

# Habitat Enhancement Effectiveness Monitoring Klickitat River Subbasin

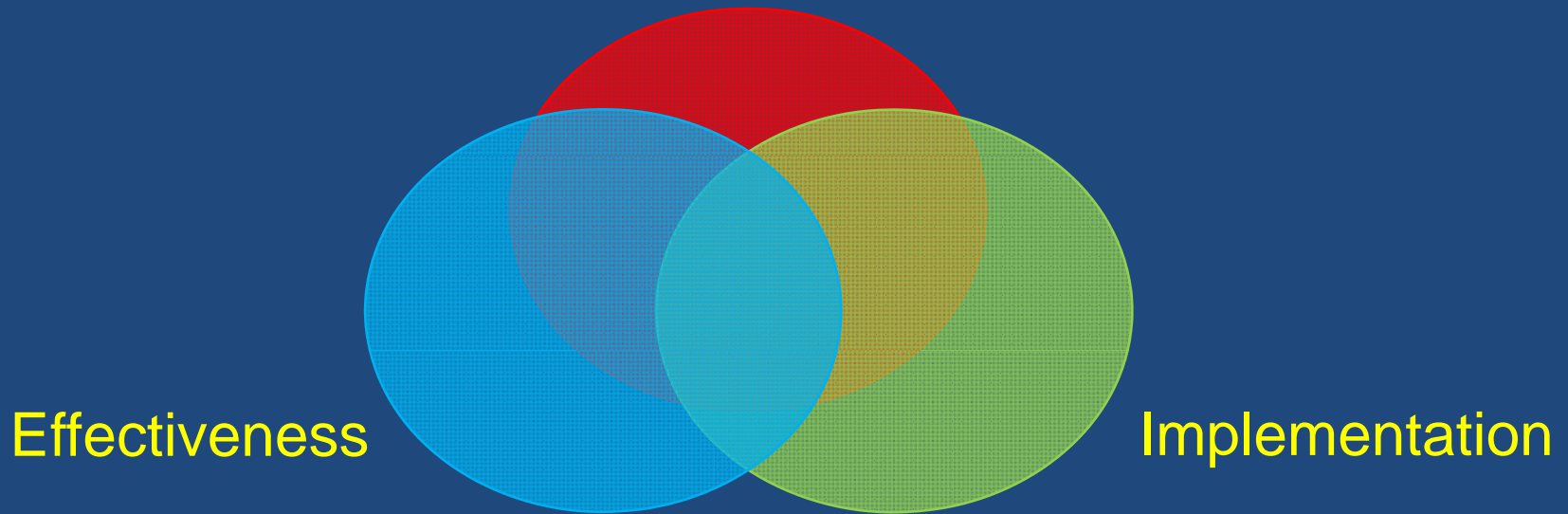


**David Lindley and Nicolas Romero**  
**Yakama Nation Fisheries Program**



# Monitoring Categories

Status and Trend



## Monitoring Activity Continuum

Qualitative

Quantitative



Photo Monitoring

Stream Inventory

Food Web Study

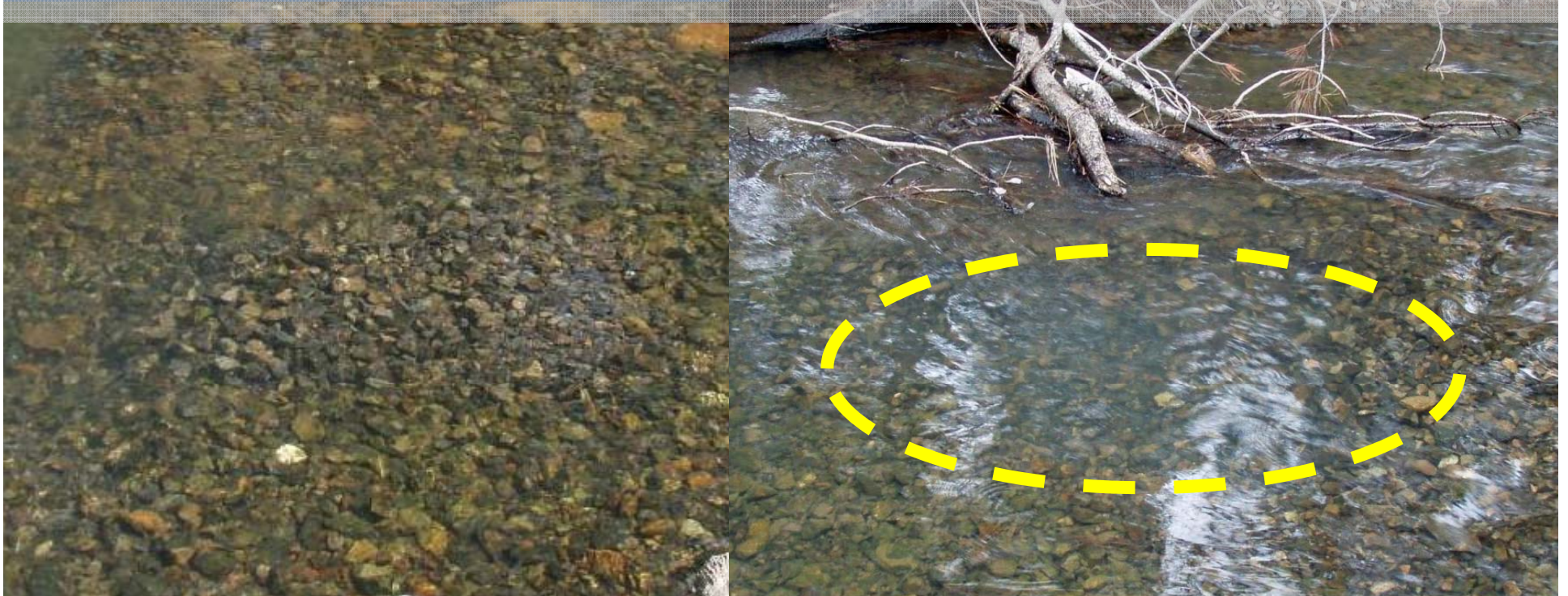
# “Classic” Types of Monitoring

- **Status and Trend Monitoring** – provide measures of change in species or habitat status over time and allow for the interpretation of those measured changes.
- **Implementation Monitoring** – documents whether or not management practices were applied as designed. Project and contract administration is a part of implementation monitoring.
- **Effectiveness Monitoring** - designed to determine if the project is effective at meeting its biological and ecological objectives.

# Status and Trend Monitoring

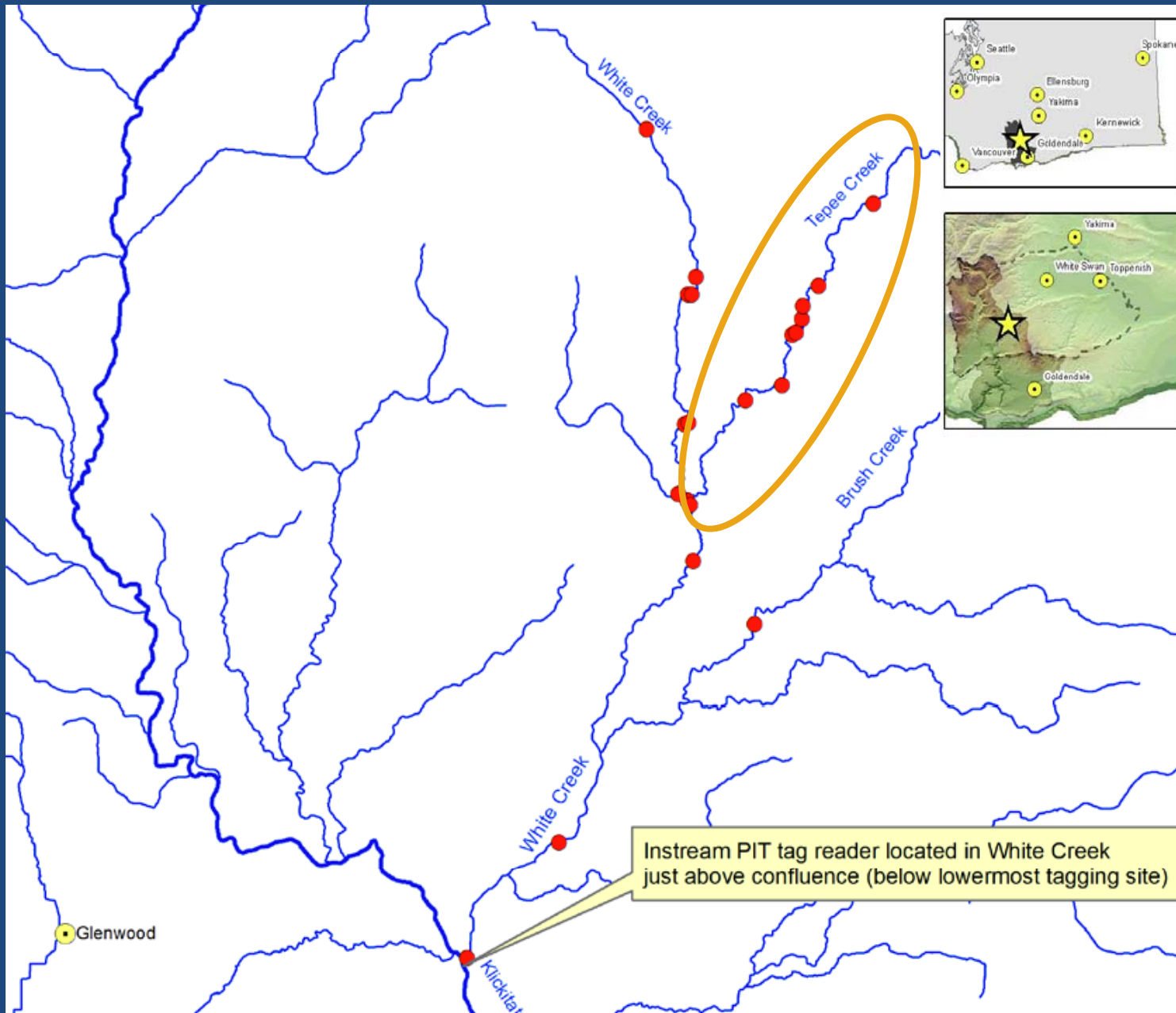
- Stream Hydrology
- Temperature
- Sediment
- Turbidity
- Habitat Surveys (TFW)
- Fish Abundance
- Population Estimates
- Escapement Estimates
- Outmigration Estimates

# Steelhead Spawning – Tepee Ck IXL



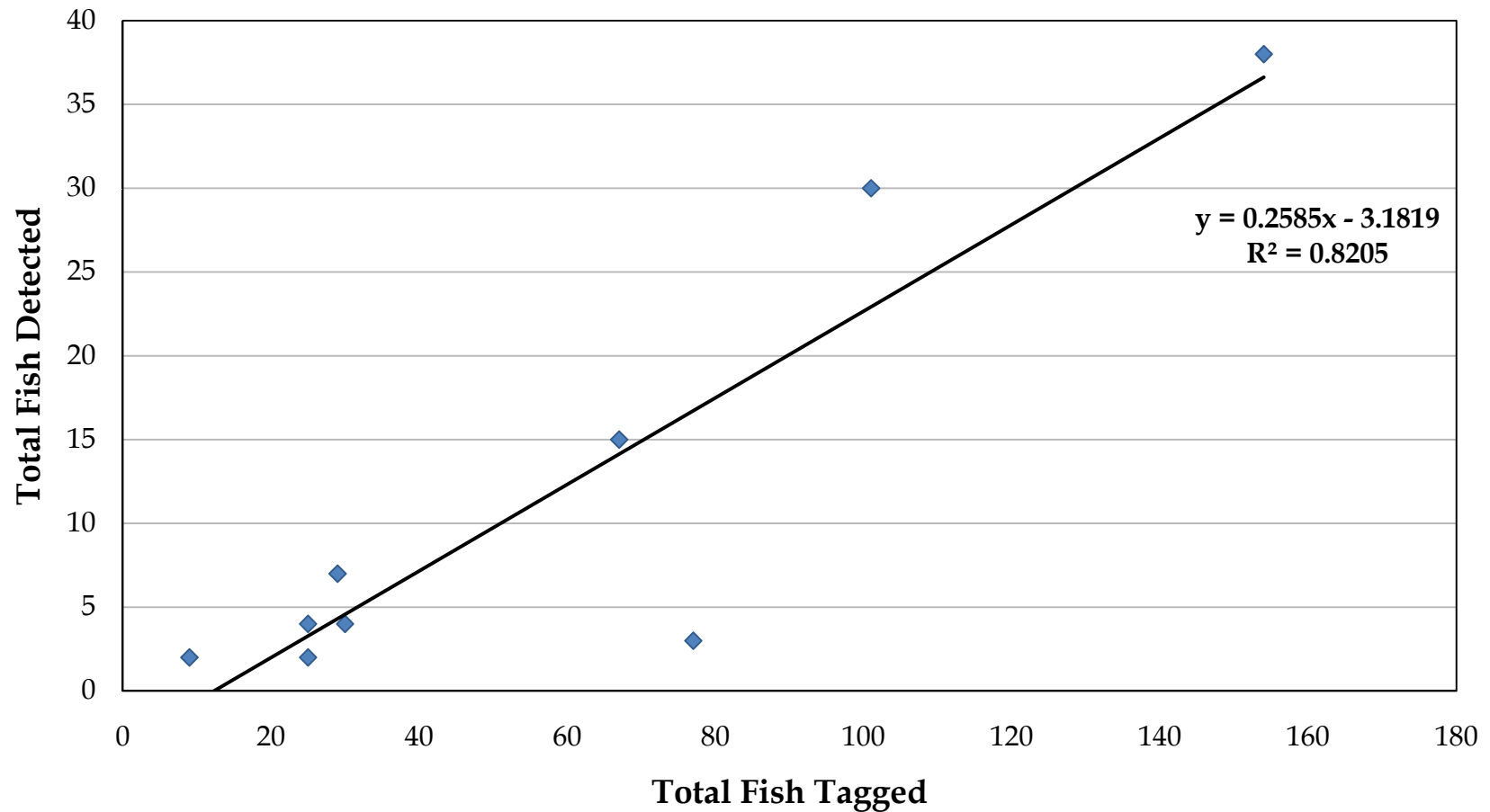
Year	Redds in Tepee IXL Reach (0.4 miles)	Redds in Tepee Cr outside of IXL reach (7.7 miles)
2007	2	1
2008	0	2
2009	4	8
2010	3	8

# White Ck PIT Tag Study



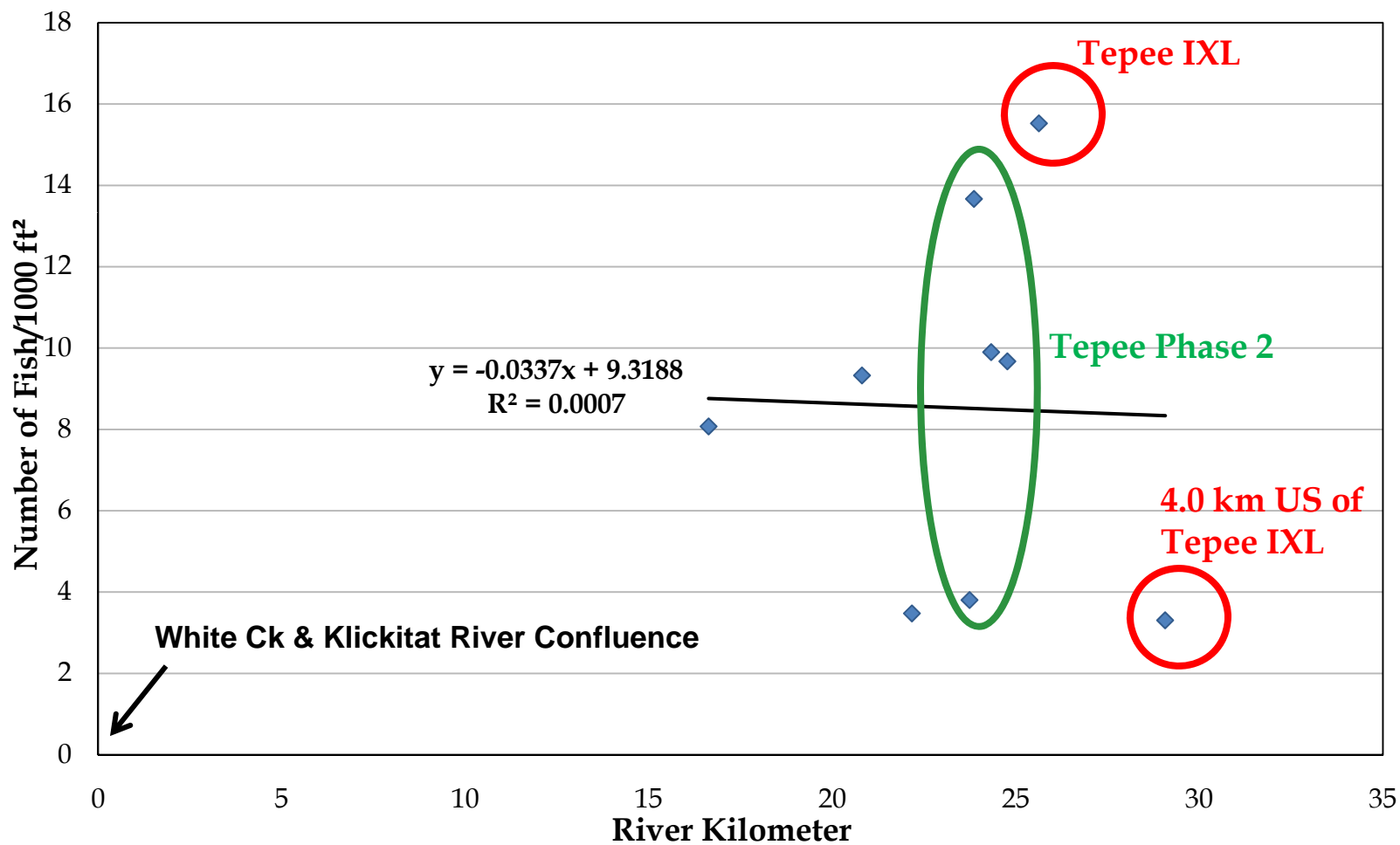
# Tepee Ck PIT Tag Study

Relationship Between Total Fish Tagged and Total Fish Detected by Tagging Site in Tepee Creek



# Tepee Ck PIT Tag Study

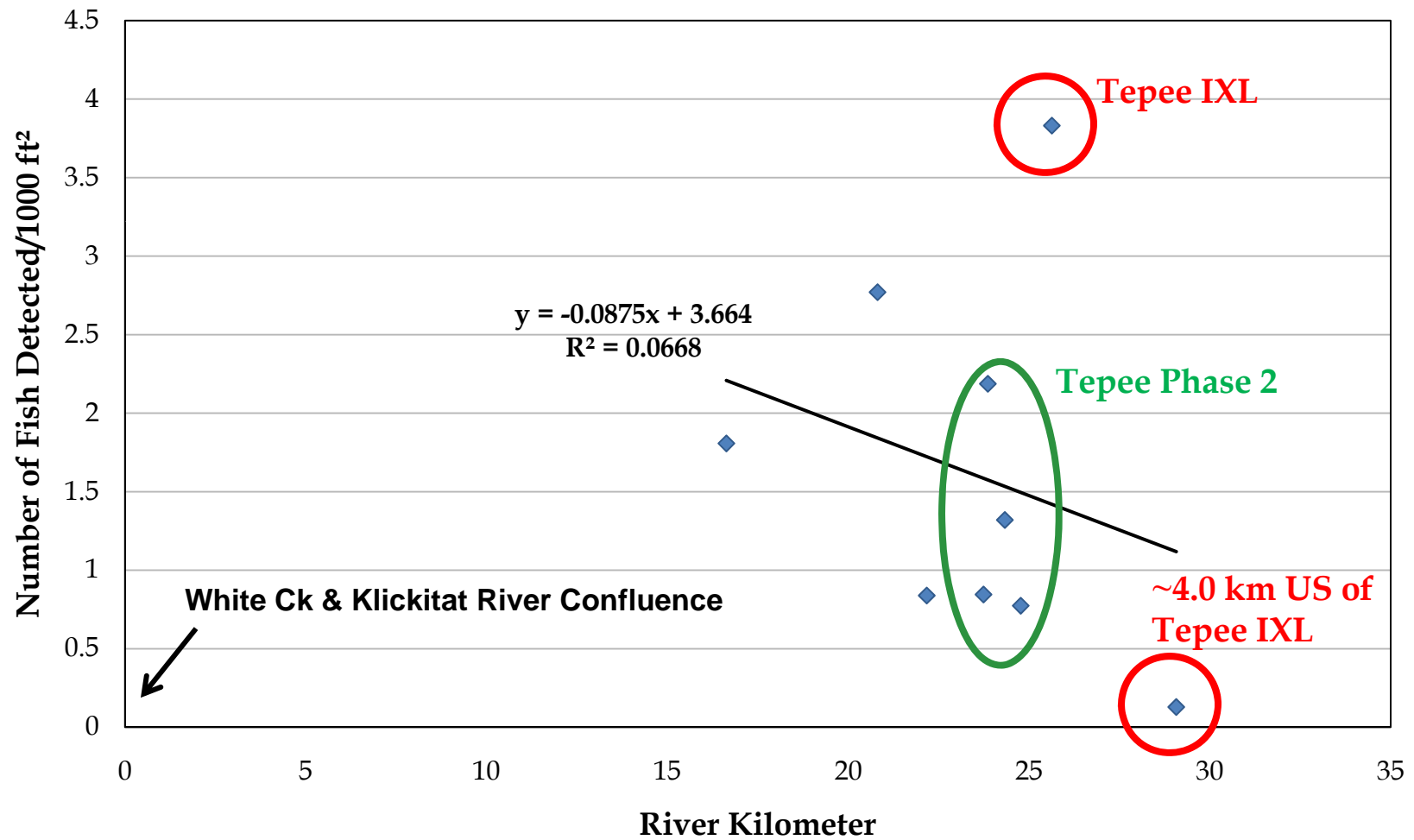
Relationship Between Fish Abundance by Site and Distance to the Klickitat River





# Tepee Ck PIT Tag Study

Relationship Between Fish Detected by Site and Distance to the Klickitat River



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# Implementation Monitoring

- Grade-checking
- Compaction testing
- Concrete testing
- Erosion control
- Planting oversight
- Torque-checking
- LWD placement
- Bearing conditions
- Geotextile installation

# Implementation Monitoring



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# Effectiveness Monitoring

The YKFP is utilizing a measured approach to apply effectiveness monitoring to every project implemented.

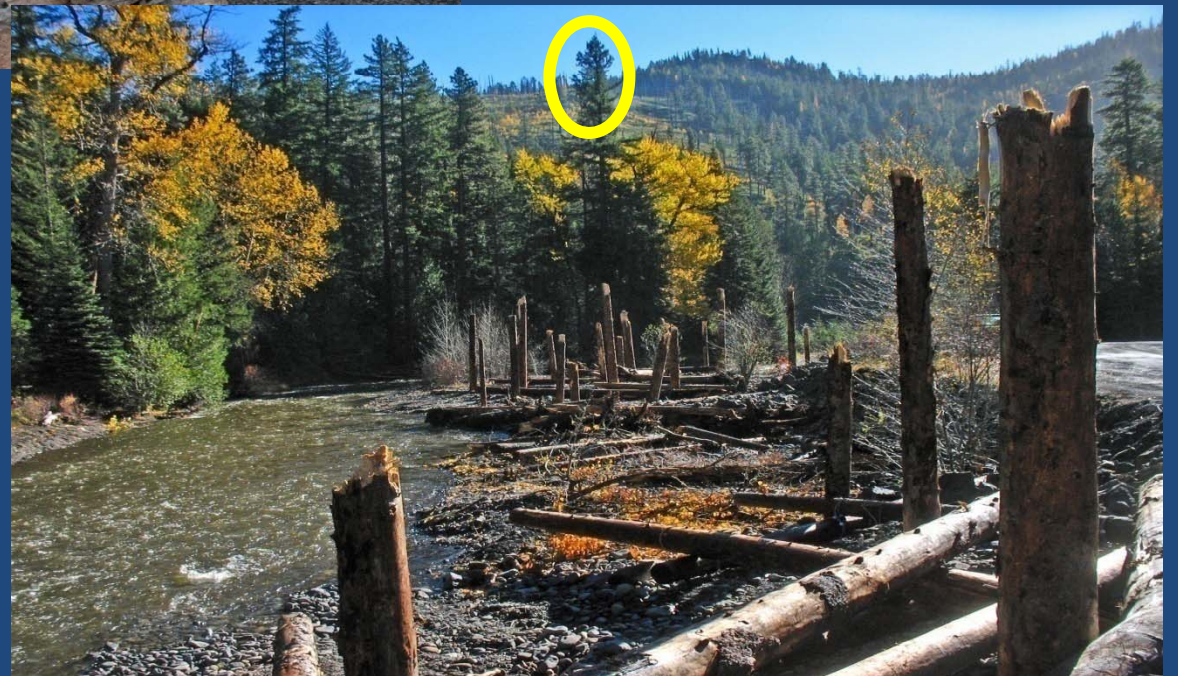
A continuum of effectiveness monitoring actions will be presented to demonstrate a spectrum ranging from qualitative descriptive measures to a quantitative experimentally designed research project.

# Photo Monitoring – Upper Klickitat Phase 2



Pre-treatment – 4/29/10

Post-treatment – 11/2/10



# Photo Monitoring – Tepee Ck IXL Meadows

Pre-treatment – 8/25/04



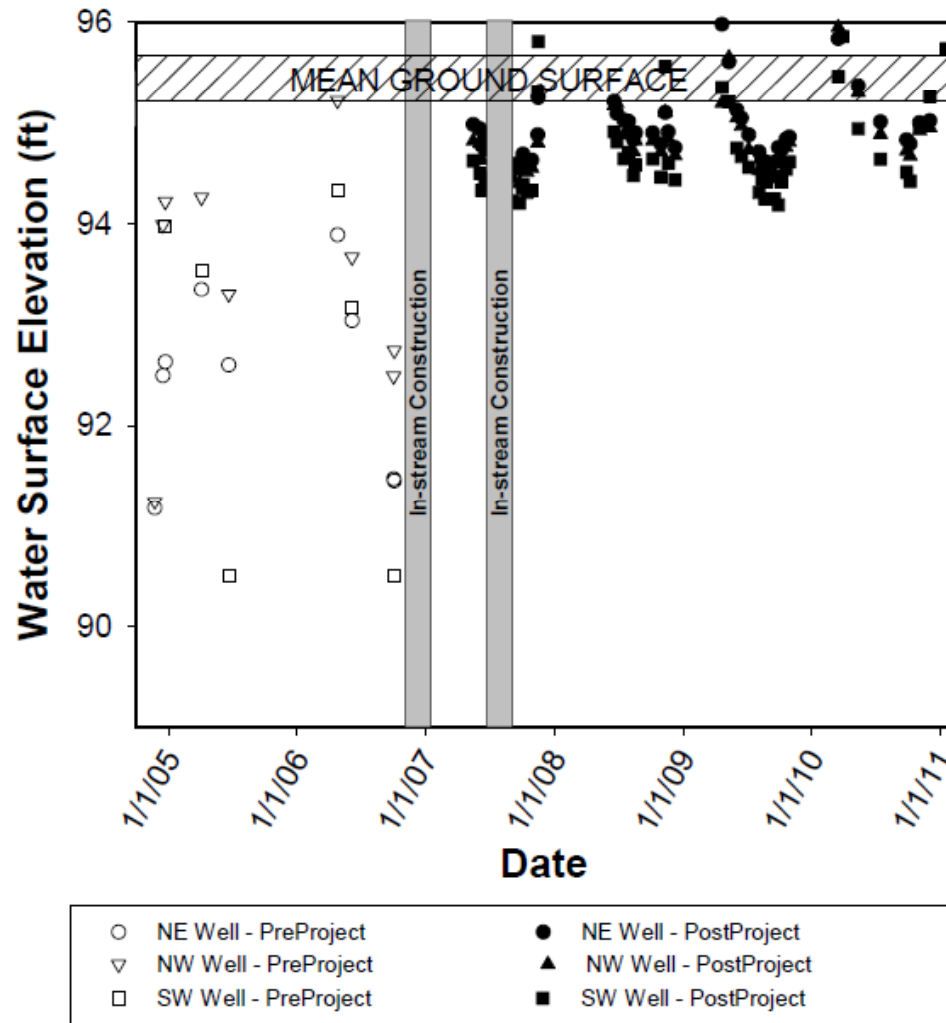
Post-treatment – 5/4/09





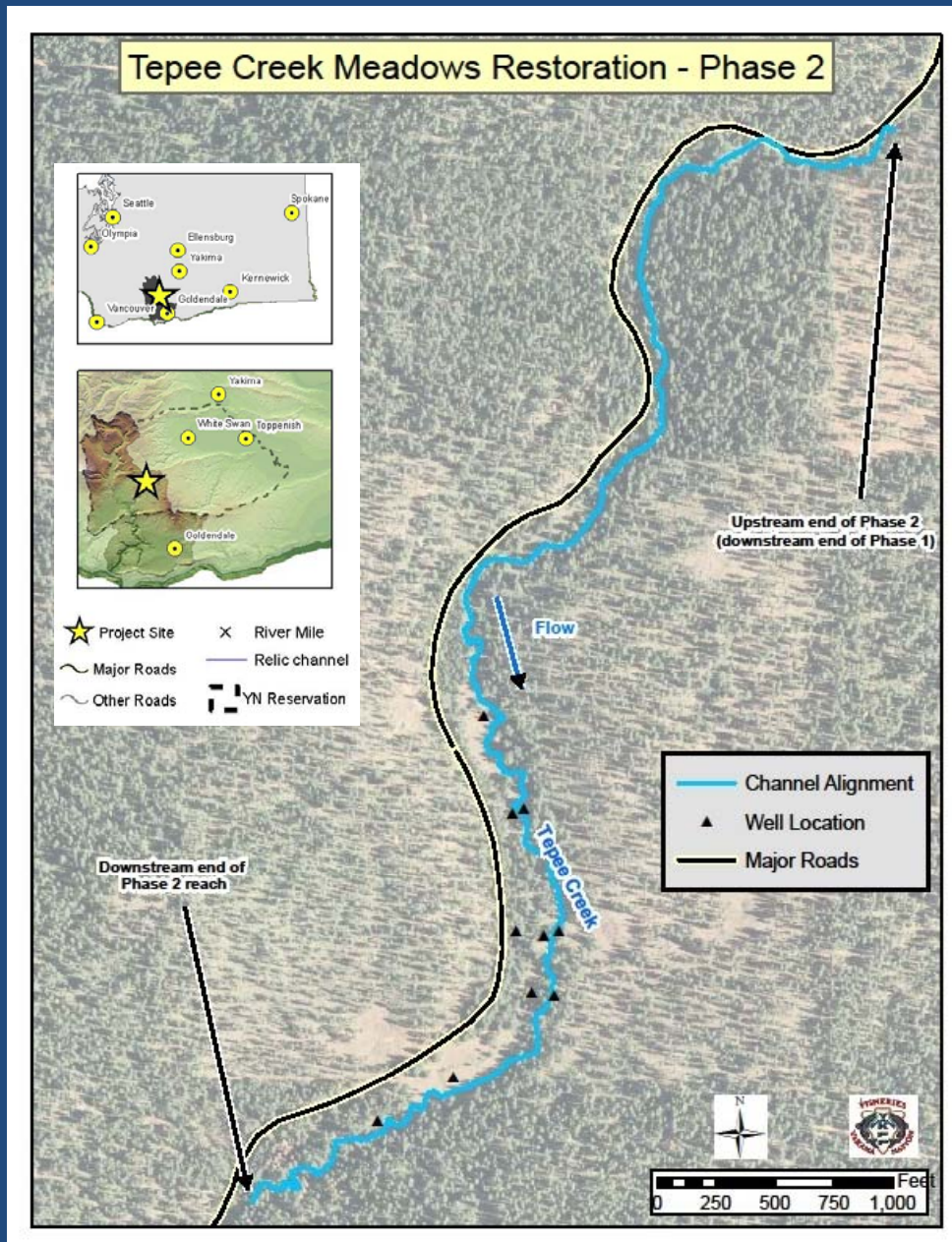
# Groundwater Monitoring – Tepee Ck IXL

Tepee Creek / IXL Meadows Restoration Project:  
Pre- and Post-Restoration Groundwater Elevations



Higher Water Table – 2' - 4' rise and less variation between and among wells

# Groundwater Monitoring – Tepee Ck 2



## Tepee Ck (12 Wells)

- 10 treatment
- 2 control

## White Ck (4 Wells)

- 4 control

# Stream Inventory / Habitat Mapping

**Rapid Aquatic Habitat Assessment Protocol**

**Methods for Stream Inventory Surveys**



**Klickitat Monitoring and Evaluation Project**

**Klickitat Watershed Enhancement Project**

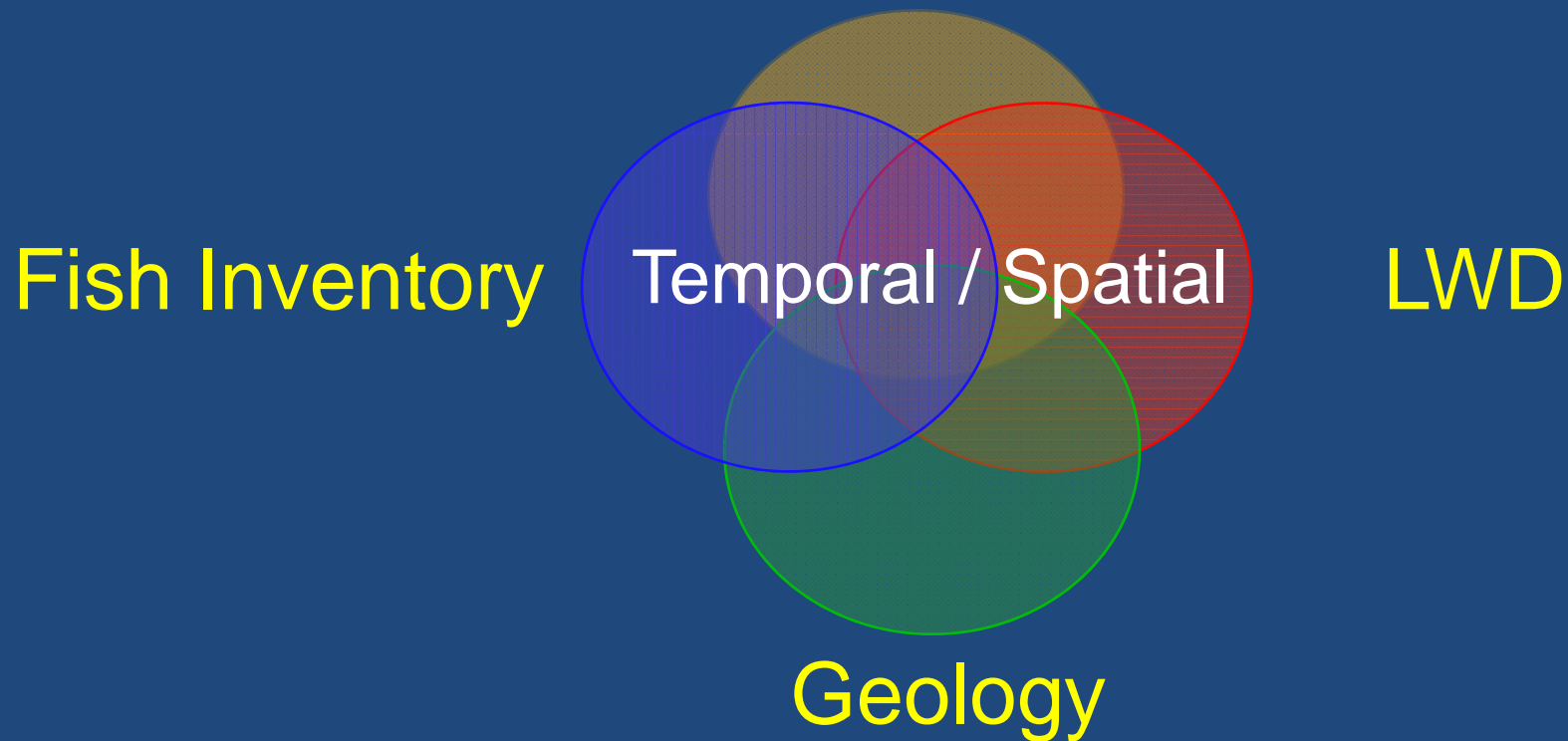
**Yakama Nation Fisheries Program**

**2010**



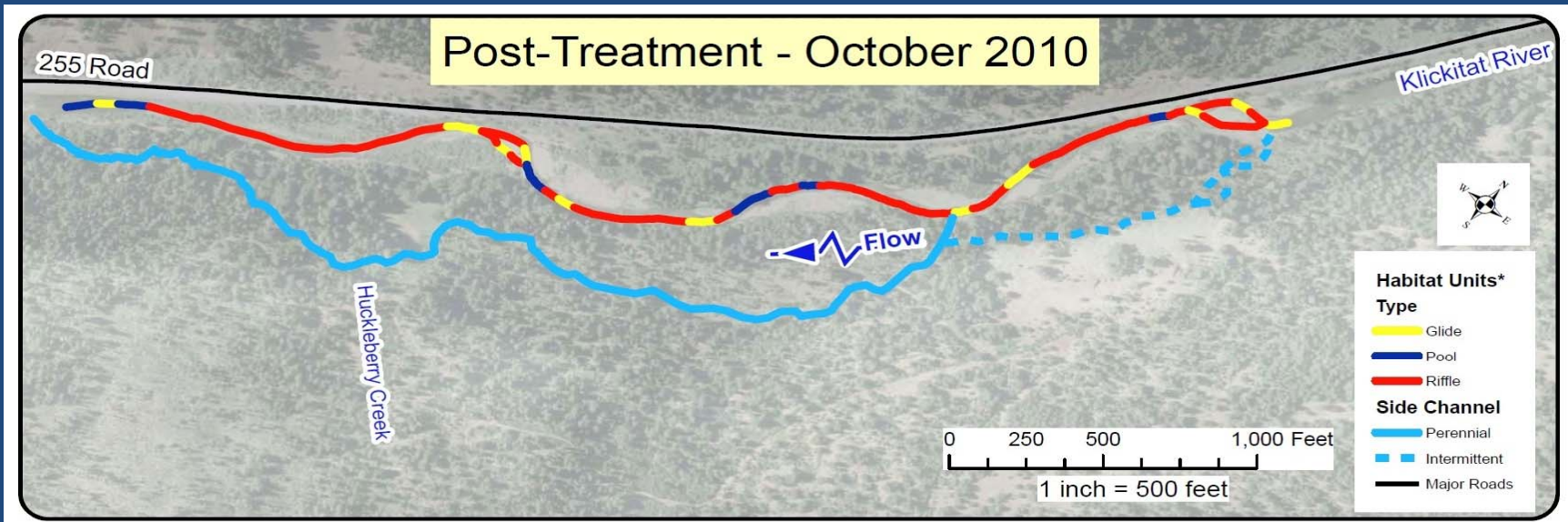
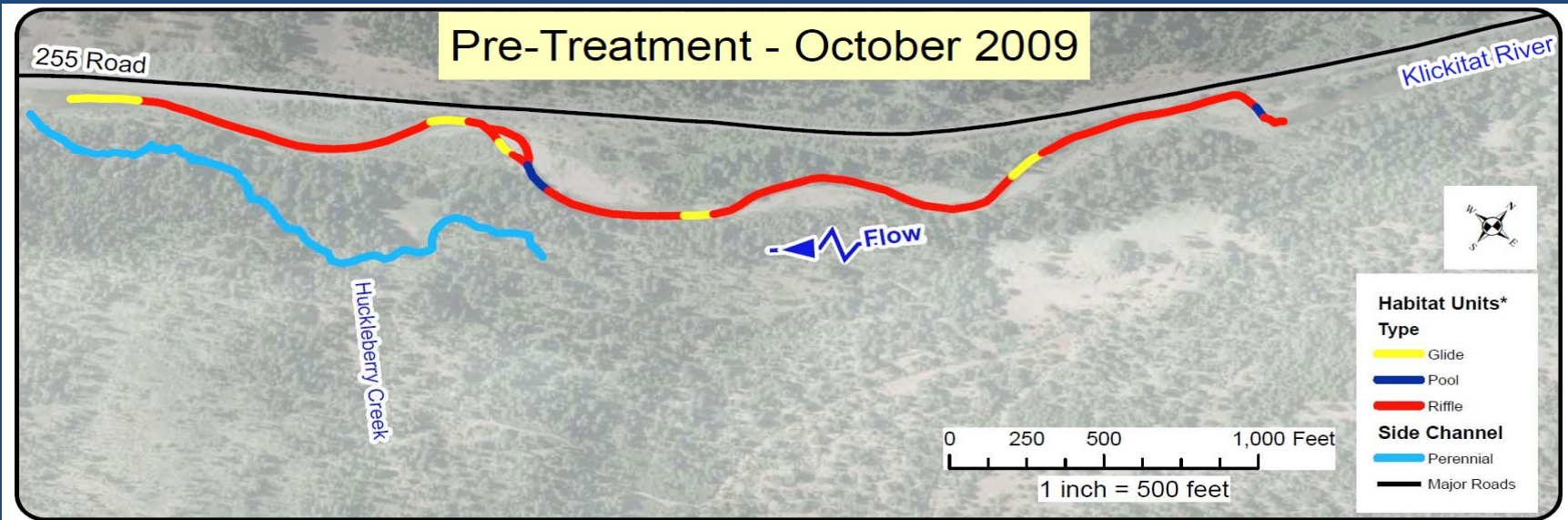
# Stream Inventory / Habitat Mapping Conceptual Framework

Instream Habitat Delineation



# Stream Inventory / Habitat Mapping

## Upper Klickitat Phase 2



# Food Web Study – Tepee Ck Phase 2

## Literature Review

- “....over 6,000 in-stream habitat enhancement projects implemented in the last decade at a cost exceeding \$1 billion.”
- “Effectiveness monitoring of restoration projects is rare....”
- “Use a rigorous study design that includes pre-and post-project monitoring replicated at both restored and external control sites to account for spatial and temporal variability.” *Miller, et al. 2009*

# Food Web Study - Tepee Ck Phase 2

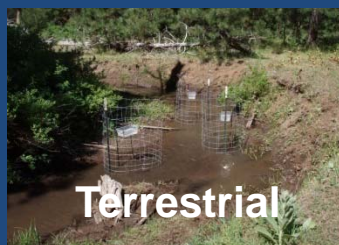
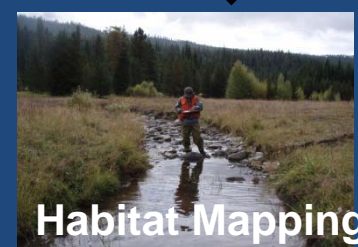
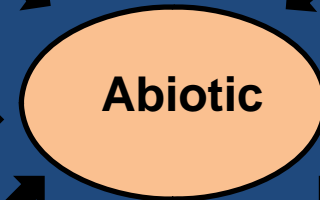
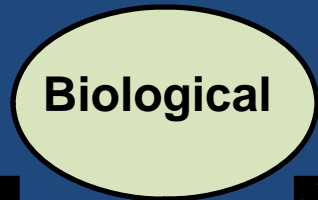
## Objectives

- Quantify biotic and abiotic conditions pre and post-treatment
  - Biotic – riparian vegetation, secondary production, higher order consumers
  - Abiotic – temperature, surface water, groundwater, habitat

## Study Design

- BACI Design (before-after-control-impact)
- Intra-annual sampling (Spring, Summer, and Fall)
- Inter-annual (five year study)
  - 1 year pre-treatment (Fall 2009 - Fall 2010)
  - 1 year treatment – minimal sampling (2011)
  - 3 years post-treatment sampling (2012 - 2014)

# Food Web Study - Tepee Ck Phase 2





# Conclusion

- Effectiveness monitoring is scaled to the individual project (monitoring activity continuum).
- Habitat enhancement project monitoring in the Klickitat subbasin is designed to encompass multiple spatial and temporal scales.
- “If effectively documented, each project can be considered as an experiment, so that failure can be just as valuable to science as success, provided lessons are learned.”  
*Brierley, et al. 2005*

# Acknowledgements

## Personnel

- Will Conley – Hydrologist
- Nico Romero – Fisheries Biologist
- Joe Zendt – Fisheries Biologist
- Mike Babcock – Data Manager
- Ralph Kiona – Watershed Technician
- Sandy Pinkham – Fisheries Technician
- Rodger Begay – Fisheries Technician
- Jeremy Takala – Fisheries Technician
- Roger Stahi – Fisheries Technician

## YN Collaborators

- Klickitat Monitoring and Evaluation
- Klickitat Data Management
- Klickitat Watershed Enhancement Project

## Funding and Materials

- Bonneville Power Administration
- WA Salmon Recovery Funding Board
- Columbia River Inter-Tribal Fish Commission
- Mid-Columbia Regional Fisheries Enhancement Group
- Columbia Land Trust
- Yakama Nation
- Bureau of Indian Affairs – Watershed Program

# Questions?

