

# DESIGNING MONITORING PROGRAMS TO EVALUATE BMP EFFECTIVENESS

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# Examples from the Little Bear River CEAP Project





# Pre-treatment problems:

Bank erosion, manure management, flood irrigation problems







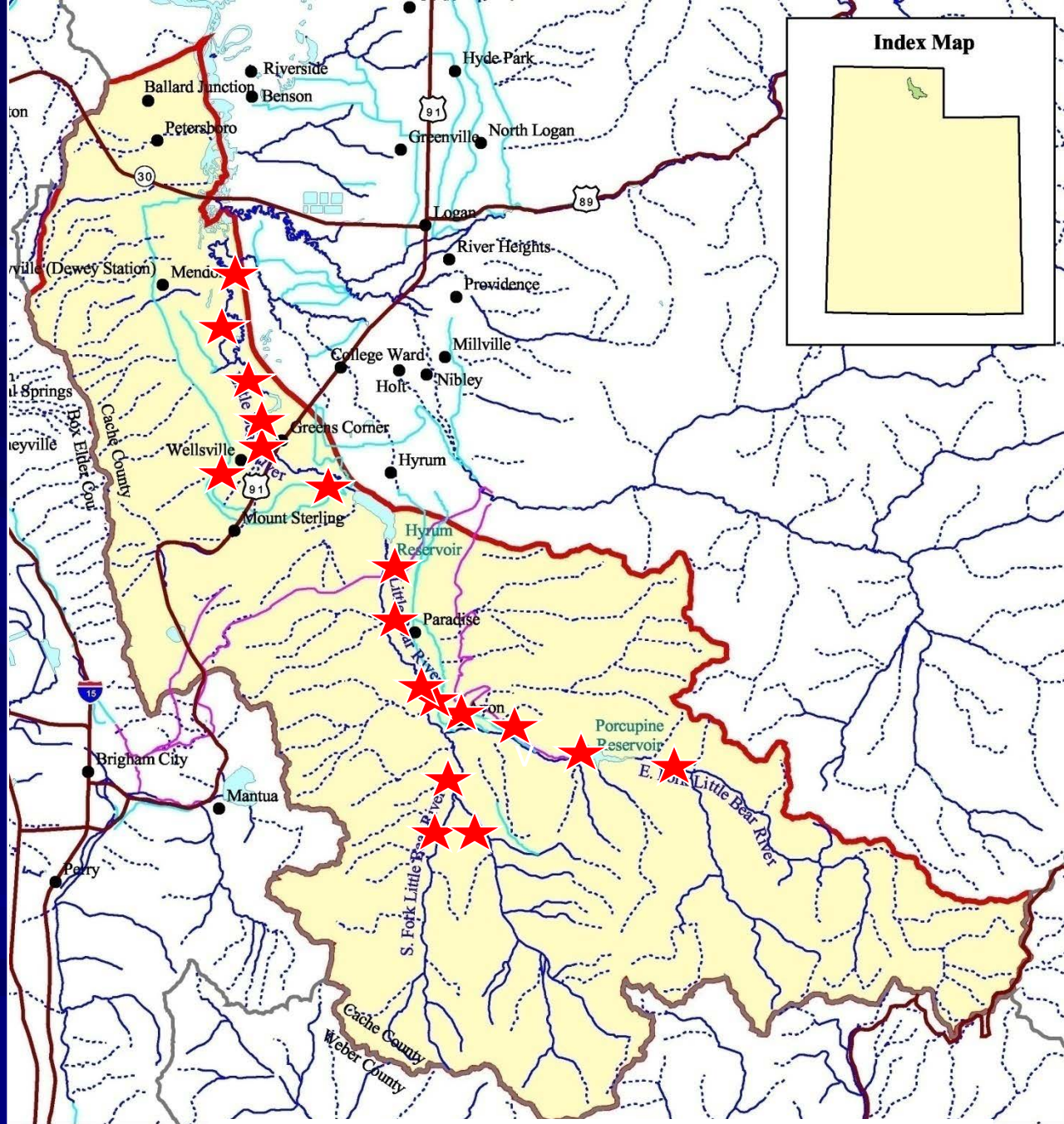
## Treatments:

- bank stabilization,
- river reach restoration,
- off-stream watering,
- improved manure and water management

# Common problems in BMP monitoring programs:

- Failure to design monitoring plan around BMP objectives
- A failure to understand pollutant pathways and transformations and sources of variability in these dynamic system.
- Tend to draw on a limited set or inappropriate approaches





Little Bear River Watershed, Utah

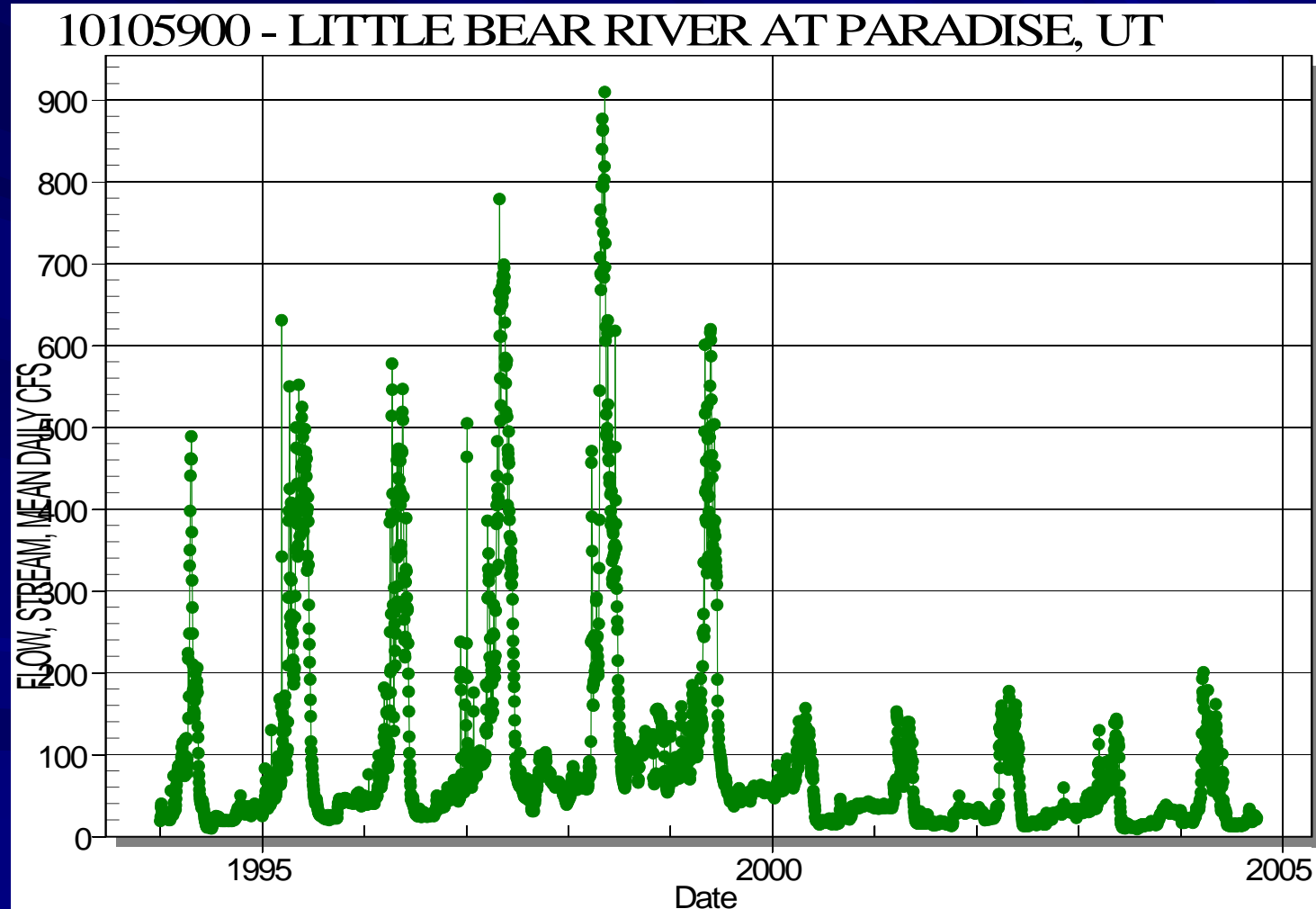
# Total Observations at Watershed Outlet site

	Discharge	Total phosphorus	
1976 - 2004:	162	241	
1994 - 2004:	72	99	
1994	11	13	} Number of observations each year
1995	10	13	
1996	10	13	
1997	11	4	
1998	6	10	
1999	7	10	
2000	6	5	
2001	4	7	
2002	2	8	
2003	4	8	
2004	1	8	

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# Understanding natural variability – annual variation



# Since 2005, measure flow and turbidity at 30 minute intervals

Stage recording devices to estimate discharge



<http://www.campbellsci.com>

Turbidity sensors



<http://www.ftsinc.com/>

Dataloggers and telemetry equipment

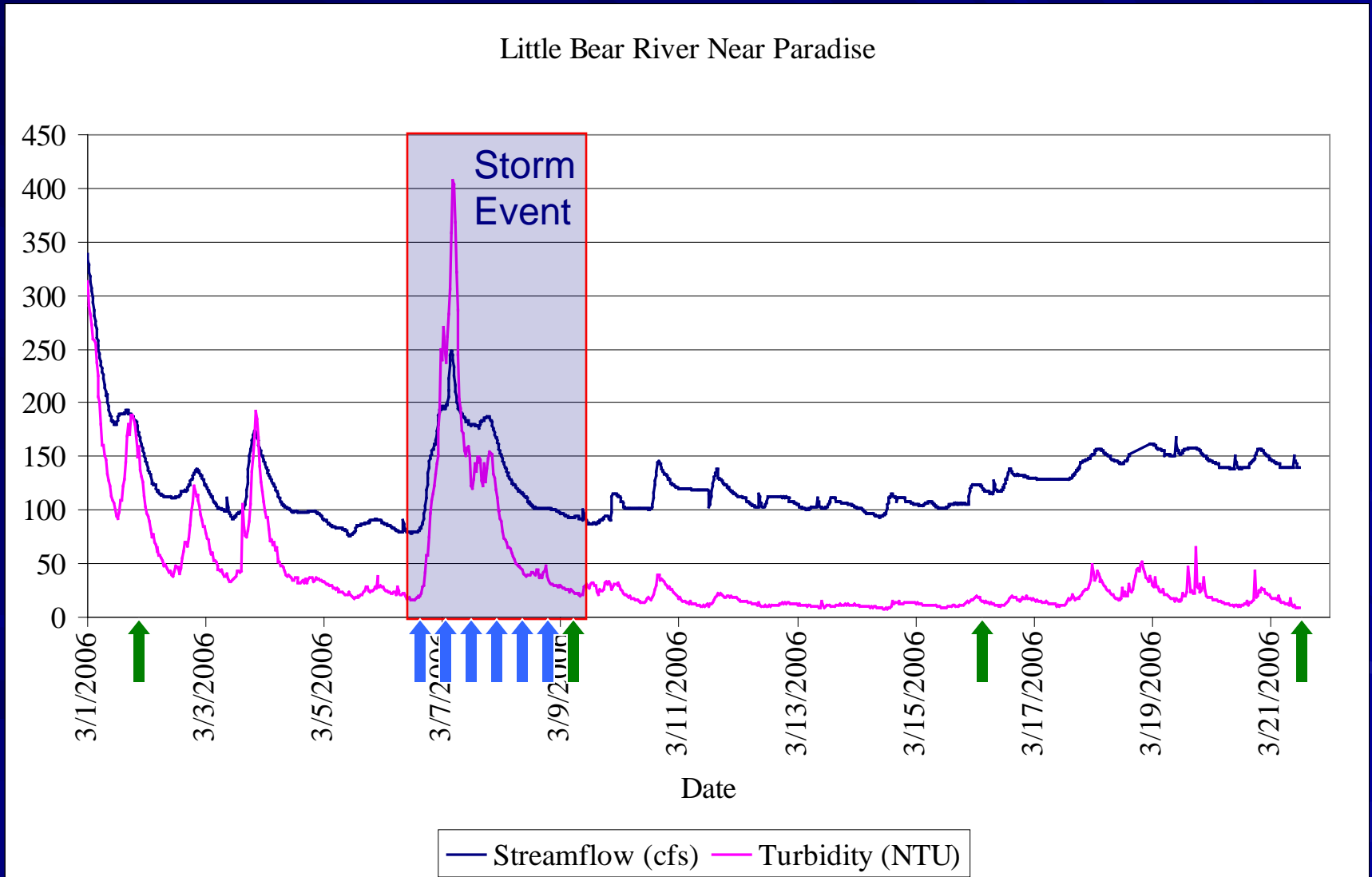


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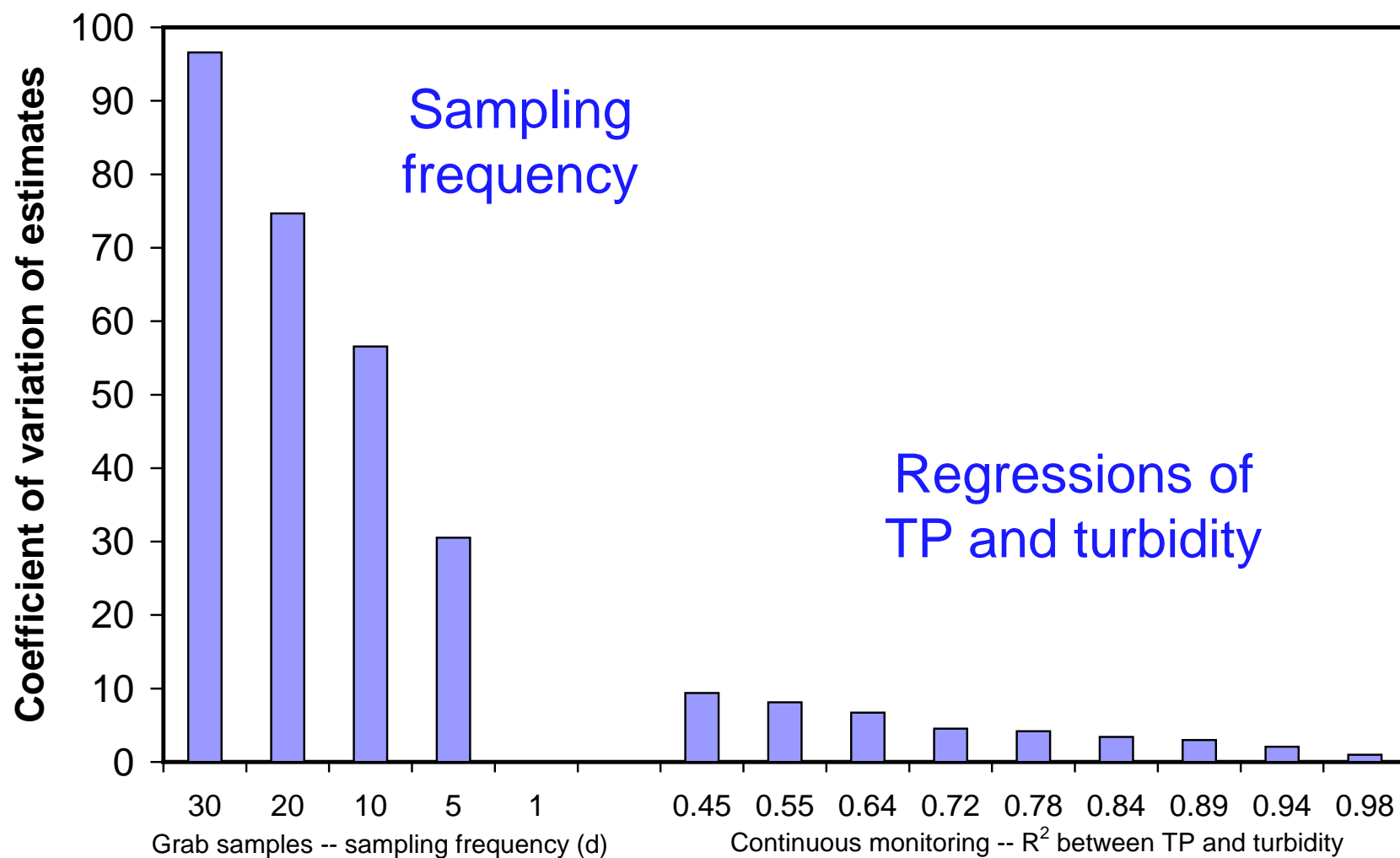




# Capturing pollutant movement from source to waterbody.



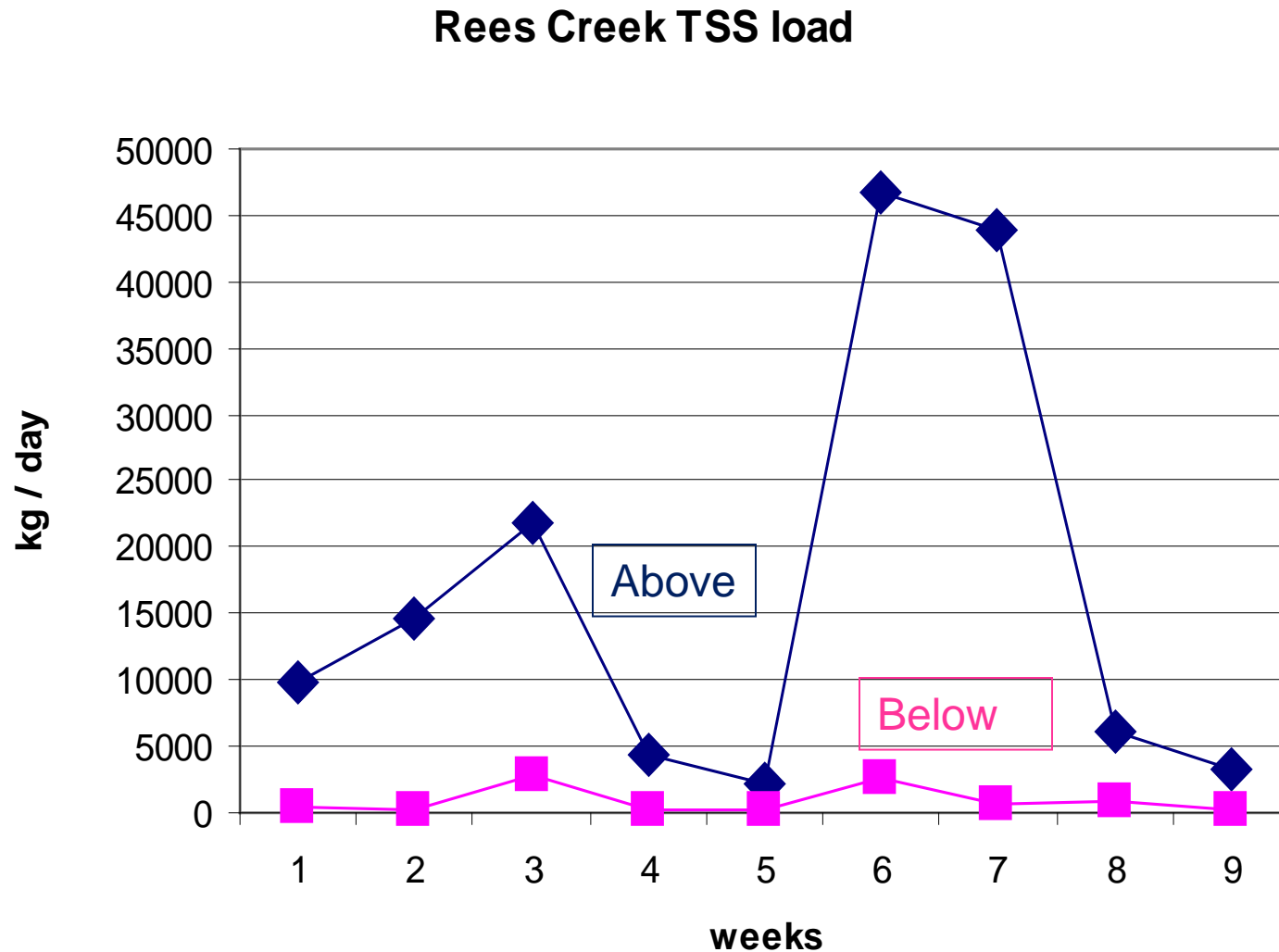
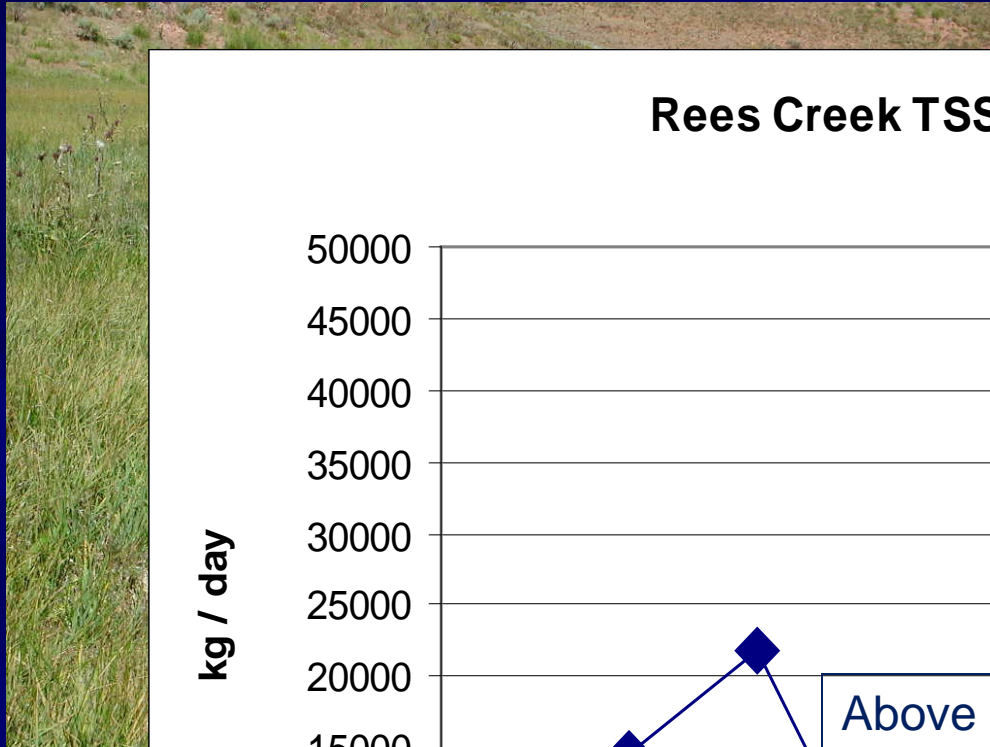
# The relative importance of different sources of variability



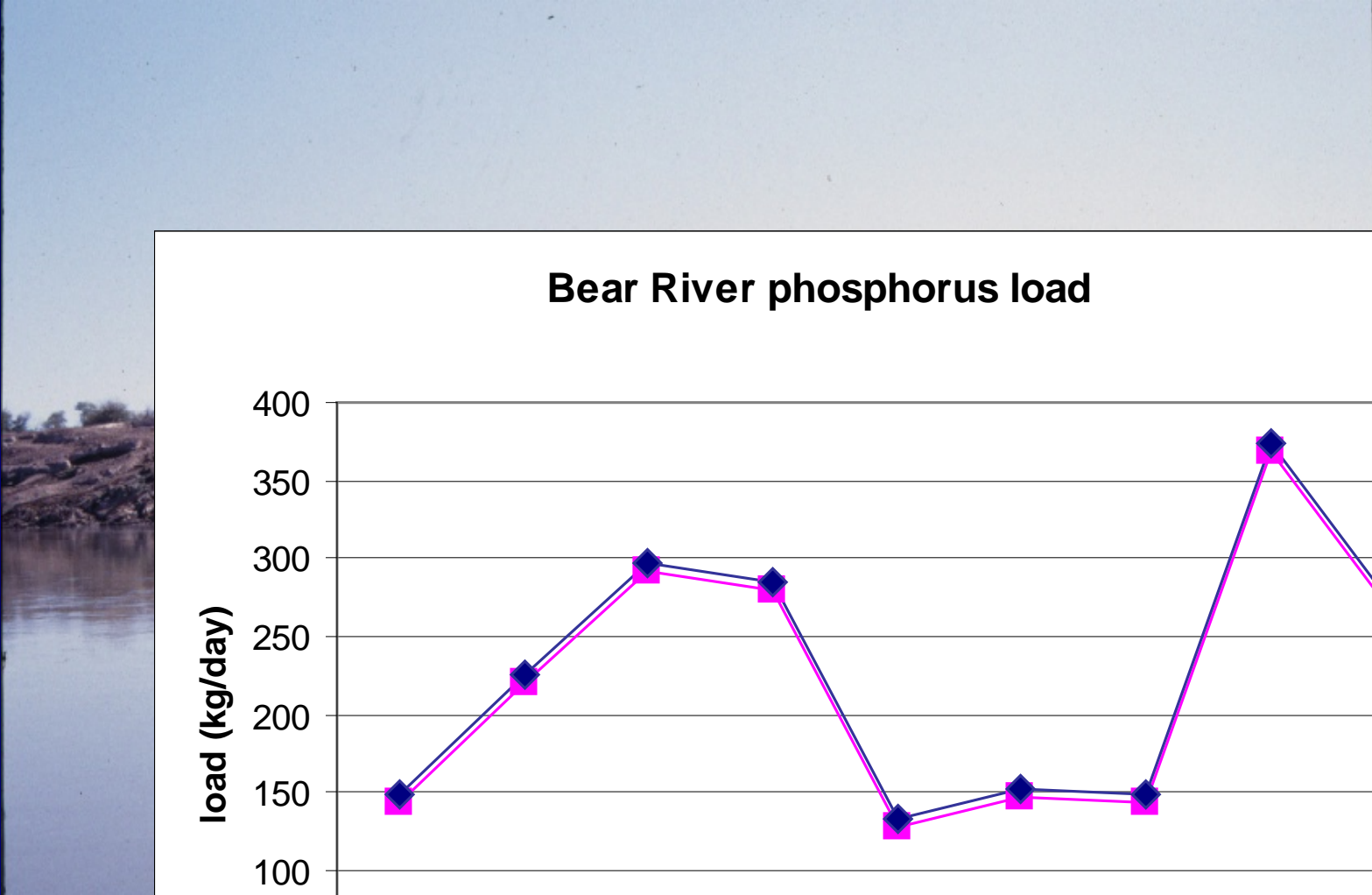


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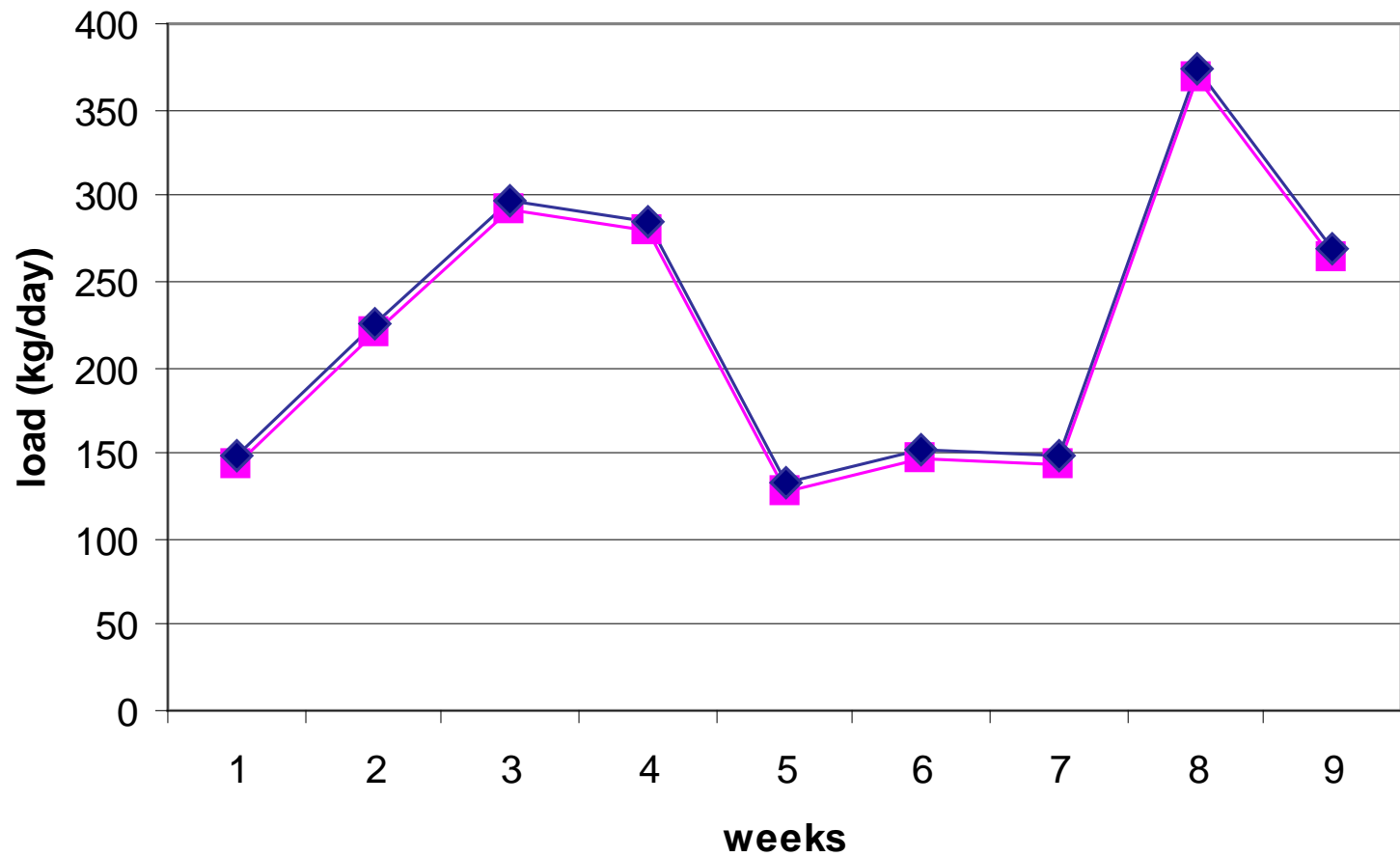
# Problems with "one-size-fits-all" monitoring design







## Bear River phosphorus load



**DRAFT**

# Best Management Practices Monitoring Guidance Document

For Stream Systems

Developed by:

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Focuses on the considerations and decisions necessary as a project is first being considered.

NOT a “how-to” manual of protocols

Document in review  
Training workshops underway



# What is your objective?

- ✓ Long term trends?
- ✓ UPDES compliance?
- ✓ Educational?
- ✓ Assessment for impairment?
- ✓ Track response from an implementation?

## How do pollutants “behave” within your watershed.

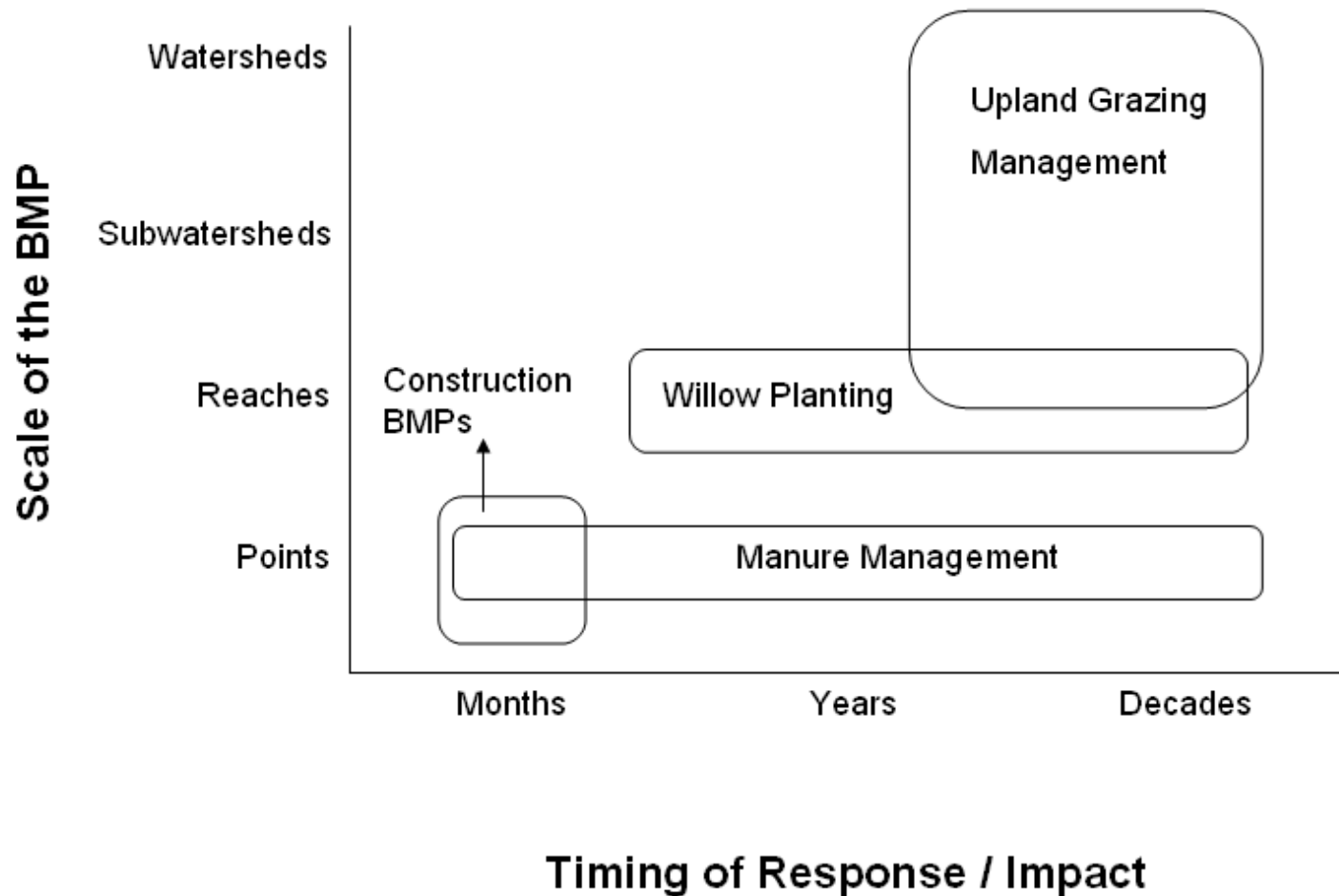
- ✓ How does the pollutant move from the source to the waterbody?
- ✓ How is the pollutant processed or transformed within a waterbody?
- ✓ What is the natural variability of the pollutant? Will concentrations change throughout a season? Throughout a day?
- ✓ What long term changes within your watershed may also affect this pollutant?
- ✓ What else must be monitored to help interpret your data?

# What to monitor?

- Monitor the pollutant(s) of concern?
- Monitor a “surrogate” variable?
- Monitor a response variables?
- Monitor the impacted beneficial use?
- Monitor the BMP itself?
- Monitor human behavior?
- Model the response to a BMP implementation.
- Collect other data necessary to interpret monitoring results OR calibrate and validate the model?



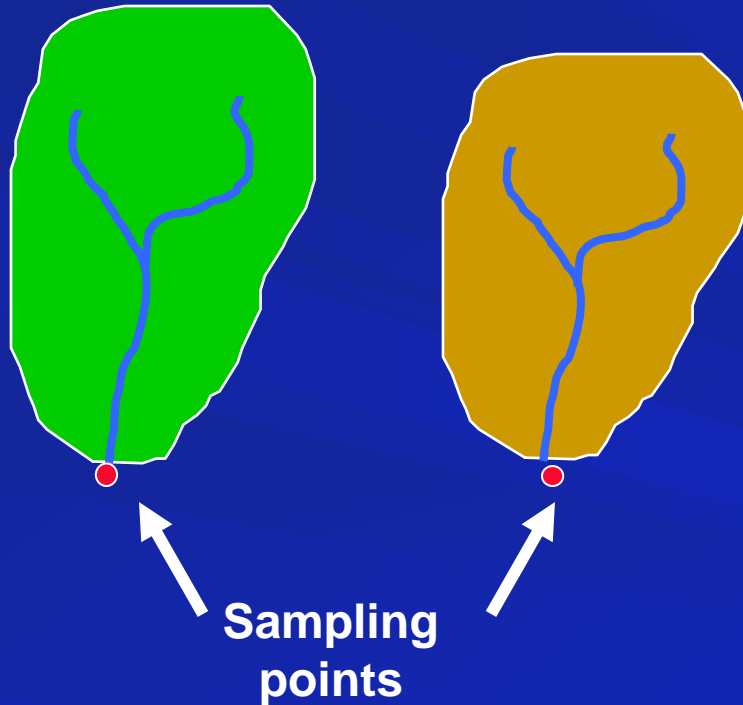
# Where and when to monitor?



# Choose appropriate monitoring or modeling

**Control**

**Treatment "A"**



**BACI Design**

**Above-  
treatment  
monitoring  
stations**

**Below-treatment  
monitoring  
stations**



**Above and below  
treatment design**

# How to monitor?

- ✓ points in time versus continuous
- ✓ integrated versus grab samples
- ✓ consider:
  - cost
  - skill and training required
  - accessibility of sites



## The road to more effective monitoring....

- Monitoring plans require careful thought before anything is implemented.
- Consider how the data will be used to demonstrate change.
- Use your understanding of your watershed and how the pollutants of concern behave to target monitoring most effectively
- Use different approaches for different BMPs



# different sources of variability in estimates of loads

