

Field Sampling Plan

Graham Creek Solar Pathfinder Monitoring Project



**State of Idaho
Department of Environmental Quality**

Coeur d'Alene Regional Office

Version 1.0

May 22, 2017

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1 Title and Approval Page

1.1 Field Sampling Plan

Title: Graham Creek Solar Pathfinder Monitoring Project

Region/Division: Coeur d'Alene Regional Office

Version Number: 1.0

Date: May 22, 2017

Parent QAPP Title: Solar Pathfinder Monitoring for Coeur d'Alene Region PNV Temperature TMDLs

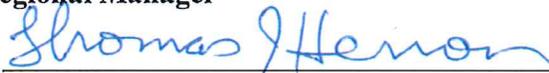
Parent QAPP TRIM Number: 2017AKL39

1.2 Approval Signatures

Note: This FSP becomes effective on the date of the last approval signature.

Program/Regional Manager

Signature:



Name: Thomas Herron, Surface Water Program Manager,
Coeur d'Alene Regional Office

5/22/2017

Date

Project Quality Assurance Officer

Signature:



Name: Mark Shumar, TMDL Program Manager, State Office

*Note: At time of FSP signature, the project QAO is required to update the DEQ
QAO project document tracker found at TRIM Record No. 2012AEB8

5/22/17

Date

Project Manager

Signature:



Name: Kajsa Van de Riet, Coeur d'Alene Restoration Plan Coordinator,
Coeur d'Alene Regional Office

5/22/2017

Date

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3 Distribution List

The following personnel will receive either an electronic or hard copy of the final signed field sampling plan (FSP) (Table 1).

Table 1. Project field sampling plan distribution list.

Name	Project Affiliation	Organization and Address/Location	Contact phone Number
45T45T Tom Herron	Regional Manager	DEQ — Coeur d'Alene Regional Office	(208) 666-4631
Mark Shumar	Project Quality Assurance Officer	DEQ – State Office	(208) 373-0132
45T45TKajsa Van de Riet	Project Manager	DEQ — Coeur d'Alene Regional Office	(208) 666-4633

4 Project/Task Organization

Key project personnel for the project-specific FSP and their responsibilities are defined in Table 2. An organizational chart for the project-specific FSP is provided in Figure 1.

The project staff duties and responsibilities described in Table 2 are not intended to be all inclusive; see sections 1.2.5 through 1.2.7 of the DEQ *Quality Management Plan* (QMP) (DEQ 2016a) for a more detailed description.

Table 2. Key field sampling plan (FSP) personnel and associated responsibilities.

Name	FSP Project Title/Responsibility
45T Tom Herron	<p>Program/Regional Manager: Note: The following description is <i>not all inclusive</i>; see section 1.2.7 of the DEQ QMP for a more detailed description. This person is the regional manager or State Office program manager for the project-specific FSP. Each project-specific FSP has an assigned program/regional manager, whose duties and responsibilities include the following:</p> <ul style="list-style-type: none"> • The program/regional manager assigned to a project-specific FSP has the same duties and responsibilities as the QAPP program/regional manager, except that these duties and responsibilities apply to the project-specific FSP. For example, the program/regional manager assigned to the project-specific FSP confirms the FSP meets the needs of the program/region in the same fashion that the associated project “parent” QAPP program/regional manager confirmed the QAPP met the needs of the program/region. See the DEQ standard QAPP example/template (DEQ 2012) and the associated project “parent” QAPP for a complete listing of the program/regional manager roles and responsibilities. Other minor variations on these duties and responsibilities are listed below. • The person assigned to this role for the project-specific FSP may be the same person assigned to the same role for the associated project “parent” QAPP. • The program/regional manager assigned to the project-specific FSP is not required to contact the DEQ quality manager for approval of the QAO assignment to the project-specific FSP. This is different than when the QAO is assigned by the program/regional manager to the associated project “parent” QAPP, which does require DEQ quality manager approval. • This person reviews the associated project “parent” QAPP prior to signing the project-specific FSP as an approver to ensure all information and requirements deferred by the QAPP to the FSP are present in the FSP.
Mark Shumar	<p>Project Quality Assurance Officer: Note: The following description is <i>not all inclusive</i>; see section 1.2.5 of the DEQ QMP for a more detailed description. Each project-specific FSP has an assigned QAO, whose duties and responsibilities include the following:</p> <ul style="list-style-type: none"> • The QAO assigned to a project-specific FSP has the same duties and responsibilities as the QAPP QAO, except that these duties and responsibilities apply to the project-specific FSP. For example, the QAO assigned to the project-specific FSP reviews and signs the FSP as an approver in the same fashion that the associated project “parent” QAPP QAO reviewed and approved the QAPP. See the DEQ standard QAPP example/template and the associated project “parent” QAPP for a complete listing of the project QAO roles and responsibilities. Other minor variations on these duties and responsibilities are listed below. • This person reviews the associated project “parent” QAPP prior to signing the project-specific FSP as an approver to ensure all information and requirements deferred by the QAPP to the FSP are present in the FSP. • The QAO assigned to the project-specific FSP is not required to contact the DEQ quality manager to discuss the project prior to signing the project-specific FSP for approval. This is different than when the associated project “parent” QAPP is signed for approval, which does require the QAPP QAO to contact the DEQ quality manager. • <i>When the project-specific FSP QAO signs the FSP for approval, the QAO is required to update the DEQ QAO project document tracker found at TRIM record #2012AEB8.</i> • The FSP QAO is not required to perform a formal audit of the FSP activities, unless the FSP activities approach or extend beyond one year from the date of approval of the project-specific FSP.

	<ul style="list-style-type: none"> • Performs an annual audit, if FSP activities approach or extend beyond one year from the date of approval. The QAO audit checklist located in Appendix A shall be used for all assigned projects to evaluate project compliance with the approved project QAPP/FSP. Files the completed audit checklist in TRIM to document the audit. • Provides data validation per the project QAPP/FSP, using the appropriate checklist located in Appendix A, and may also participate in final project report review. • Documents all audit and data validation activities in the DEQ TRIM system, per the DEQ QMP and the approved QAPP/FSP. • Selection of this person must meet the independence criteria: The project-specific FSP QAO shall not be the QAPP or FSP project manager, program manager, or be otherwise assigned to the project-specific QAPP or FSP data-generation efforts. Neither the project manager nor the QAO may directly report to the other within the DEQ organizational structure, and both of these individuals may not be directly supervised by the same person. However, the project-specific FSP QAO may be the same person as the associated project “parent” QAPP QAO.
<p>45TKajsa Van de Riet</p>	<p>Project Manager: Note: The following description is <i>not all inclusive</i>; see section 1.2.6 of the DEQ QMP for a more detailed description. Each project-specific FSP has an assigned project manager, whose duties and responsibilities include the following:</p> <ul style="list-style-type: none"> • The project manager assigned to a project-specific FSP has the same duties and responsibilities as the QAPP project manager, except that these duties and responsibilities apply to the project-specific FSP. For example, the project manager assigned to the project-specific FSP enters the approved and current project-specific FSP in the TRIM system (including a copy of the signed approval page), in the same fashion that the associated project “parent” QAPP project manager files the approved and current QAPP. See the DEQ standard QAPP example/template and the associated project “parent” QAPP for a complete listing of the project manager roles and responsibilities. Other minor variations on these duties and responsibilities are listed below. • The person assigned to this role for the project-specific FSP may be the same person assigned to the same role for the associated project “parent” QAPP. • This person reviews the associated project “parent” QAPP prior to signing the project-specific FSP as an approver to ensure all information and requirements deferred by the QAPP to the FSP are present in the FSP. • Performs data review and verification per the project QAPP/FSP, using the appropriate checklists located in Appendix A. • Documents all audit and data review/verification activities in the DEQ TRIM system, per the DEQ QMP and approved QAPP/FSP.
<p>Not Applicable</p>	<p>Laboratory Contact/Manager: This person is the primary contact at the laboratory for DEQ project-specific FSP staff.</p>

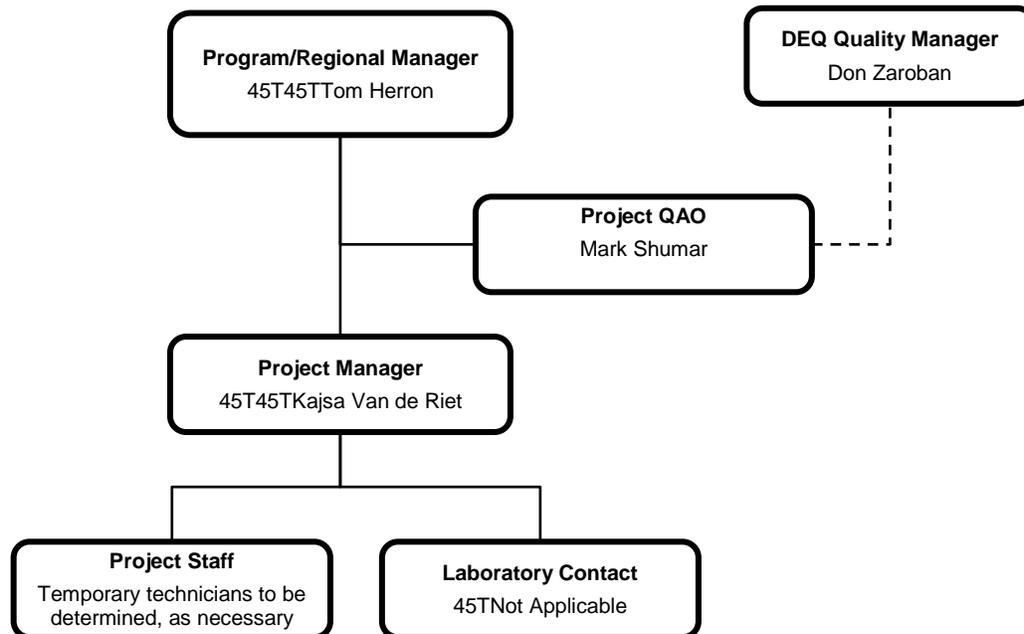


Figure 1. Project-specific field sampling plan organizational chart.

5 Problem Definition/Background

Temperature TMDLs using potential natural vegetation (PNV) techniques involve aerial photo interpretation of existing shade on streams. These are matched with estimates of shade at PNV conditions to set load allocations for solar energy, and to determine shade conditions necessary to attain TMDL goals (Shumar and de Varona 2009; DEQ 2013) (Table 3). One AU in the Graham Creek subwatershed (ID17010301PN002_03) received a solar load allocation in the 2013 North Fork Coeur d’Alene River Subbasin temperature (TMDLs) (Table 4). However, it appears that existing shade meets or exceeds PNV conditions and these streams may be attaining water quality standards for temperature. Shade analysis on an upstream AU (ID17010301PN002_02) found existing solar loads there might be higher than under PNV (Table 5). This is a reference watershed with very little human impact and good bioassessment indicators. Solar Pathfinder shade measurements will be collected to supplement bioassessment data. If existing shade meets or exceeds shade targets from the TMDLs, the data may be used to support delisting proposals.

Table 3. Existing and potential solar loads for Graham Creek (DEQ 2013).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m ² /day)	Potential Shade (fraction)	Potential Summer Load (kWh/m ² /day)	Potential Load minus Existing load (kWh/m ² /day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m ²)	Existing Summer Load (kWh/day)	Natural Segment Area (m ²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Graham Creek
Assessment Unit # ID17010301PN002_02														
2140	0.9	0.55	0.98	0.11	-0.44	1	1	2140	1177	2140	235.4	-941.6	-8	Forest Group B
280	0.8	1.1	0.98	0.11	-0.99	2	2	560	616	560	61.6	-554.4	-18	
3270	0.9	0.55	0.96	0.22	-0.33	3	3	9810	5395.5	9810	2158.2	-3237.3	-6	
330	0.8	1.1	0.94	0.33	-0.77	4	4	1320	1452	1320	435.6	-1016.4	-14	
270	0.9	0.55	0.94	0.33	-0.22	4	4	1080	594	1080	356.4	-237.6	-4	
Subtotal								14,910	9,235	14,910	3,247	-5,987	-10	
Assessment Unit # ID17010301PN002_03														
440	0.8	1.1	0.72	1.54	0.44	5	5	2200	2420	2200	3388	968	0	Nonforest Group 1
310	0.9	0.55	0.72	1.54	0.99	5	5	1550	852.5	1550	2387	1534.5	0	
490	0.6	2.2	0.65	1.925	-0.275	6	6	2940	6468	2940	5659.5	-808.5	-5	
120	0.5	2.75	0.65	1.925	-0.825	6	6	720	1980	720	1386	-594	-15	
370	0.8	1.1	0.65	1.925	0.825	6	6	2220	2442	2220	4273.5	1831.5	0	
Subtotal								9,630	14,163	9,630	17,094	2,932	-4	
Total								24,540	23,397	24,540	20,341	-3,056		

Table 4. Summary of existing load, TMDL load allocation, and reduction needed (DEQ 2013). This table summarizes loads over the entire assessment unit. Within each assessment unit, there are reach-specific shade targets and solar load allocations (see Table 3).

Assessment Unit Number	Assessment Unit Name	Existing Load (kWh/day)	Load Allocation (kWh/day)	Load Reduction Needed (kWh/day)	Percent Reduction Needed
ID17010301PN002_03	Graham Creek below Deceitful Gulch	14,163	17,094	Existing shade > potential shade	n/a

Table 5. Summary of existing solar load, estimated load at potential natural vegetation (PNV) conditions, and load reductions recommended on tributaries *not* listed for excess temperature (DEQ 2013). These are for informational purposes only and do not establish TMDLs. This load estimate is only for a portion of the assessment unit.

Assessment Unit Number	Assessment Unit Name	Existing Load (kWh/day)	Load Allocation (kWh/day)	Load Reduction Needed (kWh/day)	Percent Reduction Needed
ID17010301PN002_02	Graham Creek headwaters and tributaries	9,235	3,247	5,988	35

5.1 Problem Statement

This field sampling plan (FSP) covers stream shade monitoring using a Solar Pathfinder™ and digital photography for streams in the Graham Creek subwatershed of the North Fork Coeur d'Alene River Subbasin. One AU, Graham Creek below Deceitful Gulch (ID17010301PN002_03), is listed in the 2014 Integrated Report as impaired by temperature based on DEQ temperature data exceeding Idaho water quality criteria for salmonid spawning and EPA criteria for bull trout (DEQ 2017).

The 2013 North Fork Coeur d'Alene River Subbasin temperature total maximum daily loads (TMDLs) analyzed shade conditions for the watershed and established shade targets and load allocations for solar energy (DEQ 2013). The evaluation found shade conditions in the Graham Creek watershed that meet or exceed shade at PNV. The analysis found that existing loads are less than the load allocation. Therefore, the AU has been identified as a candidate for monitoring and temperature delisting if the stream attains water quality standards. These samples will be used to evaluate and field-verify existing shade. If existing shade meets or exceeds shade targets from the TMDLs, the data may be used to support delisting proposals.

The objective of this study is to evaluate existing shade and solar loads in the Graham Creek watershed to determine whether solar loads are at PNV conditions. If solar loads are at PNV conditions, that is also natural background and demonstrates attainment of water quality standards. Combined with recent bioassessment data and other information, these data could be used in temperature delisting rationale.

5.2 Intended Usage of Data

Data will be evaluated and compared to the aerial photo interpretation to verify estimated existing shade in accordance with procedures described in The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual (Shumar and De Varona, 2009). Solar Pathfinder™ shade measurements will be collected to supplement recent bioassessment data. If existing shade meets or exceeds shade targets from the TMDLs (DEQ 2013), the data may be used to support delisting proposals in a future Integrated Report.

6 Project/Task Description

Solar Pathfinder™ shade measurements will be collected for two assessment units in the Graham Creek subwatershed according to this FSP to evaluate attainment of water quality standards and TMDL goals. If existing shade meets or exceeds shade targets from the TMDLs (DEQ 2013), the data may be used to support delisting proposals.

6.1 General Overview of Project

In June-September 2017, crews will collect shade measurements using Solar Pathfinder™ associated with PNV-style temperature TMDLs on Graham Creek in the Upper Coeur d'Alene Subbasin (HUC 17010301) (DEQ 2013). Shade will be evaluated to determine whether existing

shade meets or exceeds shade targets from the TMDLs. This data may be used to support delisting proposals.

A Solar Pathfinder™ is a device developed for the solar panel industry for measuring the amount of openness to solar radiation when siting panel locations. The device suits ecological purposes well as it can be used to measure shade (the opposite of openness) in any location including streams. The Solar Pathfinder™ will be deployed following DEQ's The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual (Shumar and De Varona, 2009). This method will be referred to as 'PNV Manual' throughout this document. Data are collected as photographs that will be downloaded from the camera, and processed using Solar Pathfinder Assistant™ (v.1.1.6 or later) software, supplied by the Solar Pathfinder™ manufacturer.

A given set of pathfinder data for an individual site is 10 Solar Pathfinder™ readings (photographs) set at 50 paces apart along the stream reach. Other pace sizes (e.g. 25 paces) can be used when streams are small or there are known obstacles that would prevent the accumulation of 10 50-pace readings. However, pace size should not exceed 50. If the reach in question is very long and you wish to have data to characterize the entire length, it is best to perform a second site sample (another set of 10 readings at 50 paces apart).

Each photograph will be processed through the Solar Pathfinder Assistant™ software and shade values determined for each month of the year for that photograph. The shade values for the six months between April and September are averaged together to provide a single shade value for the spring/summer period. Since there are 10 photographs for a given site, the six-month average from each of the 10 is then averaged for a single shade value for that Solar Pathfinder™ site. This shade value can be anywhere between 0% and 100%.

6.2 Project Timetable

The project will occur from approximately June 2017 to December 2017 (Table 6). Field sampling is planned to occur sometime between June and September 2017. Analysis and reporting is planned for October to December 2017.

Table 6. Planned project schedule

Activity	Projected Start Date	Anticipated Date of Completion
Solar Pathfinder™ measurements	June 2017 or later	October 2017
Analyze data	Within 30 days of field data collection	Within 60 days of field data collection
Report results	November 2017	December 2017

7 Quality Objectives and Criteria

The objective of quality assurance and quality control (QA/QC) is to assure that the data gathered for this project are representative of actual field conditions.

At 10% of the monitored sites, two sets of measurements will be collected. In other words, the ten photographs of Solar Pathfinder™ traces at set intervals will be repeated in the same reach of stream as they were first taken. Processing of this second pass of a given reach will provide information on the error associated with the shade estimate generated for a given site.

Data collected under this QAPP are data quality Level II: field screening or analyses using portable instruments, generating data that are quantitative and acceptable for compliance purposes.

7.1 Data Accuracy, Precision, and Measurement Range

Precision is a measure of agreement between two measurements of the same property under prescribed conditions. The difference between the Solar Pathfinder™ readings of two similarly-placed Solar Pathfinder™ sites (i.e. the same stream reach sampled twice) will be used to assess data precision. Two sets of pathfinder data will be taken at the same stream reach, and the difference between each average of 10 measurements will be calculated. The difference between the two Solar Pathfinder™ averages will be determined and used as the level of confidence in measuring shade on streams in the field. The level of precision of measuring shade on a stream reach (Solar Pathfinder™ site) is not known, and may vary from site to site, plant community to plant community, region to region. If the duplicate site shade values differ by more than 20%, then all the datasets must be flagged/qualified to reflect the potential error and what restrictions have been placed on the use of the data as a result. To test precision, 10% of measurements will be repeated. The fifth trace of each site will be repeated to test precision of trace measurements. One sample in 10 will be repeated to test precision of samples.

The accuracy of the Solar Pathfinder™ photograph is assessed by the Solar Pathfinder Assistant™ software. Photographs that are taken incorrectly (e.g., usually by tilting the camera instead of holding it completely vertical) are identified by the software with a percent error estimation. It is common for most users to have tilting errors around 1-2% since it is nearly impossible to hold a camera completely steady in the field. Photographs with error estimates provided by the software greater than 5% will be discarded and not used in the analysis of shade for that site. Sites with less than 10 viable photographs still contain important information and will have use albeit limited (see Section 7.4).

7.2 Data Representativeness

Representativeness is defined as the degree to which the sample data accurately and precisely represent site conditions. The representativeness criterion is best satisfied by confirming that measuring locations are properly selected and that the Solar Pathfinder™ is correctly deployed. All sampling procedures will follow the PNV Manual (Shumar and de Verona, 2009).

Solar Pathfinder™ readings should be taken in a reach of stream that has been determined to be relatively homogenous with respect to shade on an aerial photo interpretation. Boundary crossings between two different levels of shade as interpreted on the aerial photograph should be avoided as much as possible. The purpose of the Solar Pathfinder™ measurement is to verify a given interpretation of an aerial photograph. The aerial photo interpretation procedure, described in the PNV Manual, requires placing reaches of stream into one of ten possible 10%-shade class

intervals. It is this shade class interval that is being field verified with the Solar Pathfinder™ readings from a stream reach.

If the Solar Pathfinder™ readings for a given site cross a shade class boundary that was not previously identified in the aerial photo interpretation, that boundary may be identified in the Solar Pathfinder™ analysis. If such boundary crossing is identified in a Solar Pathfinder™ site that is being used for QA/QC objectives (i.e. sampled twice), that site will be removed from the QA/QC process and another site will be selected for duplication.

7.3 Data Comparability

Comparability is defined as the confidence with which one data set can be compared with another data set. The use of the PNV Manual as a standard monitoring method maximizes comparability. All Solar Pathfinders™ and associated Solar Pathfinder Assistant™ software deployed by DEQ are manufactured by one company and are expected to be identical in their precision. However, the Solar Pathfinder Assistant™ software requires the user to digitize the shade boundary on a given photograph. Different users may perform this task slightly different from each other resulting in small differences in shade calculations between users. Typically, DEQ relies upon a single user to process all photographs for a given sampling event; therefore, there should be no loss of comparability within that sampling event. It should be stipulated that only one user of the software will be used for a given sampling event.

7.4 Data Completeness

Completeness is defined as the percentage of valid data relative to the total possible data points. For data to be considered valid, it must meet all of the acceptance criteria, including accuracy and precision, as well as any other criteria specified by the analytical method used.

Solar Pathfinder™ sites on streams are often limited by time and access. In general, a given sampling event to field verify an aerial photo interpretation of shade for a TMDL involves about 10 to 20 sites. However, TMDLs vary in size from one stream to many streams, and as a result, the number of Solar Pathfinder™ sites possible will vary widely. In cases of very limited access, watershed size, and available time these site number objectives may not be met. Still, a small number of sites is better than no data at all.

A single Solar Pathfinder™ site typically involves 10 Solar Pathfinder™ readings (photographs) at 50 paces apart along a stream reach. In some cases barriers or other situations that may prove dangerous, prevent the sampler from completing the 10 readings for a given site. Despite this truncation of data, DEQ strives to make use of the information as much as possible. If there are at least three readings, but less than 10, we will process the data and use it to provide information about the aerial interpretation. Since it is limited data we will not use it for QA/QC procedures or in the analysis of interpretation variance.

8 Special Training/Certification

The Project Manager and/or Program Manager is responsible for ensuring that personnel assigned to this project are appropriately trained and qualified, with the appropriate training records on file in DEQ Human Resources.

The field technician(s) will be trained and prepared by reviewing this field sampling plan, the Solar Pathfinder™ Instruction Manual (Solar Pathfinder 2008), and Shumar and de Varona (2009, pages 6-10). The technician(s) will either have prior experience with Solar Pathfinder™ sampling or will be trained with an example of trace collection prior to sampling. Preparation will include reviewing the equipment list in Attachment 2.

8.1 Safety

All work performed by DEQ personnel will be conducted in accordance with applicable health and safety plans and policies (see DEQ 2015).

Standard safety practices for stream sampling field work will be followed (refer to BURP Field Manual, Section 6 [DEQ 2016b or more current]). A staff member in the regional office will be notified of the field schedule, sampling site locations, and will be contacted upon return to the office. Boots or other closed toe shoes will be used to get to the sites. If working in the stream, felt-soled wading boots will be used to prevent slipping. Technicians will work in groups of at least two. Equipment will be decontaminated to prevent spread of aquatic invasive species. The inReach satellite communicator will be carried in case of emergency outside of cell phone range.

In case of emergency, technicians will have a copy of the regional emergency contact card and will be aware of the nearest location to seek help or medical attention. The closest hospital with emergency room to these sample sites is the Shoshone Medical Center in Kellogg. Shoshone Medical Center is located near the Kellogg McDonalds north of I-90 off the Bunker Ave exit.

Directions to Shoshone Medical Center: Take I-90 toward Kellogg, exit at Bunker Ave., north to Cameron, Bunker Ave. turns into Jacobs Gulch (called New St on Google Maps) at the corner of Cameron and Bunker; Shoshone Medical Center is on the northeast corner of Jacobs Gulch and Cameron.

9 Documentation and Records

The Project Manager is responsible for ensuring that the most current approved revision of the project QAPP, with any related FSPs and SOPs, is available in the DEQ TRIM electronic records management system.

The Project Manager will ensure that all applicable personnel are using Solar Pathfinder™ equipment and software appropriately.

Field personnel will document the deployment of Solar Pathfinder™ sampling using a field form or field book. At minimum, the following fields must be completed:

- Stream name
- Site name and description (including shade producing vegetation and structures)
- Latitude
- Longitude
- Channel width
- Sampling date

Project data must be recorded directly, promptly, and legibly. Any flags qualifying data usability will also be recorded.

At the end of the sampling effort, the Project Manager will scan and file the field forms on either a local computer or TRIM, following applicable program filing procedures. Spreadsheets will be similarly filed.

The Project Manager will ensure that the sampling event is adequately described in the applicable reports.

10 Sampling Process Design

10.1 Rationale for Sample Sites Selection

Sample sites were selected to characterize stream shade and solar loads for two AUs: ID17010301PN002_03 (002_03) and ID17010301PN002_02 (002_02). Specific selection of sites was based on the PNV Manual (Shumar and de Varona 2009) and the 2013 Temperature TMDLs (DEQ 2013). Streams have been divided into AUs, which are DEQ's numerical tracking system for water bodies. The 2013 Temperature TMDLs further divided these AUs into segments based on observations of existing shade on aerial photographs. These two AUs were each divided into five segments of varying length. Sample sites are needed to measure stream shade conditions for all of these segments. Multiple samples will be collected on long segments so that there is one site per 1,000 m stream length in each segment. Therefore, 13 sites will be sampled in addition to one duplicate (Table 7) (Figure 2).

A sample consists of 10 digital photographs (i.e., traces) collected at a standard interval. For this project, each trace will be collected at an interval of 20 paces. One stream segment is only 120 m long, and will have only 5 traces instead of 10. The downstream starting point for each sample was determined randomly to obtain a representative shade sample for that segment. The starting point in Table 7 is measured from the downstream end of Graham Creek. Crews will then work from that point upstream.

Table 7. Sample site selection and starting points for Graham Creek PNV segments.

Sample Site #	Assessment Unit #	Segment #	Segment Length (m)	Traces	Starting Point (m)
1	17010301PN002_03	1	370	10	111
2	17010301PN002_03	2	120	5	387
3	17010301PN002_03	3	490	10	602
4	17010301PN002_03	4	310	10	1,072
5	17010301PN002_03	5	440	10	1,526
5-dup	17010301PN002_03	5	440	10	1,526
6	17010301PN002_02	6	270	10	1,754
7	17010301PN002_02	7	330	10	2,038
8	17010301PN002_02	8	3,270	10	4,946
9	17010301PN002_02	8	3,270	10	2,958
10	17010301PN002_02	8	3,270	10	3,154
11	17010301PN002_02	9	280	10	5,647
12	17010301PN002_02	10	2,140	10	7,418
13	17010301PN002_02	10	2,140	10	7,617

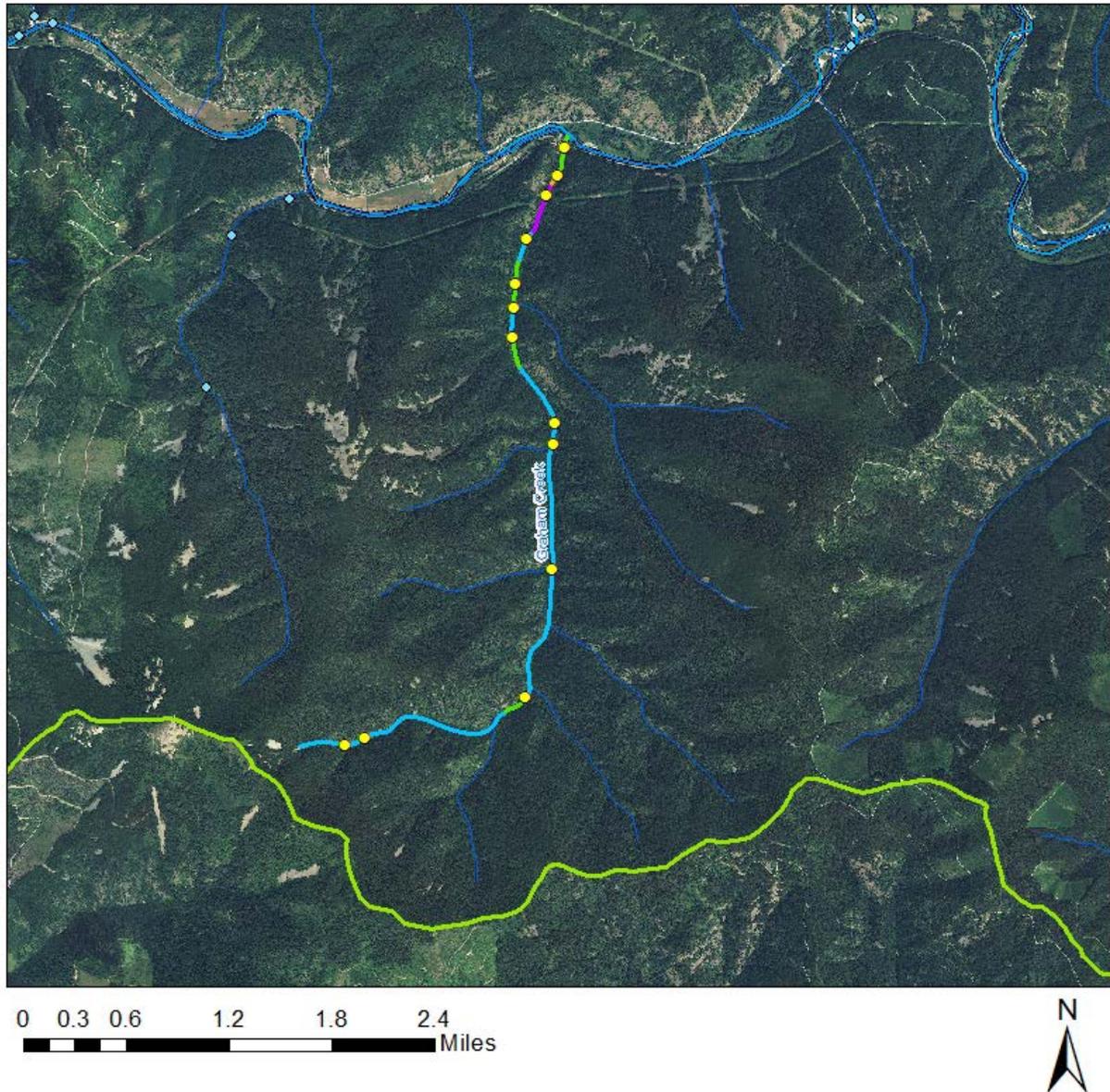


Figure 2. Overview of Graham Creek 2017 sample sites marking the starting points.

10.2 Sample Design Logistics

Please see the corresponding section of the project QAPP for requirements; no project-specific information has been deferred to this project-specific FSP.

11 Sampling Methods

Field sampling methods will be completed following the Solar PathfinderTM Instruction Manual (Solar Pathfinder 2008) and methods describes in Shumar and de Varona (2009). Field sampling will be conducted by Project Manager, Kajsa Van de Riet, with assistance from at least two other DEQ staff or volunteers. An equipment list and field forms are included as attachments to this FSP. Solar PathfindersTM, digital camera and GPS units should be in good working order and extra batteries should be carried.

Basic methods and clarifying details are described in a step-by-step process below:

- a. Locate the sampling site and starting points as described in Section 10.1 and supplemental material or maps provided by Project Manager. The exact location of the Solar PathfinderTM sampling site is identified using a GPS unit, and recorded on the waypoint function of the GPS, in the form of latitude and longitude. Project staff will also record the latitude and longitude in the project notebook by hand.
- b. Start at the downstream end of the site's reach. Then begin collecting trace subsamples at 20-pace intervals throughout the reach.
- d. To collect traces, follow the manufacturer's instructions and refer to Shumar and de Varona (2009, pages 6-10).
 - i. Measure and record bankfull width.

NOTE: Bankfull width is the distance between each the two side of the banks, at the high-water level. It is important to use bankfull width and not wetted width because stream flows change throughout the year and the wetted width is only representative of the stream at the time it is sampled rather than an entire year. Additionally, the riparian vegetation typically begins at the bankfull mark, so placing the Solar PathfinderTM in the middle of the bankfull width makes it equidistant from riparian communities on either side of the stream.

- ii. Place the Solar PathfinderTM in the stream channel at the center of bankfull width and about bankfull height (Figure 3).



Figure 3. Correct in-stream placement of a Solar Pathfinder™.

- iii. Ensure the Solar Pathfinder™ is level and oriented to face south.
- iv. The photographer should stand on the north side of the Solar Pathfinder™ and ensure no one is reflected in the dome.
- v. Hold the digital camera 1-2 feet over the Solar Pathfinder™ pointed down vertically toward the dome. The blue ring surrounding the dome should be equally visible around all sides in the photograph.
- vi. Take at least one digital photograph of the reflection in the dome's surface. The photo number will be recorded on the field form. *Note:* If there is a lot of direct sunlight or glare on the dome, it can interfere with getting a good trace (Figure 4). In those cases, reduce the glare by blocking it with your hand, hat, or other small object as described in Shumar and de Varona (2009). If using a GPS camera, the location will be stamped in the file.



Figure 4. Taking a photograph of the Solar Pathfinder™ dome. Note the photographer's raised hand blocking direct sunlight.

e. At each trace location, record the latitude and longitude or save a waypoint on a GPS unit. It's acceptable to record only the first and last trace location, but's preferable to record all 10 trace locations. It's possible to include a photo of the GPS unit as a backup for recording the waypoint (Figure 5).



Figure 5. Taking a photograph of the Solar Pathfinder™ along with a GPS unit that is displaying the latitude and longitude at that location.

f. Notes will be recorded about stream habitat conditions, riparian vegetation, and any water quality impacts observed in the watershed.

g. Photos of surrounding vegetation, topography, or other items of interest will be collected at each sampling site. Pay special attention to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade-producing ones) are present. The photo number will be recorded on the field form.

h. Continue in an upstream direction taking a trace every 20 paces to obtain 10 traces per sample site, except for Site 2 which has only 5 traces.

i. At the fifth trace for each site, collect a duplicate trace.

12 Sample Handling and Custody

Sample data are digital photographs contained within the camera after Solar Pathfinder™ photographs are taken and latitude/longitude waypoints contained within the GPS unit. Data associated with bankfull width measurements, field notes, and other photographs will also be collected and managed.

Following field sampling: Until the data are downloaded, the digital camera and GPS units will be maintained in the physical custody of the DEQ individual who collected the field data. If the camera/GPS units are not to be retained in the physical custody of the individual who collected the data from the sampling locations until data download is complete, then appropriate chain-of-custody methods and documentation will be employed for the temporary storage of the units.

All field forms will be scanned and digital photos will be downloaded from cameras. These files will be organized and shared in TRIM. If staff resources allow, field form data may be entered into Excel spreadsheets. Downloads and data entry will occur as soon as possible, and ideally within 30 days of collection.

13 Analytical Methods

Digital photographs of Solar Pathfinder™ readings require processing with the Solar Pathfinder Assistant™ software available at DEQ. GPS waypoints can be downloaded to a PC as either a spreadsheet of latitudes and longitudes or as an ArcGIS shapefile (preferred). Analysis of samples will be completed using Solar Pathfinder Assistant™ software. Methods will be as described in the Solar Pathfinder Assistant™ User Manual, Shumar and de Varona (2009), and the parent QAPP.

In summary, each sample consisting of 10 traces will be used to calculate average percent shade for the six-month period of April-September for each sampling location. These will be compared to values from the 2013 temperature TMDLs.

14 Quality Control

Please see the corresponding section of the project QAPP for requirements.

14.1 Field QC Checks

The fifth trace at every site will be duplicated, and a duplicate site will be completed for 1 out of 10 sites (10%). See section 7.1.

Please see the corresponding section of the project QAPP for requirements.

14.2 Laboratory Quality Control Checks

None; project data do not require laboratory analysis.

14.3 Data Analysis Quality Control Checks

Data may be checked or reviewed for quality by the Project Manager or the Project QAO at any time during the project, and must be checked once all of the data are collected. Corrective actions, as needed, will be documented in the event that control limits are exceeded. Data qualifiers will be assigned following appropriate data verification/validation procedures. Any qualifiers added will be defined in the project summary/technical report and will be consistent with appropriate EPA guidance (EPA 2002).

Data quality objectives are outlined in section 7. Datasets that do not meet the requirements of the data quality objectives will be identified and their use will be explained in applicable report documents. These datasets may still have limited use. For example, an inaccurate Solar Pathfinder™ reading might still give clues as to the type of riparian plant community at the sampling location and possibly an approximation of existing shade.

15 Instrument/Equipment Testing, Inspection, and Maintenance

Project field instrument/equipment testing, inspection, and maintenance will be performed in accordance with the individual instrument/equipment manual including Solar Pathfinder™ Instruction Manual (Solar Pathfinder 2008).

The Solar Pathfinder™ used will be manufactured and sold by the Solar Pathfinder Company (see www.solarpathfinder.com).

The Solar Pathfinder™, digital camera, GPS unit will be visually inspected prior to use. Damaged Solar Pathfinders™, digital cameras, GPS units will not be deployed.

The pieces of equipment listed are self-contained, and the manufacturer does not recommend any additional maintenance.

16 Instrument/Equipment Calibration and Frequency

The sampling equipment requires no calibration.

17 Inspection/Acceptance of Supplies and Consumables

With the exception of batteries for the camera and GPS unit, the sampling requires no supplies and consumables.

18 Non-Direct Measurements and Data Acquisition

This section addresses data obtained from existing data sources, not directly measured or generated in the scope of this project. Data may be acquired from the 2013 Temperature TMDLs (DEQ 2013).

19 Data Management

All field forms will be scanned and digital photos will be downloaded from cameras. These files will be organized and shared in TRIM. If staff resources allow, field form data may be entered into Excel spreadsheets.

Electronic copies of all digital photographs, GPS waypoints and processed shade reports will be kept on the sampler's office computer.

After data are verified, validated, assessed and reconciled in accordance with this QAPP, they will be uploaded to the appropriate TMDL folder in TRIM or in the appropriate surface water database as determined by the Surface Water Program.

20 Assessment and Response Actions

Assessment of the project quality control plan will be performed by reviewing field notes, photo libraries, Solar PathfinderTM reports, and by conducting field audits where possible. This assessment will be completed or directed by the Project QAO. Any errors or inconsistencies identified in the assessment will be investigated and corrected to ensure the integrity of the data and conformation to the QAPP and associated sampling protocol documents.

The Project QAO shall review the QAPP annually, to determine if revision is necessary. The Project Manager should also review the project QAPP on an annual basis to ensure that the project QAPP continues to meet the needs of the data users. If the project QAPP does require revision, the revised QAPP must be submitted for approval, prior to implementation, per the DEQ QMP.

Please see the corresponding section of the project QAPP for requirements.

21 Reports to Management

Please see the corresponding section of the project QAPP for requirements; no project-specific information has been deferred to this project-specific FSP.

22 Data Review, Verification, and Validation

Data collected under this FSP will be reviewed by the Project Manager and the Project QAO to ensure the data has been recorded, transmitted, and processed correctly. This QC effort shall include an evaluation of the completeness of the data set.

Review by the Project QAO shall include a minimum of 10 percent of all project data with a goal of at least 20 percent.

The duplicate sample sites (see 7.1) will be compared. The results will be used to quantify shade estimate precision.

Data verification and validation efforts will be recorded in project documentation.

Please see the corresponding section of the project QAPP for requirements.

23 Review, Verification, and Validation Methods

DEQ personnel performing data verification and validation are encouraged to review the EPA guidance on methods for this task, found in EPA Guidance on Environmental Data Verification and Data Validation (EPA 2002).

Data verification will be performed by the Project Manager, who will ensure that all procedures are followed correctly. This verification will include the entry and calculations for accuracy, precision, and data completeness.

Data validation will be performed by the Project QAO, extending the data evaluation beyond method and procedural compliance, to determine the analytical quality of the data set. Assignment of data validation qualifiers will be completed by the Project Manager consistent with appropriate EPA guidance.

Validation by the Project QAO will include review of data qualifiers. The intent of data validation is to determine if the data are adequate to support the objectives of the project. Items to be considered include:

- do the data meet the needs of the project?
- do the data meet the quality objectives of the project?

The Project QAO will review the duplicate Solar Pathfinder™ data. The two datasets will be directly compared, and the average discrepancy will be calculated. An assessment of data completeness will be made by the Project Manager and reviewed by the Project QAO. These measures will then be compared with project goals.

Data validation will also include a determination, where possible, of the reasons for any failure to meet method or procedural requirements, and an evaluation of the impact of such failure on the overall data set.

Any discrepancies from requirements of the QAPP, with respect to the data, will be noted during the verification and validation process. As determined by the Project Manager or the Project

QAO, if the data do not meet the needs of the project, or the quality objectives of the QAPP, and/or if the conclusions drawn from the data do not appear to be reasonable, the Project Manager and the Project QAO shall immediately report such findings to the appropriate Regional Manager and State Office Program Manager for determination of the necessary corrective actions.

The data will be considered valid if the QA checks indicate that they are accurate and precise, as defined in this plan.

Please see the corresponding section of the project QAPP for requirements; no project-specific information has been deferred to this project-specific FSP.

24 Reconciliation with User Requirements

Data Quality Assessment (DQA) will be performed in accordance with the DEQ QMP. Additional guidance can also be found in EPA Data Quality Assessment: A Reviewer's Guide (EPA 2006a), or in Data Quality Assessment: Statistical Methods for Practitioners (EPA 2006b).

The DQA, performed by the Project Manager and the Project QAO, addresses the determination of if a data set is of the right type, quality, and quantity to achieve the objectives of the project and can confidently be used to make an informed decision.

As previously stated in Section 23, if the Project Manager or the Project QAO, reach the conclusion that the project data do not meet the needs of the project, or the quality objectives of the QAPP, and/or if the conclusions drawn from the data do not appear to be reasonable, the Project Manager and the Project QA Officer shall immediately report such findings to the appropriate Regional Manager and State Office Program Manager for determination of the necessary corrective actions

If sampling activities require revision, the project QAPP and/or the project FSP will be revised as necessary. Following revision and prior to implementation, the revised project QAPP and/or FSP must be re-approved in accordance with the Idaho DEQ QMP.

Accuracy: Solar Pathfinder™ photographs with error estimations greater than 5% will be properly disposed of and data not used.

Precision: The level of precision of measuring shade on a stream reach (Solar Pathfinder™ site) is not known, and may vary from site to site, plant community to plant community, region to region. If the duplicate site shade values were to differ by more than 20%, then all the datasets must be flagged/qualified to reflect the potential error and what restrictions have been placed on the use of the data as a result.

Comparability: if the Solar Pathfinders™ have been deployed according to the monitoring plan, then they are expected to be comparable.

Completeness: all valid data may be used. A single faulty or unusable Solar Pathfinder™ photograph will not affect the results from the others. Even imprecise data may be useful in determining other information about the site.

Please see the corresponding section of the project QAPP for requirements; no project-specific information has been deferred to this project-specific FSP.

25 References

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- DEQ (Idaho Department of Environmental Quality). 2013. Upper (North Fork) Coeur d'Alene River Subbasin Temperature Total Maximum Daily Loads Addendum to the 2001 Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River. Boise, ID: DEQ. TRIM record number 2012AKV77.
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- DEQ (Idaho Department of Environmental Quality). 2015. Idaho Department of Environmental Quality Safety Manual (Draft). Boise, ID: DEQ.
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Shumar, M. and J. de Varona. 2009. The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual. Idaho Department of Environmental Quality. Boise, ID. TRIM record number 2014AKL46.

Available: https://www.deq.idaho.gov/media/528731-pnv_temp_tmdl_manual_revised_1009.pdf

Appendix A. Project Checklists

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DEQ QAPP/FSP Checklist—Data Review

The individual assigned in the project QAPP/FSP to perform project **data review** *shall complete and file this checklist in the appropriate project TRIM system files*. Project personnel are encouraged to expand this standard list, as project conditions warrant.

Printed Name of Staff Performing Data Review	Date Completed
----------------------------------------------	----------------

Project QAPP/FSP Title	QAPP/FSP TRIM Record #
------------------------	------------------------

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

 Verify that the approved current project QAPP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the QAPP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

 If the project utilizes an FSP, verify that the approved project FSP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the FSP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

 Examination and review the project QAPP (and FSP, if used) to determine if additional project-specific data *review* requirements apply. Update this checklist to include all such items.

 Examine project data, identifying errors in data entry, storage, calculation, reduction, transformation, or transcription.

 Ensure all required sample information is documented and available, in preparation for the verification, validation, and assessment process. This includes pertinent project information concerning blanks, matrixes, temperature requirements, duplicates, preservatives, shipping dates, holding times, chain-of-custody records, etc.

Yes No

- Identify if all required nondirect measurement data (existing data) information *and supporting documentation*, as required by the project QAPP (and FSP, if used), have been received and are available for the verification and validation process.

- Determine if any data deficiencies exist, such as missing data or compromised data integrity, due to issues such as loss in acquisition, storage, or processing.

- Ensure all necessary analytical laboratory support documentation, as set forth and stipulated in the project QAPP (and FSP, if used), have been received from the applicable laboratories.

- Identify programming and/or software related errors, if applicable to the project.

- Ensure that all deficiencies and/or conditions adverse to quality determined during the project data *review* process have been communicated to project management and are listed on this checklist or attached for inclusion in the TRIM record system.

- Verify that a copy of this data review checklist has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional data review actions may be required based on the checklist findings, such as a corrective action plan/reports, etc. The project manager shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

DEQ QAPP/FSP Checklist—Data Verification

The individual assigned in the project QAPP/FSP to perform project **data verification** *shall complete and file this checklist in the appropriate project TRIM system files*. Project personnel are encouraged to expand this standard list, as project conditions warrant.

 Printed Name of Staff Performing Data Verification

 Date Completed

 Project QAPP/FSP Title

 QAPP/FSP TRIM Record #

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Examine and review the project QAPP (and FSP, if used) to determine if additional project specific data *verification* requirements apply. Update this checklist to include all such items.

- Verify that all data completeness criteria, as stated in the project QAPP (and FSP, if used), have been satisfied. This shall include items such as the number of samples, number of QC samples such as spikes and duplicates, and chain-of-custody record continuity.

- Verify that the values of individual data points, and/or comparison calculations such as RPD, meet the criteria specified in the QAPP (and FSP, if used).

- Verify that the required analytical methods, as listed in the project QAPP (and FSP, if used) correspond to the analytical methods employed by the laboratory, as recorded in laboratory reports.

- Verify that QAPP (and FSP, if used) requirements relative to laboratory analytical support documentation have been satisfied by the reporting laboratory, including the correct application of data qualifiers.

- Verify that all supporting information and documentation for nondirect measurement data (existing data) meet the requirements of the QAPP (and FSP, if used). If not, identify any limitations or restriction on the use of such data.

Yes No

- Verify that data and sample collection practices adhered to procedural requirements, to include a review of project logs and field notes, as applicable.

- Verify that sample handling activities conform to QAPP (and FSP, if used) requirements. Examples include sample shipment timelines, sample holding times, preservatives, number of samples obtained, duplicate or split sample frequency, and chain-of-custody documentation.

- Verify that data calculation and handling activities conform to QAPP (and FSP, if used) requirements. Examples include correct use of mathematical formulas and numerical methods, correct use of programs and programing, and correct application of database information transfers.

- Verify that any remaining or unique project QAPP (and FSP, if used) or procedural requirements have been met, and if not, determine the extent to which these requirements failed to be achieved.

- Determine and document any limitations on the use of the project data.

- Ensure that all deficiencies and/or conditions adverse to quality determined during the project data *verification* process have been communicated to project management and are listed on this checklist or attached for inclusion in the TRIM record system.

- Verify that a copy of this data verification checklist has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional data verification actions may be required based on the checklist findings, such as a corrective action plan/reports, etc. The project QAO shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

DEQ QAPP/FSP Checklist—Data Validation

The individual assigned in the project QAPP/FSP to perform project **data validation** shall *complete and file this checklist in the appropriate project TRIM system files*. Project personnel are encouraged to expand this standard list as project conditions warrant.

Printed Name of Staff Performing Data Validation	Date Completed
--------------------------------------------------	----------------

Project QAPP/FSP Title	QAPP/FSP TRIM Record #
------------------------	------------------------

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Verify that the approved current project QAPP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the QAPP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- If the project utilizes a FSP, verify that the approved project FSP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the FSP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- Examine and review the project QAPP (and FSP, if used) to determine if additional project-specific data *validation* requirements apply. Update this checklist to include all such items.

- Evaluate and examine all (100%) of obtained field QC sample results, such as duplicates and trip blanks, etc., followed by assignment (if necessary) of appropriate data qualifiers to these data based on project criteria.

- Review project analytical laboratory reports and data, including the assigned data qualifiers, to evaluate the data quality with respect to the project DQOs. Assign data qualifiers to individual data values as necessary and appropriate.

Yes No

- Review the outcome of the data verification effort to evaluate the impact on data quality with respect to the DQOs.

- Determine, when necessary and where possible, the reasons for any failure to meet methodological, procedural, or contractual requirements and evaluate the impact of such failure on the overall data.

- Compare the project DQOs, as defined in the project QAPP (and FSP, if used), to the data obtained by the project to assess the adequacy of the data (new or existing) in relation to their intended use.

- Determine the extent to which any nondirect measurement data (existing data), and the accompanying supporting information and documentation, meet the requirements of the data user. Specifically, does the quality of the existing data adequately support the needs of the project and support the intended use of the data for the project?

- Determine and document any limitations on the use of the project data.

- Determine the adequacy of the data to proceed on to the data assessment and reconciliation with user requirements phase.

- Ensure that all deficiencies and/or conditions adverse to quality determined during the project data *validation* process have been communicated to project management and are listed on this checklist or attached for inclusion in the TRIM record system.

- Verify that a copy of this data validation checklist has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional data validation actions may be required based on the checklist findings, such as a corrective action plan/reports, etc. The project QAO shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

DEQ QAPP/FSP Checklist—Annual QAO Project Audit

The individual assigned in the project QAPP/FSP as the project quality assurance officer (QAO) shall audit the project on at least an annual basis. The QAO *shall complete this checklist as part of the audit process and file the completed form in the appropriate project TRIM system files.*

Project QAOs are encouraged to expand this standard list as project conditions warrant.

Printed Name of Staff Performing the QAO Audit

Date Completed

Project QAPP/FSP Title

QAPP/FSP TRIM Record #

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Verify that the approved current project QAPP (and FSP, if used), including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information for the QAPP (and FSP, if used) has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the QAPP (and FSP, if used) are not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.
- _____

- Verify that the approved and current project documents, such as the project QAPP (and FSP, if used), SOPs, etc., are available to project staff and are in use per project requirements.
- _____

- Determine through review and observation if the project has performed and documented project activities as described and required by the project QAPP (and FSP, if used) such that the needs of the data user are satisfied.
- _____

- Determine if the project QAPP (and FSP, if used) adequately document and describe the actual project requirements such that the needs of the data user are satisfied. If necessary, in coordination with the project manager, initiate project document revision, review, and approval efforts in accordance with the DEQ QMP.
- _____

- Determine if the project analytical requirements are adequately met by the selected laboratory, including use of proper analytical methods and sufficient analytical data support documentation.
- _____

Yes No

- Determine if project sample handling activities are in compliance with the requirements of the project QAPP (and FSP, if used).

- Determine if project field activities are in compliance with the requirements of the project QAPP (and FSP, if used).

- Determine if all nondirect data acquisition associated with the project has been addressed and properly documented in the project QAPP (and FSP, if used).

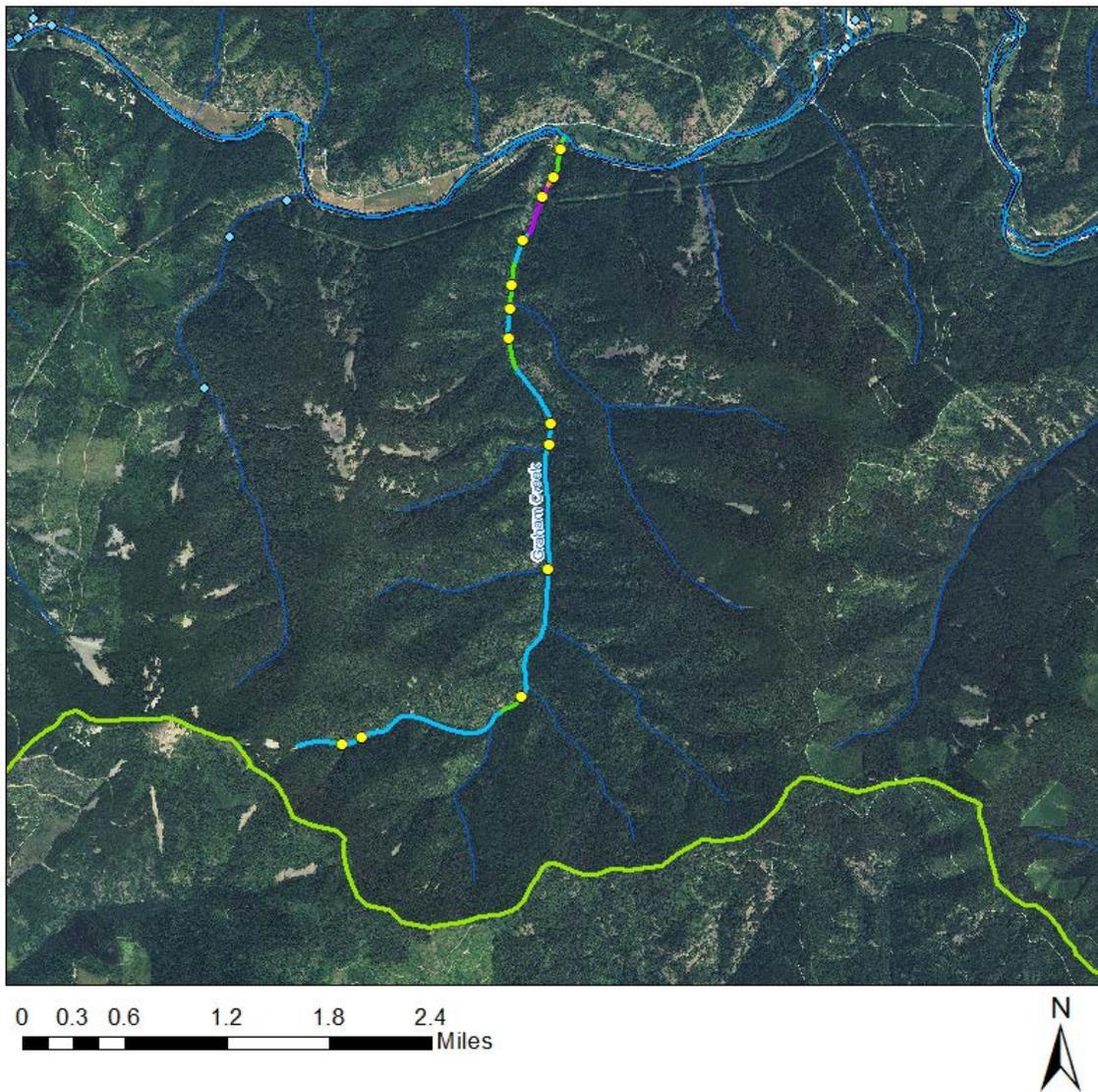
- Compare actual project documents available in the DEQ TRIM record system against the document filing requirements contained in the project QAPP (and FSP, if used). Identify existing deficiencies in the project TRIM system files, such as missing field note pages and missing chain-of-custody forms, and provide this information to the project manager for immediate resolution.

- Ensure that all deficiencies and/or conditions adverse to quality determined during the project QAO audit process are listed on this checklist or attached for inclusion in the TRIM record system.

- Verify that a copy of this annual QAO audit report has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional audit administrative actions may be required based on audit findings, such as a corrective action plan/reports, etc. The project QAO shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

Attachment 1. Candidate Sites



Attachment 2. Equipment List

- Copy of Field Sampling Plan
- Map
- Field form
- Field notebook
- Handheld GPS unit
- Tape measure
- Digital camera
- Solar PathfinderTM
 - Tripod
 - Dome
 - Sunpath diagrams

Attachment 3. Field Form

Solar Pathfinder™ Field-Verification of Shade
South Fork Coeur d'Alene River Subbasin

Date: _____ Observer(s): _____

Stream: _____ Assessment Unit #: _____

Shade Class Interval: _____ Duplicate Site: Yes No

Location Description:

Weather/Other Observations:

Stream Temperature: _____ pH: _____ Conductivity: _____

Additional Photopoints:

Photo #: _____

Description: _____

TRACES

Trace 1: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 2: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 3: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 4: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 5: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 5-Dup: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 6: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 7: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 8: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 9: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____

Trace 10: BF Width (m): _____ Photo #: _____
 Lat: _____ Long: _____