



CLIMATE CHANGE ADAPTATION PROGRAM

Integrated Farm Water Planning Project Phase 2

Report

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Integrated Farm Water Planning Pilot Phase 2

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Executive Summary

Economic Development Cowichan retained Kerr Wood Leidal Associates Ltd. (KWL) in September 2014 to conduct pilot testing of a toolkit to assist agricultural producers in the region with planning for future water needs. Pilot testing is the second phase of the Integrated Farm Water Planning Pilot Project, one of several priority projects arising from the *Cowichan Regional Adaptation Strategies*, which were developed collaboratively by local government, Ministry of Agriculture and agriculture sector partners, with core management and human resources provided by the BC Agriculture and Food Climate Action Initiative. The Farm Water Planning Toolkit was developed in the first phase of the project, completed in spring 2014.

The overall project objectives are to:

1. Increase awareness of the potential impacts of climate change on farm-level water management in the Cowichan Valley Region;
2. Develop a practical and integrated approach to farm-level planning to improve all aspects of farm water management (e.g., Water supply, Storage, Irrigation, Drainage, etc.); and
3. Increase the ability of farmers to produce successfully under increasingly variable cycles of heavy precipitation and drought.

This report summarizes the second phase of the project, including a summary of pilot testing of the materials developed in the first phase, overall findings, and recommendations for refinement and further use of the Toolkit. This report serves as a companion to the *Cowichan Integrated Farm Water Planning Pilot Phase 1 Final Report* (KWL, 2014).

Methodology

The general project workflow is illustrated in the following figure. An initial test of the toolkit was completed September 2014 at consulting team member David Tattam's farm, and pilots were conducted in November 2014 and February 2015. Nine farms were visited in total, including the initial test.



In the preparation phase, pilot candidates were identified in consultation with the client's Project Management Team. Pilot candidates were selected with the aim to maximize the diversity of conditions to be assessed in the pilots. A consultant team meeting and a full initial test of the toolkit was then conducted to refine the planning process. For piloting, no more than two farm visits were scheduled per day to ensure sufficient time to complete the process. The interviews were conducted by various members of the consulting team, with one team member participating in all pilots for consistency. The results and observations from pilot testing were incorporated in recommendations for refinement and further implementation of the Toolkit.



Findings

Pilot Sample Characteristics

The nine farms included in the Farm Water Planning Pilot represent a combined 411 ha, 6.4% of the 6,431 ha total area in cultivation in the Cowichan Valley Regional District¹. The nine pilot farms included 149 ha under irrigation, which is 9.4% of the 1,593 ha total irrigated area in the region. The pilot farms also reasonably represented the diversity of agricultural land uses and geographic distribution of agriculture in the Cowichan region.

Level of Effort and Competencies

Completing the farm water plans required substantially more time and effort than anticipated. On average, the complete process of preparing a Farm Water Plan during the pilot project required 11 to 18 hours. Although this level of effort would likely decrease with a planner's experience with the process, toolkit and resources, a total time budget of 10 to 15 hours plus travel time would likely be necessary to complete a Farm Water Plan using the piloted toolkit and planning process. Revisions to the toolkit and delivery process will be necessary to reduce the level of effort and improve cost-effectiveness of the planning process. In particular, conducting an initial scoping and preparatory interview with the producer by telephone and improving tools and facilitator skills for quick assessment of irrigation water use and efficiency have good potential to improve the efficiency of the process. However, some time must be spent in the field to validate information obtained in the producer interview. Ultimately, the processes of discovery, analysis and developing strategies take time, and it may not be practicable to reduce the overall level of effort below 8-10 hours to develop a useful water plan for a larger or more complex farm. Of this, only 2-3 hours of a producer's time would typically be required.

It would not be practicable to rely on a self-assessment process for farm water planning. Conducting a Farm Water Plan relies on a combination of technical knowledge and facilitation skills. Core competencies of the planner include general water engineering expertise, local agricultural knowledge, and capability to facilitate a purposeful conversation and effectively manage time.

Information Sources and Uncertainty

Direct measurements or records of water use were generally not available, necessitating bottom-up estimates of water demands using published unit demands to estimate overall water needs. The resulting precision of water supply and demand estimates (seasonal totals and peak rates) is in the range of ± 30 -50%. Recommendations are provided in this report to reduce uncertainty in estimates of water supply and demand.

The diversity within the pilot cohort of land uses, topography, water resources, and drainage and runoff challenges resulted in relatively few opportunities to compare and report on typical parameters for farm water use in the region. Needs related to water management were also found to vary widely among the pilot cohort.

Water Management

The combined nominal capacity of the water sources used by the nine producers is approximately 2.5 million cubic metres (Mm^3) per year, and 90 litres per second (L/s) peak flow rate. This estimate is based primarily on

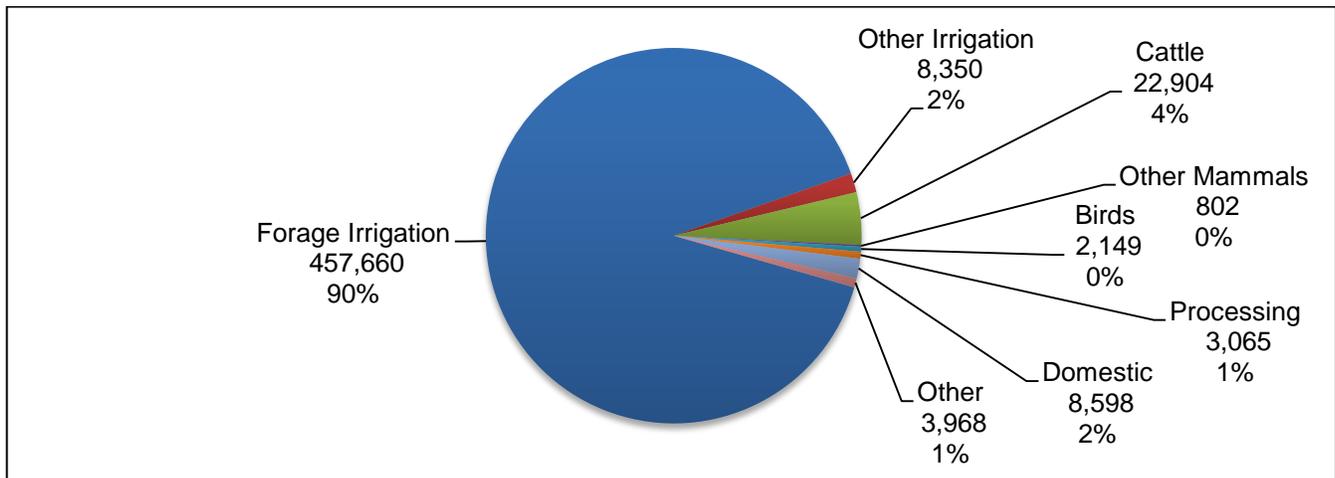
¹ *Agricultural Water Demand Model – Report for the Cowichan Valley Regional District*, Ministry of Agriculture, June 2013



drillers' estimates of well yield, and is highly uncertain. The sustainable capacity of the sources is likely to be substantially lower. All water sources are subject to year-to-year risks of a shortfall due primarily to drought.

The largest agricultural water demand by far is irrigation, which occurs only in late spring, summer and early fall, and peaks in July or August. Water resources are replenished by precipitation that occurs primarily in late fall, winter and early spring, and there is typically little or no useful precipitation between July and September in the Cowichan region. Some form of storage is needed to provide water for plants during the growing season, which may be natural or constructed. Constructed ponds on seven farms in the pilot cohort provide approximately 57,000 m³ of storage. Ponds are typically used for balancing daily or weekly variations in demand; the volume of storage is not sufficient on any of the farms to meet irrigation needs for an entire season.

The large majority of water use among Cowichan farms is for irrigating forage, primarily for dairy cattle. Nonetheless, only 36% of the forage land in the pilot cohort is irrigated. This implies that dairy forage production in the Cowichan region is highly vulnerable to drought. The major dairy producers in the pilot cohort have adapted to drought risk not by developing water supplies to bring more forage land under irrigation, but by buying or leasing available land for forage production. A breakdown of total estimated annual water demands for the 9 farms in the pilot cohort is provided in the following figure.



Estimated Annual Water Demands of Pilot Participants (cubic metres)

The *Agricultural Water Demand Model - Cowichan* (Ministry of Agriculture, 2014) indicates that the water need for irrigated farmland should be more than double what is estimated for the pilot cohort using the Farm Water Planning Toolkit (using the BC Ministry of Agriculture *Irrigation System Assessment Guide* methodology and assumptions). Although the method used by the Toolkit may underestimate water demands, the primary factors leading to the discrepancy likely include the following:

- The Water Demand Model is based on the assumption that crop production will be maximized through the entire growing season, while Cowichan producers typically only irrigate as required to finish a second cutting of hay (by mid-July); and
- The Water Demand Model assumes soils in the root zone drain freely, while high water table in some lowland areas of the Cowichan provide water to the root zone without irrigation.

Seven of the nine farms in the pilot cohort have significant issues with drainage and/or runoff. With the exceptions of aging and uncontrolled tile drains, the drainage and runoff issues are outside producers' direct control. Four of the nine farms in the pilot cohort have tile under-drains in some fields.



All water sources are vulnerable to changes over time, although the risk levels and causes vary. Producers in the pilot cohort were generally unprepared to address the range of future challenges for their farms and operations. However, strategies identified in the pilots can help them build resiliency.

Key Issues

The following key issues with farm water management were identified through the nine pilots:

- Information gaps and inaccuracies;
- Groundwater vulnerability;
- Risks with all types of water source: Over-allocation, cost and consecutive droughts;
- Water quality for domestic use (insufficient treatment);
- Runoff water quality risk;
- Lack of measurement;
- Uncertain irrigation efficiency; and
- Reliance on dryland forage.

Recommendations to Producers

Recommended strategies to producers fall into the following general themes:

- Water Resources: Obtain well records, apply for licenses for existing surface water sources, and test or monitor to determine sustainable well yields;
- Storage: Construct in natural low and flood-prone areas, or improve existing;
- Water Quality: test wells, treat as required, and monitor runoff quality;
- Water Use: Consider an irrigation assessment, use drought-tolerant seed varieties, adjust and schedule irrigation correctly; and
- Drainage/Runoff: Consider engineered improvements, engage with local authorities, maintain ditches, and implement EFP drainage guide.

Producer Feedback

At follow-up farm visits, producers were asked what was most valuable and least valuable about the Farm Water Planning process, and what recommendations they would most likely implement in the short-term. Producers found several aspects of the process to be useful, particularly including the overall plan provided as a deliverable. Criticism included redundancy of some planning questions in the Toolkit, and the lack of funding to support implementation. The recommendations most likely to be implemented included development of water sources or storage in preparation the *Water Sustainability Act*.

Recommendations for Toolkit Refinement

The following revisions to the Farm Water Planning Toolkit and instructions for its use are recommended:

- Add a short pre-visit phone interview (target 15 minutes) before the farm visit. During the phone interview, ask the Screening Questions from the Toolkit to identify the issues that will be the primary focus of the farm visit.
- Expand the Screening Questions Module to include the following:



- Determine the locations of each farm site that will be included in the Farm Water Plan, including the home farm and any satellite operations (e.g. street addresses and approximate land areas) to enable a suitable map to be prepared for the farm;
- Identify the primary water resources and their characteristics, and major runoff/drainage issues, for each farm site included in the Farm Water Plan; and
- Where municipal water is used for farm purposes, ask the producer to have at least one year of water bills available for the farm visit if possible.
- Add questions and a data table to the Groundwater Sources Module regarding well identification and use, including fields for the following information about each well in the provincial record or in use on the farm:
 - Provincial well tag number, existence of driller's logs, depth and estimated current yield for each for well known to the producer; and
 - Status of each well shown within the farm boundaries in the provincial database.
- In the Drainage Module, request to view a drainage plan prepared by the installer of a tile drain system.
- In the Water Use Module:
 - Include a question asking if the irrigation system was designed by a Certified Irrigation Designer (IIABC CID designation), and if so, request to view the design plan and specifications.
 - Use the following guidance rules to determine if a more detailed irrigation assessment is warranted:
 - The producer is uncertain of the irrigation system flow rate;
 - The producer does not seem confident that the annual water use is within the farm's licenced amount;
 - The flow rate for the irrigation system exceeds 4 US gpm/acre of irrigated area (at 4 US gpm/acre the system would be operated 24/7 during the peak of the season);
 - If the irrigation system is operated for only a few days and covers the entire farm it is likely that flow rates used are excessive; and
 - The calculated annual demand far exceeds 300 mm per year.
- Reduce the domestic demand section of the Water Use Module to include only the number of dwelling units, total number of occupants, and total area of irrigated lawn/landscape (water use will be calculated based on 230 L/cap/d year-round, 300 mm/year for annual out-door irrigation requirement, and 5 US gpm/acre for peak day irrigation).
- In the Future Scenarios Module, omit the Annual Usage and Peak Day Water Balance tables (pages 29 and 30 of the Toolkit), and replace with a water balance worksheet developed for analysis of the pilot data.
- Move the Future Plans questions from the Water Management Gaps Module to the Future Scenarios Module.
- Reduce or simplify the Water Management Gaps Module (consider eliminating questions that were not useful in the pilots, or are repeated from previous modules).
- Revise Water Management Strategies Module to reflect the recommendations made in the pilots, and consider eliminating strategies that were not useful in the pilots.



Implementation

The following potential strategies are provided for ongoing use of the Farm Water Planning Toolkit, to achieve the objectives of the Cowichan Regional Adaptation Strategy, and potentially to achieve broader objectives for supporting sustainable agriculture and water management.

Support for Groundwater Licensing

The Toolkit could serve as a component of a process for implementing monitoring/measuring technologies, benefiting both producers and government by building capacity for improved water resource management. This approach has proven successful for other purposes under the Environmental Farm Plan program, and would support Action 2.1A of the Cowichan Adaptation Strategies.

Farm Water Management Website/App

A website or app version of the Farm Water Planning Toolkit could be developed, including an interactive interface and a Farm Water Management Guide series to support recommended water management strategies, initially including:

- Runoff Water Quality Management;
- Measuring and Recording Water Supply and Use;
- Developing and Expanding Water Storage; and
- Improving Irrigation Efficiency.

This initiative would support further implementation Action 1.3A of the Cowichan Adaptation Strategies, and would improve the efficiency and effectiveness of the farm water planning process. However, it is not expected to replace the need for a facilitated approach in the short term at least.

Coordinated Drainage Management

Coordination is needed between agricultural producers, the CVRD, municipalities of Duncan and North Cowichan, Ministry of Transportation and Infrastructure, Ministry of Environment, Ministry of Agriculture and Fisheries and Oceans Canada on strategies and resources to address drainage, water quality and flood protection issues that impact agriculture and other land uses in the region. A joint planning project supported by most or all jurisdictions, with the involvement of agricultural and stewardship groups, could identify priorities for local or regional projects to improve the management of runoff to the mutual benefit of agriculture, local communities and the environment. This initiative would support Action 1.1A of the Cowichan Adaptation Strategies.

Collaborative Farm Water Planning

The Toolkit could be piloted in a collaborative planning process involving multiple producers and other stakeholders in a local area (typically sharing a common water problem such as supply, flooding or runoff management). This initiative would support further implementation of Action 1.3A of the Cowichan Adaptation Strategies, and may also support Actions 1.1A, 2.1A, 2.3A, 2.4A, 3.1A and 3.4A.

Capacity for Irrigation Assessment and Design

There is an opportunity for Cowichan agricultural groups and supporting agencies to promote the benefits to producers of obtaining irrigation system assessments, and to encourage vendors to maintain a certified local workforce and provide certified design as a bundled service with the sale of all agricultural irrigation systems.



Piloting the effectiveness of irrigation system assessments and upgrades or replacements based on IIABC best practices, including measurement of whole-system efficiency before and after the project, could demonstrate the value of assessment and design by a qualified practitioner and significantly increase the efficiency of overall agricultural water use in the region. This initiative would support Action 3.2A of the Cowichan Adaptation Strategies.

Drought-Resilient Agriculture Research

There is an opportunity for local producer groups to collaborate with universities, colleges and funding agencies in practical research and piloting of drought-resistant forage varieties and other risk-resilient agricultural practices. This initiative would support Action 3.2A of the Cowichan Adaptation Strategies.



1. Introduction

Economic Development Cowichan retained Kerr Wood Leidal Associates Ltd. (KWL) in September 2014 to conduct pilot testing of a toolkit to assist agricultural producers in the region with planning for future water needs. Pilot testing is the second phase of the Integrated Farm Water Planning Pilot Project, one of several priority projects arising from the *Cowichan Regional Adaptation Strategies*, which were developed collaboratively by local government, Ministry of Agriculture and agriculture sector partners, with core management and human resources provided by the BC Agriculture and Food Climate Action Initiative. The Farm Water Planning Toolkit was developed in the first phase of the project, completed in spring 2014.

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- Increase awareness of the potential impacts of climate change on farm-level water management in the Cowichan Valley Region;
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This report summarizes the second phase of the project, including a summary of pilot testing of the materials developed in the first phase, overall findings, and recommendations for refinement and further use of the Toolkit. This report serves as a companion to the *Cowichan Integrated Farm Water Planning Pilot Phase 1 Final Report* (KWL, 2014).

1.1 Context

Cowichan Basin Water Planning and Climate Change

The Integrated Farm Water Planning Pilot Project is one of several priority actions arising from the *Cowichan Adaptation Strategies*, developed by the BC Agriculture & Food Climate Action Initiative in partnership with local and provincial governments, and local producers. The Initiative is supported by the [BC Agricultural Research & Development Corporation](#) and the [Investment Agriculture Foundation](#) with funding provided by [Agriculture & Agri-Food Canada](#) and the [BC Ministry of Agriculture](#).

The *Cowichan Adaptation Strategies* was supported by the Cowichan Valley Regional District (CVRD), and shares several common objectives with the *Cowichan Basin Water Management Plan* and the *Cowichan Area Agricultural Plan*. The Integrated Farm Water Planning Pilot Project also supports the objectives of those plans by building capacity among local producers to effectively manage water resources for long-term farm productivity, environmental needs and other economic and community needs within the basin.

Phase 1 - Farm Water Planning Toolkit Development

In October 2013, KWL was retained to develop farm water planning materials in the first phase of the Integrated Farm Water Planning Pilot project, completed in spring 2014. More than 50 documents were identified, reviewed and catalogued for developing and implementing the resulting Farm Water Planning Toolkit. Three expert stakeholders and nine local producers were also interviewed to provide context for the development of the toolkit.

The toolkit was designed to complement existing water planning resources and programs available to producers in BC, including the Environmental Farm Plan (EFP) process and the irrigation resources published by the Ministry of Agriculture and the Irrigation Industry Association of BC. It was also intended to serve as a fully self-contained and practical resource for assessing and planning water supply, water use and drainage for a farm, or a group of neighbouring farms. The toolkit was designed to guide producers through:

- A careful review of current water resources, systems and practices on the farm;
- An analysis of significant water issues and opportunities; and
- Development of practical strategies to address issues, take advantage of opportunities, and build resilience against uncertain future conditions.

The toolkit consists of a set of questions organized in five modules, and includes resource materials that are used in completing these modules. Although a producer may complete the toolkit as a self-assessment, for pilot testing it is intended that a facilitator (consultant) familiar with the toolkit and resource materials will assist the producer with completing the questionnaire. The structure of the toolkit is illustrated in the following figure.

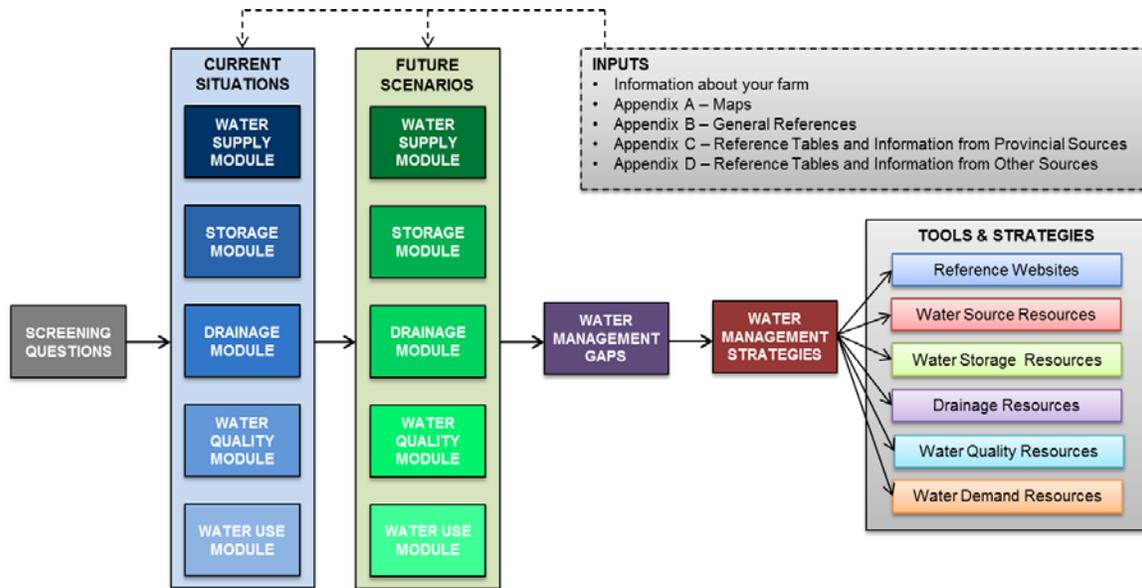


Figure 1-1: Integrated Farm Water Planning Toolkit Structure

As a facilitated interview format, it was anticipated that the planning process would be completed in less than two hours for most individual farms, including a brief field review of irrigation equipment and other water infrastructure on the farm.



1.2 Project Objectives

The objectives of Phase 2 of the Integrated Farm Water Planning Pilot Project are to:

- Through piloting and refining the toolkit in the field with 7 to 12 Cowichan agricultural producers, develop a holistic and integrated approach to farm-level water planning that will improve all aspects of water management; and
- Increase Cowichan farmers' awareness of climate change impacts on farm-level water management, and increase their ability to manage through more variable precipitation, extended dry periods and/or excessive runoff and flooding.

The Phase 2 pilot process aims to evaluate the effectiveness of the toolkit, and of a one-on-one planning approach in general. The results of Phase 2 may be applied to future farm-level water planning initiatives, and strategic public and private investments. As such, the pilot process should support the determination of common water management issues facing producers, barriers to improving water management, options for further work, and broader issues and opportunities identified through the project.

1.3 Key issues

Key technical issues to be addressed through farm-level water planning in the Cowichan region include:

- Need for increased storage capacity to manage through loss of high-elevation snowpack, drier summers and wetter winters;
- Groundwater use and quality, and interaction with surface water;
- Increasing extreme rainfall frequency, compounding existing runoff and drainage issues; and
- Wetter shoulder seasons: planting, finishing and harvesting conditions and nutrient management issues.

In addition to the technical issues, the relatively small size of most farms in the Cowichan region results in a larger number of stakeholders involved in managing land and water resources in a watershed. It is anticipated that solutions to several fundamental water issues will best be addressed collaboratively.

It was necessary to assure producers that information about their farms, water resources and future plans would be held in confidence between the producer and the consulting team, and that their participation would not result in regulatory action or a negative public image for their operations. Each producer was assured that, "all the information gathered about farm operations during the pilot program will remain confidential and will not be released. The information gathered will only be used to improve the Farm Water Planning Toolkit. Data collected will be reported only in aggregate and no individuals will be identified."

1.4 Key Plan Elements

Farm-level water planning must address the following elements in terms of current practices, long-term needs, gaps and opportunities for improvement:

- Water source capacity, quality and seasonal variations;
- Water supply and storage infrastructure;
- Water quantity, timing of use, and quality needs for irrigation, livestock and on-farm processing;
- Drainage and runoff management infrastructure, practices and needs; and
- Strategies for integrated water management.



1.5 Integrated Approach

Although Phase 2 is focused on piloting the toolkit with individual farms, the overall project is aimed at an integrated approach that considers not only the complete water cycle on individual farms, but also interactions with neighbouring properties that share common watersheds, and opportunities for producers and other stakeholders to collaborate.

Integration is the pursuit of effective synergies between systems, processes or stakeholders to achieve common objectives. When resources are perceived to be abundant, individual or 'siloes' decision-making may be favoured for simplicity and expediency, and low efficiency may be tolerated. However, this is no longer the case with water resources in the Cowichan region.

An integrated approach to farm-level water management may include some or all of the following elements, selected based on a business case analysis that considers long-term economic, environmental, social and cultural values:

- Identify and quantify basin-level water management issues and objectives that may be influenced through farm-level or local action;
- Identify farm-level implications (risks and opportunities) from basin-level analysis;
- Local collaboration on water planning and infrastructure investment (e.g., shared sources, conveyance, storage, drainage, runoff management);
- Combined strategies and infrastructure to achieve water supply and drainage/runoff management objectives (shortening water cycle and retaining soil nutrients);
- Collaboration between producers and with other stakeholders on projects;
- Shared risk management through planned adaptive approaches;
- Shared land use (e.g., agreements to locate shared infrastructure on private land); and
- Shared project funding or financing.

2. Methodology

The general project workflow is illustrated in Figure 2-1.



Figure 2-1: Phase 2 Workflow

The initial test was completed September 2014, and pilots were conducted in November 2014 and February 2015. Nine farms were visited in total, including the initial test.

2.1 Preparation

In the preparation phase, pilot candidates were identified in consultation with the client's Project Management Team. Pilot candidates were selected with the aim to maximize the diversity of conditions to be assessed in the pilots, including:

- Farm sizes and types (e.g. dairy, poultry/eggs, other livestock, forage/silage, vegetables, berries, grapes, tree fruits and nuts, greenhouses);
- Sub-regions (e.g. Koksilah, Cowichan, Chemainus and Cedar);
- Water conditions (surface and groundwater constraints, drainage and flooding issues); and
- Irrigation equipment and practices.

An information bulletin for pilot candidates was prepared, describing the process and its intended outcomes.

2.2 Toolkit Initial Test and Pre-Pilot Refinement

A consultant team meeting and a full initial test of the toolkit was conducted at David Tattam's McLay Road farm to test and refine the planning process.

Minor revisions were made to the toolkit based on the initial test, including refinement of the information resources for use in the pilots. The need for maps showing the farm and surrounding area was identified.

Following the initial test, a telephone conference was held with the PM Team to review and finalize the piloting plan, list of potential candidates, and information bulletin for pilot candidates. The results of the initial test and final preparation of the toolkit for piloting were also discussed.

Following the teleconference, the consulting team contacted producers to schedule pilot visits.



2.3 Piloting

For piloting, no more than two farm visits were scheduled per day to ensure sufficient time to complete the process. The interviews were conducted by different combinations of the following individuals:

- Colwyn Sunderland, KWL;
- Michelle Revesz, KWL;
- David Tattam, TEAM Consulting;
- Ted van der Gulik, The Partnership for water Sustainability in BC; and
- Hally Hofmeyr, Synetric Group.

An interview team of two members of the consulting team conducted the pilots. For consistency, David Tattam participated in all the pilots, and the second member of the team consisted of either Michelle Revesz or Colwyn Sunderland. Hally Hofmeyr and Ted van der Gulik each attended some pilot visits as an observer. No more than three members of the consulting team attended any single pilot interview.

Pilot visits were conducted as described in the Toolkit, including advance preparation and coordination with the producer to ensure that existing information sources (e.g. water license, well data, irrigation system specifications, water use or well electricity billing records) would be available for the farm visit.

Where information sources were unavailable or unreliable, resources included in the toolkit and the farm planners' experience were utilized to estimate key parameters for the analysis, and appropriate error margins were applied to the results. The pilot team discussed potential strategies with producers to identify priority actions to address critical information gaps for effective farm water planning.

The project schedule did not enable the consulting team to visit farms during the growing season; however, producers were generally able to recall the impacts of the very dry summer of 2014 on their water resources, demands and yields. Producers are also generally less able to commit time to participation in planning projects during the growing season than in the winter (although winter vacations must be accommodated). The four farm visits conducted in February 2015 enabled the piloting team to observe wet season conditions including flooded fields.

After completing the farm visits, the collected data were tabulated and analyzed, and a draft Farm Water Plan report was prepared for each participating producer. The Plans follow a common format incorporating data collected in the farm visits, a brief analysis, recommendations, and key resources to guide implementation. The draft Plans were reviewed by Colwyn Sunderland, Ted van der Gulik and David Tattam, and were presented and reviewed in person with producers. As of June 22, 2015, reports had been presented to seven of the nine participating producers; others are scheduled for later in the season to accommodate farm workload schedules.

2.4 Evaluation and Reporting

The results and observations from pilot testing were incorporated in recommendations for refinement and further implementation of the Toolkit. This process proceeded sequentially through:

- Preparing a summary of the findings and combined potential impact of recommendations for the farms reviewed in the pilot (for this report, the data are aggregated to protect the privacy of individual producers);
- A consultant team meeting to review each section of the toolkit and discuss its effectiveness, any gaps or redundancies, and how the toolkit and delivery process may be improved or streamlined;
- Follow-up work to address issues identified in the review of the toolkit; and



- Development of a facilitation approach, and supporting tools or resources, for using the Toolkit in a collaborative planning process involving multiple producers and other stakeholders in a local area (typically sharing a common water problem such as supply, flooding or runoff management).

The results of these evaluation steps are described in Sections 3-5 of this report. The draft report and updated Toolkit were reviewed by the PM Team, revised based on the review, and delivered in final form.



3. Findings

3.1 Sample Characteristics

The nine farms included in the Farm Water Planning Pilot represent a combined 411 ha, 6.4% of the 6,431 ha total area in cultivation in the Cowichan Valley Regional District². The nine pilot farms included 149 ha under irrigation, which is 9.4% of the 1,593 ha total irrigated area in the region (Figure 3-1).

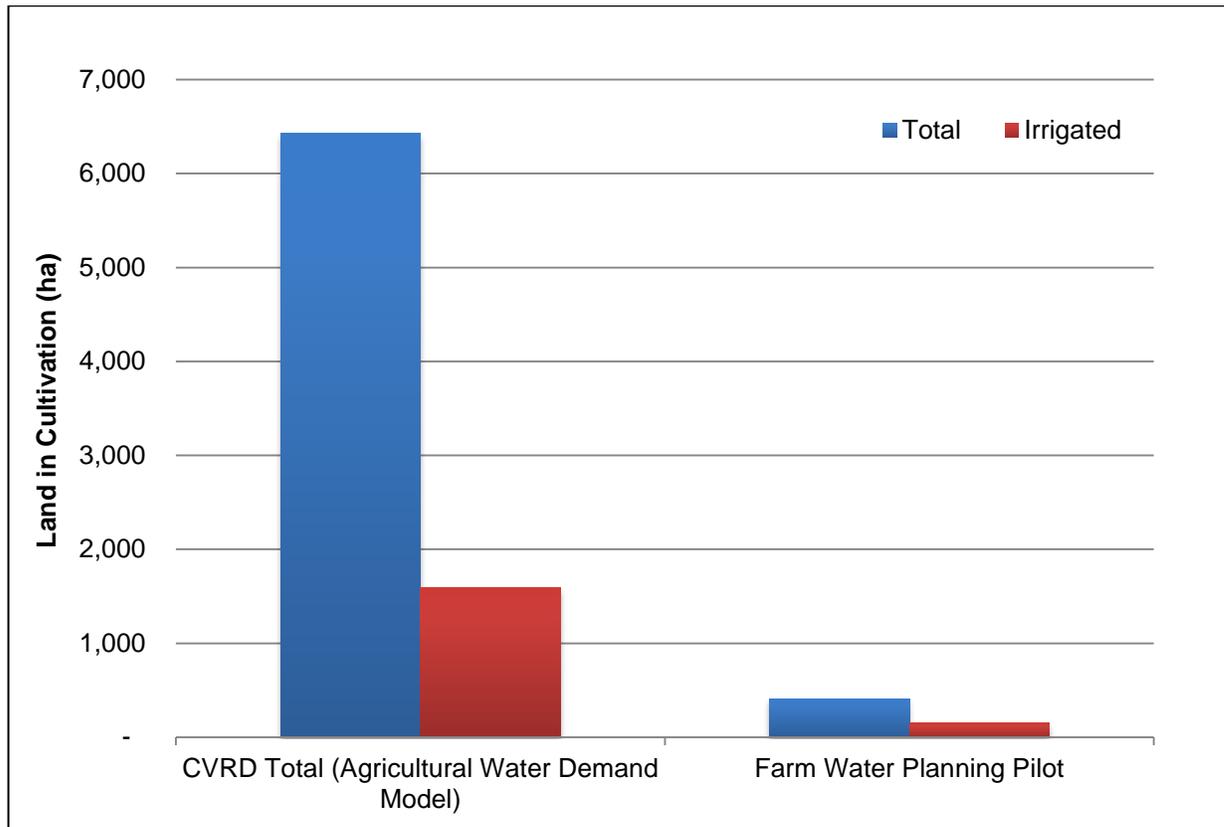


Figure 3-1: Pilot Sample Size

The pilot farms also reasonably represented the diversity of agricultural land uses in the Cowichan region (Figure 3-2).

² Agricultural Water Demand Model – Report for the Cowichan Valley Regional District, Ministry of Agriculture, June 2013

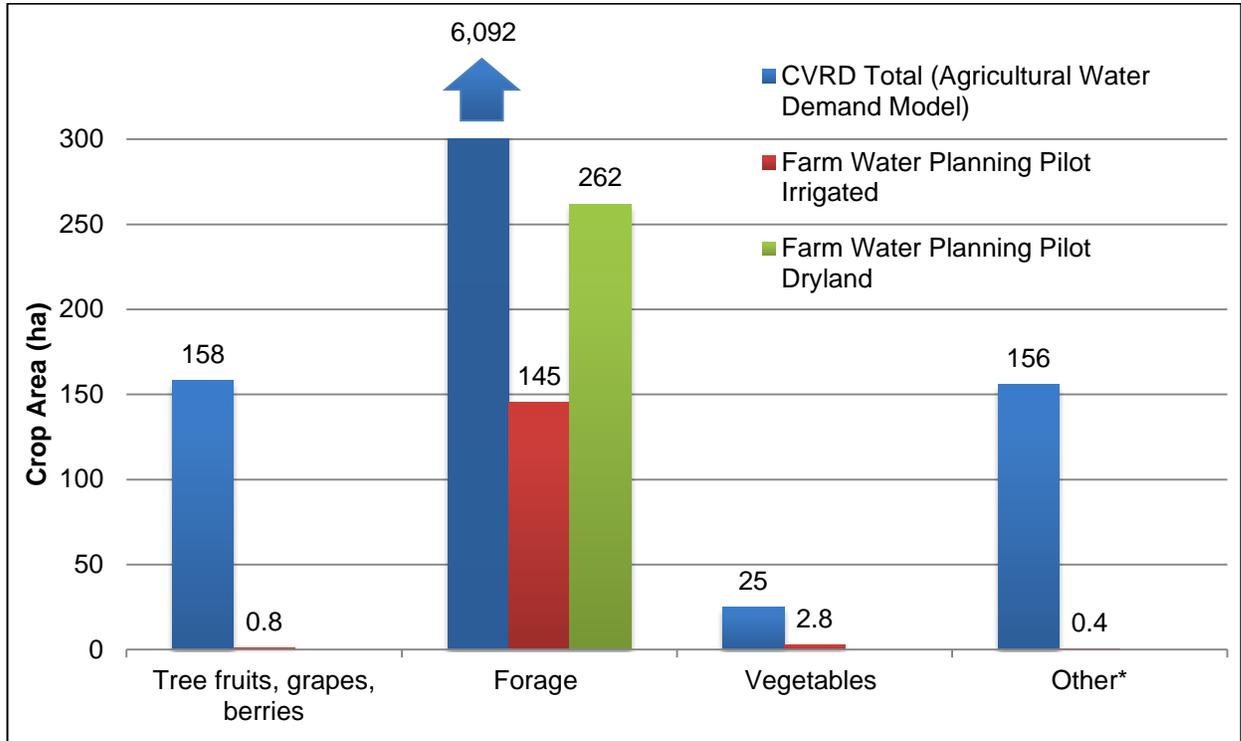


Figure 3-2: Pilot Sample Land Use Characteristics

Pilot sites were distributed throughout the agricultural areas of the Cowichan Valley Regional District (Figure 3-3).

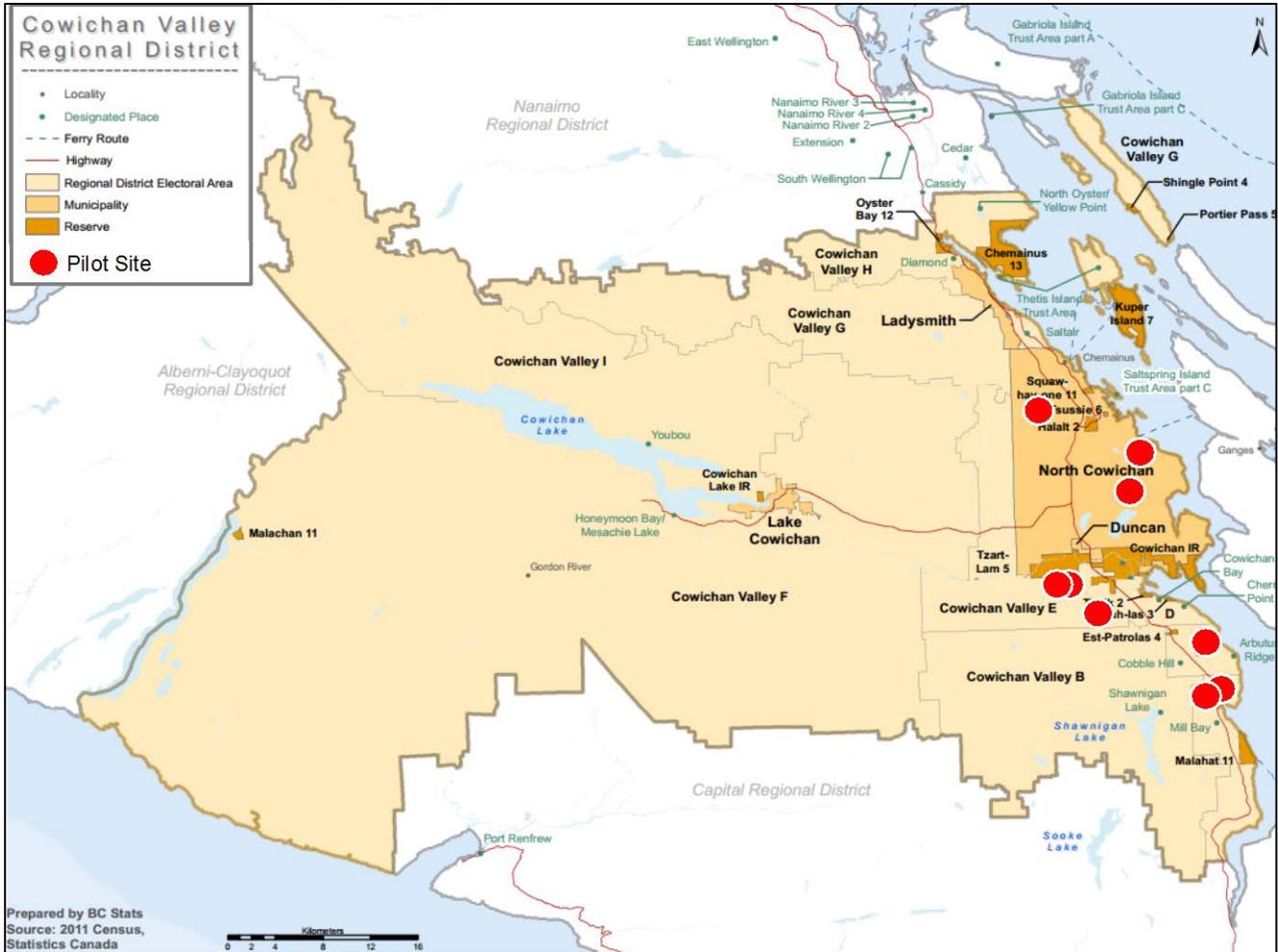


Figure 3-3: Pilot Locations

3.2 Level of Effort

Completing the farm water plans required substantially more time and effort than anticipated:

- Preparing for pilots typically required 1-2 hours per farm to compile background information on water resources, prepare base maps and schedule farm visits;
- Pilot farm visits typically required 2.5 to 4 hours to complete, significantly longer than the 2-hour target;
- Analyzing data, preparing and reviewing Farm Water Plan reports required much longer than anticipated, typically 6-10 hours in total; and
- Scheduling and conducting follow-up visits and finalizing reports required approximately 2 hours per farm.



Data collection and gaining a clear understanding of farm operations are the most time consuming parts of the process. Multiple sources of information often do not align (e.g. government data vs. producer's records and practices). Efficiency may be improved by relying on a single person to carry out the entire process for a given farm (conducting background research, the farm visit, and follow up reporting).

On average, the complete process of preparing a Farm Water Plan during the pilot project required 11 to 18 hours. Although this level of effort would likely decrease with a planner's experience with the process, toolkit and resources, a total time budget of 10 to 15 hours plus travel time would likely be necessary to complete a Farm Water Plan using the piloted toolkit and planning process.

Revisions to the toolkit and delivery process will be necessary to reduce the level of effort and improve cost-effectiveness of the planning process. In particular, conducting an initial scoping and preparatory interview with the producer by telephone and improving tools and facilitator skills for quick assessment of irrigation water use and efficiency have good potential to improve the efficiency of the process. However, some time must be spent in the field to validate information obtained in the producer interview. Ultimately, the processes of discovery, analysis and developing strategies take time, and it may not be practicable to reduce the overall level of effort below 8-10 hours to develop a useful water plan for a larger or more complex farm. Of this, only 2-3 hours of a producer's time would typically be required.

3.3 Planner/Facilitator Competencies

The pilot team relied on a combination of skills and experience to complete the pilots and develop appropriate recommendations, including:

- Water engineering, including water resources, water supply, irrigation, drainage, project costing and feasibility assessment;
- Agronomy, including regional knowledge and experience;
- Understanding of applicable statutes and regulations, including the *Water Sustainability Act* and *Health Act*, and
- Facilitation, including techniques to initiate and stimulate discussion, manage time, summarize and close out a discussion.

All of these competencies were necessary to complete the pilot Farm Water Plans, and it is anticipated that similar competencies will also be required for future use of the Toolkit.

Pilot team members made the following observations:

- There is value in having a facilitator who is knowledgeable about agriculture ("beyond just a facilitator"). Ted and other experts added significant value to the interviews.
- Although it is not practicable to bring all the required competencies to the interview, specialists can be engaged to review findings and recommendations.
- It is more effective to conduct the interview as a conversation instead of simply working through the questions in the toolkit. The questions serve as a guide for the conversation.
- The facilitator needs to be familiar with the toolkit; some orientation is necessary.
- Preparation, including collecting background information, is necessary for an effective interview with the producer; however, effective preparation was difficult for reasons discussed in the following section.



3.4 Information Sources and Uncertainty

Preparation of maps and water resource information in advance of farm visits was largely ineffective for the following reasons:

- Most of the producers own or lease satellite farmland that was not captured in the farm maps prepared for the interviews;
- Water sources including wells, ponds and surface water licenses identified from provincial data were typically not those used by the producers; and
- Water sources used by producers were often not recorded in the provincial databases.

The extensive use of satellite fields by five of the nine pilot participants was an unexpected challenge that greatly increased the complexity of the water planning pilots. Since secondary fields (whether leased or owned by the producer) are fully integrated with the operation of the home farm, they cannot be omitted from the analysis.

Of the six farms that rely on groundwater as a water source, only one was using wells for which the provincial database is complete and substantially consistent with the actual properties of the wells. Estimates of well yield by drillers and producers vary widely, and differ greatly in many cases. Without measurements of well water levels and actual withdrawal rates, sustainable yields are unknown. Only one producer measures well water levels.

Without direct measurements or records of water use, the pilot team relied on bottom-up estimates of water demands using published unit demands to estimate overall water needs based on current land uses, and checked the resulting estimates against available information and producers' observations about supply capacity (e.g. water licenses, drillers' well yield estimates based on bail testing, and pump characteristics). The resulting precision of water supply and demand estimates (seasonal totals and peak rates) is in the range of $\pm 30-50\%$. Estimates provided in this report should generally be considered to have a level of uncertainty in this range.

Reflecting the region as a whole, the diversity within the pilot cohort of land uses, topography, water resources, and drainage and runoff challenges resulted in relatively few opportunities to compare and report on typical parameters for farm water use in the region. Needs related to water management were also found to vary widely among the pilot cohort.

3.5 Current Situation: Water Supply and Demand

Water Sources

Of the nine farms included in the Pilot:

- Six use groundwater as a source, including four as their primary source of water;
- Four use surface water as a source, including three as their primary source of water;
- Two use municipal water (North Cowichan) as their only source, and one uses it as a secondary source; and
- One uses locally collected runoff as a secondary source of water.

The combined nominal capacity of the water sources used by the nine producers is approximately 2.5 million cubic metres (Mm^3) per year, and 90 litres per second (L/s) peak flow rate. This estimate is based primarily on drillers' estimates of well yield, and is highly uncertain. The sustainable capacity of

the sources is likely to be substantially lower. All water sources are subject to year-to-year risks of a shortfall due primarily to drought.

Storage

The largest agricultural water demand by far is irrigation, which occurs only in late spring, summer and early fall, and peaks in July or August. Water resources are replenished by precipitation that occurs primarily in late fall, winter and early spring, and there is typically little or no useful precipitation between July and September in the Cowichan region. Some form of storage is needed to provide water for plants during the growing season, which may be natural or constructed:

- Soil moisture (Figure 3-4) is the only means of storage for dryland forage and silage produced on six of the nine pilot farms (comprising 262 ha in the pilot cohort, 64% of the 411 ha of farmland in production), and is also a significant source of water for irrigated farmland;

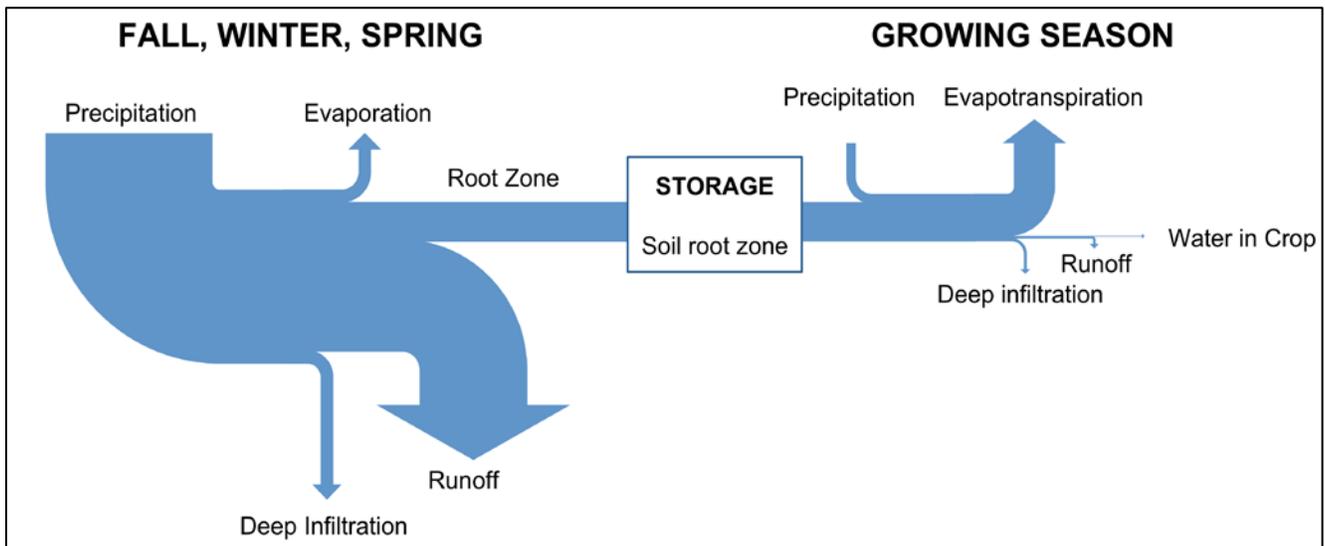


Figure 3-4: Seasonal Water Balance – Dryland Agriculture

- Constructed ponds (Figure 3-5) on seven farms in the pilot cohort provide approximately 57,000 m³ of storage (ponds are typically used for balancing daily or weekly variations in demand; the volume of storage is not sufficient on any of the farms to meet irrigation needs for an entire season);

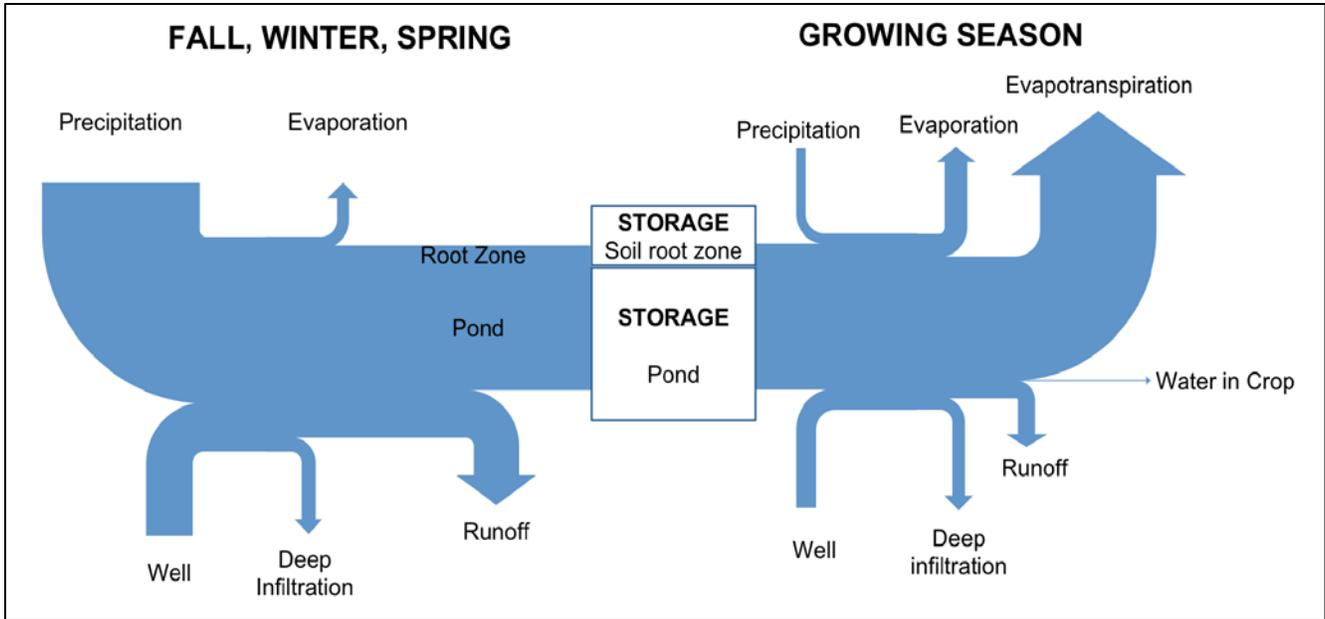


Figure 3-5: Seasonal Water Balance – Pond Storage for Irrigation

- Aquifers are replenished by winter precipitation and drawn down during the irrigation season, providing a primary means of water storage for four farms in the pilot cohort (irrigating 29 ha of forage grass, 2 ha of vegetables and 1.2 ha of tree fruits and other crops, and watering 74 cattle, 137 other mammals, and 2,750 birds); and
- For the three farms in the pilot cohort that rely on municipal water, off-site storage is provided by snowpack, lakes and groundwater for summer water demands (municipal water is used for watering 60 cattle and 60,000 birds and for produce washing, but is not used for irrigation).

Water Demands

Water demands for each of the farms in the pilot cohort were estimated using information provided by the producers, and using the published unit estimates of water demand included in the Toolkit. Where producers were able to provide specific information, the demand estimates reflect actual conditions in 2014, which was a drier than average year. A breakdown of total estimated annual and peak water demands for the 9 farms in the pilot cohort is provided in Figures 3-6 and 3-7.

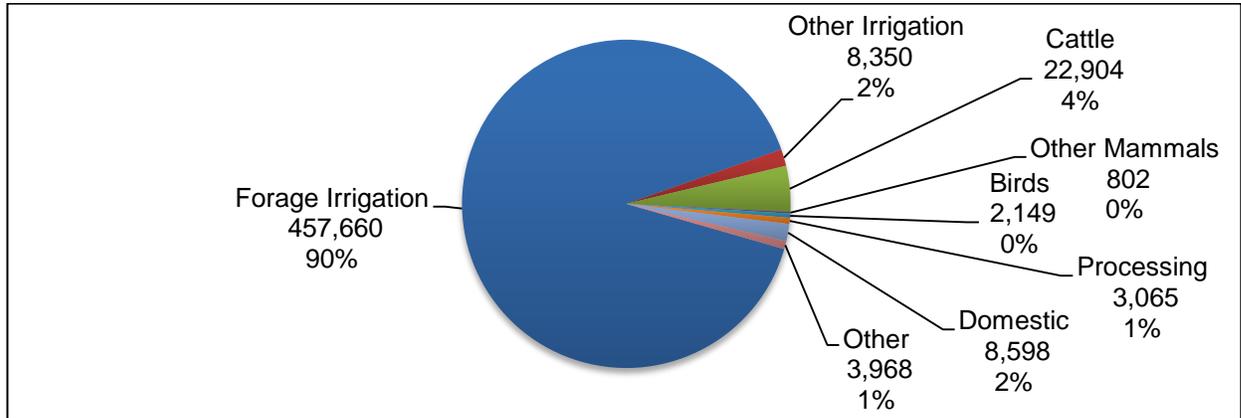


Figure 3-6: Estimated Annual Water Use (m³)

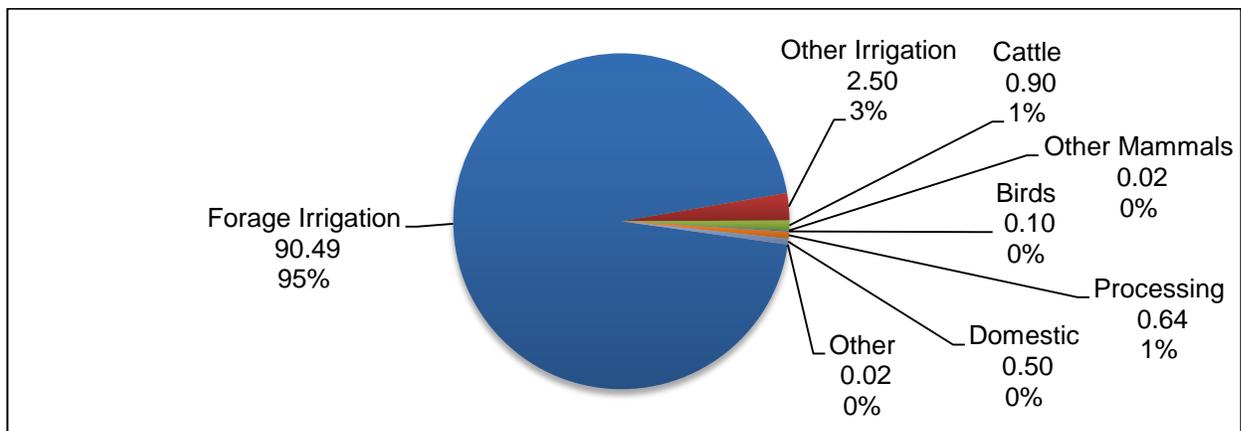


Figure 3-7: Estimated Peak Water Use (L/s)

As shown in the figures, the large majority of water use among Cowichan farms is for irrigating forage, primarily for dairy cattle. Nonetheless, only 36% of the forage land in the pilot cohort is irrigated. This implies that dairy forage production in the Cowichan region is highly vulnerable to drought. The major dairy producers in the pilot cohort have adapted to drought risk not by developing water supplies to bring more forage land under irrigation, but by buying or leasing available land for forage production.

Figure 3-8 provides a comparison between the estimates of irrigation intensity of the pilot cohort and the irrigation water needs calculated by the *Agricultural Water Demand Model*. The Demand Model included two scenarios based on historically low-demand and high-demand years (1997 and 2003, respectively). The growing season in 1997 was abnormally wet, while 2003 was a dry summer comparable to 2014.

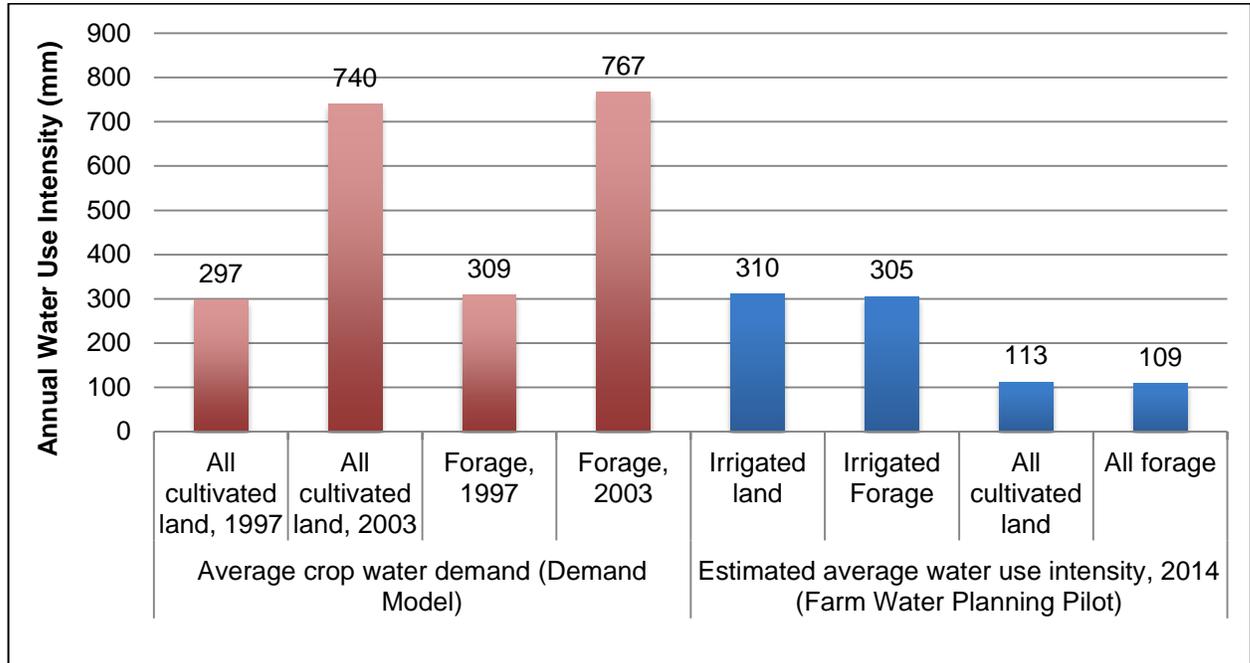


Figure 3-8: Comparison with Agricultural Water Demand Model

The model indicates that the water need for irrigated farmland should be more than double what is estimated for the pilot cohort using the Farm Water Planning Toolkit (using the BC Ministry of Agriculture *Irrigation System Assessment Guide* methodology and assumptions). Although the method used by the Toolkit may underestimate water demands, the primary factors leading to the discrepancy likely include the following:

- The Water Demand Model is based on the assumption that crop production will be maximized through the entire growing season, while Cowichan producers typically only irrigate as required to finish a second cutting of hay (by mid-July); and
- The Water Demand Model assumes soils in the root zone drain freely, while high water table in some lowland areas of the Cowichan provide water to the root zone without irrigation.

3.6 Current Situation: Flooding, Runoff and Drainage

Seven of the nine farms in the pilot cohort have significant issues with drainage and/or runoff. The issues include:

- Perched MOT road culvert floods lowest 1 ha of farm every spring;
- Tile drains discharge directly into a fish-bearing stream;
- 16 ha floods every year due to an offsite backwater condition;
- 4 ha of rented land occasionally floods;
- Tile drains failing (old);
- Creek jumps bank and floods farm; and
- Low-lying peat area (vegetable beds) floods every winter.



With the exceptions of aging and uncontrolled tile drains, the drainage and runoff issues are outside producers' direct control. Four of the nine farms in the pilot cohort have tile under-drains in some fields.

3.7 Future Scenarios

All water sources are vulnerable to changes over time, although the risk levels and causes vary:

- Surface water sources are typically over-allocated and are highly vulnerable to drought. Withdrawals from larger streams such as the Koksilah River may be regulated in the future based on priority under drought conditions, with in-stream flows and domestic uses as top priorities³; and smaller streams may completely dry up;
- Aquifer storage capacities, withdrawal and recharge rates are unknown, and combined drillers' estimates of yield (likely to be used as the primary basis for licensing) have no relationship to the sustainable yields of aquifers;
- Increasing frequency and severity of droughts under most climate change scenarios will reduce the capacities of both surface water and groundwater sources, and will reduce the productivity of dryland agriculture;
- Changes in land use within watersheds shared by the farms may reduce groundwater recharge and stream base flow, and introduce new demands on water resources; and
- Municipal water sources are vulnerable to policy and pricing changes linked to the capacity of their sources, and growth in demands.

By the 2050s, mean annual temperatures in the Cowichan region may increase by 1.6°C, and summer precipitation may both decrease by up to 18% on average and become more variable⁴. Although an increase in frost-free days and growing degree-days may benefit agriculture, higher water demands and less reliable water supply sources will pose significant new challenges.

Producers in the pilot cohort were generally unprepared to address the range of future challenges for their farms and operations. However, strategies identified in the pilots can help them build resiliency.

3.8 Key Issues

The following key issues with farm water management were identified through the nine pilots. Strategies to address these issues are discussed in Section 4 of this report. In general, further use of the Farm Water Planning Toolkit, and the resulting recommendations to producers, will also serve to address these issues.

³ <http://engage.gov.bc.ca/watersustainabilityact/the-proposal/>

⁴ Regional Adaptation Strategies Series: Cowichan



- Information gaps and inaccuracies
 - Government databases and producers' records do not accurately reflect the state of groundwater resources and agricultural land uses in the CVRD. There are discrepancies between available records and actual farm operations.
 - The provincial well data includes records of wells that are out of operation and is missing records of wells in operation.
 - Well records lack pump tests. They often include a driller's estimate. Farmer's actual use often differs from recorded estimates.
 - Producers rarely have any records of well drawdown.
 - Attempting to determine farm boundaries from on-line databases/resources was often ineffective. Farm boundaries on record were out of date. Many farmers have rental properties and/or informally use land that belongs to family members.
- Groundwater vulnerability
 - Without proper pump tests and well drawdown and usage records, producers may be unknowingly overdrawing groundwater resources and may be at substantial risk.
- Risks with all types of water source
 - Over allocated groundwater and surface water resources: Some producers have wells or surface water licences with rated capacities likely well beyond the sustainable capacity of the source, risking supply shortfalls and impacts on natural systems.
 - Change in price of municipal water, and change in water use restriction/regulations is a risk to farmers who rely on municipal supply.
 - In cycles of consecutive drought years, many risks related to water supply and demand are compounded. Some aquifers may not fully recharge in winter, stocks of animal feed may be severely depleted, and some producers may be unable to recover from successive years of low revenues and elevated costs.
- Water quality – domestic
 - Some producers supply untreated water, including surface water, to multiple dwellings for domestic purposes. This poses substantial health risk to occupants and a significant potential legal liability for the producers.
 - Future climate and land use changes could result in changes in water quality and increased risks.
- Runoff water quality risk
 - Untreated runoff from upland development, industrial operations, and farm operations pose risk to quality of surface and groundwater resources that are used for irrigation, food processing, and domestic purposes.
 - Discharge of untreated runoff to surface watercourses that may include fish habitat threatens the integrity of habitats.



- Lack of measurement
 - Lack of measurements and trends in well water levels, quantities of water used for irrigation (from groundwater, surface water, and municipal sources) combined with lack of information on irrigation system components, make estimation of actual water use for irrigation and assessment of effects on water resources highly imprecise, diminishing the capacity to plan for the future and to effectively manage risks.
 - With no established baseline for water quality and water quantity, producers have limited recourse if their resources are negatively impacted by neighbouring activities or in case of disputes over water resources or environmental impacts.
- Irrigation efficiency uncertain
 - The efficiency of most of the irrigation systems and practices reviewed for the pilots was difficult to estimate, particularly older systems where components are replaced and amended over time.
 - Most producers have developed irrigation practices based on wet years/typical years and not drought years. In a drought year, to keep production levels similar to a typical year, the crops will require more water.
 - During some of the interviews, it was evident that the irrigation systems were not being operated as efficiently as possible and that accurate irrigation flow rates could not easily be determined without doing a more detailed irrigation assessment, as described in the Irrigation Assessment Guide under the EFP program.
- Reliance on dryland forage
 - Several of the pilot participants, including large dairy producers, have adapted to limited water availability by acquiring land to increase their dryland forage production instead of developing water supplies for irrigation. Although this approach may be economically favourable under current conditions (while land is available for sale or lease at attractive rates), dryland forage production is highly vulnerable to drought and climate change.

3.9 Recommendations to Producers

This section provides a summary of the recommendations provided to producers based on the farm water planning pilots.

- Water Resource:
 - Contact contractors who drilled wells and request well records for wells in active use on the farm. This will ensure that the completion date and estimated yield of each well is correctly identified as the Province implements groundwater licensing under the Water Sustainability Act to secure rights to a share of the aquifer.
 - Apply for a surface water storage licence on the pond. This ensures your legal right to store runoff and use it for irrigation, and mitigates the risk of a future dispute with an owner of the neighbouring lot that shares the pond.
 - Test well to determine sustainable yield (e.g. 72-hour drawdown test), or measure and record well water depths and withdrawal rates on an ongoing basis.
 - Put unused existing wells into service prior to implementation of the Water Sustainability Act and comply with licensing requirements when they are issued.



- Storage:
 - Consider developing storage/expanding storage/seasonally flooding naturally low-lying area.
 - Improve existing pond to increase capacity, reduce leakage or address safety concerns (berm, lining, etc.).
- Water Quality:
 - Test water quality of active wells. If the water quality is acceptable for the uses, have samples tested periodically on an ongoing basis to confirm that the water remains safe, and to establish a baseline in case quality deteriorates over time. If the quality is deficient for the use of one or both wells, provide treatment as required based on water quality testing.
 - Provide water quality treatment prior to drip irrigation.
 - Monitor water quality of runoff into fish bearing creeks.
- Water Use:
 - Consider having an irrigation assessment conducted by a certified irrigation auditor to optimize efficiency and operation. Matching the system to climate, crop, and soil could improve efficiency at least by 30%.
 - Include more drought-resistant species (e.g. tall fescue) in forage seed blends, or consider planting other drought-resistant feed crops such as drought-resistant corn hybrids.
 - Improve irrigation efficiency by adjusting operation parameters and scheduling irrigation.
 - Consider water efficient equipment (including irrigation nozzles) when replacing/upgrading.
 - Monitor and record water usage for establishing baseline and/or future demand projection (municipal, well usage, surface water).
- Drainage/Runoff:
 - Consider engineered drainage improvement.
 - Contact governing body (MOT, Municipality, etc.) to improve regional drainage.
 - Remove invasive species, maintain/clear creek and ditches.
 - Implement EFP Drainage Management Guide.

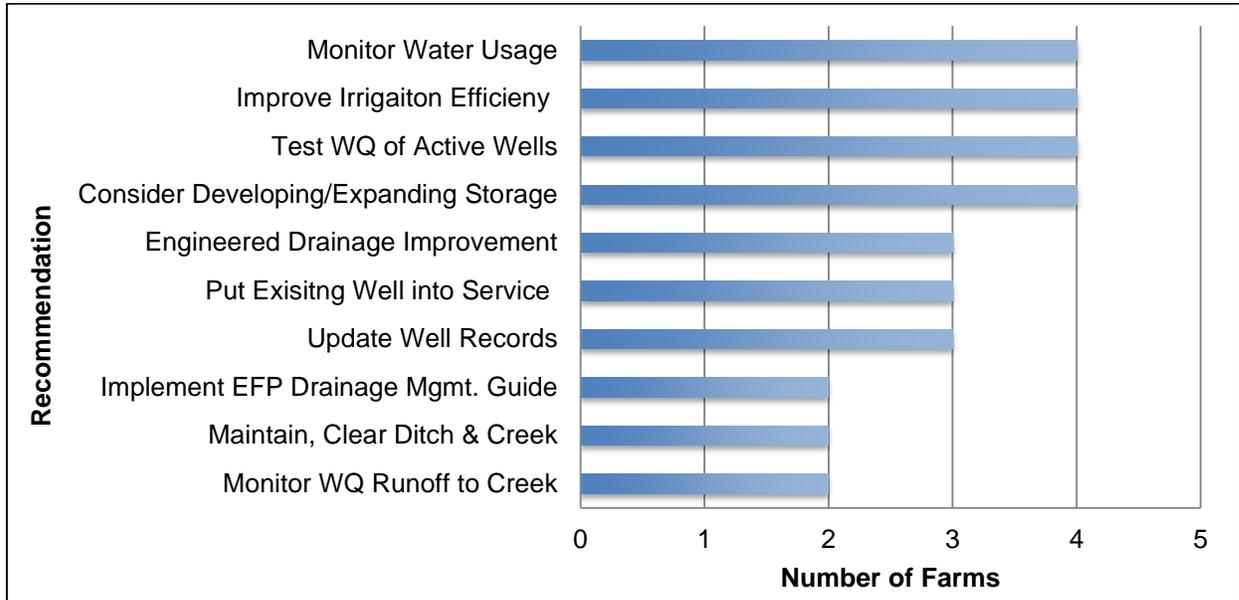


Figure 3-9: Summary of Recommendations to Pilot Participants

3.10 Producer Feedback

The following comments were provided by producers after draft farm water plans were presented and discussed with them:

What was most useful about the process?

- Overall review of water resource and system capabilities.
- Water requirement calculations were helpful as they confirmed the producer's calculations.
- Summary of options, recommendations, and information resources to support them.
- Plan may help in soliciting government support for the changes needed to develop water storage, and in obtaining bank funding for the project.
- Resource lists are helpful.
- All aspects of taking part in the pilot and the final report were valuable.
- The experience and input of expert facilitators such as Ted van der Gulik, P.Eng. regarding opportunities and options for future water supply and storage development.
- Improved understanding of water rights, and how in-stream flow requirements for fish habitat impact the availability of water for withdrawal.
- The supply calculations in Section 3, and specifically the one for the existing well.
- Understanding of the regulatory requirements if supplying water to more than one residence on the farm.



- This type of plan would be most beneficial for someone who is starting out with no irrigation system, or expanding their system.
- Having a complete overview of water issues, strategies and source information.

What was least useful?

- Too much redundancy in the plan.
- Producer's irrigation systems were all designed by certified irrigation techs; believe they are already doing all that they can to utilize the water they have.
- No opportunities for government funding for irrigation projects and water development.
- With climate change, a producer would like to see a program developed to assist with creating water supply for irrigation.

What recommendations do you expect you will implement within the next few years?

- Install a pump in an unused well to demonstrate it is in use, in anticipation of licensing in 2016.
- Develop more water storage for irrigation purposes within 2 years.
- No immediate plans to implement any of the recommended changes. Any changes would most likely be in the future and dependent upon feed availability and /or farm expansion that includes an increase in cattle herd.
- Never had any problems with domestic water, has no plans to treat it. Tenants were all informed as to the potential risk in their water source. The water used in the dairy is treated as required by dairy regulations.
- One producer plans to promote and discuss the recommendations with a new business partner/investor.



4. Refinement and Implementation

4.1 Toolkit Refinement

The primary needs for refinement of the Toolkit and planning process are to improve the efficiency of the process and reduce the level of effort to complete a Farm Water Plan. The key refinements to achieve this purpose are:

- Moving the initial scoping conversation to a phone interview in advance of the farm visit (enabling more accurate and efficient research and preparation for the interview); and
- Simplification of the Toolkit, including removal or reduction of sections that require significant time to complete but contribute little to the development of strategies.

The following revisions to the Farm Water Planning Toolkit and instructions for its use are recommended. A revised version of the Toolkit incorporating these changes is available online.

- Add a short pre-visit phone interview (target 15 minutes) before the farm visit. During the phone interview, ask the Screening Questions from the Toolkit to identify the issues that will be the primary focus of the farm visit.
- Expand the Screening Questions Module to include the following:
 - Determine the locations of each farm site that will be included in the Farm Water Plan, including the home farm and any satellite operations (e.g. street addresses and approximate land areas) to enable a suitable map to be prepared for the farm;
 - Identify the primary water resources and their characteristics, and major runoff/drainage issues, for each farm site included in the Farm Water Plan; and
 - Where municipal water is used for farm purposes, ask the producer to have at least one year of water bills available for the farm visit if possible.
- Add questions and a data table to the Groundwater Sources Module regarding well identification and use, including fields for the following information about each well in the provincial record or in use on the farm:
 - Provincial well tag number, existence of driller's logs, depth and estimated current yield for each well that is known to the producer; and
 - Status of each well shown within the farm boundaries in the provincial database.
- In the Drainage Module, request to view a drainage plan prepared by the installer of a tile drain system.
- In the Water Use Module:
 - Include a question asking if the irrigation system was designed by a Certified Irrigation Designer (IIABC CID designation), and if so, request to view the design plan and specifications.
 - Use the following guidance rules to determine if a more detailed irrigation assessment is warranted:
 - The producer is uncertain of the irrigation system flow rate;



- The producer does not seem confident that the annual water use is within the farm's licenced amount;
 - The flow rate for the irrigation system exceeds 4 US gpm/acre of irrigated area (at 4 US gpm/acre the system would be operated 24/7 during the peak of the season);
 - If the irrigation system is operated for only a few days and covers the entire farm it is likely that flow rates used are excessive; and
 - The calculated annual demand far exceeds 300 mm per year.
- Reduce the domestic demand section of the Water Use Module to include only the number of dwelling units, total number of occupants, and total area of irrigated lawn/landscape (water use will be calculated based on 230 L/cap/d year-round, 300 mm/year for annual out-door irrigation requirement, and 5 US gpm/acre for peak day irrigation).
 - In the Future Scenarios Module, omit the Annual Usage and Peak Day Water Balance tables (pages 29 and 30 of the Toolkit), and replace with a water balance worksheet developed for analysis of the pilot data.
 - Move the Future Plans questions from the Water Management Gaps Module to the Future Scenarios Module.
 - Reduce or simplify the Water Management Gaps Module (consider eliminating questions that were not useful in the pilots, or are repeated from previous modules).
 - Revise Water Management Strategies Module to reflect the recommendations made in the pilots, and consider eliminating strategies that were not useful in the pilots.

4.2 Implementation

This section identifies key opportunities for ongoing use of the Farm Water Planning Toolkit to achieve the objectives of the Cowichan Adaptation Strategies, and potentially to achieve broader objectives for supporting sustainable agriculture and water management. Linkages to specific actions identified in the Cowichan Adaptation Strategies report are identified in this section.

Support for Groundwater Licensing and Management

Implementation of groundwater licensing in 2016 under the *Water Sustainability Act* presents an immediate opportunity for the Farm Water Planning Toolkit to provide value. Agriculture is among the largest uses of groundwater in the Cowichan region, and Province-wide. With minor revisions as described in Section 4.1, the Toolkit process can efficiently identify both the provincially registered groundwater wells located on the subject farm (including satellite fields), and the wells actually used by the producer. In this manner, the Toolkit can assist producers in preparing for groundwater licensing, by highlighting critical information gaps and improving their knowledge about water supply and use quantities and constraints.

The Farm Water Plan process could also support strategies enabled under the *Water Sustainability Act* for managing prioritization of water uses through droughts. Recorded vs. estimated actual well yields and water demands will also be identified. This initiative would significantly benefit producers in securing rights to water resources while supporting the Province's objectives for sustainable water management. Budget to support this initiative may be available through water rental rates.



The Toolkit could serve as a component of a process to access funding for implementing monitoring/measuring technologies, benefiting both producers and government by building capacity for improved water resource management. This approach has proven successful for other purposes under the Environmental Farm Plan program, and would support Action 2.1A of the Cowichan Adaptation Strategies.

Farm Water Management Website/App

Producers participating in Farm Water Planning will require support in implementing several of the recommended strategies. Although the Toolkit refers to numerous Internet links to information resources to guide producers, the links will become inactive over time, and many are not specific to the recommended strategies. A Farm Water Planning website or app could be developed to include an interactive version of the Toolkit, and a library of implementation guides tailored to support water management strategies. This initiative would require significant resources to implement, but would substantially improve both the efficiency and effectiveness of the Toolkit.

Web-based planning tools have traditionally seen very limited use by producers; however, many of the available tools for farm water management are relatively old, and the demographics of agriculture are changing. The coming generation of producers will have grown up with the Internet and smart mobile devices. Nonetheless, the level of interest in using a web app as an interactive planning tool should be evaluated before initiating development of a web-based Toolkit.

A web-based Toolkit could be used interactively by the facilitator of a planning session with the producer, and could include a report module that would be available to both the facilitator for completion after the visit, and to the producer for implementation. For example, if the planning process determines that a producer could benefit from the construction of a storage pond for irrigation, an approximate size of pond would be calculated in the Toolkit based on climate and irrigation demand data in the Toolkit, and parameters provided by the producer. The producer would also have access to information through the toolkit on how to implement storage, including regulatory requirements, construction, operation and maintenance, and typical costs (assuming these can be regularly updated).

A website or app version of the Farm Water Planning Toolkit could be developed, including an interactive interface and a Farm Water Management Guide series to support recommended water management strategies, initially including:

- **Runoff Water Quality Management**
- **Measuring and Recording Water Supply and Use**
- **Developing and Expanding Water Storage; and**
- **Improving Irrigation Efficiency.**

This initiative would support further implementation Action 1.3A of the Cowichan Adaptation Strategies, and would improve the efficiency and effectiveness of the farm water planning process. However, it is not expected to replace the need for a facilitated approach in the short term at least.

Coordinated Drainage Management

Individual producers have limited ability to manage drainage, which is typically controlled by conditions outside the farm. Municipalities, other property owners in the watershed, provincial and federal governments all have a stake in decisions and plans to control flooding. Climate change will impact the extent and frequency of future flooding, and will cause sea level to rise. Agricultural priorities often need



to be balanced with protection of aquatic habitat, roads and buildings. Optimal strategies for managing drainage issues on farms may also have synergies with improvements to other property, introducing opportunities to share costs and benefits.

Coordination is needed between agricultural producers, the CVRD, municipalities of Duncan and North Cowichan, Ministry of Transportation and Infrastructure, Ministry of Environment, Ministry of Agriculture and Fisheries and Oceans Canada on strategies and resources to address drainage, water quality and flood protection issues that impact agriculture and other land uses in the region. A joint planning project supported by most or all jurisdictions, with the involvement of agricultural and stewardship groups, could identify priorities for local or regional projects to improve the management of runoff to the mutual benefit of agriculture, local communities and the environment. This initiative would support Action 1.1A of the Cowichan Adaptation Strategies.

Collaborative Farm Water Planning

The scope of water management that can be achieved on an individual farm is limited, as water resources used on the farm are impacted by other land uses in the watershed or overlying the aquifer. Runoff from the farm may also impact other land uses and ecosystem functions in the watershed. Much of the farmland in the Cowichan region will not have access to an adequate water supply for irrigation unless producers combine resources to develop conveyance and storage to serve multiple farms. Lowland flood protection will require similar collaboration.

The Integrated Farm Water Planning Toolkit could readily be adapted to a group planning process. Two general approaches may be considered:

1. Conduct individual farm water plans in a local area, then conduct a focused planning session with all producers to develop strategies that address common issues; or
2. Conduct a farm water plan concurrently with all producers and other stakeholders in a facilitated full-day workshop including break-out sessions.

Either approach has relative advantages and disadvantages: approach 1) would enable more comprehensive review and planning for each farm, while approach 2) would require less time and resources. Strategies identified under either scenario, would likely require further engineering feasibility assessment and coordination with approving agencies and other stakeholders before implementation.

The Toolkit could be piloted in a collaborative planning process involving multiple producers and other stakeholders in a local area (typically sharing a common water problem such as supply, flooding or runoff management). This initiative would support further implementation of Action 1.3A of the Cowichan Adaptation Strategies, and may also support Actions 1.1A, 2.1A, 2.3A, 2.4A, 3.1A and 3.4A.

Capacity for Irrigation Assessment and Design

Irrigation is by far the largest use of water in agriculture, and is the most vulnerable to drought and climate change since drought impacts both water supply and demand. Optimizing agricultural water use efficiency relies heavily on competent assessment, design and operation of irrigation systems. Using Certified Designers would improve the operation and efficiency of the irrigation system. There is a lack of certified irrigation designers in the Cowichan region, and there is no known forage irrigation specialist on Vancouver Island; however, ensuring irrigation systems are designed correctly is a major step to improving water management. If enough producers in the region request the services of certified



irrigation assessors and designers, it is likely that some suppliers and service providers will obtain the required training for certification through the Irrigation Industry Association of BC (IIABC). Certified designers in BC can be found at:

<https://www.irrigationbc.com/irrigation/certifications/search/>

There is an opportunity for Cowichan agricultural groups and supporting agencies to promote the benefits to producers of obtaining irrigation system assessments, and to encourage vendors to maintain a certified local workforce and provide certified design as a bundled service with the sale of all agricultural irrigation systems. Piloting the effectiveness of irrigation system assessments and upgrades or replacements based on IIABC best practices, including measurement of whole-system efficiency before and after the project, could demonstrate the value of assessment and design by a qualified practitioner and significantly increase the efficiency of overall agricultural water use in the region. This initiative would support Action 3.2A of the Cowichan Adaptation Strategies.

Drought-Resilient Agriculture Research

Some producers have experimented with drought-tolerant species of forage grasses (e.g. tall fescue) and other plants, which perform well in drought conditions but can be difficult to establish and provide less protein needed by dairy herds. Diversifying to increase production of other feed sources such as drought-resistant corn may also improve the resiliency of local feed production. Experience from other regions such as the Peace, where large livestock operations routinely must manage through droughts, may also provide learning opportunities to Cowichan producers for effectively managing risks that will increase with climate change. A culture of controlled experimentation and innovation could be fostered among Cowichan producers, to identify a set of strategies to best manage risks that will increase as climate changes.

There is an opportunity for local producer groups to collaborate with universities, colleges and funding agencies in practical research and piloting of drought-resistant forage varieties and other risk-resilient agricultural practices. This initiative would support Action 3.2A of the Cowichan Adaptation Strategies.



4.3 Report Submission

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Revision History

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