Work Plan for the Assessment of Water Quality and Biological Communities in the Lower Boise River and Selected Tributaries, Ada and Canyon Counties, Idaho Federal Fiscal Year 2015

BACKGROUND

Agricultural land and water uses, treated wastewater discharges, land development, road construction, urban runoff, animal feeding operations (AFOs), reservoir operations, and river channelization affect water quality and biotic integrity of the Boise River. Between Lucky Peak Dam (at river mile 64) and Eagle Island (at river mile 42) the river is impacted primarily by surrounding urban communities. Between Eagle Island and the confluence with the Snake River it is affected primarily by irrigation diversions and return flows, AFOs, and other small municipalities. The land- and water-use activities affect stream flow and water temperatures in the river, and increase loadings of nutrients, sediment, and bacteria. As population continues to grow in the lower Boise River Basin, large tracts of agricultural land are being converted to residential or industrial uses, the types of pollutants entering the river are likely to change, and the demand for high-quality water resources increases.

Since 1994 the United States Geological Survey (USGS) has monitored water quality and biological communities in the Boise River in cooperation with the Idaho Department of Environmental Quality (IDEQ) and the Lower Boise Watershed Council (LBWC). Early efforts were designed to assess ongoing status and trends in river quality, including the monitoring of water quality and biological communities on the Boise River and synoptic studies to identify the tributaries contributing the most significant loads of selected constituents to the river. The program evolved over the years to accommodate data needs to formulate total maximum daily loads (TMDLs) in the Lower Boise basin. Included were several short-term studies to evaluate continuous water temperatures; nutrient loads contributed by groundwater, nutrient and sediment loads discharged to the Snake River, resident fish communities, cost-effective methods to monitor nutrients and sediment more frequently, and potential applications of isotopic tracers for understanding nutrient sources and cycling.

Efforts are now underway to track trends in stream quality that might result from management of water resources and implementation of best management practices. These efforts require an emphasis on long-term monitoring on the Boise River for ongoing trend detection. The objectives and approach for this work plan have been devised in conjunction with the Technical Advisory Committee (TAC) of the LBWC to cost-effectively meet the evolving needs of basin resource managers.

OBJECTIVES

The current program is designed to help determine:

- Status and trends of stream water quality in the Boise River near Parma;
- Variability in sediment phosphorus concentrations and loads in the Boise River near Parma during short-duration events; and
- Variability in periphyton growth in the Boise River across different seasons.

APPROACH

Boise River Work

Data collection and interpretation in WY2015 will focus on maintaining and evaluating the long-term water-quality dataset at the Boise River near Parma in support of ongoing total phosphorus (TP) TMDL development. Monitoring results from the Boise River near Parma incorporate contributions and impacts from nearly all basin activities and represent the quality of Boise River discharging to the Snake River. The USGS measures continuous streamflow near Parma as funded by the USGS National Streamflow Information Program (NSIP). The streamflow gage provides information necessary to estimate and compute constituent load contributions to the Snake River.

Monitoring activities in WY15 will include sample collection and continuous monitoring of water-quality parameters at the gage near Parma. Periphyton samples will be collected and analyzed for chlorophyll-a, pheophytin-a, and biomass at three sites along the lower Boise River including the Boise River at Glenwood Bridge, the Boise River near Middleton, and the Boise River near the mouth (do we want to include Eckert Rd or Caldwell?).

In addition to collecting at least 6 water-quality samples and 9 periphyton samples during WY15, a continuous water-quality monitor will be operated at the stream gage near Parma. The continuous monitor will collect temperature, specific conductance, dissolved oxygen, and turbidity every 15 minutes and results will be updated in real time on the stream gage web page.

A previously-published statistical regression model provides the ability to estimate TP and suspended sediment in real time at Parma given continuously monitored turbidity and specific conductance (Wood and Etheridge, 2011). Event-based sample collection efforts will be used to verify and/or calibrate model estimates of TP and suspended sediment. Real-time estimates of TP and suspended sediment will be provided on line and can be used to evaluate TP and suspended sediment loading and concentrations on time scales consistent with storm events, diurnal variation, and anomalous fluctuations in stream pollutants.

During WY2014, a statistical model was used to evaluate trends in TP concentrations and loads in the Boise River near Parma using over 500 historical samples collected since the 1970s. The model employs ***W***eighted ***R***egressions of concentrations on ***T***ime, ***D***ischarge, and ***S***eason and is known as WRTDS (Hirsch and others, 2010). WRTDS is designed as a diagnostic tool useful in evaluating trends in concentrations and loads that may result from changes in the watershed related to point sources, groundwater sources, and surface-water nonpoint sources. WRTDS model results will be presented to the IDEQ and the lower Boise Watershed Council during the winter of 2014-2015.

Analytes, modeling, data presentation efforts, and quality-control sampling are outlined in the table below. All analytes will be analyzed by the USGS National Water Quality Lab (NWQL) with the exception of suspended sediment, periphyton, and *E. coli*, which will be analyzed at the USGS Cascade Volcano Observatory (CVO) sediment lab, the Bureau of Reclamation Soil and Water Lab, and the Idaho State Health Department Lab, respectively.

During FY15 the proposed scope of Boise River monitoring consists of the following components:

TASK	TIME-FRAME	NO. SITES	NO. SAMPLES	DATA TO BE COLLECTED
Water Quality sampling in the Boise River near Parma	6x / year	1	6	*E. coli*, suspended sediment, total phosphorus, total nitrogen, ammonia, nitrate+nitrite, orthophosphate, and total suspended solids.
Quality Assurance Samples	To be determined	1	1 split replicate 1 field blank	*E. coli*, suspended sediment, total phosphorus, total nitrogen, ammonia, nitrate+nitrite, orthophosphate. Blank samples will not be analyzed for suspended sediment or total suspended solids.
Periphyton Sampling	To be determined	3	9	Stream velocity; average depth; water temperature, pH, specific conductance, dissolved oxygen, and turbidity; light intensity; periphyton chl-a, pheophytin-a, and biomass.
Continuous water quality monitoring	Every 15 minutes	1		Continuous turbidity, temperature, specific conductance, and dissolved oxygen.
Continuous Estimated Total Phosphorus and Suspended Sediment	Every 15 minutes	1		Data will be published on line and updated hourly. Website will also provide access to statistical analysis, model information, and related reports.
Weighted Regression Model Results Presentation	By December 31, 2014	1		Present WRTDS findings to LBWC, TAC, and at 2015 Water Quality conference.

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PRODUCTS

During WY2015, USGS will provide updates on information collected during previous water years in presentations to the LBWC, and various technical advisory committees. USGS will also maintain an agency web presence for ongoing project information in addition to publishing real-time water-quality parameters and estimated values of total phosphorus and suspended sediment on the USGS national real-time water-quality page (http://nrtwq.usgs.gov/id/).

BUDGET AGREEMENT

The estimated cost to cover the tasks outlined in this work plan for WY2015 is $81,400. Of this total, the USGS will provide $32,560 and the IDEQ/Lower Boise Watershed Council will provide $48,840. Because the tasks may change significantly for WY2016, a budget has not been prepared beyond WY2015. The USGS plans to provide matching funds in 2015 and in the future equaling 40% of the total annual cost. The availability of 40% matching funds from USGS is uncertain beyond 2015.

A multi-year agreement has been approved through FY17 to provide flexibility in managing the budget, to accommodate collection of data based on hydrologic variability, and to manage reports through the review process. Benefits to a multi-year agreement include:

- Unspent funds from the previous year can be used in subsequent years.
- Funding can be added each year without a new agreement. Each year the funding will be determined in accordance with LBWC, IDEQ, and USGS funding availability.

- USGS can plan matching funds and if necessary, de-obligate a portion if the corresponding LBWC share is not completely available.
- The multi-year agreement can be expanded or ended at any time within the agreement timeframe.

FY 15 Budget

Water-Quality Sample Collection and Analysis: $12,300
Continuous Water-Quality Monitor Operation and Maintenance: $29,700
Periphyton sampling: $5,000 (9 samples, 3 sites 3 events)
Project and Data Management: $34,400

Total Budget FY15: $81,400

USGS Match: $32,560
IDEQ / Lower Boise Watershed Council Match: $48,840

REFERENCES

Hirsch, R.M., Moyer, D.L., Archfield, S.A., 2010, Weighted Regressions on Time, Discharge, and Season (WRTDS), with an Application to Chesapeake Bay River Inputs, Journal of the American Water Resources Association, vol. 46, issue 5, pp. 857-880.

Wood, M.S., and Etheridge, A.B., 2011, Water-Quality Conditions near the Confluence of the Snake and Boise Rivers, Canyon County, Idaho. USGS SIR 2011-5217, 70 pp.