Coeur d'Alene Lake Tributaries 2008-2009 Nutrient and Sediment Monitoring

Presented to

Coeur d'Alene Watershed Advisory Group

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Objectives

- To conduct a general reconnaissance study to begin to understand the nutreint concentrations and TP loading of some tributaries to Coeur d'Alene Lake
  - Monitoring of suspended sediment and nutrients of 13 tributaries to Coeur d'Alene Lake.

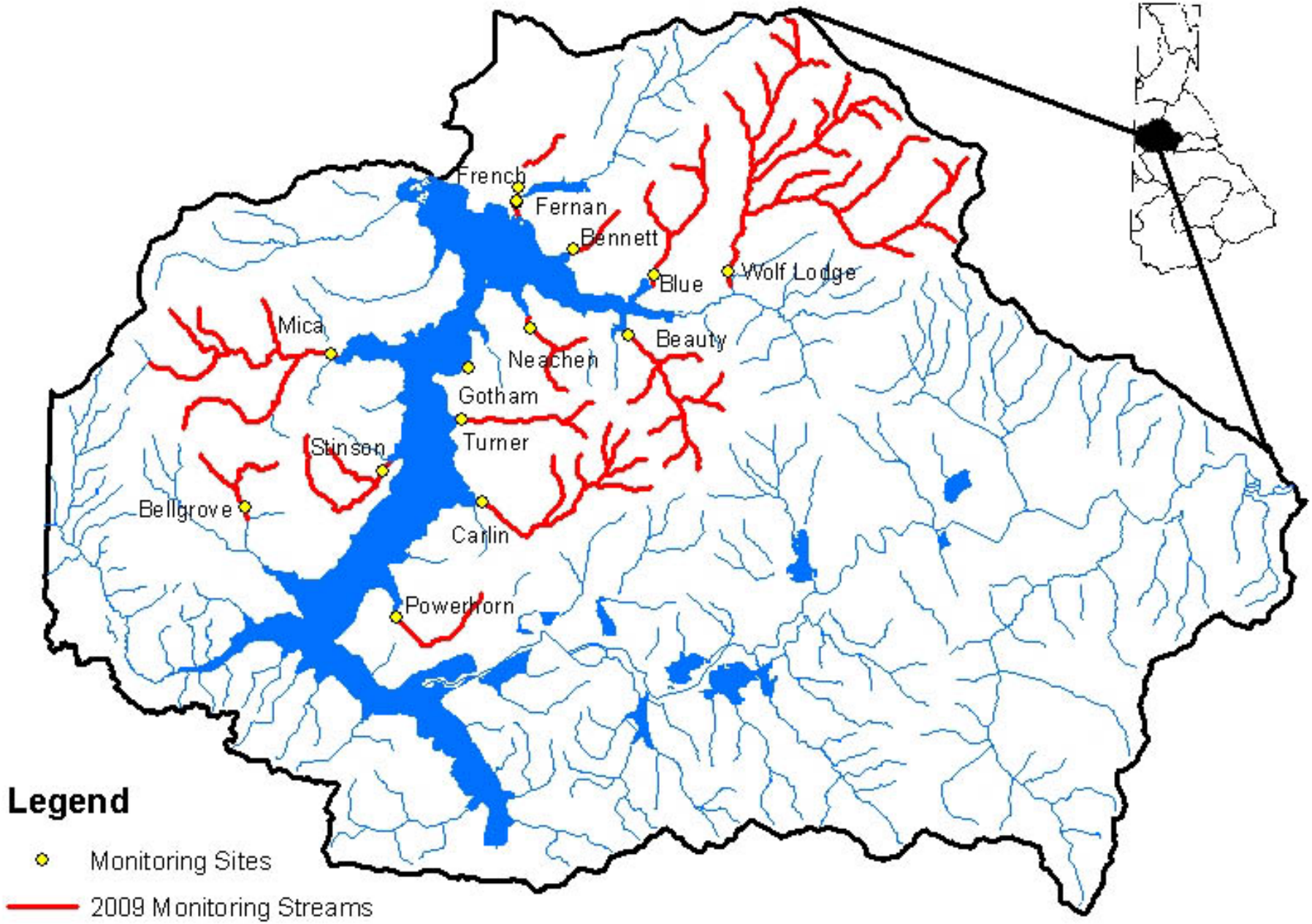

French
Fernan
Bennett
Blue
Wolf Lodge
Beauty
Mica
Neachen
Gotham
Turner
Stinson
Bellgrove
Carlin
Powerhorn
Legend
Monitoring Sites
2009 Monitoring Streams

Table 3: Monitoring Event Schedule

	2008				2009															
	May	July	August		January	February		March				April					May			June
	6	3	5	7	9	24[c]	25	3[c]	4	13	24	9	13	16	20	22	4	11	27	4
Flow Period **Stream**	*Base Flow*				*Ascending Limb*	*Peak*						*Descending Limb*					*Base Flow*			
Beauty Creek						X		X				X			X			X		
Bellgrove Creek				X		X			X[ab]			X	X							X
Blue Creek					X		X[a]	X				X			X		X			X
Carlin Creek						X		X		X					X					
Fernan Creek		X					X[a]		X[ab]				X			X		X		
French Gulch							X[a]	X					X							
Gotham Creek						X		X			X	X		X[a]						
Mica Creek				X		X		X		X						X		X		
Neachen Creek						X		X				X		X[a]					X	
Stinson Creek						X			X[ab]		X	X					X			
Turner Creek			X			X		X				X		X[a]	X					X
Unnamed Creek to Bennett Bay							X[a]	X				X		X[a]			X			
Unnamed Creek to Powderhorn Bay						X		X			X	X		X[a]			X			
Flow Period	*Base Flow*				*Ascending Limb*			*Peak*									*Descending Limb*			
Wolf Lodge Creek	X						X[a]	X					X					X		
					Ascending Limb			*Peak*			*Descending*		*Base Flow*							
Gotham Creek						X		X			X	X		X[a]						

a: TSS exceeded DQO; b: Total Nitrogen exceeded DQO
c: Rain on Snow Event

Figure 2: Beauty Creek — 2009 Monitoring Results

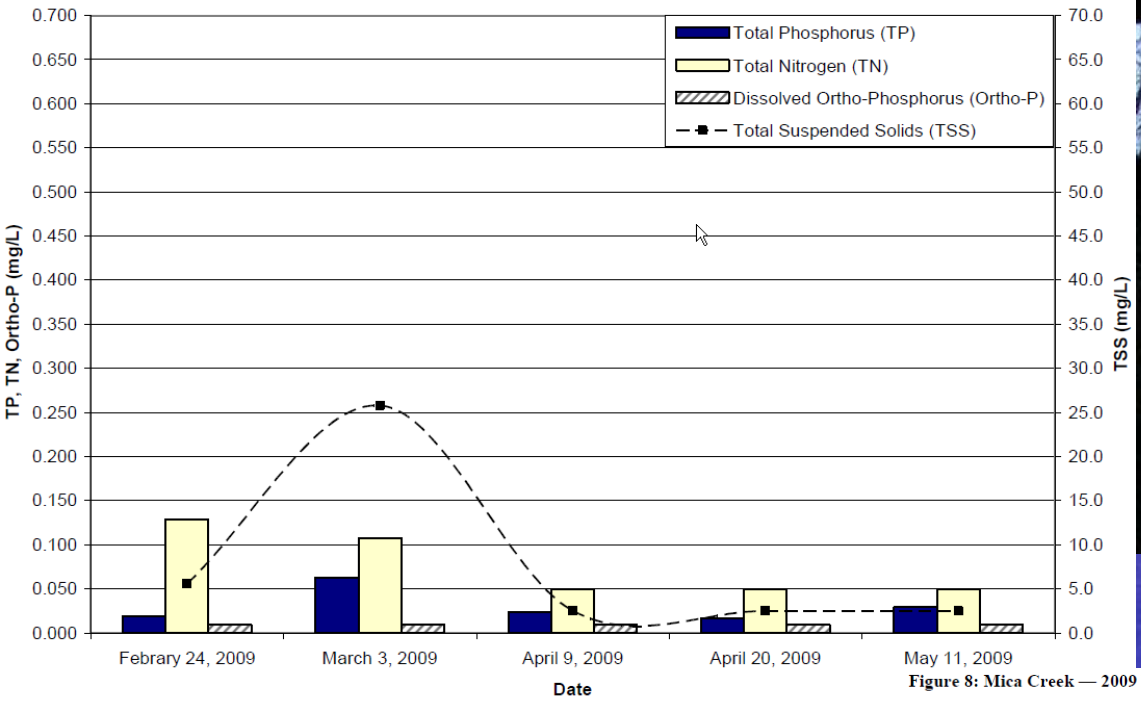


Figure 8: Mica Creek — 2009 Monitoring Results

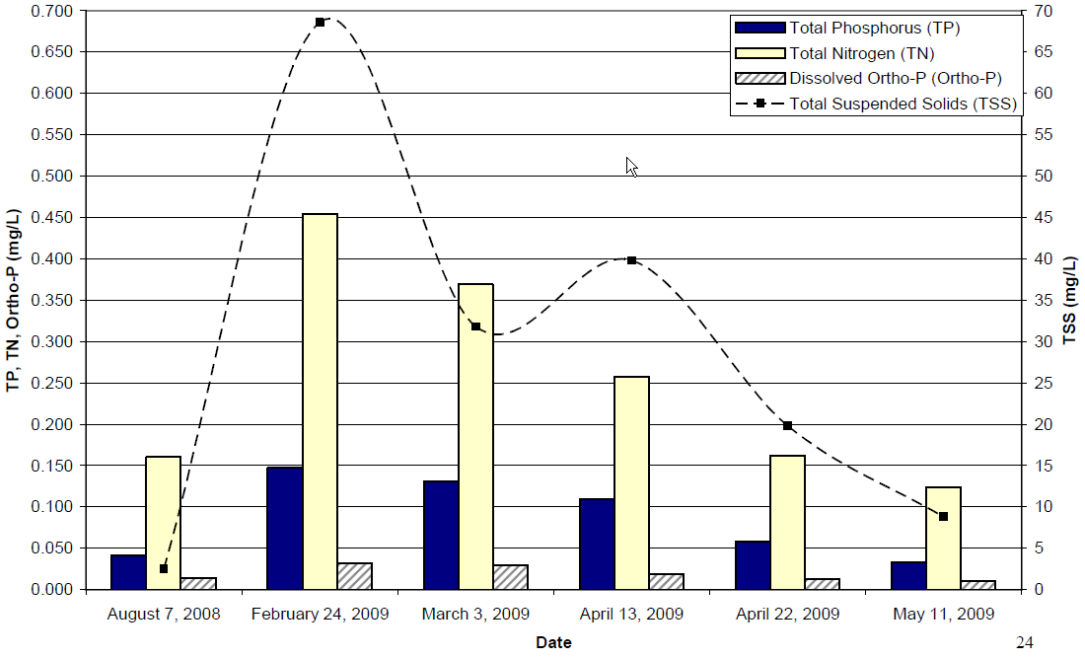


Figure 3: Bellgrove Creek — 2009 Monitoring Results

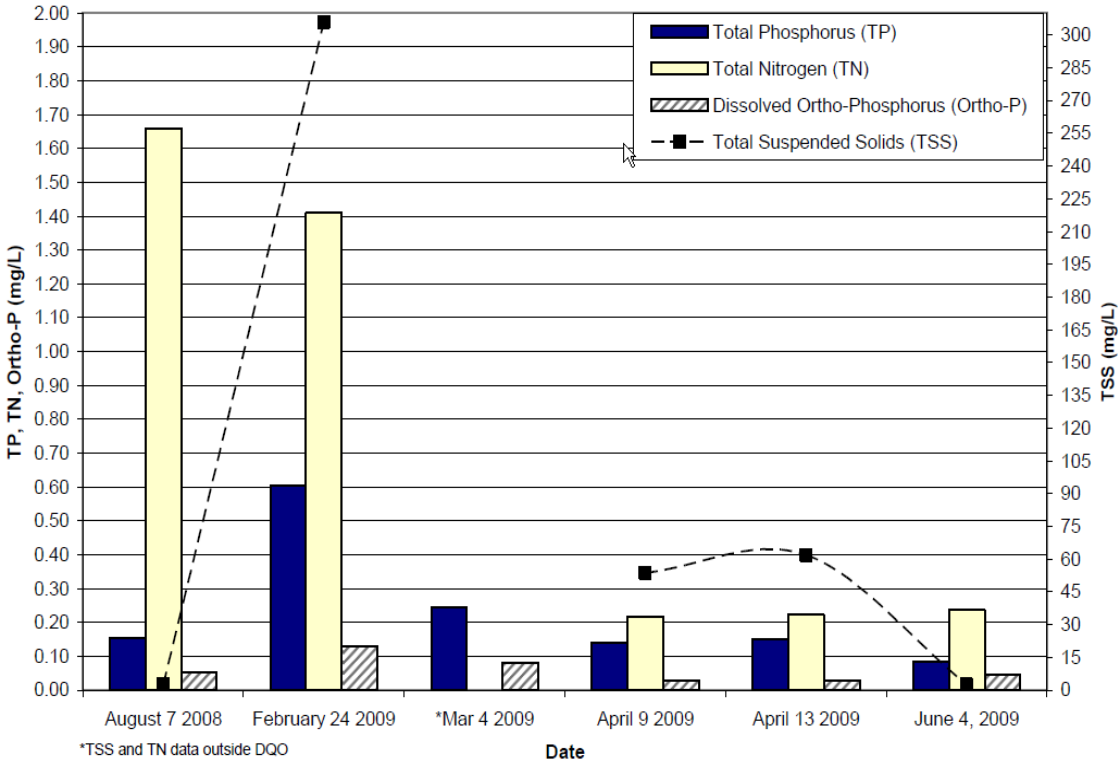
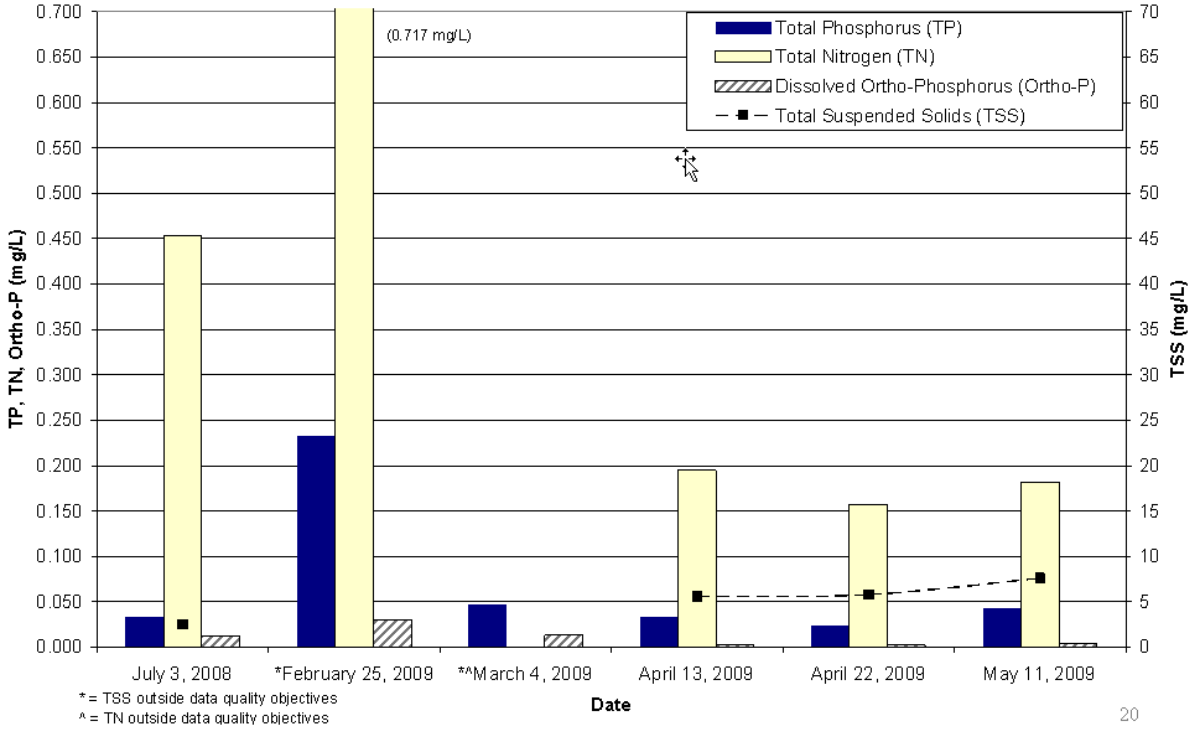
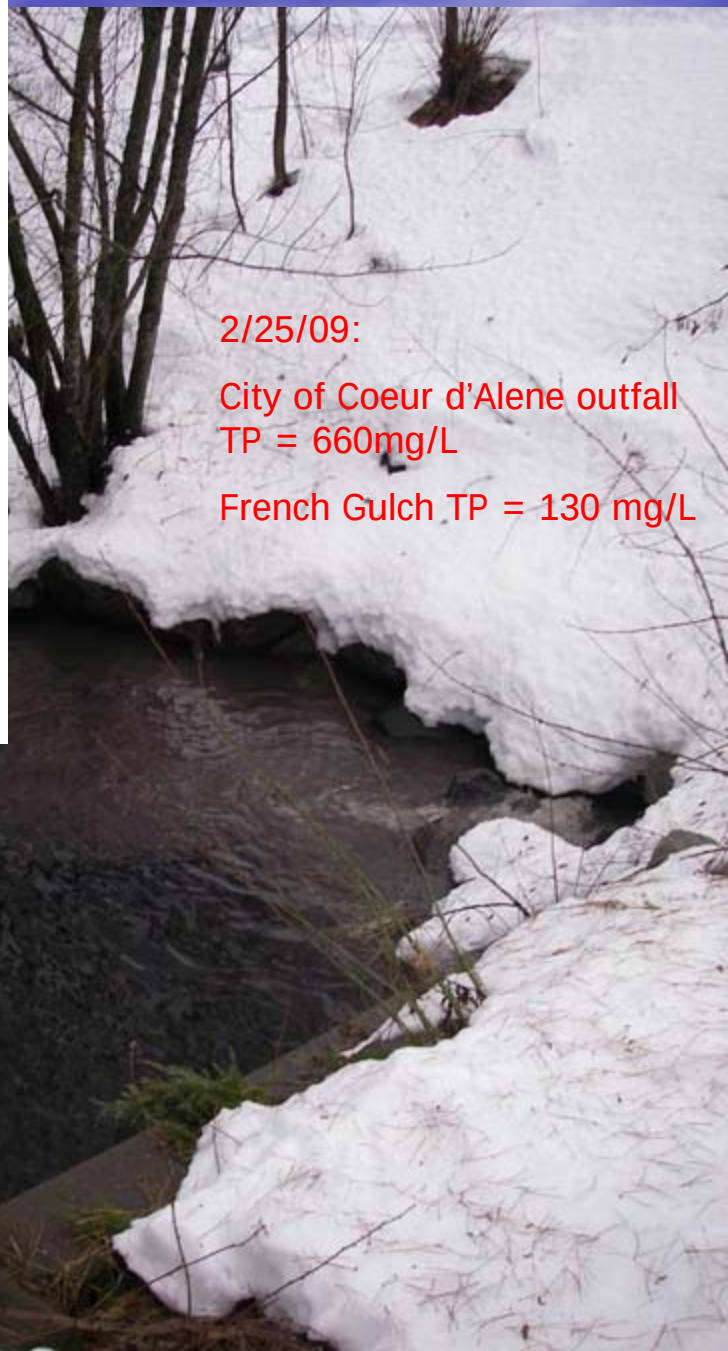


Figure 6: Fernan Creek — 2009 Monitoring Results



* = TSS outside data quality objectives
^ = TN outside data quality objectives



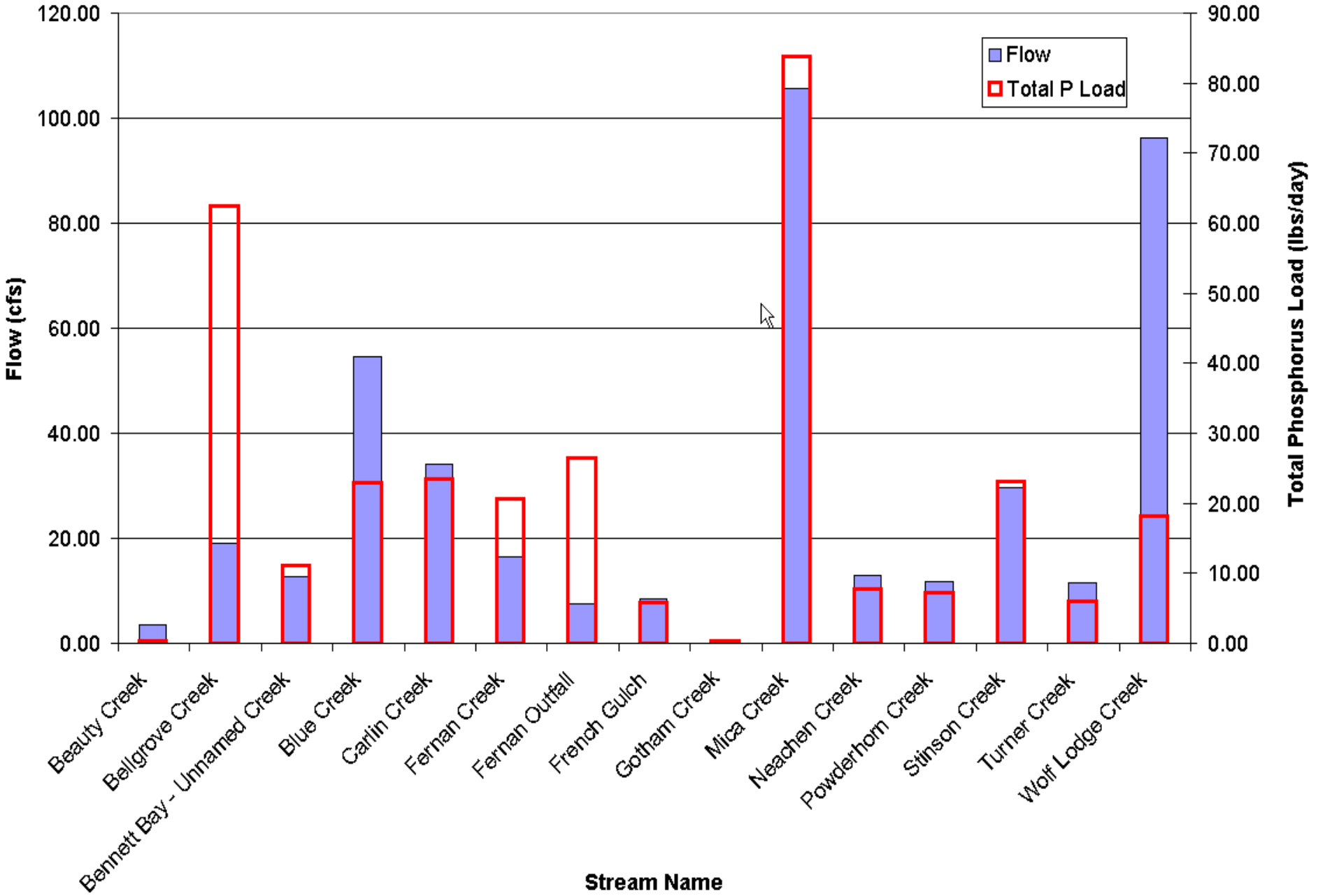
2/25/09:

City of Coeur d'Alene outfall TP = 660mg/L

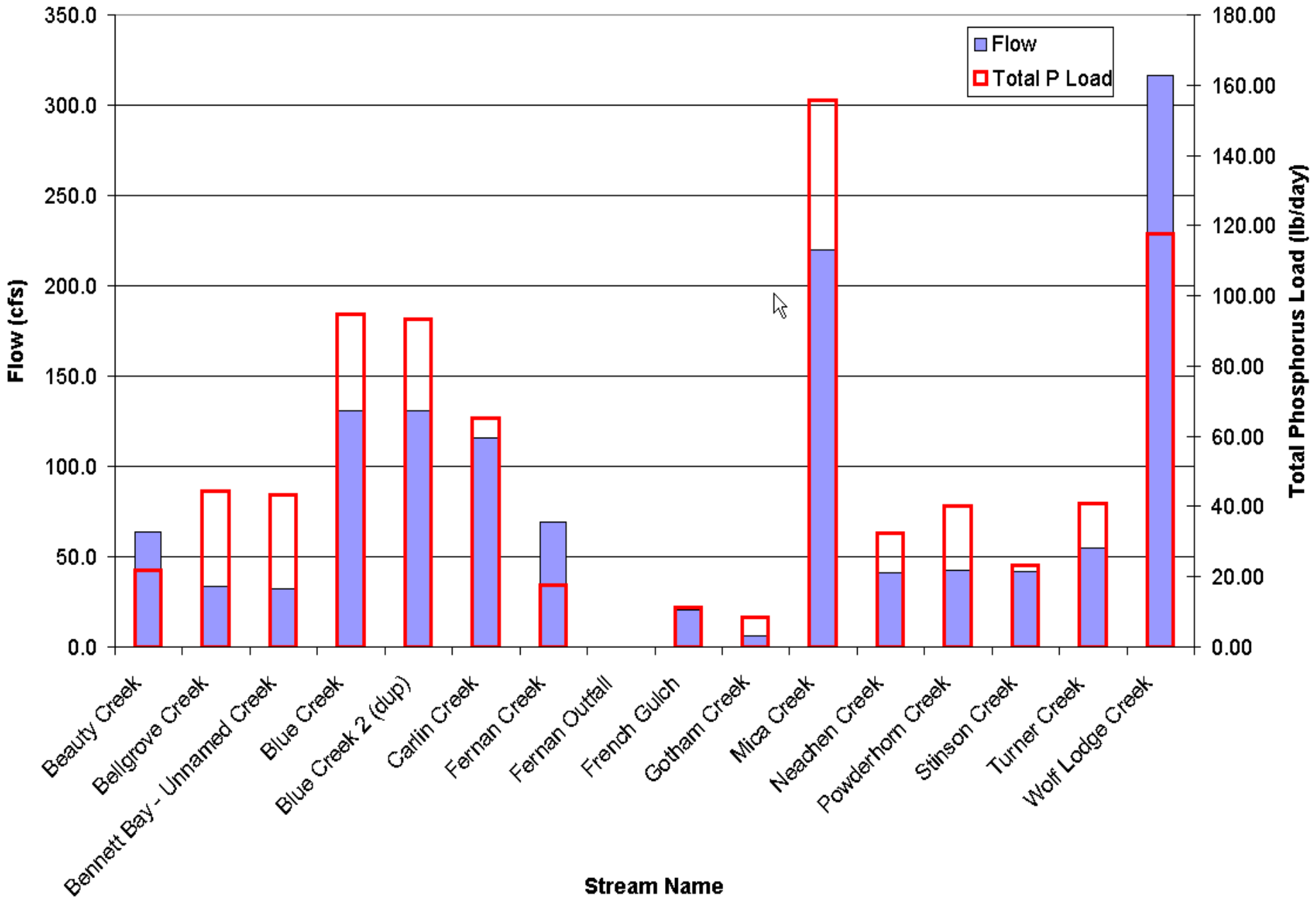
French Gulch TP = 130 mg/L

TP Load estimates of Tributaries to Lake Coeur d'Alene

February 2009 TP Loads



March TP Loads

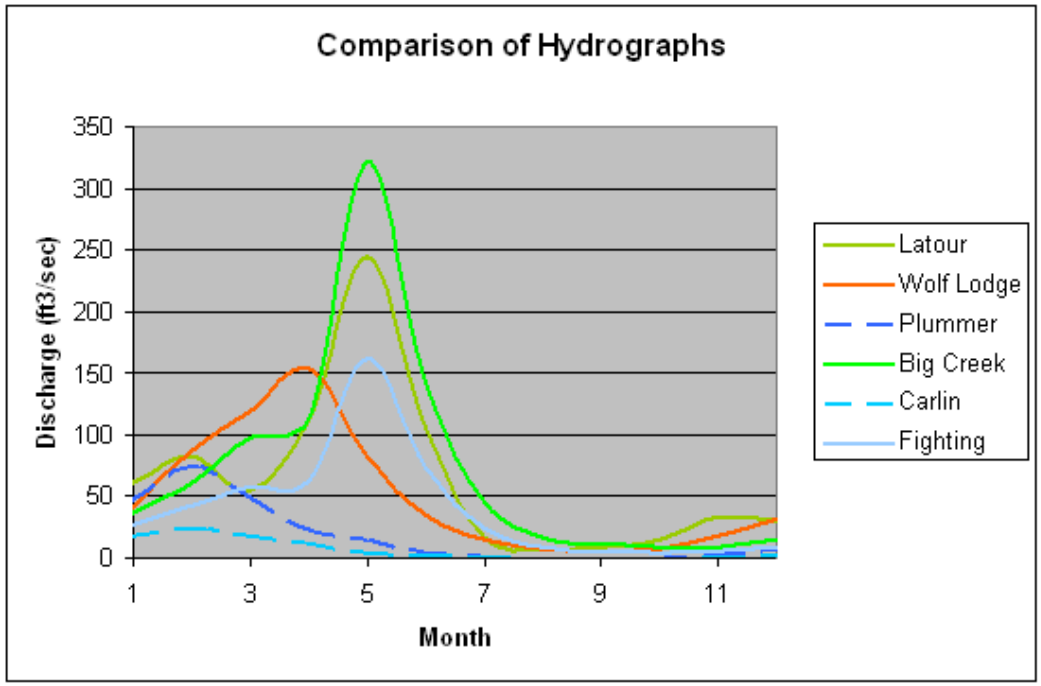


TP Loading Analysis

Table 4: Estimated average number of days for each flow condition.

	Tributaries		Wolf Lodge Creek		Gotham Creek	
Flow period	Estimated Days	Percent of year	Estimated Days	Percent of year	Estimated Days	Percent of year
Ascending Limb	30	8.2	30	8.2	30	8.2
Rain on Snow	7	1.9	7	1.9	7	1.9
Peak Flow	30	8.2	30	8.2	30	8.2
Descending Limb	60	16.4	90	24.7	60	16.4
Base Flow	238	65.2	208	57.0	30	8.2

Figure 30: Comparison of hydrographs from creeks in the Coeur d'Alene watershed.

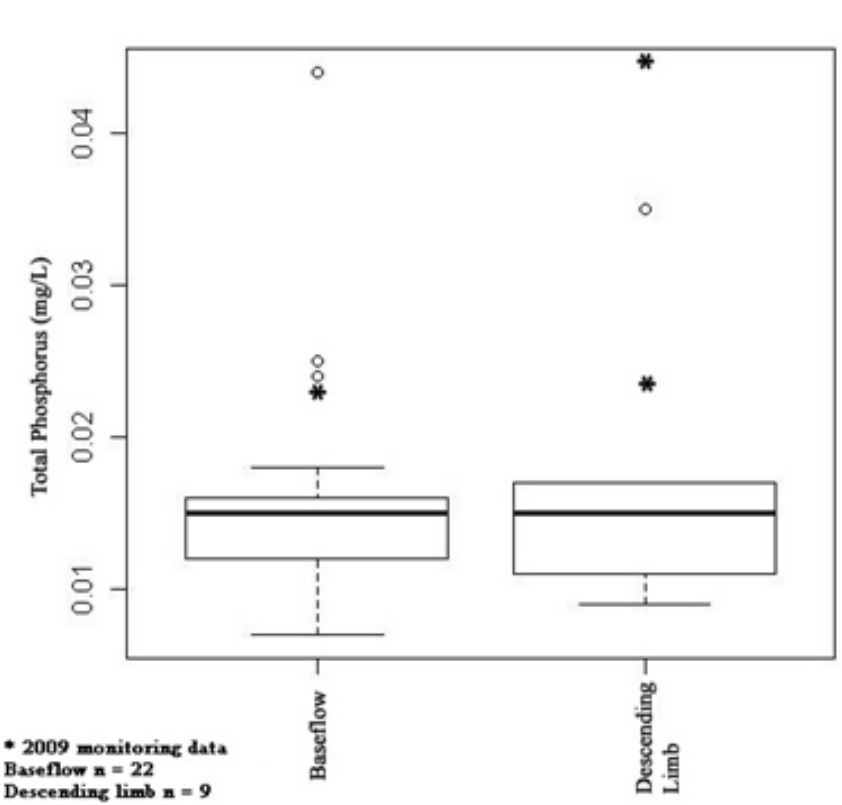


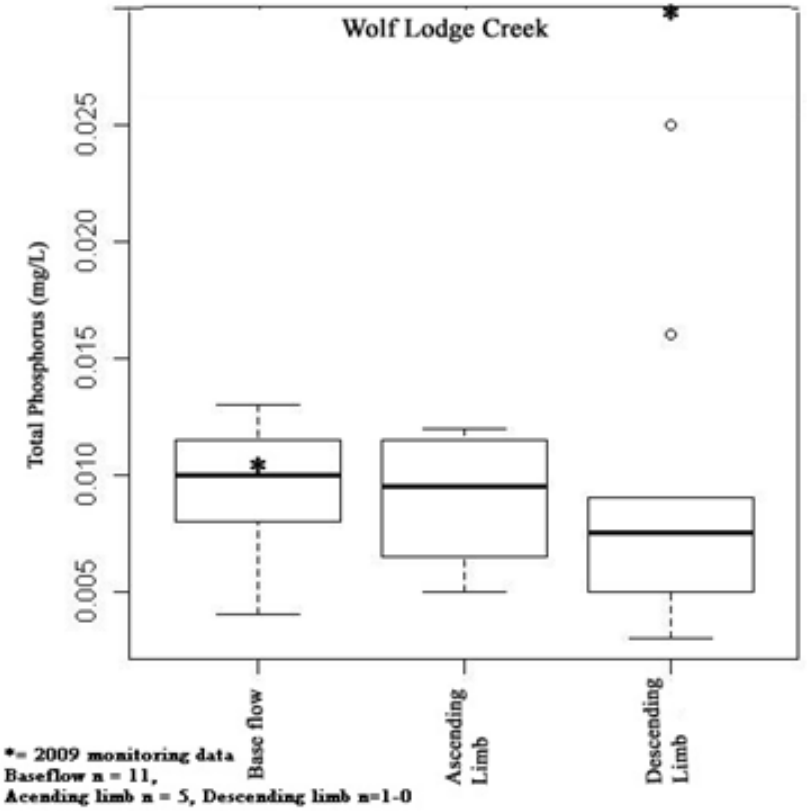
- An initial loading analysis was done to calculate an annual TP load (in lb/year) using the 24-hour TP load for the flow period and an estimate of days for the various flow periods
- Highest annual TP loads based on this analysis were from Mica Creek, Bellgrove Creek, Blue Creek, and Carlin Creek

Table 7: Loading comparison for years 1991, 1992, 2009

Carlin Creek 1991 (USGS)	Carlin Creek 1992 (USGS)	Carlin Creek 2009	Wolf Lodge Creek 1991 (USGS)	Wolf Lodge Creek 1992 (USGS)	Wolf Lodge Creek 2009
Total Phosphorus Load (lbs)					
452	234	1,881	1,300	478	18,655

Figure 28: Box and whisker plot of USGS TP data taken from Carlin and Wolf Lodge Creeks in 1991-1992 & 2009.





TP Loading Analysis

- The goal for setting priorities for phosphorus restoration efforts was to have the largest benefit for the lowest cost.

- Therefore, an alternative analysis was performed to evaluate TP loading rate (in lb/mi2/yr) of individual watersheds by using TP load, the number of days in the flow period, and watershed area information.

Priority watersheds for efforts to mitigate phosphorus loading to Coeur d'Alene Lake

Table 7: Total Phosphorus Priority Schedule for Tributaries to Coeur d'Alene Lake

			Score				
	Stream	**Priority**	**Rain On Snow**	**Peak Flow**	**Descending Limb**	**Base Flow**	**Total**
1	Bellgrove	Very High	4	2	4		10
2	Mica Creek	High	2		4	1	7
3	Blue Creek	High	1	4	2		7
4	Bennett Creek	High		4	3		7
5	Stinson Creek	Moderate			3	3	6
6	Powderhorn Creek	Moderate		4		2	6
7	Gotham Creek	Moderate		3	2		5
8	Wolf Lodge Creek	Moderate		4			4
9	Neachen Creek	Moderate		3		1	4
10	Fernan Creek	Low				2	2
11	Carlin Creek	Very Low			1		1
12	Turner Creek	Very Low			1		1
13	Beauty Creek	Very Low				1	1

Score of 1 = within the 25%tile of the range of values that exceed average load rate (lb/mi2/day) (0-0.28)
Score of 2 = between the 25 and 50%tile of the range of values that exceed average load rate (0.28-0.54)
Score of 3 = between the 50 and 75%tile of the range of values that exceed average load rate (0.54-2.86)
Score of 4 = greater than 75%tile of the range of values that exceed average load rate (>2.86)

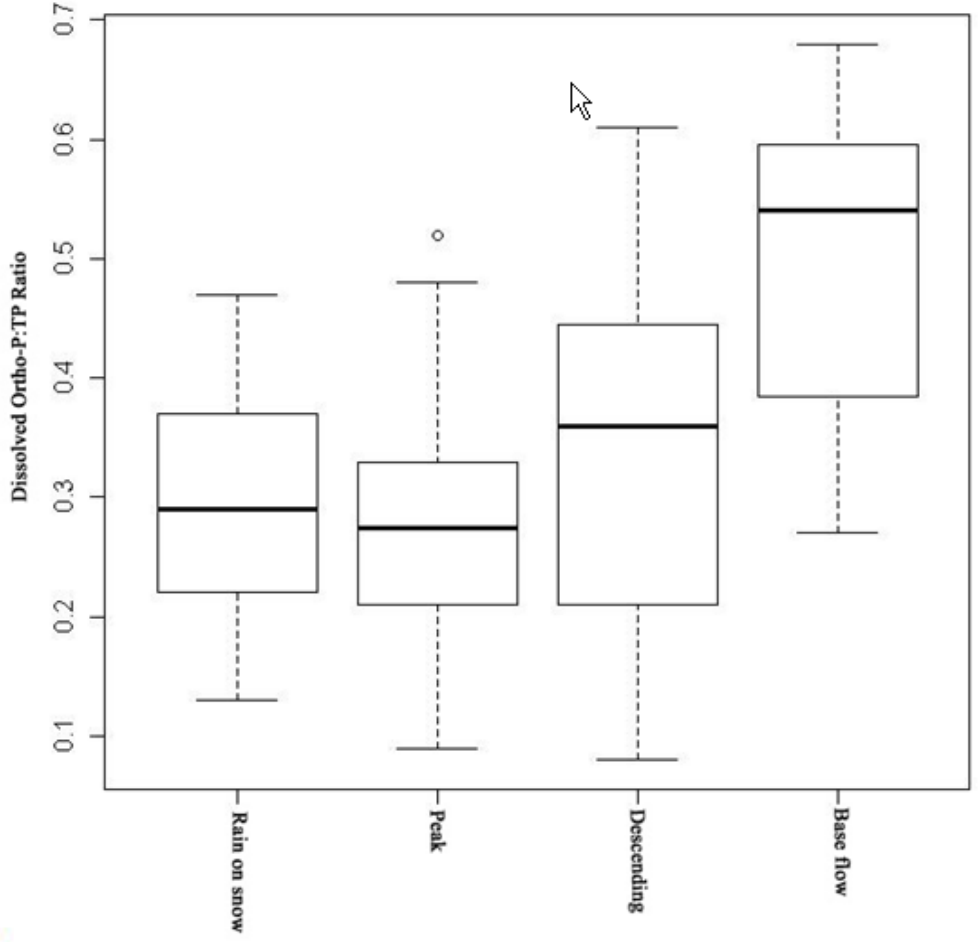
EVALUATION OF ORTHO-P:TOTAL P RATIO

- The concentration of Ortho-P to TP is an index of the amount of phosphorus immediately available for algal growth.
- An acceptable Ortho-P:TP ratio for the 90th percentile of reference streams in the Northern Rockies Ecoregion in Montana (Omernick III Ecoregion) was 0.35 (Suplee & Watson, et. al 2008).
- The median dissolved Ortho-P:TP was 0.54 during base flow

  This suggests tributaries to Coeur d'Alene Lake support more bioavailable phosphorus during the growing season than what typical reference streams in the region would support.

EVALUATION OF ORTHO-P:TOTAL P RATIO

Figure 31: Box and Whisker plots of dissolved Ortho-P:TP ratios of tributaries to Coeur d'Alene Lake



Conclusions

- The highest instantaneous suspended sediment and nutrient concentrations were observed during early rain-on-snow events.
- Dissolved Ortho-P:TP during base flow period in tributaries to Coeur d'Alene Lake are above that of reference streams in the region suggesting bioavailable phosphorus may be a concern for beneficial uses for the streams

Conclusions

- Highest annual TP loads were from Mica Creek, Bellgrove Creek, Blue Creek, and Carlin Creek.
- The highest TP loading rate (in lb/mi2/yr) of individual watersheds were from Bellgrove Creek, Mica Creek, Blue Creek, and Bennett Bay Creek.