Agenda Item #6
Status Report on Bacteria Sampling and Analysis

November 12, 2014

Richard Booth
Chief, TMDL & Basin Planning Unit

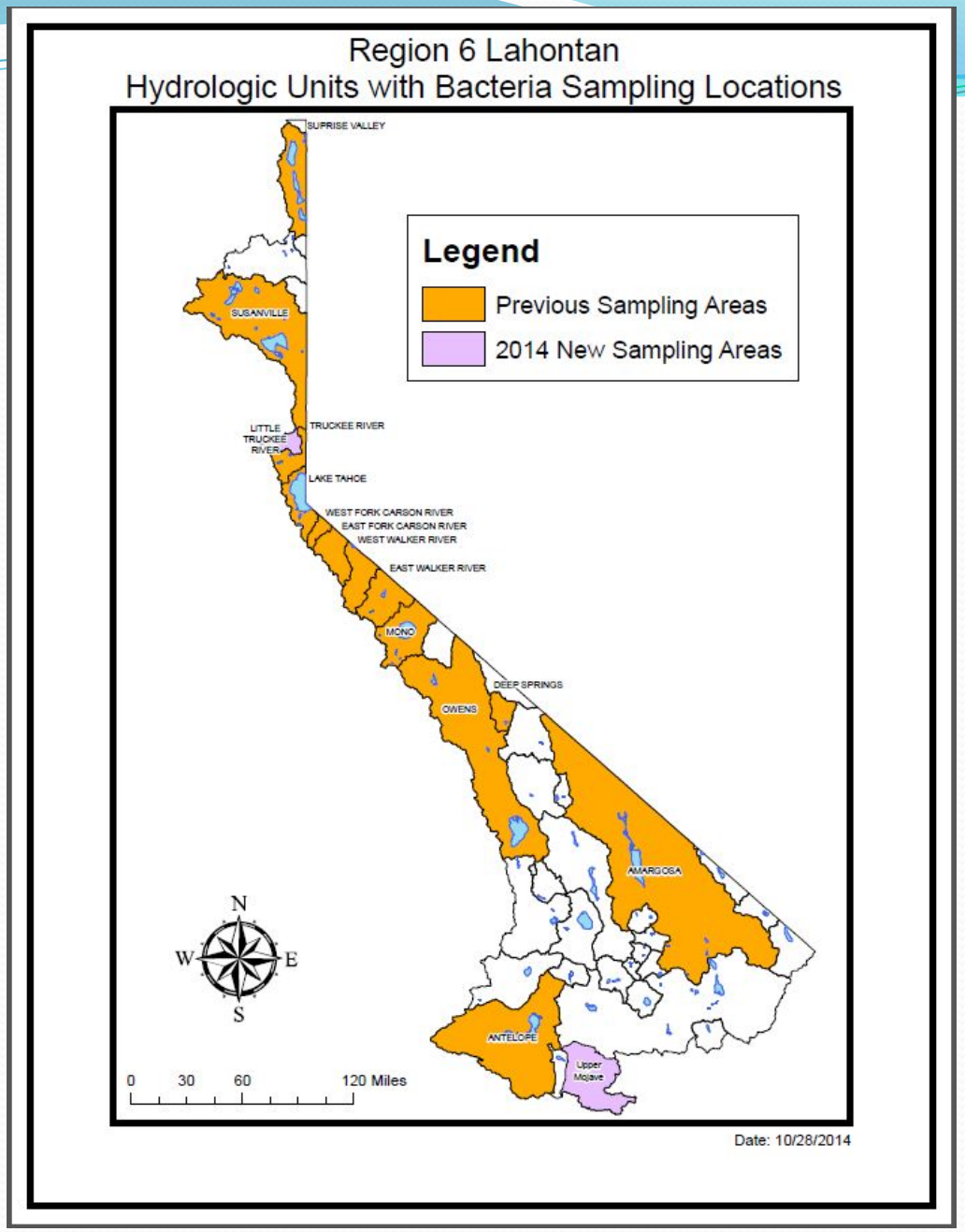
2 Questions

1. Are there some areas of our region that should be designated specifically for intentional consumption where the existing 20 fecal coliform per 100 mL standard should be protected?

2. Are there certain areas in our region where the existing 20 fecal coliform per 100 mL standard should be relaxed?

Outline

- **Background**
  What is the history of the current bacteria water quality objectives?
- **Bacteria Water Quality Objective (WQO) Project**
  What is it?
  Why do we need it?
- **Bacteria WQO Project**
  What are the steps?
- **State Board's Bacteria Effort**
  What is State Board doing about bacteria standards and how are we coordinating?
- **Current data evaluation**
  We have data (and are gathering more). Dr. Warden will present a summary of bacteria data.
- **Natural High Quality Waters**
  Intentional consumption or relax the current bacteria WQOs?
- **A Preliminary Evaluation of our Waterbodies**


Region 6 Lahontan
Hydrologic Units with Bacteria Sampling Locations
SUPRISE VALLEY
SUSANVILLE
LITTLE TRUCKEE RIVER
TRUCKEE RIVER
LAKE TAHOE
WEST FORK CARSON RIVER
EAST FORK CARSON RIVER
WEST WALKER RIVER
EAST WALKER RIVER
MONO
DEEP SPRINGS
OWENS
AMARGOSA
ANTELOPE
Upper Mojave
Legend
Previous Sampling Areas
2014 New Sampling Areas
N
W
E
S
0 30 60 120 Miles
Date: 10/28/2014

Revision of Bacteria Water Quality Objectives

- Define the need
- Reasons to revise
- Alternatives
- Approach
- How are we implementing the approach
- Monitor the effects of the revision
- Verify the revision works

Revision of Bacteria Water Quality Objectives

- What is the revision of Bacteria Water Quality Objectives?
- Why is it a priority?

Revision of Bacteria Water Quality Objectives

- What is the concern?
- What are we doing about it?

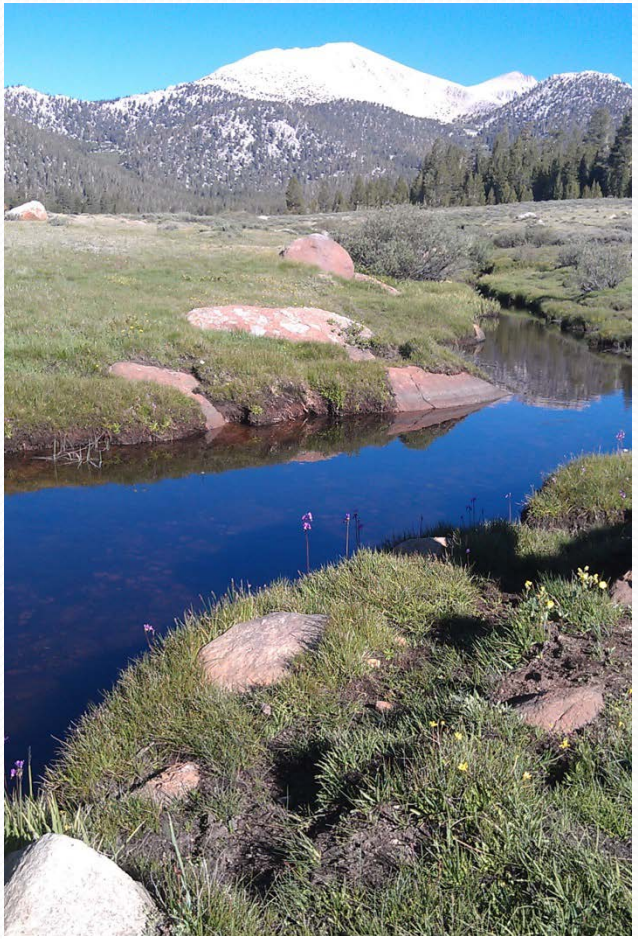


Photo : Looking upstream from “Horseshoe Meadow Creek above Trail Pass trail crossing” (603HMCB02) on 6/19/2012

State Board's Bacteria Effort

- State Board staff is proposing statewide bacteria objectives
- USEPA 2012 Recreational Water Quality Criteria
- REC-1 Beneficial Use for water contact recreation (e.g., swimming)
- Incidental ingestion of water

Natural, High Quality Waters

- Lahontan is a vertical region
- Consumption of untreated or partially treated surface water.

Image from destination360.com

Image from hellotravel.com

Compilation of Bacteria Data through 2013

Presentation by Dr. Bruce Warden, followed by

"Next Steps" and

Preliminary Evaluation of our Waterbodies

Photo : Cattle grazing downstream of "Brockman Slough at Center Road" (637BRKB02) on 6/26/2012

Agenda Item No. 6

Status Report on Bacteria Sampling and Data Analysis

Bruce T. Warden, Ph.D.

Environmental Scientist

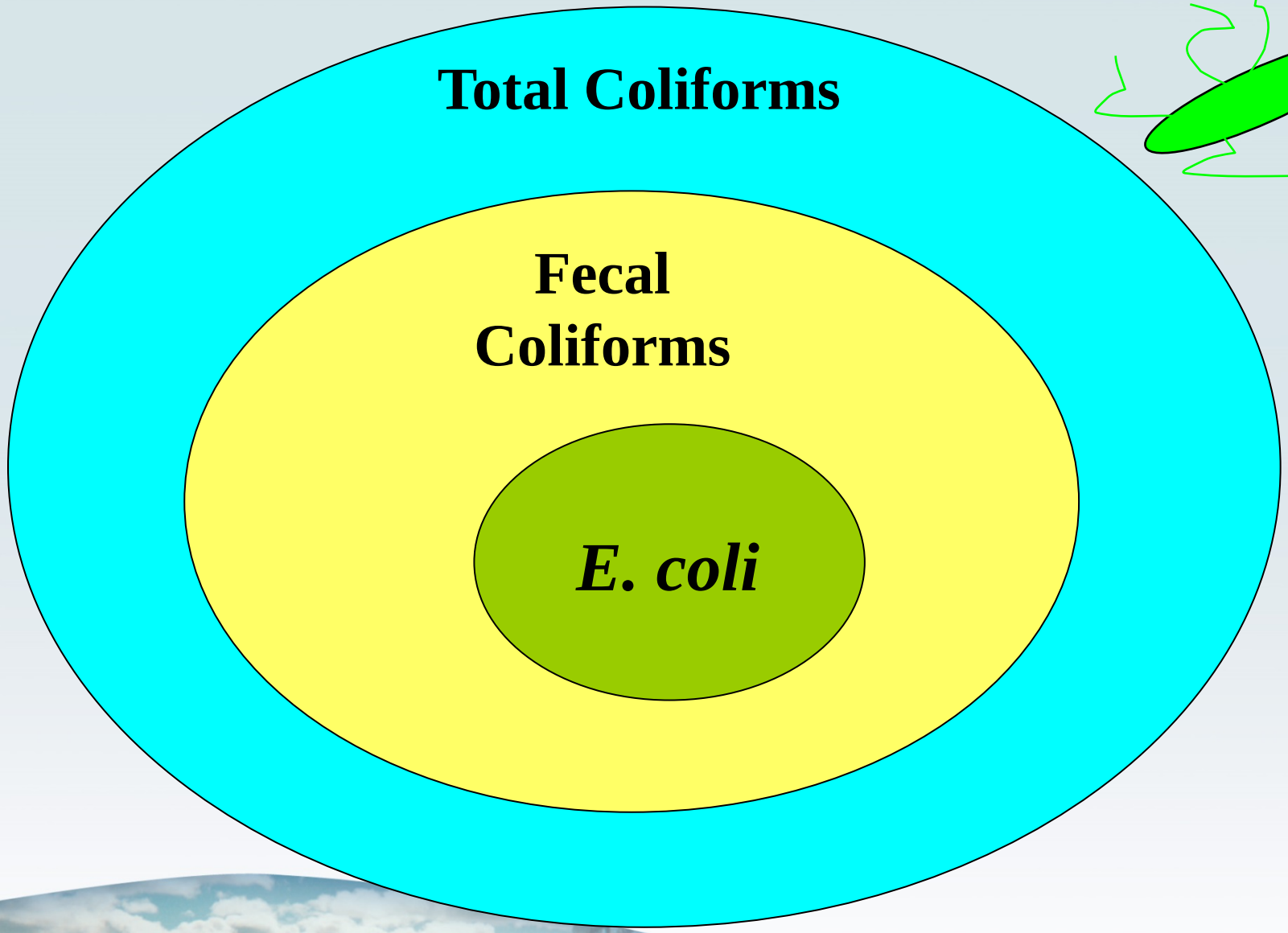
CALIFORNIA Water Boards

Presentation Overview

- Indicator bacteria monitoring efforts
- Why use indicator bacteria?
- Fecal coliform data analysis
- Elevation and anthropogenic source intensity trends
- Preliminary conclusions

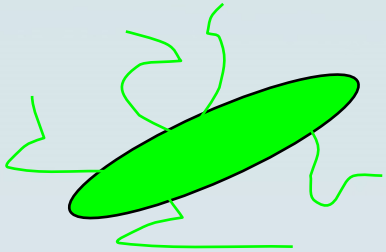
Current bacteria efforts

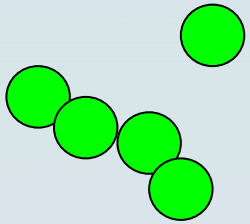
1. Ongoing CEDEN data upload
2. Five contracts (2 complete) and 1 grant for indicator bacteria / source tracking
3. Water Board bacteria sampling program for fecal coliform and *E. coli*



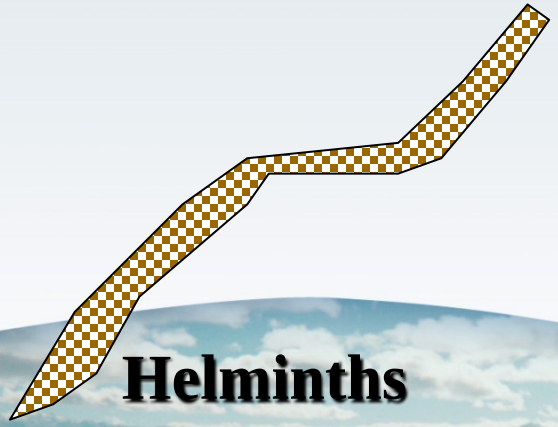
Genera: *Escherichia, Klebsiella, Citrobacter, Enterobacter, Etc.*

What are indicator bacteria?

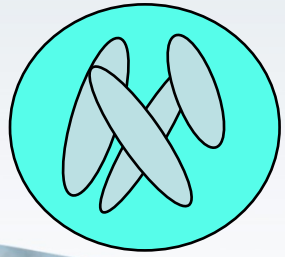




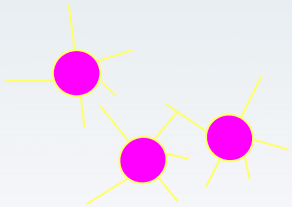
Bacterial species (*commensal or beneficial*) that when present in water, food, etc. indicate the potential presence of fecal material and associated fecal pathogens (*overt virulence or opportunistic*). These can impact human health.



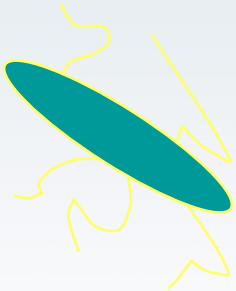
Helminths



Protozoa



Viruses



Bacteria

Bacteria found in the gastrointestinal tract of the human body

BACTERIUM	Lower GI
Staphylococcus epidermidis	+
Staphylococcus aureus*	++
Streptococcus mitis	+/-
Enterococcus faecalis*	++
Streptococcus pyogenes*	+/-
Enterobacteriaceae*(Escherichia coli)	++
Proteus sp.	+
Pseudomonas aeruginosa*	+
Bacteroides sp.*	++
Bifidobacterium bifidum	++
Lactobacillus sp.	++
Clostridium sp.*	++
Clostridium tetani	+/-
Corynebacteria	+
Mycobacteria	+
Spirochetes	++
Mycoplasmas	+

++ = nearly 100 percent + = common (about 25 percent)

+/- = rare (less than 5%) * = potential pathogen

Data Analysis

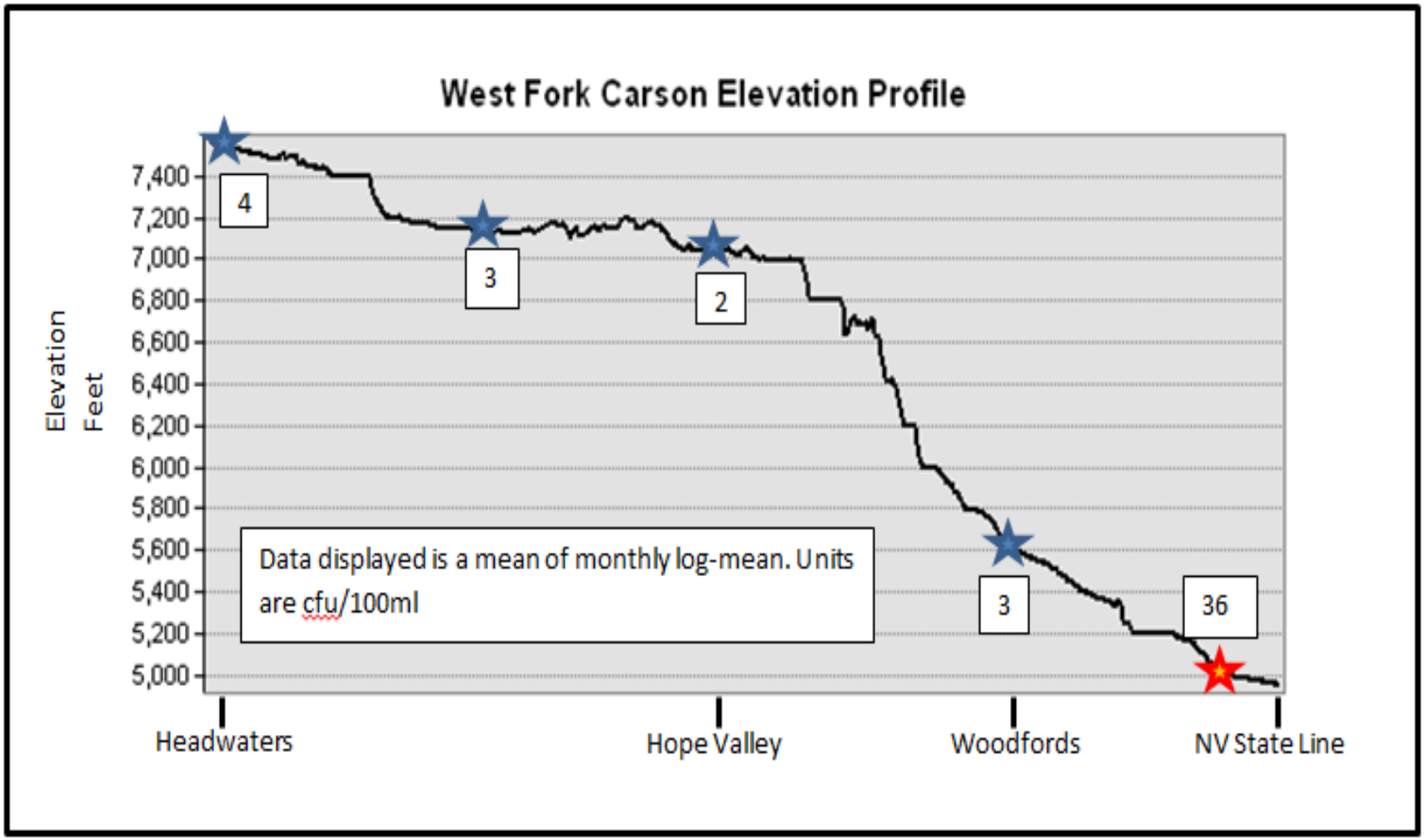
CEDEN database: http://www.ceden.org/

3542 Fecal coliform samples

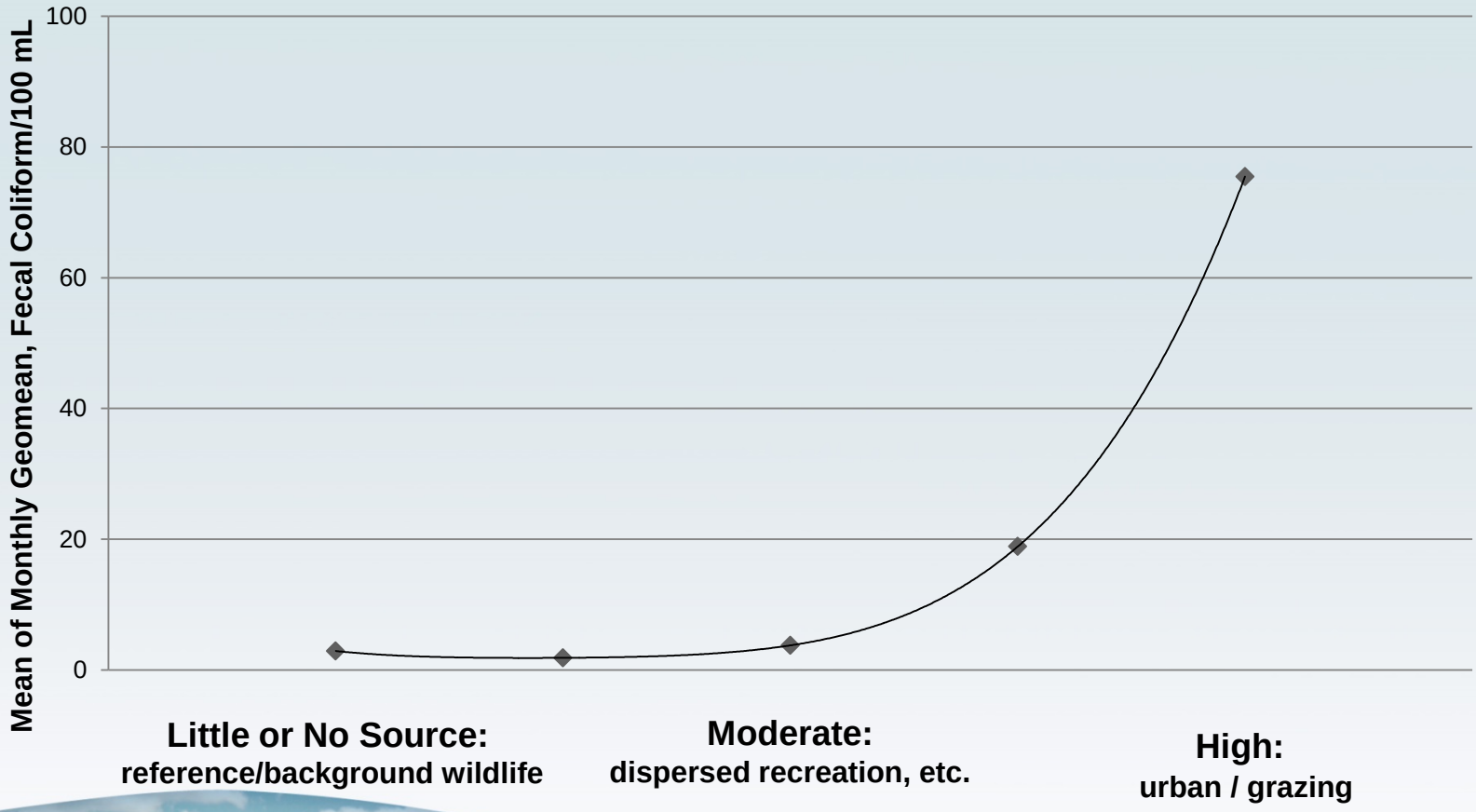
1550 Geomean calculations

132 Monitoring sites

13 Hydrologic Units


West Fork Carson Elevation Profile
Elevation Feet
7,400
7,200
7,000
6,800
6,600
6,400
6,200
6,000
5,800
5,600
5,400
5,200
5,000
4
3
2
3
36
Data displayed is a mean of monthly log-mean. Units are cfu/100ml
Headwaters
Hope Valley
Woodfords
NV State Line

Fecal Coliform Mean of Monthly Geomeans by Source Intensity



Working Hypotheses

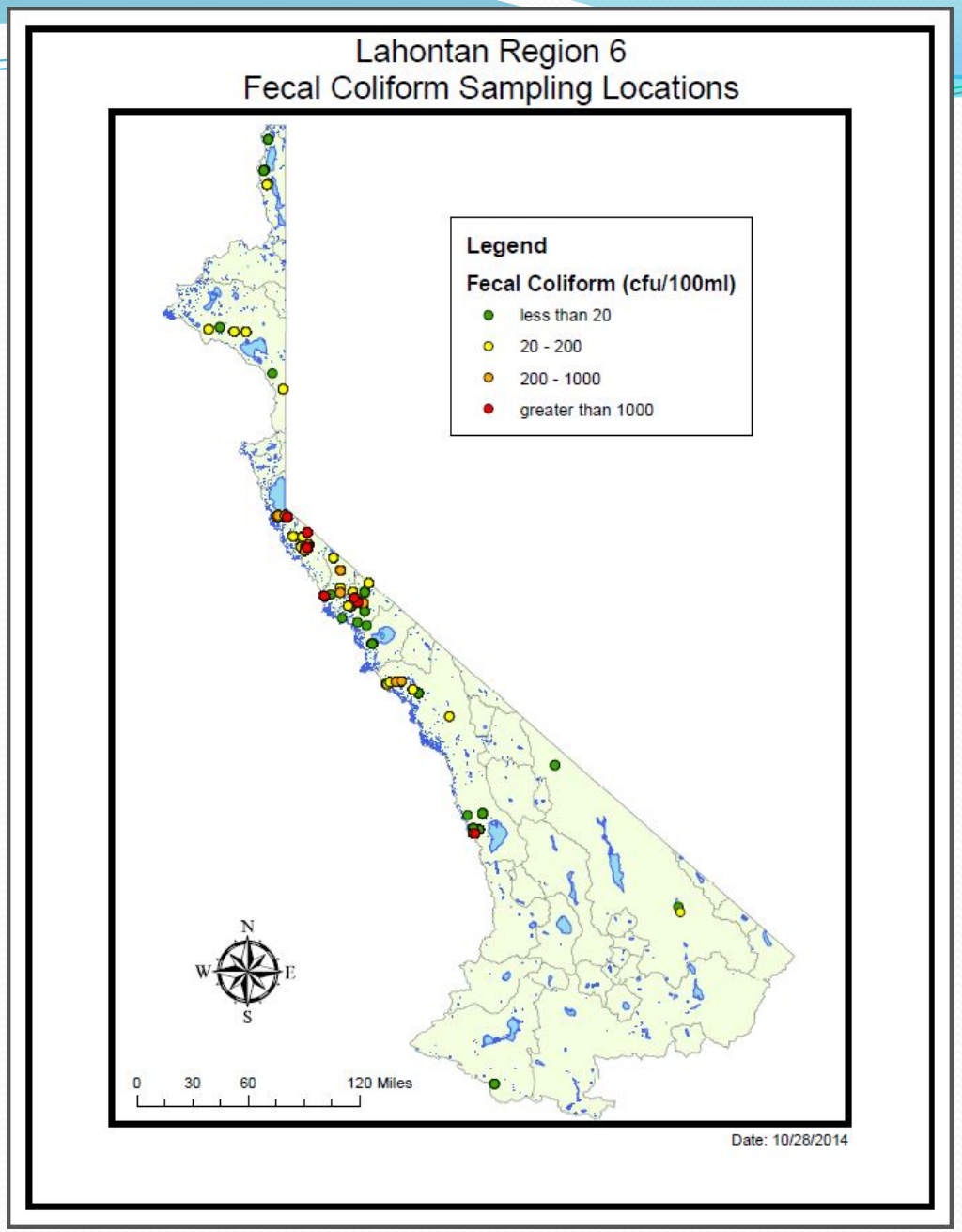
- Sources are wildlife, recreation, anthropogenic (human and livestock)
- Factors affecting fecal coliform concentrations are size of watershed, elevation, seasonality, flow regime
- Source intensity affects bacteria concentration

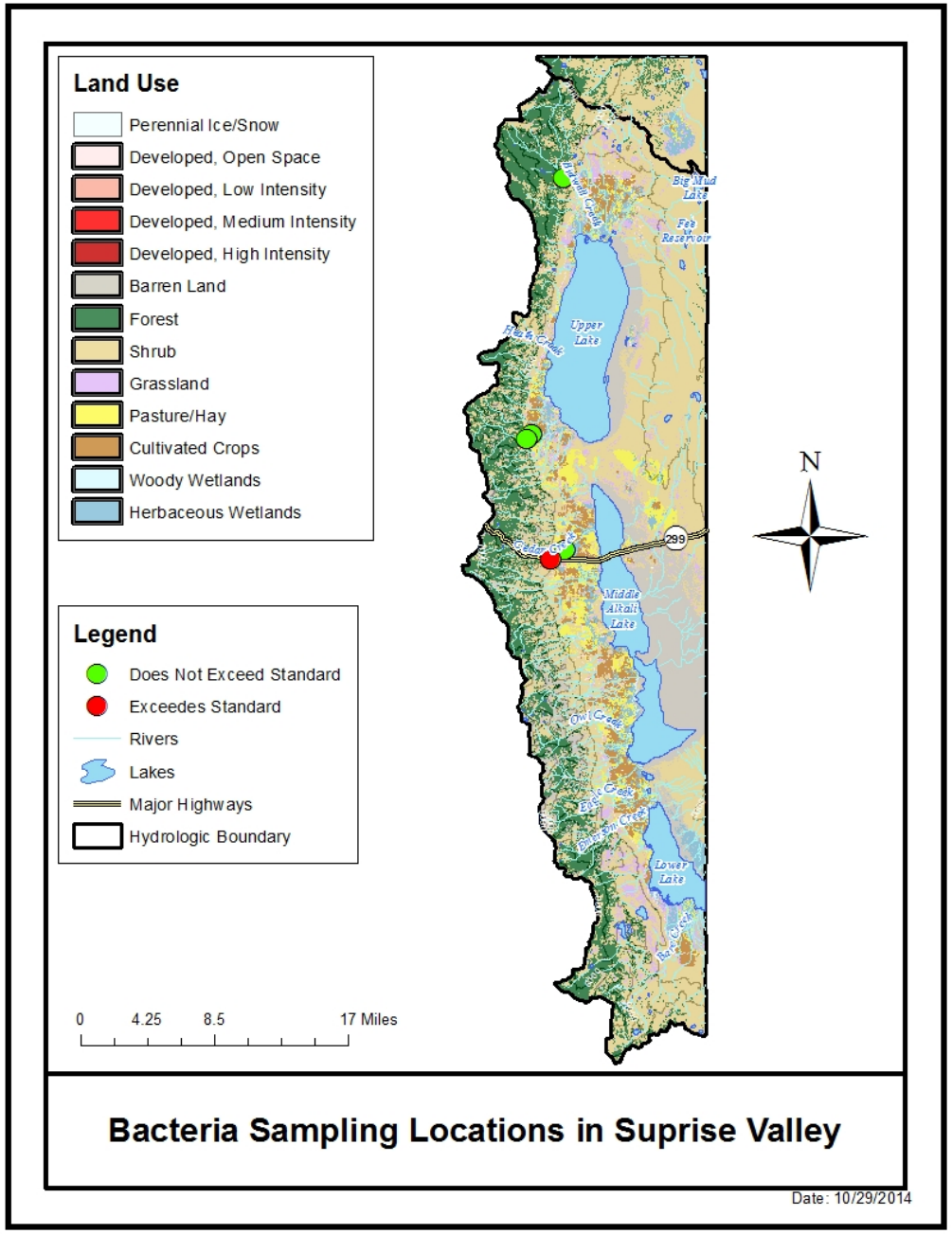
Preliminary Conclusions

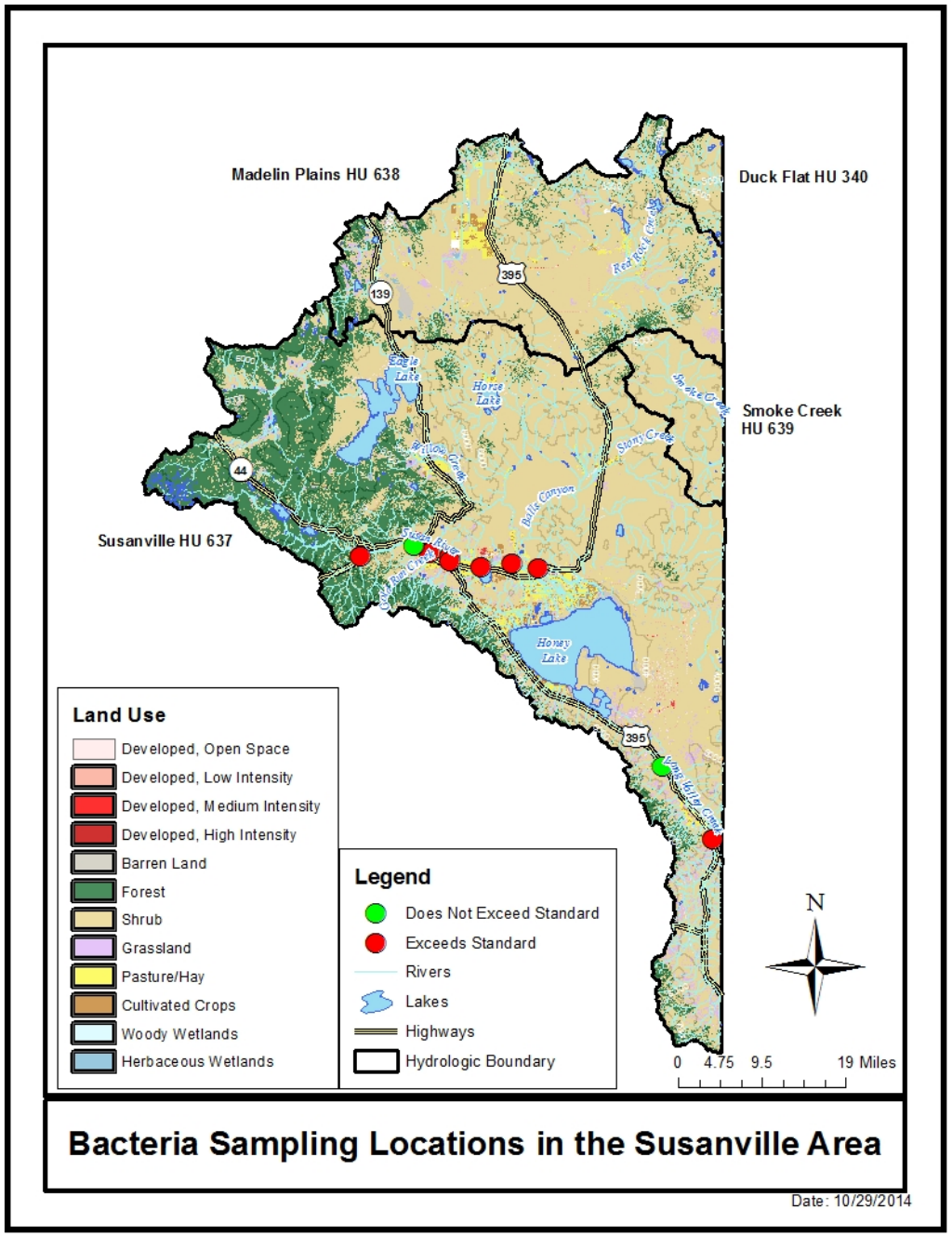
- Sixty-four of 132 locations in the region meet the existing 20 fecal coliform per 100 mL standard. The majority of locations in the Lake Tahoe watershed meet the standard.
- Sixty-eight of 132 locations do not meet the 20 fecal coliform per 100 mL standard. The majority of these locations have evidence of anthropogenic influences.

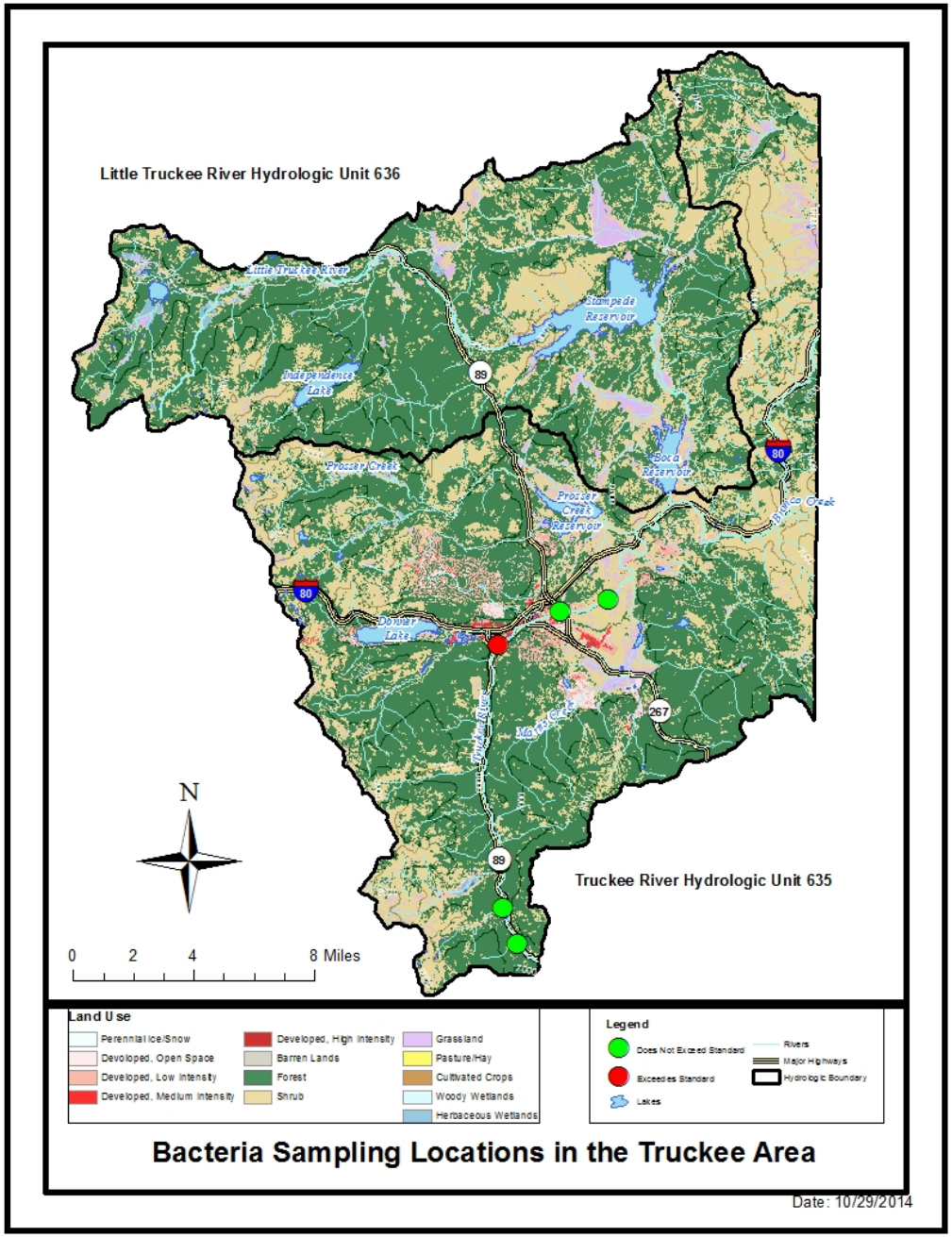
Preliminary Evaluation of our Waterbodies

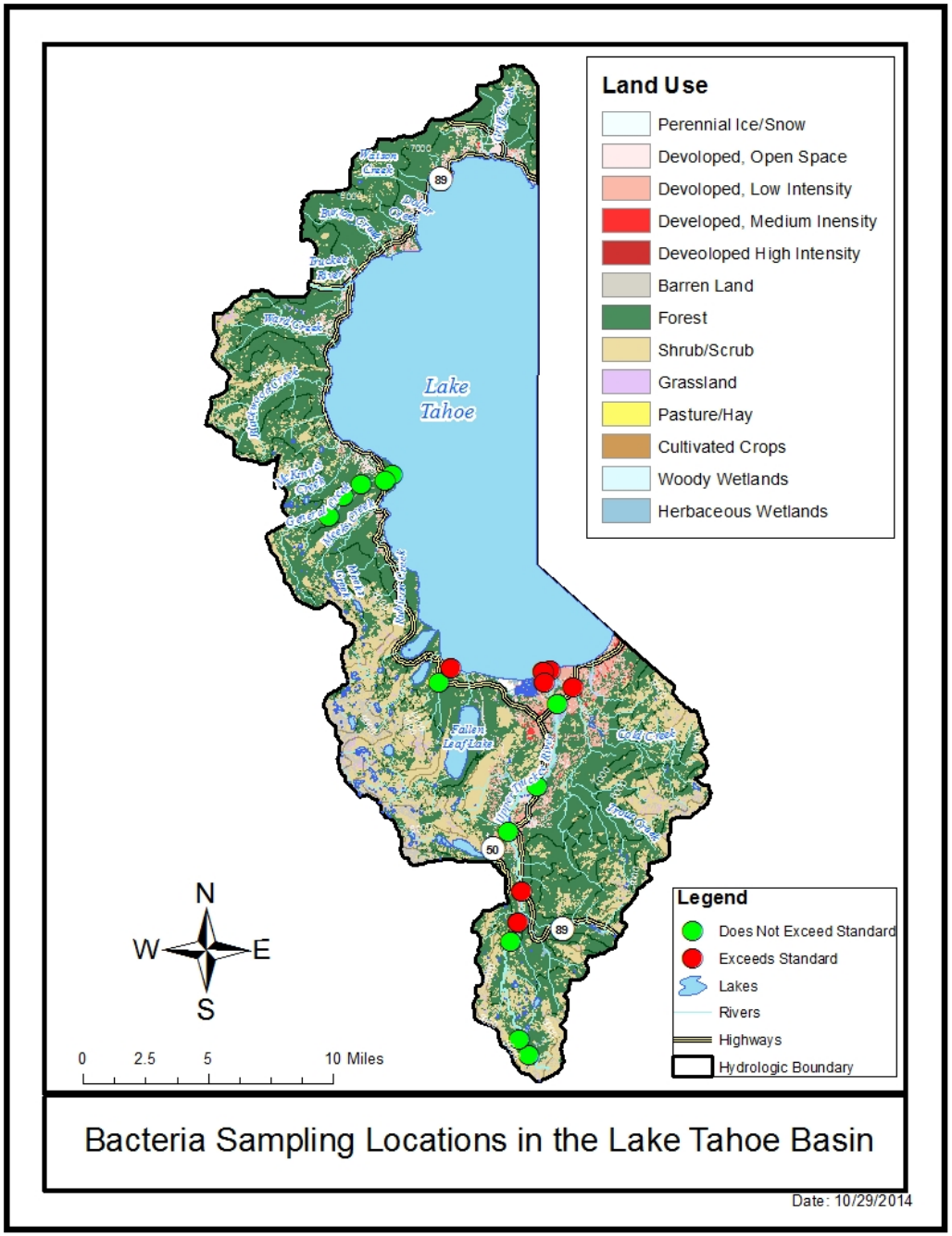
a) Approximately 64 of the 132 sampling locations in our region meet the existing 20 fecal coliform per 100 mL standard
b) Approximately 68 of the 132 locations do not meet the 20 fecal coliform per 100 mL standard
c) Approximately 24 waterbodies in our region have not been evaluated (and will likely not be evaluated)

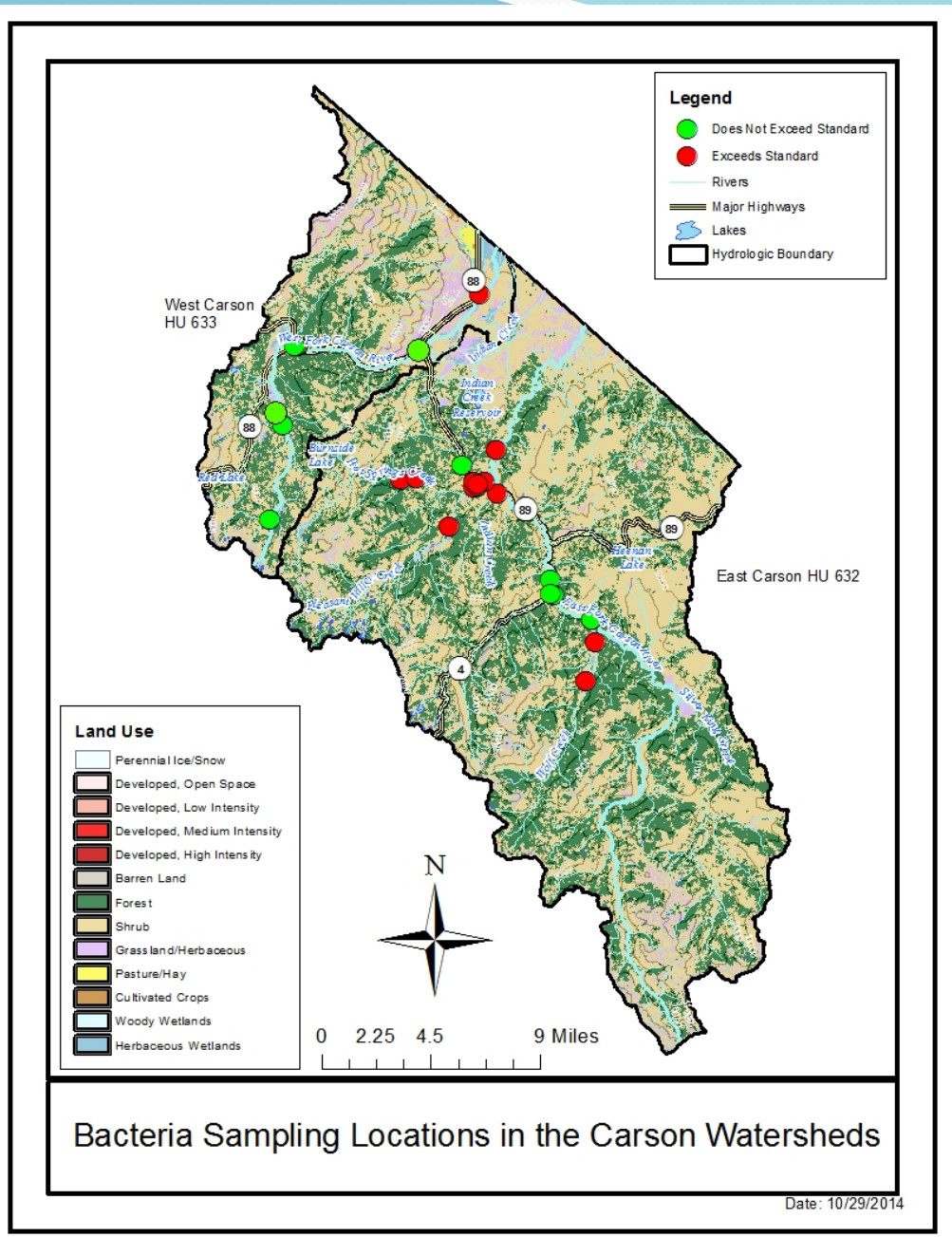

Lahontan Region 6
Fecal Coliform Sampling Locations
Legend
Fecal Coliform (cfu/100ml)
less than 20
20 - 200
200 - 1000
greater than 1000
N
W
E
S
0
30
60
120 Miles
Date: 10/28/2014

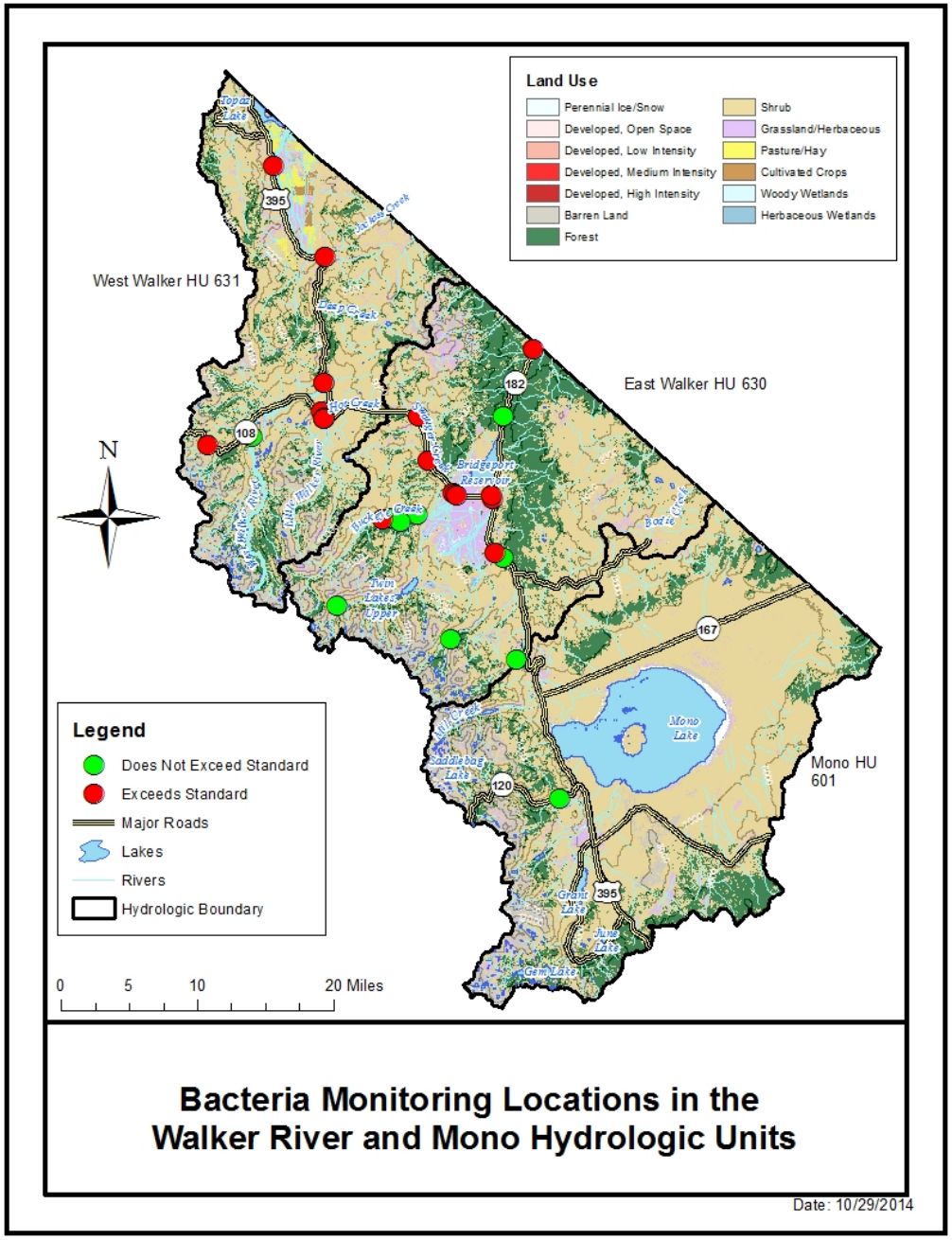

Land Use
Perennial Ice/Snow
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Forest
Shrub
Grassland
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
Legend
Does Not Exceed Standard
Exceedes Standard
Rivers
Lakes
Major Highways
Hydrologic Boundary
0 4.25 8.5 17 Miles
N
299
Upper Lake
Middle Alkali Lake
Lower Lake
Big Mud Lake
Fee Reservoir
Owl Creek
Bidwell Canal
Bidwell Creek
Bidwell Canal
Bidwell Creek
Bidwell Canal
Bidwell


Madelin Plains HU 638
Duck Flat HU 340
Smoke Creek HU 639
Susanville HU 637
Land Use
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Forest
Shrub
Grassland
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
Legend
Does Not Exceed Standard
Exceeds Standard
Rivers
Lakes
Highways
Hydrologic Boundary
N
0 4.75 9.5 19 Miles
Bacteria Sampling Locations in the Susanville Area
Date: 10/29/2014


Little Truckee River Hydrologic Unit 636
Truckee River Hydrologic Unit 635
Little Truckee River
Stampede Reservoir
Independence Lake
Prosser Creek
Prosser Creek Reservoir
Boca Reservoir
Donner Lake
Donner Creek
Truckee River
89
80
267
N
0 2 4 8 Miles
Land Use
Perennial Ice/Snow
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Lands
Forest
Shrub
Grassland
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
Legend
Does Not Exceed Standard
Exceeds Standard
Lakes
Rivers
Major Highways
Hydrologic Boundary
Bacteria Sampling Locations in the Truckee Area
Date: 10/29/2014


Land Use
Perennial Ice/Snow
Devoloped, Open Space
Devoloped, Low Intensity
Developed, Medium Inensity
Deveoloped High Intensity
Barren Land
Forest
Shrub/Scrub
Grassland
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
Lake Tahoe
Fallen Leaf Lake
N
W
E
S
0
2.5
5
10 Miles
Legend
Does Not Exceed Standard
Exceeds Standard
Lakes
Rivers
Highways
Hydrologic Boundary
Bacteria Sampling Locations in the Lake Tahoe Basin
Date: 10/29/2014


Legend
Does Not Exceed Standard
Exceeds Standard
Rivers
Major Highways
Lakes
Hydrologic Boundary
West Carson HU 633
East Carson HU 632
Land Use
Perennial Ice/Snow
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Forest
Shrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
N
0 2.25 4.5 9 Miles
Bacteria Sampling Locations in the Carson Watersheds
Date: 10/29/2014


Land Use
Perennial Ice/Snow
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Forest
Shrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
West Walker HU 631
East Walker HU 630
Mono HU 601
N
Legend
Does Not Exceed Standard
Exceeds Standard
Major Roads
Lakes
Rivers
Hydrologic Boundary
0 5 10 20 Miles
Bacteria Monitoring Locations in the Walker River and Mono Hydrologic Units
Date: 10/29/2014

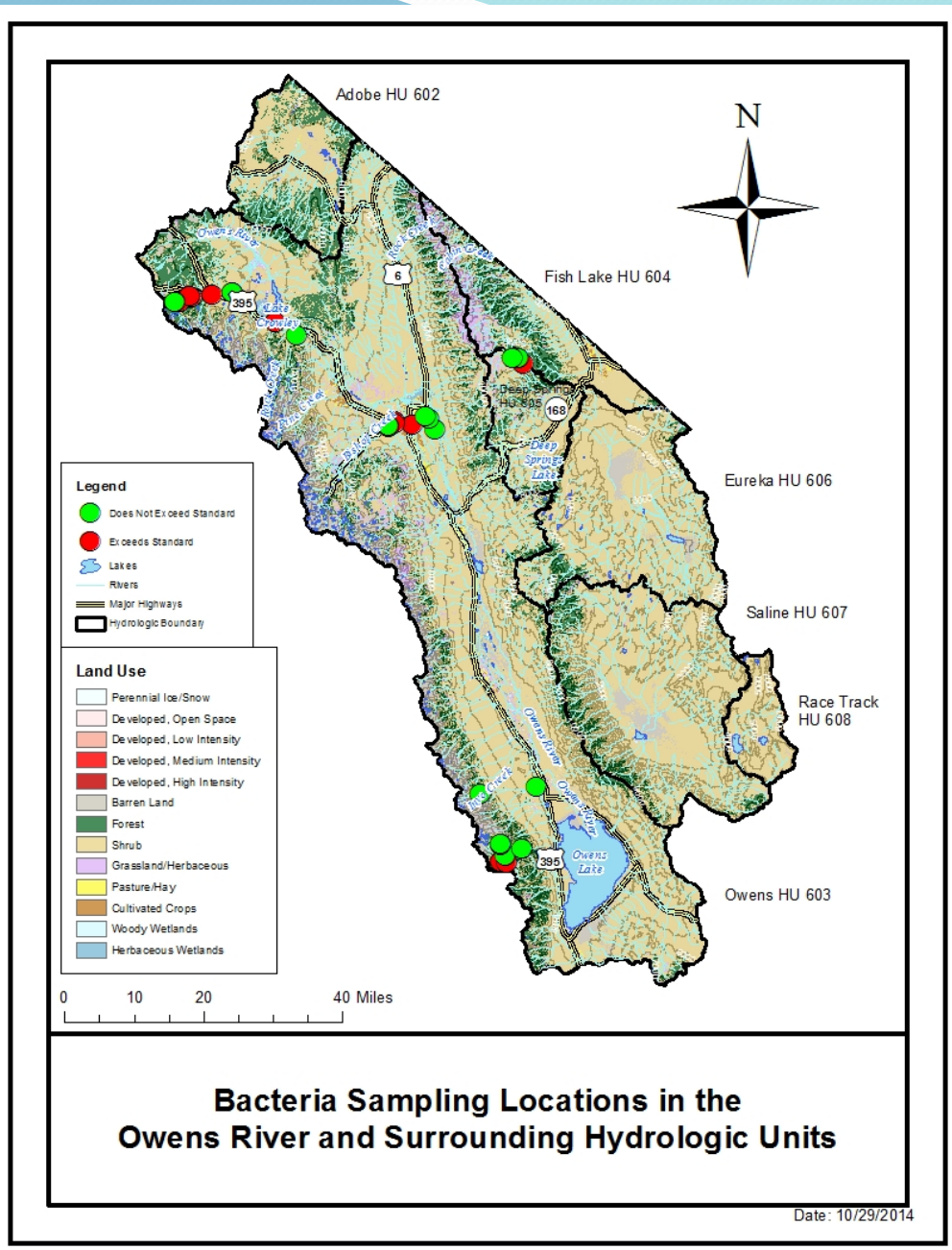
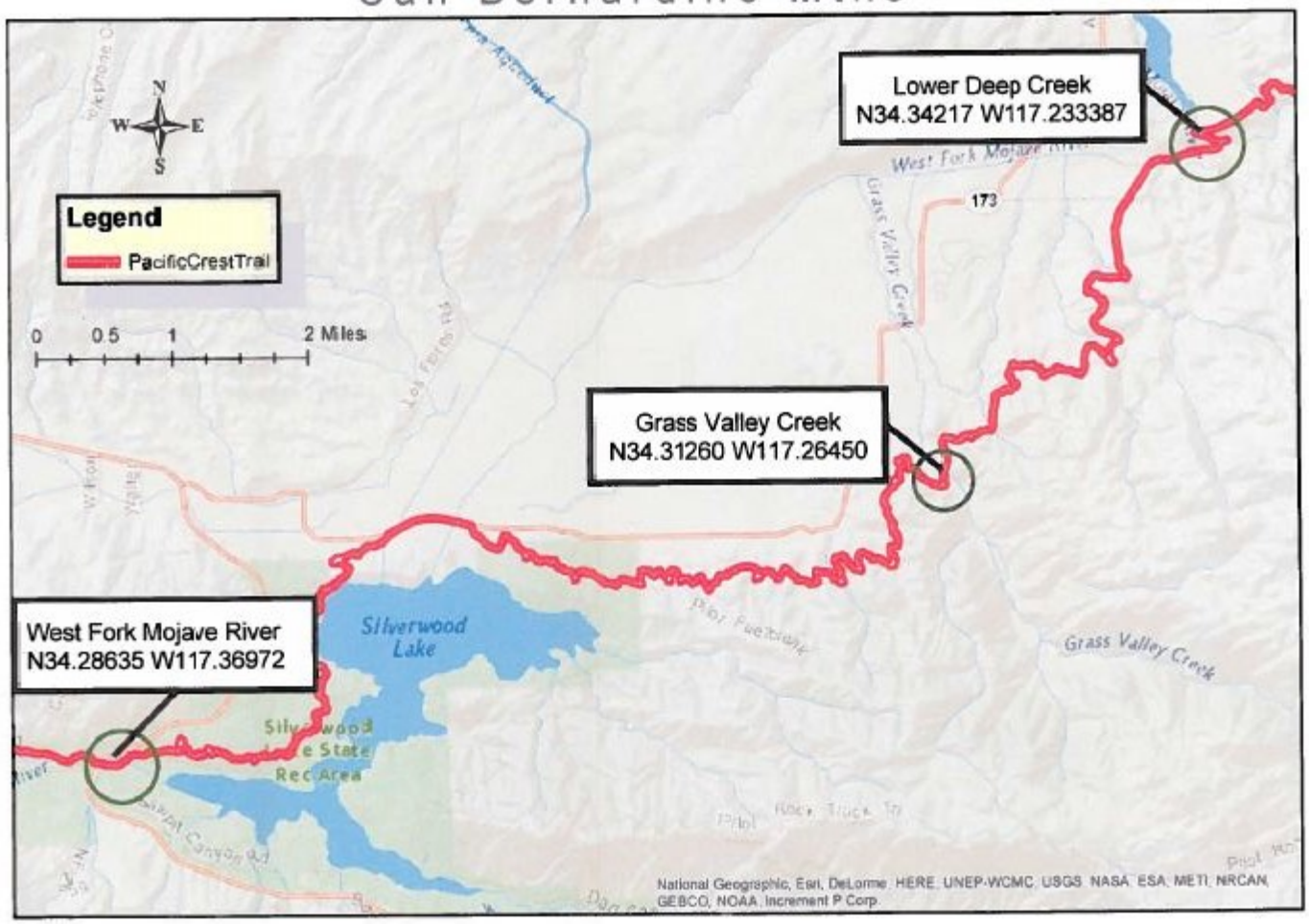

Adobe HU 602
N
Fish Lake HU 604
Eureka HU 606
Saline HU 607
Race Track HU 608
Owens HU 603
Legend
Does Not Exceed Standard
Exceeds Standard
Lakes
Rivers
Major Highways
Hydrologic Boundary
Land Use
Perennial Ice/Snow
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Forest
Shrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands
0 10 20 40 Miles
Bacteria Sampling Locations in the
Owens River and Surrounding Hydrologic Units
Date: 10/29/2014

FIGURE 1

Bacteria Sample Locations
San Bernardino Mtns



Next Steps

Continue data collection and evaluation

(including metadata [field observations] & Microbial Source Tracking analyses)

Proposed Bacteria WQO Project Final Steps:

1. Establish Beneficial Use for intentional consumption
2. Establish bacteria WQO for areas that cannot achieve 20 FC/100 mL
3. Demarcate the appropriate Beneficial Uses and bacteria WQOs for the waterbody segments, waterbodies, or Hydrologic Units

Proposed Schedule

- Begin in 2015 - host public listening sessions
- By the end of 2015 field season - complete data collection
- Spring 2016 - complete data evaluation
- During 2016 - perform Basin Planning Amendment process
- Late 2016/early 2017 - present to Board for adoption

2 Questions

1. Areas to protect for intentional consumption?

2. Areas to relax existing standard (to align with State Board statewide project)?