Water Year 2010
FINAL
Bacteria Sampling Report
for the
Klamath River Estuary

Prepared by: Tim Sandborn
AmeriCorps Watershed Stewards Project
And
Yurok Tribe Environmental Program
March 2011

Acknowledgements

The Yurok Tribe Environmental Program would like to thank its staff and the AmeriCorps Watershed Stewards Project members Dan Riddle and Charles Schembre for their help in making this sampling effort a success. We would also like to thank Humboldt County Department Public Health Laboratory for the consistent and timely processing of samples.

Table of Contents

Table of Figures

Table of Tables

I. Introduction

Since time immemorial the Klamath River has been the source of life and the primary influence and focus of Yurok Culture. Though current reservation boundaries are confined to a strip of land a mile wide on either side of the Lower Klamath River, ancestral territory encompassed land many times this area. Because of the central role the river has always played in their life ways, the health and preservation of the river system has become an essential part of contemporary Yurok culture. Today the Yurok people continue to use local waters for ceremonial and subsistence activities that can be impacted by poor water quality. This report summarizes the bacteria sampling performed in the Klamath River Estuary in Water Year 2010.

Escherichia coli and Enterococci

Escherichia coli (*E. coli*) and enterococci are two types of fecal coliform bacteria. They reside in and originate from the intestinal tracts of warm-blooded animals with primary sources being human and livestock excrement. Contact with high levels of these bacteria can lead to a variety of health complications ranging from mild cramps to severe gastrointestinal distress and death in extreme, untreated cases. Primary sources of contamination on the Klamath River Estuary include human activity, failing septic systems and livestock that have free access to waterways within the watershed. In compliance with the Yurok Tribe Coastal Monitoring Program Sampling and Analysis Plan, if the level of *E. coli* exceeds 235 Most Probable Number (MPN), or 61 MPN for enterococci, per 100 ml sample, immediate retesting is to be performed.

Total Coliforms

Coliform is a family of bacteria common to soils, plants and animals. It encompasses numerous genera, only some of which are a threat to human health. As fecal coliforms are a sub-group of total coliforms, the presence and concentration of total coliforms is used as a relative indicator of fecal coliform levels. Primary sources of total coliforms on the Klamath River Estuary include the degradation and decomposition of organic plant and animal matter in the surrounding environment. Normal bioprocessing occurring in local soils provides for the reproduction of non-fecal coliform bacteria, and thus an increase of total coliforms in the summer months is seen during this season of increased biological activity. The California State Water Resources Control Board's California Ocean Plan establishes a single sample retesting limit of 10,000 MPN per 100ml sample for total coliform.

II. Methods

At each sampling site 100 milliliter (ml) grab samples were collected in sterile, sealed sample bottles provided by Humboldt County Department of Public Health Lab. While wearing sterile Nitrile gloves, the seal and lid were removed from the bottle ensuring that the inside of the lid and no portion of the threaded opening of the bottle came into contact with any surface other than the water being sampled. The sample bottle was then submerged one foot below the surface while angled 45 degrees upstream. At one foot below the surface the bottle

was rotated vertical and brought to the surface. The cap was replaced and the sample was placed on wet ice in an insulated cooler for same day transportation to the lab. Sample location, sampling time, and bottle number were recorded for lab records. Sampling location, name of sampler, number of bathers present at sampling location, runoff quantity, amount and type of debris present in the water, tide information, length of beach, time and any additional pertinent information were recorded for departmental records. Samples were delivered the same day to the Humboldt County Department of Public Health laboratory in Eureka, CA following appropriate and documented chain of custody procedures.

III. Site Selection

YTEP collected water samples for bacterial analysis at the following locations (Figure 1).

- **Klamath River Estuary (KE)**
- **Klamath River Above KCSD Waste Water Treatment Plant (KR>WTP)**
- **Klamath River Below KCSD Waste Water Treatment Plant (KR<WTP)**

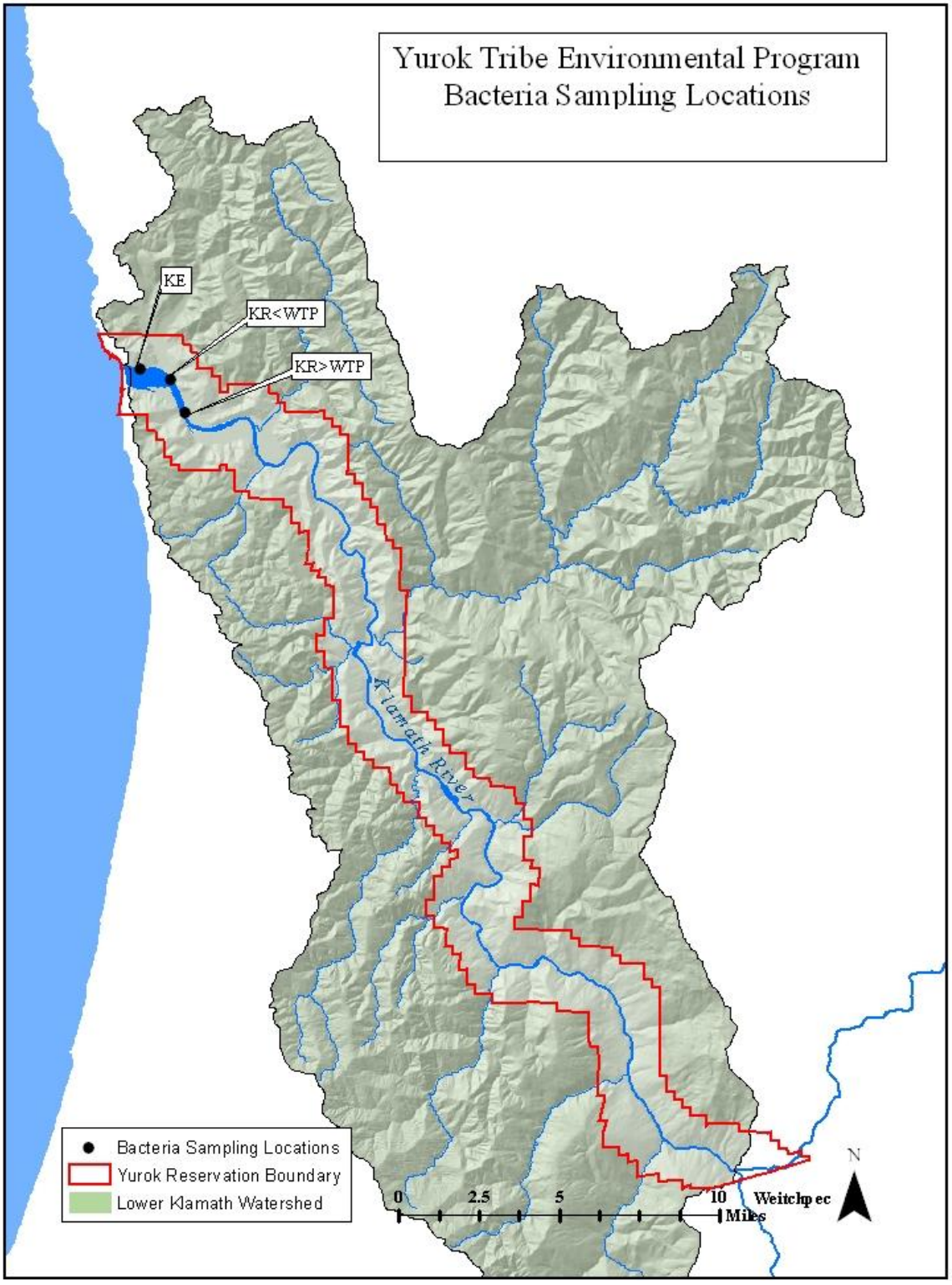

Figure 1. YTEP Bacteria Sampling Locations

Figure 2. Dan Riddle collecting a sample at the Klamath River below Water Treatment Plant

Figure 3. Charles Schembre collecting a sample at the Klamath River above Water Treatment Plant

Figure 4. Dan Riddle collecting a sample at the Klamath River Estuary (KE)

IV. Results

Table 1. Bacteria sampling results: WY2010

Bacteria Sampling Results Table

	Site	10/29/09	11/12/09	12/17/09	12/29/09	1/28/10	2/18/10	3/25/10	4/15/10	5/26/10	6/23/10	7/21/10	8/25/10	9/22/10
E. Coli	KE	20	10	30	ND	10	ND	10	ND	20	ND	ND	ND	30
Most Probable Number Report Limit: 10	KR<WTP	10	30	63	ND	ND	ND	10	ND	10	10	ND	ND	10
YTWQCP: *E. coli* single sample maximum 235 MPN/100ml	KR>WTP	10	ND	41	20	ND	ND	ND	ND	10	10	ND	ND	10

	Site	10/29/2009	11/12/2009	12/17/2009	12/29/2009	1/28/2010	2/18/2010	3/25/2010	4/15/2010	5/26/2010	6/23/2010	7/21/2010	8/25/2010	9/22/2010
Strep. Faecalis (enterococci)	KE	ND	ND	51	ND	ND	ND	10	ND	ND	ND	ND	ND	ND
Most Probable Number Report Limit: 10	KR<WTP	ND	ND	75	ND	ND	ND	10	ND	ND	ND	ND	ND	ND
YTWQCP: *Strep. faecalis* single sample maximum 61 MPN/100ml	KR>WTP	ND	ND	41	ND	ND	ND	ND	ND	ND	ND	ND	ND	10

	Site	10/29/2009	11/12/2009	12/17/2009	12/29/2009	1/28/2010	2/18/2010	3/25/2010	4/15/2010	5/26/2010	6/23/2010	7/21/2010	8/25/2010	9/22/2010
Total Coliform	KE	275	495	712	166	309	107	173	233	441	160	1354	1246	2247
Most Probable Number Report Limit: 10	KR<WTP	1354	2014	1497	417	134	233	148	417	435	132	581	1354	1669
CSWRCB: Total Coliform single sample maximum 10,000 MPN/100ml	KR>WTP	1515	530	813	327	134	223	203	155	314	185	1198	1793	2224

*** ND (No Detect) = Samples collected were below the reporting limit of 10 MPN. For graphing purposes all results below the reporting limit were given a value of one half the reporting limit.**

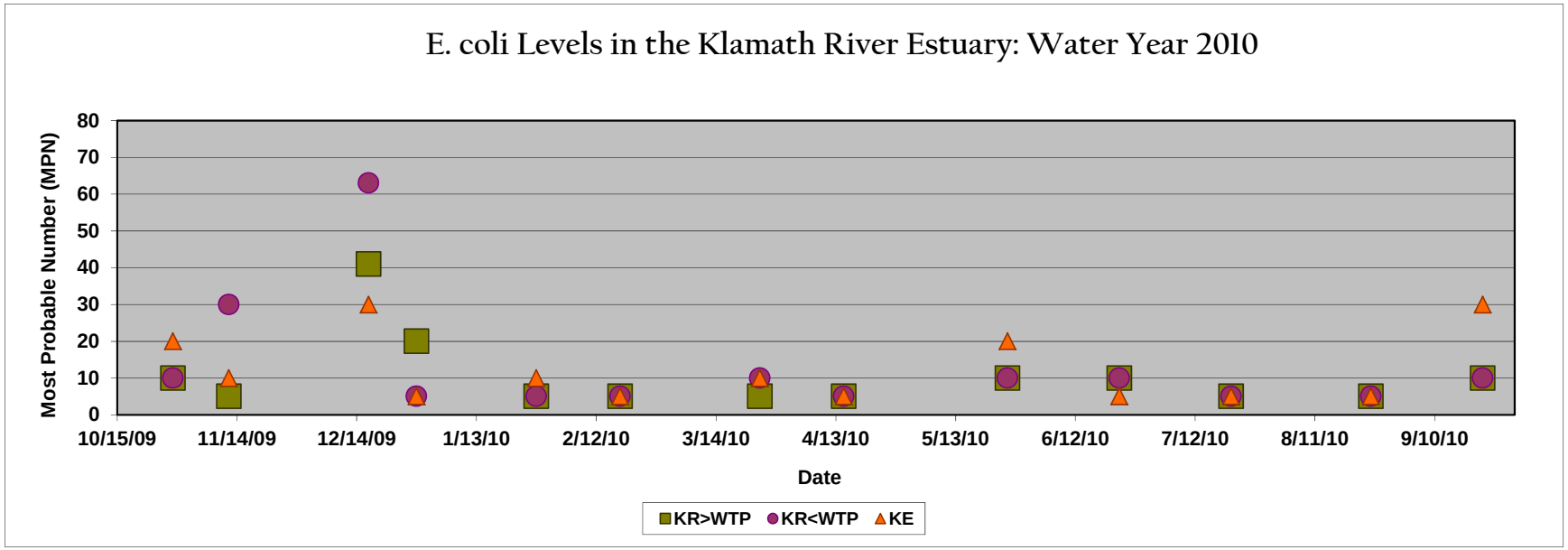

Figure 5. YTEP E. coli results: WY 2010

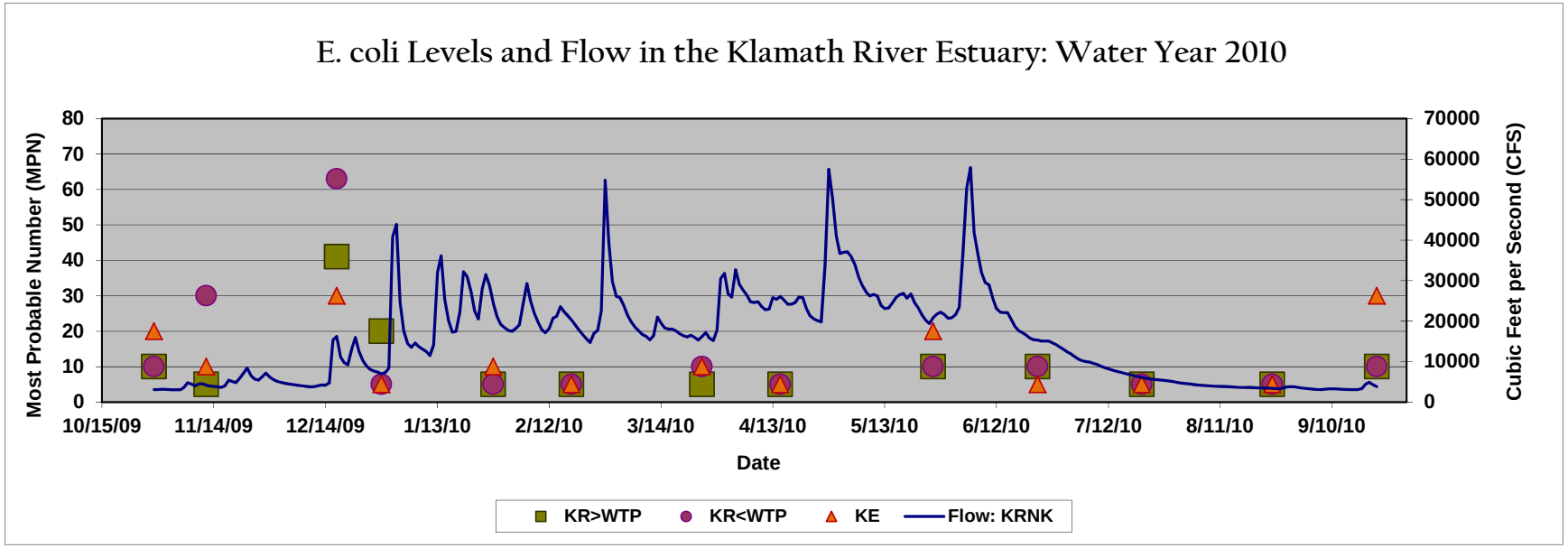

Figure 6. E. coli levels and Flow*: WY 2010
***Flow from USGS Gage: Klamath River Near Klamath (KRNK)**

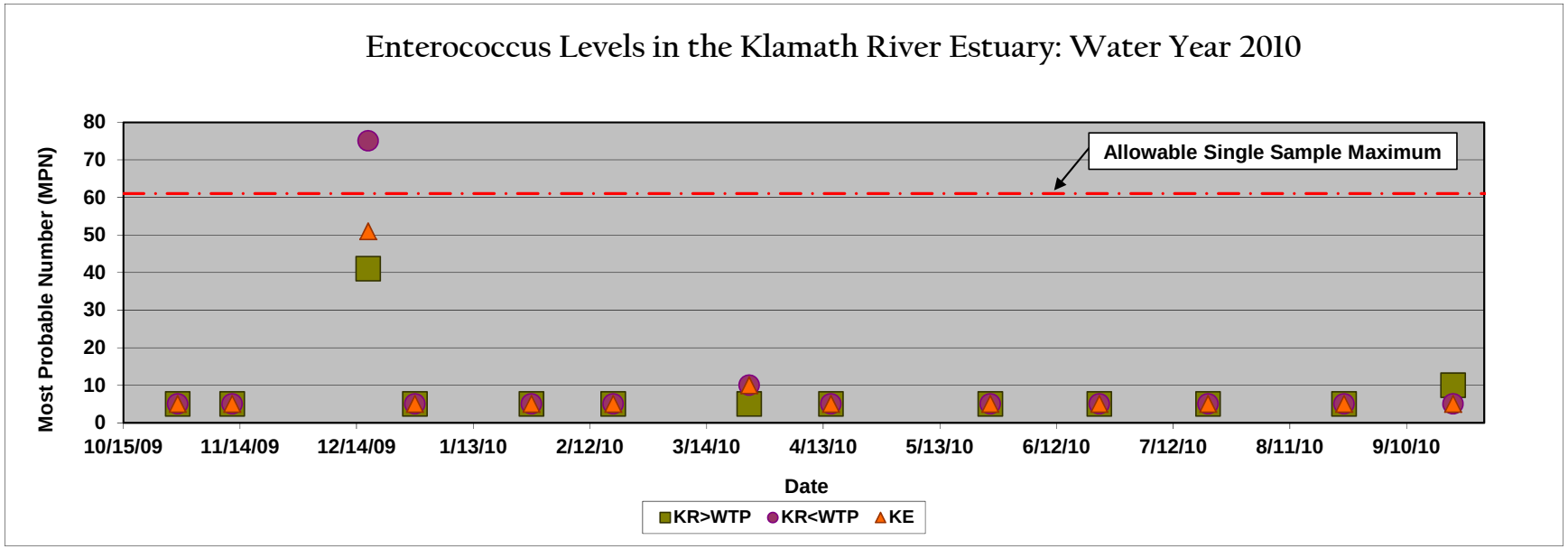

Figure 7. YTEP Enterococcus results: WY 2010

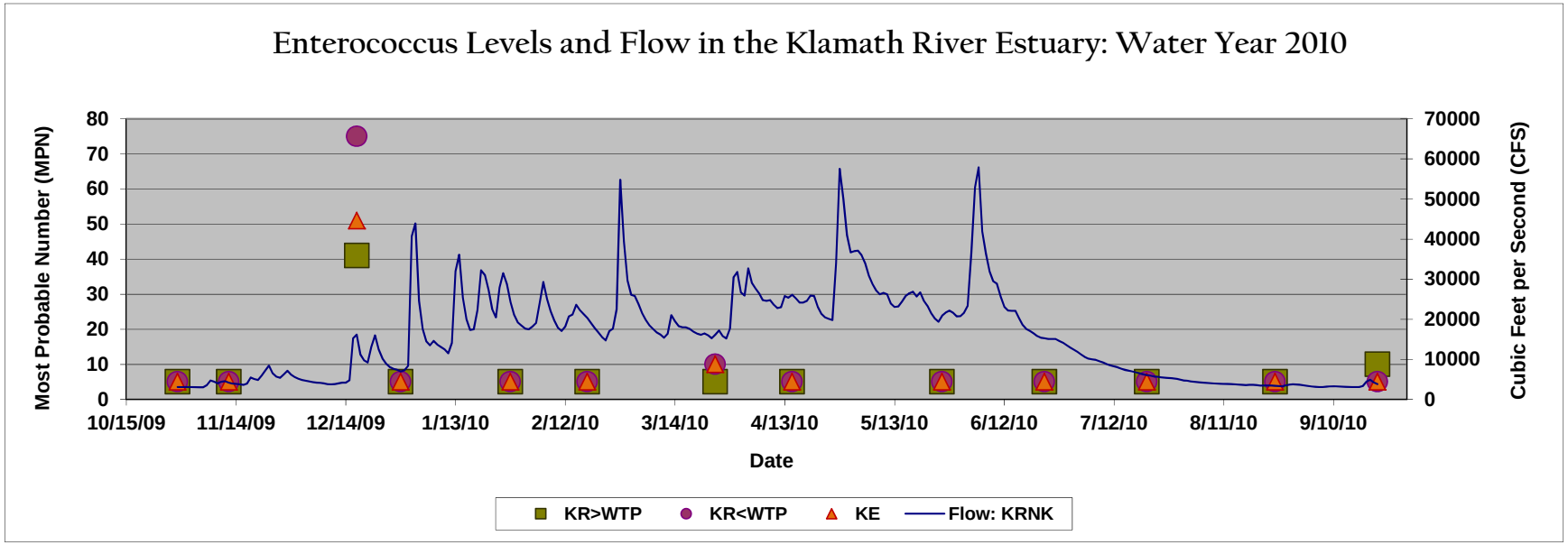

Figure 8. Enterococcus levels and Flow*: WY 2010
***Flow from USGS Gage: Klamath River Near Klamath (KRNK)**

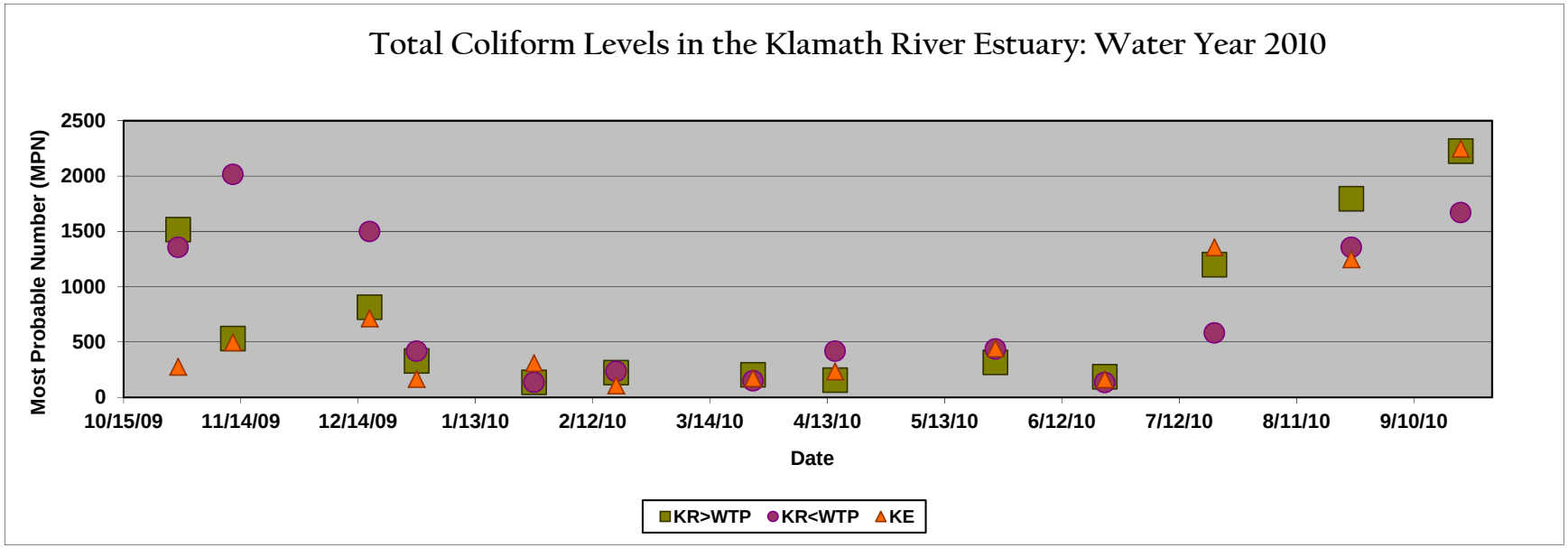

Figure 9. Total Coliform results: WY 2010

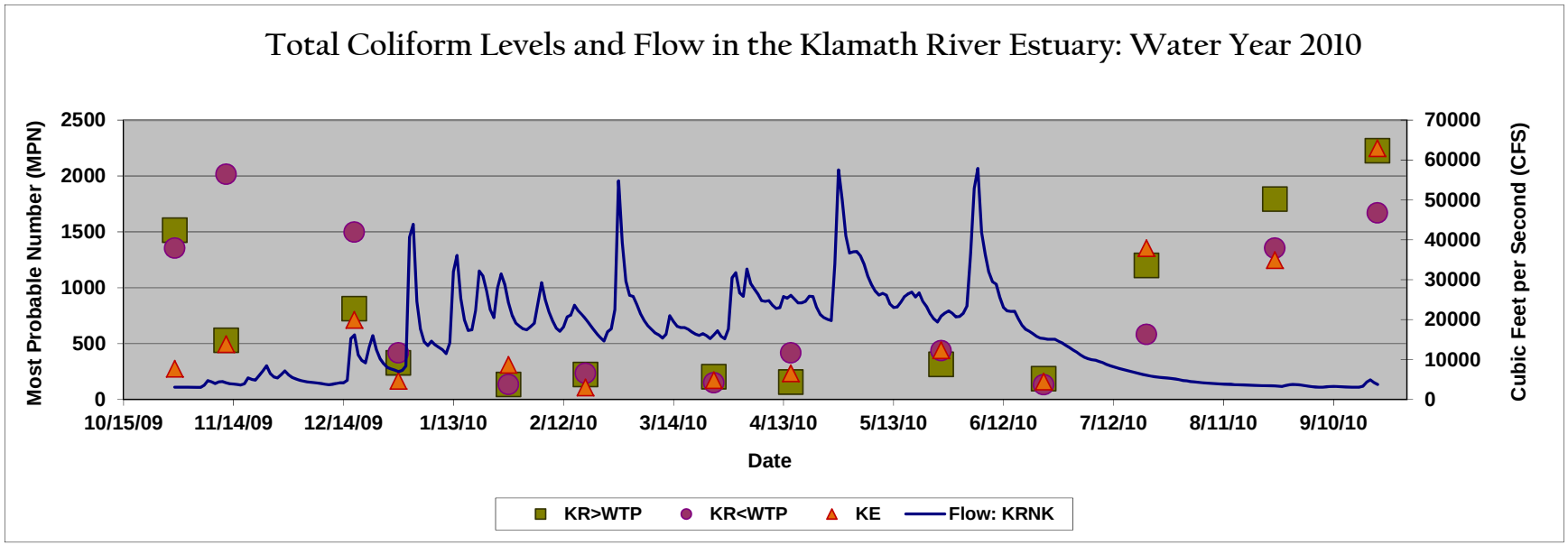

Figure 10. Total Coliform levels and Flow*: WY 2010
***Flow from USGS Gage: Klamath River Near Klamath (KRNK)**

V. Discussion

Escherichia coli

Throughout the water year, all *E. coli* samples collected showed results well below the retesting limit of 235 MPN/100 ml for recreational use set forth by the Yurok Tribe Coastal Monitoring Program Sampling and Analysis Plan. 19 of the 39 samples collected, or approximately 49 percent, tested below the minimum detection limit of 10 MPN/100 ml (Figure 5, Table 1). The highest *E. coli* level, 63 MPN, was measured at KR<WTP on 12/17/09. The sampling event on 12/17/09 seems to show a spike in *E. coli* levels. While detectable concentrations of *E. coli* averaged 9.6 MPN for the year, the sampling date of 12/17/09 shows concentrations from 30 to 61 MPN. This is 3 to 6 times the average. This spike could be explained by the increased flow due to the first major rain event of WY2010 (Figure 6). The first large precipitation events of the winter season have a high potential to flush *E. coli* that has accumulated on land within the watershed during the dry summer months into the river system.

Enterococcus

Throughout most of the year, enterococcus levels were well below the retesting limit of 61 MPN/100 ml sample. 33 of the 39 samples collected, or 85 percent, tested below the minimum detection level of 10 MPN/100 ml (Figure 7, Table 1). The highest enterococcus level, 75 MPN, was measured at KR<WTP on 12/17/2009. The sampling event on this date shows a clear spike in enterococcus levels. While detectable concentrations of enterococcus for all sampling dates other than 12/17/2009 were 10 MPN, on this date concentrations ranged from 51 MPN to 75 MPN. Again, this spike is likely due to the increased flow during the first major rain event of WY2010 (Figure 8). The first large precipitation events of the winter season have a high potential to flush enterococcus that has accumulated on land within the watershed during the dry summer months into the river system.

The concentration at KR<WTP on 12/17/2010 (75 MPN) exceeded the single sample maximum of 61 MPN as set forth in the Yurok Tribe Coastal Monitoring Program Sampling and Analysis Plan (YTCMPSAP). In accordance with the YTCMPSAP, resampling was conducted at all sites on 12/29/2009. The results from all three sites for this sampling event came back as No Detect (ND), indicating enterococcus concentrations at all sites had dropped to acceptable levels.

Total Coliform

Total Coliform was measured at detectable levels that were well below the retesting limit of 10,000 MPN/100 ml sample throughout WY2010. The highest concentration measured was 2247 MPN on 9/22/2010 at KE (Figure 9, Table 1). The lowest concentration of 107 MPN was recorded on 2/18/2010 at KE. Overall total coliform concentrations were inversely proportional to flow (Figure 10). In November and December, concentrations were rising. Beginning in late December, the concentrations of total Coliform dropped to very low levels. They stayed very low throughout the rainy season and began to increase as the discharge dropped. Total coliform levels tend to increase through the summer months due to increased biological activity and lower

water volumes within the watershed, then decrease during the winter months as biological activity within the watershed decreases and water volume increases.

On average, KR<WTP had the highest concentrations of total coliform. The average for this site was 799 MPN. KR>WTP had the second highest levels with an average of 739 MPN. KE had the lowest average at 609 MPN. The highest concentrations varied by month however. Even the site with the lowest average concentrations, KE, had the highest readings for four of the thirteen sampling events. This scattering of peak concentrations shows that there was no trend based on sample location during WY2010.