.82	7.16
Median	9,625	1	1	6.79	7.17
95th %tile	10,727	1	1	7.17	7.59
Max	10,920	8.57	8.57	7.25	7.66

Tailings Underdrain

	Cond (umhos/cm)		WAD Cyanide (mg/L)		Flow	
Date	Min	Max	Avg	Max	Avg	Max
Jan 2016	491	749	0.1	0.01	7402.58	9240
Feb 2016	668	749	-	0.01	11489	24530
Mar 2016	0	750	-	0.01	15759.7	24350
Apr 2016	692	750	-	0.01	17112.7	24330
May 2016	160	749	-	0.01	18165.2	21300
Jun 2016	719	744	-	0.01	15887.7	18570
Jul 2016	694	723	-	0.01	14728.4	16460
Aug 2016	685	702	-	0.01	13470.6	15290
Sep 2016	676	690	0.01	0.01	12282	13950
Oct 2016	681	710	0.01	0.01	8752.58	14340
Nov 2016	698	718	0.01	0.01	11042.7	15170
Dec 2016	150	723	0.01	0.01	14126.1	19070
Jan 2017	664	718	0.01	0.01	14099.66	16960
Feb 2017	593	715	0.01	0.01	9958	15570
Mar 2017	716.66	732.84	0.01	0.01	2859.03	25080
Apr 2017	713	749	0.01	0.01	8615	25480
May 2017	485.1	512.72	0.01	0.01	12459	23760
Jun 2017	387.46	510.76	0.01	0.01	14445.3	22530
Jul 2017	368.78	381.74	0.01	0.01	12855	14020
Aug 2017	365	371	0.01	0.01	13921.6	14000
Sep 2017	362	366	0.01	0.01	14000	14000
Oct 2017	351	364	0.01	0.01	14000	14000
Nov 2017	349	356	0.01	0.01	13607.3	14000
Dec 2017	346	365	0.05	0.05	9747.1	14000
Jan 2018	353.01	361.52	0.01	0.01	9611.94	14400
Feb 2018	355.41	362.37	0.01	0.01	14026.1	14420
Mar 2018	350.61	363.39	0.01	0.01	14310	14400
Apr 2018	352.9	359.27	0.01	0.01	14401.3	14420
May 2018	356.59	358.33	0.01	0.01	14400.6	14410
Jun 2018	353.7	357.48	0.01	0.01	14331.3	14400
Jul 2018	351.49	367.55	0.01	0.01	14171	14400
Aug 2018	360.71	368.34	<0.01	<0.01	13935.5	14400
Sep 2018	360.38	368.03	<0.01	<0.01	14243	14400
Oct 2018	357.28	367.51	<0.01	<0.01	13984.8	14400
Nov 2018	354.96	368.67	<0.01	<0.01	12510.3	14400
Min	0	356	0.01	0.01	2,859	9,240
Average	454.92	540.04	0.02	0.01	12,877	16,813
Median	362	510.76	0.01	0.01	13,985	14,410
95th %tile	714.1	749.3	0.044	0.01	16,255	24,695
Max	719	750	0.1	0.05	18,165	25,480
Limits	-	750	-	-	14,000	-

Tailings Underdrain Treatment System Effluent

Cond (umhos/cm)	Fe, diss (mg/L)	Mn, diss (mg/L)	NO3 + NO2 (mg/L)	pH (su)	TDS (mg/L)	SO4 (mg/L)
671.6	0.06	0.004	0.28	7.47	425	103
730.3	0.06	0.004	0.85	7.58	416	148
751.2	0.06	0.004	4.55	7.47	463	172
738.9	0.06	0.004	2.54	7.38	459	163
727.1	0.06	0.02	0.13	7.34	487	125
734	<0.05	0.03	0.057	7.48	455	148
715.2	<0.04	<0.02	<0.05	7.33	473	117
706.4	<0.039	0.0037	0.08	7.43	455	138
717.6	<0.039	0.00183	0.205	7.49	457	128
714.3	0.039	0.00155	5.06	7.1	464	239
723.4	0.042	0.00288	0.057	7.16	476	147
742.2	0.039	0.0112	0.186	7.35	485	169
757.6	0.039	0.0124	0.143	7.62	425	159
789.8	0.039	0.00342	0.085	7.59	490	149
779.1	0.039	0.0466	1.24	7.17	513	177
769	0.039	0.0214	0.412	7.54	499	168
797.4	0.045	0.07	0.23	7.45	500	173
812.6	0.045	0.02	3.87	7.37	529	201
809.5	0.045	0.02	0.076	7.36	493	119
750	0.05	0.0142	0.125	7.49	473	136
803.9	0.045	0.0119	0.1	7.59	484	148
763.9	0.045	0.0116	1.36	7.71	493	161
741	0.045	0.00606	0.18	7.36	459	117
728.4	0.045	0.00741	0.24	7.42	435	115
767.4	0.045	0.02	0.484	7.54	488	203
721.7	0.045	0.0208	0.151	7.33	447	97.6
709	0.056	0.0132	0.19	7.16	439	111
684	0.056	0.0228	0.6	7.27	451	137
730	0.056	0.0152	2.88	7.41	452	148
706.4	0.056	0.0125	0.333	7.28	452	109
710.5	0.1	0.0132	0.126	6.98	435	89.4
545	<0.056	0.0101	0.089	6.94	438	57.4
576	<0.056	0.00535	0.061	6.87	395	71.1
556	<0.056	0.0102	0.092	6.77	418	64.6
508	<0.056	0.00395	0.109	7.06	403	83
508	0.039	0.00155	0.057	6.77	395	57.4
719.7	0.050	0.01410	0.799	7.34	461	136.9
730	0.045	0.01175	0.188	7.37	459	138
805.58	0.06	0.03581	4.108	7.599	503.9	201.6
812.6	0.1	0.07	5.06	7.71	529	239

Groundwater Monitoring Wells

Well: TP-1

Date	NO3+NO2 (mg/L)	TDS (mg/L)	SO4 (mg/L)
8/19/2015	4.75	657	130
10/12/2015	4.48	640	67.1
2/11/2016	4.93	644	124
6/7/2016	1.96	535	66.5
8/17/2016	3.83	591	108
10/25/2016	4.36	593	107
3/9/2017	4.93	599	109
6/5/2017	2.85	524	101
8/3/2017	3.28	540	91.4
10/11/2017	4.25	581	77.6
1/16/2018	4.17	582	59
4/4/2018	4.83	573	55.3
8/6/2018	4.86	620	119

Min	1.96	524	55.3
Avg	4.11	591	93.5
Max	4.93	657	130
GW Limit	10	-	235

Well: TP-2

Date	NO3+NO2 (mg/L)	TDS (mg/L)	SO4 (mg/L)
8/19/2015	0.87	497	60.9
10/12/2015	0.422	486	136
2/11/2016	0.832	548	101
6/7/2016	4.28	562	106
8/17/2016	0.715	532	59.3
10/25/2016	1.11	529	68.4
3/9/2017	1.55	552	106
6/5/2017	1.98	647	161
8/3/2017	2.35	610	136
10/11/2017	3.43	603	128
1/16/2018	6.22	615	164
4/11/2018	5.21	594	146
8/15/2018	3.39	603	148

Min	0.42	486	59.3
Avg	2.49	568	117.0
Max	6.22	647	164
GW Limit	7.8	-	167

Well: TP-3

Date	NO3+NO2 (mg/L)	TDS (mg/L)	SO4 (mg/L)
8/19/2015	6.22	384	82.7
10/12/2015	5.85	384	81
2/11/2016	6.06	385	87.5
6/7/2016	5.41	357	80.6
8/17/2016	5.67	369	87.5
10/25/2016	5.3	363	85.4
3/9/2017	6.16	376	90
6/6/2017	5.86	360	87.9
8/3/2017	6.43	382	84.8
10/11/2017	5.57	374	89.4
1/17/2018	4.78	366	85.8
4/24/2018	4.07	362	76.5
8/15/2018	4.36	328	74.8

Min	4.07	328	74.8
Avg	5.52	368	84.1
Max	6.43	385	90
GW Limit	6.6	391	123