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JARED BLUMENFELD
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Lahontan Regional Water Quality Control Board

May 17, 2019

Carol Thornton, District Ranger
USFS, Lassen National Forest
Eagle Lake Ranger District
477-050 Eagle Lake Road
Susanville, CA 96130

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
7017 1450 0001 3058 7799

CORRECTED INVESTIGATIVE ORDER AND REQUIREMENT TO SUBMIT A WATER QUALITY PROTECTION PLAN FOR GRAZING OPERATIONS ALONG THE SHORE ZONE OF EAGLE LAKE, LASSEN COUNTY, CA

Please find enclosed a corrected version of the Order sent on May 14, 2019 to the Eagle Lake Ranger District of the US Forest Service Lassen National Forest by the Lahontan Regional Water Quality Control Board (Water Board). The original version of the Order sent on May 14, 2019 erroneously referred to the "Eagle Lake Field Office of the Bureau of Land Management" as the Discharger on Page 1. This correction has been made and is included in the attached, corrected Order.

The enclosed Corrected Order is issued pursuant to Water Code section 13267 by the Lahontan Regional Water Quality Control Board (Water Board) and requires Eagle Lake Ranger District of the US Forest Service Lassen National Forest to submit specific information.

The Water Board has compiled evidence that livestock grazing operations with access to waters or shore zones of Eagle Lake significantly increase nutrient and pathogen discharges and sediment delivery potential to surface waters and may adversely impact shore zone riparian habitat/vegetation. You are receiving this Order because your operation has been identified as having or potentially having grazing operations with access to waters or shore zones of Eagle Lake. Water Board staff would like to schedule a meeting within the next 30 days to discuss the requirements of this Order and potential management measures that can be implemented immediately at Eagle Lake to mitigate grazing related water quality impacts for the 2019 grazing season.

Please feel free to contact me directly with any questions or comments regarding this matter at (530) 542-5414 (Patty.Kouyoumdjian@waterboards.ca.gov), or you may contact Ben Letton, Supervising Engineering Geologist, at (530) 542-5436 (Ben.Letton@waterboards.ca.gov).

PETER C. PUMPHREY, CHAIR | PATTY Z. KOUYOUMDJIAN, EXECUTIVE OFFICER



PATTY Z. KOUYOUMDJIAN
EXECUTIVE OFFICER

Enclosure: Eagle Lake Corrected Investigative Order

cc: Ben Letton

Lahontan Regional Water Quality Control Board

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Pursuant to Water Code section 13267, subdivision (b), this Investigative Order (Order) requires the Eagle Lake Ranger District of the US Forest Service Lassen National Forest, the Discharger, to provide technical information and reporting to investigate water quality impacts to Eagle Lake, Lassen County, related to livestock grazing activities. To fulfill this requirement, the Lahontan Regional Water Quality Control Board (Water Board) requires submittal of an updated Allotment Management Plan (AMP) or Annual Operating Instructions (AOI) that significantly reduces nutrient and pathogen discharges to surface waters, and addresses shore zone impacts to riparian habitat/vegetation and sediment delivery potential from grazing operations with access to waters or shore zones of Eagle Lake. Submittal of the AMP or AOI shall occur **within 60 days receipt of this letter** and an annual update of the grazing management and water quality protection plan is required **by March 15 of each succeeding year**, beginning on March 15, 2020, as further described in this letter.

The Water Board also requests that a meeting is scheduled within the next 30 days to discuss the requirements of this Order and potential management measures that can be implemented immediately at Eagle Lake to mitigate grazing related water quality impacts for the 2019 grazing season.

The results obtained through the implementation of the actions outlined in the updated AMP or AOI may identify the need for additional investigation, continued monitoring, corrective actions, or no additional action. Nothing in this Order relieves the Discharger of their responsibility to comply with previous orders issued by the Lahontan Water Board or to comply with laws and regulations that are applicable to activities necessary to produce the above referenced reports.

For grazing operations with no access to Eagle Lake waters or shore zones (within 300 feet of the seasonal high water, typically occurring in the month of May or June), whether by exclusion fencing, natural features or other physical barrier, the Discharger is not required to

PETER C. PUMPHREY, CHAIR | PATTY Z. KOUYOUMDJIAN, EXECUTIVE OFFICER

submit an updated AMP or AOI but will be required **within 30 days receipt of this letter**, to submit in writing an explanation and any relevant documentation demonstrating how your grazing operations do not have access to Eagle Lake water or shore zones.

BACKGROUND AND CHRONOLOGY

Lahontan Water Board staff have received multiple public complaints, both verbal and by e-mail, concerning potential nutrient, sediment, and bacteria impacts to Eagle Lake from grazing. In response to these complaints, Water Board staff visited Eagle Lake on July 25, 2018, October 10, 2018, November 7, 2018, and December 19, 2018 and documented impacts from or the presence of livestock in the shore zone of Eagle Lake.

Photographs taken by Lahontan Water Board staff and from members of the public document cattle grazing impacts on the shores of Eagle Lake are provided in Enclosure 1.

Impacts documented include:

- Cattle feces and urine, rich in available nutrients, deposited in the shore zone
- Impairment of riparian vegetation
- Increased bank and shore zone trampling, disturbance, and erosion associated with cattle activity
- Impairment of wetland vegetation and aquatic habitat

Documented water quality impacts to Eagle Lake observed by Lahontan Water Board staff in 2018 highlight the need to further investigate and respond to potential water quality issues as outlined in the Water Quality Control Plan for the Lahontan Region (Lahontan Basin Plan) in at least two areas: 1) Resources Management and Restoration Section, Page 4.9-21, providing guidance for Regional Board Control Actions of Livestock Grazing at Eagle Lake, and 2) Regionwide Prohibitions 1-2, Page 4.1-1, prohibiting the discharge of waste that causes violation of a numerical or narrative water quality objective or where the discharge is causing further degradation to an objective that is already violated. A more thorough discussion of these potential impacts and justification for this Order can be found in the justification section, beginning on Page 6, and supporting technical information can be found in attached Enclosure 3.

Beneficial Uses and Species of Special Concern at Eagle Lake

Chapter 2 Present and Potential Beneficial Uses, Table 2-1, on page 2-13 of the Lahontan Basin Plan, lists the beneficial uses of Eagle Lake and associated wetlands within the Eagle Lake Hydrologic Subarea (637.32): MUN, AGR, GWR, NAV, REC-1, REC-2, COMM, COLD, FRSH, WILD, BIOL, RARE, MIGR, SPWN, WQE, and FLD.

Eagle Lake is home to the unique Eagle Lake Rainbow Trout (ELRT), which has adapted to the lake's alkaline waters. Grazing, timber harvest, and water diversions have impacted Pine Creek, the ancestral spawning grounds of ELRT to the point where non-assisted spawning only occurs about once every decade. The ELRT has been designated as a California Heritage Trout, a California Department of Fish and Wildlife Species of Special Concern and US Forest Service sensitive species. Because of sharp decline in numbers of ELRT from

historic cumulative impacts during the mid-19th century through the first half of the 20th, Eagle Lake rainbow trout were proposed to be listed under the Federal Endangered Species Act. However, listing was denied primarily because it would carry restrictions and slow conservation projects developed in the multi-agency Conservation Agreement for the Eagle Lake Rainbow Trout (CDFW-USFS-USFW. 2015)¹. Nutrients from septic, grazing, stormwater, and other sources alter trout habitat in ways that increase their health risk for whirling disease (Granath, 2014)². Additionally, native Tui Chub trout provide food for immense numbers of birds, including Bald Eagles, for which the lake is named. The lake supports the largest osprey and grebe colonies in the western United States.

Clean Water Act Section 303(d) listing for Total Nitrogen and Total Phosphorus

Eagle Lake was listed on the Clean Water Act (CWA) Section 303(d) as an impaired waterbody for Total Nitrogen (TN) and Total Phosphorus (TP) in 2006. Reductions in loading of nutrients from all sources, including sources of nutrient loading such as septic and grazing, are required to reduce nutrient concentrations to meet Water Quality Objectives for TN and TP. The following is a chronology of nutrient loading and resultant deleterious water quality impacts that led to the 2006 CWA Section 303(d) listing:

- Late 1980's - Fish kill at Eagle Lake attributed to a reduction in Dissolved Oxygen (DO) concentrations resulting from an increase in eutrophic conditions driven by excessive nutrient loading in the waterbody.
- 1990 - Integrated Report first lists Eagle Lake and Pine Creek (for fish kills and eutrophication from septic, grazing, road and urban runoff, heavy recreational uses).
- 1992 - Eagle Lake listed as impaired for Organic Enrichment/Low Dissolved Oxygen under Clean Water Act (CWA) section 303d provisions.
- 1998 - Integrated Report updates Eagle Lake listing to Organic Enrichment/Low Dissolved Oxygen. Sources include Range Land, Land Development, Septage disposal, and other Non-Point Sources of pollution.
- 2002 - Eagle Lake listing clarified to two separate listings for nitrogen and phosphorus. Sources updated to include: Agriculture, Grazing-Related Sources, Silviculture, Other Urban Runoff, Highway/Road/Bridge Runoff, Wastewater Onsite, Wastewater Systems (Septic Tanks), Marinas and Recreational Boating, Atmospheric Deposition, Internal Nutrient Cycling (primarily lakes), Sediment Resuspension, Natural Sources, Recreational and Tourism Activities (non-boating), Non-point Source.
- 2006 - Integrated Report removed Pine Creek from 303(d) list; Eagle Lake remains on CWA 303(d) as water quality impaired for TN and TP.

¹ CDFW-USFS-USFW. 2015. Conservation Agreement for the Eagle Lake Rainbow Trout (*Oncorhynchus mykiss aquilarum*), Lassen County, California

² Granath, W. O., 2014. Effects of Habitat Alteration on the Epizootiology of *Myxobolus Cerebralis*, the Causative Agent of Salmonid Whirling Disease. J. Parasitol., 100(2), 2014, pp. 157–165.

Lahontan Water Board actions to address nutrient loading to Eagle Lake

September, 1984 - The Regional Board adopted Amendments to the Water Quality Control Plan for the North Lahontan Basin Concerning the Eagle Lake Hydrologic Unit. The Amendments contained the following waste discharge prohibition:

"The discharge of waste from the Spalding Tract or Stones-Bengard subdivisions with other than a zero discharge of nutrients to any surface water or ground waters in the Eagle Lake Basin is prohibited after September 14, 1989."

This Basin Plan amendment required residents of the Spalding Tract and Stones-Bengard subdivisions to abandon septic systems and develop a wastewater treatment plant to eliminate nutrients from septage from entering Eagle Lake via groundwater flow within five years.

May, 1991 and July, 1991 - The Regional Board issued a total of 831 Cease and Desist Orders for property owners of the Spalding Tract and the Stones-Bengard Subdivisions at Eagle Lake who have parcels containing a subsurface waste disposal system. The Orders were adopted to stop discharges or threatened discharges of nutrient-laden septage into groundwaters of the Eagle Lake basin.

2009 through 2015 - Progressive Enforcement of Spalding Tract and the Stones-Bengard Prohibition of septage waste discharge using Cease and Desist Orders followed by Notices of Violation, followed by Administrations Civil Liability (fines) until all property owners are in compliance.

November, 2010 - The Water Board issued new Waste Discharge Requirements (WDR) that ordered the USFS Lassen National Forest to implement improved wastewater treatment facilities that result in zero discharge of wastes containing nutrients from the wastewater treatment facility on lands administered by the U.S. Forest Service, Lassen National Forest, to surface waters or ground waters in the Eagle Lake basin.

April, 2011 - The Water Board issued a Cease and Desist Order to stop continuing discharges of septage from USFS Lassen National Forest wastewater treatment facilities.

Existing Nutrient Monitoring of Eagle Lake

The California Department of Water Resources (DWR) has been conducting water quality monitoring of the North, Middle, and South Basins of Eagle Lake intermittently since 1971. Monitoring stations are depicted in Enclosure 2, Figure 1. Most documented cattle grazing within the shore zone of Eagle Lake occurs in the North Basin, so nutrient data at monitoring site 6B was assessed in detail. The trendline of average annual Total Nitrogen, and Total Phosphorus in the North Basin are given in Appendix 2, Tables 2 and 3, respectively.

Enclosure 2, Tables 2 and 3, show most recent data values in exceedance of the water quality objective of 1.0 ppm for TN and of 0.04 ppm for TP. Trendlines show increasing

values of 0.0111 ppm TN per year and 0.008 ppm TP per year. Values for TN and TP continue to increase after septic systems at Spaulding tract were put on sewer in 1989, suggesting that some other source of nutrients, such as grazing, is continuing to add TN and TP to Eagle Lake.³

Harmful Algal Blooms

Outbreaks of blue-green algae in surface waters are termed Harmful Algal Blooms (HABs). HAB outbreaks typically occur in high-nutrient (high TN and TP) waters and may result in release of cyanotoxins, which can harm or kill animals and trigger swimmer's itch, a severe form of dermatitis, for humans. High concentrations of blue-green algae genus's Anacystis, Anabaena, and Gomphosphaeria have been documented to occur in Eagle Lake since 1981 (CRWQCB, 1984). During the Summer of 2018, visual indicators of a harmful algae bloom (discolored water, surface scum) prompted sampling and analysis of Eagle Lake water. Samples collected from the South Basin indicated the presence of measurable levels of cyanotoxins.

JUSTIFICATION FOR INVESTIGATIVE ORDER

The Water Board's authority for issuing this Investigative Order is provided in Water Code section 13267, subdivision (b), which states, in part,

"...the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or proposes to discharge waste within its region ... shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires... In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

In compliance with Water Code section 13267, subdivision (b), the Water Board is providing the following facts and information regarding the need for the report, the evidence that supports the requirement for the report, and the benefits to be obtained from the report:

1. Eagle Lake was listed on the Clean Water Act (CWA) Section 303(d) as an impaired waterbody for TN and TP in 2006.
2. Based on Lahontan Water Board staff observations made between July 2018 and December 2018, and information and evidence provided by the public during that same time frame, cattle grazing operations are contributing to TN and TP loading to shore zone of Eagle Lake by direct deposition of feces and urine into surface waters or deposition in upland areas subject to seasonal or climatic contact with or transport by surface waters or precipitation.

³ Water Board staff will conduct monitoring of nutrients and other parameters at four Stations: 6B (North Basin), 4A (Middle Basin), and 1A & 11 (South Basin) beginning in 2019, to assess current water quality conditions of Eagle Lake.

3. Discharges described above are a potential exceedance of a numeric or narrative objective or guidance contained in the Lahontan Basin Plan, Chapter 2 General Discharge Prohibitions 1 and 2, on Page 4.1-1.

(1) The discharge of waste that causes violation of any narrative or numeric water quality objective contained in this Plan is prohibited.

Observations made by Lahontan Water Board staff between July 2018 and December 2018 (Enclosure 1) clearly demonstrate a potential exceedance of numeric water quality objectives for TN and TP and impacts to the following beneficial uses: REC-1, REC-2, COMM, COLD, FRSH, WILD, BIOL, RARE, MIGR, SPWN, WQE, and FLD (see Enclosure 3).

(2) Where any numeric or narrative water quality objective contained in this Plan is already being violated, the discharge of waste that causes further degradation or pollution is prohibited.

Observations made by Lahontan Water Board staff and photographs provided by the public between July 2018 and December 2018 (Enclosure 1) suggest that the intensity of grazing and the number of cattle accessing the shore zone of Eagle Lake have increased since Eagle Lake was listed as impaired for TN and TP in 2006. Increased numbers of cattle and resultant nutrient loading to Eagle Lake constitute further degradation of numeric water quality objective that is already being violated and listed as 303(d) impaired (see Enclosure 3).

4. Publicly available DWR data sets show an increasing trend of TN and TP in the North Basin of Eagle Lake where a higher concentration of grazing activities occur. This increasing trend includes available data since Eagle Lake was 303(d) listed as impaired in 2006 (see Enclosure 2).
5. A recent 2018 Water Board survey documented a HAB outbreak in Eagle Lake with measurable levels of cyanotoxin in the waters.

The report is needed to determine the extent of adverse impacts to Eagle Lake from grazing operations. The information may be used to determine the need for continued monitoring or corrective action to ensure that water quality is being protected. As such the burden, including costs, of these reports bears a reasonable relationship to the need for the report and the benefits to be obtained from the reports.

ORDER FOR TECHNICAL REPORTS

Pursuant to Section 13267 of the California Water Code I am requiring the following:

1. Submittal within **60 days receipt of this letter** of a new or updated AMP or AOI prepared for specific areas of your grazing operations with access to Eagle Lake waters or shore zones (i.e. within 300 feet of the seasonal high water elevation, which typically occurs in the month of May or June), including an implementation schedule.

The AMP or AOI must contain Best Management Practices (BMPs) necessary to correct existing water quality problems or to protect water quality, specifically to protect beneficial uses of Eagle Lake by precluding deposition of livestock feces and urine within the shore zone and impacts to sensitive habitat and wetland features below the Ordinary High Water Mark (OHWM). The plan must address, at a minimum, provisions to ensure that cattle are not allowed to continue to discharge animal waste along the shore zone and below the OHWM of Eagle Lake, either by livestock exclusion or implementation of grazing management (e.g. increased herding by cowboys, upland water troughs, salt licks) that can be reasonably acknowledged by the Lahontan Regional Board to protect water quality and riparian habitat. The AMP or AOI must address management measures, tracking of management measure implementation, and evaluation of the effectiveness of these actions to address water quality impairments and the rehabilitation of range areas that are in unsatisfactory condition. The report must establish the seasons of use, number of livestock permitted, and grazing system to be used.

2. The AMP or AOI shall include a schedule for initiation and maintenance of range and watershed improvements. The schedule for installing and maintaining range and watershed improvements must include priorities and planned completion dates. Regular evaluation and tracking of these improvements must also propose a method and timetable for reporting of riparian and wetland vegetation condition along the shore zone of Eagle Lake and how improvement to those conditions are providing sufficient water quality and beneficial use protection.
3. Provide an annual update of the grazing management and water quality protection plan by March 15 of each succeeding year beginning on March 15, 2020. The update is to include a summary of the effectiveness of the previous grazing season's engineered or grazing management practices and recommendations of improvements, if any, for the next grazing season. The update may be submitted as a dated addendum to, or a re-write of, the original grazing management and water quality protection plan.
4. For Grazing operations with no access to Eagle Lake waters or shore zones (within 300 feet of the seasonal high water, typically occurring in the month of May or June), whether by exclusion fencing, natural features or other physical barrier, the Discharger is not required to submit an AMP or AOI, but will be required **within 30 days receipt of this letter** to submit in writing an explanation and any relevant documentation on how grazing operations do not have access to Eagle Lake water or shore zones.

Petitioning a Decision of the Board

Any person affected by this action of the Board may petition the State Water Resources Control Board (State Board) to review the action in accordance with Section 13320 of the California Water Code and Title 23, California Code of Regulations, Section 2050. The petition must be received by the State Board within 30 days of the date of this Order. Copies of the law and regulations applicable to filing petitions will be provided upon request.

If you have any questions or comments regarding this matter, please contact me at (530) 542-5414 (Patty.Kouyoumdjian@waterboards.ca.gov), Ben Letton, Supervising Engineering Geologist, at (530) 542-5436 (Ben.Letton@waterboards.ca.gov), or Doug Cushman, Senior Water Resources Control Engineer, at (530) 542-5417 (Douglas.Cushman@waterboards.ca.gov).



PATTY KOUYOUMDJIAN
EXECUTIVE OFFICER

Enclosures: 1. Photodocumentation of Cattle Grazing on Shores of Eagle Lake
2. North Eagle Lake Total Nitrogen and Total Phosphorus Monitoring
3. Supporting Technical Information

cc: Elizabeth Beryt, SWRCB
Ben Letton, Lahontan Water Board
Doug Cushman, Lahontan Water Board

ENCLOSURE 1:

PHOTODOCUMENTATION OF CATTLE GRAZING ON SHORES OF EAGLE LAKE



Description: Cattle feces, impairment of vegetation
Date: 10-10-2018; Source: Water Board staff



Description: Trampling increases shore bank erosion, impairment of wetland vegetation
Date: 10-27-2018; Source: Eagle Lake Guardians



Description: Shore zone disturbance, impairment of vegetation, potential soil erosion
Date: 11-7-2018; Source: Water Board staff



Description: Excessive forage utilization and significant soil impacts from livestock hooves.
Date: 10-10-2018; Source: Water Board staff.



Description: Spring snowmelt runoff showing connectivity of grazed shore zone areas to Eagle Lake; Date:3-20-2019; Source: Eagle Lake Guardians



Description: Cattle feces in and adjacent to Eagle Lake, high forage utilization of shorezone vegetation; Date: 3-20-2019; Source: Eagle Lake Guardians



Description: Harmful Algal Bloom at Lassen National Forest Christie Day Use Area

Date: 7-25-2018; Source: Water Board staff

ENCLOSURE 2:

North Eagle Lake Total Nitrogen and Total Phosphorus Monitoring

The map displays Eagle Lake and its surrounding area. Key features include:

- Sampling Stations:**
 - EAGLE LK STA NO 6B:** Located on the north shore of Eagle Lake.
 - EAGLE LK STA NO 4A:** Located on the west shore of Eagle Lake.
 - EAGLE LK STA NO 11:** Located on the east shore of Eagle Lake.
 - EAGLE LK 14:** Located on the east shore of Eagle Lake.
 - EAGLE LK STA NO 1A:** Located on the south shore of Eagle Lake.
- Geographic Features:**
 - Bald Hills:** Located to the west of Eagle Lake.
 - Lassen National Forest:** Located to the south and east of Eagle Lake.
 - Willow Creek:** Located to the east of Eagle Lake.
 - Horse Lake:** Located to the northeast of Eagle Lake.
- Water Quality Objectives (mg/L):**
 - North (6B):** Nitrogen, Total (N) = 1.0; Phosphorus, Total (P) = 0.04.
 - Middle (4A):** Nitrogen, Total (N) = 1.0; Phosphorus, Total (P) = 0.04.
 - South (11):** Nitrogen, Total (N) = 1.3; Phosphorus, Total (P) = 0.04.

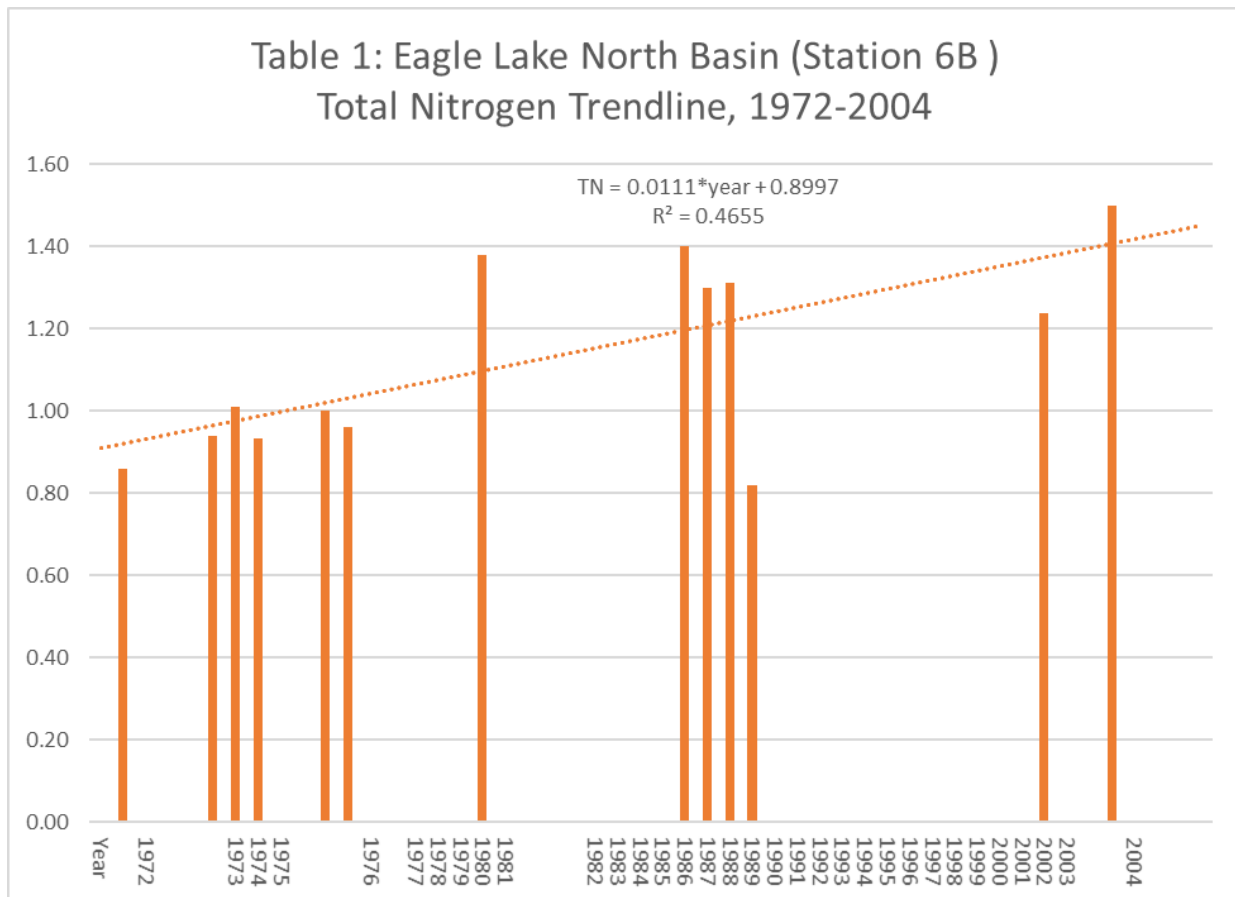
Map Labels: Bald Hills, Eagle Lake, Lassen National Forest, Willow Creek, Horse Lake, Eagle Lake near Spaulding (west shore), Pine Creek at Eagle Lake near Susanville, Eagle Lake near Susanville (east shore).

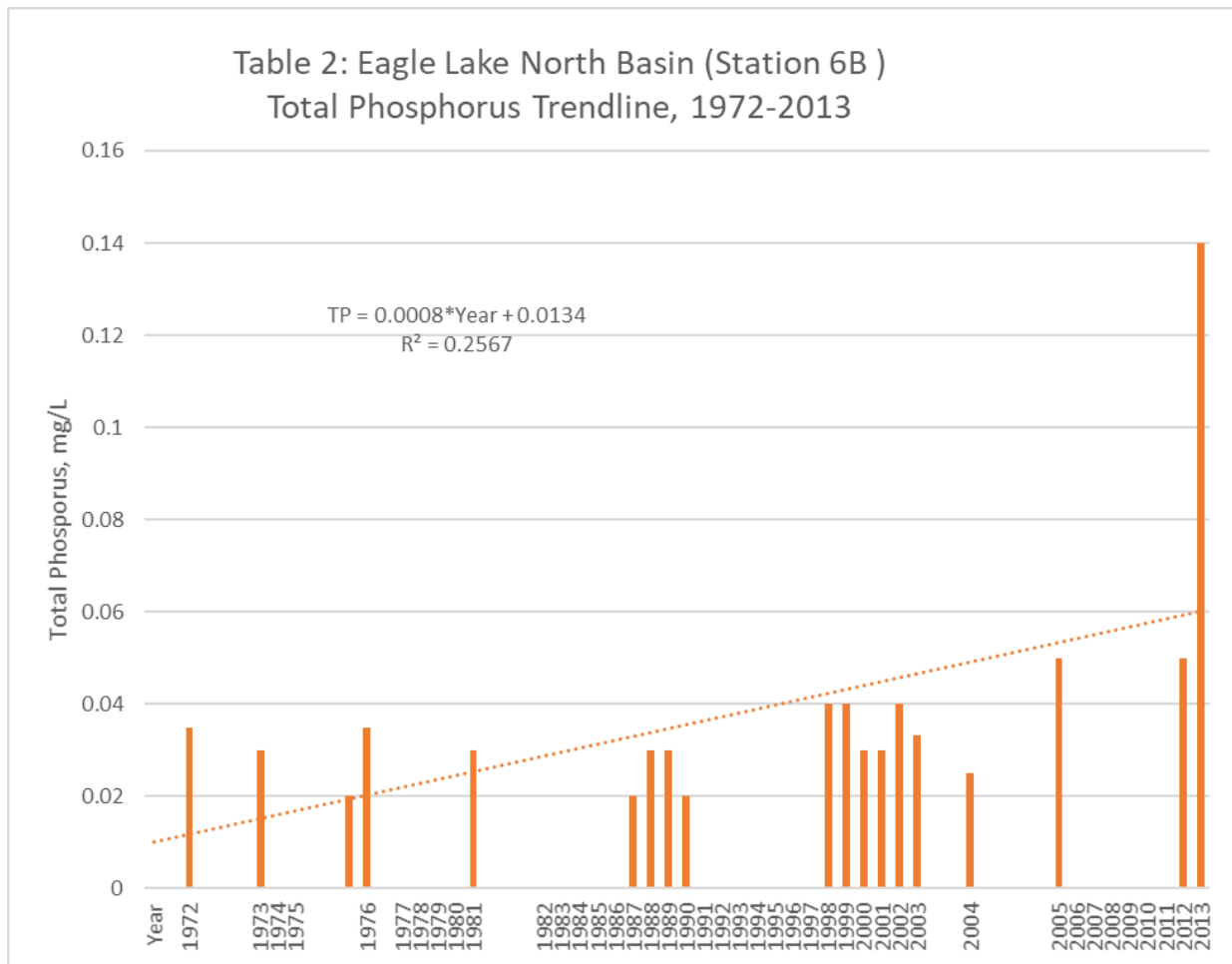
Scale: 0 to 10 miles.

Legend:

- Blue line: Road
- Green line: Stream
- Blue area: Water
- Green area: Forest
- Yellow area: Developed
- Red dot: Sampling Station
- Green dot: Sampling Station

Source: Bureau of Land Management





ENCLOSURE 3:

Supporting Technical Information

The first documented loading estimate for this was a report by the USFS (CRWQCB, 1984).⁴ The USFS assumed that waste from cattle was 16 times that of humans, which amount to 0.27 pounds nitrogen per day and 0.05 pounds of phosphorus per day from each cow. A limited USFS shore zone survey estimated an average of 80 cows over a 120 day period on the shores of Eagle Lake for an estimated annual load of 1.28 tons of nitrogen and 0.26 tons of phosphorus. Local Spaulding tract residents observed larger numbers of cattle (675) in a spot survey, estimated annual loading of 10.8 tons nitrogen and 2.2 tons phosphorus—nearly an order of magnitude greater than that of the USFS (Pankratz, Jim. 1987).⁵

Based on values in literature of O'Callaghan, 2018, (O'Callaghan, P., M. Kelly-Quinn, E. Jennings, P. Antunes, M. O'Sullivan, O. Fenton, and D. O. hUallachain. 2018)⁶ Water Board staff estimate loading of nitrogen from cattle to come primarily from urine (195 grams or 0.43 pounds per day) and loading of phosphorus to come primarily from feces (10 grams or 0.022 pounds per day). Nitrogen from feces is estimated to be 45 g (0.1 lb.) and phosphorus from urine estimated to be a negligible 0.03 g per day. Total N is then 240 g (0.53 lbs.) per day and Total P is 10.03 g (0.022 lb) from each cow with access to the lake's shorezone. These values derived from scientific literature are double those used by the USFS in their estimates of total daily loading of TN, but only 44% of that used for TP.

A recent review article of environmental impacts of cattle to watercourses reported that exclusion of cattle from surface waters consistently resulted reductions of nitrogen and phosphorus loading (O'Callaghan et al., 2018)¹. Relevant articles from Table 1 of O'Callaghan et al., 2018, reported the following: Galeone (2000) reductions of 20-31% for nitrogen loading and 19-79% for phosphorus loading; Line (2000) 33% reductions of nitrate, 78% Total Kjeldahl Nitrogen (TKN), and 78% total phosphorus; Meals (2001) a 42% reduction on total phosphorus, and Line (2016) 34% reduction of TKN, a 54% reduction ammonium-N, and 47% reduction for total phosphorus. Based on existing studies, exclusion of cattle from the shores of Eagle Lake will result in significant reductions of total nitrogen and total phosphorus loading to waters of the lake. (note: these articles are available for review upon request).

⁴ Task 3C: Near Shore Cattle Survey, Page 86 California Regional Water Quality Control Board, Lahontan Region. 1984 Staff Report on Proposed Amendments to the Water Quality Control Plan for the North Lahontan Basin for the Eagle Lake Hydrologic Unit (document available upon request).

⁵ Proposal for Amendments to Existing Water Quality Control Plan for the North Lahontan Basin for the Eagle Lake Hydrologic Unit. Presented at the CRWQCB special meeting at Eagle Lake on July 10, 1987 (document available upon request).

⁶ The Environmental Impact of Cattle Access to Watercourses: A review. J. Environ. Qual. doi:10.2134/jeq2018.04.0167 (available upon request).