



# North Coast Regional Water Quality Control Board

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## Russian River Pathogen Indicator Bacteria TMDL

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August 28, 2014

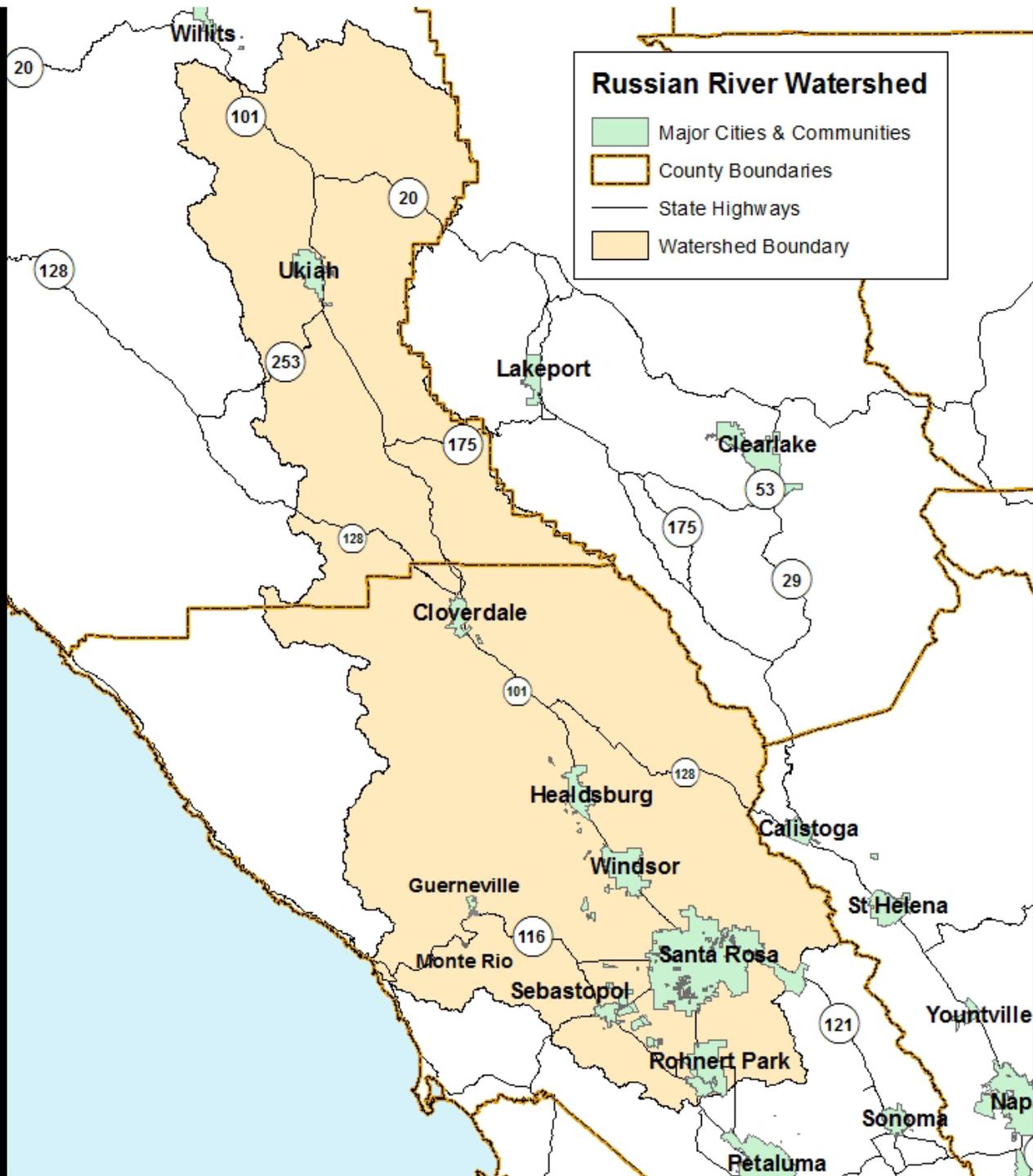


# Meeting Outline

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- Opening Remarks
- Staff Presentation
  - Overview of the Russian River Watershed and TMDLs
  - Introduction of Bacteria Objective
  - Summary of Impacted Areas
  - Summary of Sources
  - Possible Implementation Actions
- Open Discussion of Possible Implementation Actions





East Fork Russian River

Lake Mendocino

Big Sulphur Creek

Lake Sonoma

Dry Creek

Austin Creek

Mark West Creek

Green Valley Creek

Santa Rosa Creek

Laguna de Santa Rosa



## What is a TMDL?

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A **T**otal **M**aximum **D**aily **L**oad (**TMDL**) is:

- Maximum amount of a pollutant that waterbody can handle and remain healthy





## What is a TMDL?

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A **T**otal **M**aximum **D**aily **L**oad (**TMDL**) is a framework for:

- Evaluating and quantifying the factors that contribute to water quality problems in a waterbody or watershed
- Developing a strategy (called an Action Plan or Implementation Plan) to meet the loading capacity and attain water quality standards



## End Goal: Attain Water Quality Standards

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Standards include:

- Beneficial Uses of Water
  - Water Contact Recreation
- Water Quality Objectives
  - Bacteriological quality of the Russian River and its tributaries shall not be degraded beyond natural background conditions



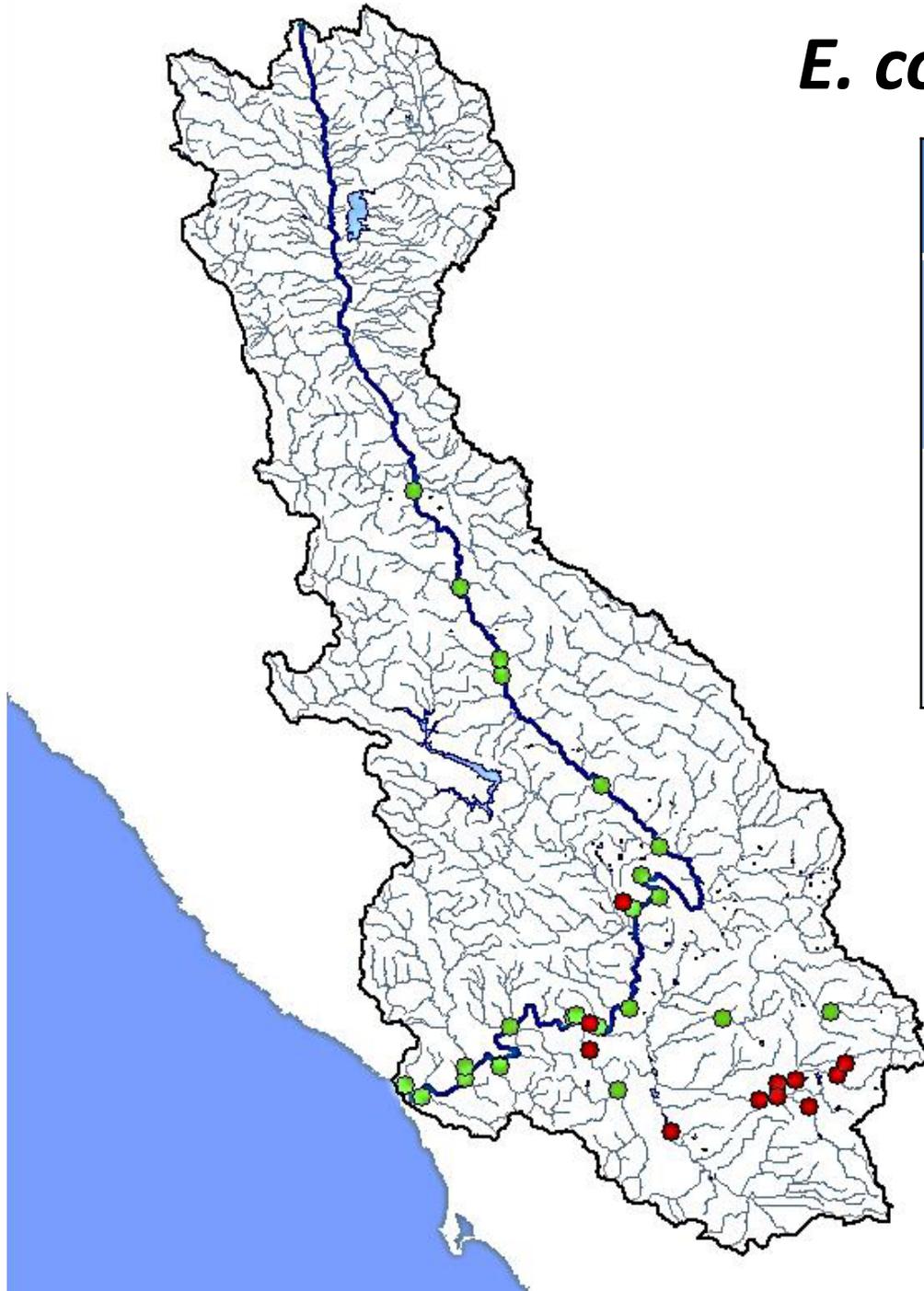
# Area of Impact

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1. Waste from humans
2. Waste from other animals

# *E. coli* Bacteria Distribution



## **E. coli REC-1 Criteria**

	Geometric Mean	Statistical Threshold Value
Estimated 36 illnesses per 1,000 recreators	126 colony forming units / 100mL water	410 cfu/100mL

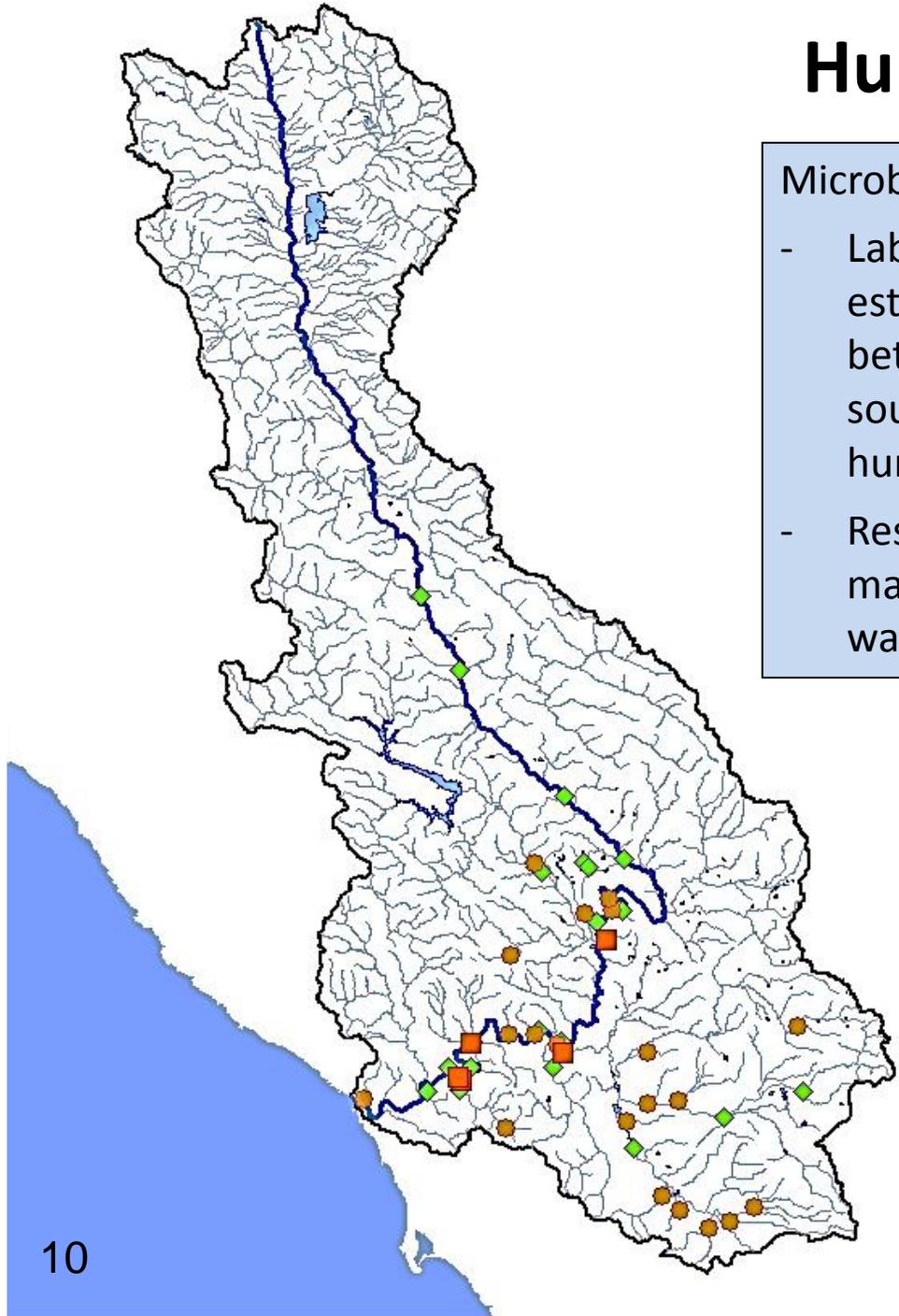
## **Russian River Watershed**

- Exceeds REC-1 criteria
- Meets REC-1 criteria
- Mainstem Russian River

# Human Waste Distribution

## Microbiological Source Identification Facts:

- Lab analysis identifies DNA gene sequences to estimate the percent of bacteria DNA matches between water sample and a known fecal source (i.e., raw sewage, septic waste, and human feces)
- Results expressed as % of bacterial DNA that matches known bacterial DNA from human waste



## Russian River Watershed

### Percent Human Waste

◆ < 5%

● 5% - 50%

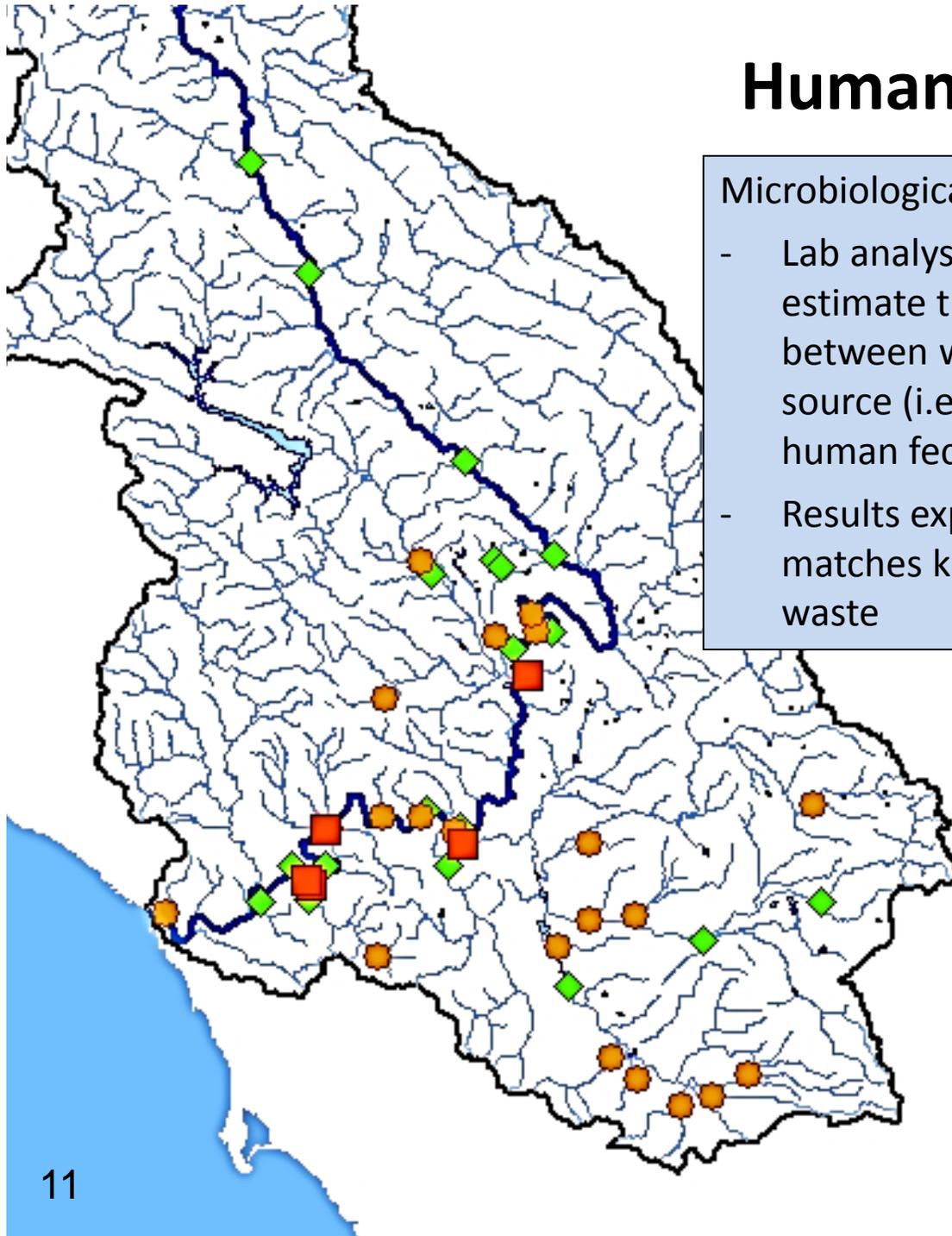
■ > 50%

— Mainstem Russian River

# Human Waste Distribution

## Microbiological Source Identification Facts:

- Lab analysis identifies DNA gene sequences to estimate the percent of bacteria DNA matches between water sample and a known fecal source (i.e., raw sewage, septic waste, and human feces)
- Results expressed as % of bacterial DNA that matches known bacterial DNA from human waste



## Russian River Watershed

### Percent Human Waste

- ◆ < 5%
- 5% - 50%
- > 50%

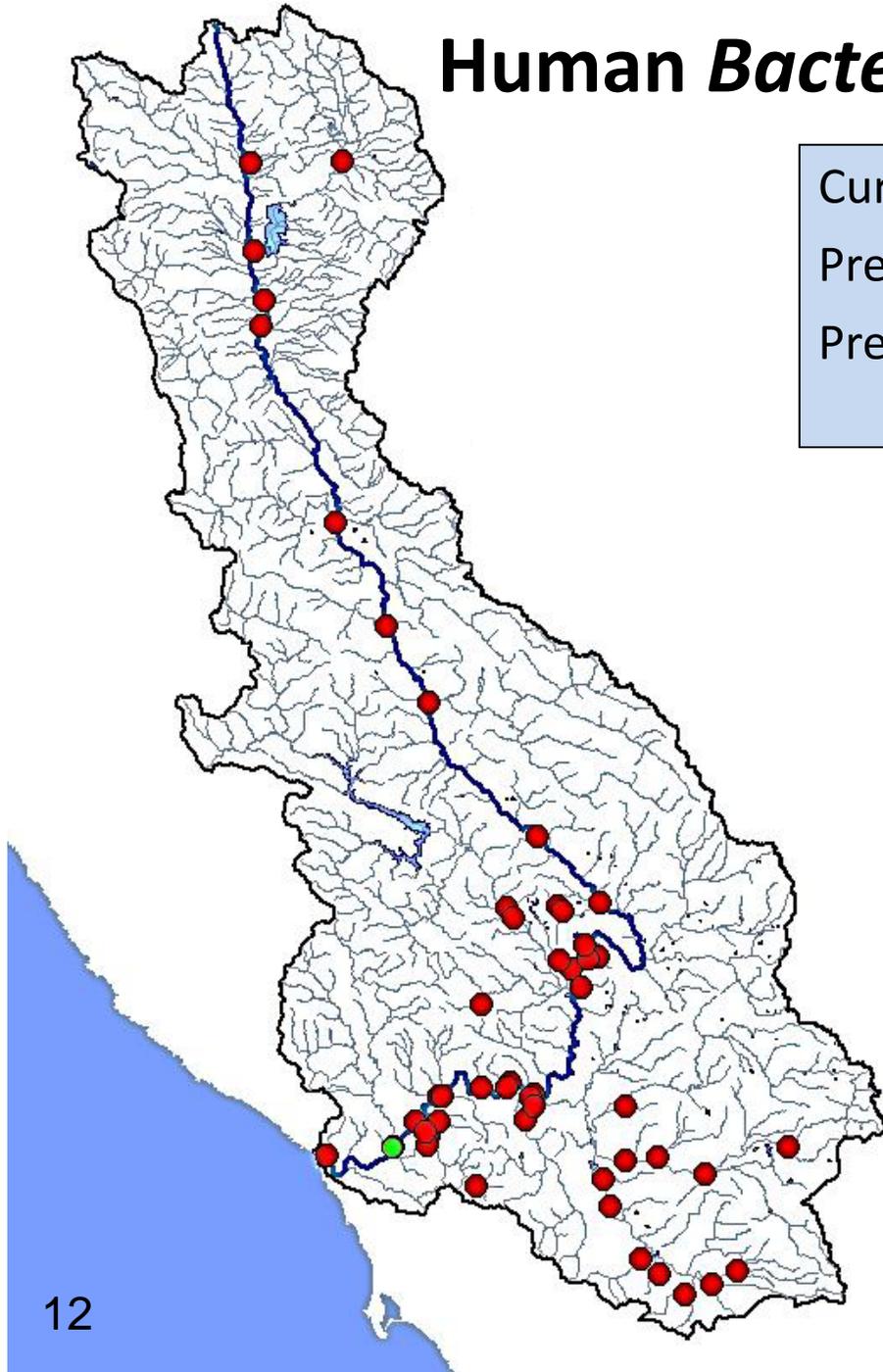
— Mainstem Russian River

# Human *Bacteroides* Bacteria Distribution

Current Reporting Limit = 60 genes/100mL

Presence = Exceedance of Reporting Limit

Presence = Exceedance of Natural Background Bacteria Objective



## Links between *Bacteroides* & Illness

	Wade et al. (2010)	Ashbolt et al. (2010)
Estimated 30 illnesses per 1,000 recreators	60 genes/100mL	860 genes/100mL

## Russian River Watershed

- Measurements less than the Reporting Limit
- Measurements greater than the Reporting Limit
- Russian River Mainstem



# Area of Impact

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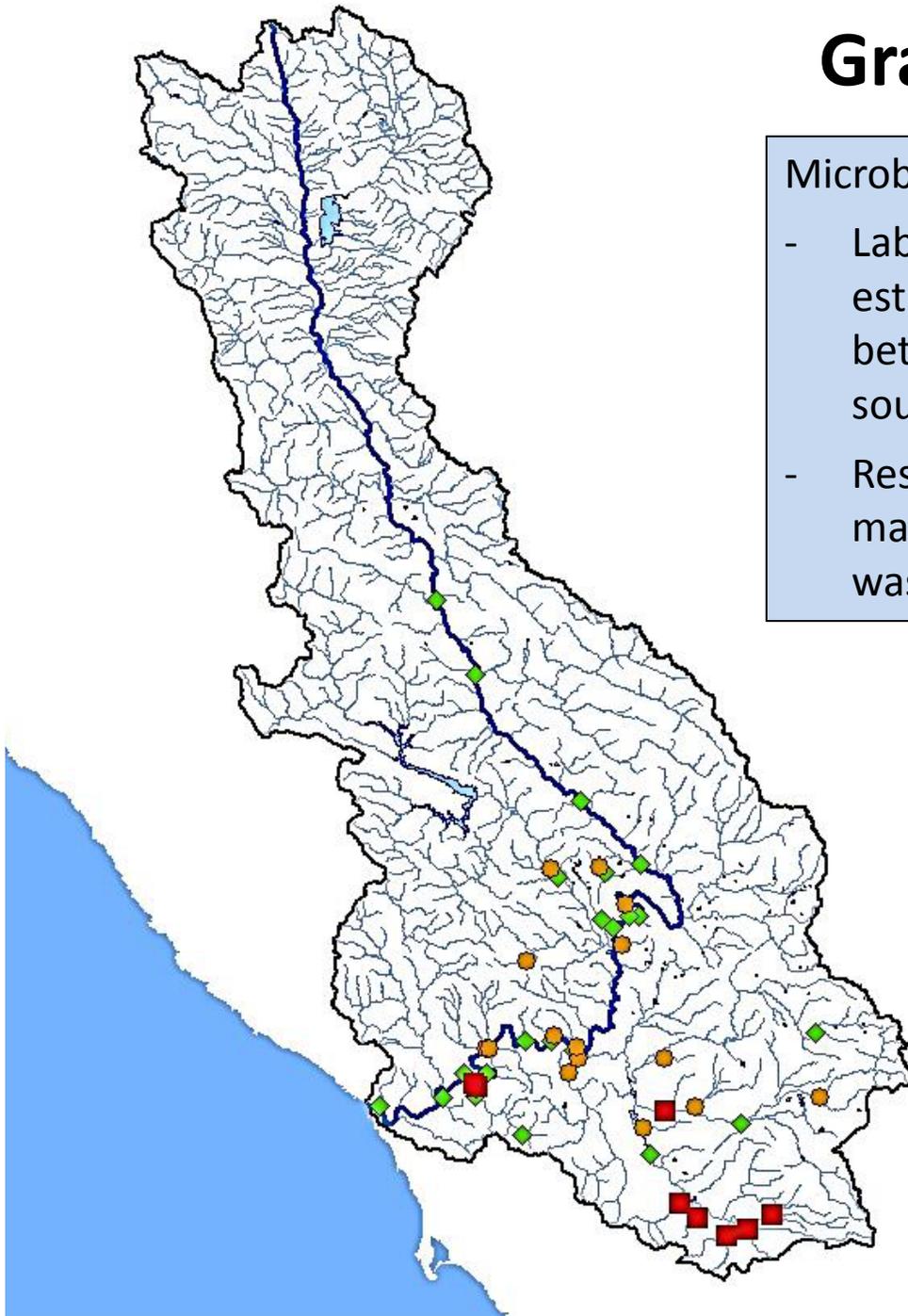
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1. Waste from humans
2. Waste from other animals

# Grazer Waste Distribution

## Microbiological Source Identification Facts:

- Lab analysis identifies DNA gene sequences to estimate the percent of bacteria DNA matches between water sample and a known fecal source (i.e., cows, horses, deer, and elk)
- Results expressed as % of bacterial DNA that matches known bacterial DNA from grazer waste



## Russian River Watershed

### Percent Grazer Waste

◆ < 5%

● 5% - 20%

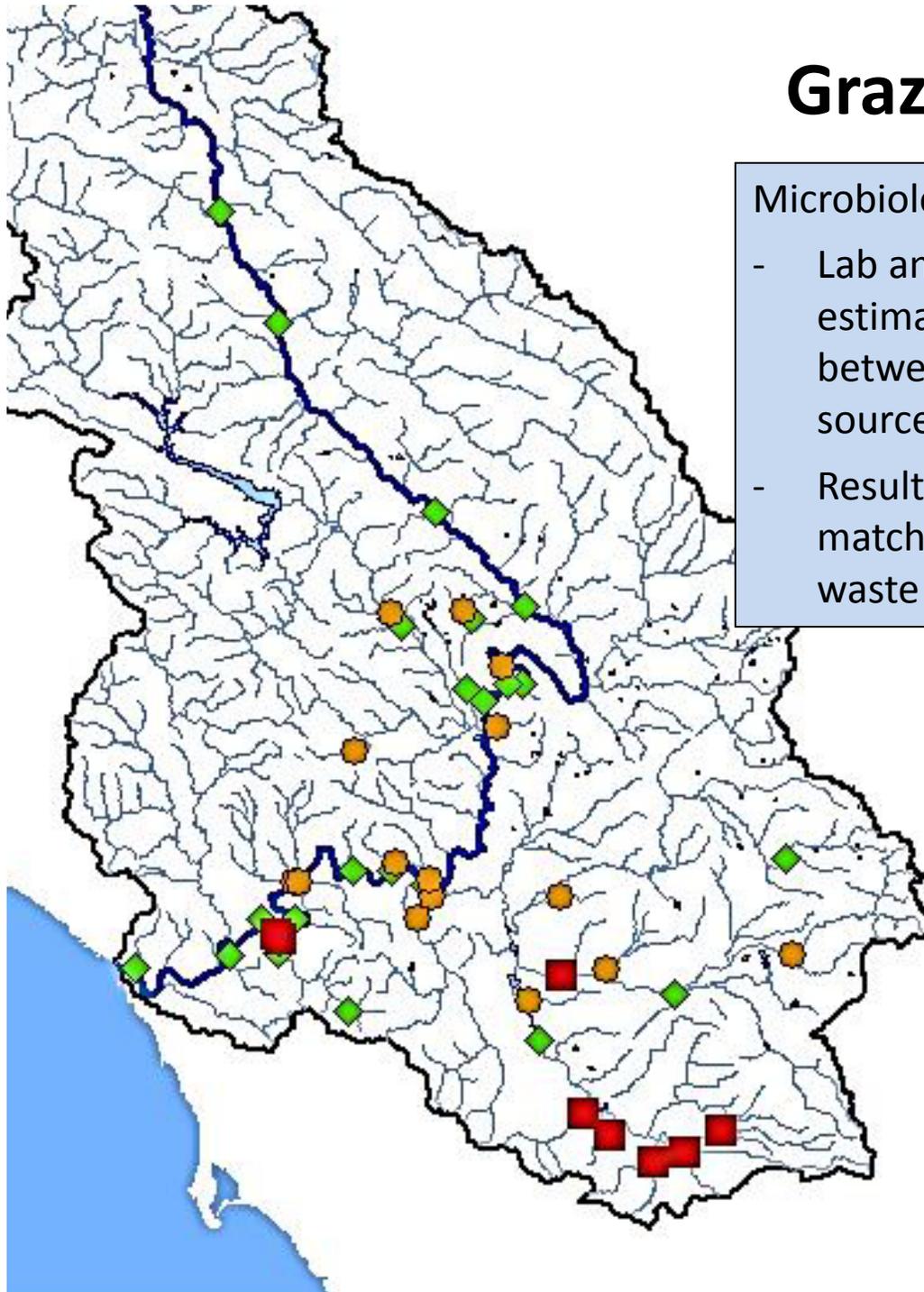
■ > 20%

— Mainstem Russian River

# Grazer Waste Distribution

## Microbiological Source Identification Facts:

- Lab analysis identifies DNA gene sequences to estimate the percent of bacteria DNA matches between water sample and a known fecal source (i.e., cows, horses, deer, and elk)
- Results expressed as % of bacterial DNA that matches known bacterial DNA from grazer waste



## Russian River Watershed

### Percent Grazer Waste

- ◆ < 5%
- 5% - 20%
- > 20%

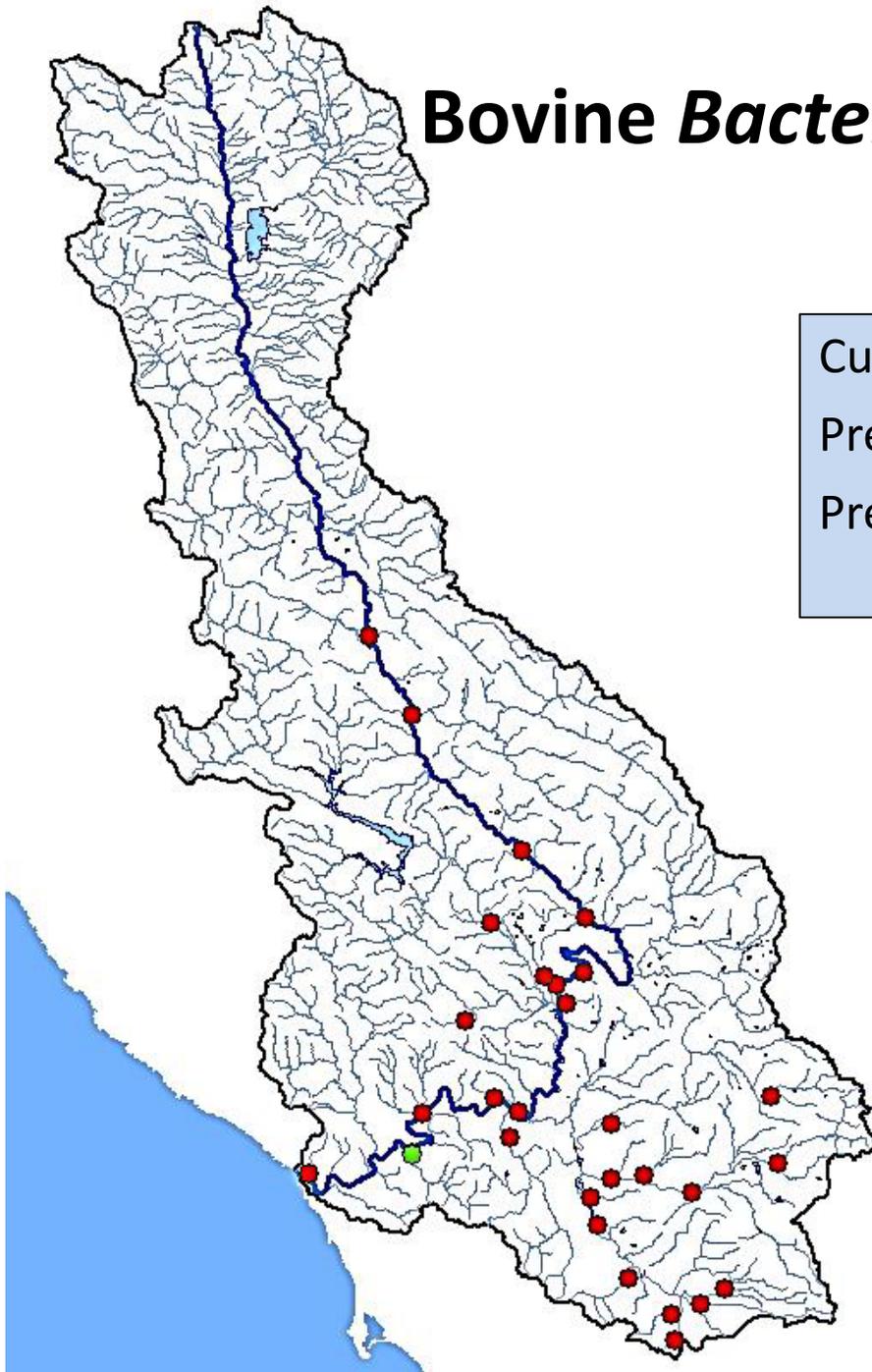
— Mainstem Russian River

# Bovine *Bacteroides* Bacteria Distribution

Current Reporting Limit = 30 genes/100mL

Presence = Exceedance of Reporting Limit

Presence = Exceedance of Natural Background  
Bacteria Objective



## Russian River Watershed

- Measurements greater than the Reporting Limit
- Measurements less than the Reporting Limit
- Mainstem Russian River



# Conclusions

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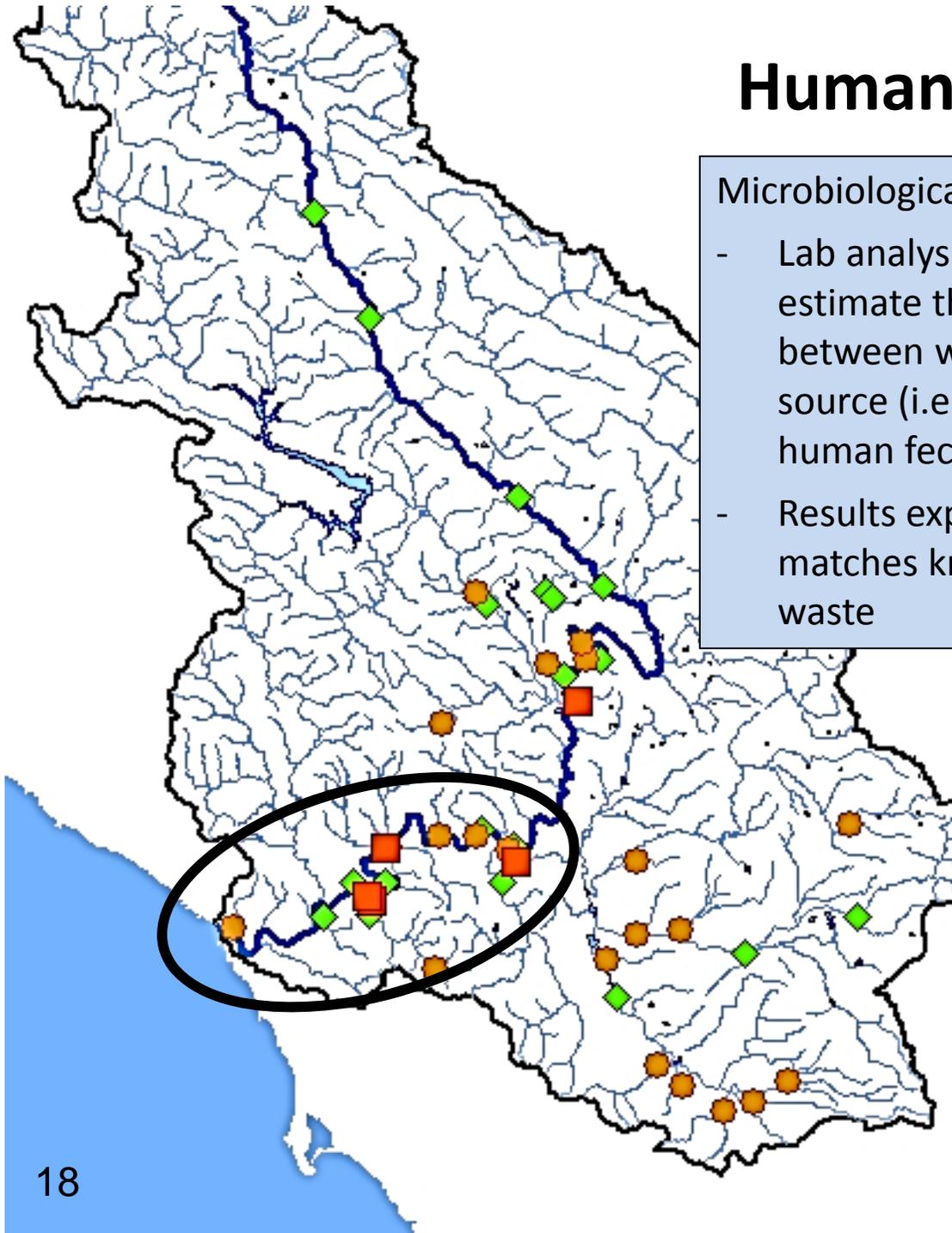
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1. Pathogens are likely present throughout the Russian River Watershed above natural background levels
2. Most significant impacts are in tributaries and the lower mainstem river

# Human Waste Distribution

## Microbiological Source Identification Facts:

- Lab analysis identifies DNA gene sequences to estimate the percent of bacteria DNA matches between water sample and a known fecal source (i.e., raw sewage, septic waste, and human feces)
- Results expressed as % of bacterial DNA that matches known bacterial DNA from human waste



## Russian River Watershed

### Percent Human Waste

- ◆ < 5%
- 5% - 50%
- > 50%

— Mainstem Russian River



# Sources

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- Sources are producing bacteria throughout the year
- Stormwater runoff is mobilizing the bacteria into waterbodies
- Bacteria levels are higher in developed areas than in less developed areas
- Bacteria levels are higher in runoff from catchments with a high density of onsite wastewater treatment systems than from areas with a low density of systems
- High recreational uses can result in high bacteria levels



# Potential Implementation Actions

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- Management of Onsite Wastewater Treatment Systems (Septic Systems)
- Management of Municipal Wastewater
- Management of Recreational Water Use
- Management of Human Waste from Homeless and Farmworker Encampments
- Management of Animal Waste



# Onsite Wastewater Treatment Systems

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- Actions for Sonoma and Mendocino counties to manage individual OWTS in accordance with the general framework established in the TMDL. The counties would develop and submit a Bacteria Load Reduction Plan for priority areas identified in the TMDL.
- Actions for municipalities and special districts to connect existing OWTS within their district boundaries and expand the boundaries where it is reasonable and feasible.
- Actions to regulate large OWTS within certain distance of mainstem and tributaries through waste discharge requirements.
- Encourage publicly-owned treatment works to develop regional program to collect and dispose of RV toilet waste from campgrounds.



# Municipal Wastewater

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- Establishment of effluent limitations for *E. coli* for municipal wastewater discharges
- Actions requiring municipalities and special districts to further minimize sanitary sewer overflows
- Actions requiring recycled water suppliers and users to further minimize spills and incidental runoff from recycled water use sites
- Actions requiring municipalities and special districts to improve management practices that prevent runoff from biosolids application areas



# Recreational Water Use

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- Actions encouraging counties to educate public about personal hygiene and public health dangers at recreational beaches.
- Actions encouraging counties to provide and maintain adequate and convenient public restroom facilities at known beach use areas.



# Homeless and Farmworker Encampments

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- Actions recommending that counties, municipalities, MS4s, and Caltrans prevent access to bridge overpasses and other areas that are known to attract illegal camping
- Actions recommending counties to fund and implement programs to address homelessness
- Actions recommending counties to investigate construction of public restrooms for use by homeless
- Actions recommending counties to enforce local ordinances prohibiting camping on public property
- Actions recommending counties to develop program to manage farmworker housing



# Animal Waste

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- Actions directing dairies enrolled under dairy waiver and/or dairy permit to improve management practices that prevent runoff from pasture lands.
- Actions directing counties to develop programs to manage pet waste.
- Establish requirements in municipal storm water permits that require management of pet waste.
- Establish requirements in municipal storm water permits to further reduce non-storm water runoff, including over-irrigation
- Actions directing counties to provide outreach to hobby farms and owners of non-dairy livestock



## Questions to Consider

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- Are any of the suggested implementation options reasonable? What might work?
- Are any of the suggested options infeasible? What might not work?
- What suggestions do you have to control bacteria and pathogens?
- How much time do you think this will take?
- How can we help?

# Contact Information

## Webpage:

[http://www.waterboards.ca.gov/northcoast/water\\_issues/programs/tmdls/russian\\_river](http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/russian_river)

## Mailing List:

[http://www.waterboards.ca.gov/resources/email\\_subscriptions/reg1\\_subscribe.shtml](http://www.waterboards.ca.gov/resources/email_subscriptions/reg1_subscribe.shtml)

## Phone:

(707) 576-2220

## E-mail:

Rebecca Fitzgerald, TMDL Unit Senior

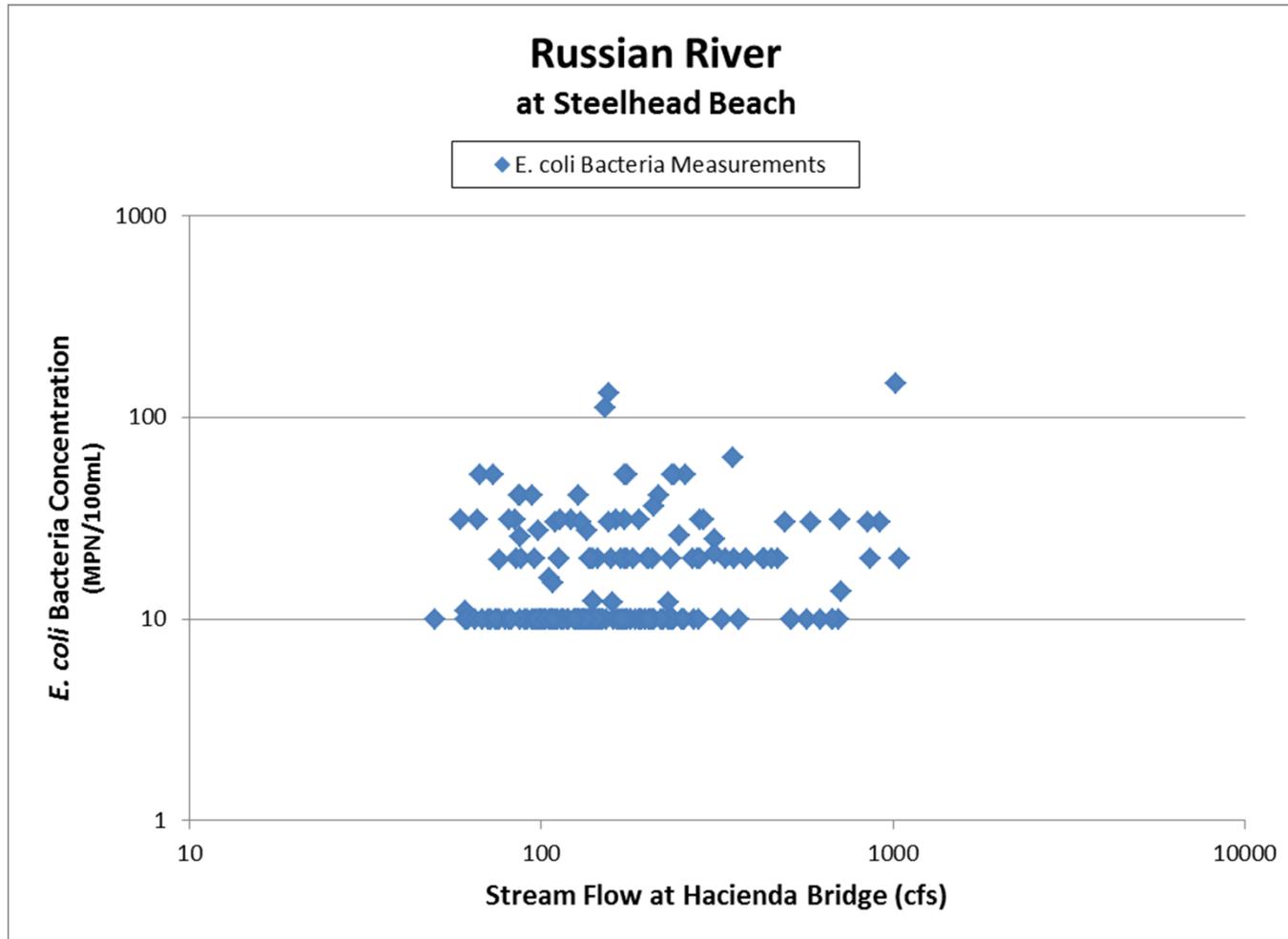
Charles Reed, Russian River TMDL Project Manager

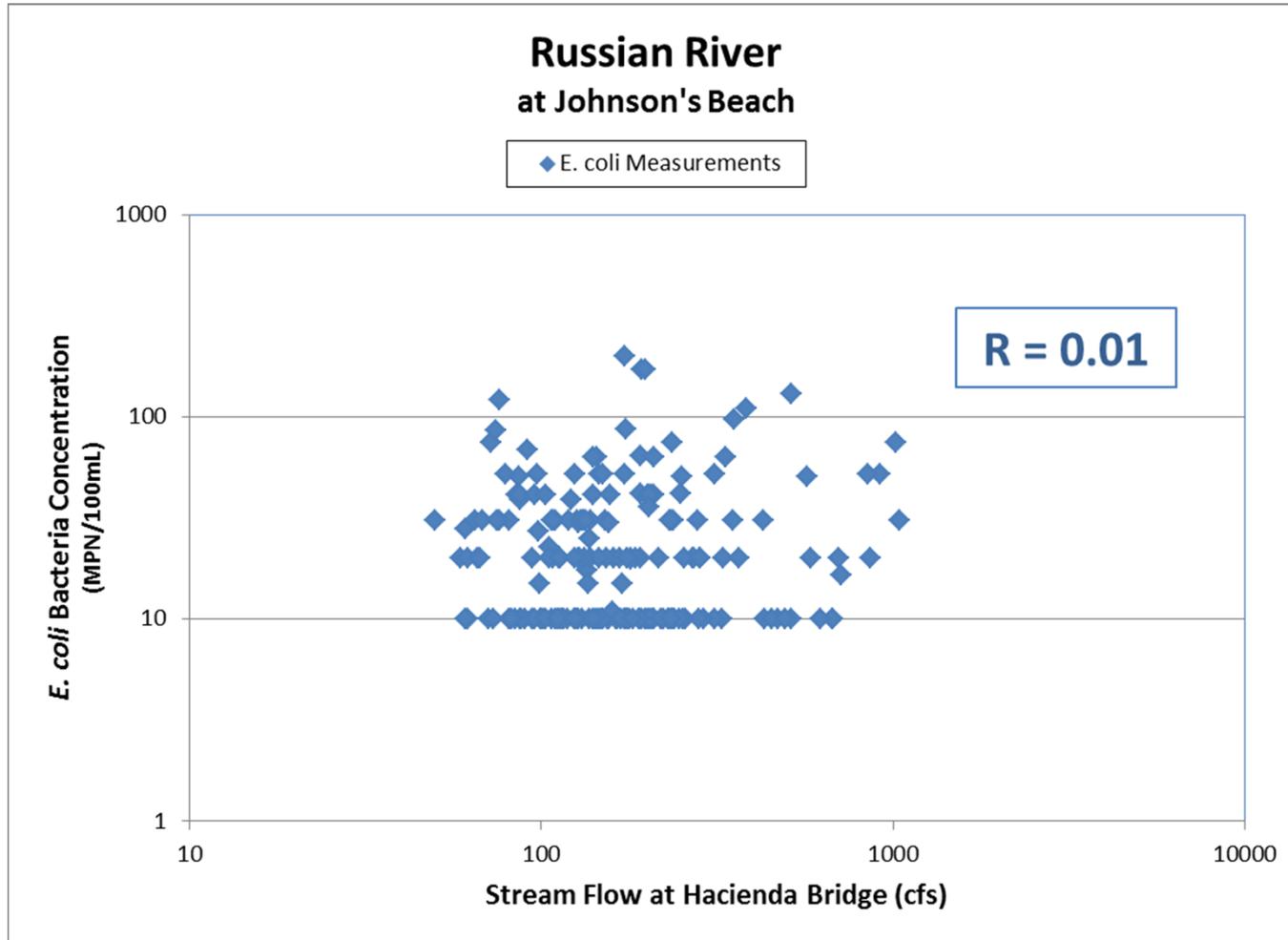


[rfitzgerald@waterboards.ca.gov](mailto:rfitzgerald@waterboards.ca.gov)

[creed@waterboards.ca.gov](mailto:creed@waterboards.ca.gov)







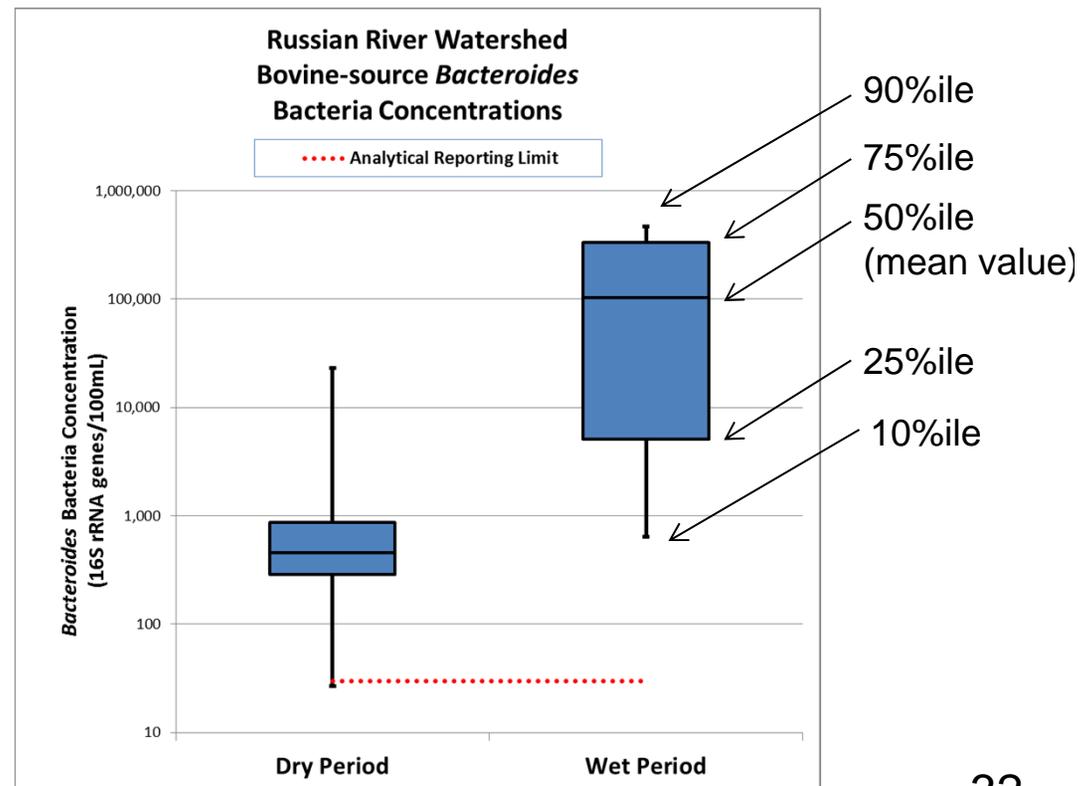
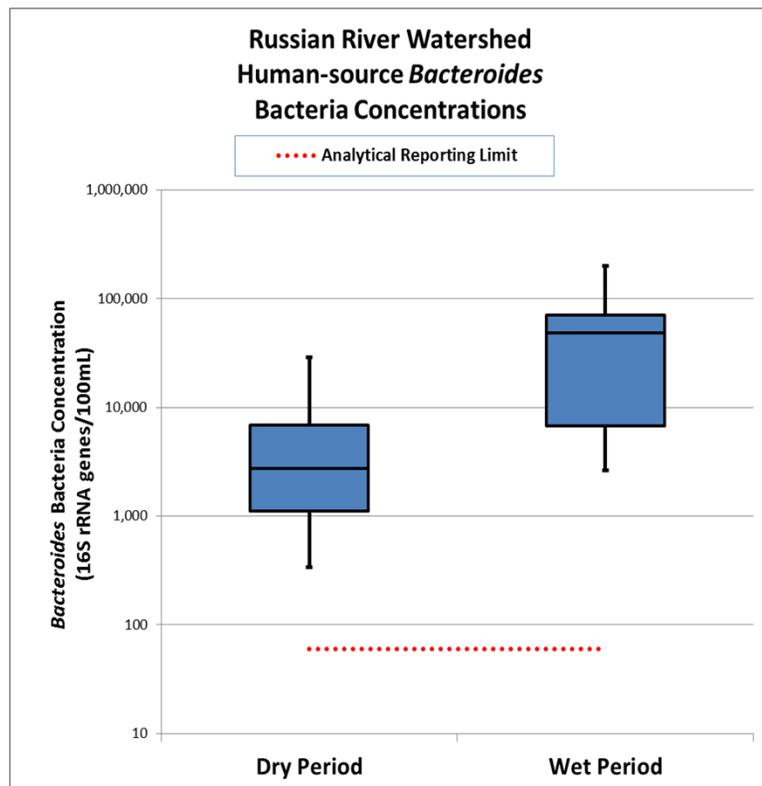


**Statistical Hypothesis Tests for Difference  
between periods 2002-2008 and 2009-2013**

<b>Measurement</b>	<b>Location</b>	<b>Mann-Whitney U Probability</b>	<b>Significant Difference?</b>
<i>E. Coli</i> Bacteria Concentration	Steelhead Beach	0.294	No
	Johnson's Beach	0.572	No
Stream Flow	Russian River near Healdsburg	<0.001	Yes
	Russian River near Guerneville	<0.001	Yes

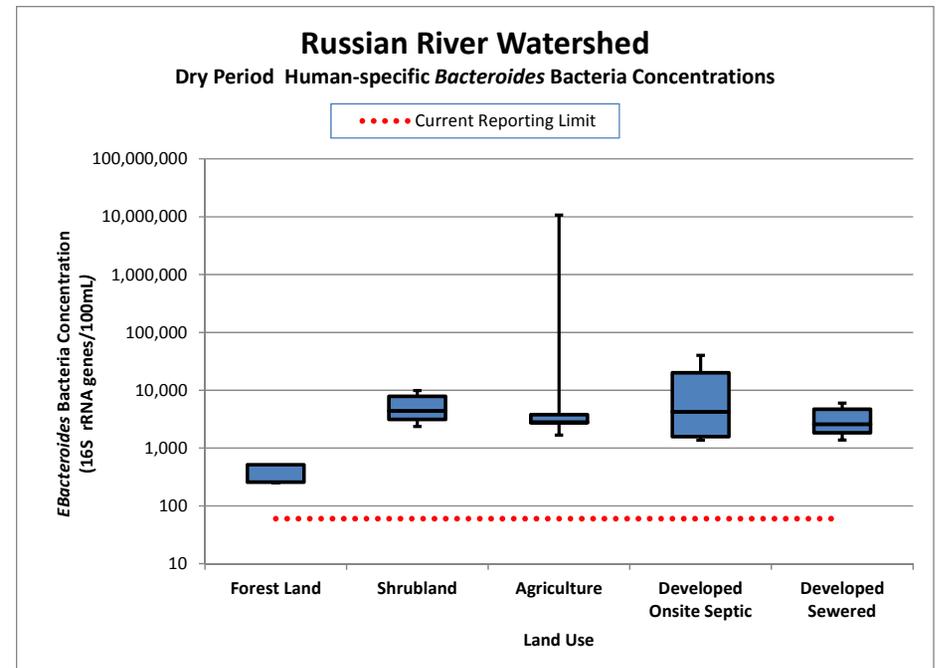
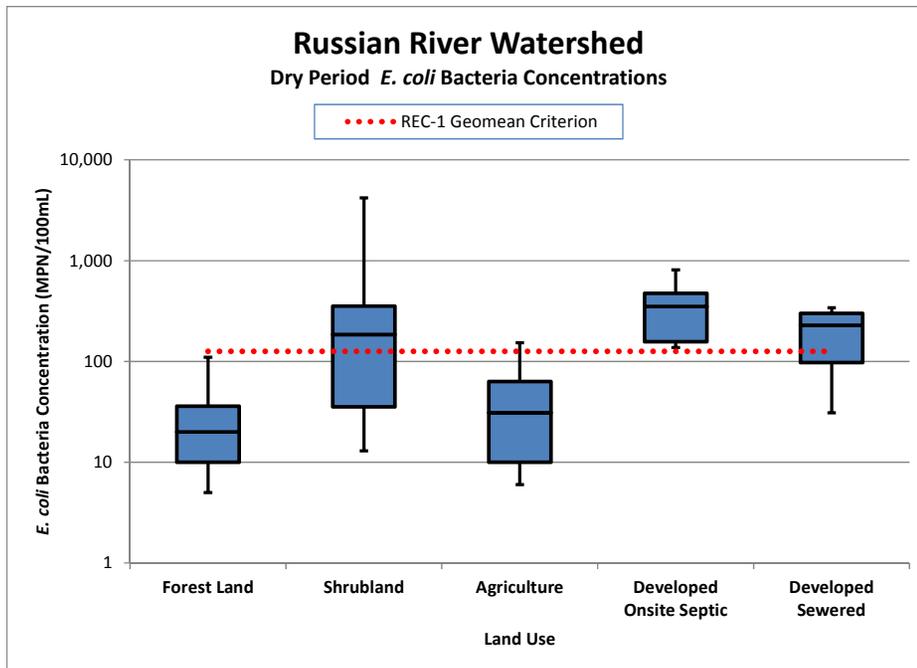
# Timing of Source Contributions

- Sources are producing bacteria throughout the year
- Stormwater runoff is mobilizing the bacteria into waterbodies



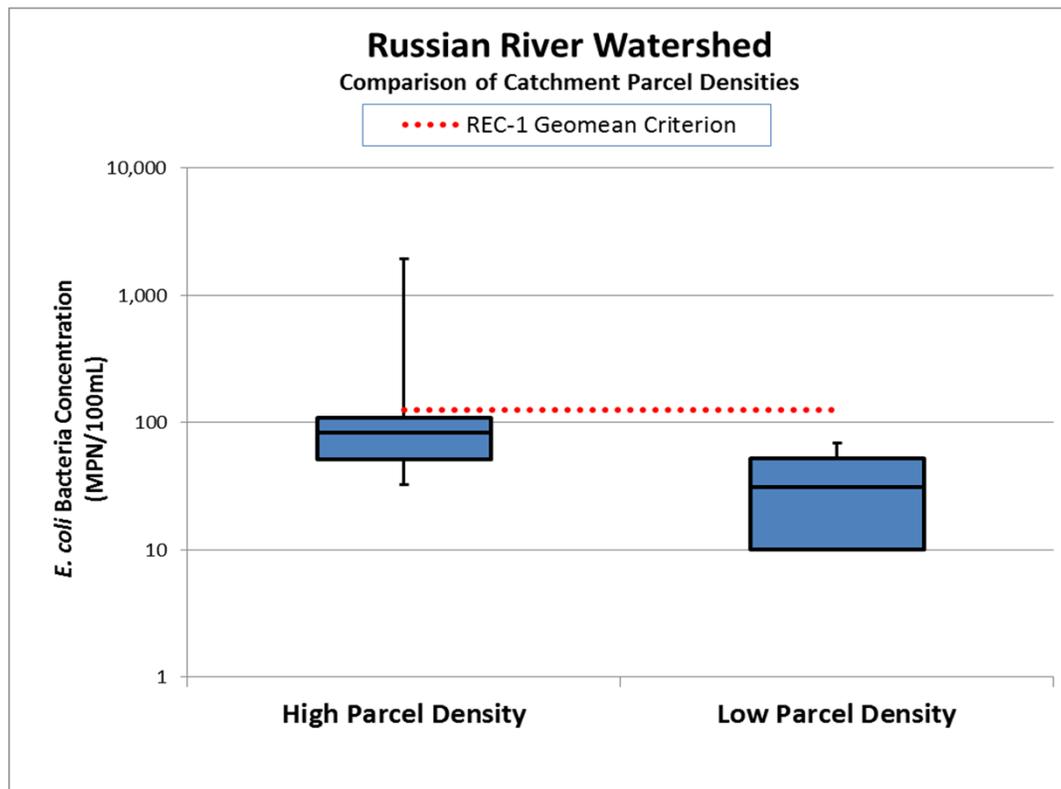
# Sources by Land Cover

- Bacteria levels are higher in developed areas than in less developed areas



# Sources from Onsite Systems

- Bacteria levels are higher in runoff from catchments with a high density of onsite wastewater treatment systems than from areas with a low density of systems

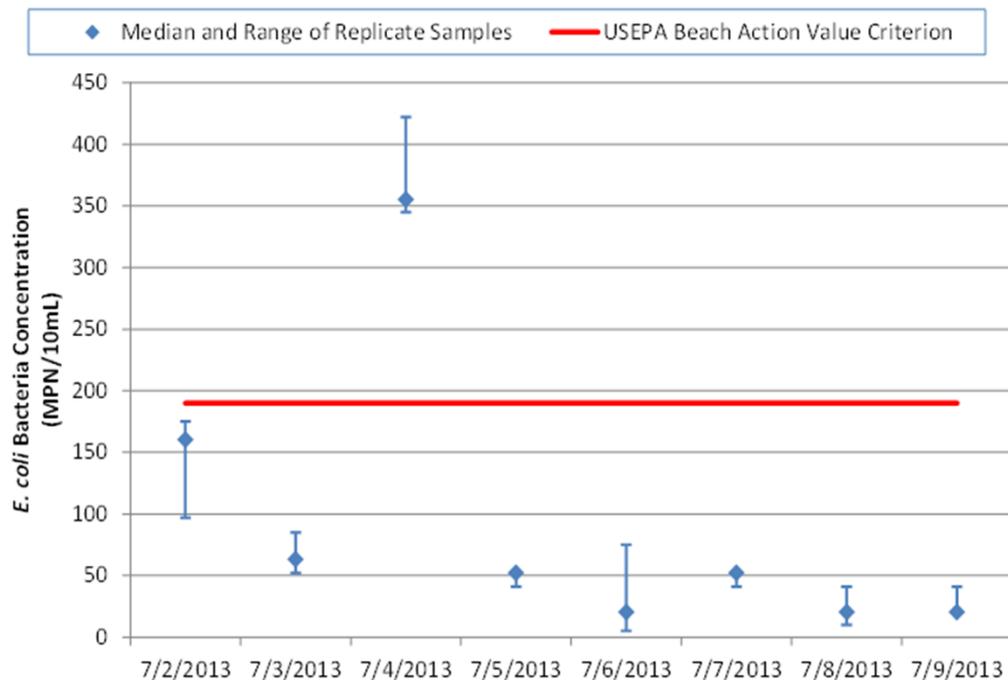


High Parcel Density:  
0.76 to 3.99 parcels/acre

Low Parcel Density:  
0.01 to 0.11 parcels/acre  
or  
100 ac. to 10 ac. parcels



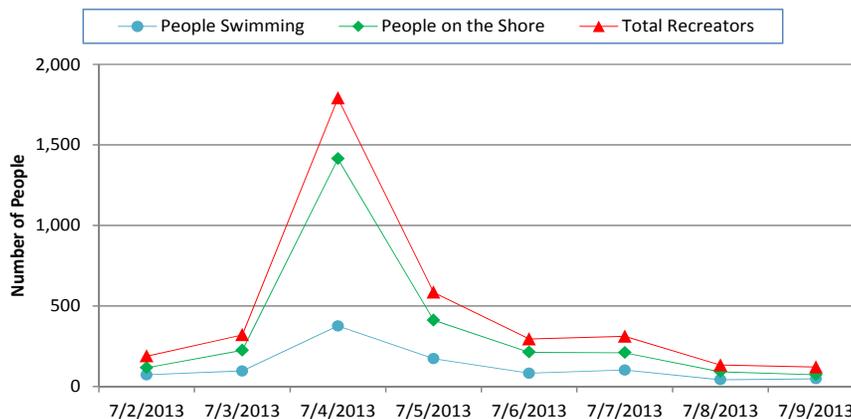
## Veteran's Memorial Beach in Healdsburg *E. coli* Bacteria Concentrations



# Beach Recreation Sources

- High recreational uses can result in high bacteria levels

## People Recreation Counts Veteran's Memorial Beach at Healdsburg



## Potential Human Pathogens Detected in the Russian River Watershed

Pathogenic Bacteria Species	Number of Locations with Detected Species		Percent of Samples with Detected Bacteria
	Mainstem	Trib	
<i>Klebsiella pneumoniae</i>	10	23	42%
<i>Proteus mirabilis</i>	1	10	11%
<i>Salmonella enterica</i>	1	9	10%
<i>Serratia marcescens</i> (bladder infections)	3	27	41%
<i>Shigella flexneri</i>	0	15	16%
<i>Staphylococcus epidermidis</i>	3	13	22%
<i>Staphylococcus haemolyticus</i>	2	0	2%
<i>Streptococcus sp.</i>	0	8	8%
<i>Vibrio cholerae</i>	0	1	1%
<i>Yersinia sp.</i> (plague)	4	7	15%

These results show a list of bacteria species found in the Russian River watershed that have the potential to be human pathogens and cause illness. The human health risk associated with the presence of pathogenic bacteria is unknown since detection of a pathogenic species does not necessarily indicate that illness will occur. Some pathogenic bacteria are only pathogenic under certain circumstances, such as contact with an open wound. Additionally, there can be more than one strain of a particular bacterium species, and not all strains are pathogenic.