TECHNICAL MEMORANDUM

Results of Cyanobacteria and Microcystin Monitoring in the Vicinity of the Klamath Hydroelectric Project

Prepared for: Demian Ebert (PacifiCorp)

Prepared by: E&S Environmental Chemistry, Inc.

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Introduction

This technical memorandum summarizes the results for the 2019 public health monitoring for cyanobacteria species and an associated toxin, microcystin, from Upper Klamath Lake and within PacifiCorp's Klamath Hydroelectric Project (Project) from Keno Reservoir to the Klamath River downstream Iron Gate Dam. Microcystin results from 2019 baseline monitoring program are also included in the results summaries below. This monitoring is particularly focused on *Microcystis aeruginosa* (MSAE) which is known to produce microcystin. This monitoring also assesses the presence of other potentially-toxigenic cyanobacteria, including *Dolichospermum* sp., and others. Monitoring is being conducted pursuant to Interim Measure 15, Water Quality Monitoring Activities, contained in the Klamath Hydroelectric Settlement Agreement (KHSA) executed between the United States Department of Interior, the states of California and Oregon, PacifiCorp, and other parties.

Results from the baseline and public health sampling are used in coordination with the appropriate public health authority to determine if public health advisories are warranted[1,2]. In addition to PacifiCorp's website (www.pacificorp.com/es/hydro/hl/kr.html#), these memos are also posted on the Klamath Basin Monitoring Program's (KBMP) website (www.kbmp.net) and inform the Blue Green Algae tracker on the KBMP website.

The data in Appendix 1 and Appendix 2 summarize results from all of the 2019 public health sampling events to date and microcystin results from the 2019 baseline sampling events, respectively.

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[1] The California State Water Resources Control Board (SWRCB) provides guidelines for posting advisories in recreation water (California SWRCB 2016) for Project waters in California. SWRCB recommends posting advisories in recreation waters at three levels based on laboratory testing for microcystin. The posting levels are Caution, Warning, and Danger at microcystin concentrations of 0.8, 6, and 20 µg/L respectively. Toxin producing cells at concentrations of over 4,000 cells/mL or blooms, scums, or mats would result in posting at the Caution level.

[2] Postings of Project waters in Oregon are coordinated with the Oregon Health Authority (OHA). The health advisory guideline for recreational use in Oregon waters is microcystin concentrations of 8 µg/L (OHA 2019).

Methods

PacifiCorp and the Oregon Department of Environmental Quality (ODEQ) are conducting public health sampling at ten sites (Table 1). Samples are collected and sent for laboratory analysis of potentially toxigenic cyanobacteria, notably MSAE and microcystin, from:

- Three shoreline sites in Upper Klamath Lake, Oregon
- One shoreline site in Keno Reservoir, Oregon
- One shoreline site in J.C. Boyle Reservoir, Oregon
- Four shoreline sites in coves in Copco and Iron Gate reservoirs (i.e., two cove sites in each reservoir), California
- One Klamath River site below Iron Gate Dam near the hatchery bridge, California

Table 1. Sites of cyanobacteria and microcystin public health monitoring in Upper Klamath Lake, Keno Reservoir, J.C Boyle Reservoir, Copco Reservoir, Iron Gate Reservoir, and the Klamath River during 2019.

Location	Approximate River Mile	Sampling Entity	Site ID
Upper Klamath Lake at Eagle Ridge County Park	N/A	ODEQ	UKEP
Upper Klamath Lake at Howard's Bay Park	N/A	ODEQ	UKHP
Upper Klamath Lake at Moore Park	N/A	ODEQ	UKMP
Keno Reservoir at Keno Park	234.0	ODEQ	KEKP
J.C. Boyle Reservoir at Topsy Campground	225.0	ODEQ	BRTC
Copco Reservoir at Mallard Cove	201.5	PacifiCorp	CRMC
Copco Reservoir at Copco Cove	200.0	PacifiCorp	CRCC
Iron Gate Reservoir at Camp Creek	192.8	PacifiCorp	IRCC
Iron Gate Reservoir at John Williams Campground	192.4	PacifiCorp	IRJW
Klamath River below Iron Gate dam near Hatchery Bridge	189.7	PacifiCorp	KRBI

Samples are planned to be taken once in May, November, and December and twice per month in June, July, August, September, and October.

In addition to public health sampling, monthly and bi-monthly baseline sampling for microcystin is conducted by PacifiCorp and the U.S. Bureau of Reclamation (BOR) from May through October at 12 locations extending from Link Dam to the Klamath River downstream of Iron Gate Reservoir (Table 2).

Table 2. Sites of microcystin baseline monitoring from Link Dam to the Klamath River downstream of Iron Gate reservoir during 2019.

Site Description	Approximate River Mile	Depth (m)	Sampling Entity	Site ID
Link Dam	254.4	0.5	BOR	KR254.4
Keno Reservoir at Miller Island	246.0	0.5	BOR	KR246.0
Klamath River below Keno Dam near a USGS Gage	231.8	0.5	BOR	KBK
Klamath River below JC Boyle Reservoir	224.6	0.5	PacifiCorp	KR22460
Klamath River at USGS Gage	219.5	0.5	PacifiCorp	KR21950
Klamath River above Shovel Creek	206.4	0.5	PacifiCorp	KR20642
Copco Reservoir at Buoy Line (surface)	198.7	0.5	PacifiCorp	KR19874
Copco Reservoir at Buoy Line (integrated)	198.7	0-8	PacifiCorp	KR19874
Klamath River below Copco 2 Reservoir	196.5	0.5	PacifiCorp	KR19645
Iron Gate Reservoir at Log Boom (surface)	190.2	0.5	PacifiCorp	KR19019
Iron Gate Reservoir at Log Boom (integrated)	190.2	0-8	PacifiCorp	KR19019
Klamath River below Hatchery Bridge	189.7	0.5	PacifiCorp	KR18973

Public health samples are taken as grab samples offshore according to the standard operating procedure (SOP) developed by the Klamath Blue Green Algae Working Group (www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring). Samples collected for potentially toxic phytoplankton are preserved in Lugol's solution and sent to Aquatic Analysts in Friday Harbor, Washington for analysis. The samples are labeled "Rush" for timely analysis and only potentially toxic cyanobacteria are identified and enumerated. Results for cyanobacteria species are reported as individual cells per milliliter.

Samples for determination of microcystin toxin are placed in a cooler on ice and shipped to the U.S. Environmental Protection Agency (EPA) Region 9 Laboratory in Richmond, California. The samples are analyzed using the competitive Enzyme-Linked ImmunoSorbent Assay (ELISA) method based on the EnviroLogix QuantiPlate Kit with a detection limit of 0.10 µg/L and a quantification limit of 0.15 µg/L. This test method does not distinguish between the specific microcystin congeners, but detects their presence to differing degrees. That is, ELISA test results yield one value as the sum of measurable microcystin variants.

Results

All public health samples (Table 3) and baseline microcystin samples (Tables 4 and 5) were collected as planned. Appendix 3 includes the raw phytoplankton results for the samples reported in Table 3.

Table 3. Summary of available public health laboratory algal identification and enumeration and microcystin results from sampling July and August 2019.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE[1]	AFA[2]	DKFA[3]	Other [4],[5], [6], [7], [8], [9], [10], or [11]	Microcystin (µg/L)
7/10/2019	13:21	UKEP	N/A	ODEQ	UKEP19005	SG	0	7,937,600	0	0	38
7/10/2019	13:37	UKHP	N/A	ODEQ	UKHP19005	SG	0	149,617	0	0	0.16
7/10/2019	13:53	UKMP	N/A	ODEQ	UKMP19005	SG	0	197,735	0	0	0.44
7/10/2019	12:39	KEKP	234	ODEQ	KEKP19005	SG	8,054	2,053,178	0	0	3.2
7/10/2019	12:25	BRTC	225	ODEQ	BRTC19005	SG	632	16,739	0	0	0.18
7/8/2019	16:10	CRMC	201.5	PacifiCorp	KR19815	SG	12,836	139	0	0	2.0
7/8/2019	13:00	CRCC	200.0	PacifiCorp	KR19816	SG	22,908	40,590	0	0	4.8
7/8/2019	12:00	IRCC	192.8	PacifiCorp	KR19817	SG	52,858	17,378	0	0	10
7/8/2019	11:40	IRJW	192.4	PacifiCorp	KR19818	SG	1,804	14,432	0	0	0.31
7/8/2019	17:40	KRBI	189.7	PacifiCorp	KR19819	SG	0	0	0	0	ND
7/30/2019	12:05	UKEP	N/A	ODEQ	UKEP19006	SG	0	4,160,224	0	0	0.13 C1, J
7/30/2019	12:21	UKHP	N/A	ODEQ	UKHP19006	SG	92,556	3,546,576	0	0	36
7/30/2019	12:35	UKMP	N/A	ODEQ	UKMP19006	SG	0	876,323	0	0	0.14 C1, J
7/30/2019	11:19	KEKP	234	ODEQ	KEKP19006	SG	8,613	408,797	0	0	2.1
7/30/2019	11:01	BRTC	225	ODEQ	BRTC19006	SG	0	6,901	0	0	ND
7/22/2019	11:00	CRMC	201.5	PacifiCorp	KR19820	SG	589,555	27,974	0	0	100
7/22/2019	9:30	CRCC	200.0	PacifiCorp	KR19821	SG	2,150,923	126,255,715	0	0	4200
7/22/2019	9:00	IRCC	192.8	PacifiCorp	KR19822	SG	14,798	135,089	0	0	4.5
7/22/2019	8:50	IRJW	192.4	PacifiCorp	KR19823	SG	1,634	75,493	0	0	2.7
7/22/2019	11:30	KRBI	189.7	PacifiCorp	KR19824	SG	0	0	0	0	0.54
8/5/2019	11:00	CRMC	201.5	PacifiCorp	KR19825	SG	73,496	7,517	0	0	*
8/5/2019	11:40	CRCC	200.0	PacifiCorp	KR19826	SG	2,439,836	115,485,574	0	0	*
8/5/2019	10:40	IRCC	192.8	PacifiCorp	KR19827	SG	134,810	161,772	0	0	*
8/5/2019	10:30	IRJW	192.4	PacifiCorp	KR19828	SG	106,753	343,048	0	0	*
8/5/2019	15:45	KRBI	189.7	PacifiCorp	KR19829	SG	3,551	4,439	0	0	*

[1]MSAE = *Microcystis aeruginosa* (cells/mL)
[2]AFA = *Aphanizomenon flos-aquae* (cells/mL)
[3]DKFA = *Dolichospermum flos-aquae* (cells/mL)
Other = Cells/mL of either [4]*Planktothrix (Oscillatoria)* sp., [5]*Gloeotrichia echinulata*, [6]*Dolichospermum* sp., [7]*Lyngbya* sp., [8]*Dolichospermum circinalis,* [9]*Dolichospermum planctonica,* [10]*Planktothrix (Oscillatoria) limosa,* or [11]*Pseudanabaena* spp.
"ND" value indicates a result less than the laboratory analytical detection limit (0.1 µg/L)
"C1" indicates the reported concentration for this analyte is below the quantitation limit.
"J" indicates the reported result for this analyte should be considered an estimated value.
"0" value indicates non-detect by analytical laboratory
"*" value indicates no result available

Table 4. Summary of July 2019 baseline laboratory microcystin results for samples collected in Oregon.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth (m)	Microcystin (µg/L)
7/9/2019	8:30	KR254.4	254.4	BOR	2019KHSA-40	0.5	0.13 C1, J
7/9/2019	11:40	KR246.0	246.0	BOR	2019KHSA-43	0.5	0.12 C1, J
7/9/2019	10:45	KBK	231.8	BOR	2019KHSA-44	0.5	ND
7/9/2019	9:15	KR22460	224.6	PacifiCorp	KR19082	0.5	ND
7/9/2019	10:15	KR21950	219.5	PacifiCorp	KR19083	0.5	ND
7/232019	9:45	KR254.4	254.4	BOR	2019KHSA-46	0.5	0.14 C1, J

"ND" value indicates a result less than the laboratory analytical detection limit (0.1 µg/L)
"C1" indicates the reported concentration for this analyte is below the quantitation limit.
"J" indicates the reported result for this analyte should be considered an estimated value.

Table 5. Summary of July 2019 baseline laboratory microcystin results for samples collected in California.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth (m)	Microcystin (µg/L)
7/8/2019	15:40	KR20642	206.4	PacifiCorp	KR19078	0.5	ND
7/8/2019	13:30	KR19874	198.7	PacifiCorp	KR19074	0.5	0.59
7/8/2019	13:50	KR19874	198.7	PacifiCorp	KR19075	0-8	0.41
7/8/2019	12:30	KR19645	196.5	PacifiCorp	KR19073	0.5	2.5
7/8/2019	9:20	KR19019	190.2	PacifiCorp	KR19069	0.5	1.4
7/8/2019	9:45	KR19019	190.2	PacifiCorp	KR19070	0-8	0.20
7/8/2019	17:00	KR18973	189.7	PacifiCorp	KR19068	0.5	0.11 C1, J
7/8/2019	17:10	KR18973	189.7	PacifiCorp	KR19081	0.5	0.1 C1, J
7/22/2019	11:40	KR18973	189.7	PacifiCorp	KR19084	0.5	0.56

"ND" value indicates a result less than the laboratory analytical detection limit (0.1 µg/L)
"C1" indicates the reported concentration for this analyte is below the quantitation limit.
"J" indicates the reported result for this analyte should be considered an estimated value.

References

California SWRCB 2016. Draft Statewide Voluntary Guidance on CyanoHABs in Recreational Waters. Available online at:
http://www.mywaterquality.ca.gov/monitoring_council/cyanohab_network/docs/triggers.pdf

Oregon Health Authority. 2019. Oregon Harmful Algal Bloom Surveillance (HABS) Program – Recreational Use Public Health Advisory Guidelines, Cyanobacterial Blooms in Freshwater Bodies. 27 pp. Available online at:
https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/RECREATION/HARMFULALGAEBLOOMS/Documents/Advisory-Guidelines-Harmful-Cyanobacterial-Blooms-Recreational-Waters.pdf

Appendix 1

Cyanobacteria Species and Microcystin Data for 2019 Public Health Samples

Table A1. Summary of 2019 public health laboratory algal identification and enumeration microcystin results.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE(1)	AFA(2)	DKFA(3)	Other (4),(5), (6), (7), (8), (9), (10), or (11)	Microcystin (µg/L)
5/21/2019	10:53	UKEP	N/A	ODEQ	UKEP19001	SG	0	0	347	0	0.11 C1, J
5/21/2019	11:09	UKHP	N/A	ODEQ	UKHP19001	SG	0	0	399	0	0.13 C1, J
5/21/2019	11:24	UKMP	N/A	ODEQ	UKMP19001	SG	0	11,318	139,555	0	4.1
5/21/2019	10:19	KEKP	234	ODEQ	KEKP19001	SG	0	2,042	6,967	449[10]	0.10 C1, J
5/21/2019	10:04	BRTC	225	ODEQ	BRTC19001	SG	0	0	0	0	ND
5/18/2019	13:05	CRMC	201.5	PacifiCorp	KR19800	SG	0	0	0	0	ND
5/18/2019	12:30	CRCC	200.0	PacifiCorp	KR19801	SG	0	0	0	0	ND
5/18/2019	12:00	IRCC	192.8	PacifiCorp	KR19802	SG	0	0	0	0	ND
5/18/2019	11:50	IRJW	192.4	PacifiCorp	KR19803	SG	0	0	0	0	ND
5/18/2019	13:50	KRBI	189.7	PacifiCorp	KR19804	SG	0	0	0	0	ND
5/30/2019	11:20	UKEP	N/A	ODEQ	UKEP19002	SG	0	9,698	29,671	0	0.22
5/30/2019	11:38	UKHP	N/A	ODEQ	UKHP19002	SG	0	0	4,747	0	0.14 C1, J
5/30/2019	11:53	UKMP	N/A	ODEQ	UKMP19002	SG	0	12,300	8,279	0	0.10 C1, J
5/30/2019	10:37	KEKP	234	ODEQ	KEKP19002	SG	0	1,793	12,361	0	0.17
5/30/2019	10:23	BRTC	225	ODEQ	BRTC19002	SG	0	480	3,060	0	0.10 C1, J
6/8/2019	16:15	CRMC	201.5	PacifiCorp	KR19805	SG	0	508	0	36[10]	ND
6/8/2019	12:30	CRCC	200.0	PacifiCorp	KR19806	SG	0	2,113	58	0	0.11 C1, J
6/8/2019	11:15	IRCC	192.8	PacifiCorp	KR19807	SG	0	0	58	0	ND
6/8/2019	11:00	IRJW	192.4	PacifiCorp	KR19808	SG	0	0	0	0	ND
6/8/2019	17:05	KRBI	189.7	PacifiCorp	KR19809	SG	0	0	0	0	ND
6/12/2019	12:09	UKEP	N/A	ODEQ	UKEP19003	SG	0	36,864	3,922	0	0.16
6/12/2019	12:31	UKHP	N/A	ODEQ	UKHP19003	SG	0	0	479,787	159,929[5]	1.4
6/12/2019	12:49	UKMP	N/A	ODEQ	UKMP18003	SG	0	641,028	83,443	0	0.10 C1, J
6/12/2019	11:26	KEKP	234	ODEQ	KEKP19003	SG	0	16,751	321,627	0	0.91
6/12/2019	11:09	BRTC	225	ODEQ	BRTC19003	SG	0	8,150	564	0	ND
6/24/2019	09:50	CRMC	201.5	PacifiCorp	KR19810	SG	0	809	0	0	ND
6/24/2019	08:40	CRCC	200.0	PacifiCorp	KR19811	SG	0	10,036	0	0	0.21
6/24/2019	08:15	IRCC	192.8	PacifiCorp	KR19812	SG	0	339	113	0	0.18
6/24/2019	07:50	IRJW	192.4	PacifiCorp	KR19813	SG	0	0	0	0	0.13 C1, J
6/24/2019	10:20	KRBI	189.7	PacifiCorp	KR19814	SG	0	738	0	0	ND
6/25/2019	12:15	UKEP	N/A	ODEQ	UKEP19004	SG	0	231,138	0	0	ND
6/25/2019	12:35	UKHP	N/A	ODEQ	UKHP19004	SG	0	269,202	0	0	0.18
6/25/2019	12:53	UKMP	N/A	ODEQ	UKMP18004	SG	0	106,802	1,622	0	0.18
6/25/2019	11:26	KEKP	234	ODEQ	KEKP19004	SG	0	133,339	0	0	0.15
6/25/2019	11:03	BRTC	225	ODEQ	BRTC19004	SG	0	18,227	0	636[10]	ND
7/10/2019	13:21	UKEP	N/A	ODEQ	UKEP19005	SG	0	7,937,600	0	0	38
7/10/2019	13:37	UKHP	N/A	ODEQ	UKHP19005	SG	0	149,617	0	0	0.16
7/10/2019	13:53	UKMP	N/A	ODEQ	UKMP19005	SG	0	197,735	0	0	0.44
7/10/2019	12:39	KEKP	234	ODEQ	KEKP19005	SG	8,054	2,053,178	0	0	3.2
7/10/2019	12:25	BRTC	225	ODEQ	BRTC19005	SG	632	16,739	0	0	0.18
7/8/2019	16:10	CRMC	201.5	PacifiCorp	KR19815	SG	12,836	139	0	0	2.0
7/8/2019	13:00	CRCC	200.0	PacifiCorp	KR19816	SG	22,908	40,590	0	0	4.8
7/8/2019	12:00	IRCC	192.8	PacifiCorp	KR19817	SG	52,858	17,378	0	0	10

Table A1 cont.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth	MSAE[1]	AFA[2]	DKFA[3]	Other [4],[5], [6], [7], [8], [9], [10], or [11]	Microcystin (µg/L)
7/8/2019	17:40	KRBI	189.7	PacifiCorp	KR19819	SG	0	0	0	0	ND
7/30/2019	12:05	UKEP	N/A	ODEQ	UKEP19006	SG	0	4,160,224	0	0	0.13 C1, J
7/30/2019	12:21	UKHP	N/A	ODEQ	UKHP19006	SG	92,556	3,546,576	0	0	36
7/30/2019	12:35	UKMP	N/A	ODEQ	UKMP19006	SG	0	876,323	0	0	0.14 C1, J
7/30/2019	11:19	KEKP	234	ODEQ	KEKP19006	SG	8,613	408,797	0	0	2.1
7/30/2019	11:01	BRTC	225	ODEQ	BRTC19006	SG	0	6,901	0	0	ND
7/22/2019	11:00	CRMC	201.5	PacifiCorp	KR19820	SG	589,555	27,974	0	0	100
7/22/2019	9:30	CRCC	200.0	PacifiCorp	KR19821	SG	2,150,923	126,255,715	0	0	4200
7/22/2019	9:00	IRCC	192.8	PacifiCorp	KR19822	SG	14,798	135,089	0	0	4.5
7/22/2019	8:50	IRJW	192.4	PacifiCorp	KR19823	SG	1,634	75,493	0	0	2.7
7/22/2019	11:30	KRBI	189.7	PacifiCorp	KR19824	SG	0	0	0	0	0.54
8/5/2019	11:00	CRMC	201.5	PacifiCorp	KR19825	SG	73,496	7,517	0	0	*
8/5/2019	11:40	CRCC	200.0	PacifiCorp	KR19826	SG	2,439,836	115,485,574	0	0	*
8/5/2019	10:40	IRCC	192.8	PacifiCorp	KR19827	SG	134,810	161,772	0	0	*
8/5/2019	10:30	IRJW	192.4	PacifiCorp	KR19828	SG	106,753	343,048	0	0	*
8/5/2019	15:45	KRBI	189.7	PacifiCorp	KR19829	SG	3,551	4,439	0	0	*

[1]MSAE = *Microcystis aeruginosa* (cells/mL)
[2]AFA = *Aphanizomenon flos-aquae* (cells/mL)
[3]DKFA = *Dolichospermum flos-aquae* (cells/mL)
Other = Cells/mL of either [4]*Planktothrix (Oscillatoria)* sp., [5]*Gloeotrichia echinulata*, [6]*Dolichospermum* sp., [7]*Lyngbya* sp., [8]*Dolichospermum circinalis,* [9]*Dolichospermum planctonica,* [10]*Planktothrix (Oscillatoria) limosa,* or [11]*Pseudanabaena* spp.
"ND" value indicates a result less than the laboratory analytical detection limit (0.1 µg/L)
"C1" indicates the reported concentration for this analyte is below the quantitation limit.
"J" indicates the reported result for this analyte should be considered an estimated value.
"0" value indicates non-detect by analytical laboratory
"*" value indicates no result available

Appendix 2
Microcystin Data for 2019 Baseline Samples

Table A2-1. Summary of 2019 baseline laboratory microcystin results for samples collected in Oregon.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth (m)	Microcystin (µg/L)
5/7/2019	08:45	KR246.0	246.0	BOR	2019KHSA-22	0.5	ND
5/7/2019	11:00	KBK	231.8	BOR	2019KHSA-23	0.5	ND
5/5/2019	08:15	KR22460	224.6	PacifiCorp	KR19047	0.5	0.10 C1, J
5/5/2019	09:20	KR21950	219.5	PacifiCorp	KR19048	0.5	ND
6/4/2019	09:00	KR246.0	246.0	BOR	2019KHSA-32	0.5	0.12 C1, J
6/4/2019	11:20	KBK	231.8	BOR	2019KHSA-33	0.5	ND
6/9/2019	8:35	KR22460	224.6	PacifiCorp	KR19064	0.5	0.14 C1, J
6/9/2019	9:20	KR21950	219.5	PacifiCorp	KR19065	0.5	0.10 C1, J
7/9/2019	8:30	KR254.4	254.4	BOR	2019KHSA-40	0.5	0.13 C1, J
7/9/2019	11:40	KR246.0	246.0	BOR	2019KHSA-43	0.5	0.12 C1, J
7/9/2019	10:45	KBK	231.8	BOR	2019KHSA-44	0.5	ND
7/9/2019	9:15	KR22460	224.6	PacifiCorp	KR19082	0.5	ND
7/9/2019	10:15	KR21950	219.5	PacifiCorp	KR19083	0.5	ND
7/232019	9:45	KR254.4	254.4	BOR	2019KHSA-46	0.5	0.14 C1, J

"ND" value indicates a result less than the laboratory analytical detection limit (0.1 µg/L)
"C1" indicates the reported concentration for this analyte is below the quantitation limit.
"J" indicates the reported result for this analyte should be considered an estimated value.

Table A2-2. Summary of 2019 baseline laboratory microcystin results for samples collected in California.

Date	Time	Site ID	RM	Sampling Entity	Sample ID	Depth (m)	Microcystin (µg/L)
5/4/2019	15:30	KR20642	206.4	PacifiCorp	KR19043	0.5	ND
5/4/2019	13:30	KR19874	198.7	PacifiCorp	KR19039	0.5	ND
5/4/2019	13:40	KR19874	198.7	PacifiCorp	KR19040	0-8	ND
5/4/2019	12:30	KR19645	196.5	PacifiCorp	KR19038	0.5	ND
5/4/2019	09:30	KR19019	190.2	PacifiCorp	KR19034	0.5	ND
5/4/2019	9:55	KR19019	190.2	PacifiCorp	KR19035	0-8	ND
6/8/2019	15:45	KR20642	206.4	PacifiCorp	KR19060	0.5	0.16
6/8/2019	13:00	KR19874	198.7	PacifiCorp	KR19056	0.5	ND
6/8/2019	13:15	KR19874	198.7	PacifiCorp	KR19057	0-8	0.12 C1, J
6/8/2019	11:45	KR19645	196.5	PacifiCorp	KR19055	0.5	ND
6/8/2019	9:00	KR19019	190.2	PacifiCorp	KR19051	0.5	ND
6/8/2019	9:20	KR19019	190.2	PacifiCorp	KR19052	0-8	ND
6/8/2019	17:15	KR18973	189.7	PacifiCorp	KR19063	0.5	ND
6/24/2019	10:30	KR18973	189.7	PacifiCorp	KR19066	0.5	ND
7/8/2019	15:40	KR20642	206.4	PacifiCorp	KR19078	0.5	ND
7/8/2019	13:30	KR19874	198.7	PacifiCorp	KR19074	0.5	0.59
7/8/2019	13:50	KR19874	198.7	PacifiCorp	KR19075	0-8	0.41
7/8/2019	12:30	KR19645	196.5	PacifiCorp	KR19073	0.5	2.5
7/8/2019	9:20	KR19019	190.2	PacifiCorp	KR19069	0.5	1.4
7/8/2019	9:45	KR19019	190.2	PacifiCorp	KR19070	0-8	0.20
7/8/2019	17:00	KR18973	189.7	PacifiCorp	KR19068	0.5	0.11 C1, J
7/8/2019	17:10	KR18973	189.7	PacifiCorp	KR19081	0.5	0.1 C1, J
7/22/2019	11:40	KR18973	189.7	PacifiCorp	KR19084	0.5	0.56

"ND" value indicates a result less than the laboratory analytical detection limit (0.1 µg/L)
"C1" indicates the reported concentration for this analyte is below the quantitation limit.
"J" indicates the reported result for this analyte should be considered an estimated value.

Appendix 3
Laboratory Phytoplankton Results

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: BRTC19001
Sample Depth:
Sample Date: 21-May-19 1004

Total Density (#/mL): <3
Total Biovolume (um^3/mL):
Trophic State Index:

Species		Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
-	-		-	-	-
No Toxic Algae Present		<3			

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF51

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	KEKP19001	
Sample Depth:		
Sample Date:	21-May-19	1019
Total Density (#/mL):	348	
Total Biovolume (um^3/mL):	623,244	
Trophic State Index:	46.4	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Dolichospermum flos-aquae	258	74.2	466,785	74.9
Aphanizomenon flos-aquae	79	22.6	128,636	20.6
Oscillatoria limosa	11	3.2	27,823	4.5

Dolichospermum flos-aquae cells/mL =	6,967
Aphanizomenon flos-aquae cells/mL =	2,042
Oscillatoria limosa cells/mL =	449

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** VF52

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKHP	
Sample Depth:		
Sample Date:	21-May-19	1109
Total Density (#/mL):	6	
Total Biovolume (um^3/mL):	26,707	
Trophic State Index:	24.0	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Dolichospermum flos-aquae	6	100.0	26,707	100.0

Dolichospermum flos-aquae cells/mL = 399

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF54

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKEP19001	
Sample Depth:		
Sample Date:	21-May-19	1053
Total Density (#/mL):	6	
Total Biovolume (um^3/mL):	23,244	
Trophic State Index:	23.0	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Dolichospermum flos-aquae	6	100.0	23,244	100.0

Dolichospermum flos-aquae cells/mL = 347

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF53

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKMP19001	
Sample Depth:		
Sample Date:	21-May-19	1124

Total Density (#/mL):	4,085
Total Biovolume (um^3/mL):	10,063,172
Trophic State Index:	66.5

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Dolichospermum flos-aquae	3,489	85.4	9,350,166	92.9
Aphanizomenon flos-aquae	596	14.6	713,005	7.1

Dolichospermum flos-aquae cells/mL =	139,555
Aphanizomenon flos-aquae cells/mL =	11,318

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF55

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	BRTC19002	
Sample Depth:		
Sample Date:	30-May-19	1023
Total Density (#/mL):	101	
Total Biovolume (um^3/mL):	235,245	
Trophic State Index:	39.4	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Dolichospermum flos-aquae	75	73.7	205,018	87.2
Aphanizomenon flos-aquae	27	26.3	30,227	12.8

Aphanizomenon flos-aquae cells/mL =	480
Dolichospermum flos-aquae cells/mL =	3,060

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF56

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	KEKP19002	
Sample Depth:		
Sample Date:	30-May-19	1037
Total Density (#/mL):	245	
Total Biovolume (um^3/mL):	941,120	
Trophic State Index:	49.4	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Dolichospermum flos-aquae	167	68.2	828,170	88.0
Aphanizomenon flos-aquae	78	31.8	112,950	12.0

Aphanizomenon flos-aquae cells/mL =	1,793
Dolichospermum flos-aquae cells/mL =	12,361

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF57

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: UKEP19002
Sample Depth:
Sample Date: 30-May-19 1120

Total Density (#/mL): 1,289
Total Biovolume (um^3/mL): 2,598,947
Trophic State Index: 56.7

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Dolichospermum flos-aquae	848	65.8	1,987,961	76.5
Aphanizomenon flos-aquae	441	34.2	610,986	23.5

Aphanizomenon flos-aquae cells/mL = 9,698

Dolichospermum flos-aquae cells/mL = 29,671

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** VF58

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKHP19002	
Sample Depth:		
Sample Date:	30-May-19	1138

Total Density (#/mL):	170
Total Biovolume (um^3/mL):	318,074
Trophic State Index:	41.6

Species	-	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
-	-		-	-	-
Dolichospermum flos-aquae		170	100.0	318,074	100.0

Dolichospermum flos-aquae cells/mL = 4,747

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF59

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKMP19002	
Sample Depth:		
Sample Date:	30-May-19	1153

Total Density (#/mL):	749
Total Biovolume (um^3/mL):	1,329,583
Trophic State Index:	51.9

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	473	63.2	774,900	58.3
Dolichospermum flos-aquae	276	36.8	554,683	41.7

Aphanizomenon flos-aquae cells/mL =	12,300
Dolichospermum flos-aquae cells/mL =	8,279

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF60

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	BRTC19003	
Sample Depth:		
Sample Date:	12-Jun-19	1109
Total Density (#/mL):	370	
Total Biovolume (um^3/mL):	551,235	
Trophic State Index:	45.6	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	354	95.7	513,464	93.1
Dolichospermum flos-aquae	16	4.3	37,771	6.9

Aphanizomenon flos-aquae cells/mL =	8,150
Dolichospermum flos-aquae cells/mL =	564

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF61

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	KEKP19003	
Sample Depth:		
Sample Date:	12-Jun-19	1126
Total Density (#/mL):	6,829	
Total Biovolume (um^3/mL):	22,604,378	
Trophic State Index:	72.3	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Dolichospermum flos-aquae	6,185	90.6	21,549,038	95.3
Aphanizomenon flos-aquae	644	9.4	1,055,340	4.7

Dolichospermum flos-aquae cells/mL =	321,627
Aphanizomenon flos-aquae cells/mL =	16,751

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF62

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKEP19003	
Sample Depth:		
Sample Date:	12-Jun-19	1209
Total Density (#/mL):	1,699	
Total Biovolume (um^3/mL):	2,585,210	
Trophic State Index:	56.7	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	1,536	90.4	2,322,454	89.8
Dolichospermum flos-aquae	163	9.6	262,757	10.2

Aphanizomenon flos-aquae cells/mL =	36,864
Dolichospermum flos-aquae cells/mL =	3,922

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF63

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKHP19003	
Sample Depth:		
Sample Date:	12-Jun-19	1231
Total Density (#/mL):	20,071	
Total Biovolume (um^3/mL):	43,020,922	
Trophic State Index:	77.0	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Dolichospermum flos-aquae	19,991	99.6	32,145,745	74.7
Gloeotrichia echinulata	80	0.4	10,875,177	25.3

Dolichospermum flos-aquae cells/mL =	479,787
Gloeotrichia echinulata cells/mL =	159,929

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF64

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKMP19003	
Sample Depth:		
Sample Date:	12-Jun-19	1249
Total Density (#/mL):	31,080	
Total Biovolume (um^3/mL):	45,975,481	
Trophic State Index:	77.5	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	27,871	89.7	40,384,770	87.8
Dolichospermum flos-aquae	3,209	10.3	5,590,711	12.2

Aphanizomenon flos-aquae cells/mL =	641,028
Dolichospermum flos-aquae cells/mL =	83,443

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF65

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	BRTC19004	
Sample Depth:		
Sample Date:	25-Jun-19	1103
Total Density (#/mL):	933	
Total Biovolume (um^3/mL):	1,187,690	
Trophic State Index:	51.1	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	911	97.7	1,148,270	96.7
Oscillatoria limosa	21	2.3	39,420	3.3

Aphanizomenon flos-aquae cells/mL =	18,227
Oscillatoria limosa cells/mL =	636

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF66

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	KEKP19004	
Sample Depth:		
Sample Date:	25-Jun-19	1126
Total Density (#/mL):	5,556	
Total Biovolume (um^3/mL):	8,400,365	
Trophic State Index:	65.2	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	5,556	100.0	8,400,365	100.0

Aphanizomenon flos-aquae cells/mL = 133,339

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF67

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKEP19004	
Sample Depth:		
Sample Date:	25-Jun-19	1215
Total Density (#/mL):	10,506	
Total Biovolume (um^3/mL):	14,561,663	
Trophic State Index:	69.2	

Species	-	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae		10,506	100.0	14,561,663	100.0

Aphanizomenon flos-aquae cells/mL = 231,138

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF68

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKHP19004	
Sample Depth:		
Sample Date:	25-Jun-19	1235
Total Density (#/mL):	12,819	
Total Biovolume (um^3/mL):	16,959,698	
Trophic State Index:	70.3	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	12,819	100.0	16,959,698	100.0

Aphanizomenon flos-aquae cells/mL = 269,202

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF69

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: UKMP19004
Sample Depth:
Sample Date: 25-Jun-19 1253

Total Density (#/mL): 4,380
Total Biovolume (um^3/mL): 6,837,192
Trophic State Index: 63.7

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	4,272	97.5	6,728,498	98.4
Dolichospermum flos-aquae	108	2.5	108,694	1.6

Aphanizomenon flos-aquae cells/mL = 106,802

Dolichospermum flos-aquae cells/mL = 1,622

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF70

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19815	
Sample Depth:	0	
Sample Date:	8-Jul-19	1610
Total Density (#/mL):	1,295	
Total Biovolume (um^3/mL):	111,432	
Trophic State Index:	34.1	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Microcystis aeruginosa	1,284	99.1	102,689	92.2
Aphanizomenon flos-aquae	12	0.9	8,742	7.8

Microcystis aeruginosa cells/mL =	12,836
Aphanizomenon flos-aquae cells/mL =	139

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD42

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19816	
Sample Depth:	0	
Sample Date:	8-Jul-19	1300

Total Density (#/mL):	4,224
Total Biovolume (um^3/mL):	2,740,433
Trophic State Index:	57.1

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Microcystis aeruginosa	2,291	54.2	183,263	6.7
Aphanizomenon flos-aquae	1,933	45.8	2,557,170	93.3

Microcystis aeruginosa cells/mL =	22,908
Aphanizomenon flos-aquae cells/mL =	40,590

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD43

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19817	
Sample Depth:	0	
Sample Date:	8-Jul-19	1200
Total Density (#/mL):	6,113	
Total Biovolume (um^3/mL):	1,517,677	
Trophic State Index:	52.9	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Microcystis aeruginosa	5,286	86.5	422,864	27.9
Aphanizomenon flos-aquae	828	13.5	1,094,813	72.1

Microcystis aeruginosa cells/mL =	52,858
Aphanizomenon flos-aquae cells/mL =	17,378

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD44

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19818
Sample Depth: 0
Sample Date: 8-Jul-19 1140

Total Density (#/mL): 782
Total Biovolume (um^3/mL): 923,648
Trophic State Index: 49.3

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	601	76.9	909,216	98.4
Microcystis aeruginosa	180	23.1	14,432	1.6

Aphanizomenon flos-aquae cells/mL = 14,432

Microcystis aeruginosa cells/mL = 1,804

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD45

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19819
Sample Depth: 0
Sample Date: 8-Jul-19 1740

Total Density (#/mL): <9
Total Biovolume (um^3/mL):
Trophic State Index:

Species		Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
-	-		-	-	-
No Toxic Algae Present		<9			

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD46

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19820
Sample Depth:
Sample Date: 22-Jul-19 1100

Total Density (#/mL): 50,602
Total Biovolume (um^3/mL): 6,478,824
Trophic State Index: 63.3

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Microcystis aeruginosa	49,130	97.1	4,716,437	72.8
Aphanizomenon flos-aquae	1,472	2.9	1,762,387	27.2

Microcystis aeruginosa cells/mL = 589,555

Aphanizomenon flos-aquae cells/mL = 27,974

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD58

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19821
Sample Depth:
Sample Date: 22-Jul-19 930

Total Density (#/mL): 6,026,054
Total Biovolume (um^3/mL): 7,971,317,454
Trophic State Index: 114.7

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	6,012,177	99.8	7,954,110,069	99.8
Microcystis aeruginosa	13,877	0.2	17,207,385	0.2

Aphanizomenon flos-aquae cells/mL = 126,255,715

Microcystis aeruginosa cells/mL = 2,150,923

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD59

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19822	
Sample Depth:		
Sample Date:	22-Jul-19	900

Total Density (#/mL):	8,985
Total Biovolume (um^3/mL):	8,628,969
Trophic State Index:	65.4

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	7,505	83.5	8,510,581	98.6
Microcystis aeruginosa	1,480	16.5	118,388	1.4

Aphanizomenon flos-aquae cells/mL =	135,089
Microcystis aeruginosa cells/mL =	14,798

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD60

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19823	
Sample Depth:		
Sample Date:	22-Jul-19	850

Total Density (#/mL):	3,758
Total Biovolume (um^3/mL):	4,769,162
Trophic State Index:	61.1

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	3,595	95.7	4,756,089	99.7
Microcystis aeruginosa	163	4.3	13,072	0.3

Aphanizomenon flos-aquae cells/mL =	75,493
Microcystis aeruginosa cells/mL =	1,634

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD61

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19824
Sample Depth:
Sample Date: 22-Jul-19 1130

Total Density (#/mL): <8
Total Biovolume (um^3/mL):
Trophic State Index:

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
-	-	-	-	-
No Toxic Algae Present	<8			

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD62

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	BRTC19005	
Sample Depth:		
Sample Date:	10-Jul-19	1225

Total Density (#/mL):	733
Total Biovolume (um^3/mL):	1,059,597
Trophic State Index:	50.3

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	670	91.4	1,054,544	99.5
Microcystis aeruginosa	63	8.6	5,053	0.5

Aphanizomenon flos-aquae cells/mL =	16,739
Microcystis aeruginosa cells/mL =	632

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF71

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: KEKP19005
Sample Depth:
Sample Date: 10-Jul-19 1239

Total Density (#/mL): 98,576
Total Biovolume (um^3/mL): 129,414,611
Trophic State Index: 84.9

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	97,770	99.2	129,350,183	100.0
Microcystis aeruginosa	805	0.8	64,429	0.0

Aphanizomenon flos-aquae cells/mL = 2,053,178

Microcystis aeruginosa cells/mL = 8,054

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** VF72

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: UKEP19005
Sample Depth:
Sample Date: 10-Jul-19 1321

Total Density (#/mL): 360,800
Total Biovolume (um^3/mL): 500,068,800
Trophic State Index: 94.7

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	360,800	100.0	500,068,800	100.0

Aphanizomenon flos-aquae cells/mL = 7,937,600

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** VF73

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKHP19005	
Sample Depth:		
Sample Date:	10-Jul-19	1337
Total Density (#/mL):	7,875	
Total Biovolume (um^3/mL):	9,425,900	
Trophic State Index:	66.0	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	7,875	100.0	9,425,900	100.0

Aphanizomenon flos-aquae cells/mL = 149,617

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF74

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKMP19005	
Sample Depth:		
Sample Date:	10-Jul-19	1353
Total Density (#/mL):	8,597	
Total Biovolume (um^3/mL):	12,457,325	
Trophic State Index:	68.0	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	8,597	100.0	12,457,325	100.0

Aphanizomenon flos-aquae cells/mL = 197,735

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF75

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	BRTC19006	
Sample Depth:		
Sample Date:	30-Jul-19	1101
Total Density (#/mL):	363	
Total Biovolume (um^3/mL):	434,776	
Trophic State Index:	43.8	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	363	100.0	434,776	100.0

Aphanizomenon flos-aquae cells/mL = 6,901

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF76

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: KEKP19006
Sample Depth:
Sample Date: 30-Jul-19 1119

Total Density (#/mL): 18,635
Total Biovolume (um^3/mL): 25,823,117
Trophic State Index: 73.3

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	17,774	95.4	25,754,214	99.7
Microcystis aeruginosa	861	4.6	68,903	0.3

Aphanizomenon flos-aquae cells/mL = 408,797

Microcystis aeruginosa cells/mL = 8,613

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF77

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: UKEP19006
Sample Depth:
Sample Date: 30-Jul-19 1205

Total Density (#/mL): 198,106
Total Biovolume (um^3/mL): 262,094,140
Trophic State Index: 90.0

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	198,106	100.0	262,094,140	100.0

Aphanizomenon flos-aquae cells/mL = 4,160,224

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** VF78

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: UKHP19006
Sample Depth:
Sample Date: 30-Jul-19 1221

Total Density (#/mL): 186,584
Total Biovolume (um^3/mL): 224,174,767
Trophic State Index: 88.9

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	177,329	95.0	223,434,319	99.7
Microcystis aeruginosa	9,256	5.0	740,448	0.3

Aphanizomenon flos-aquae cells/mL = 3,546,576

Microcystis aeruginosa cells/mL = 92,556

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** VF79

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample Site:	UKMP19006	
Sample Depth:		
Sample Date:	30-Jul-19	1235
Total Density (#/mL):	39,833	
Total Biovolume (um^3/mL):	55,208,326	
Trophic State Index:	78.8	

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	39,833	100.0	55,208,326	100.0

Aphanizomenon flos-aquae cells/mL = 876,323

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: VF80

Sample:	Klamath Basin	
Sample ID:	KR19825	
Sample Depth:		
Sample Date:	5-Aug-19	1500

Total Density (#/mL):	7,767
Total Biovolume (um^3/mL):	1,061,520
Trophic State Index:	50.3

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
-	-	-	-	-
Microcystis aeruginosa	7,350	94.6	587,970	55.4
Aphanizomenon flos-aquae	418	5.4	473,550	44.6

Microcystis aeruginosa cells/mL =	73,496
Aphanizomenon flos-aquae cells/mL =	7,517

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD73

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19826
Sample Depth:
Sample Date: 5-Aug-19 1140

Total Density (#/mL): 5,271,525
Total Biovolume (um^3/mL): 7,295,109,836
Trophic State Index: 114.0

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Aphanizomenon flos-aquae	5,249,344	99.6	7,275,591,148	99.7
Microcystis aeruginosa	22,180	0.4	19,518,689	0.3

Aphanizomenon flos-aquae cells/mL = 115,485,574

Microcystis aeruginosa cells/mL = 2,439,836

Note: Toxic Algae Only

Aquatic Analysts **Sample ID:** WD74

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample ID: KR19827
Sample Depth:
Sample Date: 5-Aug-19 1040

Total Density (#/mL): 20,834
Total Biovolume (um^3/mL): 11,270,098
Trophic State Index: 67.3

Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
Microcystis aeruginosa	13,481	64.7	1,078,478	9.6
Aphanizomenon flos-aquae	7,353	35.3	10,191,620	90.4

Microcystis aeruginosa cells/mL = 134,810

Aphanizomenon flos-aquae cells/mL = 161,772

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD75

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19828	
Sample Depth:		
Sample Date:	5-Aug-19	1030
Total Density (#/mL):	26,268	
Total Biovolume (um^3/mL):	22,466,037	
Trophic State Index:	72.3	

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Aphanizomenon flos-aquae	15,593	59.4	21,612,016	96.2
Microcystis aeruginosa	10,675	40.6	854,021	3.8

Microcystis aeruginosa cells/mL =	106,753
Aphanizomenon flos-aquae cells/mL =	343,048

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD76

Phytoplankton Sample Analysis

Sample:	Klamath Basin	
Sample ID:	KR19829	
Sample Depth:		
Sample Date:	5-Aug-19	1545

Total Density (#/mL):	577
Total Biovolume (um^3/mL):	308,065
Trophic State Index:	41.4

Species	**Density #/mL**	**Density Percent**	**Biovolume um^3/mL**	**Biovolume Percent**
Microcystis aeruginosa	355	61.5	28,409	9.2
Aphanizomenon flos-aquae	222	38.5	279,656	90.8

Microcystis aeruginosa cells/mL =	3,551
Aphanizomenon flos-aquae cells/mL =	4,439

Note: Toxic Algae Only

Aquatic Analysts

Sample ID: WD77