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Memorandum

From: Dave Dilks

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Project: SRRTTF

To: SRRTTF

CC:

SUBJECT: **DRAFT: Initial Data Collection Strategy for PCB Comprehensive Plan**

Summary

The Spokane River Regional Toxics Task Force (SRRTTF) is developing a comprehensive plan to reduce toxic pollutants in the Spokane River, and recognizes that additional data will need to be collected to support development of the comprehensive plan. LimnoTech is serving as a technical advisor to the SRRTTF, with a scope of work that includes defining the additional data collection necessary to support development of the comprehensive plan. The purpose of this memorandum is to present an initial data collection strategy, based on feedback received from the Monitoring Objectives memorandum (LimnoTech, 2013b) and findings of the Data Gap Assessment (LimnoTech, 2013c).

This document presents an *initial* data collection strategy, as the SRRTTF is still weighing some key higher level monitoring objectives. The memorandum is designed to provide the broad basis for a monitoring plan that can be refined during additional discussions with the SRRTTF, potentially via a meeting in late fall. The initial data collection strategy consists of two components: 1) Baseline monitoring, and 2) Discretionary special studies. The baseline monitoring will include routine dry weather monitoring of the Spokane River upstream of Lake Spokane to supplement the existing Ecology mass balance assessment and address data gaps related to groundwater and upstream sources of PCBs. The baseline monitoring will also include monitoring in Lake Spokane, the Spokane River downstream of Lake Spokane, and key tributaries to provide data necessary to support water quality modeling efforts. The cost for the baseline monitoring is on the order of $400,000, with the exact amount depending on monitoring frequency. The discretionary special studies are intended to help define true sources and pathways, and include:

- Wet weather sampling in the Spokane River to estimate PCB loads delivered during storm events
- Additional sampling within the Spokane storm water system, designed to better define true sources
- Sampling of PCB concentrations in biota, to supplement pattern tracing efforts and to support a revised assessment of bioaccumulation in the Spokane River and Lake Spokane food chain.
- Research on atmospheric PCB cycling and contribution to watershed.

Overall monitoring costs including special studies could range as high as $1,200,000 depending upon which of the studies are selected for implementation and the level of detail in which they are implemented.

Introduction

The SRRTTF is developing a comprehensive plan to reduce toxic pollutants in the Spokane River, designed to identify specific management actions that can be undertaken to control pollutant loads such that water quality objectives can ultimately be attained. Comprehensive plans of this type typically rely upon mathematical models to describe the relationship between pollutant sources and resulting environmental concentrations. These models require data capable of describing the site-specific processes that drive resulting concentrations. Initial efforts towards developing a monitoring plan to provide these data have been conducted in prior tasks: work has been conducted to begin defining higher level SRRTTF monitoring objectives, as well as to identify key gaps in the existing data set. These efforts are described below, followed by a discussion of outstanding questions related to monitoring plan design.

Monitoring Objectives

LimnoTech (2013b) described the types of management-oriented monitoring objectives that must be defined prior to development of a formal monitoring plan. The monitoring objectives memorandum was originally presented at the July 24th SRRTTF meeting and subsequently discussed further at the September 25th SRRTTF meeting. Consensus was obtained on the following objectives:

- The primary management objectives of this study are to: 1) define the nature and magnitude of existing pollutant loads, 2) define the relationship between loads and resulting environmental concentration, and 3) assess the effectiveness of toxic reduction measures towards reducing pollutant loading and resulting environmental concentrations.
- PCBs are the pollutant of primary concern; dioxins will be addressed as resources allow
- The spatial domain of the system to be considered starts at the Lake Coeur d'Alene outlet and extends to where the Spokane River joins Lake Roosevelt.

Questions were raised at the September 25th SRRTTF meeting regarding whether an additional objective should be added corresponding to conducting a revised assessment of bioaccumulation in the Spokane River and Lake Spokane food chain. This topic is discussed below in the Outstanding Questions section.

Data Gap Assessment

LimnoTech (2013c) reviewed the amount of data available describing the processes controlling PCB concentrations in the Spokane River and Lake Spokane and concluded that the primary data gaps correspond to:

- The magnitude of true sources contributing to stormwater loads.
- The nature PCB sources upstream of the Idaho/Washington border.
- The significance of loading from atmospheric and groundwater sources.

The data gap related to true sources contributing to stormwater loads is especially problematic, as available data indicate that the PCBs are widely distributed and difficult to trace back to their origin. Additional data gaps were also identified related to the significance of PCB fate and transport processes in Lake Spokane such as volatilization and release of historical sediment contamination.

Outstanding Questions

Some key management objectives that affect the monitoring program design remain unresolved, corresponding to:

- Whether the water quality model will be used as an adaptive management tool or a regulatory tool
- The time frame for development of the comprehensive plan, given the uncertainty of true PCB sources
- Whether a revised assessment of bioaccumulation is necessary

Each is discussed separately below, although all three questions are inter-related.

Use of the Water Quality Model as an "Adaptive Management" Tool vs. a Regulatory Tool

Consensus exists that a primary objective of this study is to "assess the effectiveness of toxic reduction measures towards reducing pollutant loading and resulting environmental concentrations." It is less clear that consensus exists regarding the specifics of how the assessment will be conducted. In traditional TMDL applications, the model is used to define specific load reductions and implementation measures necessary to attain compliance with water quality standards. Water quality models can also be used in an "adaptive management" mode, to allow assessment of which best management practices are the most effective in reducing PCB concentrations in the Spokane River. The stated goal of the SRRTTF (SRRTTF.org Home Page) is "to develop a comprehensive plan to bring the Spokane River into compliance with applicable water quality standards for PCBs," which could be interpreted as a regulatory application. Given the uncertainty in true sources discussed below, however, adaptive management is likely the more viable near-term approach.

Schedule for the Comprehensive Plan In Consideration of Uncertainty of Sources

The existing SRRTTF work plan/schedule calls for a single year of monitoring prior to development of the comprehensive plan. The data gap assessment identified the lack of understanding of true PCB sources to stormwater as the most significant data gap. This limited understanding is driven more by the very diffuse nature of observed PCBs than the lack of data, such that an additional one year of term monitoring cannot be expected to definitively define true PCB sources. This finding is not unique for stormwater-driven PCB sites. The San Francisco Bay PCB TMDL process collected several years of stormwater data and was unable to clearly distinguish true sources. The resulting San Francisco Bay PCB TMDL implementation plan (California Regional Water Quality Control Board, 2008) therefore followed an adaptive management approach of requiring an initial level of control to be implemented, with future stormwater controls to be based on ongoing monitoring over a 20 year period.

Given the difficulty in defining true sources, it is not feasible to develop a comprehensive plan to bring the Spokane River into compliance with applicable water quality standards with a one-year monitoring program. The more viable options consist of either: 1) development of an adaptive management-based plan after one year of monitoring, or 2) a more prescriptive plan developed after several years of monitoring.

Need for Revised Assessment of Bioaccumulation

As discussed above, questions have been raised regarding whether an additional management objective should be added to this project corresponding to conducting a revised assessment of

bioaccumulation in the Spokane River and Lake Spokane food chain. It was reported at the September 25 SRRTTF meeting that available data indicate that the default bioaccumulation factor used to translate acceptable fish tissue levels to water column water quality standards is not representative of conditions in Spokane, and that a revised assessment may be necessary to accurately describe the relationship between PCB concentrations in the water column and those observed in fish.

Development of a revised bioaccumulation assessment will require collection of significantly more data than would be necessary if the existing bioaccumulation factor is maintained. Two questions need to be resolved regarding whether the upcoming monitoring needs to collect data specific to a revised bioaccumulation assessment:

- Does the scope of the SRRTTF's mission include revision of how water quality standards are interpreted?
- Even if a revised bioaccumulation assessment is desired, how quickly does the revision need to be conducted? If the initial model application approach is for adaptive management and designed solely to define which best management practices are most effective in reducing ambient pollutant concentrations, the data required for a revised bioaccumulation assessment can be collected in subsequent years if/when a regulatory approach is being considered.

Baseline Monitoring

The core component of the initial strategy consists of two types of baseline monitoring:

1. Routine dry weather monitoring of the Spokane River upstream of Lake Spokane to supplement the mass balance assessment
2. Supplemental downstream and tributary monitoring to provide data necessary to support water quality modeling efforts.

Each component is described below.

Routine Dry Weather Monitoring of the Spokane River Upstream of Lake Spokane

The primary component of the proposed baseline monitoring consists of routine dry weather sampling in the Spokane River upstream of Lake Spokane at the following locations:

- River locations with river flow gaging stations
- NPDES permitted sources
- Hangman Creek mouth

These locations are represented schematically in Figure 1. This aspect of the monitoring is designed to build upon the existing Ecology mass balance assessment (Serdar et al, 2011) and address data gaps related to groundwater and the nature of upstream sources of PCBs. Collection of data specifically at locations where flow gaging data are available will allow all concentration measurements to be converted to mass loads. Knowledge of PCB mass loading at multiple river locations will allow the amount of PCB gained from and/or lost to groundwater between each station to be directly calculated. By extending the monitoring network to cover multiple locations in Idaho, this strategy will also provide necessary understanding of the relative contribution of the different Idaho sources (i.e. Lake Coeur d'Alene, point sources, groundwater). It is recommended

that sampling be conducted 4-6 times during the summer period to reduce the uncertainty in the resulting mass balance assessment caused by variability in sources and instream concentrations.

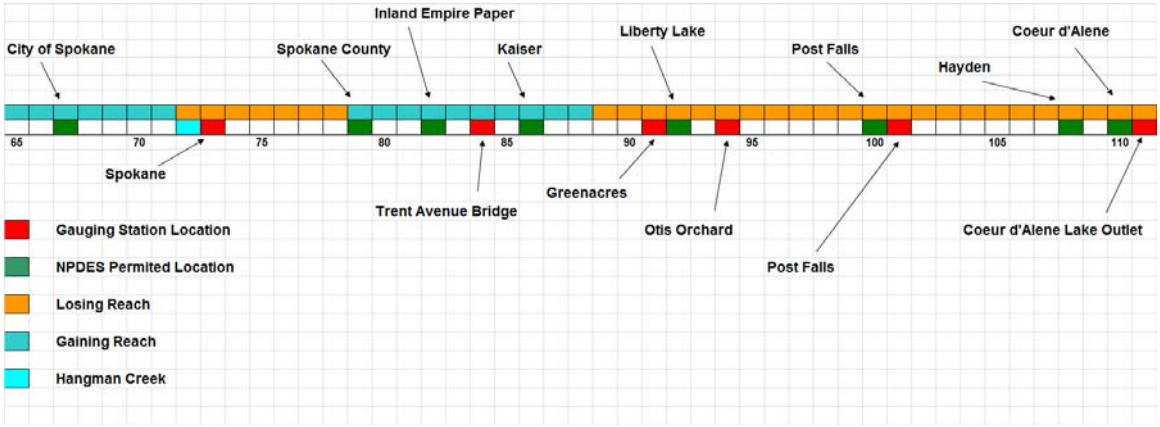

Figure 1. Schematic of Baseline Dry Weather Monitoring Upstream of Lake Spokane

Supplemental Downstream and Tributary Monitoring

The second component of the proposed baseline monitoring consists of PCB monitoring in Lake Spokane, the Spokane River downstream of Lake Spokane, and major tributaries. This aspect is designed to provide data necessary to support water quality modeling efforts. Specific monitoring locations are:

- Four Lake Spokane stations located longitudinally down the length of the lake, with monitoring conducted at multiple depths at each station
- Tributary mouths of the Little Spokane River, Latah Creek, and Hangman Creek
- Spokane River at two locations downstream of Lake Spokane

It is recommended that sampling be conducted four times during the summer period to reduce the uncertainty caused by variability in concentrations. Sampling in the river and lake can be conducted strictly during dry weather. Tributary sampling should include two dry weather periods at the Little Spokane River and Latah Creek (dry weather monitoring of Hangman Creek is covered under the routine dry weather monitoring component) and two wet weather events at all three tributary mouths, to better define nonpoint source loading from these watersheds.

Costs

The overall cost for most PCB monitoring is driven by the cost of laboratory analysis, such that monitoring cost is roughly proportional to the number of samples analyzed. The monitoring frequency recommended for this component was based on balancing the desire to collect enough data to significantly improve our understanding, at a cost consistent with the lower bound of the Phase II monitoring budget estimate of $400,000.

Discretionary Special Studies

The baseline monitoring effort described above is considered the most effective means to fill existing data gaps in the short term at a cost consistent with prior expectations. Several additional

studies have also been identified that would provide additional valuable information, and merit consideration for inclusion in the monitoring program. These consist of:

- Wet weather sampling in the Spokane River to estimate PCB loads delivered during storm events
- Additional sampling within the Spokane storm water system, designed to better define true sources
- Sampling of PCB concentrations in biota, to supplement pattern tracing efforts and to support a revised assessment of bioaccumulation in the Spokane River and Lake Spokane food chain Research on atmospheric cycling and contribution to watershed
- Research on Atmospheric PCB Cycling and Contribution to Watershed

Some of the individual studies are more speculative in nature, and described in less detail than the baseline monitoring activities.

Wet Weather Sampling in the Spokane River

The routine dry weather monitoring program described above is designed to provide an improved understanding of PCB loading from upstream, point sources, and groundwater. It does not provide an increased understanding of the overall stormwater load. Estimation of total stormwater load from direct measurements within the stormwater system has shown to be highly uncertain, due to the variability of observed concentrations and difficulty of measuring stormwater flow. An improved understanding of stormwater load could be gained by extending the routine dry weather monitoring program to include wet weather events. Measurement of wet weather PCB concentrations at river locations with gaging stations will allow stormwater loads to be estimated based upon the observed increase in PCB mass between river stations. Measurement of PCB concentrations in the river should dampen out much of the variability observed in individual stormwater samples, and provide a more accurate estimate of the stormwater loading rate.

Two wet weather sampling events are recommended, to improve the likelihood of obtaining at least one robust sampling event (accounting for logistical issues that commonly occur in conducting wet weather sampling events.)

Additional Sampling within the Spokane Storm Water System

The Source Investigation monitoring conducted to date by the Urban Waters Initiative (Fernandez, 2012) provides an excellent data base to begin understanding the distribution of PCB sources to the Spokane River system. These data show the PCBs in stormwater originate from a wide number of diffuse sources, and that much more data will be needed to better identify true sources. For this reason, we recommend coordinating with the Urban Waters Initiative (and other parties, as appropriate) to develop a plan for additional stormwater monitoring. Development of this monitoring plan may benefit from the application of advanced pattern recognition techniques on the already collected data prior to additional field data collection.

Sampling of PCB Concentrations in Biota

All of the monitoring activities discussed above have focused on measurement of PCB in the water column. There are two potential benefits for also measuring PCB concentrations in the biota (i.e. fish, macroinvertebrates):

- These data will be necessary to support a revised bioaccumulation assessment, if/when one is required.
- PCB data from biota in the Spokane River near Spokane can assist in identification of true sources via pattern assessment, as biotic concentrations represent an integrated exposure to sources over time. The presence of dams in this portion of the river makes the fish data more valuable for supporting source assessment than in other systems, as the migration of fish over long stretches of river (allowing exposure to different sources) is much less of an issue here than other systems.

Research on Atmospheric PCB Cycling and Contribution to Watershed

The significance of atmospheric PCB loading to the watershed, and whether this loading originates from local or global sources, is a key unknown in the PCB assessment. Experience has shown that this contribution is not easily quantified. Era-Miller (2011) conducted a literature review of atmospheric PCB deposition rates for sites around the world and reported deposition rates that varied by several orders of magnitude between sties. TMDLs that have considered atmospheric sources have typically only explicitly focused on the direct exchange between the atmosphere and surface waters, and have not quantified atmospheric PCB contributions to the watershed itself (e.g. California Regional Water Quality Control Board, 2008; LimnoTech, 2011; LimnoTech, 2013a). For this reason, we believe that quantification of atmospheric PCB loading is best assessed as part of a separate research effort and not included as a specific near-term monitoring component.

Costs

Similar to the baseline monitoring, the overall cost for these studies is driven by the number of samples analyzed. All of the special studies can be conducted to some degree within the upper bound of the Phase II monitoring budget estimate of $1,200,000.

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