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Spokane County Department of Utilities
1026 West Broadway Avenue
Spokane, Washington 99260-0430

Attention: Ben Brattebo
Water Resources Specialist

Subject: Ranked Data Collection Alternatives
Subtask 6.1 of Phase 2
Bi-State Nonpoint Source Phosphorus Study
File No. 0188-135-01

INTRODUCTION

Subtask 6.1 of Phase 2 of the Bi-State Nonpoint Source Phosphorus Study (NPS Study) consists of a limited field investigation designed to fill one or more high priority data gaps. In our draft Quality Assurance Project Plan (QAPP) dated January 2010, the GeoEngineers/HDR consultant team presented a total of 26 field data collection alternatives for review by Spokane County and the Nonpoint Advisory Committee (NPAC). In Table 3 of the draft QAPP, we presented a preliminary prioritization of those data collection alternatives with respect to utilization of project and future funding. A number of comments were received from the NPAC with respect to these data collection alternatives and associated prioritization. These comments, as well as their interpreted impact to the alternative prioritization, have been compiled in the attached Table 1.

Based on the original alternative prioritization, our subsequent field reconnaissance, and NPAC comments, the top-ranked data collection alternatives are identified in the attached Table 2 and described in more detail below. The top-ranked alternative was given a ranking of 1. Note that data collection alternatives within the Hangman Creek subbasin, which previously had been assigned high priorities, now have relatively low priorities based on the data and studies recently provided by the NPAC.

A general scope of service and preliminary cost estimate is provided below for each top-ranked alternative. These are intended to provide a basis for Spokane County to select which alternatives will be funded under existing resources. Additional detail will be added to the scope and the cost estimate refined for the selected alternatives during development of final QAPP(s).

ASSUMPTIONS

General

The cost estimates presented herein are based on the following general assumptions.

- All monitoring will be performed during the period from March (pending QAPP approval) through June 2010.
- The locations and timing of surface water and groundwater monitoring will be selected to support analyses that will be performed as a component of Subtask 6.2 of the NPS Study.

Groundwater

The scope for each groundwater data collection alternative described herein is assumed to contain the following elements:

- A survey will be conducted of the surface and top of casing elevations of each well in the monitoring well network.
- Slug tests will be performed in selected wells to estimate aquifer hydraulic conductivity.
- Each groundwater monitoring event will consist of the following:
  - Measure groundwater elevations relative to the top of casing in each well.
  - Collect groundwater samples from each well using existing sampling ports or by standard low-flow sampling techniques for analysis of total phosphorus and soluble reactive phosphorus concentrations.
- Draft and final groundwater Technical Memoranda summarizing data collection methods and results will be prepared.

We anticipate that collected groundwater data will be used during execution of Subtask 6.2 to estimate the following for the target aquifer(s):

- Groundwater flow direction, velocity, and contaminant travel time.
- Groundwater volume (flux) within unconsolidated aquifers and groundwater discharge volumes and rates to area surface water.
- Background phosphorus concentrations in groundwater.
- Impact to groundwater phosphorus concentrations caused by adjacent septic systems and other anthropogenic nonpoint sources
- Phosphorus loading to area surface water.
- Potential phosphorus loading reduction achievable through septic tank elimination.

Surface Water

The scope for each surface data collection alternative described herein is based on the following assumptions:

- Two staff will be required to efficiently and safely collect field data and samples.

- Staff can collect samples from six locations per day.
  - § Measure stream flow (to be able to do load calculations) likely using a Marsh-McBirney flow meter.
  - § Samples will be composite samples for most streams (grab samples will be used for bank seeps, springs, and other low flows) collected using standard protocols.
  - § The Washington Department of Ecology ambient monitoring program collects their nutrient samples with a single grab sample; typically from the thalweg of the water body cross-section. Much of the historical data in the Spokane basin has been collected in this fashion. This protocol may not collect a sample that is always representative of the water moving through the "cross-section" of a given sampling point. For example, a sampling location may have an upstream tributary or discharge that has not completely mixed with the rest of the receiving waterbody.

    Flow-integrated sampling is used to collect a composite water sample in a stream cross-section such that the pollutants in the sample are in proportion to water flow in the cross-section. A flow-integrated sampling technique employed by USGS is known as the equal width increment/equal transit rate (EWI) method (Edwards and Glysson, 1988; Ward and Harr, 1990). In this method a sampler that allows water to enter without changing its velocity relative to the stream is lowered and raised at a uniform transit rate through equally-spaced verticals in the stream cross-section. Samples are collected by wading with hand-held samplers.

    Based on comments from the NPAC and since the plan is to measure flow as well at all sites, we recommend collecting a composite water quality sample at each flowing stream site (grab samples will be collected at bank seeps, springs, and other low flows). The additional expense is minimal and will remove a potential criticism of the monitoring.
- Samples will be analyzed for total phosphorus, soluble reactive phosphorus, total suspended solids, and total dissolved solids by Aquatic Research, Inc.
- Draft and final surface water Technical Memoranda summarizing data collection methods and results will be prepared.

We anticipate that collected surface water data will be used during execution of Subtask 6.2 to estimate the following:

- Surface water loads.
- Spatial and temporal variation analysis.

TOP-RANKED DATA COLLECTION ALTERNATIVES

General

For each top-ranked data collection alternative, our cost estimates assume that the following groundwater and surface water-based tasks will be performed in addition to those listed above under *Assumptions*.

1. Alternative 2.11. Eaglewood

Additional Groundwater Tasks

- Review existing information regarding the geometry and hydraulic characteristics of shallow unconsolidated aquifers underlying Eaglewood, the interaction of those aquifers with Little Deep Creek and Deadman Creek, and previously-performed septic density analyses.
- Develop a network of existing, accessible monitoring and water supply wells in those target aquifers. Redevelop wells as necessary.
- Perform one to two groundwater monitoring events (a network consisting of 10 wells is assumed).

Additional Surface Water Tasks

- Develop detailed watershed maps of the area and identify runoff patterns.
- Identify surface water monitoring locations in the Eaglewood with a focus on isolating a variety of nonpoint sources and land uses such as developed, rural (on septic systems), transitional, and agriculture. Perform additional reconnaissance, garner NPAC input, and/or other to verify accessible and reasonable sample site(s).
- Perform 6 to 8 surface water monitoring events (12 to 16 locations).

TABLE 3. PRELIMINARY COST ESTIMATE – ALTERNATIVE 2.11

Total Estimated Monitoring Program Cost		**$65,000 to $105,000**
Groundwater		
Locations	**Sampling Trips**	**Cost**
8 to 10	1	$20,000 to $30,000
Surface Water		
Locations	**Sampling Trips**	**Cost**
12 to 16	6 to 8	$45,000 to $75,000

2. Alternative 2.17. Deep Creek

Additional Groundwater Tasks

- Review existing information regarding the geometry and hydraulic characteristics of shallow unconsolidated aquifers in the area, the interaction of those aquifers with Deep Creek, and the potential interconnectivity with Long Lake.
- Develop a network of existing, accessible monitoring and water supply wells. Redevelop wells as necessary.
- Perform one to two groundwater monitoring events (a network consisting of 6 wells is assumed).

Additional Surface Water Tasks

- Identify surface water monitoring locations for the Deep Creek watershed. Perform additional reconnaissance, garner NPAC input, and/or other to verify accessible and reasonable sample site(s).

- Review existing information such as discharges (i.e., Medical Lake), flow patterns and rates, within the Deep Creek watershed.
- Perform 4 to 6 surface water monitoring events (4 to 8 locations).

TABLE 4. PRELIMINARY COST ESTIMATE – ALTERNATIVE 2.17

Total Estimated Monitoring Program Cost		**$35,000 to $62,500**
Groundwater		
Locations	**Sampling Trips**	**Cost**
8 to 10	1	$18,000 to $28,000
Surface Water		
Locations	**Sampling Trips**	**Cost**
4 to 8	1 to 3	$15,000 to $32,500

3. Alternative 2.10. Lake Spokane Nearshore Unconsolidated Aquifers

Additional Groundwater Tasks

- Coordinate with Stevens County Conservation District and Stevens Public Utility District to avoid duplication of effort.
- Review existing information regarding the geometry and hydraulic characteristics of nearshore unconsolidated aquifers adjacent to Lake Spokane, the interaction of those aquifers with Lake Spokane, and previously-performed septic density analyses.
- Develop a network of existing, accessible monitoring and water supply wells in proximity to Lake Spokane. Redevelop wells as necessary.
- Perform one to two groundwater monitoring events (a network consisting of 10 wells is assumed).

Additional Surface Water Tasks

- Identify surface water monitoring locations in the nearshore to support the groundwater monitoring, such as bank seeps. Perform additional reconnaissance, garner NPAC input, and/or other to verify accessible and reasonable sample site(s). Potential appropriate surface water monitoring locations may not exist.
- Perform 1 to 3 surface water monitoring events (4 to 8 locations).

TABLE 5. PRELIMINARY COST ESTIMATE – ALTERNATIVE 2.10

Total Estimated Monitoring Program Cost		**$20,000 to $37,500**
Groundwater		
Locations	**Sampling Trips**	**Cost**
8 to 10	1	$20,000 to $30,000
Surface Water		
Locations	**Sampling Trips**	**Cost**
0 to 8	0 to 3	$0,000 to $17,500

4. Alternative 2.13. Cheney Metro

Additional Groundwater Tasks

- Review existing information regarding the geometry and hydraulic characteristics of shallow unconsolidated aquifers in the area, the interaction of those aquifers with surface water, and surface seeps to Hangman Creek.
- Develop a network of existing, accessible monitoring and water supply wells include near Cheney. Redevelop wells as necessary.
- Perform one groundwater monitoring events (a network consisting of 6 wells is assumed).

Additional Surface Water Tasks

- Review existing information and examine hydrology of the area.
- Identify surface water monitoring locations for the Cheney area and coordinate with groundwater monitoring locations. Sampling will include seeps and springs identified by the SCCD. Perform additional reconnaissance, garner NPAC input, and/or other to verify accessible and reasonable sample site(s).
- Review existing information regarding wastewater discharges within the Cheney area.
- Perform 4 to 6 surface water monitoring events (4 to 8 locations).

TABLE 6. PRELIMINARY COST ESTIMATE – ALTERNATIVE 2.13

Total Estimated Monitoring Program Cost		**$65,000 to $105,000**
Groundwater		
Locations	**Sampling Trips**	**Cost**
8 to 10	1	$18,000 to $28,000
Surface Water		
Locations	**Sampling Trips**	**Cost**
12 to 16	6 to 8	$45,000 to $75,000

DATA COLLECTION ALTERNATIVES BUDGET

Cost estimates for individual data collection alternatives range from $20,000 to $105,000. The total cost required to complete all four alternatives is estimated to be $185,000 to $310,000, significantly more than project resources. These cost estimates are based on our recommendations regarding the optimum scope appropriate for each alternative given project schedule and analytical requirements. However, please note that, for each alternative, scope could potentially be modified to better accommodate project budget constraints. We'd be happy to discuss these options (and associated impact to the data set) with you if appropriate.

Please contact us if you have any questions about the contents of this letter.

Sincerely,
GeoEngineers, Inc.

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Senior Hydrogeologist

Bruce D. Williams
Principal

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List of Tables

Table 1

Compilation of NPAC Comments Related to Data Collection Alternatives

Bi-State Nonpoint Source Phosphorus Study

Spokane River Watershed Field Data Collection

Person	Firm/Agency	Comment Date	Alternative	Comment	Interpreted Impact to Alternative Prioritization	Additional Considerations/Alternatives to Sampling for Filling Data Gaps
Joy, Joe	Department of Ecology	02/04/10	2.1	Agricultural Impacts: Streams and primary tributaries in the Mt. Hope area are very difficult to access, both to the Rock Creek and Hangman Creek flow paths. Upper Rattler Run or Cove Creek might be more accessible for Palouse type agricultural practices. I've been told upper Little Deep Creek and Peone Creek might be candidates in the LSR basin. Jon Jones says some agricultural practices in Deep Creek/Coulee Creek might be worth evaluating. Also, it should be understood that soil types, slopes, crops, crop rotations, and practices vary greatly through the basin and one set of samples would not necessarily translate to agricultural areas in adjoining drainages less than 5 miles away.	2.1 sampling priority less important. 2.17 sampling priority more important.	Collecting data in Long Lake subbasin, Deep Creek watershed may be valuable.
Joy, Joe	Department of Ecology	02/04/10	2.11	Eaglewood, etc.: This seems like a groundwater study, not a high-flow event study. The time of year is inappropriate unless surface water is being the focus of monitoring.	Maintain 2.11 sampling priority	Collecting synoptic groundwater and surface water may be useful. Spokane County may have some data/reports available for insights.
Joy, Joe	Department of Ecology	02/04/10	2.12	Rural Community Point and NPS Impacts: Same trouble as Stormwater-Centric idea, i.e. the streambank and agricultural/range land uses upstream and downstream will mask any contribution of stormwater from these towns. The 'higher concentrations of phosphorus' mentioned are probably low-flow rather than storm event conditions. I would encourage the consultants to check this before going much further.	2.12 sampling priority less important	Check database values. Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Joy, Joe	Department of Ecology	02/04/10	2.13	Cheney Metro: My impression is that not much reaches surface water directly in the Cheney area. It's caught in wetlands and ponds or sent to groundwater. I can't say for sure, but that's been my impression from talking to others and briefly driving through the area.	Maintain 2.13 sampling priority	Conflicting impressions on Cheney area. May warrant further examination.
Joy, Joe	Department of Ecology	02/04/10	2.15	Lower Hangman Rural to Urban: I think unless some streambank erosion assessment is done, identifying individual sources from Valley Chapel Road to Hatch Road or within the urban setting downstream will be difficult during high-flow events. Golf course impacts may not be observable until streamflows drop and if greens are treated. Otherwise, I think additional SRP/TP and nitrogen data are needed in the area.	2.15 sampling priority less important	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Joy, Joe	Department of Ecology	02/04/10	2.16	Subbasin Permitted and Non-Permitted Point Sources: I thought ERO-WQ had all of these monitoring TP now. I don't think HDR would have data ready for fall 2010. Not sure what 'non-permitted point sources' are.	2.16 sampling priority less important	Project team has contacted EPA on non-permitted sources.
Joy, Joe	Department of Ecology	02/04/10	2.17	Deep Creek/Coulee Creek: Not my problem…yet, but no one seems to know too much about the sources and nutrient characteristics these creeks. Might be worth a baseline survey.	2.17 samping priority more important.	Collecting data in Long Lake subbasin, Deep Creek watershed may be valuable.
Joy, Joe	Department of Ecology	02/04/10	2.18	Watershed Boundaries: Is there a chosen model yet? I wouldn't do this until you have one.	Maintain 2.18 at lowest sampling priority	Insufficient schedule to select analysis method(s) and data gaps to fill.
Joy, Joe	Department of Ecology	02/04/10	2.19	Sediment Sampling: Not sure if they are speaking of soils or bed sediments. I don't see that it's any more 'difficult…and expensive' than anything else. I think the preliminary work SCCD did on soils, streambank, and bed sediments in parts of the Hangman watershed was instructive.	Maintain 2.19 sampling priority	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Joy, Joe	Department of Ecology	02/04/10	2.2	Hangman Creek BMP Study and Conservation Tillage: It's been awhile since I looked at this 1995 – 1999 study, but I seem to remember there were several problems with the monitoring locations, BMP study design, and analytical data. Also, a lot would depend on current situation at the sites. It could be that O & M has fallen off or the owners are growing something else. Rick Noll should know more about the past and present conditions. He also may have some alternative sites where conservation and conventional practices are being used or switching. Again, it will be very specific to crops, soils, and slopes – not universally transferable.	2.2 sampling priority less important	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Joy, Joe	Department of Ecology	02/04/10	2.3	Forest Land Use Impacts: Hasn't the CdA Tribe looked at this in various watersheds on the reservation? Seems like they would have some sites established where data could be enhanced. March – April access could be a problem if snows are present.	2.3 sampling priority less important	Contact Coeur d'Alene for potentially supplemental data.

Person	Firm/Agency	Comment Date	Alternative	Comment	Interpreted Impact to Alternative Prioritization	Additional Considerations/Alternatives to Sampling for Filling Data Gaps
Joy, Joe	Department of Ecology	02/04/10	2.4	Background/Natural Conditions: Yeah, we've tried this…not very feasible because of the variability in ecoregional characteristics. The description of 'background/natural' here is very simplistic and ignores the fact that background concentrations in the Northern Rockies or Okanogan Highlands are not going to represent 'background' in a natural Palouse or Spokane Valley Outwash environment. Unfortunately, finding 'natural' and 'background' sites in the lowlands, or even in some of the upland areas, is nearly impossible. It's why we went to 'best potential/full protection' definition of background. It would be helpful if the committee could identify sites that are 'best potential' candidates to monitor – sort of related to the BMP/Conservation Tillage, but even broader to include streambank and urban/suburban BMPs.	Data may not be attainable. Maintain 2.4 at lowest sampling priority	
Joy, Joe	Department of Ecology	02/04/10	2.5	Ambient Conditions: I foresee arguments in the future about total phosphorus vs. soluble or available phosphorus – even in NPS source assessment. We really don't have total vs. soluble data at many places in the tributaries, especially as it relates to suspended sediment concentrations. All of the most recent studies left soluble analysis out due to funding resource limits. It would be good to start building data up in the tributary watersheds to address the issue.	Maintain 2.5 at lowest sampling priority for NPS Study but recognize importance for Implementation Plan	Supplemental TP and OP complimentary analysis of database values may provide some insights. Not part of "what" and "where" of Reduction Plan, but important element of continued monitoring and funding mechanisms for Implementation Plan.
Joy, Joe	Department of Ecology	02/04/10	2.7	Pollutographs: These could be instructive, especially if the committee is still suspicious of Ecology's method of monthly/seasonal loading calculations for the tributaries. The load changes from baseflow to event and back with associated loading calculations should address how seasonal loads should be monitored and targeted. It would be important to catch true baseflow before and after the event to gain a clear picture of the differences. The timing will be different at various sites – LSR hydrograph/runoff patterns are much different than Hangman Creek's. Every 6 hours may be short an interval in the former, but too long in the latter.	2.7 sampling priority more important.	May or may not fill data gaps. Maintain as a high priority for recommended continued monitoring as part of Implementation Plan.
Joy, Joe	Department of Ecology	02/04/10	2.8	Stormwater-Centric: I doubt much will come out of this for the small towns named for Hangman & LSR. In my opinion, the streambank and agricultural/range land uses upstream and downstream will mask any contribution of stormwater from these towns. But, I guess we won't know for sure until we test it. It might be more productive to look at stormwater releases to tributaries to LSR and Hangman from MS4 Phase I & II areas closer to the City of Spokane.	2.8 sampling priority more important.	May or may not fill data gaps. Maintain as a high priority for recommended continued monitoring as part of Implementation Plan. Existing MS4 data may reveal some insights.
Joy, Joe	Department of Ecology	02/04/10	2.9	BMP-Centric: This is what I suggested in Hangman Creek BMP and Background/Natural sections above.	Maintain 2.9 at a moderately high priority.	May or may not fill data gaps. Existing stormwater/MS4 data may reveal some insights.
Joy, Joe	Department of Ecology	02/04/10	General	The biggest gap I see missing from the list is the relationship between streambank erosion –> sediment -> phosphorus -> biologically available phosphorus. Or, even the last three phases, i.e. sediment to biologically available phosphorus.	None	Ecology and SCCD provided additional supplemental data for Hangman subbasin. Schedule may not permit BAP testing.
Joy, Joe	Department of Ecology	02/04/10	General	Also, I see no concept of evaluating phosphorus transport & storage mechanisms in the tributaries, i.e. an agricultural field or WWTP in the upper tributary watershed may deliver 'x' lbs. of phosphorus, but will it get to the Spokane River directly, or will it be delayed mechanically or biologically?	None	Transport & storage are important components to understanding phosphorus; however, the NPS Study is focused on source controls, the "what" and "where".
Kessler, Charlie	Stevens County	02/25/10	2.10	On page 10 the 20 monitoring wells are mentioned. I Dr. John Buchanan of EWU collaborated on this study. I talked with him about using these wells for a project we proposed and he said they all had to be abandoned at the end of the project so they are not useable. This is another point HDR might want to check on.	Suggests implementation of 2.10 could not utilize Soltero wells	Use of existing data (2.10).
Kessler, Charlie	Stevens County	02/25/10	2.10 and 2.11	In determining the contribution from septic systems, Ecology has encouraged the District to include chloride as one of the sampling parameters. The local health district feels that the presence of caffeine is a simple, reasonably cost test to use for determining human input. Just a couple of things for HDR to consider.	None	
Kessler, Charlie	Stevens County	02/25/10	General	On page 14, DQO#4, perhaps looking at the loading based upon a per unit area basis would help in determining the magnitude of contribution from the different sampling areas.	None	

Person	Firm/Agency	Comment Date	Alternative	Comment	Interpreted Impact to Alternative Prioritization	Additional Considerations/Alternatives to Sampling for Filling Data Gaps
Neher, Michael	City of Post Falls	02/25/10	2.10 and 2.11	I think it would be money well spent to get a reasonable assessment of nutrient loading coming from the near shore development on Long Lake and also on the Little Spokane River (subdivision and the fish hatchery). It seems that for the reservoir, a series of samples taken on a cross sectional transect up stream of Suncrest and one below Suncrest and/or Tum Tum would help answer this question directly (rather than inference from well data). Multiple samples along the transect would help determine a total nutrient load in the river/reservoir, and an evaluation of the near shore and midstream samples will help discern the influence of near shore development. The sampling date(s) should be during low flow in the summer for greatest sensitivity. The reason for this recommendation is the possible significant (and perhaps over-riding) impact those sources may have on the DO issue in the reservoir, and the information may be crucial to a cost effective MIP. If the data indicate these sources are not significant, then at least that avenue can be put on the back burner.	2.10 and 2.11 sampling priority more important. Suggests surface water approach for 2.10	Use of existing data (2.10).
Pilgrim, Jessica	City of Spokane	02/19/10	2.10	The Suncrest Development (Urban SubUrban)Justification: This area does not have current data. The most recent data for this area was indicated as being at least 20 years old. The comment was made that data could be "inferred" based on the old data. The City feels it is in the best interest of the study that this data be updated. The population of the Suncrest area has increased, and as such the soil saturation of phosphates has most likely changed. Further, this area should be easy to sample as it was indicated that there are shallow wells available. The data would be valuable to the study since this area could be sampled and from there the new data could be used to extrapolate data for other areas' similar in septic density.	Maintain 2.10 at highest sampling priority	Collecting data in Long Lake subbasin, Suncrest area may be valuable.
Pilgrim, Jessica	City of Spokane	02/19/10	2.1	Hangman/Latah Creek, especially during a storm event (Agricultural) Justification: If there is sufficient data then disregard this recommendation. It has long been recognized that Hangman/Latah creek is a large contributor of phosphate laden sediment loads during late winter/early spring snowmelt/runoff events. The city is interested in further studies concerning these events.	Maintain 2.1 at highest sampling priority	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Pilgrim, Jessica	City of Spokane	02/22/10	General	On the comments I sent out on Friday on behalf of the City of Spokane, Lars wanted me to emphasize that the data gap for Hangman Creek exists regarding the sediment "hang time" in the reservoir. During the January-April heavy flow periods Hangman Creek releases a lot of sediment (possibly correlating to heavy phosphorus loads) the data gap exists in that we don't know how far or how fast those sediments travel to/through Long Lake/Lake Spokane. As such, it would be interesting to do a study regarding the sediment and how saturated with phosphates it is, as well as how far/how fast it travels. Is it being washed down to Long Lake during high flow months, but then settling and staying in Long Lake during the critical period?	None	Transport & storage are important components to understanding phosphorus; however, the NPS Study is focused on source controls, the "what" and "where".
Pilgrim, Jessica	City of Spokane	02/19/10	General	Because there is limited time and money and several data gaps it was indicated that there is a distinct possibility only three sites may be chosen. If this is the case, then the City of Spokane believes that it is in the best interest of the study that three different site categories are selected. It is recommended by the City of Spokane that one site be urban/suburban, one should be agricultural, and the third should include the main stem of the Spokane River.	Consider with overall prioritization	Recommendation may not be feasible. Need to rely on NPAC and continued monitoring during Implementation.
Pilgrim, Jessica	City of Spokane	02/19/10	Various	Little Spokane RiverJustification: This is a known source of phosphorus loading that would be easy to mitigate through BMPs (implementing riparian buffer areas, eliminating septic tanks, and controlling the use of fertilizers near the river). As such, it would be beneficial to have scientific data to further confirm the sources of phosphorus and identify and support BMPs.	2.11 sampling priority more important.	Collecting data in Little Spokane subbasin may be valuable.
Ragsdale, Dave	Department of Ecology	02/02/10	2.12-A	Also, the discussion about the developed areas (small towns) in the Hangman watershed representing higher loading sources during high flow/loading events is incorrect. Loading from these areas are the larger of the ongoing sources during the summer critical season but the total loading from Hangman during the low flow period is insignificant.	2.12-A sampling priority less important	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Ross, James D	Department of Ecology	02/04/10	General	We need the best bang for the buck. We should focus on areas where we 1) have no data 2) get results we can use and 3) have no other potential source to meet 1 & 2.	Increase sampling priorities for areas with no data and where useful data can be obtained readily.	Rely on NPAC for existing data (such as Ecology and SCCD in Hangman, County and City on stormwater). Septic areas (Suncrest & Eaglewood), Deep Creek, and Cheney with little data more important for consideration of field data collection.

Person	Firm/Agency	Comment Date	Alternative	Comment	Interpreted Impact to Alternative Prioritization	Additional Considerations/Alternatives to Sampling for Filling Data Gaps
Ross, James D	Department of Ecology	02/04/10	General	So I would stay away from stormwater, ag and forestry related projects. Two notable data gaps are Deep/coulee creeks and the effect of near-shore developments (Suncrest) The Deer/Deadman project is interesting too. In light of the fact that there is a series on monitoring wells around Suncrest, that project has my vote. We can see spatial variation and GW loads. I see no need to sample weekly. It would be better if the sampling occurred from March through August, so we could see if GW conc. increased during the dry season.	Decrease in support for 2.1 through 2.4, 2.7, and 2.8. Increase in support for 2.10 and 2.11	Rely on NPAC for existing data (such as Ecology and SCCD in Hangman, County and City on stormwater). Septic areas (Suncrest & Eaglewood), Deep Creek, and Cheney with little data more important for consideration of field data collection.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.1	2.1 Agricultural Impacts – should utilize Spokane CD soil monitoring data when selecting potential sites. Also consider crop rotation and other factors that might make a short term study inappropriate. To truly characterize may need a longer study.	2.1 sampling priority less important.	Rely on Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.10	2.10 Lake Spokane near shore Unconsolidated Aquifers, including Suncrest – data needed.	Maintain 2.10 at highest sampling priority	Collecting data in Long Lake subbasin, Suncrest area may be valuable.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.12	2.12 Rural Community Point and Nonpoint Source Impacts – this is probably a less significant source compared to agricultural runoff and streambank erosion. Would be better suited to later stages of implementation.	2.12 sampling priority less important	Check database values. Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.13	2.13 Cheney Metro – Not likely a priority. Unlikely P from WWTP or Cheney nonpoint sources would travel the 7 to 8 miles through groundwater to make it to Hangman Creek. At the meeting there was discussion about monitoring the groundwater seeps along Hangman Creek near the mouth of Marshall Creek, however, high P results would not be able to be attributed to a particular source. It's most likely if the groundwater was high in P it would be due to a source within ½ mile or less – likely nonpoint. The cause/effect would be very difficult to determine and the budget would need to be significantly larger than the scope of this project. If this is pursued should check with WWTP and their consultants to determine what data they have been collecting and if it might be useful.	2.13 sampling priority less important.	Conflicting impressions on Cheney area. May warrant further examination. Pursue alternative sources for existing data.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.15	2.15 Lower Hangman Rural to Urban – Ecology is scheduled to conduct a groundwater study in the area of Hangman Creek Golf Course and Latah Creek WWTP in 2010. Therefore, any study of this area would probably benefit from waiting for the results of this work to better separate out what may be coming through groundwater. This type of study would also benefit from a longer timeframe to see seasonality of sources.	2.15 sampling priority less important	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.16	2.16 Subbasin Permitted and Non-Permitted Point Sources – Most if not all treatment plants in the Hangman Watershed are now required to conduct some level of TP monitoring. The term non-permitted point sources is confusing – consider changing to illicit discharges which would be very difficult to find/isolate and likely fairly small (agricultural ditches, pipes, etc???).	2.16 sampling priority less important	Ask Ecology to provide TP monitoring data.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.17	2.17 Deep Creek – data needed!	2.17 samping priority more important.	Collecting data in Long Lake subbasin, Deep Creek watershed may be valuable.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.18	2.18 Watershed Boundaries – what this study entails is really not clear from the discussion. The benefit/objective is not clear.	Maintain 2.18 at lowest sampling priority	Insufficient schedule to select analysis method(s) and data gaps to fill.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.19	2.19 Sediment Sampling – Is this in-stream sediment sampling, lake sediment sampling, soil/phosphorus relationship sampling? Not clear from the description. If it's the latter the work should be coordinated with Spokane CD soil sampling efforts.	Maintain 2.19 sampling priority	Ecology and SCCD provided additional supplemental data for Hangman subbasin.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.2	2.2 Hangman Creek BMP Study and Conservation Tillage – not sure the past BMPs are the same or have been maintained. Dr. Jeff Ullman at WSU has been doing some research on conventional agriculture vs. direct seed agriculture in the Palouse that may be of interest in preparing for this type of research.	2.2 sampling priority less important	Contact Dr. Jeff Ullman potentially via Ecology or Dr. Barber for input.

Person	Firm/Agency	Comment Date	Alternative	Comment	Interpreted Impact to Alternative Prioritization	Additional Considerations/Alternatives to Sampling for Filling Data Gaps
Snouwaert, Elaine	Department of Ecology	02/17/10	2.4	2.4 Background/Natural Conditions - background in upper watershed is not necessarily background in other reaches. It is unlikely that you will be able to extrapolate what background at the mouth should be from any upper watershed background sampling. Background at the mouth would still need to take in the cumulative effect of flowing through the watershed. Overly simplified definition of background that wouldn't provide useful data.	Maintain 2.4 at lowest sampling priority	Data may not be attainable.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.7	2.7 Pollutographs – States it would be "one intensive period" but it seems you would also need before/after and a non-event period sampled for comparison. Would fit limitation of timeframe but not sure if stormwater should be a priority. Seems continuous loading should have a higher priority.	2.7 sampling priority less important.	Budget limitations and considerations may make this alternative infeasible. Maintain as a high priority for recommended continued monitoring as part of Implementation Plan.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.8	2.8 Stormwater-Centric – this source is probably not a priority at this stage of implementation. It is likely insignificant compared to other sources such as agricultural runoff and streambank erosion. This study would likely be more beneficial at later stages of implementation.	2.8 sampling priority less important.	Need to examing existing stormwater data for insights before concluding significance. May or may not fill data gaps. Maintain as a high priority for recommended continued monitoring as part of Implementation Plan.
Snouwaert, Elaine	Department of Ecology	02/17/10	2.9	2.9 BMP-Centric – The effects of BMPs would likely be better monitored and understood through a longer term study. Monitoring a single storm wouldn't tell as much as monitoring a season or a year. This is especially true this year with the unusually warm temperature and rain – erosion has been much worse. This work should be coordinated with Spokane CD's soil monitoring results and their suggestions for locations.	2.9 sampling priority less important.	May or may not fill data gaps. Existing SCCD and stormwater/MS4 data may reveal some insights. Include in Reduction Plan recommendation for conservation district monitoring.
Snouwaert, Elaine	Department of Ecology	02/17/10	General	Budget/timeframe (page 4, 1st paragraph) – The dollar amount is really going to limit the scope of any field work and should be carefully considered in choosing the project. The goal to have all data analyzed by mid-2010 also limits the study to a seasonal or event type study. This should also be considered in selecting the project because some of the studies outlined would really benefit more from year round data collection or at least a longer timeframe to truly characterize the source with confidence. I wouldn't consider stormwater related projects a high priority but due to these limitations it might be what pans out. If it's possible to have some flexibility with budget/timeframe it might result in better characterization of a source.	See specific comments below and parallels other Ecology staff comments above.	Yes, schedule and budget are limitations and considerations. Input from NPAC is important.
Snouwaert, Elaine	Department of Ecology	02/17/10	General	Field project selection: Overall, for the timeframe and budget I feel the projects that have the most promise would be the Deep Creek project or the Lake Spokane/Suncrest project. These are both areas with significant data gaps that would likely benefit from a cursory data collection.	Increase in support for 2.10 and 2.17	Field data collection could fill data gaps.

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Table 2

Impact of NPAC Comments on Potential Field Collection Alternatives

Bi-State Nonpoint Source Phosphorus Study

Spokane River Watershed Field Data Collection

General Category (Priority and Type) [1]	Subbasin for Sampling (Priority and Location) [2]	Data Gaps (Priority and Type) [3]	Recommended Studies (Priority and Type) [4]	Alternative Number	Alternative Name Monitoring Programs	Basic Description (see text for additional information)	Sample Type Surface Water (SW), Groundwater (GW)	Duration of Sampling	Spring Runoff Important[5]	Minimum Number of Samples	Sampling Priority[6]	Synopsis of NPAC Comments	Highest Ranked Alternatives[7]
1 Agriculture	1 Hangman Creek	2 Event load 3 Land use	1 Reduction basis 2 Event based	2.1-A	Agricultural Impacts – Hangman Creek	Sample streams below areas dominated by agriculture.	SW	4 times a month	High	8	1	Mild negative feedback. Use existing data from SCCD.	
1 Agriculture	3 Coeur d'Alene Lake	2 Event load 3 Land use	1 Reduction basis 2 Event based	2.1-B	Agricultural Impacts – Coeur d'Alene Lake		SW	4 times a month	High	8	1	Mild negative feedback	
1 Agriculture	1 Hangman Creek	2 Event load 3 Land use	1 Reduction basis 2 Event based 3 Land use	2.2	Hangman Creek BMP Study and Conservation Tillage	Sample the two subbasins (with and without BMPs) as a follow-up to SCCD study and/or new areas with conservation tillage or other BMPs	SW	24-hours or 4 times a month	High	8	1	Mild negative feedback	
3 Forestry	2 Little Spokane River	2 Event load 3 Land use	1 Reduction basis 2 Event based	2.3-A	Forest Land Use Impacts – Little Spokane River	Sample streams below areas dominated by forestry both natural and managed areas.	SW	4 times a month	High	8	2	Mixed feedback	
3 Forestry	2 St. Joe River	2 Event load 3 Land use	1 Reduction basis 2 Event based	2.3-B	Forest Land Use Impacts – St Joe River		SW	4 times a month	High	8	2	Mixed feedback	
3 Forestry	2 Little Spokane River	7 Long term data	3 Land use	2.4-A	Background/Natural Conditions – Little Spokane River	Sample streams as high up in the subbasins as possible to reduce the potential for anthropogenic effects.	SW	4 times a month	Low	5	4	Strong negative feedback	
3 Forestry	2 St. Joe River	7 Long term data	3 Land use	2.4-B	Background/Natural Conditions – St. Joe River		SW	4 times a month	Low	5	4	Strong negative feedback	
3 Mainstem	3 Spokane River (Upper and Lower)	7 Long term data	5 P loads	2.5	Ambient Conditions	Coordinate with Ecology/IDEQ on continuing sampling of existing long term monitoring sites.	SW	4 times a month	Moderate	8	4	None	

General Category (Priority and Type) [1]	Subbasin for Sampling (Priority and Location) [2]	Data Gaps (Priority and Type) [3]	Recommended Studies (Priority and Type) [4]	Alternative Number	Alternative Name Monitoring Programs	Basic Description (see text for additional information)	Sample Type Surface Water (SW), Groundwater (GW)	Duration of Sampling	Spring Runoff Important[5]	Minimum Number of Samples	Sampling Priority[6]	Synopsis of NPAC Comments	Highest Ranked Alternatives[7]
3 Mainstem	5 Upper Spokane River ID	7 Long term data	5 P loads	2.6	Idaho to Stateline	Sample short reaches between Coeur d'Alene and Stateline (mainstem, seeps, outfalls, tributaries) to investigate differences observed in data between CdA and Stateline stations	SW	24-hours or 4 times a month	Moderate	12	4	None	
3 Stormwater	3 Upper Spokane River	2 Event load	2 Event based	2.7 - A	PollutoGraph Spokane R.	Fine scale sampling (hours instead of weeks or months) to track changes in concentrations from upstream to downstream	SW	24-hours	Moderate	16	3	Mixed feedback	
3 Stormwater	1 Hangman Creek	2 Event load	2 Event based	2.7 – B	PollutoGraph Hangman Creek		SW	24-hours	Moderate	16	2	Mixed feedback	
3 Stormwater	1 Little Spokane River	2 Event load	2 Event based	2.7 - C	PollutoGraph Little Spokane R.		SW	24-hours	Moderate	16	2	Mixed feedback	
3 Stormwater	All (Not Prioritized)	2 Event load 1 Land use (GW)	2 Event based 1 Temporal GW	2.8	Stormwater-centric	Sample stormwater outfalls and flows dominated by stormwater runoff to characterize the mobilization of phosphorus.	SW, GW	24-hours	Moderate	20	3	Moderate negative feedback	
3 Stormwater	All (Not Prioritized)	2 Event load 1 Land use (GW)	1 Reduction basis 8 & 9 BMPs	2.9	BMP-centric	Sample BMPs to investigate performance in reducing phosphorus loads.	SW, GW	24-hours	Moderate	16	2	Mixed feedback	
2 Urban/Suburban	1 Lower Spokane River	3 Land use 2 Land use (GW)	1 Reduction basis 3 Land use	2.10	Lake Spokane nearshore unconsolidated aquifers, including Suncrest	Focus on impacts from on-site septic systems.	SW, GW	4 times a month	Moderate	8	1	Moderate to strong support. Might overlap with future Stevens County Conservation District efforts.	3
2 Urban/Suburban	2 Little Spokane	3 Land use 1 Land use (GW)	1 Reduction basis 3 Land use 6 Land use (GW)	2.11	Eaglewood - East of Highway 2 btwn E Day Mt Spokane Rd and E Mt Spokane Park Dr	Focus on impacts from on-site septic systems as well as impacts from a higher density unincorporated area.	SW, GW	4 times a month	Moderate	8	2	Strong Support	1
2 Urban/Suburban	1 Hangman Creek	2 Event load 3 Land use	1 Reduction basis 2 Event based 3 Land use	2.12-A	Rural Community Impacts – Hangman Creek	Sample upstream and downstream as well as seeps, outfalls, etc., to measure impacts from small communities in the subbasins.	SW	24-hours or 4 times a month	High	12	1	Moderate negative feedback	

General Category (Priority and Type) [1]	Subbasin for Sampling (Priority and Location) [2]	Data Gaps (Priority and Type) [3]	Recommended Studies (Priority and Type) [4]	Alternative Number	Alternative Name Monitoring Programs	Basic Description (see text for additional information)	Sample Type Surface Water (SW), Groundwater (GW)	Duration of Sampling	Spring Runoff Important[5]	Minimum Number of Samples	Sampling Priority[6]	Synopsis of NPAC Comments	Highest Ranked Alternatives[7]
2 Urban/Suburban	2 Little Spokane River	2 Event load 3 Land use	1 Reduction basis 2 Event based 3 Land use	2.12-B	Rural Community Impacts – Little Spokane River		SW	24-hours or 4 times a month	High	12	1	Moderate negative feedback	
2 Urban/Suburban	3 Coeur d'Alene Lake	2 Event load 3 Land use	1 Reduction basis 2 Event based 3 Land use	2.12-C	Rural Community Impacts – Coeur d'Alene Lake		SW	24-hours or 4 times a month	High	12	2	Moderate negative feedback	
2 Urban/Suburban	1 Hangman Creek	2 Event load 3 Land use 1 Land use GW	1 Reduction basis 2 Event based 3 Land use 6 Land use GW	2.13	Cheney Metro	Sample area in and around Cheney lacking data.	SW, GW	4 times a month	High	12	1	Mixed feedback	4
2 Urban/Suburban	5 South Fork Coeur d'Alene River	2 Event load 3 Land use	2 Event based 3 Land use	2.14	South Fork Coeur d'Alene River Corridor	Sample upstream and downstream as well as seeps, outfalls, etc.	SW	4 times a month	Moderate	16	3	None	
2 Urban/Suburban	1 Hangman Creek	2 Event load 3 Land use	2 Event based 3 Land use	2.15	Lower Hangman Rural to Urban	Sample along lower Hangman Creek where land use changes from agriculture to rural to urban.	SW	24-hours or 4 times a month	Moderate	16	1	None	
2 Urban/Suburban	1 Hangman Creek	1 P type	5 P loads	2.16	Subbasin Permitted and Non-Permitted Point Sources	Sample permitted and non-permitted sources not directly discharging to Spokane R.	SW	4 times a month	Low	2	2	Mixed feedback	
Other (Not Prioritized)	3 Lower Spokane River	5 Near lake	4 Near sources	2.17	Deep Creek	Sample Deep Creek area due to lack of data and directly flows into Lake Spokane.	SW	24-hours or 4 times a month	High	8	4	Strong support	2
Other (Not Prioritized)	All (Not Prioritized)	6 Historical	5 Ploads	2.18	Watershed Boundaries	Sample throughout the watershed.	SW	4 times a month	Moderate	12	4	None	
Other (Not Prioritized)	All (Not Prioritized)	4 Soils	6 Relationships 7 Storage/release	2.19	Sediment Sampling	Sample for sediment to phosphorus relationships.	SW	4 times a month	Low	5	3	None	

Notes.

[1]Category type and associated priority are adapted from Table 1.

[2]Location and associated priority adapted from Table 2.

[3]Data gap type and associated priority adapted from GeoEngineers (2009a).

[4]Study type and associated priority adapted from GeoEngineers (2009a).

[5]The importance of monitoring during peak spring runoff to the success of the monitoring program is ranked from low to high.

[6]Before receiving NPAC feedback, the alternatives were prioritized from a priority of 1 (high) to 4 (low) based on the information provided in columns 1 through 4, professional judgment, and a preliminary evaluation of the feasibility of gathering significant data with project resources .

[7]Based on the prioritization described in footnote 6, our subsequent field reconnaissance, and NPAC feedback, the top data collection alternatives are identified in this column. 1 represents the highest ranked alternative.