SECTION 6
APPLICATION TO PROVINCIAL WATERSHEDS

6.1 Introduction

Comprehensive watershed management models can be effective in predicting the effects of implementing best management practices (BMPs). Models can be applied to wide range of field conditions and can help land managers make better decisions. Models can also save time and money since they can reduce need for extensive field monitoring, which is expensive and often difficult to conduct. During the last decade, numerous models have been developed to accurately predict specific environmental impacts (Renaud et al. 2006), such as stream flow and concentration of sediment, nutrients, or pesticides in runoff. However, land managers often want to know the effectiveness and economic impacts of proposed BMPs on their farm operation prior to implementation. Currently, there are not too many models that automatically evaluate the economical and environmental long-term impacts of various BMPs on water and soil quality at the field and watershed scales.

The Comprehensive Economic and Environmental Optimization Tool - Livestock and Poultry (CEEOT-LP) model (Osei et al. 2000) is one of the most advanced tools that can predict these effects at the field and watershed scales. The CEEOT-LP model was developed in 1995 as part of United States National Pilot Project by Texas Institute for Applied Research (TiAER) of Tarleton State University, and it is a modeling system that incorporates three models: Soil and Water Assessment Tool (SWAT) (Arnold et al. 1998), Agricultural Policy/Environmental eXtender (APEX) (Williams et al. 2000), and Farm Economic Model (FEM) (Osei et al. 2000). The CEEOT-LP model is a public domain modeling system and its software and documentation are available free of charge.

Alberta Agriculture and Rural Development (ARD) selected the CEEOT-LP model for the Nutrient BMP Evaluation Project in Alberta. The selection was based on the ability of CEEOT-LP to simulate the effect of land use change on soil and water quality in snowmelt conditions and to evaluate the BMP economic impact on the farm operation. The SWAT and APEX models included in the modeling system have been extensively evaluated and tested in many countries by many users representing universities, government agencies, and the private sector. They have a long application and evaluation history on variety of projects, and currently there are over 200 peer-reviewed publications available (Gassman et al. 2007). Renaud et al. (2006) and Gordon et al. (2005) reviewed several models suitable for colder climate conditions, and SWAT received high ranking in their reviews. The FEM was also tested and evaluated on different types of farms in Iowa and Texas of the United States (Osei et al. 2000; Osei et al. 2003).

6.2 Description of SWAT, APEX, and FEM

The SWAT and APEX models are continuous-time simulation models designed to predict on a daily bases the impact of management practices on soil and water quality at river-basin and edge-of-field scales. Both models use similar subroutines to simulate hydrology; weather; water erosion; soil temperature; crop growth; the transport of nutrients, pesticides, and bacteria; and land use scenarios. Although these models require large amount of input data, most of the data are available in ARD databases or it can be collected at the research sites.

The SWAT model is a basin-scale model. It configures large watersheds into sub-basins and Hydrologic Response Units (HRU) areas. Each HRU represents unique land use, management, and soil conditions within each sub-basin. The main assumption in SWAT simulations is that there is no interaction among HRUs and spatial relationships can only be defined at the sub-basin level. This type of configuration allows SWAT to efficiently perform long-period computations in large watersheds. The advantage of SWAT is its ability to route efficiently predicted flows, nutrients, pesticides, and bacteria through streams and reservoirs, and accept input data, which are measured or predicted values (e.g., weather, flow, or water quality data) either from weather stations, sewer treatment plants, or other models. In addition, the SWAT model comes with a GIS interface called AvSWAT (Di Luzio et al. 2004), which generates an input database, provides links to other models, calculates sensitivity analyzes, calibrates predicted values against observed values, and helps illustrate spatially the predicted values.

The APEX model is a field-scale model, and it was developed using components of the Erosion-Productivity Impact Calculator (EPIC) model (Williams 1990, 1995). The APEX model includes additional functions for routing water, sediment, nutrients, and pesticides across complex landscapes and channel systems to the watershed outlet. This model can also simulate groundwater and reservoir effects. In the model, field-scale watersheds are divided into fields that have similar land use, management, and soil scenarios. In contrast to SWAT, APEX allows interactions and keeps track of spatial relationships among fields so that runoff routing can be performed in a specified order. Also in APEX, it is possible to simulate multiple cropping systems, management practices related to farm animal production, economic impacts of BMPs, wind erosion, and use physical-based functions to simulate the effects of filter strips.

The FEM is a farm-scale economic simulation model. It simulates annual costs and returns of proposed BMPs. The model deals with livestock and crop operations, ownership and characteristics of structures, facilities and equipment, financing terms, land areas and uses, livestock nutrition, and manure production and handling.

6.3 The Modeling Approach

The modeling approach is based on a research proposal submitted by Dr. Ali Saleh from Texas Institute for Applied Environmental Research (TiAER) of Terleton State University for the Nutrient BMP Evaluation Project. In similar studies, Saleh et al. (2000) and Osei et al. (2000) took advantage of the combined capabilities of the SWAT, APEX, and FEM models and developed the computer interface called CEEOT-LP, which is an integrated suite of economic and environmental models designed to simulate economic and environmental impacts of policy alternatives and individual practices or combinations of management practices. In addition, CEEOT-LP is designed to work with AvSWAT model and to use its capability to help generate input files, run models simultaneously, and compare the output results (Figure 4.1).

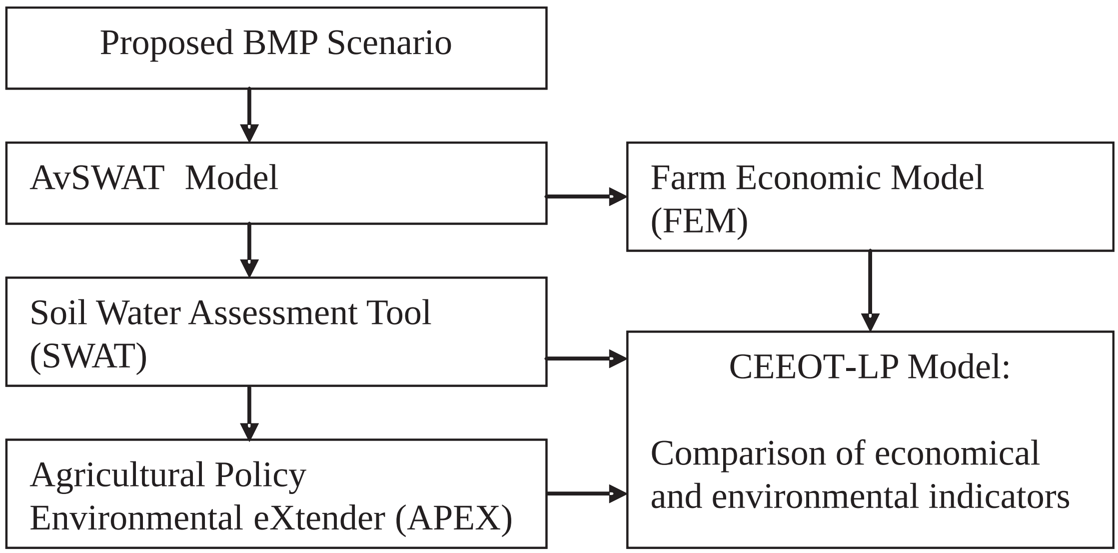


Figure 6.1. Data flow chart of the CEEOT-LP modeling system.

6.4 Main Activates of CEEOT-LP Model Application

In the first year of the project, the modeling activities were directed towards developing and collecting input database necessary to run the model. The collected data were organized into five categories: climate, soil, topography, land management, and economics. At this point, the collected data have been entered into computer files and awaits further quality control check and formatting.

To satisfy CEEOT-LP input requirements, land management data were collected at field and watershed scales using two different collecting methods. For one method, the watershed scale data were collected by recording observed land cover information using AgCapture software while driving on the county roads. The other method involved interviewing producers and completing a questionnaire (Appendix 1). The producers were asked to provide land management and economic information. Two questionnaires were used: a long version for the producers with BMP evaluation sites on their property, and a short version for other producers who were willing to participate in the survey. In total, 12 producers were interviewed in the IFC Watershed and 26 producers were interviewed in the WHC Sub-watershed. These numbers represented about 18% of the producers in the IFC Watershed and 50% producers in the WHC Sub-watershed.

The assembly of climate input files was initiated using available data from Lacombe and Pincher Creek climate stations. Both stations provide daily precipitation, temperature, wind velocity, solar radiation, and relative humidity. In addition to existing data, measured daily precipitation, temperature, and relative humidity data will be added after the installation of four weather stations in the IFC Watershed and two weather stations in the WHC Sub-watershed in 2008.

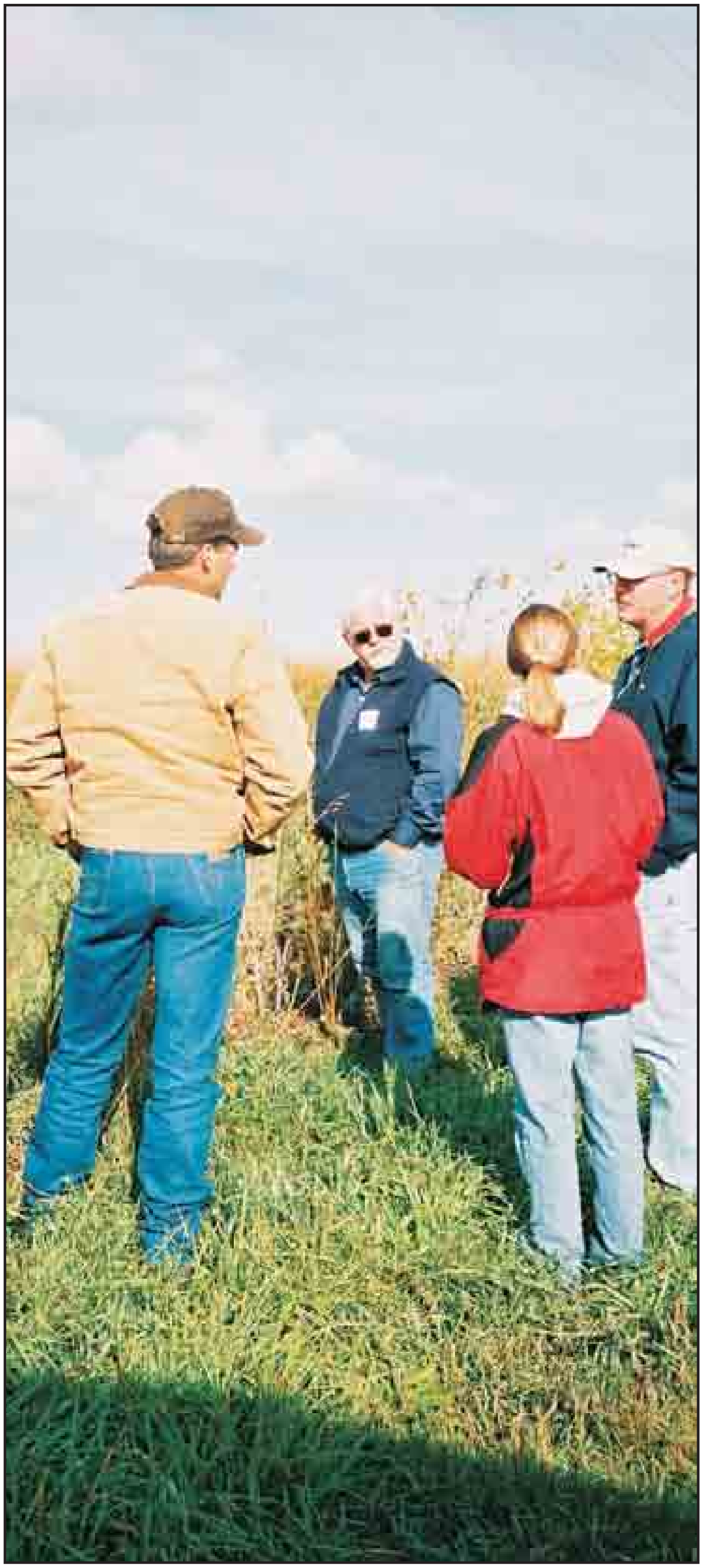
Soil input data for both watersheds was derived initially from the Agricultural Region of Alberta Soil Inventory Database (AGRASID: Alberta Soil Information Centre 2001) database (MacMillan and Pettapiece 2000). Within each watershed, AGRASID identifies the number and types of soil polygons and relative distribution of unique soils series in each polygon. The spatial distribution of agricultural soil series within each soil polygon is not available. Currently, we are in process of applying LandMapR program (MacMillan et al. 2000) to define spatial properties of the series. In summer of 2008, we are planning to conduct ground truthing to verify LandMapR prediction and to collect additional soil data from BMP sites.

The landscape parameters of the IFC and WHC watersheds were calculated using the existing 25-m grid resolution Digital Elevation Model (DEM) data. Currently, we are in the process of using a Geographic Position System (GPS) to develop a 5-m grid resolution DEM data for all sub-watersheds where the BMP sites are located.

Initial hydrology analyzes were conducted to delineate contributing drainage areas for each BMP site and to define the drainage pattern. In the process, AvSWAT was used to overlay the DEM data with a hydrographic image data and with field-measured locations of the existing culverts and some smaller channels.

Late in August 2007, a two-day workshop was organized on the application of the CEEOT-LP model. The workshop was conducted by Dr. Ali Saleh and Dr. Osei from TiAER. During the first day, 19 participants received a general overview about the model and on the second day, nine participants received more detailed instructions on the application of the model. In conjunction with the workshop, a field tour was organized for the TiEAR scientists to the WHC and IFC watersheds so they could become familiar the farming practices, soil, climate, and landscape conditions in the watersheds. In addition, ARD staff had the opportunity to exchange ideas with the TiEAR scientists.

SECTION 7
COMMUNICATIONS



7.1 Introduction

Effective communication with participating producers, partners, and other stakeholders is critical to the success of this project. The communication team has taken a proactive community-based approach with the communication strategies and activities to help promote the project and to solicit participation. The communication plan and activities have been developed and initiated on an ongoing basis since spring 2007.

7.2 Communication Plan

The communication plan for this project was developed by a communication team with feedback from the rest of the project members and managers (Appendix 7). The plan outlines how information will be developed and delivered to the target audiences. The main objectives of the plan are to increase awareness and adoption of beneficial management practices (BMPs). The strategies and activities completed to date are described in the following section.

7.3 Communication Strategies and Activities

Communication strategies and activities are outlined in the communication plan (Appendix 7). Strategies have focused on local contact with producers, municipalities, and the public to establish a level of trust and awareness within the community. Local Members of the Legislative Assembly (MLAs) and county representatives were informed of the project in early 2007 regarding the project objectives in collaboration with the Alberta Agriculture and Rural Development (ARD) Communications Branch. Communication activities and extension resources completed to date include on-farm visits, brochures, letters, producer agreements, media interviews, producer meetings, presentations, a display, and a website. The following is a brief outline of the communication activities and outcomes to date:

Government contacts

- Agriculture and Rural Development Minister meetings with MLA's – The Honourable George Groeneveld met and discussed the project with Ray Prins (MLA for Lacombe-Ponoka) and David Coutts (MLA for Lingstone-MacLeod)
- Communications with county Counselors and Agriculture Fieldmen

Producer contacts and meetings

- Met individually with producers in the watershed to solicit participation
- Met with BMP cooperators to discuss project and thank them for their participation
- Hosted information meetings with producers in the watersheds regarding the project
- Personalized letters and agreements for participating producers

Media and public relations

- Newspaper articles (Lacombe, Pincher Creek, Western Producer) (Appendix 8)
- Magazine article: Farming for Tomorrow – Spring 2008 edition (Appendix 8)
- Brochures – highlighted the objectives and scope of the project (Figure 7.1)
- Website – posted information on AF website regarding the project http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/epw11955
- Display – developed to profile the project and partners (Appendix 8)

Conferences and events

- Alberta Soil Science Workshop presentation – presentation to over 100 attendees
- Alberta Beef Industry Conference – setup a project display for over 600 attendees
- Oldman Watershed Council Workshop – presentation to over 100 attendees
- Battle River Watershed Alliance Meeting – presentation to over 50 attendees
- Red Deer River Watershed Alliance Meeting – poster presentation to 100 attendees
- Canadian Water Resources Association Conference – poster presentation to 150 attendees

Future communication activities are listed below.

- Environmental Farm Plan workshops are planned for 2008 depending on the timelines of program changes and funding
- With support and interest from local producers, assist in the formation of watershed stewardship groups within each watershed - start in 2008.
- Collaboration with Watershed Planning and Advisory Councils and other interested stakeholders and potential partners
- Ongoing communication with producers and stakeholders to help meet project objectives and to ask for feedback on the progress and impact of our efforts

7.4 Evaluation and Feedback

Ongoing evaluation is a key component to this plan and will focus primarily on responses from producers and team members regarding how our activities have affected levels of awareness and practice change. The land management survey results will be used to measure the degree of practice change and the effects of our communication efforts for the project. We have also been corresponding with producers and landowners informally and at information sessions to receive input on the project. Overall, producer participation and feedback have been positive. The communication approach taken has been similar in both watersheds to ensure consistency. Although, the amount of time spent with producers in the two watersheds has varied due to travel time and time constraints.

The Indianfarm Creek Watershed producers were approached individually in the fall of 2006 to introduce the project and solicit participation. Producers in the Whelp Creek Sub-watershed were contacted on an individual basis in the spring of 2007.

Producer meetings were effective in discussing the projects and how the results will benefit the industry. Over 20 producers attended each of the meetings in February 2008. The idea of forming local watershed stewardship groups was received openly by producers at the meetings. The producers also support the need to be proactive in addressing issues. However, a few of the Whelp Creek Sub-watershed producers indicated some concern over the use of the study results by the public. This watershed received some media attention in spring 2007 due to some concerns raised by local residents regarding the quality of water that has been diverted from the creek into Lacombe Lake during the past 30 yr. These concerns were addressed by the project team with producers individually and during meetings to reassure them regarding the project objectives and respecting confidentiality. Overall, the communication team is pleased with how well producers are responding and demonstrating a proactive approach towards environmental sustainability.

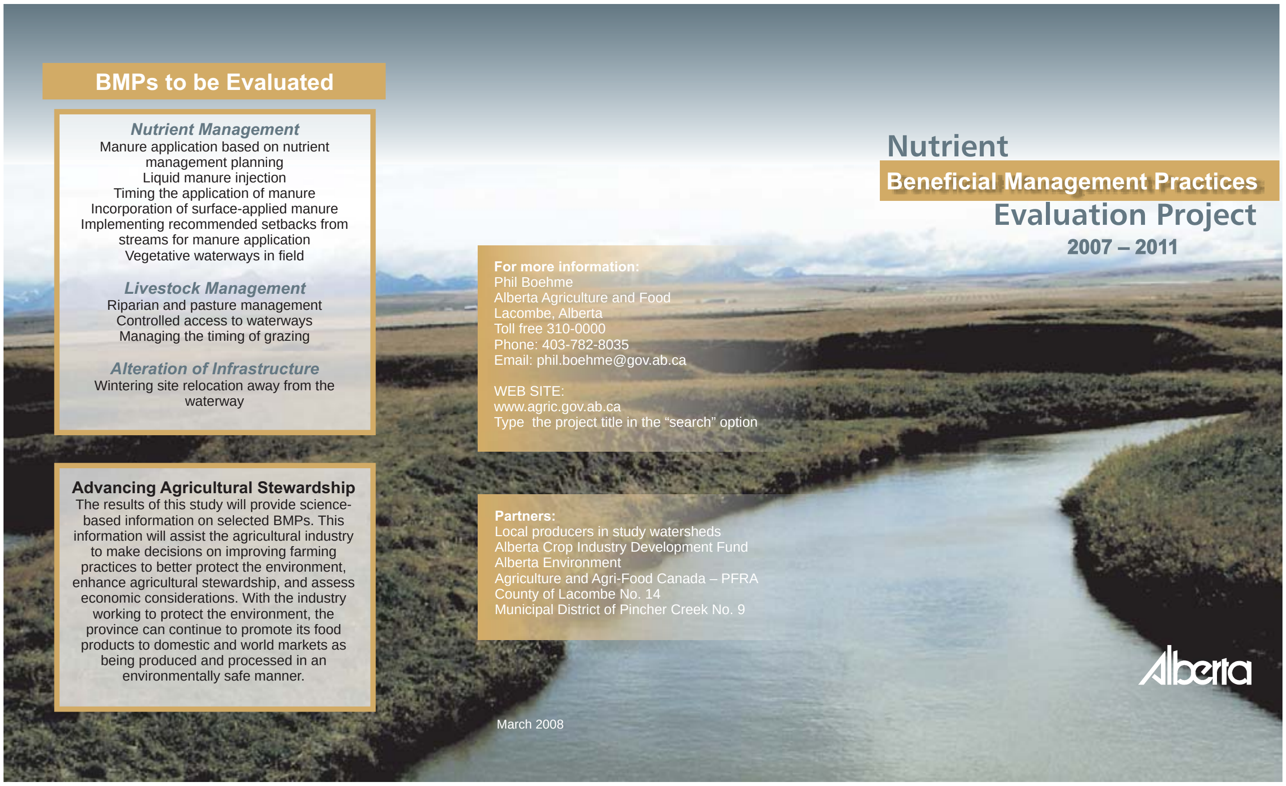


Figure 7.1. A brochure was developed to provide information about the project to the producers in the study watershed and to the public.

SECTION 8
SUMMARY OF PROGRESS AND FUTURE WORK

8.1 Summary of Progress

8.1.1 Watershed Selection

A 5-yr field study was initiated in 2007 to evaluate nutrient beneficial management practices (BMPs) at a field scale within selected agricultural watersheds. Two main watersheds were selected: Indianfarm Creek (IFC) Watershed (14,650 ha) near Pincher Creek, Alberta, and Whelp Creek (WHC) Sub-watershed (4,500 ha) near Lacombe, Alberta. Selection criteria was based on watershed size, ease of access, agriculture intensity and diversity, hydrology, and local producer cooperation. The two watersheds are in the Black Soil Zone. Agriculture is intensive and is the primary land use in both watershed.

In addition to the two main watersheds, two fields sites were selected: one in the Battersea Drain Watershed and the other in the Lower Little Bow River Watershed. These watersheds are adjacent to each other, primarily in the Dark Brown Soil Zone, and about 20 to 35 km northeast of Lethbridge, Alberta. The Battersea Drain Field (BDF) site is 65 ha in size and the Lower Little Bow River Field (LLB) site is 130 ha in size. Both field sites have been evaluated in previous studies, and both fields are under irrigated annual crop production and have received high rates of cattle manure for several years. The BDF and LLB sites were included in the study because they have excessive levels of soil-test phosphorus (STP) caused by repeated applications of manure.

8.1.2 Indianfarm Creek Watershed

The IFC Watershed and BMP sites within the watershed were selected in 2006. Seven BMP sites were selected in IFC: three manured fields, an off-stream water site, a pasture management site (PST), a corral site

(COR), and a livestock wintering site (WIN). The manured fields included the North Manured Field (NMF), the South Manured Field (SMF), and the Dairy Manured Field (DMF). The NMF and SMF sites receive beef cattle manure. The off-stream watering BMP is at a water impoundment site (IMP), which is a body of water created by an earthen dam across one of the tributaries of IFC. A cereal field, without manure application, was also selected to serve as a reference site (REF). The runoff from the REF site will be monitored during the duration of study without applying a BMP.

In addition to the evaluation of individual BMPs, watershed-wide land use and economic data were collected. A drive-through survey was carried out in September 2007 to obtain a near complete inventory of land cover for a point in time. An in-person interview and survey was also conducted with producers within the watershed. All producers in the watershed were invited to participate and about 18% completed the survey. The IFC Watershed is dominated by pasture (44%), annual cereal crops (40%; mainly barley), hay land (12%), and livestock. Livestock is mainly beef cattle including cow-calf and confined feeding operations.

The BMP sites were instrumented in late 2006 and early 2007 for collecting water flow data and water samples. A combination of circular flumes, in-stream flow monitoring, grab sampling, and automatic samplers were used or installed for in-stream and/or edge-of-field sites. The number of water quality monitoring stations associated with BMP sites vary from one to four stations. There are 21 water monitoring stations in the IFC Watershed. Year 2007 was the first year of the pre-BMP phase for the watershed.

Weather conditions in the watershed and area were warmer and much dryer than normal, particularly during the growing season in 2007. As a result, flow rates were low and little runoff occurred. Most total phosphorus (TP) values measured in IFC exceeded the protection of aquatic life guideline of 0.05 mg L^{-1}. The IFC outlet had an average TP concentration of 0.16 mg L^{-1}. The majority of the TP was particulate P (PP) suggesting significant stream-bed erosion. The mean TP concentration at the outlet was higher during runoff events (0.21 mg L^{-1} for rainfall events and 0.26 mg L^{-1} for snowmelt events) compared to base flow (0.07 mg L^{-1}). During runoff events, TP concentration was higher at the edge-of-field stations (0.32 to 2.09 mg L^{-1}) than in the main stream (0.03 to 1.43 mg L^{-1}). Most in-stream total nitrogen (TN) values and all edge-of-field TN values exceeded the protection of aquatic life guideline of 1.0 mg L^{-1}. The IFC outlet had an average TN concentration of 1.68 mg L^{-1}. Total N mean concentration at the outlet was higher during runoff events (1.76 mg L^{-1} for rainfall events and 2.41 mg L^{-1} for snowmelt events) compared to base flow (1.22 mg L^{-1}). During runoff events, TN concentration was higher at the edge-of-field stations (1.60 to 27.9 mg L^{-1}) than in the main stream (0.60 to 8.53 mg L^{-1}). Mean total coliforms (TC) concentration was 3161 mpn 100 mL^{-1} and mean *E. coli* concentration was 305 mpn 100 mL^{-1} at the IFC outlet. The water quality irrigation guideline for TC is 1000 mpn 100 mL^{-1}. Watershed-wide, the mean concentrations of TC and *E. coli* were higher for edge-of-field (251,783 and 20,462 mpn 100 mL^{-1}, respectively) than for in-stream (6134 and 602 mpn 100 mL^{-1}, respectively). One year of preliminary data suggests that edge-of-field sites at the SMF, WIN, and COR sites are contributing N, P, and bacteria to IFC. Not enough flow occurred at the PST, NMF, and DMF sites to determine preliminary conclusions. The REF site was not instrumented until the summer of 2007 and subsequently, no flow occurred either.

Soil samples (0 to 15 cm) were collected from all the manure management BMP fields and non-cultivated BMP sites. Soil-test phosphorus ranged from 12 to 113 mg kg^{-1}, extractable NO_3-N ranged from 5 to 61 mg kg^{-1}, and extractable NH_4-N ranged from 5 to 15 mg kg^{-1} in 2007. The STP levels were generally at or below the agronomic threshold of 60 mg kg^{-1}.

Crop samples were collected for tissue analysis and yield estimates from the three manure management fields in IFC (all barley). The TN and TP contents in crop tissue were within published values.

Cows and Fish carried out riparian assessments at the WIN, PST, and IMP sites in June 2007. The surveys showed these sites were unhealthy and suffered from impairment to many riparian functions.

Six rangeland health assessment transects were carried out at the PST site. The results showed the pasture was in an unhealthy to moderately healthy state, with degradation in all assessed categories.

8.1.3 Whelp Creek

The WHC Sub-watershed was selected in 2007 and the BMP sites instrumented in late 2007 and early 2008 in preparation for water monitoring in 2008. Five BMP sites and two reference sites were selected in WHC. One BMP is a pasture management site (WPS) and the other four BMP's are manure management fields, designated as the West Field (WFD), North Field (NFD), East Field (EFD), and the South Field (SFD). Liquid hog manure is applied to the WFD site, and dairy manure is applied to the EFD (liquid), SFD (liquid), and NFD (liquid and solid) sites. The WHC Sub-watershed was selected a year after the IFC Watershed, and the first year of pre-BMP monitoring will start in 2008.

A drive-through land cover survey was carried out in August and September 2007. About 45% of the crop was in barely production and about 33% was in hay or pasture land. The remaining area produced canola, wheat, potatoes, and corn. Livestock operation included hog, dairy cattle, and beef cattle. In addition, in person interviews were carried out with local producers to obtain more in depth land use and economic information. About 50% of the producers participated in the survey.

The BMP sites were instrumented similar to IFC in preparation for water monitoring in 2008. In addition, during the selection and establishment phase in 2007, grab samples were collected seven times from mid March to early July 2007 in the WHC Sub-watershed. At the outlet, TP ranged from 0.46 to 1.1 mg L^{-1}, TN ranged from 1.5 to 5.8 mg L^{-1}, and TC ranged from 1 to 26,000 mpn 100 mL^{-1}. The guidelines for the protection of aquatic life were exceeded for TP (0.05 mg L^{-1}) and for TN (1.0 mg L^{-1}), as well as the guideline for agricultural use was exceeded for TC (1000 mpn 100 mL^{-1}).

Soil samples (0 to 15 cm) were collected from the five BMP sites and the two REF sites. Average nutrient content in the soils ranged from 21 to 66 mg kg^{-1} for STP, 8 to 25 mg kg^{-1} for NO_3-N, and 5 to 19 mg kg^{-1} for NH_4-N. Agronomically, the soil nutrient content was not excessive.

Manure samples were taken when three of the manure nutrient BMP fields were manured in 2007. Analyses showed that the nutrient content were similar or above published values.

8.1.4 Battersea Drain Field and Lower Little Bow River Field

The BDF and LLB sites were selected because of excessive nutrient levels in the soil caused by cattle manure application. Also, both sites are under irrigation. These features are not represented in the IFC and WHC watersheds. The first year of pre-BMP monitoring was carried out in 2007.

The LLB site was instrumented in late 2006 with a single edge-of-field water monitoring station. The BDF site was instrumented in June 2007 with four edge-of-field water monitoring stations, as well as upstream and downstream stations in the Battersea Drain, which bisects the field.

Because of the dry conditions in 2007, there was no snowmelt runoff and few rainfall runoff events. The majority of the runoff events were generated by irrigation. The in-stream mean TP concentration at the BDF site was 0.08 mg L^{-1} (upstream and downsteam); whereas, the edge-of-field station TP mean concentrations were 0.95 to 3.49 mg L^{-1} at the BDF site and 1.67 mg L^{-1} at the LLB site. The in-stream mean TN concentration at the BDF site was 0.77 mg L^{-1} (upstream) and 5.0 mg L^{-1}(downstream); whereas, the edge-of-field station TN mean concentrations were 2.21 to 5.30 mg L^{-1} at the BDF site and 5.30 mg L^{-1} at the LLB site. Total coliform (6,100 to 751,857 mpn 100 mL^{-1}) and *E. coli* (below detection limit to 4,270 mpn 100 mL^{-1}) concentrations were higher at the edge-of-field at the BDF and LLB sites compared to the in-stream TC (9,688 to 11,357 mpn 100 mL^{-1}) and *E. coli* (228 to 241 mpn 100 mL^{-1}) at the BDF site. The guidelines for the protection of aquatic life were exceeded for TP (0.05 mg L^{-1}) and for TN (1.0 mg L^{-1}), as well as the guideline for agricultural use was exceeded for TC (1000 mpn 100 mL^{-1}).

Soil (0 to 15 cm), crop, and manure samples were collected from both sites in 2007. Between the two sites, STP ranged from 221 to 349 mg kg^{-1}, soil extractable NO_3-N ranged from 24 to 62 mg kg^{-1}, and soil extractable NH_4-N ranged from 5 to 49 mg kg^{-1}. Corn was grown at the LLB site and potatoes were grown at the BDF site. Feedlot cattle manure was applied to both sites in the fall of 2007.

8.1.5 Modeling

The Comprehensive Economic and Environmental Optimization Tool - Livestock and Poultry (CEEOT-LP) model was selected for use in the project. The CEEOT-LP model was developed in 1995 as part of United States National Pilot Project by the Texas Institute for Applied Research (TiAER) of Tarleton State University. We are collaborating with TiAER scientists regarding this aspect of the project.

The CEEOT-LP model is a combination of three models: Soil and Water Assessment Tool (SWAT), Agricultural Policy/Environmental eXtender (APEX), and Farm Economic Model (FEM). The SWAT and APEX models are continuous-time simulation models designed to predict on a daily bases the impact of management practices on soil and water quality at watershed (SWAT) and edge-of-field (APEX) scales.

In the first year of the project, the modeling activities were directed towards developing and collecting the input database that is necessary to calibrate and run the model. The collected data were organized into five categories: climate, soil, topography, land management, and economics. At this point, the collected data has been entered into computer and awaits further quality control check and formatting.

8.1.6 Communications Plan

Effective communication with participating producers, partners, and other stakeholders, as well as among the research team members, is critical to the success of this project. A communication plan was developed by the Communication Team. The plan outlined how information will be developed and delivered to the target audiences. Poster and oral presentations at several meetings and conferences were carried out. A few media articles highlighted the new project. An information brochure and web site were developed. Extensive discussions were carried with the producers during the selection process of the BMP sites. In particular, two producer information and discussion meetings were held in each watershed. One was for the cooperating producers who agreed to host BMP sites on their property. The second meeting was a general information session open to all producers in the watersheds. Keeping local producers informed on the progress of the project is a an important strategy of the communication plan.

8.2 Future Work

Year 2008 will be the second year of pre-BMP data collection for the IFC Watershed and the BDF and LLB sites. This will be the first year of pre-BMP data collection for the WHC Sub-watershed. In-stream and edge-of-field water samples and flows will be collected and analyzed.

Depending on the weather and runoff event frequency during the year, the BMPs are scheduled to be implemented in the IFC Watershed and at the BDF and LLB sites during the later half of 2008. The first year of post-BMP data collection will be in 2009. However, if it is determined the baseline data are not adequate for the pre-BMP phase in the IFC Watershed, due to dry conditions, the timing of BMP implementation will be reconsidered. In preparation for BMP implementation, detailed plans will be developed for each BMP site. The plans will include BMP options and the cost of implementation. The planning of the BMPs will be done in cooperation with the producers.

Weather stations will be installed at the sites. Four weather stations will be installed in the IFC Watershed, two weather stations in the WHC Sub-watershed, and one station each at the BDF and LLB sites.

Additional soil, crop, and manure samples will be collected as required. Soil samples will include surface (0 to 15 cm) samples, which will be related to runoff water quality, agronomic samples (0 to 60 cm) for nutrient management plans, and site characterization samples. Additional riparian and rangeland assessments will be carried out in the IFC Watershed. The first rangeland assessment will be carried out on the pasture management site in the WHC Sub-watershed.

Data and training will be developed for use of the CEEOT-LP model. The input files for the IFC and WHC watersheds will be completed and verified. Research staff will receive training on the CEEOT-LP model at the TiAER facility.

During the information meetings held for the producers in the two watersheds, attendees expressed interest in forming watershed stewardship groups. Assistance will be provided to organize the formation of watershed stewardship groups in the IFC Watershed and the WHC Sub-watershed.