Black Lake
Sub-basin Assessment and TMDL

Watershed Advisory Group
Meeting

August 27, 2009

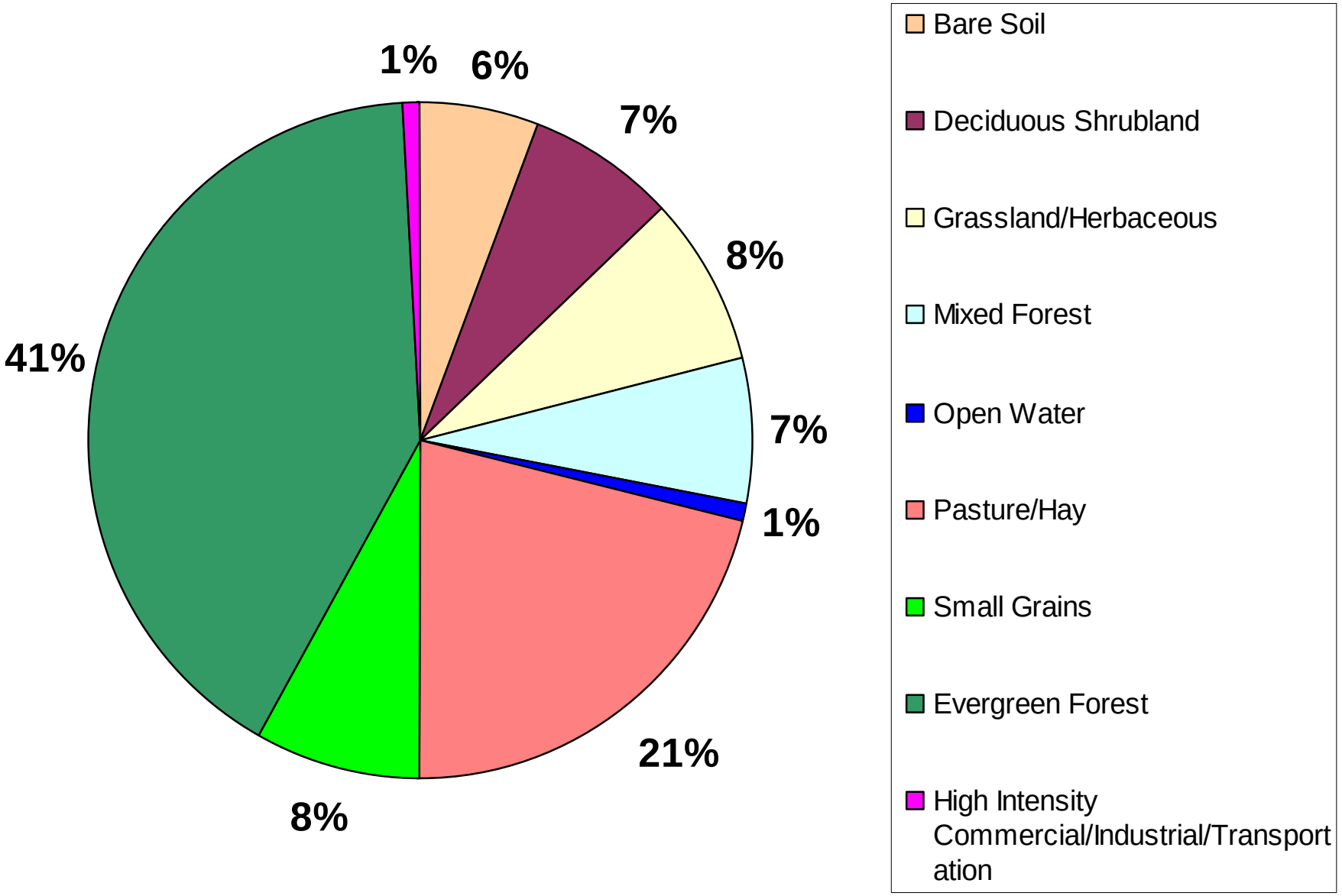
Sub-Basin Assessment

- Determine the degree of designated beneficial use support of the water body (assess attainment of water quality standards).
- Determine the degree of achievement of biological integrity.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- Determine the causes and extent of the impairment when water bodies are not attaining water quality standards.

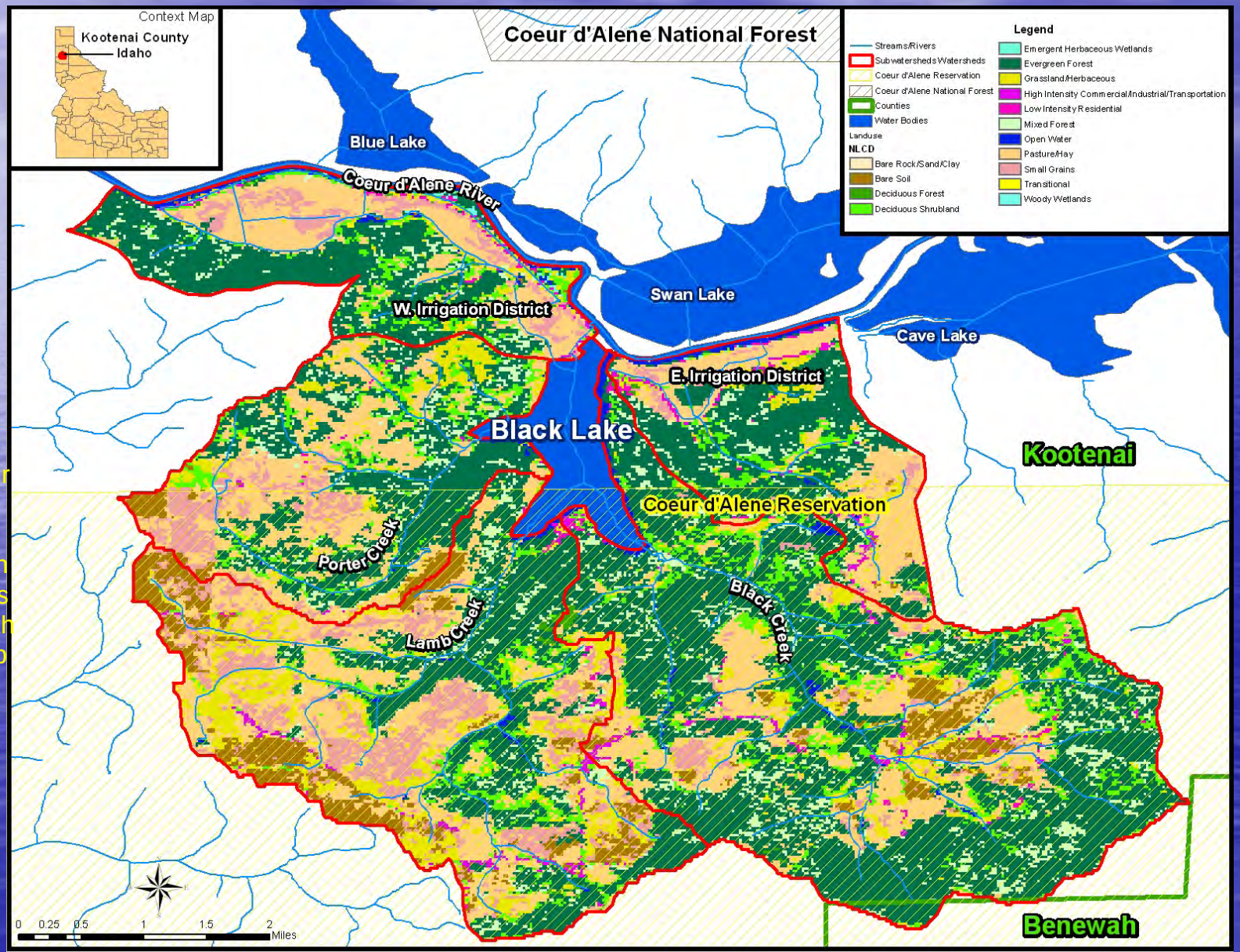
Morphometry of Black Lake

Characteristic	Value
Morphometry	
Elevation	647.1m
Area of Watershed or Drainage	16.06 miles^2 (10,282 acres)
Surface Area	0.54 miles^2 (347 acres)
Average Depth	4.3 m (14.1 feet)
Greatest Depth	7.3 m (23.95 feet)
Flushing Rate	1.4 years
Lake Volume	5,280 acre feet
Hydraulic Residence Time	0.55 year

Land Use in Black Lake Watershed



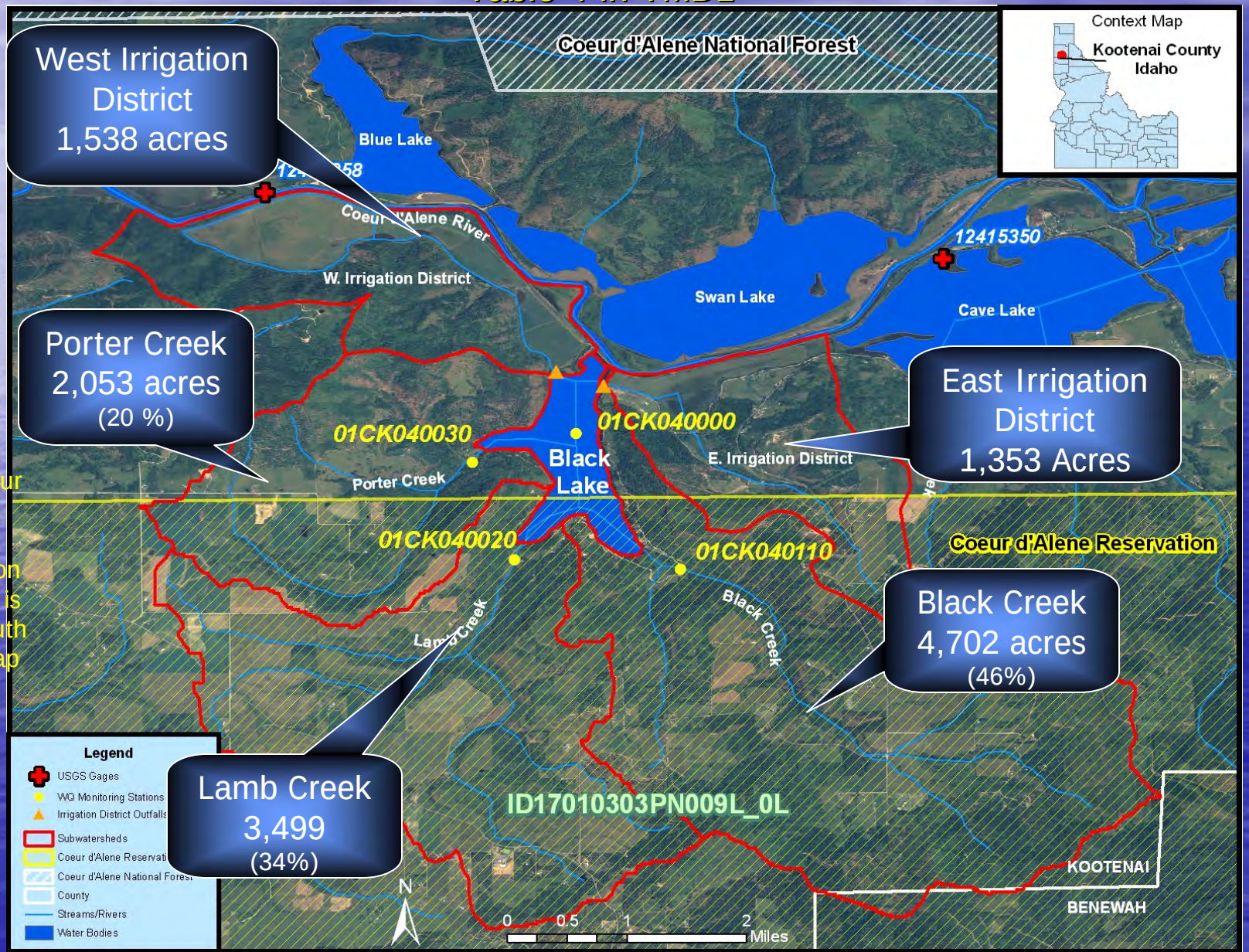
Land Cover



Note: Coeur d' Alene Reservation Boundary is too far south on the map

Subwatersheds

Table 4 in TMDL



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Water Quality Data

- Black Lake has weak periods of stratification from June through August, when water below 5m depth often becomes anaerobic (Kann and Falter 1987).
- Some mixing of the deeper water occurs periodically during strong wind events during the summer.
- The flushing rate and hydraulic residence time of the lake are high (1.4 yr^{-1} and 0.55 yrs).
- The percentage of TP contributed by internal loading is relatively small at 9.3% (Kann and Falter).

Water Quality Data

Waterbody	Number of Samples	Period of Record	TP Average (µg/L)	Data Source
Coeur d'Alene River	15	10/03-8/05	21.4	USGS
Blake Lake	15	8/02-8/06	32.5 upper 52.1 lower	CDA Tribe
Black Creek	10	12/04-9/06	73.9	CDA Tribe Kann and Falter (1985)
Lamb Creek	10	12/04-9/06	114.9	CDA Tribe Kann and Falter (1985)
Porter Creek	7	6/05-4/06	104.7	CDA Tribe
West Discharge Pipe	3	5/05-8/05	48	Kann and Falter (1985)

Biological Data

- Specific fishery population information and other relevant biological data are not available for Black Lake and its tributaries.
- 2005 Paleolimnology analysis of Black Lake using a sediment core from the center of the lake (Bos and Stockner 2005).
  - Results verify Black Lake has been mesotrophic throughout its history; however eutrophic conditions have prevailed since 20th century.
  - Blue-green algae has recently dramatically increased to well above historical levels.
  - Change in nutrient composition due to erosion from various disturbances within the watershed.

SBA Conclusions

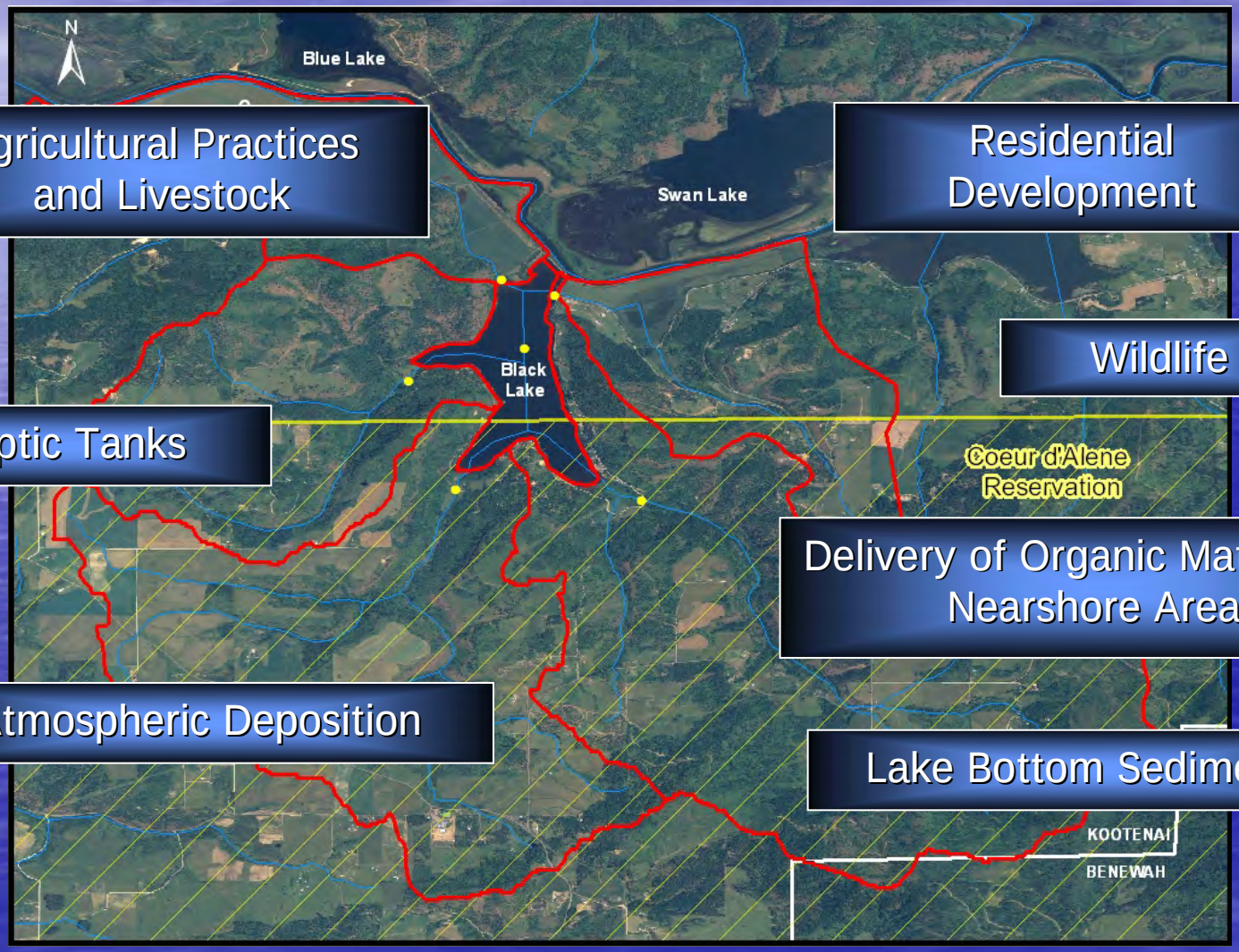
- Water Quality Data indicates lake is not supporting cold water aquatic life use as a result of excessive nutrient loading.
- TP concentrations indicative of eutrophic conditions.
- Paleolimnology data verified that Black Lake has always been productive and productive and probably mesotrophic until recent years, when human activity has accelerated eutrophication.
  - Productivity has decreased during the past decade, but it is 300% higher than prior to human-induced disturbance
- The percentage of TP contributed by internal loading is relatively small at 9.3% (Kann and Falter).
- Major sources of TP to Black Lake are the result of external loading, which warrants the need for a loading analysis, TMDL allocation, and implementation plan

TMDL

- A TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards.
  - TMDL is water body, and pollutant specific
  - It allocates allowable discharges of individual pollutants among the various sources.
- Coeur d'Alene Tribe and DEQ collaborate on Black Lake to ensure consistency in water quality management programs. *This includes collaboration on the Black Lake Watershed Assessment and TMDL, which is a joint effort between the Coeur d'Alene Tribe and Idaho DEQ.*

Pollutant Sources

Nutrient sources within the Black Lake watershed include:



Agricultural Practices and Livestock

Residential Development

Wildlife

Septic Tanks

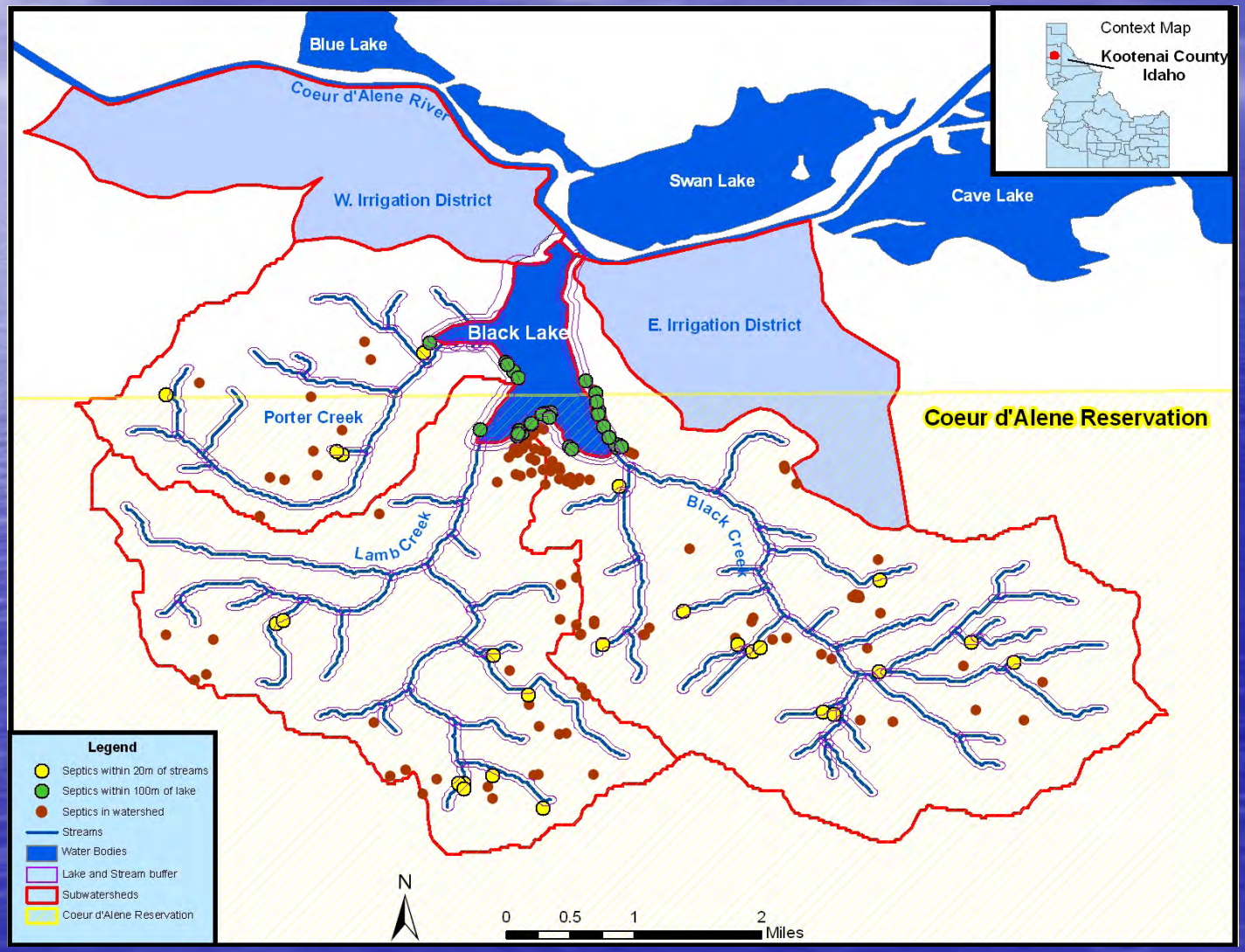
Delivery of Organic Matter from Nearshore Areas

Atmospheric Deposition

Lake Bottom Sediments

Note: Coeur d' Alene Reservation Boundary is too far south on the map

Septic System Inventory
CDA Tribe



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Septic Systems by Subwatershed Near Black Lake Shoreline

Waterbody	Number of Septic Tanks	Estimated Population Served[a]	Effluent Flow (L/day)[b]	Estimated Phosphorous Load (mg/day)[c]
Blake Lake	92	368	55,200	828,000
Lamb Creek	59	236	35,400	531,000
Porter Creek	19	76	11,400	171,000
Black Lake Nearshore within 100 meters	34	136	20,400	306,000

[a] Assumed 4 people/home
[b] Assumed system effluent flow 150 L/person/day (Woods 1991)
[c] Assumed Total Phosphorous concentration in effluent 15 mg/L (Woods 1991)

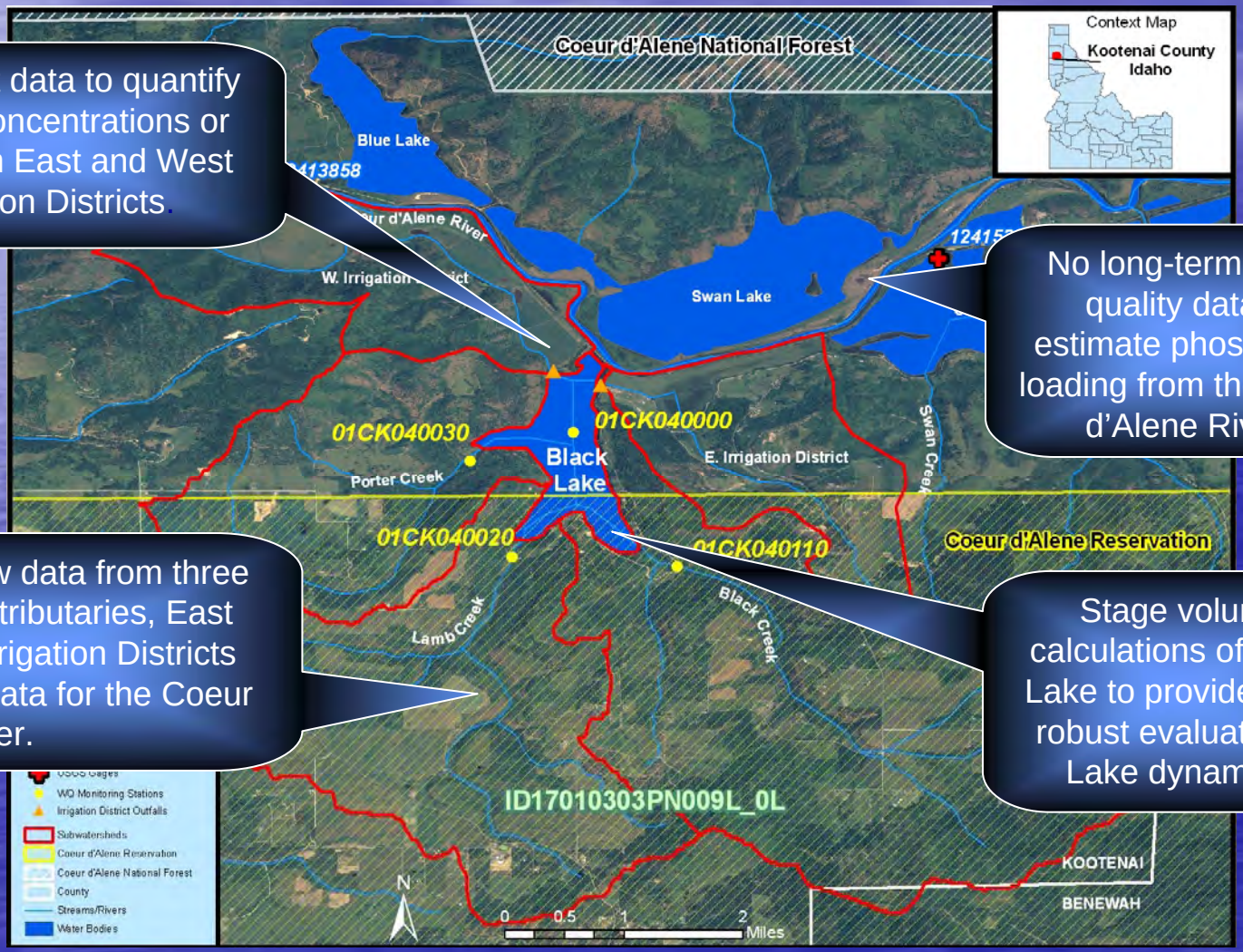
Data Gaps

Insufficient data to quantify nutrient concentrations or loads from East and West Irrigation Districts.

No long-term water quality data to estimate phosphorus loading from the Coeur d'Alene River.

Monthly flow data from three Black Lake tributaries, East and West Irrigation Districts and stage data for the Coeur d'Alene River.

Stage volume calculations of Black Lake to provide more robust evaluation of Lake dynamics.



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347 acre lake; Elevation: 2,123'; Avg. Depth: 14'

Goal Setting

- Tribal goal - Oligotrophic
- State goal - Mesotrophic

Oligotrophic	Mesotrophic	Eutrophic
2-10 µg/L	10-28 µg/L	>28 µg/L

- Setting a numeric goal for a narrative based impairment
- Used paleolimnology, USEPA ecoregion criteria, and IDEQ lake studies to select 20 µg/L as the water quality goal.
  - It is assumed that reduction s in TP to meet this water quality target will reverse the trend of eutrophication and diminish the conditions that cause algal blooms in Black Lake.
- Ultimate goal is to support beneficial uses.

Pollutant Load Allocations

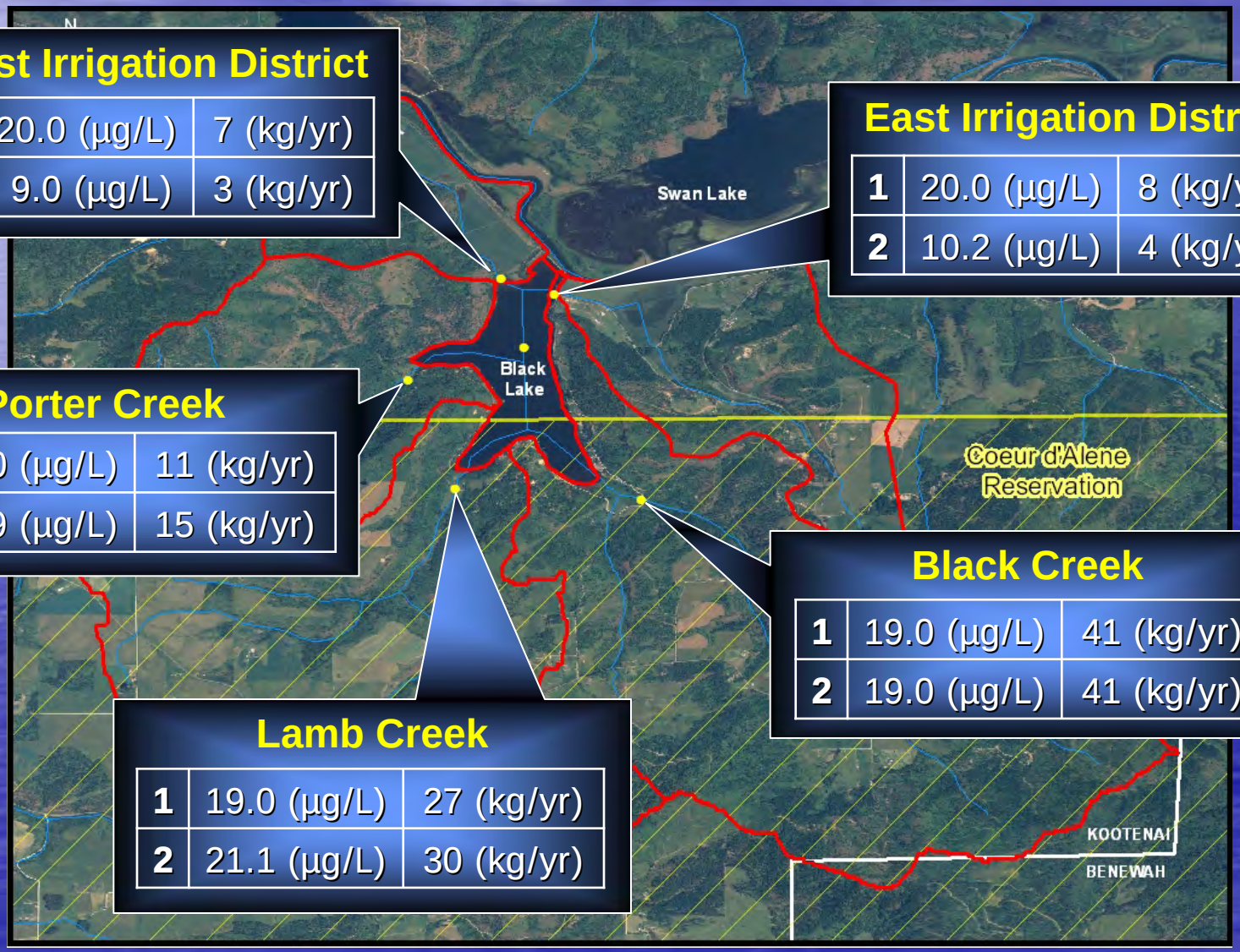
Inputs for Steady-state BATHTUB model:

- Lamb Creek - GWLF
- Black Creek - GWLF
- Porter Creek - GWLF
- West Irrigation District - GWLF
- East Irrigation District - GWLF
- Coeur d'Alene River – Direct input
- Septic Systems around Black Lake – Direct inputs
- Atmospheric Deposition – Default Value

TMDL Allocations

Source	Avg Annual Flow (million m^3/yr)	Existing Condition		Option 1 BATHTUB: Average Annual Allocation			Option 2: Average Annual Allocation		
		Concentration (ug/L)	Load (kg/yr)	Allocated Concentration (ug/L)	Allocated Load (kg/yr)	% Load Reduction	Allocated Concentration (ug/L)	Allocated Load (kg/yr)	% Load Reduction
Lamb Creek	1.41	105.4	149	19.0	27	82%	21.1	30	80%
Black Creek	2.14	93.3	199	19.0	41	80%	19.0	41	80%
Porter Creek	0.60	125.5	76	19.0	11	85%	24.9	15	80%
West Irrigation District	0.35	45.1	16	20.0	7	56%	9.0	3	80%
East Irrigation District	0.39	51.3	20	20.0	8	61%	10.2	4	80%
Coeur d'Alene River	3.92	21.0	82	21.0	82	0%	21.0	82	0%
Septic Systems	0.003	11700	39	11700**	6	85%	2480.4	8	79%
Atmospheric Deposition	-	39.5*	37	39.5	37	0%		37	0%
	Existing Load		617	Load Capacity	219		Load Capacity	220	
	Overall Reduction Needed		64%						

Allocating Nonpoint Source Loads: Option 1 & 2



West Irrigation District

1	20.0 (µg/L)	7 (kg/yr)
2	9.0 (µg/L)	3 (kg/yr)

East Irrigation District

1	20.0 (µg/L)	8 (kg/yr)
2	10.2 (µg/L)	4 (kg/yr)

Porter Creek

1	19.0 (µg/L)	11 (kg/yr)
2	24.9 (µg/L)	15 (kg/yr)

Black Creek

1	19.0 (µg/L)	41 (kg/yr)
2	19.0 (µg/L)	41 (kg/yr)

Lamb Creek

1	19.0 (µg/L)	27 (kg/yr)
2	21.1 (µg/L)	30 (kg/yr)

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Uncertainty: TMDL vs. Implementation Monitoring

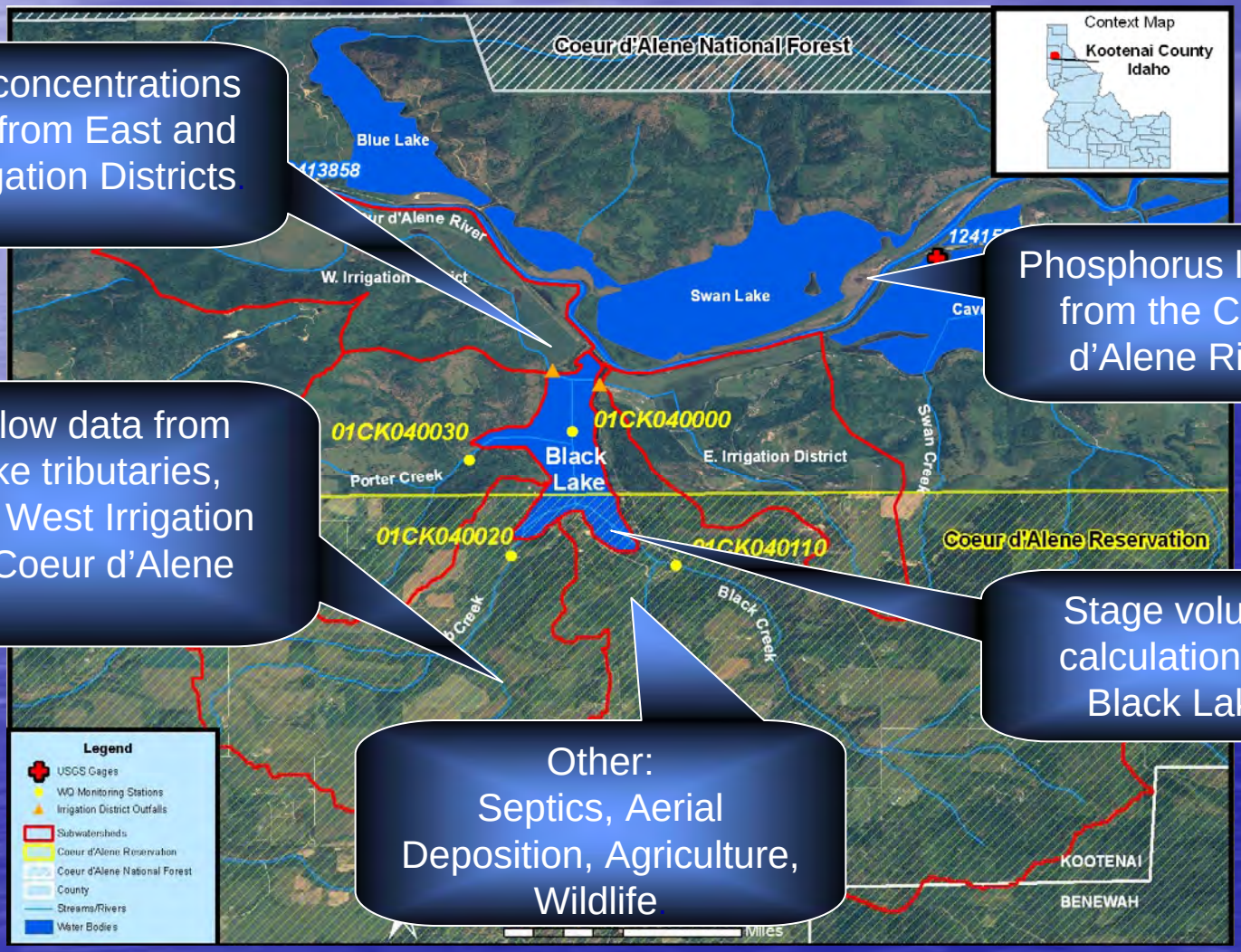
Nutrient concentrations or loads from East and West Irrigation Districts

Phosphorus loading from the Coeur d'Alene River.

Monthly flow data from Black Lake tributaries, East and West Irrigation Districts Coeur d'Alene River.

Stage volume calculations of Black Lake

Other:
Septics, Aerial Deposition, Agriculture, Wildlife



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