Evaluation of the Foothills Stream Crossing Program's Data Management

Prepared for:

Foothills Research Institute (FRI)
Foothills Stream Crossing Program (FSCP)

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The Forestry Corp.
Suite 101, 11710 Kingsway NW
Edmonton, AB, T5G 0X5
Phone: 780-452-5878
Fax: 780-453-3986

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1. Introduction

1.1 Background

The Foothills Stream Crossing Program (FSCP), provides specialized expertise in assessing (inspecting) and recommending remediation efforts required for watercourse crossings, for the purpose of maintaining and enhancing watershed health. The program provides assessment services for member companies, who through their membership in the program, are committed to undertake the remediation efforts.

In December 2010, Ngaio Baril (FSCP Project Coordinator) and Jerry Bauer (FSCP Program Lead) met with The Forestry Corp. for the purpose of assessing the potential fit of an online mapping application within the scope of the FSCP. During this meeting, the participants collectively determined that prior to proceeding with initiating any online mapping solution, that a more thorough review of the program's data and process flow should be reviewed and evaluated to identify opportunities for improvement. This document summarizes the sources of information used in the evaluation, the current approach, and opportunities for improvement to the current approach.

1.2 Information Gathering and Evaluation

Three progressive information exchange sessions were conducted between FSCP management and The Forestry Corp. During these sessions, we concentrated our efforts on furthering our understanding of the program's purpose, value to its members, current process flow, and known challenges. In addition to these sessions, we worked with the FSCP Project Coordinator (Ngaio Baril) and FRI's GIS Specialist (Julie Duval), to gather information sources and further insight into various components of the program.

The following information sources and components were evaluated to varying degrees as part of our evaluation:

- Foothills Stream Crossing Program – How to: Load Data from the Datalogger Tables to the FSCP_MAIN.mdb database, Version 2010;
- Relevant portions of the document: How to… Operational Inventory Output Report Guidelines;
- Stream Crossing Inspection Manual (Version 2), McCleary, R, et al, 2007;
- Foothills Stream Crossing Program – Inspection Output Report (Crossing 3175);
- Stream Crossing Inspection Form (May 12, 2010, Version 10);
- Watershed Proposed Remediation Plan (Watershed: Pine Creek);
- FSCP Production Databases (FSCP_MAIN.mdb, FSCP_Photos_3.mdb, FSCP_Reports.mdb);
- FSCP Data Preparation Database (FSCP_Loading.mdb,);
- FSCP Data Loading Database (FSCP_Loading_GIS.mdb);
- FRI Production Geodatabases (HydroNetwork, FMFFishWatershed); and
- FRI Fish and Watershed Allegro CX datalogger with FSCP "STRCROSS" data collection application;

The information collected during the above sessions and through investigating the above sources, provided the basis for our evaluation and the contents of this summary document.

2. Current Process

The current process applied to complete one annual cycle of the FSCP is summarized within this section for the purposes of portraying our understanding and for referral through the rest of this document. The summary is not intended to serve as a step-by-step guide, which one would follow operationally, but rather to highlight the program's critical steps and components.

Figure 1 illustrates the current process, and identifies the phases described within this section (1 – 10). Each step within the ten phases has been color coded to indicate the individual/role responsible for its completion.

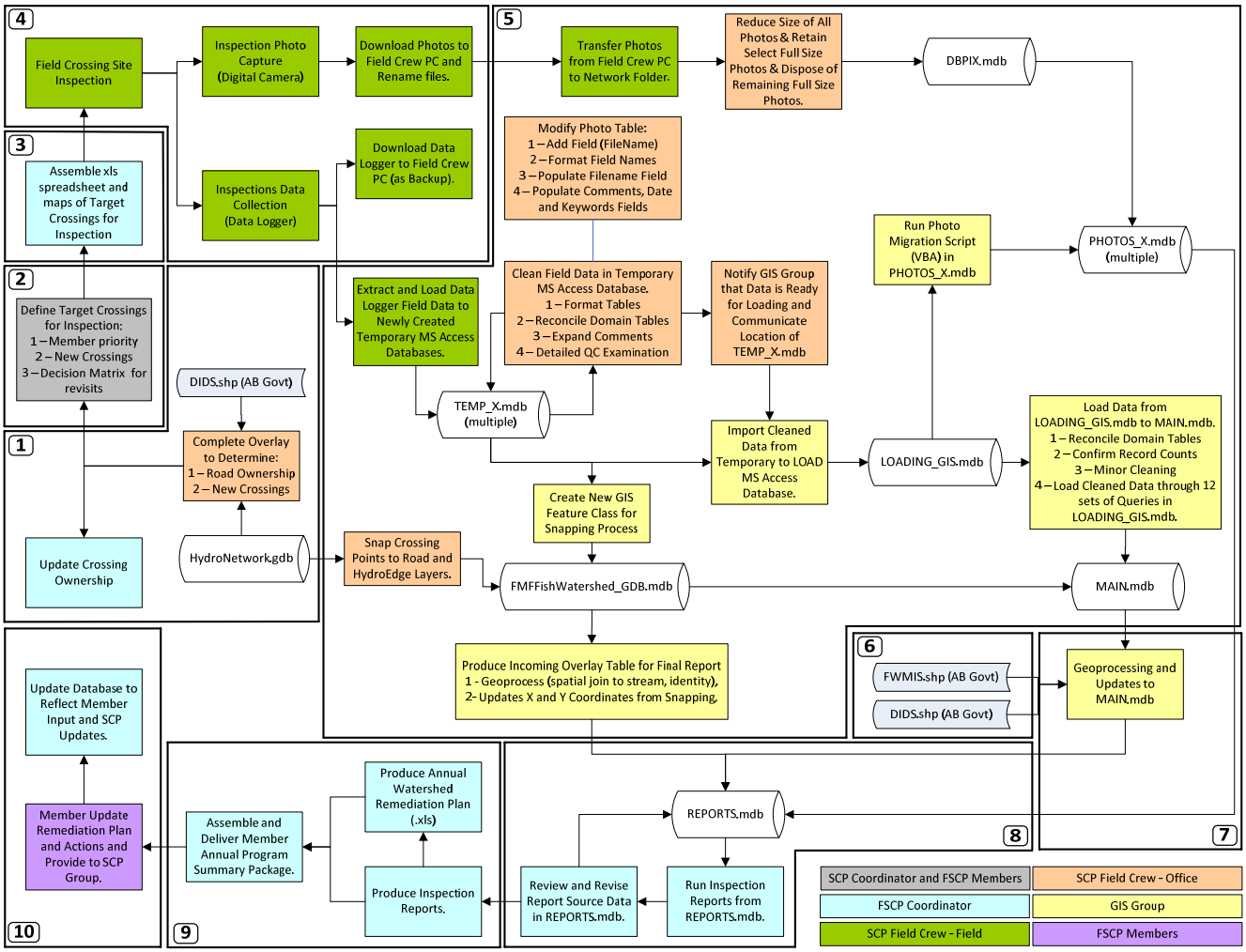

Figure 1. Current process flow diagram.

2.1 Site Selection Preparation

In preparation for the selection of crossings to inspect during a program year, new sites must be identified and the ownership of new and existing sites must be confirmed.

The identification of new sites is achieved through completing a spatial overlay of the stream lines contained within FRI's HyrdoNetwork geodatabase and the road lines (converted from polygons) contained with the Alberta Government's Digital Integrated Dispositions (DIDs) layer.

The confirmation and update of the crossing ownership (equivalent to the ownership of the road on which the crossing is contained) is achieved through a reconciliation process completed through comparing the company assigned to the crossing (or road) in the FSCP_MAIN.mdb with the information contained in the DIDs layer.

2.2 Site Selection

The process of site selection for a program year is dependent on: 1) Program members' priority and budget; 2) new crossings that have been identified; and 3) scheduled re-inspection timing assigned to each existing crossing (Figure 2).

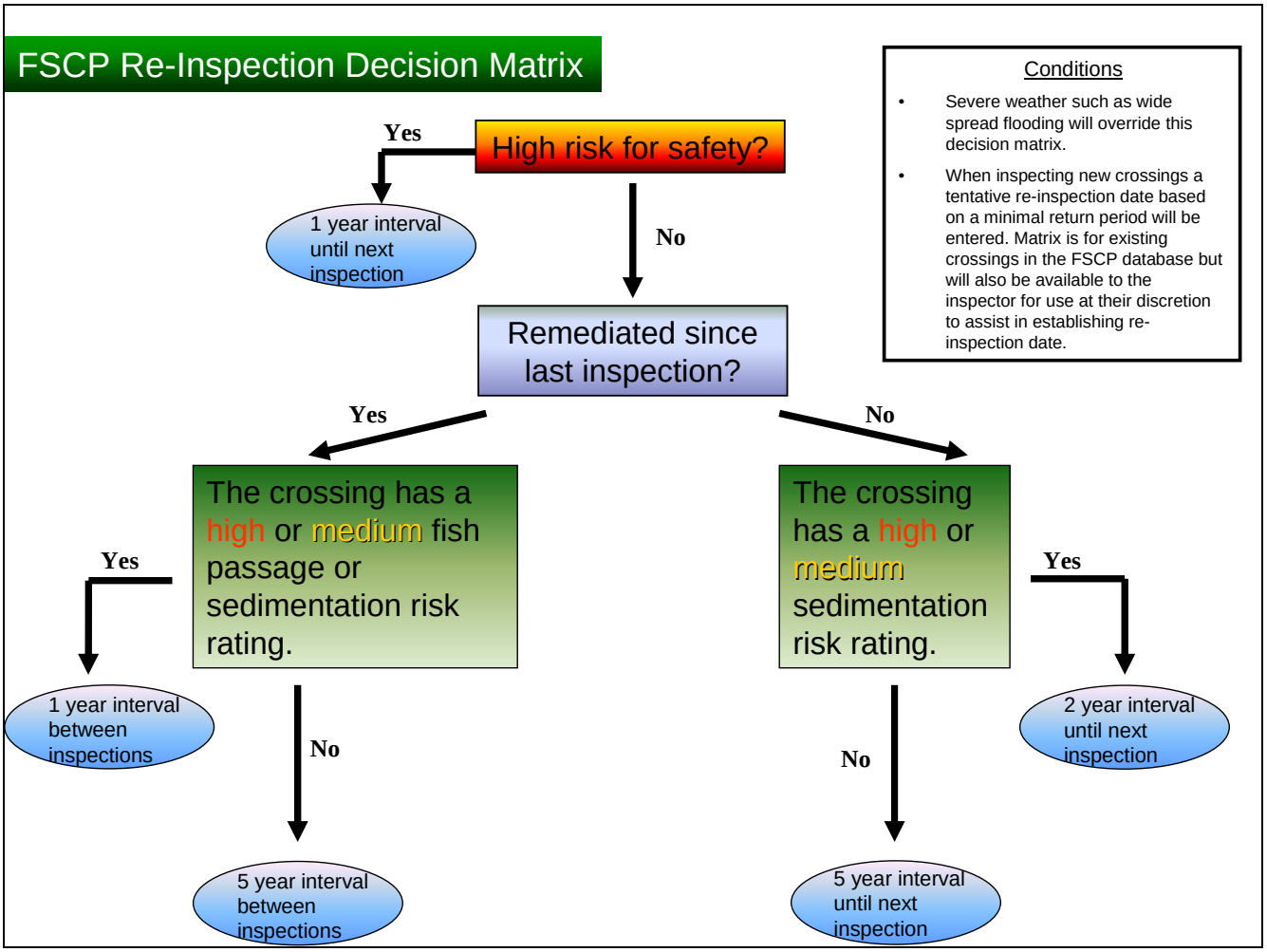

Figure 2. FSCP Re-inspection decision support process.

2.3 Field Package Preparation

Once the sites to be inspected have been established, the FSCP Project Coordinator will prepare an MS Excel spreadsheet listing the sites along with which crew will be responsible for completing the inspection. In addition, the FSCP Project Coordinator will prepare a map showing base layers (roads, streams, survey grid, etc.) and the crossings scheduled for inspection, along with their temporary assigned unique ID label.

The FSCP Project Coordinator will distribute the field packages to the crew, who will use these packages to locate their crossing inspection sites and to track their progress in completing the inspections assigned to them.

2.4 Field Data Collection & Backup

2.4.1 Attribute Data

Attribute data collected during the crossing inspections is captured using a data logger (currently Juniper Systems Inc. Allegro), or on the Stream Crossing Inspection Form, when the data logger is not available for use. Installed on the data logger, and developed and maintained by FRI technical staff, is the STRCROSS application, which provides for the entry of the inspection data with data quality control through limiting the user to values contained in picklists, where applicable.

Using the STRCROSS application, the user starts by selecting a crossing (the parent) and navigates through, and populates, some of the parent's child forms (ie. SCP_LOCA, SCP_BRDG, SCP_CULV, SCP_FISH, SCP_SAFE, etc.), which correspond to the sections contained on the Stream Crossing Inspection Form. Not all of the child tables will be populated at any given crossing (ie. if the crossing type was a bridge, as opposed to a culvert, the SCP_BRDG should be populated, while the SCP_CULV should not be populated). The spatial location of the crossing is captured in the data logger through manually entering the east and north coordinates returned from a GPS unit that the field crew carries.

Attribute data collected on the data logger is not subject to a formal backup regime across the crews, but each crew downloads all the data contained on their respective data logger to the local drive of the crew's PC that accompanies them during the field season. It is up to the crew to complete these downloads at their discretion, and there is no additional redundancy of the data beyond the local drive of the crew's PC.

2.4.2 Photographs

At each inspection, six photos of pre-defined perspectives (ie. view of road to the left of the upstream direction, view of road to the right of the upstream direction, crossing structure inlet, crossing structure outlet, etc.) are required to be captured by the crew. At the crew's discretion, additional photos can also be captured. The photo capture form is accessed directly from the SCP_LOCA child form for each crossing and provides for the entry of the digital camera photo identifier (as assigned by the camera) associated with each of the six pre-defined perspectives.

The photos are downloaded from the field crew's camera to the local drive of the field crew's PC that accompanies them during the field season. It is up to the field crew to complete these downloads at their discretion, and there is no additional redundancy of the photos beyond the local drive of the crew's PC. Once the photos are downloaded from the camera to the crew's PC, the files are re-named according to clearly defined protocols.

2.5 Data Transfer, Cleaning and Loading

This section presents the current process for transferring, cleaning, preparing and loading the attribute data, spatial data and the photos, and is broken down according to the responsibilities of the FSCP crew and the FRI GIS group.

2.5.1 FSCP Crew

2.5.1.1 Attribute Data

At the end of the field season, the inspection data collected by each crew is transferred from their respective data logger to the FRI network. This is achieved through connecting the data logger to a PC and running the specific transfer application installed on the PC. This application transfers the data from the data logger to the

PC, in database table format (dbf). Currently the FSCP utilizes two models of the data logger, each requiring different transfer process and returning differently formatted tables.

Each of the crew's dbf tables are imported to their own newly created temporary MS Access database, for the purpose of preparing them for subsequent loading into the FSCP's production databases. The crew undertakes table formatting (re-naming of table fields), expansion of the data contained within the "Comments" fields and an extensive manual review and revision of all data in all the tables (focusing on missing information, errors, and suspicious values).

2.5.1.2 Photos

The photo table transferred from the data logger requires significant formatting, as well as population of the "Filename", "Date" and "Keywords" field and expansion of the contents of the "Comments" field.

The crews transfer the field photos from their field PC to the application DBPIX on FRI's network, and process and prepare them for alignment and subsequent loading into the FSCP's production database(s). If the photos have not already been re-named, then this step is completed. All of the photos are reviewed to: 1) Assess value for retaining in high resolution; 2) ensure adequate quality; and 3) where required, adjust orientation to accommodate the report templates. Those photos that may potentially be used for presentation or promotion purposes, are copied and stored to a different location at their high resolution. Photos that are of insufficient quality (ie. blurred), are discarded, and those that are not oriented correctly for inclusion in the reporting templates are re-oriented. The remaining, and re-oriented images, are then reduced in size to achieve a manageable report for distribution.

2.5.1.3 Spatial Data

The GPS east and north coordinates transferred from the data logger are assembled within the UserPoints feature class within the FMFFishWatershed_GDB.mdb by the GIS group in preparation for the review and adjustment by the crews. The crews review each crossing location and adjust their spatial position through a process known as "snapping" to align with the intersection of the road and the stream spatial data.

2.5.2 GIS Group

Once the crews have completed their preparation of the attribute data, photos and spatial data, they notify the GIS group that these components are ready for them to load into the FSCP's production databases.

2.5.2.1 Attribute Data

The cleaned and formatted attribute data tables contained within the crew's temporary MS Access database are imported to the FSCP_LOADING_GIS.mdb database, which contains table linkages to the tables of the FSCP_MAIN.mdb database. The GIS group first reconciles any new domain table values that have been added by the field crews to those contained within the FSCP_MAIN.mdb. Next, they run through a series of twelve sets of queries that undertake the necessary linkages and transformations to load the FSCP_MAIN.mdb database with the data contained in the crew's temporary MS Access database. Following this loading process the GIS group undertakes a review of the data to ensure that the expected number of records have been added and that the loading process was successful. The GIS group may also undertake minor data cleaning tasks if required.

2.5.2.2 Photos

Within the current FSCP_Photos_X.mdb database (there are multiple photo databases as MS Access databases have size limitations that have been exceeded by the current photo set of the FSCP), the GIS group links to the photo table within the crew's temporary MS Access databases (as described earlier, this table has

been reviewed and modified by the crew, most notably, they have re-named the photos and expanded the comments associated with each) and to the CrossingSurvey table in the FSCP_MAIN.mdb. Next, the GIS Group executes a Visual Basic Application (VBA) module contained within the current FSCP_Photos_X.mdb database. The execution of this module results in the importing of the photos from the DBPIX database into the Photos table in the current FSCP_Photos_X.mdb database.

2.5.2.3 Spatial Data

The GIS group is responsible for loading the GPS coordinates into the UserPoints feature class within the FMFFishWatershed_GDB.mdb, for the crews to complete their snapping process (as described in Section 2.5.1.3).

2.6 External Data Incorporation

The end reports generated for the program's members and for assessing watershed health and remediation plans requires the inclusion of data collected or produced outside of the scope of the FSCP. Most notably, these relate to fish inventory and disposition (road) ownership.

The GIS Group secures these datasets and prepares them for inclusion in the upcoming Geoprocessing and Attribute Update phase.

2.7 Geoprocessing and Attribute Updates

Once the FSCP_MAIN.mdb database has been populated with newly collected field data and the linkages to the associated photos, the GIS group undertakes a series of geoprocessing and attribute updates to tables within the FSCP_MAIN.mdb database for the purposes of populating the information for each crossing. These geoprocessing and attribute updates include information associated with fish probability, fish habitat rating, bull trout habitat rating, fish barriers, etc.

2.8 Preliminary Report Production

The FSCP Project Coordinator produces draft inspection reports and reviews them for accuracy and completeness. These reports are produced within the FSCP_Reports.mdb, which contains linkages to the program's FSCP_MAIN.mdb, all the FSCP_Photos_X.mdb databases, FRI's FMFFishWatershed geodatabase, and the DIDS spatial information. The combination of these data sources within the FSCP_Report.mdb database provide the input data for creating the reports, using the report templates contained within this database. The reports are produced using a form contained within the database that provides the functionality for the user to view and print inspection reports for a specific company, from a picklist, and for a specific year by clicking on the button tagged with the available years (these buttons appear to be hard coded for each year of interest).

The FSCP Project Coordinator makes revisions to the data contained within the report through updating the appropriate table (generally a table contained within the FSCP_MAIN.mdb database, which is linked to the FSCP_Reports.mdb database).

2.9 Final Report Production and Distribution

Once the FSCP Project Coordinator is satisfied that the Inspection Reports are accurate and complete, for each member company, they produce all the inspection reports in portable document format (pdf). This set of inspection reports comprises of one of the main program deliverables.

The Watershed Remediation Plan is the other main program deliverable for each member company. This plan is created for each defined watershed within the FSCP. It identifies each crossing that has been inspected within the watershed and provides basic information regarding the crossing and/or the stream on which the crossing resides (ie. disposition, owner, legal location, UTM coordinates, fish probability rating, fish species, stream class, etc.), all of which is exported directly from the FSCP_Reports.mdb database into an MS Excel worksheet (one per watershed). The FSCP Project Coordinator reviews each crossing record's information and inspection report and manually inputs a descriptive summary of any issues and remediation recommendations for consideration by the crossing owner.

For each member company, their individual inspection reports (in pdf format) and the watershed remediation plan, listing only their crossings (in MS Excel format), along with a shapefile containing the spatial location of their crossings, are assembled by the FSCP Project Coordinator on DVD, and delivered to the member company. Depending on the company, a risk rating map may also be included in the distribution package, identifying the risk level of the crossing for safety, sedimentation and/or fish passage.

2.10 Remediation Efforts Capture and Reporting

Upon receipt of the FSCP deliverables, the member companies review the FSCP deliverables and in particular the remediation recommendations, and input their response to the recommended remediation efforts proposed by the FSCP Project Coordinator into the MS Excel file (including description of activity, timing and whether these activities will require in-stream/in-channel work). In addition to the member company responding to what remedial measures they plan to undertake, they also have the opportunity to report on what remedial measures they have accomplished (within the Work Completed section of the worksheet). The FSCP Project Coordinator will review the responses to this and validate it, and in many instances will update the information in this section based on field reconnaissance or discussions with the member company representatives.

Upon receiving the member companies responses and incorporating them into the FSCP_MAIN.mdb, the FSCP Project Coordinator compiles an updated Watershed Remediation Plan for each watershed, and submits it to the Alberta Government.

3. Opportunities for Improvement

This section identifies opportunities for improving particular aspects of the current process, as described within Section 2. While we have identified these opportunities, it is worthwhile to note that the current process does not appear to have any critical failings and that it could continue to serve the FSCP's members with the current level of products with the current level of effort for the foreseeable future. However, given our understanding of the FSCP's management's desires for progressing the program's profile and value to its members, we have presented the opportunities for improvement below.

For each of these opportunities, we have specified which phase of the current process they would impact, how they would do so, whether they have dependencies, their overall effectiveness on improving the current process, our assessment of their priority, an approximate assessment of the effort (cost) of undertaking each, and an approximate timeline for their completion.

The order of presentation of the opportunities is not intended to align with the current process flow illustrated and described within Section 2, but rather it is presented based on the priority and overall impact the opportunity would have to the current process and the value to the member companies and the program team.

3.1 Opportunity Identification and Description

3.1.1 Data Collection, Backup and Transfer

The data collection, backup and transfer process and protocols should be identical among the crews, and should be clearly documented to smoothly facilitate personnel transitions at both the project level and/or the field crew level. The adherence to a single type of data collection device and software, along with consistency among the field crew PCs would be the first step to achieving this. This would provide for the ability to execute data transfers that would be consistently formatted (ie. table and field names and properties), which requires a more simplified (less error prone) approach for the subsequent data loading process.

Additionally a robust backup regime should provide additional data redundancy beyond the field collection device and the field crew PC, and should ultimately include downloads to FRI's network.

3.1.2 Field Data Validation

In an effort to improve the quality of the attribute data collected during the crossing inspections, and to reduce the level of effort (and potentially uncertainty) associated with quality assurance review and updates/corrections following the field season, additional validation should be incorporated into the process. As described in Section 2.4, the current field data validation within the STRCROSS application is achieved through the use of picklist controls within the data entry interface. Further development of validation functionality into the STRCROSS application was investigated as part of the scope of this project, and we concluded that the effort to implement such validation appears to be cost prohibitive, when compared to the cost of re-developing the field data collection program (including a real-time validation component).

The field data validation we are recommending would be completed by the crew as part of the process when data is transferred from the data logger to the crew PC. Once the data is downloaded the crew would run a newly created utility to review the data and identify errors or potential data that the crew would need to investigate. This approach would permit the crew to review and correct (or confirm) data values flagged by the utility, while the information they collected during the inspection is fresh in their mind, or while they still may be able to logistically re-visit the crossing. In addition, the proper development and implementation of this validation process should dramatically reduce the amount of effort required to complete the current manual quality assurance review and revision process at the end of the field season.

3.1.3 Production Database Structure

In order to accommodate an online application for viewing spatial and attribute data and photos (as described in Section 3.1.4), these datasets need to reside in a database structure other than MS Access. This does not mean that the FSCP's production data cannot be stored in its existing MS Access databases, but in order to do so, a form of linkage or update process between the MS Access databases and that which the online application interacts with would need to be established.

The total migration of the FSCP's production databases from MS Access to an enterprise database that interacts with an online application, represents a more involved undertaking. This solution would simplify the data storage (attribute, photo and potentially spatial), but would require the re-development of the data loading process (as described in Section 3.1.6) and the means to access the data through a tool/application that would permit the FSCP management to readily connect to this database for the purposes of interacting with their data (ie. creating and running ad-hoc queries).

3.1.4 Static Online Viewing Capabilities

Implement an operational on-line spatial viewing application that provides authorized users (member company representatives and FSCP management) the ability to view the spatial location of their respective crossings, and the associated attribute data, actual formatted pdf reports, and the photographs. This application would contain a standard set of base layers (ie. road, stream, legal survey, etc.), as well as crossing and watershed layers, which could be dynamically displayed according to their attribute information from the most recent inspection and/or updates to the remediation data (ie. all crossings that don't require attention would be displayed as green dots, while all crossings that require attention would be displayed as red dots).

Since this opportunity would provide the member companies access to inspection results and remediation plans online, the effort currently required to assemble and distribute this information to the member companies on an annual basis may be reduced (or eliminated).

3.1.5 Data Collection Device and Software

Based on conversations with FSCP management, they plan to replace one or both of the data logging devices currently used by the field crews. As stated in Section 3.1.1, consistency among the data collection devices and the software is important for achieving a simplified and consistent data loading process.

While the FSCP data collection requires robust devices, such as the costly Allegro, there are other options available and should be considered, such as one of the less costly tablet hardware devices. While these devices do not compete or compare to the Allegro in terms of their "ruggedness", they open up options for simplified development of highly configured data collection software (including data validation and data transfer modules) and the integration of cameras, and in some cases, GPS receivers, both of which are utilized in the FSCP program field data collection, and could be integrated directly into the application.

While re-development of a data collection application requires significant up-front investment, it provides time savings associated with data validation, transfer and simplification of the data loading process.

3.1.6 Data Loading Process

The current data loading process, starting after the data has been transferred from the collection devices (data logger and camera) and ending once the data has been successfully loaded into the FSCP's production databases, appears to require more effort than may be necessary. While not a comprehensive list, this additional effort can be attributed to: 1) Minimal automated data validation, requiring extensive manual review and quality assurance efforts; 2) Inconsistently formatted data due to the different data logger devices and software, requiring reconfigured queries to maintain and execute; and 3) The complexity of the photo storage and the process of preparing the photos for linking to the report database.

The current process of loading the cleaned field data and prepared photos to the FSCP's production databases, is performed through the manual execution of a series of queries. Overall, this approach and any attempts to make it more efficient would be dependent on changes to the format of the data for loading and the database ultimately receiving the data.

If the production databases are retained in MS Access format, it is likely that some modifications to the queries could be undertaken to further reduce year-to-year maintenance, and that the entire series of queries could be executed through a module contained within the main database or the loading database.

If the production databases were migrated to an enterprise database, new loading queries would be optimally developed for the cleaned data and the prepared photos. Ideally, a small utility would be developed to manage the loading process, including: 1) Identification of where the cleaned data and photos are located; 2) reconciliation of domain table values; 3) identification of potential issues encountered in the loading process, to the extent that they can be pre-defined and incorporated; and 4) any processing or calculations that could be

incorporated (ie. fish ratings). In addition, the enterprise database would provide the capacity to store all the programs photos within the same database as the attribute data, as opposed to the current approach, which utilizes a growing number of MS Access databases.

3.1.7 Road Layer and Ownership Updates

Tracking road location and road ownership changes is an important component for the FSCP program under its current process as this information is the source of determining: 1) New crossings locations and ownership, and 2) ownership changes to existing crossings. If the FSCP adopts an online viewing medium, the road ownership information would logically form the linkage between who would be authorized to view (and potentially edit) crossing information (ie. if the database incorrectly represents a road as owned by Company A, when it is really owned by Company B, Company A could view the crossing information, while Company B could not, and if there are less than favourable findings in the crossing information, the representatives from Company B may be unsatisfied with the application or the FSCP management). Given this, the FSCP management should commit to regularly scheduled road and ownership updates and that the member companies are aware and accepting of the process and update timelines.

The road location and road ownership information are derived from the Government of Alberta's DIDs layer. This spatial layer contains all dispositions in polygon format, while the FSCP requires the spatial road data in line format for completing their processes. A consistent process for converting road polygon data to line data should be established and automated, to the extent that it can be.

3.1.8 Incorporation of External Data

In the current process, there are several external data sources that are utilized to populate the FSCP production databases. Examples of these include: 1) Fish probability and species for a given stream; 2) stream barriers; and 3) geographic location description – coordinates and Alberta Legal Survey Grid location.

The external data sources used to populate the FSCP production databases should be linked directly to the database and where processing of these data sources is required to determine the values for the production databases, automated processes should be developed. The value in formalizing the process for incorporating external data is realized in the consistent determination of the values as well as the reduced time in assembling and updating them to the databases.

If the incorporation of external data was to be automated, there may be a need to design its incorporation as to not revise information that was distributed on current reports.

3.1.9 Animated Online Viewing Capabilities

Reliant on the implementation of an operational on-line spatial application, animated processes could be incorporated within the interface to display changes to crossings and watersheds overtime, ideally, highlighting the value that the FSCP is returning in terms of the management of the water resource. The underlying database would contain the historical attribute data associated with spatial data (ie. crossing, watershed, stream, etc.), and the process would return the state of these spatial shapes at pre-defined steps in time for a defined duration. Depending on the exact type of information desired by the FSCP management, this functionality could contain components for public or authorized user access. The public access would logically contain a subset of the information (ie. watershed) such that no particular crossing could be associated with a particular member company.

3.1.10 Online Data Entry Capabilities

Reliant on the implementation of an operational on-line spatial application, data entry and edit functionality could be developed within the application, providing edit-authorized users to modify certain attribute information. The

most logical starting point for the edit functionality from the members' perspective appears to be that associated with their response to the remediation action recommendations for individual crossings, which have traditionally been input into a MS Excel worksheet and returned to the FSCP Project Coordinator for entry into the main database. Provision of data entry and edit capabilities represents a risk to the overall integrity of accessible (or impacted) data, and therefore the associated business process needs to be clearly established and controls implemented within the application to protect the data.

The implementation of any online data entry/edit functionality realistically requires that the FSCP's production databases be migrated from MS Access to an enterprise database solution. The rationale for this is associated with the challenges posed by keeping the two databases synchronized. While anything is possible, the effort required to successfully address the synchronization issue would likely be unwarranted.

3.1.11 Data Collection – Reporting Turnaround Time

With the implementation of the online viewing capabilities, and a streamlined data collection and loading process, the potential for providing shorter turnaround time on reports for members to view exists. The shorter turnaround time would provide the member companies with the inspection results sooner and allow them to proceed with remediation efforts sooner.

3.2 Opportunity Linkages, Ratings, Budgets and Timelines

This section presents the opportunities for improvement identified and described above in a tabular summary where for each opportunity, linkages to the current process, dependencies on other opportunities, rating of potential degree of improvement, rating of priority for undertaking and estimated effort (value) range for undertaking are summarized (Table 1). The "Opportunity Dependency" column illustrates the connection between the opportunities, and can mean either: 1) That the opportunity cannot proceed without completing the dependency; or 2) that the approach and effort required for implementing an opportunity is dictated by the approach of the dependency. The "Estimated Effort Range ($)" column represents the effort (or value) of undertaking the individual opportunities, without full knowledge of the approach for undertaking the other opportunities (ie. if opportunity #2, Field data validation, is undertaken, the direction of opportunity #6, Data loading process, would be different than if opportunity #5, Data collection device and software, was undertaken).

Table 1. Opportunities for improvement summary.

ID	Opportunity for Improvement	Current Phase Impacted[1]	Opportunity Dependency[2]	Overall Improvement Rating[3]	Priority Rating[4]	Estimated Effort Range ($)[5]
1	Data collection, backup and transfer	4, 5	5	1	1	1 - 2 K
2	Field data validation	4, 5	1, 5	1	1	6 - 8 K
3	Production database structure	1, 5, 7, 8, 9, 10	N/A	1	2	5 - 8 K
4	Static online viewing capabilities	9, 10	3	1	2	12 - 20 K
5	Data collection device and software	3, 4, 5	N/A	1	2	10 - 17 K
6	Data loading process	5, 6	2, 3 or 3, 5	1	2	4 - 10 K
7	Road layer and ownership updates	1, 7, 8	N/A	2	3	2 - 4 K
8	Incorporation of external data	1, 6, 7	N/A	3	3	1 - 3 K
9	Animated online viewing capabilities	N/A	3	2	3	4 - 7 K
10	Online data entry capabilities	10	3	3	3	3 - 7 K
11	Data collection - reporting turnaround time	4, 5, 7, 8, 9, 10	1, 2, 3, 6, 8	3	3	1 - 3 K

1 - Numbers refer to the phase as defined in the Current Process section of this document.

2 - Numbers refer to the Opportunity defined within the Opportunities for Improvement section of this document and the ID in this table.

3 - Qualitative ranking (1 - 3), assigned by TFC based on knowledge of current process and potential improvement to the process and value to the FSCP's participants.

4 - Qualitative ranking (1 - 3), assigned by TFC based on knowledge of the current process with focus on the risks and the values to the FSCP's participants.

5 - Estimated effort range, assuming that work was performed external (non FSCP personnel), at day rates ranging from 650 - 900/day.

The same uncertainty associated with estimating the effort required to undertake and implement the opportunities presented, makes it difficult to forecast timelines for their completion. Given our current understanding of the FSCP's field collection and reporting timelines and those associated with the program's fiscal year, we provide initiation and completion timelines (presented as months in which the opportunity would be completed during that month) for groupings of opportunities as we would see them (Table 2). These timelines are presented for consideration, should the FSCP's management wish to engage The Forestry Corp. to undertake some of the opportunities identified within this document.

Table 2. Opportunities for improvement timeline summary.

ID	Opportunity for Improvement	Overall Improvement Rating[3]	Priority Rating[4]	Estimated Effort Range ($)[5]	Initiation Timing (month-year)	Completion Timing (month-year)
1	Data collection, backup and transfer	1	1	1 - 2 K	Mar-11	Mar-11
2	Field data validation	1	1	6 - 8 K	Mar-11	Mar-11
3	Production database structure	1	2	5 - 8 K	Mar-11	Apr-11
4	Static online viewing capabilities	1	2	12 - 20 K	Mar-11	Apr-11
7	Road layer and ownership updates	2	3	2 - 4 K	Mar-11	Apr-11
8	Incorporation of external data	3	3	1 - 3 K	Jun-11	Apr-11
6	Data loading process[1]	1	2	4 - 10 K	Mar-11	May-11
5	Data collection device and software	1	2	10 - 17 K	Apr-11	Jun-11
9	Animated online viewing capabilities	2	3	4 - 7 K	Jun-11	Sep-11
10	Online data entry capabilities	3	3	3 - 7 K	Jun-11	Sep-11
11	Data collection - reporting turnaround time	3	3	1 - 3 K	Jun-11	Sep-11

1 - May-11 completion timing assumes that the current hardware and software are utilized (not a new device and new program).

4. Conclusion

The information presented in this document was assembled for consideration by the FSCP's management for the purpose of identifying and potentially implementing improvements to their current data management flow.

To this end, The Forestry Corp. has identified eleven opportunities for improvement. These opportunities for improvement range significantly in the amount of effort required to implement and the extent of overall improvement to the process. Many of them are linked with others where the value of implementing them together exceeds the sum of implementing them independently.

The Forestry Corp. welcomes the opportunity to provide additional insight into the opportunities for improvement, as presented in this document, and to potentially be involved in their implementation.

For additional information, please contact:
The Forestry Corp.
101-11710 Kingsway
Edmonton, AB
T5G 0X5
(780) 452-5878
www.forcorp.com

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