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Staff Report

Cinder Cone Springs, Placer County

Recommendation to Remove Cinder Cone Springs from the Clean Water Act Section 303(d) List of Impaired Waterbodies

California Regional Water Quality Control Board
Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150

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recent data

Contact Person:
Anne Sutherland
Engineering Geologist
Asutherland@rb6s.swrcb.ca.gov
530/542-5450

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Tables and Figures

1. INTRODUCTION

Cinder Cone Springs are included on the Clean Water Act Section 303(d) list of impaired waters due to elevated measurements of total dissolved solids, nutrients, chlorides and salinity. Percolation trenches in the vicinity of Cinder Cone Springs were used for land disposal of primary-treated sewage effluent in the 1970's, contributing pollutants to the groundwater-fed springs. Sewage disposal in the area has not occurred since 1978, and the data that led to the 303(d) listing is over 25 years old. Regional Board staff investigated the water quality of Cinder Cone Springs in 2003, and found that natural attenuation has been effective in restoring the springs to conditions better than those reported before sewage discharge began. This report summarizes and compares the available data on historical and current water quality for the springs, and recommends that Cinder Cone Springs be removed from the 303(d) list of impaired waters.

2. BACKGROUND

Watershed Description

Cinder Cone Springs are located in the Truckee River Hydrologic Unit (635.00), just northwest of Lake Tahoe (Figure 1). They are a group of springs originating from a dormant volcanic cinder cone composed of feldspar-rich fractured volcanic rocks overlying older Tertiary andesitic volcanic flows. The cinder cone sits at an elevation of 7,600 feet above mean sea level and is located about three miles northwest of Tahoe City in Placer County. The springs outcrop primarily near the base of the Truckee River canyon to the northwest, west and south of the cinder cone, and are tributary to the Truckee River, downstream of the outlet of Lake Tahoe.

Cinder Cone Springs are located on mostly undeveloped federal land administered by the U.S. Forest Service - Tahoe National Forest. Nearby populated areas include the town of Truckee, the developed shoreline of Lake Tahoe, and small communities near ski resorts such as Squaw Valley and Alpine Meadows. A tract of summer-use cabins is located at Twin Crags, along Highway 89. In the immediate area of the Cinder Cone, land uses consist mainly of hiking, biking and other forest recreation uses.

The climate is typical of high mountain areas, characterized by mild summers and cold winters. From 1948 to 2000, the average annual temperature was 43 °F, with average highs of 78 °F during summer and 41 °F in winter months. Precipitation measured at the Truckee Range Station averaged 33 inches annually, ranging from 16 to 55 inches for the period of record. (1948-2000). Precipitation is mostly in the form of snow, which averages 208 inches (www.wrcc.dri.edu). Elevations in the Truckee River watershed range from peaks of 10,000 feet in the Sierra Nevada to 4,000 feet on the east end entering Nevada.

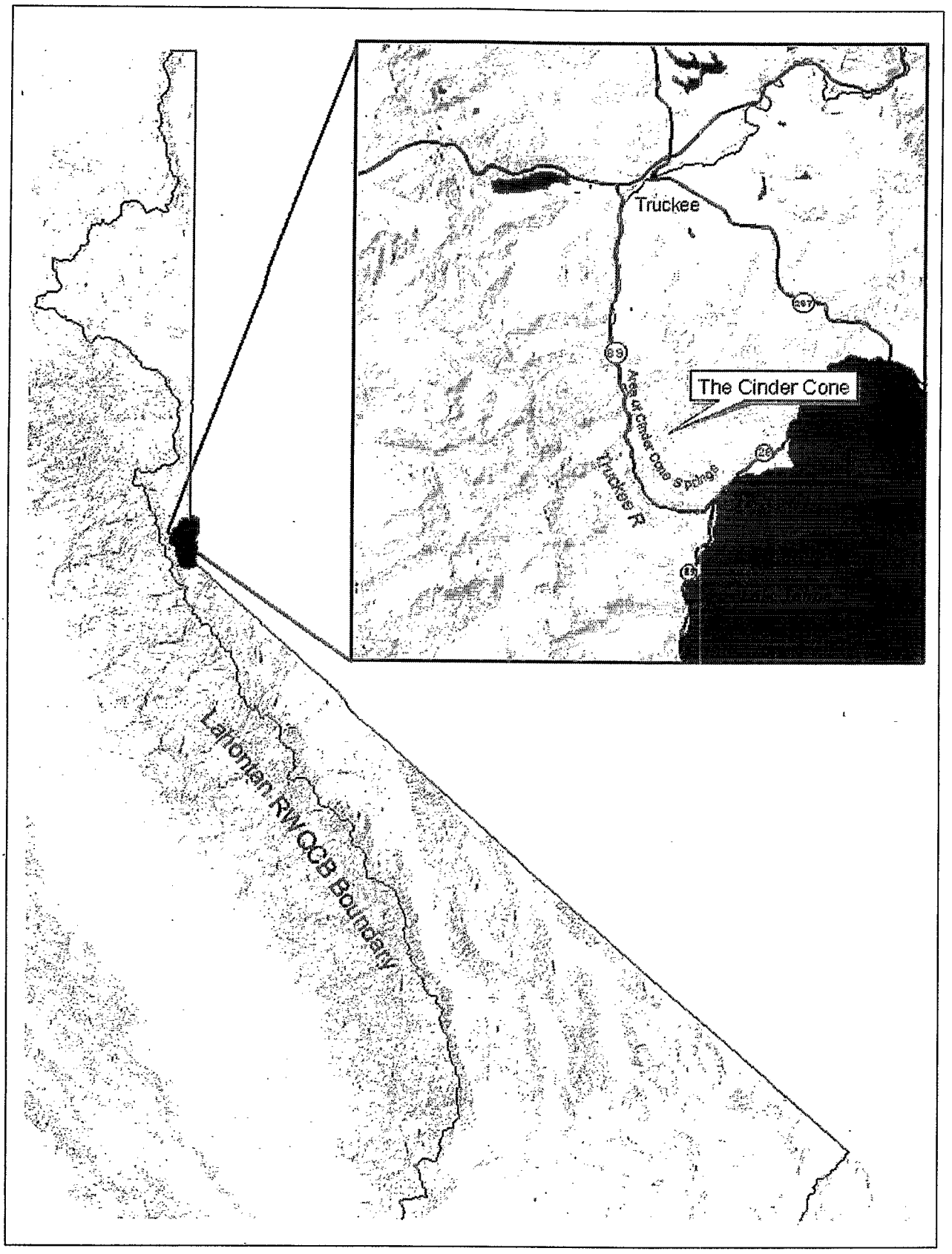

Figure 1. Cinder Cone Springs Location Map.

Conditions Leading to Impairment

The Cinder Cone was used by the North Tahoe and Tahoe City Public Utility Districts (PUDs) to dispose of sewage effluent from the Lake Tahoe basin from April 1970 to February 1978. The increasing pace of urbanization in the Lake Tahoe area beginning in the 1950's led to regulations requiring that sewage effluent be exported from the basin to protect the lake's famed clarity. The site was selected after extensive field investigations and evaluations by representatives from federal and state agencies, local PUDs, and private citizens. Seismic refraction and drilling investigations indicated favorable conditions for infiltration of effluent, including a subsurface ridge or barrier beneath the fractured volcanic rock of the Cinder Cone, which directed groundwater flow west to the Truckee River drainage, keeping effluent out of the Lake Tahoe basin.

Primary-treated liquid waste was percolated into trenches in the highly fractured volcanic bedrock, with a maximum allowable seven-day average flow of 2.8 million gallons per day. Thirteen receiving water sampling sites were established to monitor the effects of the discharge on the springs and the Truckee River (Lahontan RWQCB, 1976).

Effluent disposal to the Cinder Cone ended when the Tahoe-Truckee Sanitation Agency's (TTSA) regional wastewater treatment plant (WWTP) became operational in 1978. This facility discharges treated wastewater to a subsurface leachfield, ultimately percolating through soil to Martis Creek and the Truckee River, about 13 miles downstream from the Cinder Cone (TTSA, 1981). The WWTP has been expanded since 1978, and currently provides sewage treatment for its five member districts located in the Tahoe and Truckee River basins.

3. 303(D) LISTING BASIS

Data Discussion

Cinder Cone Springs is included on the Clean Water Act Section 303(d) list due to elevated total dissolved solids (TDS), nutrients, chlorides (Cl) and salinity (specific conductance [SC]). The listing is based on data collected by Regional Board staff in 1977 to document water quality in the Truckee River and its tributaries prior to the opening of TTSA's advanced wastewater treatment facilities. The data are contained in the 1979 *Truckee River Water Quality Control Plan* (Lahontan RWQCB, 1979), and summarized in Table 1, below.

Table 1. Water Quality Data from Six Cinder Cone Springs Sites, 1977.

		TDS	Cl	Nitrate	TKN	Total Phosphate	SC
Fall 1977 Spring Sampling Site #	# of Samples	*Mean Concentrations (mg/L)*					*(µmhos/cm)*
10	11	66	1.4	0.8	0.65	0.03	52
11	11	69	1.9	2.0	0.59	0.05	96
12	11	398	66.6	70.2	0.18	0.14	425
13	11	380	90.0	105.0	0.47	0.33	462
15	11	428	78.7	98.0	0.47	0.37	408
17	11	200	25.8	30.0	0.31	0.03	223
Averages	**11**	**257**	**44.0**	**51.0**	**0.45**	**0.16**	**278**

No specific water quality objectives are designated for the springs, but in 1969, prior to the Cinder Cone effluent discharges, the Tahoe City PUD collected baseline data to document water quality before discharges commenced. When compared to that baseline data, the 1977 data show significant increases in TDS, chlorides, and nitrate-nitrogen, particularly for sites 12, 13, 15 and 17. The sampling sites are described as "springs draining the Cinder Cone Disposal Site", but no map was included that depicted the exact locations of each sampling site. The *Truckee River Water Quality Control Plan* notes that the influences of wastewater discharges from Cinder Cone Springs were "marked on results for specific conductance, total dissolved solids, chloride, nitrate, and phosphate" (Lahontan RWQCB, 1979).

Additional concerns regarding the spring's effects on the Truckee River were outlined in environmental documents related to the expansion of TTSA's WWTP in the early 1980's. These reports contained data showing changes in water quality mostly related to nitrate-nitrogen, and changes in abundance of algae and benthic organisms in the Truckee River above and below the springs (Brown and Caldwell, 1979; TTSA, 1981). For example, in 1977, water quality and biological sampling in the Truckee River below Lake Tahoe showed a 1 to 2 mg/L increase in nitrate-nitrogen downstream of the Cinder Cone Springs discharge, and certain diatom, green and blue-green algae species, and black fly abundance numbers showed substantial changes above and below the discharge.

Changes in Impairment Conditions

Over twenty-five years have passed since the data that led to the 303(d) listing was collected and sewage effluent was last discharged to the Cinder Cone. Updated information was needed to evaluate the effectiveness of natural attenuation in addressing any remaining water quality issues. Regional Board staff initiated a sampling program in 2003 to investigate the current water quality of the springs. The results of this sampling are summarized below, and compared to water quality data collected in 1969 (representing baseline or background), and to the 1977 data that led to the inclusion of the springs on the 303(d) list.

4. BENEFICIAL USES AND WATER QUALITY OBJECTIVES

Beneficial uses for Cinder Cone Springs are listed in the *Water Quality Control Plan for the Lahontan Region* (Basin Plan) under "minor surface waters" of the Truckee River Hydrologic Unit (Lahontan RWQCB, 1995). They are:

- Municipal Supply (MUN)
- Agricultural Supply (AGR)
- Groundwater Recharge (GWR)
- Freshwater Replenishment (FRSH)
- Contact and Non-Contact Water Recreation (REC-1 and REC-2)
- Commercial and Sportfishing (COMM)
- Cold Freshwater Habitat (COLD)
- Wildlife Habitat (WILD)
- Rare, Threatened or Endangered Species (RARE)
- Spawning, Reproduction and Development (SPWN).

Complete definitions of these uses can be found in Chapter 2 of the Basin Plan.

Regional Board staff are not aware of conditions or information indicating impairment to these beneficial uses related to the constituents for which the springs are listed, and no specific water quality objectives are defined for the springs. Water quality objectives for the Truckee River are listed in the Basin Plan; however, given the differences between the sources and characteristics of the two waterbodies, it is not realistic to apply the Truckee River's objectives to the springs (i.e., low-flow groundwater-fed volcanic springs would not be expected to have the same water quality as the Truckee River, fed by oligotrophic Lake Tahoe). Therefore, the water quality necessary to protect beneficial uses will be determined by the 1969 baseline data, collected before effluent discharge began.

5. 2003 SAMPLING PROGRAM OVERVIEW

The U.S. Geological Survey (USGS) were contracted to collect and analyze surface water samples from three of the spring sites that were previously monitored by the PUD. These historical monitoring stations were located by Regional Board staff based on rough descriptions in the 1976 Waste Discharge Requirements (WDRs) for the Cinder Cone disposal site. Sampling sites were selected based on ability to locate and duplicate previous monitoring sites, safe access, and late-season flow potential. Budget constraints limited the sampling to two events with a maximum of three sites.

Sites were assigned the same alpha-numeric code as those contained in the 1976 WDRs for the PUD. Site descriptions are listed in Table 2 and depicted in Figure 2.

Table 2. Cinder Cone Springs Sampling Locations

Site Code	Description	Latitude	Longitude
R4	Spring at Bunker Drive, Tahoe City	39.175890	-120.147754
R5	Spring Box near Twin Crags Access Road	39.164355	-120.161009
R13	Spring near water tank on Western States Trail Bridge	39.197210	-120.194524

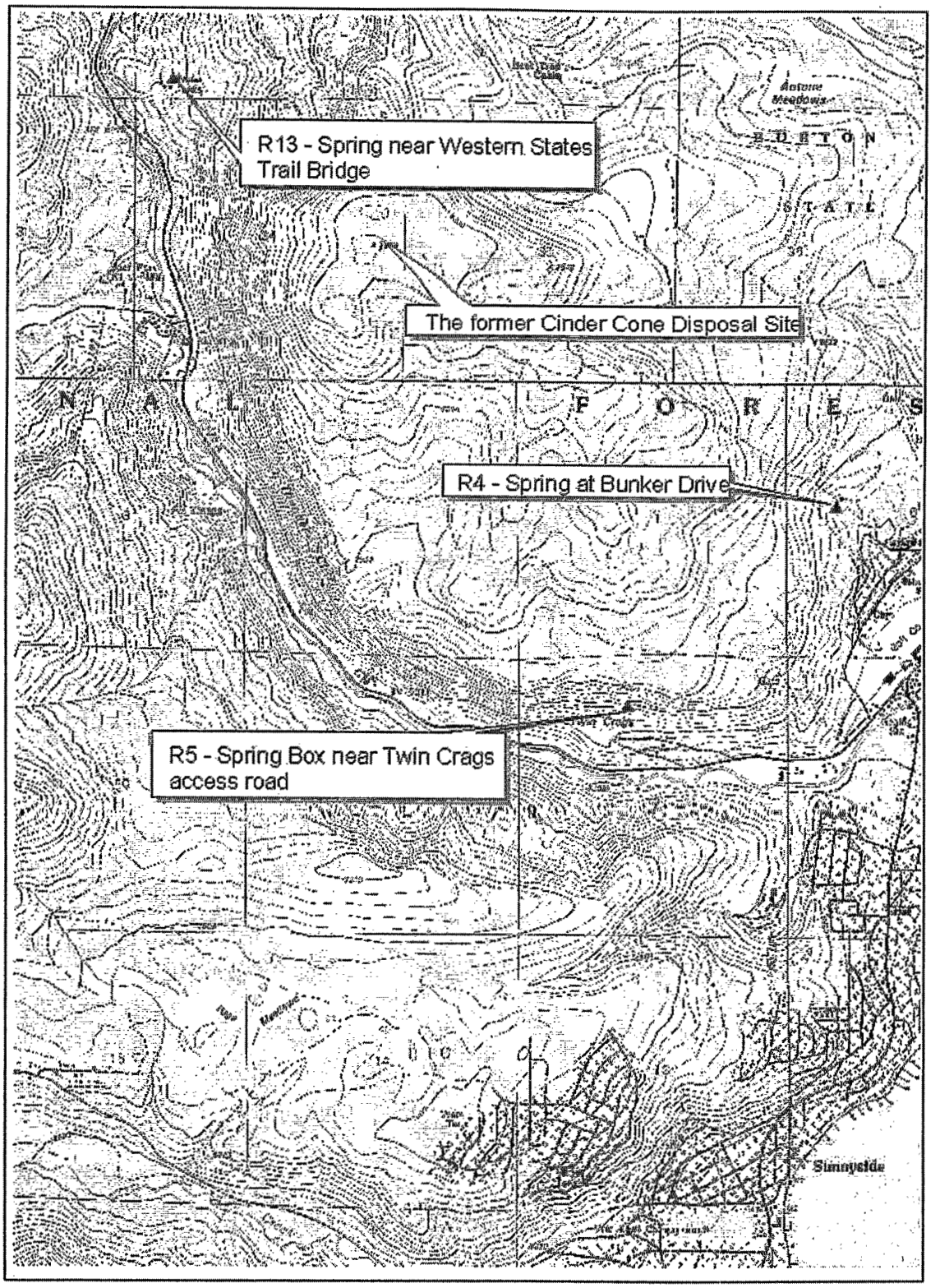

Figure 2. Former Cinder Cone Springs Disposal Site and 2003 Sampling Locations

Samples were collected in early July and October 2003, to assess water quality during high and low flow periods. Samples were analyzed for total dissolved solids (TDS), chloride, nitrite plus nitrate, total kjeldahl nitrogen (TKN), orthophosphate, total phosphorus and total nitrogen. Field measurements of discharge, temperature, dissolved

oxygen, specific conductance, and pH were recorded. Sampling protocols and quality assurance/control procedures followed the USGS *National Field Manual for the Collection of Water Quality Data.*

6. 2003 CINDER CONE SPRINGS SAMPLING RESULTS

Table 3 shows the results of sampling in July and October 2003. Discharge rates varied both between sites and between sampling events, with higher flows recorded in early July by an average of 62 percent. Concentrations of chloride, nitrate-nitrogen and total nitrogen were somewhat higher in the low-flow October sampling round. Specific conductance, TDS, orthophosphate and pH were fairly consistent between the two sampling events. Figure 3 shows comparisons of several constituents for the July and October sampling events.

Table 3. Sampling Results for Cinder Cone Springs, July and October 2003.

Date	Site	Discharge cfs	SC µs/cm	pH	Temp °C	DO mg/L	TDS mg/L	Cl mg/L	P mg/L	Ortho P mg/L	Total N mg/L	TKN mg/L
July 3 2003	**R4** (Bunker Drive)	0.1	91	7.1	8.5	10.7	98	0.23	0.04	0.031	0.09	0.12
Oct 10 2003		0.02	98	7.9	6.5	9.7	92	0.35	0.07	0.048	0.09	
July 3 2003	**R5** (Twin Crags)	0.14	118	7.1	8.0	10.7	93	0.87	0.04	0.03	0.14	0.04
Oct 10 2003		0.13	118	8	4.5	9.7	79	0.8	0.03	0.027	0.11	
July 3 2003	**R13** (Western States Trail Bridge)	0.69	88	6.9	9.5	11.3	88	1.57	0.16	0.144	1.04	0.08
Oct 10 2003		0.2	102	8.4	4.5	10.9	93	2.03	0.14	0.125	1.63	
Averages			**102.5**	**7.6**	**6.9**	**10.5**	**90.5**	**0.98**	**0.08**	**0.068**	**0.52**	**0.08**

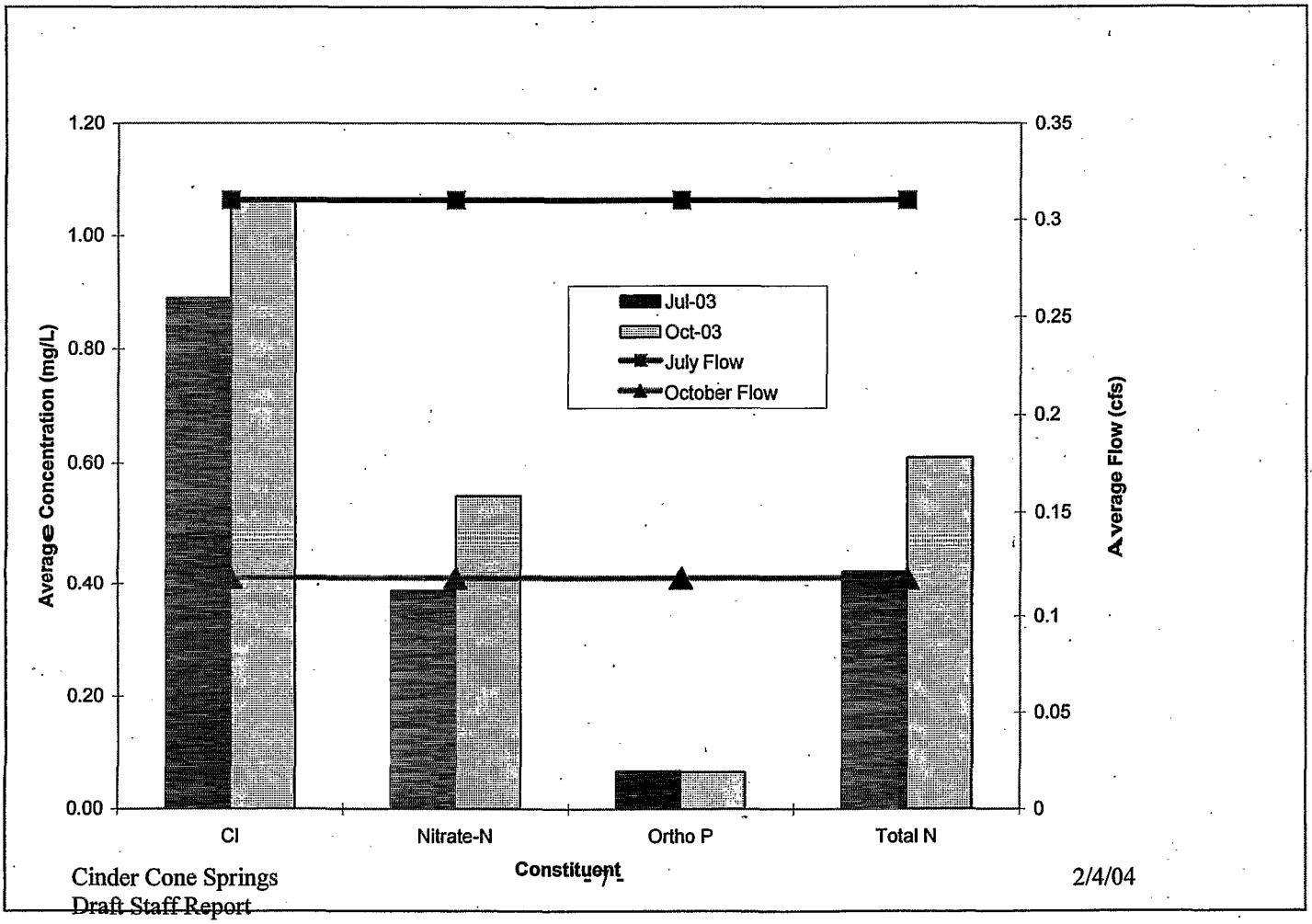

Figure 3. Comparison of Flow, Cl, Nitrate, Orthophosphate and Total N Concentrations, July & October, 2003 (TDS and SC are not included because of inconsistent concentration units and magnitude of concentrations).

7. CONCLUSIONS AND RECOMMENDATIONS

Sampling at Cinder Cone Springs was conducted in 1969, prior to effluent discharge, to establish baseline values for chlorides, phosphate, nitrate, TDS and other constituents (Tahoe City PUD, 1970). Because no specific water quality objectives are designated for the springs, attainment of water quality standards is best determined by comparing current conditions with the baseline data to determine if conditions have returned to pre-discharge baseline conditions. Comparison of these data with the recent analytical results shows that the averages and ranges of constituents measured in 2003 have returned to or improved over the baseline data recorded in 1969.

Table 5 summarizes and compares all data discussed in this memo. It is apparent that current conditions are significantly improved when compared to the 1977 data that led to the listing. No sewage effluent has been disposed to the Cinder Cone site since 1978, and natural attenuation has been effective in returning the water quality of the springs to baseline conditions. Based on the information outlined in this report, Regional Board staff recommend removing Cinder Cone Springs from the 303(d) list of impaired waterbodies.

Table 4. Summary and Comparison of 1969, 1977 and 2003 Cinder Cone Springs Water Quality Data.

	TDS	CL	Nitrate	TKN	Phosphate	SC
Sampling Period	mg/L					µs or µmhos/cm
1969 (Baseline)						
average	106	2.71	22	NA	25	NA
minimum	14	0.25	0.18	NA	0.18	NA
maximum	482	25	130	NA	130	NA
# of samples	28	68	11	NA	25	NA
1977 (Impaired)						
average	257	44	51	0.45	0.16	278
minimum	66	1.4	0.80	0.18	0.03	52
maximum	428	90	105	0.65	0.37	462
# of samples	11	11	11	11	11	11
2003 (Current)						
average	91	0.98	0.47[1]	0.08	0.07[2]	103
minimum	79	0.23	0.06[1]	0.04	0.03[2]	88
maximum	98	1.6	1.0[1]	0.12	0.14[2]	118
# of samples	6	6	6	3	6	6
Current conditions equal to or better than 1969 baseline?	***YES***	***YES***	***YES***	***NA***	***YES***	***NA***
Current conditions equal to or better than 1977 impairment data?	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***

1. Measured as nitrite + nitrate as nitrogen, filtered.
2. Measured as orthophosphate.

8. REFERENCES

Brown and Caldwell, 1979. *Assessment of Biological Response to Waste Additions to the Truckee River, Bear Creek, Squaw Creek and Martis Creek.* Prepared for Tahoe-Truckee Sanitation Agency.

Lahontan RWQCB, 1976. *Board Order No. 6-76-6: Revised Waste Discharge Requirements and Monitoring and Reporting Program for North Tahoe and Tahoe City PUD Joint Sewerage Facility, Placer County.*

----------1979. *Truckee River Water Quality Control Plan.* Appendix E.

----------1995. *Water Quality Control Plan for the Lahontan Region.* Chapters 2 & 3.

Tahoe City PUD, 1970. *"An Invitation to Visit the Cinder Cone"*, Tahoe City PUD Cinder Cone Monitoring Program, pp. 20-22.

Tahoe-Truckee Sanitation Agency, 1981. *Final Environmental Impact Report, Increasing Wastewater Treatment Capacity.* Appendix G.