Environmental Impact Assessment for the Collins Farms Ltd. Proposed Irrigation Project

FINAL REPORT

Prepared for:
Collins Farms Ltd.

Prepared by:
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June 30, 2015

Sign-off Sheet

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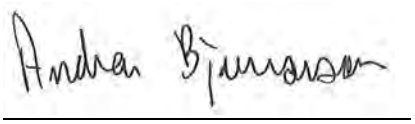
Prepared by 

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Executive Summary

Collins Farms Ltd., a family-owned and -operated company, is proposing to construct groundwater wells and associated irrigation infrastructure to develop an approximately 640-acre (260-hectare) landbase for irrigation. The land is owned by Collins Farms Ltd. The purpose of the Project is to provide the farming operation with financial and agronomic risk management, while providing necessary food production. The Project is located in southern Manitoba in the Rural Municipality of Argyle.

The Project consists of using wells to access groundwater to irrigate land parcels that have previously been developed for annual dryland crop production. The Glenora aquifer is the proposed groundwater source and is anticipated to be reliable, cost-effective and environmentally sustainable. The current crop rotation is a soybean-cereal (wheat)-oilseed (canola) 3-year rotation; future crop rotations may include potatoes and/or corn. A total of 571 acres within 19-03-12W1 will be irrigated using four centre-pivot irrigation units.

The Project is considered a Class 2 Development (Water Development) pursuant to s. 3(5) of the Manitoba *Classes of Development Regulation (Manitoba Regulation 165/88)* of *The Environment Act* as it will withdraw between 200 and 10,000 dam^3 of water per year. The total Project water use requirement is estimated to be 494 dam^3 (400 acre-feet).

Project construction is anticipated to commence in the fall of 2015, pending regulatory approval, and be completed by the fall of 2017.

The following is a summary of the existing environment attributes of the Project area which were deemed pertinent to the environmental impact assessment conducted.

- The surficial geology consists dominantly of shallow loamy lacustrine sediments overlying sandy-skeletal glaciofluvial deposits.
- The land base predominantly contains soils that are considered prime agricultural lands (Agricultural Capability Classes 1-3) and that have an irrigation suitability rating of Good.
- A Land Assessment Report for the determination of land suitability for irrigated crop production was completed according to the draft guidelines presented by Stantec (2011) for land parcels proposed for inclusion. The field was rated as Recommended Precautionary for irrigation development.
- The land base contains soils that dominantly fall into Class 3 for Irrigated Potato Suitability due to the predominance of soils with medium-textured lacustrine material overlying coarse skeletal glaciofluvial material.

- A desktop plant and wildlife assessment conducted by Stantec Consulting Ltd. did not identify any environmental or ecological issues which would prevent the development of the Project.

    - Given that the Project is being developed in an area that is highly disturbed and influenced by the surrounding agricultural land use, it is unlikely that the area to be disturbed supports any important populations of rare plants or has a diverse assemblage of birds, mammals, amphibians, reptiles or invertebrates.

There are positive socio-economic effects associated with the Project.

- Project design and construction costs are estimated to be in the order of $425-650 thousand (2014 $Can).

- Associated with Project construction will be an increase in local employment and increased income related to the use of local services (e.g., hotels, restaurants) and construction materials (e.g., fuel).

- During construction and operation, additional employment will be required through construction contractors and seasonal operations, support staff/contractors.

Potential adverse effects of Project construction are considered minor and primarily related to controlled temporary episodes of noise nuisance associated with heavy equipment vehicle use, which is already common in this agricultural area.

- Effects to terrestrial and aquatic flora and fauna within the Project footprint and immediate local area are anticipated to be minimal during project construction and operation.

- Construction will occur primarily during typical windows of seasonal agricultural operations and during normal agricultural operation hours; therefore, the noise nuisance from construction is not anticipated to result in a significant adverse effect.

- Pumping tests conducted (Stantec 2015) confirmed groundwater availability for the Project and concluded that effects to other groundwater users (e.g., Town of Pilot Mound well to the north of the Project) are not anticipated.

The Project is not anticipated to contribute significantly to greenhouse gas emissions due to the short-term duration of the construction phase as well as the non-continuous nature of agricultural operations (e.g., harvest and tillage) which will not change substantively over baseline operations.

The Proponent is committed to the following to protect the environment during Project construction and operation:

- Implement environmental protection measures and monitoring in compliance with the conditions of the *Environment Act* License during Project construction and operation.

- Monitor the work site (i.e., wells, pump, irrigation equipment and the fields under irrigation) for effectiveness of measures put in place to protect the environment.
- Maintain all environmental control and protection devices, and other equipment, e.g., regular maintenance checks for vehicles.
- Take appropriate and timely action to correct any deficiencies.
- Take action where it is recognized that an impact to the environment will occur.
- Train and empower staff and contractors to identify, address and report potential environmental problems.
- Report any reportable environmental incidents to Manitoba Conservation and Water Stewardship as soon as possible after they occur.

Study Team

The Study Team involved in this assessment included:

Daniel Saurette, M.Sc., P.Ag.	Project Manager, Senior Soil Scientist
David Whetter, M.Sc., P.Ag.	Senior Soil Scientist, Reviewer
Andrea Bjarnarson, M.Sc.	Environmental Scientist
Aaron Campigotto, B.A.	GIS Analyst
David McLeod, M.A.	Senior Archaeologist
Cole Mozynski, B. Env. Sc. Hons.	Wildlife Biologist
Kristin Mozel, MNRM, Adv. Dip. GIS	Vegetation Ecologist

1.0 Introduction

Collins Farms Ltd. is a local, family-owned farm business and is proposing to construct and operate an irrigation project ("the Project") in southern Manitoba in the Rural Municipality (RM) of Argyle, between the towns of Glenora and Pilot Mound (Figure 1-1).

The Project consists of developing approximately 640 acres (260 hectares) of land in 19-03-12-W1 for the purposes of irrigating annual crops. Approximately 571 ac (231 hectares) will be irrigated. The land is privately-owned by Collins Farms Ltd. and is currently under agricultural land use for annual, dryland crop production. Specifically, the Project will consist of developing a groundwater source within 19-03-12-W1 with groundwater wells, pump works, interconnected piping, and an overhead irrigation system. Collins Farms Ltd. proposes to construct all project infrastructure on 19-03-12-W1. The groundwater wells will use water from the Glenora Aquifer.

Construction is anticipated to commence in 2015, pending regulatory approval. The Project will be considered a Class 2 Development under the Classes of Development Regulation (Regulation 164/88), and will require an Environment Act License under Manitoba's *The Environment Act* prior to construction and operation.

1.1 THE PROPONENT

For the purposes of development licensing, the proponent of the Project is Collins Farms Ltd. (hereafter "the Proponent").

For further information regarding Collins Farms Ltd., please contact the following:

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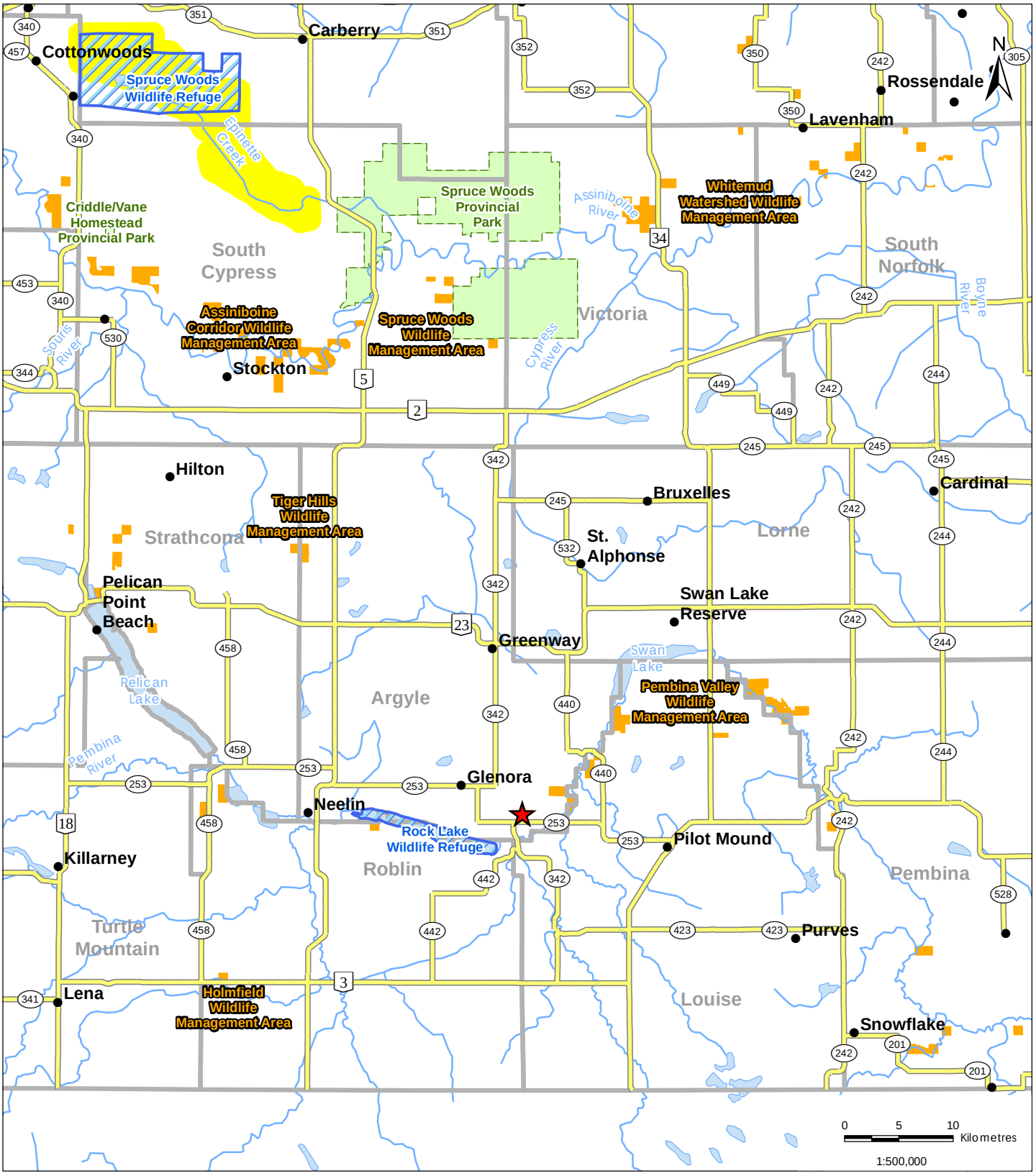

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Revised: 2015-05-04 By: acampigotto

May 2015
Project No. 111440257

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features courtesy of Manitoba Land Initiative and CANVEC

Legend

- Site Location
- Major Road
- Wildlife Refuge
- Wildlife Management Area
- Important Bird Area
- Provincial Park
- Rural Municipality

Client/Project

COLLINS FARMS
Environmental Impact Assessment
Section 19-3-12-W

Figure No.

1-1

Title

Regional Area Map

2.0 Project Description

2.1 PROJECT PURPOSE AND NEED

The purpose of the Project is to supply supplemental water to crops, in addition to that provided by soil water storage and effective rainfall (i.e., the portion of rainfall that infiltrates the soil and is stored within the crop rooting zone) received throughout the growing season.

The Project is located in an agricultural landscape that supports the production of a range of annual crops. Crop production is important to the economy in the region and is the basis of the Proponent's family-owned farming operation.

Crop-available water is a limiting factor to the yield and quality of the crops grown in the area. Crop water demand for commonly grown crops in the area generally exceeds precipitation received during the growing season, creating a crop water deficit situation. Supplemental water made available for crops through irrigation removes or minimizes the crop water deficits experienced under dryland annual crop production. The Project will provide risk management for the Proponent and will allow water to be applied as required by the crop to maximize crop yield and quality. Further, the Project will allow for the increased crop type selection including corn and potatoes.

2.2 ALTERNATIVES TO THE PROJECT

A potential alternative irrigation source for the project would be irrigating from the Pembina River, however this would not be economically feasible for this operation. Not irrigating and continuing to practice dryland farming will not provide the desired risk management, and yield and quality enhancement and increased crop type selection desired by the Proponent. There are no reasonable alternatives to the Project.

2.3 PROJECT SUMMARY

The Project is comprised of one parcel of land (Figure 2-1) located in the RM of Argyle within Section 19, Township 3, Range 12, west of the Prime Meridian (WPM). The Project is located approximately 12 km northwest of the town of Pilot Mound and village of Crystal City, 10 km north of the village of Clearwater, and 4.5 km southeast of the village of Glenora.

The Project is summarized as follows:

- Infrastructure: four groundwater wells, pump works, interconnected piping, and an overhead, sprinkler irrigation system consisting of four centre-pivot irrigation units.
- Acreage: approximately 571 acres (231 hectares) will be irrigated within the 640 acres (260 hectares) total land area within 19-03-12-W1.

- Crops: the primary crop is soybeans, with cereals and oilseeds grown in rotation. The proposed crop rotation is a 3 year rotation. It is planned that all crops in the rotation will be irrigated. Future cropping plans include corn and potatoes being added to the crop rotation.

- Water source: groundwater wells will access water from the Glenora aquifer. The system will be owned and managed by Collins Farms Ltd. The proponent will hire the services of an agricultural consultant to support operational management of the irrigation project, including irrigation scheduling and timing and nutrient management.

2.4 PREVIOUS STUDIES

Two previous studies are pertinent to this Project:

- Stantec Consulting Ltd. 2014. Land assessment report and producer survey for the Collins Farms Ltd. Irrigation Development Project. Prepared for Collins Farms Ltd., October 2014. (Appendix B)

- Stantec Consulting Ltd. 2015. Review of PW15-01 Pumping Test, Collins Farms Ltd. Letter report, June 2015. (Appendix C)

2.5 DETAILED PROJECT DESCRIPTION

Four centre-pivot irrigation units will be constructed. The irrigation units will be low-pressure systems to maximize water use efficiency and reduce energy consumption. Water will be delivered through rotating sprinkler heads on drop tubes. It is planned that irrigation units will be "corner-pivots" with swing-out sections with end-guns to maximize irrigated areas within each field. The pivots will be driven by electrical motors. Three of the centre-pivot units will be 1547 feet in length and will require 63.1 L/s (1000 US gpm), and one unit will be 1289 feet in length and will require 50.5 L/s (800 US gpm). The proposed layout of the irrigation units is found in Figure 2-1.

The required instantaneous flow rate to service all four pivots is 240 L/s (3800 US gpm). However, only two will be operated simultaneously so it is assumed that 126 L/s (2000 US gpm) will be adequate to supply the pivots.

Supply wells will be located on the eastern side of NE19-03-12W1 and will access water from the Glenora aquifer. Based on pump testing conducted at the site (Stantec Consulting Ltd., 2015; Appendix C) four 8-inch wells similar in design to the pump test well can achieve the required withdrawal rate. The 8-inch well installed for pump testing could be used as a supply well.

During testing, it was found that groundwater drawdown was considered to be negligible at a distance of 75 m from the pumping well. Following construction, additional testing would be

required to confirm capacity and drawdown with the supply wells. Additional test wells should be spaced at least 75 m away from any other test well.

Electric pumps will be used to draw water from the supply wells and deliver water through buried pipeline distribution system to irrigation units. Three-phase electrical power, located along the eastern boundary of the section, will be used to provide electrical power to the pumps.

The proposed irrigation pipeline network will consist of buried, high-density polyethylene (HDPE) piping. The pipeline will traverse disturbed and cultivated land owned by the Proponent. Pipelines will consist of pipes of 15-, 12- and 10-inch diameters and will be sized according to final irrigation system design.

2.5.1 Water Use Requirements

In order to estimate water use requirements for the Project, two crop rotation scenarios are considered based on current (*i.e.,* crop rotation 1) and future (*i.e.,* crop rotation 2) cropping plans. Proposed maximum or allowable irrigation depths by crop type are outlined in Table 2-1.

The proposed allowable irrigation depths consider crop water demand relative to average precipitation received in the region (see Section 4.1.6) and typical allowable irrigation depths allocated in Manitoba. While the proposed allowable irrigation depths exceed average crop water deficit levels (see Section 4.1.6), they allow for provision of irrigation water to satisfy crop water deficits at a reasonable risk level. The average crop water deficits are expected to be exceeded one in every two years. For example, growing season precipitation received during 2006 was much lower than long-term average (50 to 60% of normal) and would have required substantively more water than the average crop water deficit estimates (MASC 2007).

Table 2-1: Crop Rotation Scenarios and Proposed Irrigation Depths by Crop Type

Crop Rotation Scenario	Crop by Year (Proposed Allowable Irrigation Depth)		
	Year 1	Year 2	Year 3
Crop Rotation 1	Soybean (6 inches)	Cereal (Wheat) (6 inches)	Oilseed (Canola) (4 inches)
Crop Rotation 2	Corn or Potato (12 inches)	Oilseed (Canola) (4 inches)	Cereal (Wheat) (6 inches)

The estimated Project water use requirement was determined for each of the crop rotation scenarios based on the following assumptions:

- allowable irrigation depths by crop, as presented above
- all crops in rotation will be irrigated

- total irrigated area is 571 acres and average field size is 143 acres for the four fields (actual field size is variable)

- total water use requirement for each crop rotation scenario is based on the year in which the requirement is the greatest:

  - crop Rotation 1: Field 1 – Wheat, Field 2 – Soybean, Field 3 – Canola, Field 4 – Wheat

  - crop Rotation 2: Field 1 – Potato or Corn, Field 2 – Wheat, Field 3 – Potato or Corn, Field 4 - Canola

Based on the assumptions above, the estimated Project water use requirements are presented in Table 2-2. To provide sufficient irrigation water for crop rotation 2, the total estimated Project water use requirement was found to be 400 acre-feet.

Table 2-2: Estimated Project Water Use Requirements

Crop Rotation Scenario	Annual Irrigation Area	Estimated Project Water Use Requirement	
	acres	acre-feet	dam^3
Crop Rotation 1	571	260	321
Crop Rotation 2	571	400	494

2.5.2 Project Schedule

Project construction is due to commence in fall 2015, pending regulatory approval. The construction will consist of installation of groundwater wells and installing associated irrigation infrastructure. It is anticipated that supporting irrigation infrastructure including wells, pumps, pipelines and electrical supply will be installed in the first year of construction. Two of the four pivots are anticipated to be installed in the first year of construction with the remaining two pivots to be installed in the second year of construction. Two years of construction are anticipated to complete the construction phase of the Project, with construction anticipated to be complete by the fall of 2017.

2.5.3 Land Assessment for Irrigation Suitability

The parcel of land for the proposed project, 19-03-12W1, has been assessed for irrigation suitability. Results of the land assessments conducted are reported in Stantec Consulting Ltd. (2014, Appendix B) and are summarized in Section 5.3.2. Land was determined to have an irrigation suitability recommendation of “Recommended-Precautionary” due to limitations in soil water holding capacity. Mitigation and monitoring is recommended to address these limitations.

2.6 PROJECT PHASES

2.6.1 Construction

Construction will consist of the following key activities:

- Installation of irrigation supply wells.
- Trenching and installation of irrigation pipelines and electrical supply lines.
- Construction of centre-pivot irrigation units.

2.6.2 Operation and Maintenance

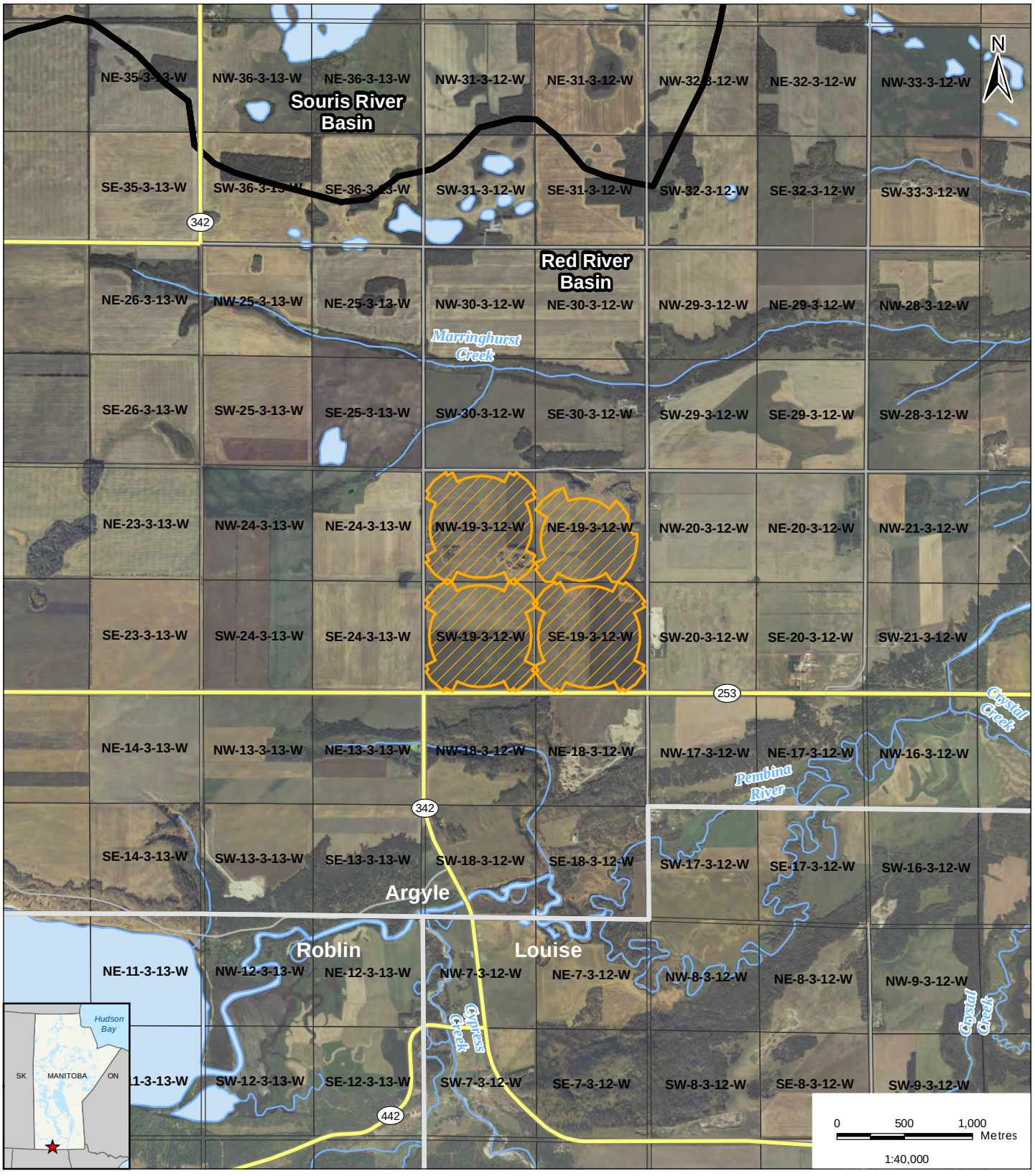
Operations and maintenance will consist of the following key activities:

- Annual irrigation including withdrawal of water from the Glenora aquifer and application through centre-pivot irrigation units.
- Ongoing monitoring of soil moisture conditions to support irrigation scheduling and timing of irrigation applications.
- Ongoing and routine maintenance activities of irrigation infrastructure.
- Ongoing and routine annual crop production practices including seedbed preparation, seeding, nutrient management, pest management, and harvesting, similar to what is already being conducted for dryland crop production operations.

2.6.3 Decommissioning and Abandonment

Decommissioning and abandonment is not planned for a period of at least 50 years. Decommissioning and abandonment would be anticipated to consist of removal of all aboveground infrastructure, primarily irrigation pivots, decommissioning and sealing of irrigation supply and monitoring wells, and abandonment of buried irrigation infrastructure, primarily pipelines and electrical supply. Decommissioning and abandonment would be conducted according to License conditions and regulatory requirements at the time of decommissioning and abandonment.

Decommissioning and abandonment is not considered further in this assessment.



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Revised: 2015-05-04 By: acampigotto

May 2015
Project No. 111440257

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features courtesy of Manitoba Land Initiative and CANVEC

Legend

- Proposed Irrigation Pivots
- Major Road
- Minor Road
- Rural Municipality
- Waterbody
- Watershed Boundary

Client/Project

COLLINS FARMS
Environmental Impact Assessment
Section 19-3-12-W

Figure No.

2-1

Title

Project Description

3.0 Scope of the Assessment

3.1 REGULATORY AND POLICY SETTING

The following is an overview of the regulatory and policy setting relative to the Collins Farms Ltd. Irrigation Project and the statutes and regulations that were considered in this assessment.

3.1.1 Federal

Fisheries Act (R.S.C. 1985, c. F-14)

Amendments to the *Fisheries Act, 1985* came into effect on November 25, 2013. The focus of the amended Act is protecting the sustainability and productivity of recreational, commercial and Aboriginal fisheries. With the amendments, DFO introduced project activities and criteria where DFO review is not required. Further, s.35 prohibits serious harm to fish and fish habitat, unless authorized under the Act.

Migratory Birds Convention Act, 1994 (S.C. 1994, c.22)

The *Migratory Birds Convention Act* implements the international Convention through the protection and conservation of migratory bird individuals and populations and their nests.

Disturbance or destruction of a migratory bird nest or eggs is prohibited pursuant to the *Migratory Birds Regulation* under the Act.

Species at Risk Act (S.C. 2002, c. 29)

A purpose of the *Species at Risk Act* is to prevent wildlife species from being extirpated or becoming extinct as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened.

3.1.2 Provincial

The Environment Act, C.C.S.M. c. E125

The Environment Act provides for the environmental assessment of projects, or "developments," that may have potential for significant effects on the environment. Irrigation projects withdrawing 200 – 10,000 dam^3 (160-8100 acre-feet) per year are considered a Class 2 Development under the Classes of Development Regulation (Manitoba Regulation 164/88) and require a valid and subsisting Environment Act License from the Manitoba Conservation and Water Stewardship Environmental Approvals Branch for construction and operation.

The Project is anticipated to withdraw greater than 200 dam^3 but less than 10,000 dam^3 per year and is therefore considered a Class 2 Development under the Act.

The Water Rights Act, C.C.S.M. c. W80

The Water Rights Act, as administered by the Water Licensing Branch of Manitoba Conservation and Water Stewardship, is the legislative mechanism for allocating provincial water resources in the best possible manner. The diversion of water for irrigation purposes requires a valid and subsisting license pursuant to the *Water Rights Act.* Water for irrigation purposes is defined as:

> *"the use of water at a rate of more than 25,000 litres per day for the artificial application to soil to supply moisture essential to plant growth."*

A license is required for each source and/or location from which surface or groundwater is obtained. Licenses are issued for a maximum of 20 years, but generally for 10 years, with renewal available upon application. Municipal, agricultural and irrigation projects are exempt from water use fees.

The Project is anticipated to use water at a rate of more than 25,000 litres per day. Collins Farms Ltd. has not yet submitted an application for a license to Manitoba Conservation and Water Stewardship.

The Water Protection Act, C.C.S.M. c. W65

Existing and prospective agricultural lands within the province are regulated under the Nutrient Management Regulation (Manitoba Regulation 62/2008) of *The Water Protection Act*, as administered by Manitoba Conservation and Water Stewardship. The purpose of the Regulation is to protect water quality by encouraging responsible nutrient planning and by regulating the application to land of substances containing nitrogen or phosphorus and the development of certain types of nutrient generating facilities in areas where waterbodies or groundwater are sensitive to impact. The Regulation outlines criteria for determining Nutrient Management Zones (NMZs) N1-N5 based on the soil agricultural capability ratings and Nutrient Buffer Zones around groundwater, drainage and waterbody features.

Irrigation projects that include the use of fertilizer application through an irrigation system (i.e., fertigation) or traditional fertilizer application methods as part of the proposed crop production system are required to operate in accordance with the prohibitions and buffer distances outlined in the Regulation of the Act.

The Heritage Resources Act, C.C.S.M. c. H39.1

Known heritage resources are archaeological sites, buildings and objects that have been recorded but are not legally designated as provincially or municipally significant. A heritage site refers to a location or structure that has been protected by Provincial designation as outlined in Part I of *The Heritage Resources Act*. Significant locations or structures that have been legally protected by a municipality are Municipal Heritage Sites, also outlined in Part I of the Act.

Human remains are a special concern of the Act and considered separate from heritage resources. Human remains that are discovered outside of a recognized cemetery or burial ground are protected under the Act. For additional information, see the 1987 Province of Manitoba Policy entitled *"Policy Respecting the Reporting, Exhumation and Reburial of Found Human Remains"* (http://www.gov.mb.ca/chc/hrb/pdf/factsheet_human-remains.pdf).

Impacts to heritage resources by land-based development are discussed in Section 12(2) of the Act. This legislation provides a clear process for proponents and authorities to review and assess the potential impacts to known or potential heritage resources or human remains.

3.1.3 Permits and Approvals

3.1.3.1 Federal

The Project is not anticipated to require any permits or approvals from federal agencies or departments.

3.1.3.2 Provincial

Environment Act License

The Project requires an Environment Act License for construction and operation as a Class 2 Development under *The Environment Act*.

The scope of the assessment was developed to meet the requirements of *The Environment Act*, specifically the guidelines for conducting an environmental assessment provided in "Information Bulletin – Environment Act Proposal Report Guidelines"[1]. The guidelines prescribe what is required in environmental assessment reports supporting an Environment Act Proposal.

Water Use License

The Project requires a Water Use License. Collins Farms Ltd. has not yet filed an application with the Water Use Licensing Section of Manitoba Conservation and Water Stewardship.

3.1.3.3 Municipal

According to the RM of Argyle there are no requirements under the RM pertaining to this project (Collins pers. comm. 2015).

[1] Guidelines dated February 2014 found at http://www.gov.mb.ca/conservation/eal/publs/info_eap.pdf

3.2 ENGAGEMENT

Due to the small scale of the project, that it is contained on one privately-owned section of land, and the low potential for off-site impacts, public engagement sessions were not held to support this environmental assessment. The Proponent notified the town of Pilot Mound of the proposed development prior to completing groundwater exploration at the site.

The Proponent recognizes the value of public participation and understands this environmental assessment will be posted on Manitoba Conservation and Water Stewardship's public registry for public review and comment.

3.3 ASSESSMENT APPROACH

This assessment was completed to meet the requirements of an Environment Act Proposal, and includes assessing project-specific environmental effects, as well as potential cumulative effects likely to result from the Project, in combination with other projects or activities that have been or will be carried out.

For the purposes of this assessment, the term *environment* refers broadly to biophysical and socio-economic elements of the environmental setting.

The assessment focuses on valued components (VCs), which are environmental elements of particular value or interest to regulators and other parties and are identified based on biophysical and socio-economic elements.

Project-related and cumulative effects on these VCs are assessed sequentially in the assessment. Residual effects are characterized using specific predetermined criteria (e.g., direction, magnitude, geographical extent, duration, frequency).

If there is an identified potential for the residual environmental effects of the Project to interact cumulatively with the residual environmental effects of other projects or physical activities, these cumulative environmental effects are also assessed. The significance of Project-related residual effects and cumulative effects are then determined based on pre-defined criteria or thresholds (i.e., benchmarks).

3.3.1 Selection of Valued Components

To focus the assessment on matters of greatest importance, potential interactions of the Project with the surrounding biophysical and socio-economic environment are identified using a variety of sources, including:

- applicable provincial regulatory requirements
- existing information regarding biophysical and socio-economic components found in the project area (e.g., species at risk, existing land uses, existing and proposed projects)

- results of Project-specific field and desktop studies
- professional judgment of the assessment practitioners, based on experience with similar projects elsewhere and other projects and activities in the project area

Biophysical and socio-economic VCs that could be affected through interactions of the environment with the Project are identified to scope the assessment. The VCs that were selected:

- represent a broad biophysical or socio-economic component that might be affected by the Project; or
- are a part of the heritage of Aboriginal peoples[2] or a part of their current use of lands for traditional purposes; or
- are of scientific, historical or archaeological importance.

The rationale for selecting each VC is explained in Table 3-1.

Table 3-1: Valued Components

Biophysical and Socio-economic Element	Potential Project Interaction	Valued Component (VC)	Rationale for Inclusion or Exclusion in the Assessment
Soil Capability	✓	✓	Included because the Project could have an effect on soil quality.
Surface Water Quality and Quantity	x	x	Excluded because the project is not anticipated to interact with surface water.
Groundwater Quality and Quantity	✓	✓	Included because the Project could affect groundwater quantity as groundwater is the irrigation source; and could impact other water users.
Vegetation and Wetlands	✓	✓	Included because the Project will result in the removal of small amounts of native vegetation.
Fish and Fish Habitat	x	x	Excluded because the Project activities and components are not anticipated to interact with a fish-bearing water body.
Wildlife and Wildlife Habitat	✓	✓	Included because the Project has the potential to affect species of conservation concern and/or species at risk and their habitat.

[2] As defined by the *Constitution Act, 1982*

Table 3-1: Valued Components

Biophysical and Socio-economic Element	Potential Project Interaction	Valued Component (VC)	Rationale for Inclusion or Exclusion in the Assessment
Air Quality and Greenhouse Gas Emissions	x	x	Excluded on the basis that proposed agricultural activities during operations will not differ appreciably from current, common agricultural activities, and, contributions to greenhouse gas emissions and repetitive effects to air quality from construction activities are anticipated to be negligible considering the minor and short-term nature of proposed construction activities.
Socio-Economy, Infrastructure and Resource Use	✓	✓	The Project could alter resources used by others, including groundwater users.
Heritage Resources	x	x	Excluded because heritage resource sites found on cultivated fields are considered to be of low heritage importance and the construction footprint is contained within previously disturbed and cultivated fields..
Traditional Land and Resource Use	x	x	Excluded because the Project is located on privately owned land and the Project will not affect traditional activities and sites.

VCs included in this assessment are:

- Soil Capability
- Groundwater Quality and Quantity
- Vegetation and Wetlands
- Wildlife and Wildlife Habitat
- Socio-Economy, Infrastructure and Resource Use

3.3.2 Selection of Environmental Effects and Measurable Parameters

Once interactions that are likely to have effects are identified, one or more measurable parameter(s) are selected to facilitate quantitative (where possible) and qualitative measurement of potential project effects and cumulative effects. The measurable parameter

that is selected must provide defensible and acceptable means to measure the change in condition of a VC between its existing condition and its condition during the selected timeframe (e.g., during construction or during operations). The degree of change in these measureable parameters is used to help characterize Project-specific and cumulative environmental effects and evaluate their significance

Table 3-2 provides the potential environmental effects, measurable parameters and the rationale for inclusion of each parameter in the assessment.

Table 3-2: Potential Environmental Effects and Measurable Parameters

Valued Component	Potential Environmental Effect	Measurable Parameter(s) and Units of Measurement	Notes or Rationale for Selection of the Measureable Parameter
Soil Capability	Change in Soil Quality	Agricultural capability class	Project activities may result in a change in agricultural capability class
Groundwater Quantity and Quality	Change in Groundwater Quantity	Quantitative groundwater pump test results	Directly relates to the groundwater flow patterns, rate of movement, and availability of groundwater.
	Change in Groundwater Quality	Qualitative interpretation of changes in the groundwater quality	Changes in groundwater quality within existing groundwater wells can affect both human and ecological receptors, as well as current and potential future land uses.
Wildlife and Wildlife Habitat	Change in Wildlife Habitat Availability	Direct habitat loss for native vegetation or wetlands that act as wildlife habitat	Loss or degradation of native vegetation and/or wetlands will reduce the capacity of the landscape to support wildlife, including wildlife SAR and SOCC.
		Loss of SAR/SOCC or critical habitat	Identified critical habitat for SAR (i.e., designated area in a species' recovery strategy or action plan) is a key factor in the viability of these individual species.
Vegetation and Wetlands	Change in Native Vegetation and Wetlands	Direct Loss of native vegetation or wetlands	Loss or degradation of native vegetation and/or wetlands will reduce the capacity of the landscape to support plant SAR and SOCC.
		Change in native vegetation types, abundance and distribution	Project activities could affect the abundance and distribution of native vegetation. Project could allow for colonisation of non-native or invasive plant species.
		Change to abundance of SAR or SOCC, and change to designated critical SAR habitat	Project activities could affect the abundance and distribution of SAR and SOCC.

Table 3-2: Potential Environmental Effects and Measurable Parameters

Valued Component	Potential Environmental Effect	Measurable Parameter(s) and Units of Measurement	Notes or Rationale for Selection of the Measureable Parameter
Socio-Economy, Infrastructure and Resource Use	Change in Community Infrastructure and Services	Change in the amount of traffic using access roads to the Project	Project activities affect traffic due to construction and maintenance of infrastructure
		Disruption of services from existing utility providers	Project activities could affect existing utilities
	Changes to Land and Resource Use	Conflict including change/restriction of others' land and resource use	Project activities could affect land and resource use, particularly groundwater resource users

3.3.3 Spatial Boundaries

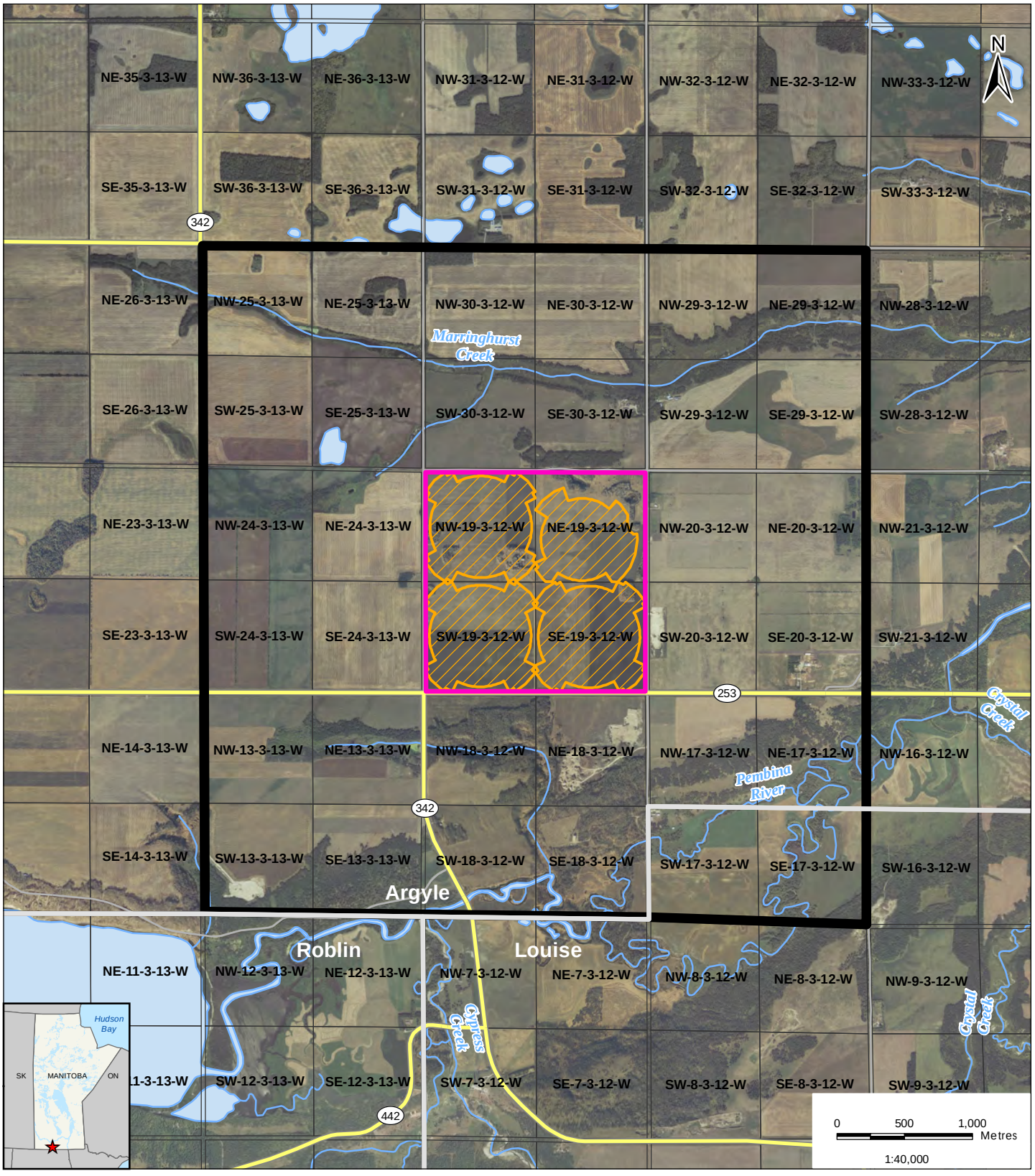
The Project is located in southern Manitoba in the RM of Argyle. For the purposes of this environmental assessment, the Project Development Area, Local Assessment Area and Regional Assessment Area are defined as (Figure 3-1):

- Project Development Area (PDA) – the physical footprint of the Project, or the irrigation pivot footprints and associated infrastructure including groundwater wells, and pipelines.
- Local Assessment Area (LAA) – the outer boundary of the Project footprint which is section 19-03-12W1. For the purposes of the assessment, the LAA is the area over which direct effects of the Project are expected to occur.
- Regional Assessment Area (RAA) –the adjacent sections of land surrounding 19-03-12W1. For the purposes of the assessment, the RAA is the area over which direct effects of the Project area are compared to determine the significance of effects. The RAA is also used as the basis for assessing cumulative effects.

3.3.4 Temporal Boundaries

For the purposes of this assessment, the following temporal boundaries are defined:

- Construction phase – the period of construction of the Project, anticipated to be two years, commencing following project approval represented by the issuance of an Environment Act License. It is anticipated that a License will be issued in late summer or early fall 2015, with construction commencing in the fall of 2015 and being completed in the fall of 2017.
- Operation phase – the period over which the Project will be in Operation, which is anticipated to be at least 50 years.



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Revised: 2015-05-04 By: acampigotto

May 2015
Project No. 111440257

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features courtesy of Manitoba Land Initiative and CANVEC

Legend

- Project Development Area
- Local Assessment Area
- Regional Assessment Area
- Major Road
- Minor Road
- Rural Municipality
- Waterbody

Client/Project

COLLINS FARMS
Environmental Impact Assessment
Section 19-3-12-W

Figure No.

3-1

Title

Spatial Boundaries

3.4 RESIDUAL ENVIRONMENTAL EFFECTS DESCRIPTION CRITERIA

Terms used to characterize the residual environmental effects are summarized in Table 3-3.

Table 3-3: Characterization of Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive**— an improvement in the parameter compared with existing conditions and trends **Adverse**— a decline in the parameter compared with existing conditions and trends **Neutral**— no change in the parameter from existing conditions and trends
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible**—no measurable change **Low**— a change that falls within the level of natural variability, therefore no measurable change **Moderate**— a measurable change which is unlikely to affect the measurable parameter **High**— a measurable change which is likely to affect the measurable parameter
Geographic Extent	The geographic area in which an environmental, effect occurs	**PDA**—residual effects are restricted to the PDA **LAA**—residual effects extend into the LAA **RAA** – residual effects interact with those of other projects in the RAA
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	**Single event**— residual effect occurs once throughout the life of the Project **Multiple irregular event**— residual effect occurs sporadically and intermittently (no set schedule) throughout **Multiple regular event**— residual effect occurs repeatedly and regularly throughout **Continuous**—residual effect occurs continuously throughout the life of the Project
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	**Short-term**— residual effect restricted to the duration of the construction phase **Medium-term**— residual effect extends to five years following construction **Long-term**— residual effect extends for longer than five years following construction **Permanent**—measurable parameter unlikely to recover to existing conditions within the life of the Project

Table 3-3: Characterization of Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible**—the effect is likely to be reversed after activity completion and decommissioning **Irreversible**—the effect is unlikely to be reversed even after decommissioning
Ecological and Socio-economic Context	Existing condition and trends in the area where environmental effects occur	**Undisturbed**—area is relatively undisturbed or not adversely affected by human activity **Disturbed**—area has been substantially previously disturbed by human development or human development is still present

3.5 SIGNIFICANCE THRESHOLDS FOR RESIDUAL ENVIRONMENTAL EFFECTS

Where standards or established thresholds are available, the environmental or socio-economic effects on each measurable parameter or VC are evaluated against them. Standards include government regulations or industry-set goals for biophysical aspects such as water quality and fish habitat. Established thresholds reflect the limits of an acceptable state for a measurable parameter or VC based on resource management goals or scientific literature.

Significance thresholds for residual environmental effects are summarized in Table 3-4.

Table 3-4: Significance Thresholds for Residual Environmental Effects

Valued Component	Significance Threshold
Soil Capability	A significant adverse residual effect is a measurable effect which results in a change in soil quality resulting in a reduction in agricultural capability class that cannot be offset through mitigation.
Groundwater Quantity and Quality	A significant adverse residual effect is a measurable effect to groundwater quality or quantity which results in the loss of use of groundwater by other current and future resource users and which cannot be mitigated.
Wildlife and Wildlife Habitat	An overall determination of significance is made for the combined Project residual effects on wildlife and wildlife habitat for all Project phases (i.e., construction and operation) after mitigation is implemented. A significant adverse residual effect is defined as one that threatens the long-term persistence or viability of a wildlife species in the RAA, or effects that are contrary to or inconsistent with the goals, objectives, or activities of recovery strategies, action plans, and management plans.

Table 3-4: Significance Thresholds for Residual Environmental Effects

Valued Component	Significance Threshold
Vegetation and Wetlands	An overall determination of significance is made for the Project residual effects on vegetation and wetlands after mitigation measures are implemented. No specific provincial or federal regulations set thresholds for determining the significance of environmental effects on vegetation and wetlands. Consequently, for this assessment, a significant adverse residual effect is defined as: • For SAR: any residual effects on SAR, including effects that are contrary to or inconsistent with federal objectives (including recovery strategies and critical habitat). • For native plant species (including plant SOCC) or native vegetation types: any effect that threatens their long-term persistence or viability in the RAA, including effects that are contrary to or inconsistent with provincial management objectives. • For wetlands: any effect that will lead to a net loss of wetland function which cannot be mitigated or compensated for, or is otherwise in contravention of wetland policies or regulations.
Socio-Economy, Infrastructure and Resource Use	A significant adverse residual effect is a measurable effect that is defined as one where: • The Project does not comply with established land use plans, policies or by-laws; • The Project will create a change to infrastructure or services that exceeds available capacity or substantially decreases quality of service provided on a persistent and ongoing basis, and cannot be managed with current or anticipated programs, policies, or mitigation measures, or • The Project will create a change or disruption that restricts or degrades present resource or land use capability to a point where the activities cannot continue at or near current levels.

4.0 Environmental and Socio-Economic Setting

4.1 PHYSICAL ENVIRONMENT

4.1.1 Physiography and Climate

The RAA is located in south central Manitoba within the Hilton and Manitou Ecodistricts of the Aspen Parkland Ecoregion, which is within Manitoba's Prairie Ecozone (Smith *et al.* 1998).

The local relief in the Hilton Ecodistrict is moderate, with the landscape described as undulating to hummocky or kettled end moraine with gentle to moderate slopes (6-15%). The local relief in the Manitou Ecodistrict is moderate, with the landscape described as undulating to hummocky glacial till plain with gentle to moderate slopes (<5-15%) (Smith *et al*. 1998).

The surficial geology within the RAA consists of distal glaciofluvial sediments comprised of fine sand, minor gravel and thin silt and clay interbeds (Matile and Keller, 2004). The underlying bedrock consists of Upper Cretaceous shaly sediments that form the eastern edge of the Western Canada Sedimentary Basin (Smith *et al*. 1998). Beneath the Mesozoic-era rocks is Precambrian granite.

The climate of the Hilton Ecodistrict is characterized by short, warm summers and long cold winters. The mean annual temperature is approximately 2.4˚C. The mean annual precipitation is approximately 510 mm, but varies greatly from year to year. Snow accounts for one quarter of the precipitation. The climate of the Manitou Ecodistrict is characterized by short, warm summers and long cold winters. The mean annual temperature is approximately 2.7˚C. The mean annual precipitation is approximately 530 mm, but varies greatly from year to year. Snow accounts for one quarter of the precipitation.

The nearest meteorological station to the LAA is located in Pilot Mound, Manitoba (Environment Canada 2015). The average growing season precipitation to maturity for potatoes is 10.1 to 10.5 inches (257 – 267 mm) in the Pilot Mound region (Manitoba Agriculture, Food and Rural Initiatives (MAFRI, 2001). Monthly climate normals are provide in Table 4-1 below.

Table 4-1: Climate Normals for Pilot Mound, Manitoba (1981-2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
Temperature (°C)													
Daily Avg.	-15.7	-11.9	-5.6	4.1	11.8	17	19.2	18.6	13.1	4.9	-4.5	-12	3.0
Daily Max.	-11.1	-7.1	-1.1	9.8	18.2	22.8	24.9	24.8	19	10.1	-0.4	-7.9	9.3
Daily Min.	-20.2	-16.6	-10.1	-1.6	5.4	11.1	13.4	12.3	7	-0.3	-8.6	-16.1	-3.3
Precipitation													
Rainfall (mm)	0	2.2	8	15.7	70.4	92.9	82.1	72.5	44.1	29.4	5.9	0.3	423.5
Snowfall (cm)	23.2	17.5	16.3	10	4.5	0	0	0	0.8	6.6	20.6	25.1	124.6
Total (mm)	23.3	19.7	24.3	25.6	75	92.9	82.1	72.5	44.8	35.9	26.5	25.4	548
Source: http://www.weatheroffice.ec.gc.ca													

4.1.2 Hydrogeology and Groundwater

The RAA is underlain by Riding Mountain Formation (Cretaceous age) shale and siltstone. The bedrock is overlain by overburden, which is 1 to 75 m thick and includes the Glenora aquifer. The Glenora Aquifer is an unconfined aquifer composed of beds of coarse sand to medium gravel; in some cases the gravels contains large amounts of clay. The aquifer rests of lacustrine clays which in turn rest of till deposits (Render 1987). This aquifer contains potable water and regional groundwater flow direction in the Glenora aquifer is to the southeast.

To confirm the regional coarse-scale data with respect to the LAA, a search of the Province of Manitoba Water Stewardship Division (MCWS) "GWDRILL" database was conducted. The GWDRILL search indicated that there is an old well located in 19-03-12W1 (MCWS, 2013). A soil log and well construction details were available for the well. The log indicated the well has been screened in the aquifer approximately 13 meters below ground (mbg), below clay extending approximately 4 mbg, followed by clay and sand extending to approximately 10.7 mbg. Driller's records also indicated that the groundwater level is approximately 6.7 mbg. The current status of the well is unknown.

Drilling and pump testing conducted to support this assessment (Stantec 2015, Appendix C) indicated that the water table at the testing location along the eastern boundary of NW-19-03-12W1 was found to be at 1.66 mbg.

4.1.3 Surface Water

The RAA falls within the Pilot Mound division of the Red River watershed, which is part of the Nelson River system which drains into Hudson Bay (Smith et al. 1998). The southeast corner of the RAA is located within the Pembina River Valley which is the dominant surface drainage feature

in the area. The Pembina River Valley is described as a broad meltwater channel containing numerous lakes created by natural dams created by sedimentation from tributary ravines (Smith et al. 1998).

Surface water bodies within proximity of the LAA, include Rock Lake 2.5 km to the southwest northeast of Rock Lake, Pembina River 1.0 km to the south, and Marringhurst Creek 0.6 km to the north. A small tributary of the Marringhurst Creek is located within 200 m of the LAA to the northwest. A small tributary of the Pembina River is located within 400 m of the LAA to the south.

4.1.4 Soil Landscape

The existing soil resource information (SRI) for the LAA is based on reconnaissance (1:50,000) survey intensity level (SIL) data (Haluschak et al. 1997). At minimum, a detailed survey intensity level (1:20,000) is required for irrigation suitability assessment. As such, Stantec conducted a detailed soil survey on August 12 and 13, 2014. Detailed soil profile descriptions were conducted according to the guidelines established by the Expert Committee on Soil Survey (1983). Soil classification was conducted to the subgroup level according to the criteria established by the Soil Classification Working Group (1998). The soils inspected were correlated to existing SRI soil series names based on subgroup classifications and soil properties. Soil series were correlated to existing series described in the SoilAID (Manitoba Land Initiative 2014) soil database for Manitoba soils. A Land Assessment Report (Phase I/II) for the determination of land suitability for irrigated crop production was completed according to the draft guidelines presented by Stantec (2011) for the land parcel (full section) proposed for inclusion. The land assessment report includes interpretive figures for soil-landscape, drainage, irrigation suitability, nutrient management zone, and irrigated potato production suitability, which were developed from detailed soil survey data collected by Stantec (Stantec 2014, Appendix B). Irrigation system information (including type of irrigation units to be used, water source and quality) is also presented in the Phase I/II report.

This section presents baseline soil resource information and discusses the potential impacts on soil resources as well as mitigation measures for the field.

4.1.4.1 Overview of Soils

The dominant soil in the LAA belongs to the Croyon series (approximately 60% of LAA) which consists of well drained, Orthic Black Chernozems developed on loamy (L, SiL, CL) lacustrine deposits overlying sandy-skeletal (GrS, GrLS) glaciofluvial deposits. Considerable portions of the RAA contain soils that belong to the Fairland series (approximately 18% of LAA) and Dorset series (approximately 13% of LAA). The Fairland and Dorset series are classified as Orthic Black Chernozems developed on loamy lacustrine deposits and sandy to sandy-skeletal glaciofluvial deposits, respectively.

Agricultural capability of the soils is limited mostly by moderate to very severe moisture limitations. The coarse soils are prone to wind erosion. Soils within the LAA dominantly have medium to low available water holding capacity. There are no soil salinity concerns within the

LAA. For a detailed description of soils found within individual fields see the Land Assessment Report (Stantec 2014).

4.1.5 Soil-landscape Considerations for Agricultural Productivity

4.1.5.1 Agricultural Capability

The LAA predominantly contains soils that are prime agricultural lands (Classes 1-3; Table 5-3). The dominant portion of the land base has moderate limitations for agriculture (i.e., Class 3 soils) due to a moisture limitation. A considerable portion of the LAA (approximately 14%) contains soils which have very severe moisture limitations (5M). Minor portions of the land base contain soils with excess wetness (2W and 5W) and topography (5T) limitations. Table 4-2 shows the agricultural capability of fields to be included.

Table 4-2: Summary of Agricultural Capability within the LAA

Soil Agricultural Capability Class	Area (ha)	Proportion of Total Area (%)
1	48	18.3
2	18	6.9
3	158	60.4
4	0	0
5	38	14.4
6	0	0
7	0	0
Total	**261**	**100.0**

4.1.5.2 Irrigation Suitability

Soil factors affecting irrigation suitability are those which control infiltration, internal soil drainage, and water holding capacity of the soil (Agriculture and Agri-Food Canada 1987).

The land base contains soils that dominantly fall under an Irrigation Suitability Rating of "Good" (Table 4-3). Although recognized as prime dryland agricultural soils, the suitability of these soils for irrigated crop production is primarily limited by low available water holding capacity (m). Other limitations for irrigation suitability are drainage (w) and topography (t2).

Table 4-3: Summary of Irrigation Capability within the LAA

Irrigation Suitability Rating	Area (ha)	Proportion of Total Area (%)
Excellent	48	18.3
Good	161	61.7
Fair	15	5.6
Poor	38	14.4
Total	**261**	**100**

4.1.5.3 Suitability of Soils for Irrigated Potato Production

The assessment of soils for potato irrigation suitability depends on soil and landscape properties (soil texture and thickness and uniformity of deposits, topography, stoniness, salinity, soil drainage and soil order and subgroup) (MAFRI 2014b). Under the Land Suitability for Irrigated Potato Production rating system, soils are rated from Class 1 to Class 5 based on the degree of the limitations noted above, with the suitability of soils for irrigated potato production generally considered to be progressively lower from Class 1 to Class 5.

The LAA contains soils that dominantly fall into Class 3 for Irrigated Potato Suitability (Table 4-4), due to the loamy over coarse-textured soils (Croyon and Druxman series). The areas identified in Class 5 are areas of the Dorset series, while the Class 1 areas are associated with the Fairland and Torcan soil series. The Class 5 soils under the PDA are predominantly located within SE-19-03-12-W1.

Table 4-4: Summary of Land Suitability for Irrigated Potato Production within the LAA

Potato Irrigation Suitability Class	Area (ha)	Proportion of Total Area (%)
1	48	18.3
2	0	0
3	178	67.3
4	0	0
5	38	14.4
Total	**261**	**100.0**

4.1.5.4 Low Available Water Holding Capacity

Available water holding capacity (AWHC) is the maximum amount of water retained in the soil that can be readily extracted by plant roots, and can be estimated as the difference between soil moisture content at permanent wilting point (1500 kPa) and field capacity (33kPa) [Agriculture and Agri-Food Canada 1987]. Available water holding capacity is lowest in coarse-textured materials (0.6-1.3 mm/cm) and highest in fine-textured materials (2.4-2.5 mm/cm).

Given that soils in the LAA are predominantly well drained, a combination of medium-textured over very coarse textured and very coarse textured materials, available water holding capacity presents a limitation to irrigated potato production.

The beneficial management practices (BMPs) recommended to minimize the limitation of low water holding capacity are outlined in Section 5.1.

4.1.5.5 Low-Nutrient Holding Capacity

Leaching of nutrients reduces the amount of plant-available nutrients in the root zone, and reduces yield potential, while potentially posing environmental risks to underlying groundwater.

The soils in the RAA are dominantly comprised of medium-textured lacustrine materials overlying very coarse textured glaciofluvial materials, with moderate infiltration rates and nutrient holding capacity, and do not present a high risk for nutrient leaching. However, 14% of the land base contains very coarse textured soils (Dorset series) which are prone to leaching of soluble nutrients, particularly nitrate, and colloidal materials and present a risk for nutrient leaching.

Nutrient runoff losses are not a major concern within the RAA due to the nearly level to gently sloping landscape.

The beneficial management practices (BMPs) recommended to minimize the potential for nutrient leaching are outlined in Section 5.1.

4.1.5.6 Soil Erosion

Soil loss to wind and water erosion is an agronomic and environmental issue. Eroded soils have reduced capability and productivity, through reduced water holding capacity, and nutrient holding and supplying capacity, and have reduced ability to resist further erosion. Soil deposition following erosion events may result in in-filling of ditches and accumulation of soil along fence lines and shelterbelts. Crops damaged at their seedling stage due to a “sand blasting” effect, can have reduced yield as a result of damaged growth points and photosynthesis surface area of the seedlings. The potential for erosion on soils under potato production is much greater than that under cereal and oilseed production (MAFRI 2014a).

Although none of the soils in the land base fall under the erosion subclass for agricultural capability classification, the occurrence of soils that can become susceptible to wind erosion (Dorset) is a potential concern. Given the nearly level to gently sloping topography and medium to coarse-texture surface soils, the risk of water erosion is low, with the exception of the small area in the northeast corner of the section with steep slopes (slope class f). This area would be at high risk for water erosion under irrigation; however this area has been excluded from the proposed irrigation pivot design.

Beneficial management practices (BMPs) recommended to minimize the wind erosion risk are discussed in Section 5.1.

4.1.6 Agro-Climate/Seasonal Parameters

The RAA is located within the Grassland Transition ecoclimatic region and is described as cool subhumid (Haluschak 1997).

Average growing season precipitation in the Pilot Mound area is 269-279 mm (based on total amount of precipitation from planting to maturity for corn) [Manitoba Agriculture, Food and Rural Initiatives (MAFRI) (2015)]. The area has an average of 116-125 frost free days, a period comparable to the frost-free period required by potatoes to reach maturity (i.e., 110-140 frost-free days; MAFRI 2015). On average, the area accumulates 1,550-1,650 growing degree days above 5°C and 900-1000 growing degree days above 10°C. The area falls in a high-end region for P-days (physiological days for potatoes) accumulation in the province (average of 801-850 P-days; MAFRI 2015). The region is also well suited for cereal and oilseed production, which require on average 1,200 growing degree days above 5°C (MAFRI 2015). The region accumulates on average 2,400 to 2,500 corn heat units, making it suitable for silage corn (2,100 corn heat units) and grain corn (2,400 corn heat units) (MAFRI 2015).

Potato crops are particularly sensitive to water deficits. The most sensitive period to avoid moisture stress for potatoes, as to not limit yield potential, is during the period of tuber set or initiation, while the majority of the crop water use is during the time of tuber bulking, when optimum potato yields can be realized with adequate moisture. The best tuber yield and quality is set and maintained when the soil moisture is maintained at or above 65% of available soil water holding capacity within the active crop rooting zone during all stages of crop development (MAFRI 2014).

To optimize quality and yield in the PDA, supplemental water through irrigation is needed since the growing season precipitation to maturity for the crops currently grown and planned to be grown in the future is less than the crop water demands (Table 4-5). Data provided in Table 4-5 is based on average values obtained from literature review. Average values represent a 50% risk level. In other words, the growing season precipitation would be expected to be less than the average value provided in the table in one out of every two years.

Based on the growing season parameters, the area accumulates enough warmth to sustain crops to maturity. However, the growing season precipitation to maturity for the current and planned crops does not meet crop water demand to maturity for the crops. Supplemental irrigation will reduce the water deficit affecting crop quality and yield for the Project.

Table 4-5: Average Growing Season Precipitation and Crop Water Demand to Maturity around Pilot Mound, MB

Crop	Days to Maturity[1]	Growing Season Water Use		Growing Season Precipitation (May 15 to crop maturity)		Estimated Irrigation Water Demand (mm)	
		mm	in			mm	in
Spring Wheat	90-100	305-334[2, 3]	12.0-13.1	266	10.5	68	2.7
Canola	92-102	325-350[4]	12.8-13.8	271	10.7	79	3.1
Soybeans	140	427-434[2]	16.8-17.1	332	13.1	102	4.0
Potatoes	110-140	400-500[5]	15.8-19.7	332	13.1	118	4.6
Corn	110-120	396-462[2]	15.6-18.2	303	11.9	159	6.3

Sources:
[1] MAFRI 2015
[2] Bauder and Ennen 1977
[3] Chant 2012
[4] Canola Council of Canada 2015
[5] Tomasiewicz et al. n.d.

4.2 TERRESTRIAL ENVIRONMENT

The RAA straddles both the Manitou and Hilton Ecodistricts within the Apsen Parkland Ecoregion of Manitoba's Prairie Ecozone. Land use in the area is primarily agricultural in nature and dominated by crops such as spring wheat and other cereal grains, oil seeds, and hay crops through continuous cropping and dryland methods. With irrigation, potato production is feasible in the region. Remaining patches of natural vegetation are usually found on the steeper slopes of gullies and ravines found to the south of the RAA.

Within the RAA, land unsuitable for agricultural development often supports small populations of native plants and wildlife. In the RAA, such habitat is limited, occurring:

- Within fragments of mature riparian vegetation along the Pembina River and Marringhurst Creek, and associated tributaries.
- On the margins of small wetlands.

- Within road allowances that experience minimal to moderate disturbance (mowing, herbicide).

- Where private landowners have incorporated native shrub or trees species into shelterbelts (Smith *et al.* 1998).

Agricultural development has affected wildlife distribution through the loss of wetland habitats, grassland habitats and loss and fragmentation of wooded areas. Although patches of non-agricultural/native vegetation may provide habitat for some species of ground squirrels, voles, mice, snakes and frogs, these habitats are generally too small and isolated to provide more than low value, temporary cover for migrating birds or dispersing mammals such as foxes, coyotes and deer.

4.2.1 Vegetation

Historically, natural vegetative cover in the northern portion of the RAA within the Hilton Ecodistrict consisted of a mixture of woods and grasslands, riparian areas and numerous wetlands (Smith et al. 1998). The southern portion of the RAA within the Manitou Ecodistrict historically consisted of aspen groves and grasslands supporting tall grasses and herbs.

The majority of the LAA currently consists of rural farmland and is predominantly utilized in the cultivation of canola, wheat, and soybeans (AAFC 2015). Seventy-six percent of the vegetated land-cover within the RAA is agricultural land, while 17% is forested. Ninety-four percent of the vegetated land-cover type within the LAA is agriculturally developed land, while 6% of the LAA has treed areas or wetlands where native vegetation communities might persist. The treed vegetation stands within the LAA are deciduous and include native bluffs and abandoned yard-site shelter stands. The dominant tree species in the Hilton and Manitou Ecodistricts is trembling aspen (*Populus tremuloides*); other species that occur are bur oak (*Quercus macrocarpa*), green ash (*Fraxinus pennsylvanica*), white birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*) and willow (*Salix spp.*, Smith et al. 1998).

The Manitoba Conservation Data Centre (CDC) database lists 135 upland and wetland plant species of conservation concern that have the potential to occur in the RAA (Appendix A, Table A-1). Six of these plant species, which are all open prairie species, are protected under SARA and/or the *Manitoba Endangered Species Act* (MESA) including:

- Rough Purple False-foxglove (*Agalinis aspera*) – Listed as *Endangered* under MESA and SARA

- Buffalograss (*Buchloe dactyloides*) – Listed as *Threatened* under MESA and SARA

- Hairy Prairie-clover (*Dalea villosa var. villosa*) – Listed as *Threatened* under MESA and SARA

- Smooth Goosefoot (*Chenopodium vubglabrum*) – Listed as *Endangered* under MESA, Threatened under SARA

- Western Spiderwort (*Tradescantia occidentalis*) – Listed as *Threatened* under MESA and SARA

- Small White Lady's-slipper *(Cypripedium candidum*) – Listed as *Endangered* under MESA and SARA

Within the RAA and LAA, small areas could be characterized as open prairie, including some pasture or grasslands and grassed road allowances; therefore the likelihood of these plants occurring in the RAA or LAA is limited. No portion of the PDA is considered to be open prairie; therefore it is less likely to find these species within the PDA.

4.2.2 Wildlife

4.2.2.1 Birds

Over 200 species of birds potentially occur within the RAA (Manitoba Breeding Bird Atlas 2015). The Project Footprint is not located within a managed or regulatory-protected wildlife area (i.e., Wildlife Management Area or migratory bird sanctuary) and does not support locally, regionally or nationally important sites for waterfowl (Poston *et al.* 1990).

The Manitoba Conservation Data Centre (CDC) database lists 36 bird species of conservation concern, 19 of which are listed by SARA, MESA or by COSEWIC, which could potentially be found in the RAA (Appendix A, Table A-2). Mature riparian woodlands exist along portions of the Marringhurst Creek and the Pembina River, and small remnants of deciduous woodlands occur within the LAA. The riparian woodlands provide continuous habitat or corridors for birds to use, while isolated patches within the agricultural matrix provide limited opportunities for suitable habitat. No mature riparian woodlands exist in the LAA. The remnant, small patches of woodlands in the RAA may provide limited nesting habitat for those species that are not sensitive to impacts of agriculture including:

- Noise disturbance.

- Potential bioaccumulation of herbicides and pesticides in invertebrate prey.

- Exposure to exotic avian competitors, parasites or predators common in farmland habitats of southern Manitoba (American crow, common raven, brown-headed cowbird and black-billed magpie).

The MB CDC has indicated that there was one occurrence on the road allowance adjacent to 19-3-12W1 and 20-3-12W1 of a bobolink (*Dolichonyx oryzivorus*), S4, COSEWIC: Threatened (Friesen pers. comm., 2014). Bobolink is a grassland species and is unlikely to reside in the LAA or PDA, but may occur in the limited grassland areas within the RAA. There is limited potential for

wetlands in the NE corner of the LAA to support waterfowl and other bird species of conservation concern.

4.2.2.2 Mammals

Approximately 51 species of mammals may occur in the RAA (Appendix A, Table A-3). Suitable habitat for many of these species includes woodlands of a certain size or habitat connectivity, which is limited in the LAA. White-tailed deer are expected to be particularly common in the cultivated fields and wooded areas in the RAA. Other species with similar abilities to successfully utilize cropland, ROWs are also expected to be present in the LAA, such as deer mice, skunks and rabbits.

The Manitoba Conservation Data Centre (CDC) database lists only mammal SOCC that potentially use the RAA. The long-tailed weasel (*Mustela frenata*) is listed as S3 in the province, but assessed by COSEWIC, listed under MESA or SARA. The mule deer (*Odocoileus hemionus*), which is listed as threatened under MESA occurs in the ecoregion, but its range does not extend into the RAA.

4.2.2.3 Reptiles and Amphibians

Seven species of reptiles and eleven species of amphibians have the potential to occur in the RAA and may be present within the LAA (Appendix A, Table A-4). Six of the seven reptile species are listed by the MB CDC database as SOCC that potentially use the RAA (Appendix A, Table A-5). One species, the common snapping turtle (*Chelydra serpentina)* has been assessed by COSEWIC and listed under SARA as special concern. The northern prairie skink (*Eumeces septentrionalisis*) listed as *endangered* by MESA and SARA is listed by the MBCDC as occurring in the ecoregion, however, the population is well documented and is not documented in the vicinity of the Project.

Three of the eleven amphibian species are listed by the MB CDC database as SOCC that potentially use the RAA (Appendix A, Table A-5), and two species have been assessed by COSEWIC and are listed by MESA and/or SARA:

- Northern leopard frog (*Lithobates pipiens)* – listed as *special concern* under SARA
- Great plains toad (*Bufo cognatus)* – listed as *threatened* under MESA and *special concern* under SARA

Relatively few waterbodies occur in the LAA. Intermittent roadside ditches receive both granular road and cropland runoff which may contain sediment, fertilizers and pesticides and are expected to reduce the suitability of these areas as breeding or foraging locations for reptiles and amphibians. Two small wetlands and permanent grassland occur in the northeast portion of the LAA. Local conditions are expected to support low population numbers of both reptiles and

amphibians within the LAA; however the highest likelihood for presence of reptiles and amphibians would be in the wetlands and grassy area described above.

4.3 AQUATIC ENVIRONMENT

The Pembina River sub-watershed is located within the Red River Basin within the Red River South Division.

4.3.1 Fish Habitat

Available fish habitat in the RAA is predominantly confined to the Pembina River and Marringhurst Creek. Fish habitat information is limited to survey results compiled by the Department of Fisheries and Oceans (DFO) Manitoba Branch and published fish species list information for major waterbodies with connectivity to the Red River (Stewart and Watkinson 2004). As there are no permanent waterbodies in the LAA, there is no fish habitat.

4.3.2 Fish Species

According to Milani (2013), 16 species of fish have been caught in the streams within the RAA (Appendix A, Table A-6). Both rivers are potentially connected to fisheries present in the Red River. However, this connectivity is limited by dams, weirs and agricultural diversions. Other species may exist within the area, but their presence has not been confirmed.

Three of the fish species potentially present in the Pembina River have been identified by the MB CDC database as SOCC and are listed by MESA or SARA:

- Chestnut lamprey (Ichthyomyzon castanaeus) – listed as special concern under SARA
- Silver chub (Macrhybopsis stoeriana) – listed as special concern under SARA
- Bigmouth shiner (Notropis dorsalis) – listed as special concern under SARA

These species may occur within the RAA, but there is no potential for occurrence within the LAA or PDA.

4.4 SOCIO-ECONOMIC ENVIRONMENT

This section examines the baseline social data in the RM of Argyle. A background of the general area surrounding the project is described, along with population, transportation, parks and protected areas, resource use and recreation areas and heritage resources.

4.4.1 Land Description, Ownership and Use

The parcel of land for the proposed Project, 19-03-12W1, is privately owned and has been previously developed for dryland agricultural production but has not been developed for irrigation. The land base to be developed for irrigation purposes is largely in annual cropping and will be typically be under a 1-in-3 year crop rotation, including cereals, oilseeds, soybeans, corn and potatoes. The parcel of land is approximately 640 acres (260 ha) and has been assessed as suitable for irrigation development.

4.4.2 Population

The RM of Argyle was primarily settled starting in the 1870s and 1880s by Scottish, Irish, British and Icelanders from Quebec, Ontario, Gimli, and Great Britain. The RM was incorporated and became the RM of Argyle in 1881 (RM of Argyle 1981).

The RM of Argyle had a population of 1,071 in 2011 (Table 5-5), a -0.2% increase from the 2006 population of 1,073, and a population density of 1.4 persons per km^2 (Statistics Canada 2012).

Table 4-6: Population of the RM of Argyle, 2011

	RM of Argyle	Manitoba
Population 2011	1,071	1,208,268
Population 2006	1,073	1,148,401
% change in population between 2006 and 2011	-0.2	5.2
Land area (km^2)	770.44	2.2
Population Density per km^2	1.4	552,329
Source: Statistics Canada 2012a		

4.4.3 Infrastructure

4.4.3.1 Roads

The LAA can be accessed by provincial roads (PR) 253 and 342. PR 253 has a paved-surface, two-lanes and is an undivided road. PR 342 has a gravel surface. Mile and half mile roads can also be used to access the Project Footprint and typically have gravel-surfaces.

4.4.3.2 Railroads

The nearest VIA rail station is located at 123 Main Street in Winnipeg, MB (Via Rail 2014). The nearest rail lines are CP which area located approximately 10 km south and 12 km north of the LAA (CN Rail 2014).

4.4.3.3 Airports

The Louise Airport, located four miles south of Pilot Mound and 16 km southeast of the LAA is the nearest airport (www.pilotmound.com). The nearest major national and international airport is the Winnipeg James Armstrong Richardson International Airport, located approximately 150 km from the LAA.

4.4.3.4 Utilities

Overhead electricity lines are adjacent to the eastern and southern boundaries of the LAA. Other utilities are anticipated to be present within the RAA.

4.4.4 Aboriginal Communities

There are no Aboriginal Communities located within the RAA. The closest First Nation Reserve is the Swan Lake First Nation, located approximately 16 km northeast of the area.

4.4.5 Parks and Protected Areas

There are no parks or protected areas located in the LAA. The nearest protected area is a segment of the Pembina Valley Wildlife Management Area, located approximately 1.8 km from the north-eastern Project boundary. Another segment of the Pembina Valley Wildlife Management Area is located approximately 3.3 km from the eastern Project boundary. The Spruce Woods Provincial Park is located approximately 43 km north of the RAA.

4.4.6 Resource Use and Recreation

Recreational attractions in the RM of Argyle include the Baldur Campground, viewing historical sites in the area such as churches, school cairns and the Baldur Museum, the Baldur Regals, baseball diamonds, walking paths, and the recreation centre which includes an arena, curling club, and community hall (Town of Baldur 2014). The Town of Balder is located approximately 20 km northwest of the LAA.

The southern area of the RM of Argyle has Rock Lake located in a natural setting. There are many opportunities around Rock Lake for outdoor activities such as camping, boating and fishing and swimming (Tourism Westman 2014). There also is Rock Lake Ministries, located along Rock Lake approximately 4 km southwest of the LAA, which provides playgrounds, water sports, hiking, snowmobiling, and tobogganing (Rock Lake Ministries 2014).

A municipal well is in operation within the RAA, immediately north of the northern boundary of the LAA in the southeast corner of SE-30-3-12-W1. The municipal well is used to provide potable water for the Town of Pilot Mound.

4.4.7 Heritage Resources

Heritage and palaeontological resources are tangible remnants of past lifeways and are considered non-renewable and highly perishable. These resources consist of fossilized plants and animals remains , objects that were discarded as a result of the daily activities of First Nation hunters, gatherers and horticulturalists prior to *ca*. A.D. 1700 (the Precontact Period) and objects, buildings, streetscapes and landscapes of activities of First Nation, Métis, European, Canadian, etc., after A.D. 1700 (the Historic Period).

Baseline data for the RAA were collected from the Historic Resources Branch (www.gov.mb.ca/chc/hrb); with contact with the Heritage Resources Registrar, Historical Assessment Services, Historic Resources Branch for a list of previously recorded archaeological sites; from the Manitoba Historical Society website for a list of historic sites (www.mhs.mb.ca); the Hudson's Bay Company Archives website for any historic trade post locations (www.gov.mb.ca/chc/archives/hbca); previous research in and adjacent to the RAA, and from topographic maps available from Natural Resources Canada (www.nrcan.gc.ca).

There are no provincially or municipally designated sites present in the RAA. There are no previously recorded archaeological sites within the RAA. The closest archaeological sites were recorded on the surface of cultivated fields along the Pembina River 8.5 km northeast of the RAA. None of the sites were subjected to subsurface testing to determine the nature and extent of any intact heritage resources below the plough zone.

Glacial lake Agassiz drained from the immediate study area approximately 11,000 years ago. Based on pollen studies conducted in the Glenboro, MB, area in the 1960s, it is apparent that the vegetation at this time would have been a spruce (*Picea glauca*) dominated forest from approximately 12,000 to 10,000 years ago (Ritchie and Lichti-Federovich 1968). Approximately 9,500 years ago, in response to a warmer and drier climate than present, the spruce forest gave way to non-arboreal vegetation dominated by *Artemisia*, *Gramineae*, *Ambrosieae* and *Chenopodiineae*. The expanded prairie grassland persisted until about 5,000 years ago whereupon oak and birch slowly increased until they reached their modern values about 3,000 years ago.

Plains-adapted hunters and gathers appear to have moved into the immediate area soon after the glacial lake receded. Lanceolate points diagnostic of the Plano culture have been recovered in the Miami, MB area northeast of the RAA (Hill 1984). Projectile points diagnostic of the Middle Precontact Period have been found in the RAA (Table 4-7). This is based on the recovery of projectile points diagnostic of the Oxbow culture.

Continued occupation into the Late Precontact Period is evidenced by recovery of projectile points diagnostic of the Besant and Anvonlea cultures and ceramics diagnostic of the Laurel and Blackduck traditions adjacent to the RAA. The First Nation groups that were in the area would have been primarily bison hunters using the pound for trapping bison. They would have

also augmented their diet with medium and small game as well as seasonal plants when in season (Pettipas 1984). Medicinal plants would also have been harvested when in season.

These groups were also noted for burying their dead by covering the deceased with earthen mounds. Several of these mounds, such as the Star Mound, also known as Nebogwawin Butte and Merry Dance Hill, west of Snowflake in the Rural Municipality of Louise, were shaped in the form of an animal effigy. Precontact Period burials were also recovered from Pilot Mound. Bison bone recovered within Star Mound have been carbon dated to 1170 ± 70 years ago (Morlan 2000).

Historical maps drafted during the 1740s time indicate the general area was inhabited by groups of Assiniboine and Cree (Burpee 1927). Direct European contact by First Nation groups of the area was probably with independent fur traders from Montreal who established a trading post, Pine Fort, on the Assiniboine River approximately 60 km north in the late 1760s. Prior to this time the First Nation groups had probably heard of the fur trade posts established by the Hudson's Bay Company on the shores of Hudson's Bay and may have acquired European goods through trade networks with groups in closer proximity to the coastal fur trade establishments. During the late 1780s, both the Hudson's Bay Company and the NorthWest Company operated trade posts along the Assiniboine River 50 to 60 km north of the RAA (Voorhis 1930).

During the early to mid-1800s, the bison herds moved further west and First Nation and Métis hunting strategies were adapted to available game within the area and/or a major shift in the seasonal resource areas. The local groups would have hunted for their own subsistence and for provisions traded to the Hudson's Bay Company. The RAA is within lands encompassed by Treaty1, signed at Lower Fort Garry in August 1871.

The RAA township was surveyed by Hector Le Ber of the Dominion Land Survey between July and October 1872. The land section is identified as being under rolling prairie and a large hill at the south end of a swamp is noted along the northwest edge of the section (www.mli2.gov.mb.ca/spatial_ref/index_twp_diag.html). The area was homesteaded during the late 1870s and early 1880s and the Rural Municipality of Argyle was established in 1881 (Rural Municipality of Argyle 1981).

Table 4-7: Suggested Archaeological Time Periods Based on Technology

Archaeological Period	Technology	
	Container Type	Food Procurement
Late Historic Period (ca. 143 – 80 B.P.) (A.D. 1870 – 1940)	Porcelain Tableware Earthenware Dinnerware Stoneware Storage Jars Glass Sealers Tin Cans	Repeating Rifles Automatic Shotguns Gas/Diesel Agricultural Equipment

Table 4-7: Suggested Archaeological Time Periods Based on Technology

Archaeological Period	Technology	
	Container Type	Food Procurement
Middle Historic Period (ca. 192 – 143 B.P.) (A.D. 1821 – 1870)	Earthenware Dinnerware Stoneware Storage Jars Glass Bottles/Jars Copper Pots/Kettles	Breach Loading Rifles/Shotguns Percussion Cap Muskets Animal-drawn Agricultural Equipment
Early Historic Period (ca. 300 – 192 B.P.) (A.D. 1700 – 1821)	Copper Pots/Kettles	Flintlock Muskets/Shotguns Metal Traps Metal Projectile points Metal Knives/Axes
Late Precontact Period (ca. 2500 - 300 B.P.)	Clay vessels: Selkirk (Late Woodland) Blackduck (Middle Woodland) Rainy River Composite (Middle Woodland) Laurel (Early Woodland)	Bow and Arrow Bone Harpoons Nets Projectile Points Side-notched Points Eastern and Plains Triangular
Middle Precontact Period (ca. 6500 - 2500 B.P.)	Fiber baskets/Bags Animal Viscera/Hide	Atlatl Bone Harpoons Nets/Fishing Weirs Oxbow Corner-notched Points McKean Lanceolate Points Pelican Lake Points Old Copper Points/Adzes
Early Precontact Period (ca. 9500 – 6500 B.P.)	Fiber Baskets/Bags Animal Viscera/Hide	Spears/Bone Harpoons Lanceolate Projectile Points Trihedral Adzes Agate Basin Logan Creek Late Sisters Hill Plano

5.0 Environmental Effects and Mitigation

A discussion of residual effects for each VC following the consideration of mitigation to be implemented is found below. A summary of the residual environmental effects for each VC is provided in Table 5-3.

5.1 SOIL CAPABILITY

The suitability of the soil-landscape for irrigated crop production for the LAA was assessed following the guidelines established by Stantec (2011). The field-specific Land Suitability Assessment for Irrigation – Phase I/II Report is reported by Stantec (2014, Appendix B). Recommended Beneficial Management Practices to mitigate against environmental risks associated with soil-landscape features are indicated in the report. A summary of recommended BMPs for the Project landbase is provided in Table 5-1.

5.1.1 Low Available Water and Nutrient Holding Capacity

The predominatly Class 3M soils in the LAA have low available water holding capacity (AWHC). The low AWHC results in soils being droughty and prone to leaching of soluble nutrients (i.e., nitrogen) and will require intensive irrigation and nutrient management.

Irrigation scheduling and soil moisture monitoring is recommended for the majority of the land base. Implementation of these recommendations will improve productivity under irrigation and will ensure efficient use of irrigation water and improved productivity. These practices will ensure adequate soil water is available and that excessive water is not applied.

The risk of nutrient loss, particularly soluble nitrogen, below the crop rooting zone through leaching, can occur in areas that contain very coarse textured soils of the Dorset series and in areas where coarse-textured soils have thin lacustrine overlays (Croyon series). Therefore, groundwater is at a higher risk of impact from nutrient leaching in these areas. Because the soils are dominantly medium-textured and occur on level to gently sloping landscape, the risk of nutrient loss through runoff to surface water bodies is low.

Nutrient management activities including nutrient management planning, annual soil nutrient testing, and the use of slow release nitrogen will ensure efficient nutrient application and use efficiency and, in combination with intensive irrigation management, will help mitigate the potential for soluble nutrient losses via leaching.

Beneficial management practices for mitigating environmental concerns associated with limited water holding capacity are found in Table 5-2. Additional information on irrigation management to mitigate the low AWHC is provided in Section 5.1.3.

5.1.2 Soil Erosion

During the construction phase, trenching for irrigation pipeline installation during the construction phase will disturb soils along the proposed routes, increasing the susceptibility of these soils to wind and water erosion. However, only a small proportion of the PDA will be affected, and for only a short time during construction, resulting in a minimal potential for adverse environmental effects.

Since a considerable portion of the LAA is covered by very coarse-textured soils, wind erosion of soils is of concern during the operation phase of the Project. However, because the lands proposed for this Project are already under annual crop production, the wind erosion risk and impacts will not be exacerbated. Some beneficial management practices that are or will be implemented to mitigate the wind erosion during Project operation are listed in Table 5-2.

Table 5-1: Summary of Land Suitability Assessment for Irrigation and Recommended BMPS for the LAA

Legal Land Location	Irrigation Suitability Recommendation	Recommended Beneficial Management Practices (BMPs)*																				Tile Drainage Installed
		Nutrient Management				Soil Erosion				Soil Salinity				Drainage Management				Irrigation Management			Other		
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	
19-03-12W1	Recommended Precautionary	x		x	x	x	x											x	x				No

* Refer to Legend below for specific Beneficial Management Practice recommendations and to Phase 1 reports for which Soil Management Areas are applicable for each parcel.

Nutrient Management

1. Nutrient Management Planning
2. Fertigation
3. Other: Slow Release N
4. Other: Variable rate nutrient application

Soil Erosion

1. Residue Management
2. Fall Seeded Cereal Crop
3. Reduced Tillage
4. Other:

Soil Salinity

1. Subsurface Drainage Improvements
2. Salinity Monitoring Program
3. Permanent Cover Crop
4. Other

Drainage Management

1. Subsurface Drainage Improvement
2. Surface Drainage Management
3. Drainage Assessment
4. Other

Irrigation Management

1. Irrigation Scheduling
2. Soil Moisture Monitoring
3. Other

Other

1. Other
2. Other

Table 5-2: Beneficial Management Practices (BMP) for Sustainable Crop Production in the LAA

Soil Management Issue	Agronomic and Environmental Effects	Mitigation (Recommended BMPs)
Soil erosion (primarily wind-related)	Loss of productive topsoil Reduced yields Reduced air quality	Residue Management: • Crop rotations including high-residue crops. • Promote stubble and trash maintenance, and minimal fall tillage to protect these soils from erosive spring winds. • Shredding 35-40 large round straw bales on the potato fields and lightly incorporate the straw to increase the trash cover that the potato vines provide. Fall Seeded Cereal Crops: • Planting cover crops, e.g., fall rye or barley on all potato fields harvested early in the season (before Sept 20th, when timing permits). Tillage Practices: • Zero or minimum tillage. • Fall tillage operations that promote partial residue incorporation and surface roughness following potato crops. • Lightly disking the soil after potato harvest to embed the vines and create a rough soil surface. • Avoiding, if possible, the use of pre-planting herbicides which require incorporation of residue, on fields considered erosive. However, if incorporation is required, it should be done in the spring as close to planting as possible. Other Practices: • Application of irrigation water to dry soils on an emergency basis if soil conditions are dry, soils are exposed and there is the potential for a wind erosion event. • Permanent grass cover on steep slopes. • Shelterbelts will be considered along irrigated field boundaries.
Low nutrient holding capacity	Reduced yields Leaching of nutrients below root zone	Nutrient Management Planning: • Annual spring soil testing to provide availability of as accurate as possible knowledge of soil fertility status which forms the basis of fertilizer recommendations. • Application of fertilizers as close as possible to planting. • Use of slow release N sources (e.g., N Serve).

Table 5-2: Beneficial Management Practices (BMP) for Sustainable Crop Production in the LAA

Soil Management Issue	Agronomic and Environmental Effects	Mitigation (Recommended BMPs)
		• Apply and manage nitrogen and phosphorus to meet criteria outlined in the *Nutrient Management Regulation of the Water Protection Act* (see Section 3.2.2). • Consulting a Professional Agrologist for assistance with nutrient management planning. • Variable rate nutrient application
Low water holding capacity	Reduced yields due to crop-water stress Inefficient water use (e.g., over-application)	Irrigation Scheduling: • Intensive irrigation scheduling. Soil Moisture Monitoring: • Intensive soil moisture monitoring. Other Practices: • Residue management to reduce evaporation water losses. • Rotation of potatoes with less water-demanding crops (oilseed, grains).

5.1.3 Irrigation Management

The AWHC of a soil represents the maximum amount of water available for extraction by plant roots and use for plant growth, and is determined as the difference between *field capacity* (FC) and *permanent wilting point* (PWP). *Field capacity* is the maximum amount of water that a soil can hold under gravity. Soil water content above FC (i.e., saturated soil conditions) is considered excess water unusable by plants, which freely drains from the soil under gravity. *Permanent wilting point* is the soil water content below which plants wilt irreversibly and water is held strongly by soil particles and is unavailable for plant uptake.

AWHC is of particular importance for efficient irrigation management, for example, when determining net depth of irrigation events and irrigation intervals. In soils with low AWHC, consideration of site-specific AWHC is also important for environmental irrigation management, to minimize the potential of leaching of nutrients and other agro-chemicals below the rooting zone.

For irrigation purposes, a *lowest acceptable moisture* (LAM) level is set, depending on the susceptibility of the crop to moisture stress, the capacity of the irrigation system, the comfort level of the land manager and other factors. For potato crops in Manitoba, the generally accepted LAM level is set such that 70% of AWHC is maintained until tubers are four ounces in

size, and 65% of AWHC is maintained for the remainder of the growing season (MAFRI 2011). The amount of water between FC and LAM is termed *allowable depletion* (AD). This value represents the net depth of an irrigation event and is used for irrigation scheduling purposes. Values for FC, PWP, LAM and AD are generally reported on a volumetric basis (e.g., cm of water per cm of soil depth).

5.1.3.1 Irrigation Scheduling and Soil Moisture Monitorintg

Based on the determined values of FC, PWP, LAM and AD, irrigation scheduling can be conducted for planning purposes to determine the interval between irrigation events, as well as depths of irrigation water required for each event.

The challenges inherent in managing irrigation for potatoes in an agronomically and environmentally sustainable manner are apparent. Early in the cropping season, irrigation scheduling is intensive due to the shallow effective rooting zone and low AWHC; later in the season, the high daily evapotranspiration (ET) demand confounds management. Rainfall events also confound irrigation management, particularly for soils with low AWHC and short irrigation intervals. Due to the low AWHC, major rainfall events may result in the leaching of nutrients beyond the rooting zone.

Evapotranspiration is the primary basis for irrigation scheduling throughout much of the growing season. Even when soils are at field capacity, during periods of maximum ET, an AD of 35% can be reached within one day.

Irrigation scheduling throughout the growing season can be conducted using the checkbook method or direct determination of soil moisture, or a combination of the two methods (MAFRI 2011). The checkbook method is based on estimated values of AWHC, crop water demand throughout the growing season and soil moisture status. It is preferable to conduct soil moisture verification in combination with the checkbook method for managing irrigation scheduling throughout the growing season. Soil moisture may be measured and monitored using a variety of approaches, including the feel method, gravimetric method and soil moisture monitoring devices.

The Proponent will retain the services of a Professional Agronomist to evaluate soil moisture conditions and advise on irrigation scheduling. Additionally, the Proponent will implement soil moisture monitoring to confirm irrigation application timing.

5.1.4 Summary

With the application of recommended BMPs, the residual effect of a change in soil quality on soil capability is anticipated to be neutral in direction, low in magnitude and confined to the PDA.

5.2 GROUNDWATER QUALITY AND QUANTITY

5.2.1 Groundwater Quality

The Glenora Aquifer is an unconfined aquifer composed of beds of coarse sand to medium gravel resting on lacustrine clays which in turn rest on till deposits (Render 1987). There is potential for nutrient leaching into the aquifer as a result of nutrient applications, rainfall and irrigation. The LAA is dominantly comprised of medium-textured soils overlying very coarse materials that do not present a high risk for nutrient leaching. A small portion of the LAA is comprised of very coarse soils which are prone to leaching of soluble nutrients and present a higher risk for nutrient leaching. The beneficial management practices (BMPs) recommended to the Proponent, to minimize the potential for nutrient leaching are outlined in Table 5-2.

The depth to groundwater is expected to be variable across the LAA with a general decrease in depth from the southwest to northeast; based on previous (MCWS, 2013) and current (Stantec 2015, Appendix C) drilling records.

With the application of recommended BMPs, the residual effect of a change in groundwater quality is anticipated to be adverse in direction, low in magnitude and confined to the RAA.

5.2.2 Groundwater Quantity

Withdrawal of water from the Glenora Aquifer has the potential to affect groundwater levels and groundwater availability. A groundwater well performance test and 8-hr constant rate pumping test were completed to evaluate the potential groundwater supply (Stantec 2015). A maximum instantaneous flow rate to service the four proposed pivots is 240L/s; however only two pivots will be operated simultaneously, resulting in a required flow rate of 126L/s. Based on the data collected from the pumping tests, drawdown of the groundwater is negligible at a distance of approximately 75 m. Therefore, effects of groundwater drawdown may extend slightly beyond the LAA but are not anticipated to overlap with other groundwater resources users in the RAA. Groundwater level monitoring is recommended and will be used to confirm the Project groundwater drawdown is not influencing or being influenced by the use of the groundwater by the Town of Pilot Mound supply well north of the Project.

The residual effect of a change in groundwater quantity is anticipated to be adverse in direction, low in magnitude and confined to the RAA.

5.3 VEGETATION AND WETLANDS

5.3.1 Change in Native Vegetation and Wetlands

The proposed irrigation development is located on previously disturbed agricultural land. A small amount of mixedwood forested bluffs will be cleared to allow for the operation of centre pivot irrigation units within the PDA. Within the LAA a total of 4.1 ha (1.6% of LAA; 34% of total native

vegetation) of 12 ha (4.6% of LAA) (100%) of native forest vegetation will be removed. Loss of existing vegetation will be minimized to the extent possible, including avoidance of wetlands and grassland in the northeast corner of the LAA.

Six species of conservation concern were identified to potentially occur within the RAA. Given that the six species are open prairie species and are not likely to occur in the remnant tree bluffs, and that the Proponent will develop the groundwater wells and irrigation pipelines within the PDA and outside the grassed road allowance and NE corner of the LAA, the loss of SOCC, should any be present, is highly unlikely.

The residual effect of a change in native vegetation and wetlands is anticipated to be adverse in direction, low in magnitude and confined to the PDA.

5.4 WILDLIFE AND WILDLIFE HABITAT

5.4.1 Change in Habitat Availability

Due to relatively low levels of land use changes (e.g., continuation of current agricultural cultivation), it is anticipated that the Project should have little to no effect on wildlife species currently using the LAA and RAA.

Construction of the pipeline network will be timed outside of the sensitive breeding period for mammals and wildlife (April 1 to July 31), as feasible, to avoid disruption of active bird nests and breeding mammals.

The MB CDC has indicated that there was one occurrence on the right-of-way adjacent to 19-3-12W1 and 20-3-12W1 of a bobolink (Dolichonyx oryzivorus), S4, COSEWIC: Threatened (Friesen pers. comm. 2014). Potential for presence of SAR in the LAA is expected to be low. Presence of rare or threatened species in the LAA have the potential to occur as these species move through the area to more suitable habitat. During this movement, fragments of forest or patches of wetland plants in the LAA may act as “stepping stones” between larger patches of suitable habitat (Beier and Noss 1998; Bennett 2003; Fahrig 2003). These potentially important corridors will be preserved whenever possible including the larger areas in the eastern and northeastern portion of the section which are not planned to be removed.

Due to relatively low levels of land use change and the low potential for the presence of SAR, the residual effect of a change in wildlife and wildlife habitat is anticipated to be adverse in direction, low in magnitude and confined to the LAA.

5.5 SOCIO-ECONOMY, INFRASTRUCTURE, AND LAND AND RESOURCE USE

5.5.1 Employment and Economy

Over the short-term, the project is likely to provide a small, but measurable benefit to the local economy in terms of employment for the construction of project infrastructure, and local purchasing of consumables (e.g. fuel) and supplies associated with construction. The project will increase farm revenues by providing increased crop production. In the longer term, a shift to potato production in the rotation could provide additional employment at the farm level for harvesting operations, and outside the farm for potato processing or other associated activities.

Positive, low magnitude economic benefits are expected for local and regional retailers, contractors, farmers and other suppliers during the Project construction and operation phases.

5.5.2 Infrastructure and Services

Slight increases in local traffic due to construction and delivery vehicles (trucks) are expected during construction; however, these increases are not anticipated to be substantive. The potential infrastructure and services traffic-related residual effects of the Project as a result of increased traffic are expected to occur primarily during the construction phase, be adverse in direction, low in magnitude and confined to the LAA.

Utility locates will be conducted by Collins Farm Ltd., or their designate, prior to any ground disturbance and will be updated on an as-needed basis depending on the specifications of each underground utility and pipeline present. Special requirements associated with any utilities or pipelines must be determined with the respective utility owners prior to ground disturbance.

The residual effect of impacts to existing utilities is anticipated to be adverse in direction, negligible in magnitude and confined to the RAA.

5.5.3 Land and Resource Use

The LAA is contained within one privately owned section of land and is therefore not anticipated to have much interaction with, or a measurable effect on, other land or resource uses, with the exception of groundwater use as discussed below and previously in Section 5.2.2.

Construction will occur primarily during typical windows of seasonal agricultural operations and during normal agricultural operation hours. These activities are not expected to affect other land and resource users. Noise from construction may be noticeable in the LAA and RAA, depending on weather conditions (e.g., prevailing winds for construction noise), but are not anticipated to be above typical, baseline levels and are not anticipated to be of concern for other land and resource users.

An indirect effect to land and resource use is the withdrawal of groundwater from the Glenora aquifer. Withdrawal of water could potentially affect others' ability to extract water currently and in the future. Future uses of water from the Glenora aquifer in within the RAA are unknown. A municipal well to service the Town of Pilot Mound is located north of the LAA in the southeast corner of SE-30-03-12-W1. Based on the pump test results and as discussed in Section 5.2.2 above, the drawdown of the water table due to the Project during withdrawal for irrigation is not anticipated to interact with the drawdown area of the municipal well north of the LAA.

The residual effect for groundwater quantity is presented in Section 5.2.2.The residual effect on other land and resource uses is anticipated to be adverse in direction, negligible in magnitude and confined to the RAA.

5.6 ACCIDENTS AND MALFUNCTIONS

The effects of accidents and malfunctions for the Project are primarily related to the potential for accidental power outages, pump and pipe failure, and fuel, fertilizer or other chemical spills. Given the seasonally-based operational nature of this project, such malfunctions would be limited to the cropping and irrigation season, plus a seasonal buffer for prepration and cleanup activities, or approximately seven months from April to October, annually.

In the event of a pump/pipe or power failure, backflow of water will be prevented by automatic check valves within the pump-pipe network. Maintenance checks on equipment including pumps and pipes will be conducted regularly to minimize the risk of breakdowns and accidents associated with pump/pipe failures.

The following measures will be taken to prevent the adverse environmental effects associated with fuel, fertilizer or other chemical spills:

- Potentially hazardous materials will be stored and handled at dedicated areas in accordance with all regulatory requirements.
- All hazardous materials will be labeled in accordance with applicable regulatory requirements.
- Hazardous materials will be stored in appropriate containment in accordance with applicable regulations.
- Hazardous materials will be transported in accordance with the *Dangerous Goods Handling and Transportation Act*. Hazardous materials will be used according to product-use instructions.

5.7 SUMMARY OF RESIDUAL ENVIRONMENTAL EFFECTS CHARACTERIZATION

A summary of residual environmental effects characterization is found in Table 5-3.

Table 5-3: Summary of Residual Environmental Effects

Project Effects	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Soil Capability							
Change in soil quality	N	L	PDA	L	S-MI	R	D
Groundwater Quality and Quantity							
Change in groundwater quality	A	L	RAA	L	MI	R	D
Change in groundwater quantity	A	L	RAA	P	C	R	D
Vegetation and Wetlands							
Change in native vegetation and wetlands	A	L	PDA	S	P	R	D
Wildlife and Wildlife Habitat							
Change in habitat availability	A	L	LAA	S	P	R	D
Socio-Economy, Infrastructure and Land and Resource Use							
Change to employment and economy	P	L	RAA	L	MR	R	D
Change in infrastructure and services	A	N	RAA	S	MI	R	D
Changes to land and resource use	A	N	RAA	S	MI	R	D

Table 5-3: Summary of Residual Environmental Effects

Project Effects	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
KEY See Table 7-2 for detailed definitions							
KEY ***Direction*** P Positive A Adverse N Neutral ***Magnitude*** N Negligible L Low M Moderate H High ***Geographical Extent*** PDA Project Development Area LAA Local Assessment Area RAA Regional Assessment Area				***Duration*** S Short-term M Medium-term L Long-term P Permanent ***Frequency*** S Single event MI Multiple irregular event MR Multiple regular event C Continuous ***Reversibility*** R Reversible I Irreversible			***Ecological/Socio-Economic Context:*** U Undisturbed D Disturbed N/A Not applicable

6.0 Assessment of Cumulative Effects

To assess the potential for cumulative effects, the effects of past, current and future projects must be considered in relation to the Project. For the purposes of this assessment a period of 10 years was used to assess cumulative effects with past and future projects.

Two conditions must be met for the Project to act cumulatively with the environmental effects of other activities:

- There are residual Project effects on the VC; and,
- The residual effect act cumulatively with effects of other projects or physical activities.

The only residual effects from the Project anticipated to have the potential to act cumulatively with other past and future projects are changes in groundwater quality and changes in groundwater quality.

The project and activity inclusion list includes all past, present, and known future projects and physical activities within the RAA and whose residual environmental effects could overlap spatially and temporally with the residual Project effect being considered.

Table 6-1: Project Inclusion List

Project*	Type of Project	General Location	Description	Potential Cumulative Environmental Effects	
				Change in Groundwater Quantity	Change in Groundwater Quality
Past and Present Physical Activities and Resource Use					
Agricultural Irrigation Projects	Agricultural	Surrounding lands in RAA	Existing and past agricultural irrigation projects have influenced the existing conditions of groundwater quantity in the Glenora aquifer.	✓	✓
Municipal Water Supply	Water	Immediately north of LAA in SE-30-3-12-W	Withdrawal from the Glenora aquifer for municipal water supply has influenced the existing conditions of groundwater quantity.	✓	--

Table 6-1: Project Inclusion List

Project*	Type of Project	General Location	Description	Potential Cumulative Environmental Effects	
				Change in Groundwater Quantity	Change in Groundwater Quality
Current or Reasonably Foreseeable Projects and Activities					
Agricultural Irrigation Projects	Agricultural	Surrounding lands in RAA	Future agricultural irrigation projects within the RAA could influence the local conditions of groundwater quantity in the Glenora aquifer.	✓	✓

From a groundwater resource perspective, this Project will be developed on a landscape that has been heavily modified by agricultural practices. Activities such as native vegetation removal and cultivation of annual crops will have influenced the hydrologic regime and groundwater conditions. The municipal well located north of the Project LAA and within the RAA, will have influenced groundwater availability and water table levels within the RAA, and is anticipated to have influenced groundwater levels within the Project LAA. Therefore, past and present projects (e.g., irrigation) within the RAA will have influenced groundwater quantity and availability.

Future projects withdrawing groundwater within the RAA have the potential to act cumulatively with the Project. However, the Proponent is unaware of other future projects within the RAA, including increases in municipal withdrawals that would potentially act cumulatively with the Project, and is unaware of other anticipated projects that would require large allocations of the aquifer's water.

Future and unknown irrigation projects within the RAA may act cumulatively with the Project to reduce local water availability from the Glenora aquifer. However, the effects of these cannot be assessed.

Water Rights Licenses generally include conditions that the Minister of Manitoba Conservation and Water Stewardship may request that a Licensee reduce or cease water withdrawal. Based on adjustments to allowable withdrawals in a dry year, allocation of water resources should not result in a significant cumulative effect on groundwater resources.

Low-magnitude, adverse effects to shallow groundwater quality are anticipated from the Project as well as from other crop production within the RAA. Proposed mitigation and monitoring wil reduce the potential for these effects and th3 Project's contribution to cumulative effects to groundwater quality.

7.0 Determination of Significance

7.1.1 Significance of Residual Environmental Effects from the Project

Soil Capability

With the application of recommended BMPs, the residual effect of a change in soil quality on soil capability is anticipated to be neutral in direction, low in magnitude and confined to the PDA. No significant adverse effects to soils due to admixing, wind and water erosion, low available water holding capacity and low soil nutrient holding capacity are anticipated as a result of project activities.

Groundwater Quantity and Quality

With the application of recommended BMPs for irrigation management and adherence to the Water Rights License conditions, the residual effect of a change in groundwater quantity is anticipated to be adverse in direction, low in magnitude and confined to the RAA. No significant adverse effects due to water extraction from the Glenora aquifer are anticipated as a result of project activities.

With the application of recommended BMPs for irrigation and nutrient management, the residual effect of a change in groundwater quality is anticipated to be neutral in direction, negligible in magnitude and confined to the RAA. No significant adverse effects due to nutrient losses via leaching or runoff are anticipated as a result of project activities.

Vegetation and Wetlands

Given the limited area of the LAA that is not already in agricultural land use, the avoidance of the northeast corner of the LAA, and a commitment to minimize disturbance within the road allowance during pipeline installation, the residual effect of a change in native vegetation and wetlands is anticipated to be adverse in direction, low in magnitude and confined to the PDA. No significant adverse effects are anticipated as a result of project activities.

Wildlife and Wildlife Habitat

Due to relatively low levels of land use change and the low potential for the presence of SAR, the residual effect of a change in wildlife and wildlife habitat is anticipated to be adverse in direction, low in magnitude and confined to the PDA. No significant adverse effects are anticipated as a result of project activities.

Socio-Economy, Infrastructure and Resource Use

Project activities are anticipated to result in a positive, low magnitude effect on employment and economy due to employment and purchasing during Project construction and operation.

The residual effect of an increase in traffic associated with construction will be adverse in direction, low in magnitude, and confined to the RAA. With adherence to proper utility locate procedures, the residual effect to existing utilities is expected to be neutral in direction, negligible in magnitude and confined to the PDA for the construction phase. Overall, no significant adverse effects to socio-economy, infrastructure and land and resource use are anticipated as a result of project activities.

7.1.2 Significance of Residual Cumulative Environmental Effects

Given that the Project will be developed on a landscape that has been heavily modified by agricultural practices, and that the proponent is not aware of any future projects which would require substantial water from the Glenora aquifer, the cumulative effect of a change in groundwater quality or a change in groundwater quantity are not anticipated to result in significant adverse cumulative effects.

7.1.2.1 Project Contribution to Cumulative Environmental Effects

Given that the landscape has been heavily modified by agricultural activities and the effects resulting from the Project, the Project's contribution to cumulative environmental effects is expected to be of low magnitude and localized.

7.2 PREDICTION CONFIDENCE

Prediction confidence is high regarding the effects of potential project interactions with soil capability. Prediction confidence is high based on good-quality soil data gathered during the 2014 land assessment field program and knowledge of soil management concerns in relation to irrigation development projects. Best management practices have been well established and have proved to be effective at controlling soil resource concerns. Best management practices are provided in the Land Assessment report (Stantec 2014, Appendix B) and tailored to Soil Management Areas for effective management of the soil resource.

Prediction confidence is high regarding the effects of potential project interactions with groundwater. Completion of pump tests to confirm the magnitude of potential project interactions on groundwater quantity, there is a high degree of confidence in predicting the effects of Project interactions.

Prediction confidence is high regarding the effects of potential project interactions with vegetation and wetlands. Small remnants of native vegetation will be cleared from the PDA, however areas with the potential for species of conservation concern, limited to the northeast portion of the LAA, will remain intact through partial pivot design.

Prediction confidence is high regarding the effects of potential project interactions with wildlife and wildlife habitat. Due to the relatively low levels of land use change to occur with the project

construction and to the likelihood that occurrence of SAR in the LAA is most likely linked to moving through the area to more suitable habitat.

Prediction confidence is high regarding the effects of potential project interactions with socio-economy, infrastructure, and land and resource use given the understanding of the Project construction and operation phases.

8.0 Follow-up and Monitoring

No specific follow-up is recommended.

The Proponent will implement environmental protection measures and monitoring in compliance with the applicable Environment Act License during the construction and operation phases of the Project. Recommended monitoring during the construction and operations phases are outlined below.

The Proponent will undertake the following monitoring during construction of the Project:

- Monitor the work site to ensure effectiveness of measures put in place to protect the environment.
- Report all reportable environmental incidents to Manitoba Conservation and Water Stewardship as soon as possible after they occur.

The Proponent will undertake the following monitoring during operation of the Project:

- Monitor the irrigation system regularly during operation. This monitoring will be conducted to ensure the wells, irrigation pumps, pipelines and irrigation units are operating properly.
- Monitor and maintain records of water withdrawal and irrigation water application to each field on a daily basis. This information will be reported to Manitoba Conservation and Water Stewardship according to License requirements.
- Monitor groundwater levels regularly during pumping.
- Soil moisture monitoring to support irrigation scheduling and determining timing of irrigation applications.
- Soil nutrient monitoring annually to support nutrient management.
- Report all reportable environmental incidents to Manitoba Conservation and Water Stewardship as soon as possible after they occur.

The Proponent is willing to cooperate with Manitoba Conservation and Water Stewardship to determine and implement appropriate additional monitoring to confirm the effectiveness of mitigation measures and minimize environmental effects of the Project.

9.0 Summary

Stantec has prepared this environmental impact assessment report of the Collins Farms Ltd. Proposed Irrigation Development Project, on behalf of Collins Farms Ltd., to support the Environment Act Proposal for the same.

The Proponent is committed to implementing mitigation measures to minimize potential adverse effects to the environment, and confirm through monitoring that planned and implemented mitigation is effectively minimizing adverse effects.

On the basis of the studies undertaken and information available to date and presented in this report, the Project is not anticipated to create significant adverse effects to the biophysical environment and is anticipated to yield socioeconomic benefits. Further, the Project is not anticipated to contribute to or act cumulatively with other reasonable and foreseeable past and future projects in a manner that will result in significant adverse cumulative effects.

10.0 References

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10.2 PERSONAL COMMUNICATIONS

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Appendix A Species Potentially Occurring within the RAA

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
UPLAND PLANTS							
Achnatherum hymenoides (Poaceae)	Indian Rice Grass	S2	FACU	Upland	NL	NL	NL
Agalinis aspera (Scrophulariaceae)	Rough Purple False-foxglove	S1S2	FACU	Upland	EN	EN	EN
Ambrosia acanthicarpa (Asteraceae)	Sandbur	S1S2	U	Upland	NL	NL	NL
Andropogon hallii (Poaceae)	Sand Bluestem	S2S3	U	Upland	NL	NL	NL
Aristida purpurea var. longiseta (Poaceae)	Red Three-awn	S1	U	Upland	NL	NL	NL
Arnica fulgens (Asteraceae)	Shining Arnica	S2	U	Upland	NL	NL	NL
Artemisia cana (Asteraceae)	Silver Sagebrush	S2	FACU	Upland	NL	NL	NL
Asarum canadense (Aristolochiaceae)	Wild Ginger	S3S4	FACU	Upland	NL	NL	NL
Asclepias lanuginosa (Asclepiadaceae)	Sidecluster Milkweed	S2	U	Upland	NL	NL	NL
Asclepias verticillata (Asclepiadaceae)	Whorled Milkweed	S3	FACU	Upland	NL	NL	NL
Asclepias viridiflora (Asclepiadaceae)	Green Milkweed	S3	U	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Astragalus gilviflorus (Fabaceae)	Cushion Milkvetch	S1	U	Upland	NL	NL	NL
Astragalus pectinatus (Fabaceae)	Narrow-leaved Milkvetch	S2S3	U	Upland	NL	NL	NL
Atriplex argentea (Chenopodiaceae)	Saltbrush	S2	FACU/FAC		NL	NL	NL
Bidens amplissima (Asteraceae)	Beggar-ticks	SNA	U	Upland	NL	NL	NL
Botrychium campestre (Ophioglossaceae)	Prairie Moonwort	S1	U	Upland	NL	NL	NL
Botrychium multifidum (Ophioglossaceae)	Leathery Grape-fern	S3	FACU	Upland	NL	NL	NL
Bouteloua curtipendula(Poaceae)	Side-oats Grama	S2S3	U	Grassland, parklands	NL	NL	NL
Bromus porteri (Poaceae)	Porter's Chess	S3	U	Upland	NL	NL	NL
Bromus pubescens (Poaceae)	Canada Brome Grass	SNA	FACU	Upland	NL	NL	NL
Buchloe dactyloides (Poaceae)	Buffalograss	S1	FACU	Upland	TH	SC	TH
Calamagrostis montanensis (Poaceae)	Plains Reed Grass	S3	FACU	Moderately dry grassland, prairie	NL	NL	NL
Carex hallii (Cyperaceae)	Hall's Sedge	S3	FAC/FACW	Swamps, wet meadows, boreal forest	NL	NL	NL
Carex torreyi (Cyperaceae)	Torrey's Sedge	S4	FACU	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Carex xerantica (Cyperaceae)	White-scaled Sedge	S3	U	Upland	NL	NL	NL
Celtis occidentalis(Ulmaceae)	Hackberry	S1	FACU/FAC		TH	NL	NL
Chamaesyce geyeri (Euphorbiaceae)	Prostrate Spurge	S1	U	Upland	NL	NL	NL
Chenopodium Subglabrum (Chenopodiaceae)	Smooth Goosefoot	S1	U	Upland	EN	TH	TH
Circaea lutetiana Ssp. canadensis (Onagraceae)	Large Enchanter's-nightshade	S2	U	Upland	NL	NL	NL
Clematis ligusticifolia (Ranunculaceae)	Western Virgin's-bower	S1	FACU	Upland	NL	NL	NL
Clematis virginiana(Ranunculaceae)	Virgin's-bower	S2	FACU/FAC		NL	NL	NL
Coreopsis tinctoria (Asteraceae)	Common Tickseed	SH	FAC	Wetland	NL	NL	NL
Corispermum americanum var. americanum (Chenopodiaceae)	American Bugseed	S2S3	U	Upland	NL	NL	NL
Corispermum hookeri var. hookeri (Chenopodiaceae)	Hooker's Bugseed	S1	U	Upland	NL	NL	NL
Corispermum pallasii (Chenopodiaceae)	Pallas' Bugseed	SU	U	Upland	NL	NL	NL
Corispermum villosum (Chenopodiaceae)	Hairy Bugseed	S1S2	U	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Cornus alternifolia (Cornaceae)	Alternate-leaved Dogwood	S3	FAC	Wetland	NL	NL	NL
Coryphantha vivipara (Cactaceae)	Pincushion Cactus	S2	U	Upland	NL	NL	NL
Cryptotaenia canadensis (Apiaceae)	Honewort	S2	FAC	Wetland	NL	NL	NL
Cycloloma atriplicifolium (Chenopodiaceae)	Winged Pigseed	S2	FACU	Upland	NL	NL	NL
Cymopterus acaulis (Apiaceae)	Plains Cymopterus	S2S3	U	Upland	NL	NL	NL
Cyperus houghtonii (Cyperaceae)	Houghton's Umbrella-sedge	S2	U	Sandy areas, boreal forest, parklands	NL	NL	NL
Cyperus schweinitzii (Cyperaceae)	Schweinitz's Flatsedge	S2	FACU	Upland	NL	NL	NL
*Dalea villosa var. villosa (Fabaceae)****	Hairy Prairie-clover***	S2S3	U	Upland	TH	SC	TH
Desmodium canadense (Fabaceae)	Beggar's-lice	S2	FACU/FAC		NL	NL	NL
Dichanthelium linearifolium (Poaceae)	White-haired Panic-grass	S2	U	Upland	NL	NL	NL
Elymus hystrix (Poaceae)	Bottle-brush Grass	S2	FACU	Open woods, boreal forest, parklands	NL	NL	NL
Erigeron caespitosus (Asteraceae)	Tufted Fleabane	S2	U	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Eriogonum glavum (Polygonaceae)	Yellow Eriogonum	S3	U	Upland	NL	NL	NL
Festuca hallii (Poaceae)	Plains Rough Fescue	S3	U	Upland	NL	NL	NL
Festuca subverticillata (Poaceae)	Nodding Fescue	S1	FACU	Upland	NL	NL	NL
Galium aparine (Rubiaceae)	Cleavers	SU	FACU	Upland	NL	NL	NL
Hackelia floribunda (Boraginaceae)	Large Flowered Stickseed	SU	FACU	Upland	NL	NL	NL
Helianthus nuttallii ssp. rydbergii (Asteraceae)	Tuberous-rooted Sunflower	S2	U	Upland	NL	NL	NL
Juncus interior (Juncaceae)	Inland Rush	S1	FAC	Wetland	NL	NL	NL
Krascheninnikovia lanata (Chenopodiaceae)	Winterfat	S2	U	Upland	NL	NL	NL
Leucophysalis Grandiflora (Solanaceae)	Large White-flowered Ground-cherry	S3	U	Upland	NL	NL	NL
Linum sulcatum (Linaceae)	Grooved Yellow Flax	S3	U	Upland	NL	NL	NL
Lomatium foeniculaceum (Apiaceae)	Hairy-fruited Parsley	S3	U	Upland	NL	NL	NL
Lomatium macrocarpum (Apiaceae)	Long-fruited Parsley	S3	U	Upland	NL	NL	NL
Lomatium orientale (Apiaceae)	White-flowered Parsley	S1	U	Upland	NL	NL	NL
Lotus unifoliolatus (Fabaceae)	prarie trefoil	S2S3	U	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Malaxis monophyllos (Orchidaceae)	White Adder's-mouth	S2	U	Upland	NL	NL	NL
Mentzelia decapetala (Loasaceae)	Gumbo-lily	SH	U	Upland	NL	NL	NL
Mertensia lanceolata (Boraginaceae)	Tall Lungwort	S2	U	Upland	NL	NL	NL
Mimulus glabratus (Scrophulariaceae)	Smooth Monkeyflower	S1	U	Upland	NL	NL	NL
Mimulus glabratus var. jamesii (Scrophulariaceae)	Smooth Monkeyflower	S1	U	Upland	NL	NL	NL
Musineon divaricatum (Apiaceae)	Leafy Musineon	S2	U	Upland	NL	NL	NL
Nassella viridula (Poaceae)	Green Needle Grass	S3	U	Upland	NL	NL	NL
Orobanche ludoviciana (Orobanchaceae)	Louisiana Broom-rape	S2	U	Upland	NL	NL	NL
Osmorhiza claytonii (Apiaceae)	Wooly or Hairy Sweet Cicely	S2	FACU	Upland	NL	NL	NL
Ostrya virginiana (Betulaceae)	Hop-hornbeam	S2	FACU	Upland	NL	NL	NL
Oxytropis sericea (Fabaceae)	Early Yellow Locoweed	S1	U	Upland	NL	NL	NL
Parietaria pensylvanica (Urticaceae)	American Pellitory	S4	FAC	Wetland	NL	NL	NL
Penstemon nitidus (Scrophulariaceae)	Smooth Blue Beard-tongue	S2	U	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Penstemon procerus (Scrophulariaceae)	Slender Beard-tongue	S1	U	Upland	NL	NL	NL
Phlox hoodii (Polemoniaceae)	Moss Pink	S3	U	Upland	NL	NL	NL
Phryma leptostachya (Verbenaceae)	Lopseed	S3	FACU	Upland	NL	NL	NL
Piptatherum micranthum (Poaceae)	Little-seed Rice Grass	S2	U	Upland	NL	NL	NL
Plagiobothrys scouleri var. scouleri (Boraginaceae)	Scouler's Allocarya	S1	U	Upland	NL	NL	NL
Plantago elongata ssp. elongata (Plantaginaceae)	Linear Leaved-plantain	S2	U	Upland	NL	NL	NL
Platanthera orbiculata (Orchidaceae)	Round-leaved Bog Orchid	S3	FAC	Wetland	NL	NL	NL
Poa arida (Poaceae)	Plains Blue Grass	S4	FAC	Wetland	NL	NL	NL
Poa cusickii (Poaceae)	Mutton-grass	S2	U	Upland	NL	NL	NL
Poa fendleriana (Poaceae)	Mutton Grass	S2	U	Upland	NL	NL	NL
Polanisia dodecandra ssp. dodecandra (Capparaceae)	Clammyweed	S1	U	Upland	NL	NL	NL
Polanisia Dodecandra Ssp. Trachysperma (Capparaceae)	Clammyweed	S1	U	Upland	NL	NL	NL
Polygala verticillata var isocycla (Polygalaceae)	Whorled Milkwort	S2	U	Upland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Polygala verticillata (Polygalaceae)	Whorled Milkwort	S2	U	Upland	NL	NL	NL
Potentilla Gracilis Var. Flabelliformis (Rosaceae)	Graceful Cinquefoil	S1	U	Upland	NL	NL	NL
Sanguinaria canadensis (Papaveraceae)	Blood-root	S2	U	Upland	NL	NL	NL
Schedonnardus paniculatus (Poaceae)	Tumble-grass	S2	U	Upland	NL	NL	NL
Selaginella densa (Selaginellaceae)	Prairie Spike-moss	S3	U	Upland	NL	NL	NL
Shinnersoseris rostrata (Asteraceae)	Annual Skeletonweed	S1S2	U	Upland	NL	NL	NL
Sisyrinchium campestre (Iridaceae)	White-eyed Grass	SU	U	Rock outcrops, prairies	NL	NL	NL
Sisyrinchium mucronatum (Iridaceae)	Michaux's Blue-eyed Grass	S1	FAC	Wetland	NL	NL	NL
Sporobolus neglectus (Poaceae)	Annual Dropseed	S3	U	Upland	NL	NL	NL
Thermopsis rhombifolia (Fabaceae)	Golden Bean	S2	FACU	Upland	NL	NL	NL
Townsendia exscapa (Asteraceae)	Silky Townsend-daisy	S2	U	Upland	NL	NL	NL
Tradescantia occidentalis (Commelinaceae)	Western Spiderwort	S1	U	Upland	TH	TH	TH

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Uvularia sessilifolia (Liliaceae)	Small Bellwort	S2	FACU	Upland	NL	NL	NL
Verbena bracteata (Verbenaceae)	Bracted Vervain	S3	FACU	Upland	NL	NL	NL
WETLAND PLANTS							
Alisma gramineum (Alismataceae)	Narrow-leaved Water-plantain	S1	OBL	Wetland	NL	NL	NL
Boltonia asteroides var recognita (Asteraceae)	White Boltonia	S2S3	FACW/OBL	Wetland	NL	NL	NL
Callitriche heterophylla (Callitrichaceae)	Larger Water-starwort	S2	OBL	Wetland	NL	NL	NL
Carex bicknellii (Cyperaceae)	Bicknell's Sedge	SH	FACW	Wetland	NL	NL	NL
Carex cristatella (Cyperaceae)	Crested Sedge	S2	FACW	Swamps, wet meadows, prairies	NL	NL	NL
Carex cryptolepis (Cyperaceae)	Northeastern Sedge	S1	OBL	Wetland	NL	NL	NL
Carex emoryi (Cyperaceae)	Emory's Sedge	S2	OBL	Wet meadows	NL	NL	NL
Carex gravida (Cyperaceae)	Heavy Sedge	S1	FACW	Wetland	NL	NL	NL
Carex hystericina (Cyperaceae)	Porcupine Sedge	S3	OBL	Wetland	NL	NL	NL
Carex parryana (Cyperaceae)	Parry's Sedge	S3	FACW	Wetland	NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Carex pedunculata (Cyperaceae)	Stalked Sedge	S3	OBL	Wetland	NL	NL	NL
Carex prairea (Cyperaceae)	Prairie Sedge	S4	OBL	Wetland	NL	NL	NL
Carex sterilis (Cyperaceae)	Dioecious Sedge	S2	OBL	Wetland	NL	NL	NL
Carex supina var spaniocarpa (Cyperaceae)	Weak Sedge	S2	OBL	Beaches, boreal forest, parklands	NL	NL	NL
Carex tetanica (Cyperaceae)	Rigid Sedge	S2	FACW	Wetland	NL	NL	NL
Carex tribuloides (Cyperaceae)	Prickly Sedge	SNA	FACW	Wetland	NL	NL	NL
*Cypripedium candidum (Orchidaceae)****	Small White Lady's-slipper	S2	OBL		EN	EN	EN
Drosera anglica (Droseraceae)	Oblong-leaved Sundew	S3	OBL	Wetland	NL	NL	NL
Eleocharis engelmannii (Cyperaceae)	Engelmann's Spike-rush	S1	FACW	Wetland	NL	NL	NL
Eragrostis hypnoides (Poaceae)	Creeping Teal Love Grass	S4	FACW	Wetland	NL	NL	NL
Heliotropium curassavicum (Boraginaceae)	Seaside Heliotrope	SH	OBL	Wetland	NL	NL	NL
Hypoxis hirsuta (Liliaceae)	Yellow Stargrass	S4	FACW	Wetland	NL	NL	NL
Leersia oryzoides (Poaceae)	Rice Cutgrass	S3	OBL		NL	NL	NL

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]
Lemna turionifera (Lemnaceae)	Duckweed	SU	OBL	Wetland	NL	NL	NL
Lomatogonium rotatum (Gentianaceae)	Marsh Felwort	S2S3	OBL	Wetland	NL	NL	NL
Malaxis paludosa (Orchidaceae)	Bog Adder's-mouth	S1	OBL	Wetland	NL	NL	NL
Myosurus minimus ssp. minimus (Ranunculaceae)	Least Mousetail	S1	FACW	Wetland	NL	NL	NL
Potamogeton amplifolius (Potamogetonaceae)	Large-leaved Pondweed	S2	OBL	Wetland	NL	NL	NL
Potamogeton illinoensis (Potamogetonaceae)	Illinois Pondweed	S2	OBL	Wetland	NL	NL	NL
Potentilla plattensis (Rosaceae)	Low Cinquefoil	S2	FACW	Wetland	NL	NL	NL
Ranunculus cymbalaria var saximontanus(Ranunculaceae)	Seaside Crowfoot	S1S2	OBL	Wetland	NL	NL	NL
Rhynchospora alba (Cyperaceae)	White Beakrush	S3	OBL	Wetland	NL	NL	NL
Rhynchospora capillacea (Cyperaceae)	Horned Beakrush	S2	OBL	Wetland	NL	NL	NL

Notes:
Source: Manitoba Conservation Data Centre 2004

* deemed species at risk by COSEWIC
** deemed species at risk by MESA

Table A-1: Plant Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name (Family)	Common Name	CDC Rank[1]	Habitat[2]	Habitat Description	MESA[3]	COSEWIC[3]	SARA[3]

*** deemed species at risk by MESA and COSEWIC

[1] Conservation Data Centre Rank:

S1 - Critically imperiled because of extreme rarity (5 or fewer occurrences).

S2 - Imperiled because of rarity (6 - 20 occurrences).

S3 - Rare or uncommon (on the order of 21 - 100 occurrences).

S4 - Apparently secure, with many occurrences (>100).

[2] Individual species habitat descriptions (values in bold are estimates derived from published habitat descriptions):

U - Obligate Upland Plants

FACU - Facultative Upland Plants found most often in non-wetlands

FAC - Facultative Plants found equally in wetlands and non-wetlands

FACW - Facultative Wetland Plants found most often in wetlands

OBL - Obligate Wetland Plants

[3]Provinvial and Federal Species Rankings:

NL - not listed

NA - not active

SC - special concern

TH - threatened

EN - endangered

EX – extirpated

Table A-2: Birds Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	Status[2]	MESA[3]	COSEWIC[3]	SARA[3]
Waterbirds						
*Podiceps auritus**	Horned Grebe*	S3	B	NL	TH	TH
Podiceps nigricollis	Eared Grebe	S4S5	B	NL	NL	NL
Aechmophorus occidentalis	Western Grebe	S4	B	NL	NL	NL
Cygnus buccinator	Trumpeter Swan	S1S2	B	NL	NL	NL
Phalacrocorax auritus	Double-crested Cormorant	S5	B	NL	NL	NL
Ardea herodias	Great Blue Heron	S4S5	B	NL	NL	NL
Nycticorax nycticorax	Black-crowned Night-heron	S3S4	B	NL	NL	NL
Bubulcus ibis	Cattle Egret	S1S2	B	NL	NL	NL
*Coturnicops noveboracensis**	Yellow Rail*	S3S4	B	NL	SC	SC
*Charadrius melodus***	Piping Plover***	S1	B	EN	EN	EN
*Numenius borealis****	Eskimo Curlew***	SNA	B	EN	EN	EN
Sterna forsteri	Forster's Tern	S4	B	NL	NL	NL
Chlidonias niger	Black Tern	S4	B	NL	NL	NL
Raptors						
Accipiter cooperii	Cooper's Hawk	S4S5	B	NL	NL	NL
*Buteo regalis****	Ferruginous Hawk***	S1S2	B	EN	TH	TH
*Falco peregrinus anatum****	Peregrine Falcon***	S1	B	EN	SC	SC
Strix varia	Barred Owl	S4	B	NL	NL	NL
*Athene cunicularia****	Burrowing Owl***	S1	B	EN	EN	EN
*Asio flammeus****	Short-eared Owl***	S2S3	B	TH	SC	SC
Passerines						
*Contopus cooperi**	Olive-sided Flycatcher*	S3S4	B	NL	TH	TH

Table A-2: Birds Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	Status[2]	MESA[3]	COSEWIC[3]	SARA[3]
Empidonax traillii	Willow Flycatcher	S2S3	B	NL	NL	NL
Sayornis saya	Say's Phoebe	S2S3	B	NL	NL	NL
*Lanius ludovicianus excubitorides***	Loggerhead Shrike***	S2	B	NL	TH	TH
Eremophila alpestris	Horned Lark	S3	B	NL	NL	NL
*Hirundo rustica**	Barn Swallow*	S4	B	NL	NL	NL
*Anthus spragueii****	Sprague's Pipit***	S2	B	TH	TH	TH
*Vermivora chrysoptera****	Golden-winged Warbler***	S3	B	TH	TH	TH
*Wilsonia A.14anadensis****	Canada Warbler***	S4	B	EN	TH	TH
Calamospiza melanocorys	Lark Bunting	S1	B	NL	NL	NL
Ammodramus savannarum	Grasshopper Sparrow	S2	B	NL	NL	NL
*Ammodramus bairdii***	Baird's Sparrow**	S1	B	EN	EN	NL
*Calcarius ornatus****	Chestnut-collared Longspur***	S1S2	B	EN	TH	TH
*Dolichonyx oryzivorus**	Bobolink*	S4	B	NL	TH	NL
Other Birds						
*Chordeiles minor****	Common Nighthawk***	S3	B	TH	TH	TH
*Chaetura pelagica****	Chimney Swift***	S2	B	TH	TH	TH
*Melanerpes erythrocephalus****	Red-headed Woodpecker***	S2	B	TH	TH	TH

Notes:
Source: Godfrey 1986; Carey et al. 2003; Sauer et al. 2004; COSEWIC 2005

* deemed species at risk by COSEWIC
** deemed species at risk by MESA
*** deemed species at risk by COSEWIC and MESA

[1] Conservation Data Centre Rank:

Table A-2: Birds Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	Status[2]	MESA[3]	COSEWIC[3]	SARA[3]
S1 - Critically imperiled because of extreme rarity (5 or fewer occurrences)						
S2 - Imperiled because of rarity (6 - 20 occurrences)						
S3 - Rare or uncommon (on the order of 21 - 100 occurrences)						
S4 - Apparently secure, with many occurrences (>100)						
[2] Individual species qualifiers:						
B - breeding occurrences						
M - migrant						
P - permanent resident						
N - northern extent of range						
W - winter range						
I - introduced						
[3] Provincial and Federal Species Rankings:						
NL - not listed						
NA - not active						
SC - special concern						
TH - threatened						
EN - endangered						
EX – extirpated						

Table A-3: Mammal Species Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name
ORDER INSECTIVOR (Insectivores)	
Family Soricidae	
Blarina brevicauda	Short-tail Shrew
Sorex arcticus	Arctic Shrew
Sorex cinereus	Masked Shrew
Sorex haydeni	Prairie Shrew
Microsorex hoyi	Pygmy Shrew
Sorex palustris	American Water Shrew
ORDER CHIROPTERA (Bats)	
Family Vespertilionidae	
Myotis lucifugus	Little Brown Myotis
Myotis septentrionalis	Northern Myotis
Lasionycteris noctivagans	Silver-haired Bat
Lasiurus borealis	Eastern Red Bat
Eptesicus fuscus	Big Brown Bat
Lasiurus cinereus	Hoary Bat
ORDER CARNIVORA (Carnivores)	
Family Felidae	
Lynx rufus	Bobcat
Family Canidae	
Canis latrans	Coyote
Vulpes vulpes	Red Fox
Family Mustelidae	
Mustela nivalis	Least Weasel
Mustela frenata	Long-tail Weasel
Mustela erminea	Short-tail Weasel
Mustela vison	Mink
Taxidea taxus	American Badger
Family Mephitidae	
Mephitis mephitis	Striped Skunk
Family Procyonidae	
Procyon lotor	Raccoon
ORDER ARTIODACTYLA (Cloven-hoofed Mammals)	
Family Cervidae	

Table A-3: Mammal Species Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name
Odocoileus virginianus	White-tailed Deer
Cervus canadensis	Elk
Alces alces	Moose
Family Antilocapridae	
Antilocapra Americana	Pronghorn Antelope
ORDER RODENTIA (Rodents)	
Family Sciuridae	
Marmota monax	Woodchuck
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel
Poliocitellus franklini	Franklin Ground Squirrel
Urocitellus richardsoni	Richardson's Ground Squirrel
Tamias striatus	Eastern Chipmunk
Tamias minimus	Least Chipmunk
Sciurus carolinensis	Eastern Gray Squirrel
Tamiasciurus hudsonicus	Red Squirrel
Glaucomys sabrinus	Northern Flying Squirrel
Sciurus niger	Eastern Fox Squirrel
Family Castoridae	
Castor canadensis	Beaver
Family Geomyidae	
Thomomys talpoides	Northern Pocket Gopher
Family Heteromydiae	
Perognathus fasciatus	Olive-backed Pocket Mouse
Family Dipodidae	
Zapus hudsonius	Meadow Jumping Mouse
Zapus princeps	Western Jumping Mouse
Family Cricetidae	
Ondatra zibethicus	Muskrat
Peromyscus maniculatus	Deer Mouse
Onychomys leucogaster	Northern Grasshopper Mouse
Microtus pennsylvanicus	Meadow Vole
Microtus ochrogaster	Prairie Vole
Myodes gapperi	Southern Red-backed Vole
Family Erethizontidae	

Table A-3: Mammal Species Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name
Erethizon dorsatum	Porcupine
ORDER LAGOMORPHA (Hares and Rabbits)	
Family Leporidae	
Sylvilagus floridanus	Eastern Cottontail
Lepus townsendii	White-tailed Jackrabbit
Lepus americanus	Snowshoe Hare
Source: Banfield 1974; Burt and Grossenheider 1980 * deemed species at risk by COSEWIC ** deemed species at risk by MESA *** deemed species at risk by MESA and COSEWIC	

Table A-4: Mammal Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	MESA[2]	COSEWIC[2]	SARA[2]
ORDER CARNIVORA (Carnivores)					
Family Mustelidae					
Mustela frenata	Long-tailed Weasel	S3	NL	NL	NL
ORDER ARTIODACTYLA (Cloven-hoofed Mammals)					
Family Cervidae					
*Odocoileus hemionus***	Mule or Black-tailed Deer**	S3	TH	NL	NL

Source: Banfield 1974; Burt and Grossenheider 1980

* deemed species at risk by COSEWIC
** deemed species at risk by MESA
*** deemed species at risk by MESA and COSEWIC

[1] Conservation Data Centre Rank:
- S1 - Critically imperiled because of extreme rarity (5 or fewer occurrences)
- S2 - Imperiled because of rarity (6 - 20 occurrences)
- S3 - Rare or uncommon (on the order of 21 - 100 occurrences)
- S4 - Apparently secure, with many occurrences (>100)

[2] Provincial and Federal Species Rankings:
- NL - not listed
- NA - not active
- SC - special concern
- TH - threatened
- EN - endangered
- EX - extirpated

Table A-5: Reptile and Amphibian Species Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name
CLASS REPTILA	
Order Squamata (Lizards and Skinks)	
Opheodrys vernalis	*Smooth Green Snake*
Thamnophis radix haydeni	*Western Plains Garter Snake*
Thamnophis sirtalis parietalis	*Red-sided Garter Snake*
Storeria occipitomaculata occipitomaculata	*Northern Redbelly Snake*
Heterodon nasicus	*Western Hognose Snake*
Order Testudines (Turtles)	
Chrysemys picta belli	Western Painted Turtle
*Chelyfra serpentina serpentina**	Common Snapping Turtle*
CLASS AMPHIBIA	
Order Anura (Frogs and Toads)	
*Rana pipiens**	Northern Leopard Frog*
Rana sylvatica	Wood Frog
Pseudacris triseriata maculata	Boreal Chorus Frog
Hyla chrysoscelis	Cope's Gray Tree Frog
Hyla versicolor	Gray Tree Frog
Bufo americanus hemiophrys	Canadian Toad
Bufo americanus	American Toad
*Bufo cognatus****	Great Plains Toad***
Spea bombifrons	Plains Spadefoot Toad
Order Caudata (Salamanders)	
Ambystoma tigrinum diaboli	Gray Tiger Salamander
Ambystoma mavortium	Barred Tiger Salamander

Source: Preston 1982

* deemed species at risk by COSEWIC
** deemed species at risk by MESA
*** deemed species at risk by MESA and COSEWIC

Table A-6: Reptile and Amphibian Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	MESA[2]	COSEWIC[2]	SARA[2]
CLASS REPTILA					
Order Squamata (Lizards and Skinks)					
*Eumeces septentrionalis****	Northern Prairie Skink***	S1	EN	EN	EN
Liochlorophis vernalis	Smooth Green Snake	S3S4	NL	NL	NL
Thamnophis radix haydenii	Western Plains Garter Snake	S4	NL	NL	NL
Storeria occipitomaculata	Northern Redbelly Snake	S3S4	NL	NL	NL
Heterodon nasicus	Western Hognose Snake	S1S2	NL	NL	NL
Order Testudines					
*Chelydra serpentina serpentina**	Common Snapping Turtle*	S3	NL	SC	SC
CLASS AMPHIBIA					
Order Salientia (Frogs and Toads)					
*Lithobates pipiens**	Northern Leopard Frog*	S4	NL	SC	SC
*Bufo cognatus****	Great Plains Toad***	S2	TH	SC	SC
Spea bombifrons	Plains Spadefoot Toad	S2S3	NL	NL	NL

Notes:
Source: Preston 1982

* deemed species at risk by COSEWIC
** deemed species at risk by MESA
*** deemed species at risk by MESA and COSEWIC

[1] Conservation Data Centre Rank:
S1 - Critically imperiled because of extreme rarity (5 or fewer occurrences)
S2 - Imperiled because of rarity (6 - 20 occurrences)
S3 - Rare or uncommon (on the order of 21 - 100 occurrences)

Table A-6: Reptile and Amphibian Species of Conservation Concern Potentially Existing in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	MESA[2]	COSEWIC[2]	SARA[2]
S4 - Apparently secure, with many occurrences (>100)					
[2] Provincial and Federal Species Rankings:					
NL - not listed					
NA - not active					
SC - special concern					
TH - threatened					
EN - endangered					
EX - extirpated					

Table A-7: Status of Fish Species Known or Expected to Reside in Waterbodies in the Regional Assessment Area

Order	Family	Genus	Species[1]	Common Name	MESA[2]	MB CDC[3]	COSEWIC[4]	SARA[5]
Cypriniformes	Cyprinidae	*Hybognathus*	*hankinsoni*	brassy minnow	NL	G5, S4	NL	NL
		Luxilus	*cornutus*	common shiner	NL	G5, S5	NL	NL
		Notropis	*dorsalis*	bigmouth shinner	NL	S3	NL	SC
		Notropis	*stramineus*	sand shiner	NL	G5, S5	NL	NL
		Pimephales	*promelas*	fathead minnow	NL	G5, S5	NL	NL
		Rhinichthys	*cataractae*	longnose dace	NL	G5, S5	NL	NL
		Rhinichthys	*obtusus*	western blacknose dace	NL	G5, S5	NL	NL
		Semotilus	*atronaculatus*	creek chub	NL	G5, S5	NL	NL
	Catostomidae	*Catostomus*	*commersoni*	white sucker	NL	G5, S5	NL	NL
		Moxostoma	*anisurum*	silver redhorse	NL	G5, S5	NL	NL
Esociformes	Umbridae	*Umbra*	*limi*	central mudminnow	NL	G5, S5	NL	NL
Percopsiformes	Percopsidae	*Percopsis*	*omiscomaycus*	troutperch	NL	G5, S5	NL	NL
Gasterosteiformes	Gasterosteidae	*Culaea*	*inconstans*	brook stickleback	NL	G5, S5	NL	NL
Perciformes	Percidae	*Etheostoma*	*exile*	lowa darter	NL	G5, S5	NL	NL
		Etheostoma	*nigrum*	johnny darter	NL	G5, S5	NL	NL
		Perina	*maculata*	blackside darter	NL	G5, S5	NL	NL

Notes:
Source: COSEWIC 2005; Milani 2013

[1] Species list is based on information from Milani (2013) for the Pembina and Marringhurst Creek
[2] Species status according to the *Manitoba Endangered Species Act*
[3] Species status according to the Manitoba Conservation Data Centre
[4] Committee on the Status of Endangered Wildlife in Canada
[5] *Species At Risk Act*

Table A-7: Status of Fish Species Known or Expected to Reside in Waterbodies in the Regional Assessment Area

Order	Family	Genus	Species[1]	Common Name	MESA[2]	MB CDC[3]	COSEWIC[4]	SARA[5]
MB CDC Abundance Rankings: G = species abundance over its entire range (based on number of records of species occurrence) S = species abundance over its Manitoba range (based on number of records of species occurrence) 1 - Very rare throughout its range or in the province (5 or fewer occurrences, or very few remaining individuals). May be especially be vulnerable to extirpation 2 - Rare throughout its range or in the province (6 to 20 occurrences). May be vulnerable to extirpation 3 - Uncommon throughout its range or in the province (21 to 100 occurrences) 4 - Widespread, abundant, and apparently secure throughout its range or in the province, with many occurrences, but the element is of long-term concern (>100 occurrences) 5 - Demonstrably widespread, abundant, and secure throughout its range or in the province, and essentially eradicable under present conditions E - An exotic established in the province; may be native in nearby regions MESA, COSEWIC and SARA Rankings: NL - Not Listed NaR - Not at Risk = A species that has been evaluated and found to be not at risk								

Table A-8: Fish Species of Conservation Concern Potentially Residing in Waterbodies in the Regional Assessment Area

Scientific Name	Common Name	CDC Rank[1]	MESA[2]	COSEWIC[2]	SARA[2]
ORDER PETROMYZONTIFORMES					
Family Petromyzontidae					
Ichthyomyzon castanaeus	Chestnut lamprey	S3S4	NA	NL	SC
ORDER CYPRINIFORMES					
Family Cyprinidae					
Macrhybopsis stoeriana	Silver chub	S3	NA	NL	SC
Notropis dorsalis	Bigmouth shiner	S3	NL	NL	SC

Notes:
Source: Stewart and Watkinson 2004, COSEWIC 2005

[1] Conservation Data Centre Rank:
- S1 - Critically imperiled because of extreme rarity (5 or fewer occurrences).
- S2 - Imperiled because of rarity (6 - 20 occurrences).
- S3 - Rare or uncommon (on the order of 21 - 100 occurrences).
- S4 - Apparently secure, with many occurrences (>100).

[2] Provincial and Federal Species Rankings:
- NL - not listed
- NA - not active
- SC - special concern
- TH - threatened
- EN - endangered
- EX - extirpated

Appendix B Land Assessment Report and Producer Survey for the Collins Farm Ltd. Irrigation Development Project, Stantec Consulting Ltd. (2014)

Land Assessment Report and Producer Survey for the Collins Farms Ltd. Irrigation Development Project

FINAL REPORT

Prepared for:
Collins Farms Ltd.

Prepared by:
Stantec Consulting Ltd.
603-386 Broadway
Winnipeg, MB R3C 3R6

111440257

October 23, 2014

Sign-off Sheet

This document entitled Land Assessment Report and Producer Survey for the Collins Farms Ltd. Irrigation Development Project was prepared by Stantec Consulting Ltd. for the account of Collins Farm Ltd. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by 

(signature)

Daniel Saurette, M.Sc., P.Ag.

Reviewed by 

(signature)

David Whetter, M.Sc., P.Ag.

Table of Contents

LIST OF TABLES

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LIST OF APPENDICES

1.0 Introduction

This report contains a Land Suitability Assessment for Irrigation – Phase I/II Report and corresponding Producer Surveys for fields proposed for irrigation development as part of the Collins Farms Ltd. Irrigation Development Project (the Project). The intent of this report is to provide land and agronomic information, including irrigation suitability recommendations for the land base to support the environmental assessment for the Project.

The Phase I/II report was developed following a draft guideline document commissioned by Agriculture and Agri-Food Canada – Agri-Environmental Services Branch (AAFC-AESB) to establish a new standardized land suitability assessment process for land being considered for irrigation development (Stantec 2011). Prior to writing the Phase I report, it was determined that a Phase II assessment (soil resource inventory update) would be required. As such, the information was collected and a Phase I/II report was produced.

Land suitability assessment for irrigation typically involves a consideration of soil and landscape factors as well as agronomic management information on an individual field (typically a quarter-section) basis. The land and agronomic assessment process is intended to support the environmental regulatory process for proposed irrigation developments and alterations of existing irrigation developments.

A total of 645 ac (261 ha) is proposed for irrigation, with groundwater aquifer as the proposed water source. None of the land parcels within the proposed land base were previously assessed for irrigation suitability.

The Land Suitability Assessment for Irrigation – Phase I/II Report presented in this report is based on newly collected soil resource information (SRI) at a detailed survey intensity level (scale = 1:20,000). Soils identified during the soil survey were correlated to existing soil series from the Soils of the Rural Municipality of Argyle, Report No. D84 (Haluschak et al. 1997).

2.0 Methodology

The Phase I/II Land Suitability for Irrigation Assessment is the minimum requirement of the land suitability for irrigation assessment process and consists of a desktop assessment based on the collection, review, interpretation and reporting of two information components:

- Phase I/II Report – based on existing or newly collected soil resource information
- Producer Survey

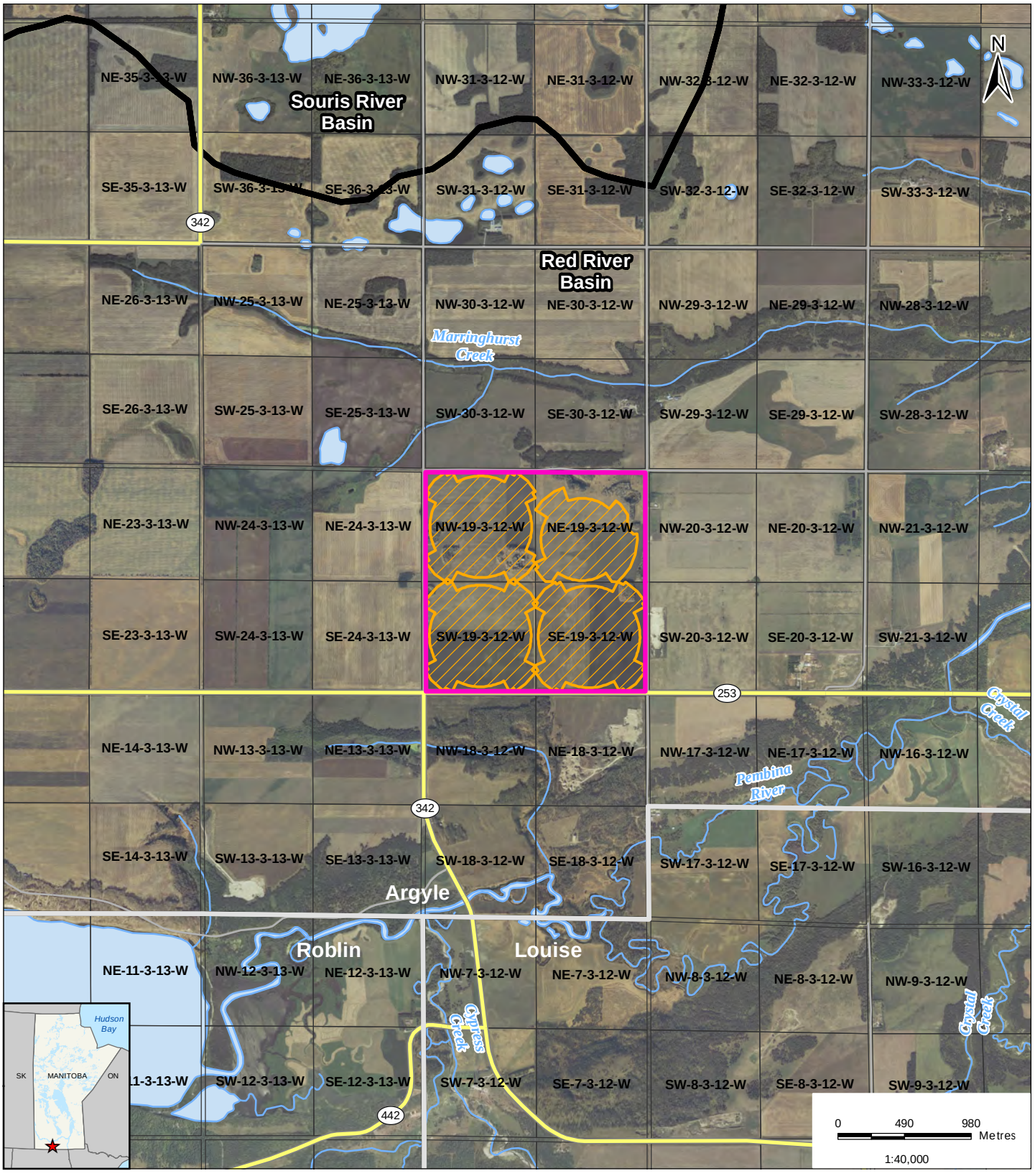
2.1 PHASE I/II REPORT

Phase I/II Reports are typically done on a quarter section basis since most irrigation systems irrigate a circular footprint spanning most of the area in a quarter-section (160 ac) or a portion of it. However, for the Collins Farms project, a full section with 4 pivots is being proposed (see Figure 2-1). As a result, a single Phase I/II Report was developed for the project using the standardized reporting format (Stantec 2011). The report presents general project information, soil resource information, irrigation system information, soil management considerations, and provides an irrigation suitability recommendation and supporting comments. Additional to this, the Phase I/II Report includes identification of recommended beneficial management practices by defined soil management areas within the field being assessed.

Mandatory supporting attachments to the Phase I Report include a standard suite of interpretive map figures, including soil-landscape; general irrigation suitability, suitability for irrigated potato, drainage regime and nutrient management zone map figures.

2.2 PRODUCER SURVEY

A Producer Survey was completed by Collins Farms Ltd. in support of the Land Assessment Phase I/II Report. The Producer Survey consists of a four page survey form that has to be filled out by the agricultural producer, or proponent, proposing land for irrigation development. The objective of the Producer Survey is to collect information on any significant land use changes that have been or may be undertaken (e.g., land clearing, land leveling) and agronomic information pertinent to irrigated crop production to support the Phase I/II Report.



G:_GIS_Project_Folder\111440257_CollinsFarm\ArcMaps\Area_Features_20141010.mxd
Revised: 2014-10-23 By: acampigotto

October 2014
Project No. 111440257

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features courtesy of Manitoba Land Initiative and CANVEC

Legend

- Site Location Section
- Proposed Irrigation Pivots
- Major Road Minor Road
- Minor Road
- Rural Municipality
- Waterbody
- Watershed Boundary

Client/Project

Collins Farms Ltd.
Land Assessment
Pilot Mound, MB

Figure No.

2-1

Title

Area Features

3.0 Summary of Findings

3.1 LAND SUITABILITY FOR IRRIGATION REPORT

Table 3-1 shows the irrigation suitability recommendations for the field assessed. The Phase I/II Report and supporting maps are provided in Appendix A.

Following the assessment, the land base was classified as "Recommended – Precautionary". This rating was assigned due to the following soil or landscape limitations identified within these fields: very coarse textured soils with low available water holding capacity, low nutrient holding capacity, and with the potential for erosion by wind or water, and soils with geological discontinuity (3 textural group difference between materials, medium texture over very coarse). These limitations require special soil management considerations, beneficial management practices and other mitigation and/or monitoring. However, these fields are not precluded from irrigation development. The recommended beneficial management practices (BMPs) are presented in Table 3-1.

3.2 PRODUCER SURVEY

The Producer Survey reports the different crop rotations planned for implementation within each quarter or half section under irrigation (Appendix B).

The survey indicates that Collins Farms Ltd. is already implementing some of the BMPs recommended for adoption in the Phase I/II Report (Appendix A), to mitigate adverse environmental effects that may develop under irrigation. These BMPs are:

- Annual soil testing for nutrient management and planning;
- Variable rate fertilizer application;
- Use of slow release N to minimize nutrient losses through leaching;
- No till/minimal tillage in the fall

In addition to these BMPs, the proponent has indicated plans to assess the feasibility of using fertigation at a later date.

Table 3-1: Summary of Land Suitability Assessment for Irrigation and Recommended BMPS for the Collins Farms Irrigation Project

Field I.D.	Legal Land Location	Irrigation Suitability Recommendation	Recommended Beneficial Management Practices (BMPs)*																				Tile Drainage Installed
			Nutrient Management				Soil Erosion				Soil Salinity				Drainage Management				Irrigation Manage-ment			Other		
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	
	19-03-12W1	Recommended	x		x	x	x	x											x	x				No

* Refer to Legend below for specific Beneficial Management Practice recommendations and to Phase 1 reports for which Soil Management Areas are applicable for each parcel.

Nutrient Management

1. Nutrient Management Planning
2. Fertigation
3. Other: Slow Release N
4. Other: Variable rate nutrient application

Soil Erosion

1. Residue Management
2. Fall Seeded Cereal Crop
3. Reduced Tillage
4. Other:

Soil Salinity

1. Subsurface Drainage Improvements
2. Salinity Monitoring Program
3. Permanent Cover Crop
4. Other

Drainage Management

1. Subsurface Drainage Improvement
2. Surface Drainage Management
3. Drainage Assessment
4. Other

Irrigation Management

1. Irrigation Scheduling
2. Soil Moisture Monitoring
3. Other

Other

1. Other
2. Other

4.0 References

Haluschak, P.W., E. St.Jacques, I.G. Podolsky. 1997. Soils of the Rural Municipality of Argyle. Soil Resource Section, Manitoba Agriculture. Report D84. Available online at: http://sis.agr.gc.ca/cansis/publications/surveys/mb/mbd84/index.html (October 8, 2014).

Stantec Consulting Ltd. 2011. Guideline for Assessment of Land Suitability for Irrigated Crop Production in Manitoba. DRAFT Version 1. March 31, 2011.

5.0 Closure

This report was prepared on behalf of Collins Farms Ltd. The report may not be relied upon by any other person or entity without the express written consent of Stantec Consulting Ltd. and Collins Farms Ltd.

Any use which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with accepted scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgment of Stantec Consulting Ltd. based on the data obtained from the work and on the site conditions encountered at the time the work was performed at the specific sampling, testing, and/or observation locations.

Appendix A Land Assessment Phase I/II Report

LAND SUITABILITY ASSESSMENT FOR IRRIGATION – PHASE I/II REPORT

The interpretation and recommendations contained within this Phase I/II Report are based on detailed soil resource information collected and interpreted by Stantec.

GENERAL PROJECT INFORMATION

Project Location					Producer Name and Contact Information				
QTR	SEC	TWP	RGE	MER	Business Name	Collins Farms Ltd.	Mailing Address 1	Box 105	
					Contact Name	Tammas Collins	Mailing Address 2		
	19	03	12	W1	Phone	(204) 825-8228	City/Town	Pilot Mound	MB
					Email	collins@mymts.net	Postal Code	R0G 1P0	

SOIL RESOURCE INFORMATION

Source:	Stantec Consulting Ltd.	Date:	2014	Scale:	1:20,000

Summary of Existing Soil Resource Information

The dominant soils in this field are well drained, Orthic Black Chernozems (O.BLC) of the Croyon series developed on loamy (L, SiL, CL) lacustrine deposits overlying sandy-skeletal (GrS, GrLS) glaciofluvial deposits. Significant portions of the field are well drained, O.BLC of the Fairland series developed on loamy lacustrine deposits, and well drained, O.BLC of the Dorset series, developed on sandy to sandy skeletal glaciofluvial deposits. The landscape is dominantly nearly level (0.5-2%) with significant portions very gently sloping (2-5%).

Interpretive Ratings

Extent	Irrigation Suitability	Nutrient Mgmt Zone
Dominant (>40 %)	Good	N2
Significant (10-40 %)	Excellent Poor	N1

Soil Property	Range	Dominant	Soil Property	Range	Dominant
Surface Texture	Medium to Very Coarse	Medium	**Infiltration Rate**	6 - 25 mm/hr 0.31 - 0.71 in/hr	6 - 14 mm/hr 0.31 - 0.51 in/hr
Drainage Class	Well, Imperfect and Poor	Well	**Available Water Holding Capacity**	0.6 - 2.2 mm/cm 0.7 - 2.6 in/ft	1.7 - 2.2 mm/cm 2.0 - 2.6 in/ft

IRRIGATION SYSTEM INFORMATION

Centre pivot – full	x	Travelling gun	
Centre pivot – partial	x	Other:	
Irrigation application rate :			
Irrigation water source:		Groundwater well (Glenora aquifer)	
Water quality concern (yes/no):		No	
If "yes" to above, describe:			
Is field tile drained? (yes/no)	N	If yes, give extent of tiles in field as whole (W) or partial (P)	

SOIL MANAGEMENT CONSIDERATIONS

Soil erosion (wind_x water_x)	x	Soil salinity	
Topography/slopes	x	Drainage - surface	
Nutrient holding capacity	x	Drainage - subsurface	
Nutrient runoff		Other:	
Water holding capacity	x	Other:	
Nutrient management buffer zone?	Yes		No x
If yes to above, describe:			

IRRIGATION SUITABILITY COMMENTS

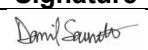
Dominant materials in this field include loamy over very coarse soils (Croyon) and very coarse soils (Dorset). These soils have low water and nutrient holding capacities, which will require the use of intensive beneficial management practices for irrigation and nutrient management to ensure water and nutrient applications are tailored to crop use. In addition, the NE corner of the section has steep slopes and poorly drained soils that are not considered suitable for irrigation – these areas have been excluded from the proposed irrigated area as per the proposed pivot layout and design.

Irrigation Suitability Recommendation	Recommended - Precautionary

ATTACHMENTS

Standard interpretive figures	X	Producer survey	X	Other: RM of Argyle 1:50,000 Soil Map	X

REPORT CLOSURE

Sign-Off	Printed Name	Signature	Date (yyyy-mm-dd)
Report compiled by:	Daniel Saurette, P.Ag.		2014-10-23
Report approved by:	David Whetter, P.Ag.		2014-10-23
Producer review:	Tammas Collins		

Report Issuer: Stantec

LAND SUITABILITY ASSESSMENT FOR IRRIGATION – PHASE I/II REPORT

The interpretation and recommendations contained within this Phase I Report are based on detailed soil resource information collected and interpreted by Stantec.

SOIL MANAGEMENT AREAS (SMA)

Note: SMAs are based on existing soil map units.

PHASE II INVESTIGATION REQUIRED

Investigation	X	SMA No.
Soil resource inventory update	x	All
Salinity assessment (EM38/Veris)		
Available water holding capacity assessment		
Drainage assessment		
Other:		
Other:		

Phase II Investigation Comments

Stantec conducted a detailed (Survey Intensity Level 2 [SIL2]) soil survey in August 2014. The report and interpretive maps wihtin this Phase I/II are based on this detailed survey.

RECOMMENDED BENEFICIAL MANAGEMENT PRACTICES (BMP)

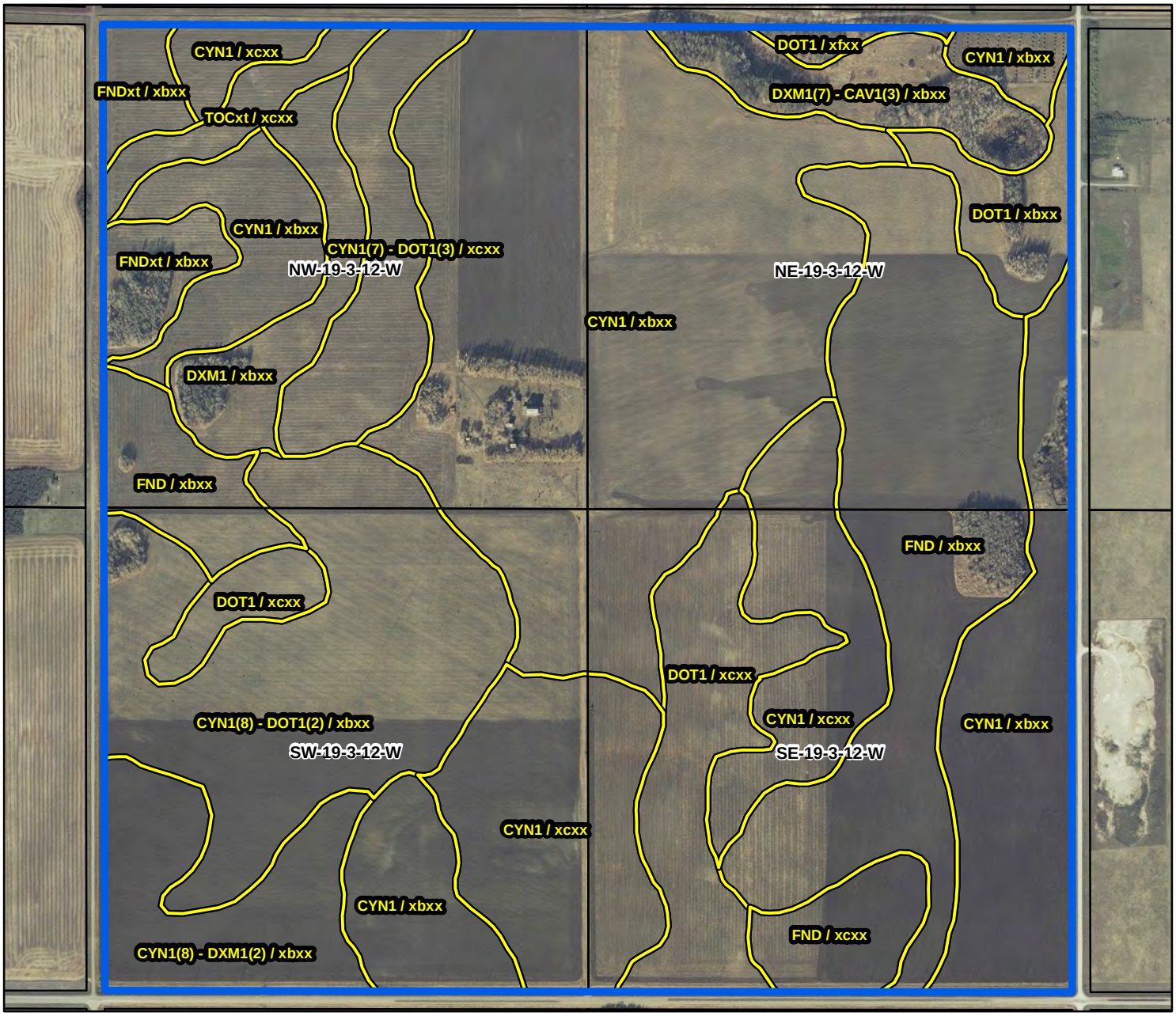
BMP	X	SMA No.
Nutrient Management		
Nutrient management planning	x	All
Fertigation		
Other: Slow Release N	x	2, 3, 4
Other: Variable rate nutrient application	x	2, 3, 4
Soil Erosion		
Residue management	x	3, 4
Fall seeded cereal crop	x	3, 4
Other:		
Other:		
Soil Salinity		
Subsurface drainage improvements		
Salinity monitoring program		
Permanent cover crop		

BMP	X	SMA No.
Drainage Management		
Subsurface drainage improvements		
Surface drainage improvements		
Drainage assessment		
Other:		
Irrigation Management		
Irrigation scheduling	x	2, 3, 4
Soil moisture monitoring	x	2, 3, 4
Other:		
Other:		
Other		
Other:		
Other:		
Other:		

Beneficial Management Practices Comments

The coarse textured soils within this field require intensive irrigation scheduling (e.g., checkbook method) and soil moisture monitoring to ensure appropriate irrigation timing and water application depths base on crop needs. Intensive nutrient management planning based on practices including soil fertility analysis, slow release N and precision farming practices such variable rate nutrient application tailored to soil limitations will ensure efficient nutrient use. Combined, the water and nutrient management practices will help minimize the potential for nitrogen losses through leaching. The proponent has also indicated plans to assess the feasibility of using fertigation at a later date.

Good residue management will help improve soil moisture retention and minimize the potential for soil losses due to wind erosion. This may include partial incorporation and maintenance of residues and fall-seeded cover crops, particularly following potato crops, and minimum or zero tillage during other crop years.



Summary of Soil Extents

Soil Code	Soil Name	Area ha	Area ac	Area %
CYN1	Croyon, shaly	163	403	62
FND	Fairland	48	119	18
DOT1	Dorset, shaly	30	74	12
DXM1	Druxman, shaly	15	37	6
TOC	Torcan	3	7	1
CAV1	Carvey, shaly	2	5	1

Summary of Assessment Areas

	ha	ac
Total Area Assessed	261	645

Legend

- Soil Unit Boundary with Soil Map Unit
- Quarter Section Boundary
- Field Boundary

Phases

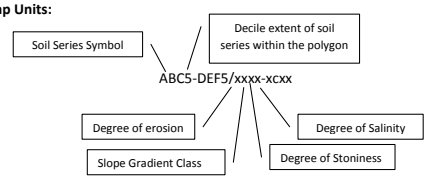
Degree of Erosion

x	non-eroded or minimal
1	slightly eroded
2	moderately eroded
3	severely eroded
o	overblown

Degree of Stoniness

		Surface Covered
x	non-stony	<0.01%
1	slightly stony	0.01-.1%
2	moderately stony	0.1-3%
3	very stony	3-15%
4	exceedingly stony	15-50%
5	excessively stony	>50%

Map Units:



Topography (Slope Gradient Class)

Slope Gradient

x	0-0.5%	level
b	0.5-2%	nearly level
c	2-5%	very gently sloping
d	5-9%	gently sloping
e	9-15%	moderately sloping
f	15-30%	strongly sloping
g	30-45%	very strongly sloping
h	45-70%	extremely sloping

Degree of Salinity

		Conductivity (mS/cm)
x	non-saline	0-4
s	weakly saline	4-8
t	moderately saline	8-15
u	strongly saline	15+

PROJECT: COLLINS FARM
FILE NO: 111440257

DATE: October 2014
DATA SCALE: 1:20,000
MAP SCALE: 1:10,000

QTR	SEC	TWP	RGE	MER
	19	3	12	W

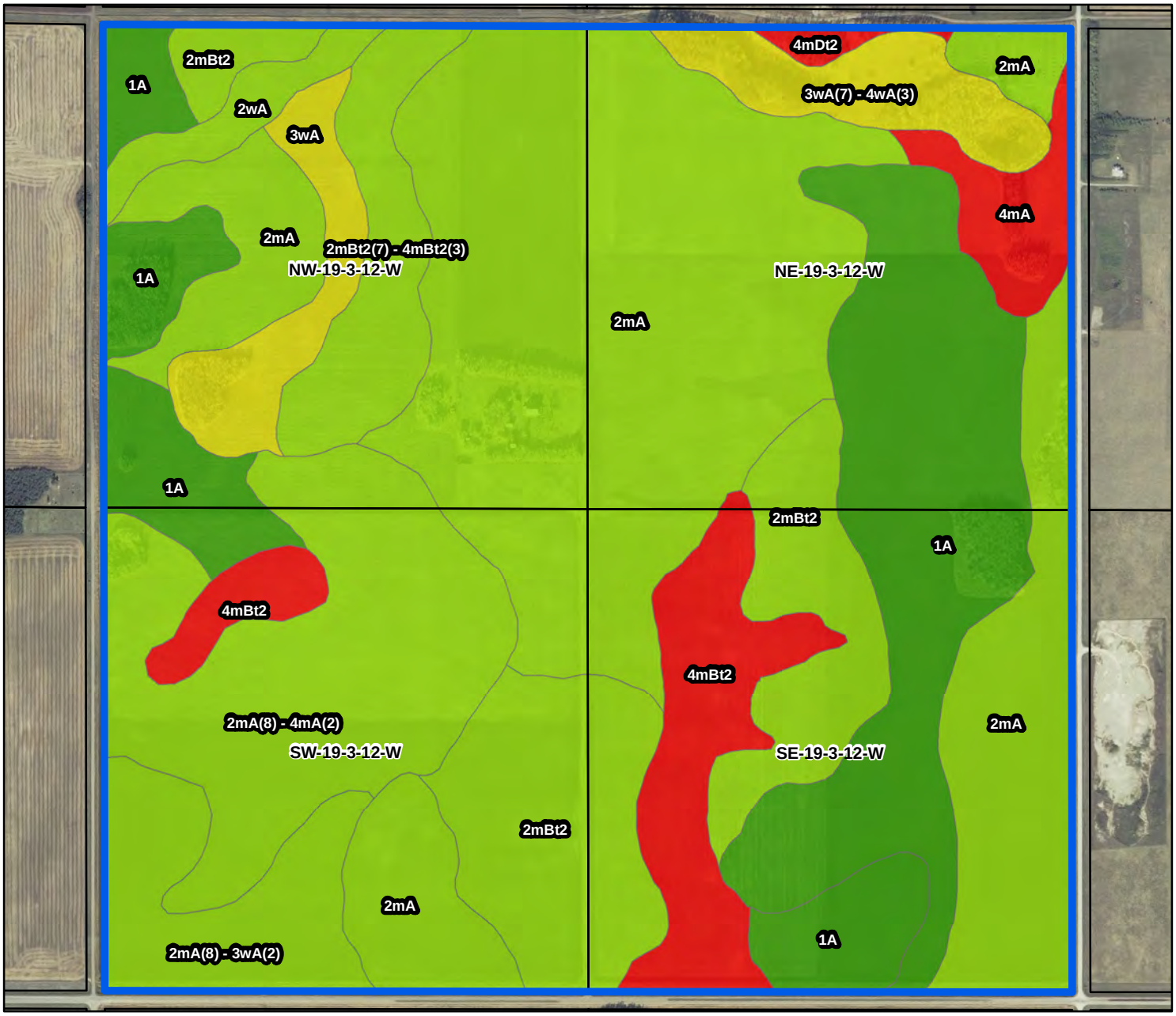
0 50 100 200
Metres

NORTH

PRODUCED BY
Stantec

Soil Landscape Map

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.



Summary of General Irrigation Suitability Extents

Irrigation Suitability	Area		
	ha	ac	%
Excellent	48	118	18
Good	166	410	64
Fair	14	36	6
Poor	33	81	12

Legend

Field Boundary

Quarter Section Boundary

Irrigation Suitability

- Excellent
- Good
- Fair
- Poor

Irrigation Suitability Map Unit Notation

Soil Limitation Class — Extent of Suitability Class in Decile Format (i.e. 7 = 70% of polygon area)

2Akw(7)

Landscape Limitation Class — Specific Limitations (up to three characters)

Soil Limitation Class

Class	Limitation Description
1	None
2	Slight
3	Moderate
4	Severe

Landscape Limitation Class

Class	Limitation Description
A	None
B	Slight
C	Moderate
D	Severe

Specific Soil Limitations

Symbol	Limitation Type
d	soil structure
g	geological uniformity
h	depth to water table
k	hydraulic conductivity within the surface 1.2 m
m	available water holding capacity to 1.2 m depth
n	sodicity
q	water intake rate
r	depth to bedrock
s	salinity
w	drainage class
x	drainability within the 1.2 to 3 m depth

Specific Landscape Limitations

Symbol	Limitation Type
a	potential for adverse impact on irrigated areas
c	potential impact on non-target areas
e	average local relief
i	inundation
p	stoniness
t	slope gradient
v	horizontal variation of infiltration

PROJECT: COLLINS FARM
FILE NO: 111440257

DATE: October 2014
DATA SCALE: 1:20,000
MAP SCALE: 1:10,000

QTR	SEC	TWP	RGE	MER
	19	3	12	W

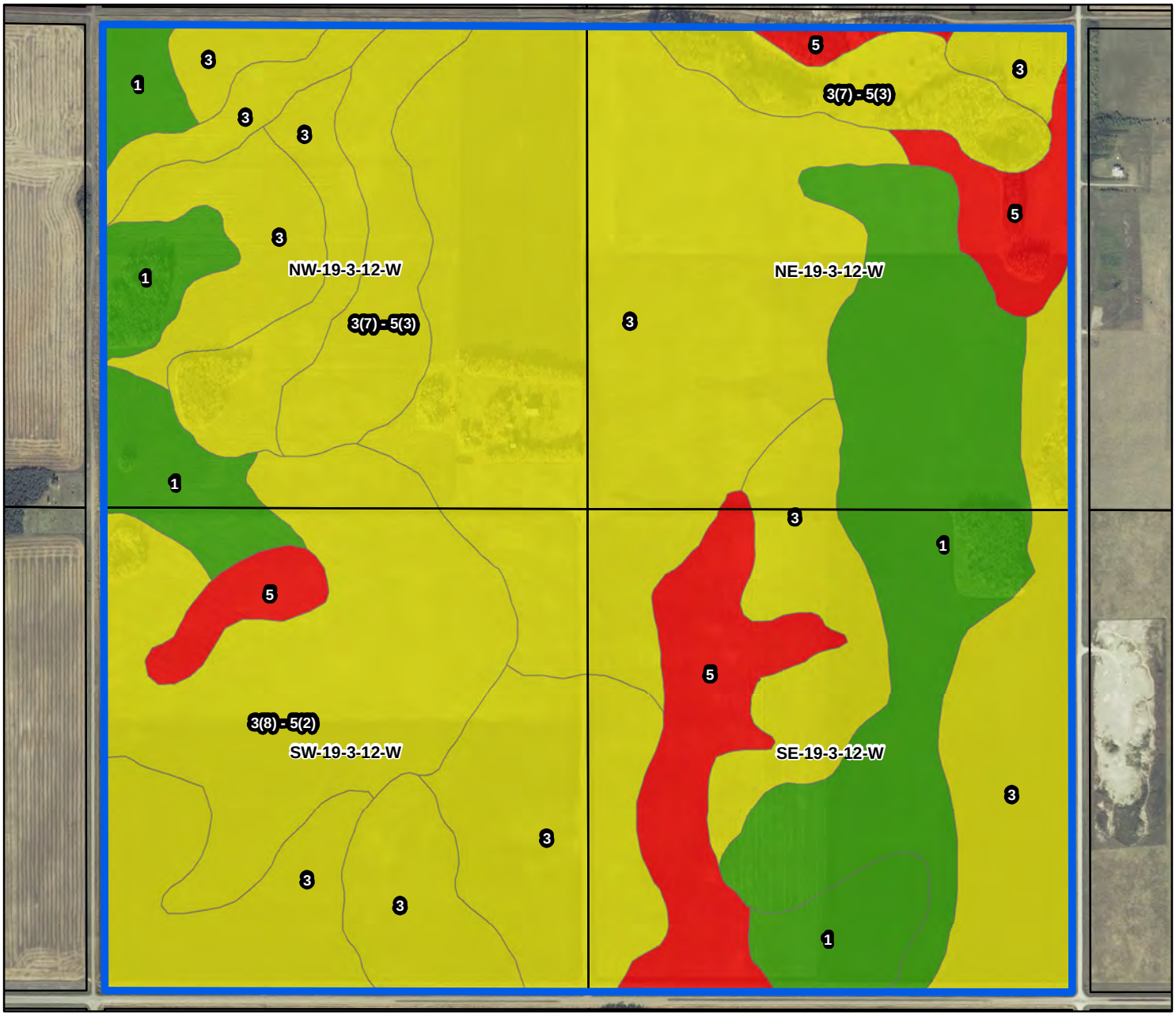
0 50 100 200
Metres

NORTH

PRODUCED BY Stantec

General Irrigation Suitability

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.



Summary of Suitability for Irrigated Potato Extents

Suitability for Irrigated Potato	Area		
	ha	ac	%
1	48	119	18
2			
3	180	446	69
4			
5	33	81	13

Legend

Suitability for Irrigated Potato

- 1
- 2
- 3
- 4
- 5

Field Boundary

Quarter Section Boundary

PROJECT: COLLINS FARM
FILE NO: 111440257

DATE: October 2014
DATA SCALE: 1:20,000
MAP SCALE: 1:10,000

QTR	SEC	TWP	RGE	MER
	19	3	12	W

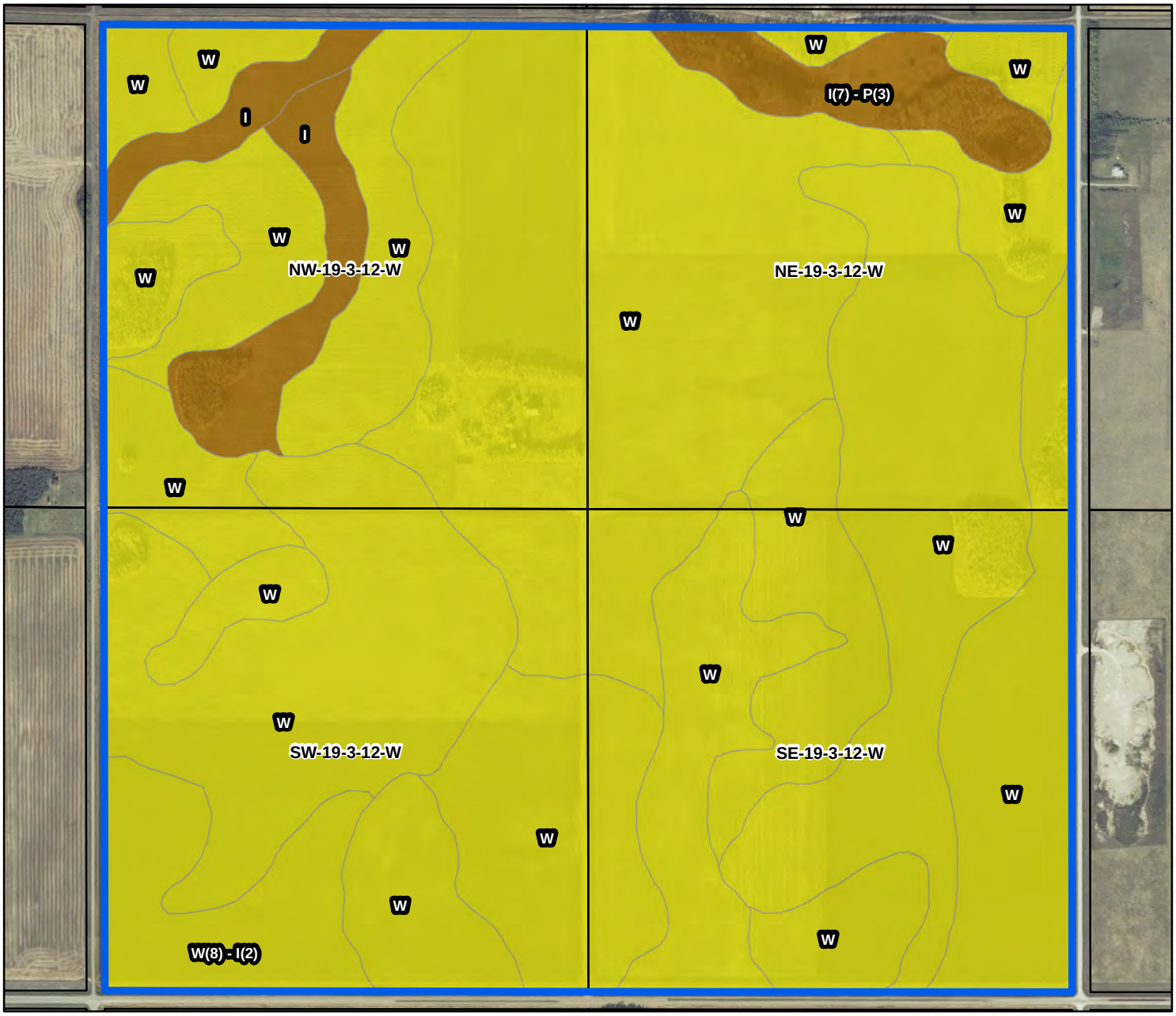
0 50 100 200
Metres

NORTH

PRODUCED BY Stantec

Suitability for Irrigated Potato

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.



Summary of Drainage Regime Extents

Drainage Class	Area		
	ha	ac	%
VR			
R			
W	241	595	92
MW			
I	18	45	7
P	2	5	1
VP			

Legend

- Field Boundary
- Quarter Section Boundary

Drainage Class

- Very Rapid
- Rapid
- Well
- Moderately Well
- Imperfect
- Poor
- Very Poor

Drainage Class	Definition (modified from CanSIS (http://sis.agr.gc.ca/cansis/)
Very Rapid (VR)	Water is removed from the soil very rapidly in relation to supply. Soils have very low available water storage capacity (<2.5 cm) within the control section.
Rapid (R)	Water is removed from the soil rapidly in relation to supply. Soils have low available water storage capacity (2.5-4 cm) within the control section.
Well (W)	Water is removed from the soil readily but not rapidly. Soils have intermediate available water storage capacity (4-5 cm) within the control section.
Moderately Well (MW)	Water is removed from the soil somewhat slowly in relation to supply. Soils have intermediate to high available water storage capacity (5-6 cm) within the control section.
Imperfect (I)	Water is removed from the soil sufficiently slowly in relation to supply. Soils have a wide range in available water storage capacity.
Poor (P)	Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soi is not frozen. Soils have a wide range in available water storage capacity and excess water is evident in the soil.
Very Poor (VP)	Water is removed so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Soils have a wide range in available water storage capacity and excess water is present in the soil.

PROJECT: COLLINS FARM
FILE NO: 111440257

DATE: October 2014
DATA SCALE: 1:20,000
MAP SCALE: 1:10,000

0 50 100 200
Metres

NORTH

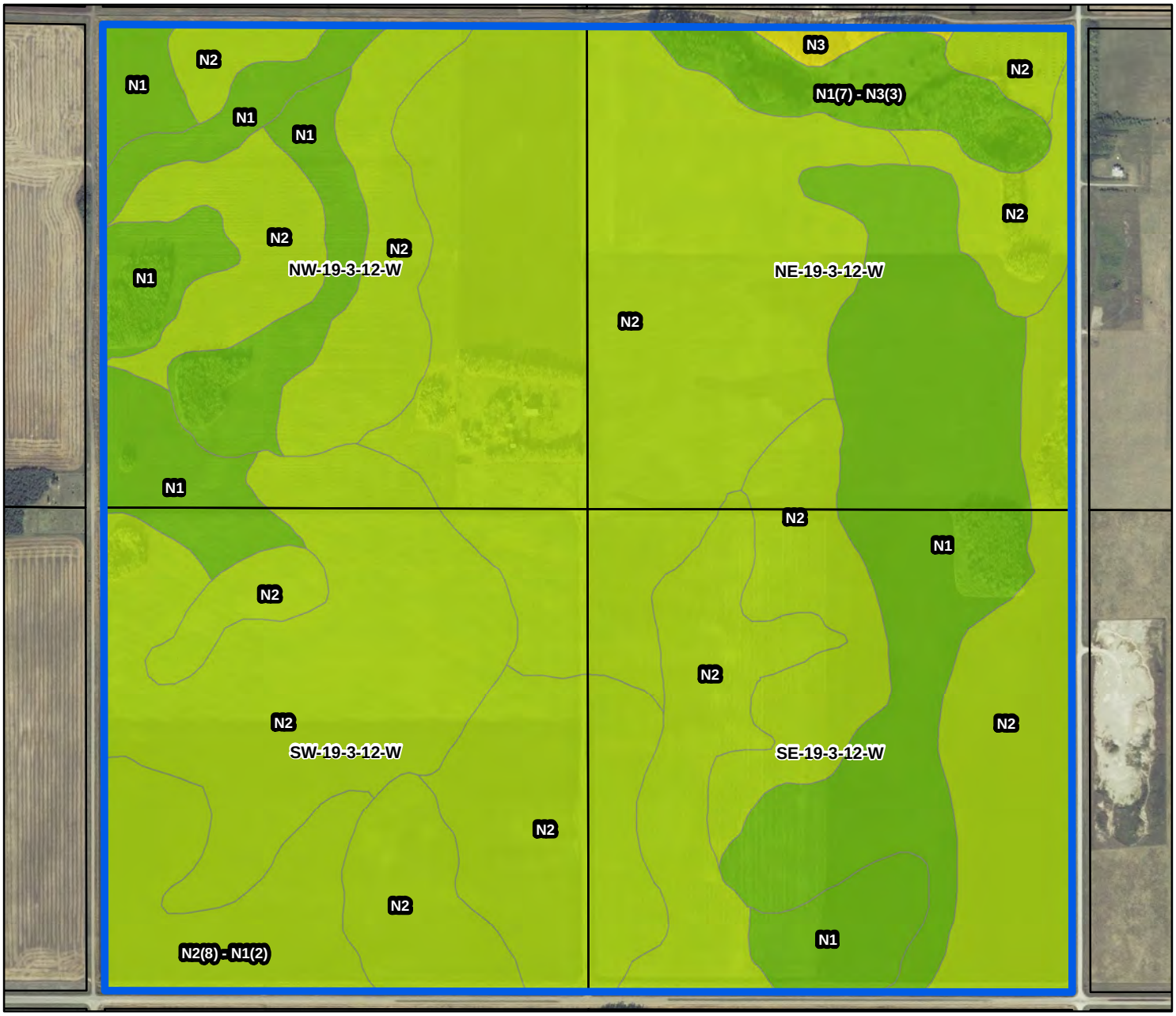
QTR	SEC	TWP	RGE	MER
	19	3	12	W

Drainage Regime

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.

PRODUCED BY

Stantec



Summary of Water Quality Management Zone Extents

Water Quality Management Zone	Area		
	ha	ac	%
N1	66	163	25
N2	192	474	74
N3	3	8	1
N4			
N5			

Legend

- Field Boundary
- Quarter Section Boundary

Nutrient Management Zone

- N1
- N2
- N3
- N4
- N5

Nutrient Management Buffer

- Nutrient Management Buffer Zone

(as interpreted based on definitions found on p. 7-8 of the *Nutrient Management Regulation* (62/2008))

Nutrient Application Limits and Residuals

Nutrient Management Zone (NMZ)	Nitrogen (N)		Phosphorus (P)
	kg/ha	lbs/ac	
N1	157.1	140	No P application except at a rate that does not exceed: A. 2X the P removal rate, if the soil test P levels are < 120 ppm, or B. the P removal rate, if the soil test P levels are ≥120 ppm but < 180 ppm,
N2	101	90	
N3	33.6	30	
N4	No nutrients to be applied in Zone N4[3]		
N5	Urban, subdivision or built-up area - not applicable		

1 Based on Nutrient Management Regulation (62/2008)

2. No N or P (on land where soil test P >60 ppm) shall be applied except as a fertilizer; and either (i) in accordance with a registered plan, or (ii) in the absence of a registered plan, following the nutrient limits and residuals above.

3. No person shall apply N or P to land in NMZ N4, except if on November 8, 2006, a person was carrying on an operation that involved application of N or P to land in NMZ N4, the person may continue to apply them in the course of carrying out that operation, but only in accordance with a registered nutrient management plan

PROJECT: COLLINS FARM
FILE NO: 111440257

DATE: October 2014
DATA SCALE: 1:20,000

QTR	SEC	TWP	RGE	MER
	19	3	12	W

MAP SCALE: 1:10,000

0 50 100 200
Metres

NORTH

PRODUCED BY Stantec

Water Quality Management Zones

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.

Summary of Soil Extents

Soil Code	Soil Name	Area ha	Area ac	Area %
CYN1	Croyon, shaly	147	363	56
DOT1	Dorset, shaly	63	156	24
DXM1	Druxman, shaly	51	126	20

Summary of Assessment Areas

	ha	ac
Total Area Assessed	261	645

Legend

- Soil Unit Boundary with Soil Map Unit
- Quarter Section Boundary
- Field Boundary

Phases

Degree of Erosion

x	non-eroded or minimal
1	slightly eroded
2	moderately eroded
3	severely eroded
o	overblown

Degree of Stoniness

		Surface Covered
x	non-stony	<0.01%
1	slightly stony	0.01-.1%
2	moderately stony	0.1-3%
3	very stony	3-15%
4	exceedingly stony	15-50%
5	excessively stony	>50%

Map Units:

Soil Series Symbol | Decile extent of soil series within the polygon

ABC5-DEF5/xxxx-xcxx

Degree of erosion | Degree of Salinity | Slope Gradient Class | Degree of Stoniness

Topography (Slope Gradient Class)

Slope Gradient

x	0-0.5%	level
b	0.5-2%	nearly level
c	2-5%	very gently sloping
d	5-9%	gently sloping
e	9-15%	moderately sloping
f	15-30%	strongly sloping
g	30-45%	very strongly sloping
h	45-70%	extremely sloping

Degree of Salinity

		Conductivity (mS/cm)
x	non-saline	0-4
s	weakly saline	4-8
t	moderately saline	8-15
u	strongly saline	15+

PROJECT: COLLINS FARM
FILE NO: 111440257

DATE: October 2014
DATA SCALE: 1:20,000
MAP SCALE: 1:10,000

QTR	SEC	TWP	RGE	MER
	19	3	12	W

0 50 100 200
Metres

NORTH

PRODUCED BY Stantec

Existing Soils Map (MLI)

Acknowledgements: Orthophoto Imagery and Soil Resource Information provided by Manitoba Land Initiative, Province of Manitoba.

Appendix B Producer Survey

LAND SUITABILITY ASSESSMENT FOR IRRIGATION – PRODUCER SURVEY

The Producer Survey consists of land use and agronomic information provided by the "Producer" and is intended to supplement the information contained in the Land Suitability Assessment for Irrigation - Phase I Report. The Producer Survey will become an attachment to the Phase I Report.

GENERAL PROJECT INFORMATION

Project Locations

QTR	SEC	TWP	RGE	MER	QTR	SEC	TWP	RGE	MER
NE	19	03	12	W1	NW	19	03	12	W1
SE	19	03	12	W1	SW	19	03	12	W1

Producer Name and Contact Information

Business Name	Collins Farms Ltd	
Contact Name	Mr. Tammas Collins	
Phone	(204)825-8228	
Email	collins@mymts.net	
Mailing Address 1	Box 105	
Mailing Address 2		
City/Town	Pilot Mound	MB
Postal Code	R0G 1P0	

CROPPING INFORMATION

Provide typical crop rotation information below.

Rotation Year	Crop	Currently Irrigated?				Target Yield (include unit – e.g. bu/ac)
Crop Year 1:	Wheat	Yes		No	X	35 bu/ac
Crop Year 2:	Canola	Yes		No	X	30 bu/ac
Crop Year 3:	Soybeans	Yes		No	X	30 bu/ac
Crop Year 4:	Wheat	Yes		No	X	35 bu/ac

Provide any general comments regarding cropping information.

GENERAL LAND USE INFORMATION

Provide information on general land use or land modifications below relative to existing soil resource information presented in the Phase I Report.

Describe any significant land use changes (e.g. clearing, land leveling, etc.) that have been completed or are planned.
We need to remove 3 small bluffs of trees to allow the irrigation pivots to work.

Provide any general comments regarding the existing soil resource information presented in the Phase I Report.

NUTRIENT MANAGEMENT

Provide typical nutrient management information below.

Do you conduct annual soil tests?	Yes – all crops		x	Yes – irrigated crops only		No						
If Yes to the above, what Parameters do you test for?	Macronutrients (N,P,K,S)		x	Micronutrients	x	Salinity						x
Do you use fertigation for N?	Yes		No	x	Do you use slow release N?			Yes	X	No		
Do you split application for N?	Yes		No	X	Do you apply animal manures?			Yes		No		X
If you have lands rated as Nutrient Management Zone N4, do you submit Nutrient Management Plans annually?								Yes		No		X

Provide any general comments regarding nutrient management.
We use Farmers Edge on all of our acres for soil testing and variable rate fertilizer application. We use slow release nitrogen as part of our plan to ensure that the crop gets the proper nutrient and to reduce leaching.

Version: v1.2011-03-31

LAND SUITABILITY ASSESSMENT FOR IRRIGATION – PRODUCER SURVEY

The Producer Survey consists of land use and agronomic information provided by the "Producer" and is intended to supplement the information contained in the Land Suitability Assessment for Irrigation - Phase I Report. The Producer Survey will become an attachment to the Phase I Report.

SOIL EROSION

Describe tillage management practices by crop below.

Crop:	**wheat**	**canola**	**soybeans**	
Fall Tillage:	One pass	harrow	none	
Spring Tillage:	Direct seed	Direct seed	Direct seed	

Is wind erosion a problem in this field?	Yes		No	x	If yes, please discuss below.

Is water erosion a problem in this field?	Yes		No	x	If yes, please discuss below.

Describe residue management practices for low-residue or high-tillage crops (e.g. potatoes, beans).

We try not to till in the fall to prevent erosion. We practice minimum till to conserve moisture and soil.

What beneficial management practices are used to reduce wind erosion risk (e.g. cover crops, residue maintenance, crop rotation, irrigation)?

Installing irrigation on this land will significantly reduce the threat of erosion. We do not till if we feel there is insufficient residue to hold the soil. If necessary we would go zero till on some fields and some types of soil to prevent erosion. We never burn or bale straw, it all gets left on the land to try to build up the organic matter.

What beneficial practices are used to reduce water erosion risk (e.g. contour cropping, buffer strips, riparian buffers, etc)?

We just don't farm areas that are prone to erosion. We leave those areas along creeks and slopes that are prone to erosion.

General Comments:

We feel we are good stewards of the land. We are not one generation farmers. We try very hard to improve our land base so the next generations of our family can use and maintain the same practices.

SALINITY

Is soil salinity a concern for the landbase?	Yes		No	x	If yes, please describe area affected, impact to crop, etc.

If yes to the above, please describe beneficial management practices used to reduce the risk of further salinity development.

LAND SUITABILITY ASSESSMENT FOR IRRIGATION – PRODUCER SURVEY

The Producer Survey consists of land use and agronomic information provided by the "Producer" and is intended to supplement the information contained in the Land Suitability Assessment for Irrigation - Phase I Report. The Producer Survey will become an attachment to the Phase I Report.

Drainage Management
Is drainage an issue for crop production? No.
What is the depth to water table? 6 to 8 feet
What surface drainage improvements have been conducted? None.
What subsurface drainage improvements have occurred on the landbase? None.
How is drainage water handled? Have no drainage on this land.
How much crop area is lost to excess water annually? None.

Irrigation Management
What type of irrigation is planned or currently used? Center pivot.
What is the current or planned water source? Underground aquifer
Are there any concerns with the water quality of the source noted above? No.
How is soil moisture monitored during the irrigation season or how will it be? I am a first time irrigator so I am not sure if there is a tool for that. I think it would be with frequent visits to the land to closely monitor the soil and crop conditions.
How is irrigation scheduling conducted or how will it be? Only as needed as soil moisture is depleted.
Approximately how much supplemental irrigation will be required by crops to be irrigated? This land does quite well for most of the growing season it is just the dry 2 to 3 week period we seem to get every year where it needs to get irrigated.

LAND SUITABILITY ASSESSMENT FOR IRRIGATION – PRODUCER SURVEY

The Producer Survey consists of land use and agronomic information provided by the "Producer" and is intended to supplement the information contained in the Land Suitability Assessment for Irrigation - Phase I Report. The Producer Survey will become an attachment to the Phase I Report.

Other Soil-Landscape Management Comments

Discuss any other soil-landscape management practices, issues, concerns that may be relevant.

We feel by soil sampling every year and by variable rate fertilizing we are making sure that the only nutrient we put down is taken up by the crop.

Wind erosion is a concern for this land. Irrigation should help this problem as it will produce more and start putting more organic matter back into the soil.

REPORT CLOSURE

Sign-Off	Printed Name	Signature	Date (yyyy-mm-dd)
Producer:	Tammas Collins		

This report has been prepared by the "Producer" and for the sole benefit of the "Producer". The signature of the "Producer" above provides acknowledgement that the information provided in this survey by the "Producer" is accurate.

Appendix C Review of PW15-01 Pumping Test, Collins Farm Ltd., Stantec Consulting Ltd. (2015)

Stantec Consulting Ltd.
500–311 Portage Avenue
Winnipeg MB R3B 2B9
Phone: 204-489-5000
Fax: 204-453-9012

June 26, 2015
File: 111440257

Attention: Mr. Tammas Collins
Collins Farms Ltd.
P.O. Box 105
Pilot Mound, Mb R0G 1P0

Dear Tammas,

Reference: Review of PW15-01 Pumping Test
Collins Farms Ltd.

Collins Farms Ltd., a family owned and operated company, is proposing to construct groundwater wells and associated irrigation infrastructure to irrigate an approximately 260 hectare property owned by the company. The proposed irrigated development (herein referred to as 'the Site') is located on 19-03-12-W1 in southern Manitoba in the Rural Municipality of Argyle.

Collins Farm Ltd. retained Stantec Consulting Ltd. (Stantec) to evaluate potential groundwater irrigation supply. The proposed irrigation plan is to use groundwater wells to supply water and irrigate land parcels that have previously been developed for annual dryland crop production.

Test Well PW15-01 was constructed to 13.9 m below ground surface (BGS) within coarse shale and gravel material as a potential future irrigation well. Prior to construction of further supply wells to support irrigation at the Site, an eight (8) hour performance test was completed to confirm the capacity of the well and to determine the aquifer properties at the Site.

Details regarding the site setting, geology and hydrogeology are presented within the environmental assessment supporting the proposed development. The following letter summarizes the results of the performance test and the eight (8) hour constant rate pumping test conducted on March 25, 2015.

STUDY APPROACH

A performance test and an eight (8) hour constant rate pumping test were completed on PW15-01 to determine supply potential. The pumping equipment for the testing was installed by a separate contractor (Watkins and Argue Well Drilling) with monitoring completed by Stantec.

Performance testing was completed at PW15-01 on March 25, 2015 and consisted of 30 minute step rate test at 26.4 L/s (418 gpm), 33.4 L/s (529 gpm), and 35.5 L/s (562 gpm). Note that for the first 11 minutes of the first step, the rate was measured at 27.1 L/s (430 gm).

Immediately following the performance test, an eight (8) hour constant rate pumping test was completed, with no recovery between the performance test and constant rate test. The eight (8)

Reference: Review of PW15-01 Pumping Test
Collins Farms Ltd.

hour constant rate test commenced on March 25, 2015 at 11:02 am. The constant rate pumping test was completed at 27.1 L/s.

Throughout the testing, Stantec monitored water levels at the pumping well (PW15-01) and several nearby monitoring wells (MW15-01, MW15-02, OB23, and MW13-01) using a combination of manual and automated techniques. Pressure transducer loggers were installed at each of the wells. **Figure 1** (**Attachment A**) shows the monitored locations and **Attachment B** includes copies of the well logs.

The loggers are not vented to the atmosphere and therefore record total pressure. As a result, data obtained from the loggers were corrected for atmospheric pressure to obtain actual height of water above the sensor. The atmospheric corrections were made using data collected from a barologger installed at the Site.

RESULTS

Performance Testing

Figure 2 (**Attachment A**) presents the results of the performance testing. Drawdowns at PW15-01 of 3.9 m, 5.1 m, and 5.6 m were observed at the end of each step, resulting in specific capacities after 30 minutes of pumping of 6.8 L/s/m, 6.5 L/s/m, and 6.3 L/s/m.

Constant Rate Pumping Test

Figure 2 (**Attachment A**) presents the drawdown in pumping well PW15-01 as well as the water levels at MW15-01 and MW15-02. **Figure 3** (**Attachment A**) presents the water levels at MW13-01 and OB23, which showed no response to pumping. Prior to the start of the performance test, a static water level of 1.66 m BGS was measured at PW15-01. The constant rate pumping test commenced at the third step, or 1.0 hours into the performance testing. Drawdown at the end of the eight (8) hour constant rate pumping period at PW15-01 was 5.9 m and at MW15-01, the final drawdown was 2.0 m. Pumping influence was clearly noted at MW15-02; however, water levels were declining prior to the pumping test and the impact due to pumping is interpreted to range from 0.03 m to 0.08 m at this location. At OB23 and MW13-01, located further afield and in the vicinity of the Town of Pilot Mound municipal supply well (see **Figure 1**), water levels fluctuated but no clear response to pumping was observed. All of the monitoring wells are screened at approximately the same depth as the pumping well.

Test Well Capacity

Based on the results of the eight (8) hour pumping test, an assessment of the potential capacity of PW15-01 was completed. Figure 4 presents a semi-log plot of the time drawdown data. During the constant rate pumping test, drawdown at PW15-01 reached 5.9 m. As shown in **Figure 2**

Reference: Review of PW15-01 Pumping Test
Collins Farms Ltd.

(**Attachment A**), steady state or near steady state water levels were achieved at the tested rate of 35.5 L/s. Assuming conditions remain the same, continuous pumping at 35.5 L/s for 10 years would result in a drawdown of 6.5 m with the water level at 8.2 m BGS (**Figure 4, Attachment A**). The top of the screen is at 11.7 m BGS, resulting in a remaining available drawdown of 3.5 m (see **Figure 4**). Based on these data, PW15-01 is capable of pumping 35.5 L/s over a 10-year period. **Figure 5** (**Attachment A**) presents a plot of drawdown versus distance from the pumping well which shows that drawdown is negligible at a distance of approximately 75 m after 8 hours of pumping at 35.5 L/s.

Construction of Additional Supply Wells

The irrigation proposed for the Site requires four (4) irrigation pivots to be constructed. The required instantaneous flow rate to service all four (4) pivots is 240 L/s (3800 gpm). However, only two (2) will be operated simultaneously so it is assumed that 126 L/s (2000 gpm) will be adequate. Therefore, each of the four (4) supply wells need to provide 31.5 L/s.

Based on available data, it is expected that a total of four (4) irrigation wells of similar construction will provide the required 126 L/s. It is recommended that these additional wells be spaced a minimum of 75 m from each other and/or other supply well(s). Following construction, additional testing/monitoring, including one or more irrigation seasons depending on meteorological conditions, will be required to confirm capacity and drawdown with the supply wells and to document any interaction with the municipal supply well to the north. As the municipal well was not in operation at the time of this study, the potential impacts at the Site due to municipal well pumping could not be evaluated and should be reviewed as part of the long-term monitoring.

Limitations

This letter report has been prepared in support of the environmental assessment for the proposed irrigation development. This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected environmental conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others. The opinions in this report can only be relied upon as they relate to the condition of the portion of the identified property that was assessed at the time the work was conducted.

Reference: Review of PW15-01 Pumping Test
Collins Farms Ltd.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report, and are based solely on the scope of work described in the report, the data available and the results of the work. The conclusions are based on the site conditions encountered by Stantec at the time the work was performed at the specific testing and/or sampling locations, and conditions may vary among sampling locations. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities or claims, howsoever arising, from third party use of this report.

The locations of any utilities, buildings and structures, and property boundaries illustrated in or described within this report, if any, including pole lines, conduits, water mains, sewers and other surface or sub-surface utilities and structures are not guaranteed. Before starting work, the exact location of all such utilities and structures should be confirmed and Stantec assumes no liability for damage to them.

Regards,

STANTEC CONSULTING LTD.

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Reference: Review of PW15-01 Pumping Test
Collins Farms Ltd.

Attachment: Attachment A: Figures
Figure 1 – Site Plan
Figure 2 – Pumping Test Hydrograph (PW15-01, MW15-01, MW15-02)
Figure 3 – Pumping Test Hydrograph (OB23, MW13-01)
Figure 4 – Projected Drawdown
Figure 5 – Distance-Drawdown Plot
Attachment B – Borehole Logs

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Stantec Consulting Ltd.
500–311 Portage Avenue
Winnipeg MB R3B 2B9
Phone: 204-489-5000
Fax: 204-453-9012

Attachment A: Figures

G:_GIS_Project_Folder\111440257_CollinsFarm\ArcMaps\Well_Overview_Map_20150316.mxd
Revised: 2015-03-18 By: acampigotto

March 2015
Project No. 111440257

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features courtesy of Manitoba Land Initiative and CANVEC

Legend

- Well Location
- Quarter Section
- Major Road
- Minor Road

Client/Project

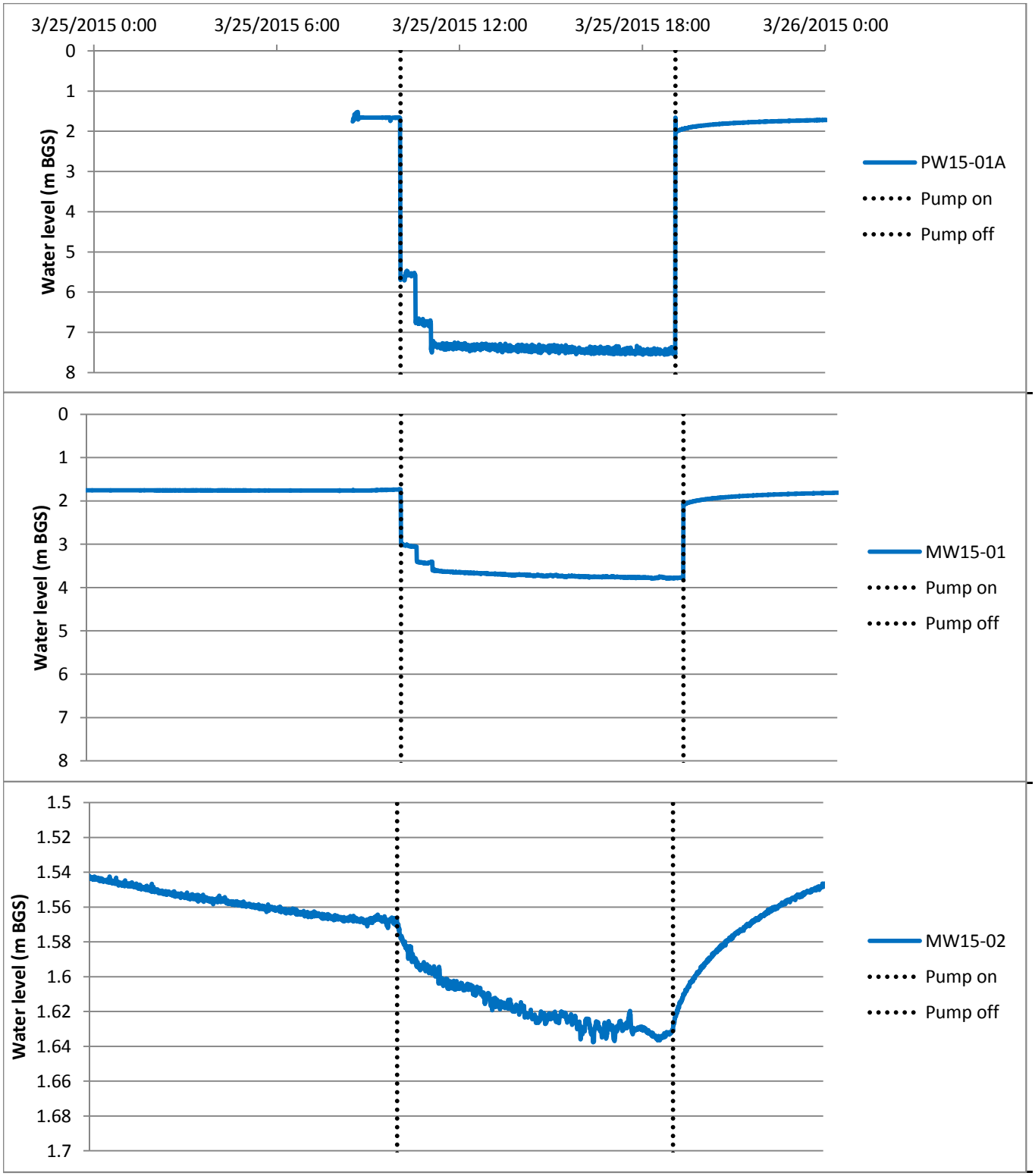
COLLINS FARMS LTD.
Environmental Impact Assessment
Proposed Irrigation Development Project

Figure No.

1

Title

Well Locations



Notes:

Distance to Pumping well:
MW15-01 (4 m)
MW15-02 (76 m)

Client/Project

2015 Pump Test

Collins Farm Ltd.

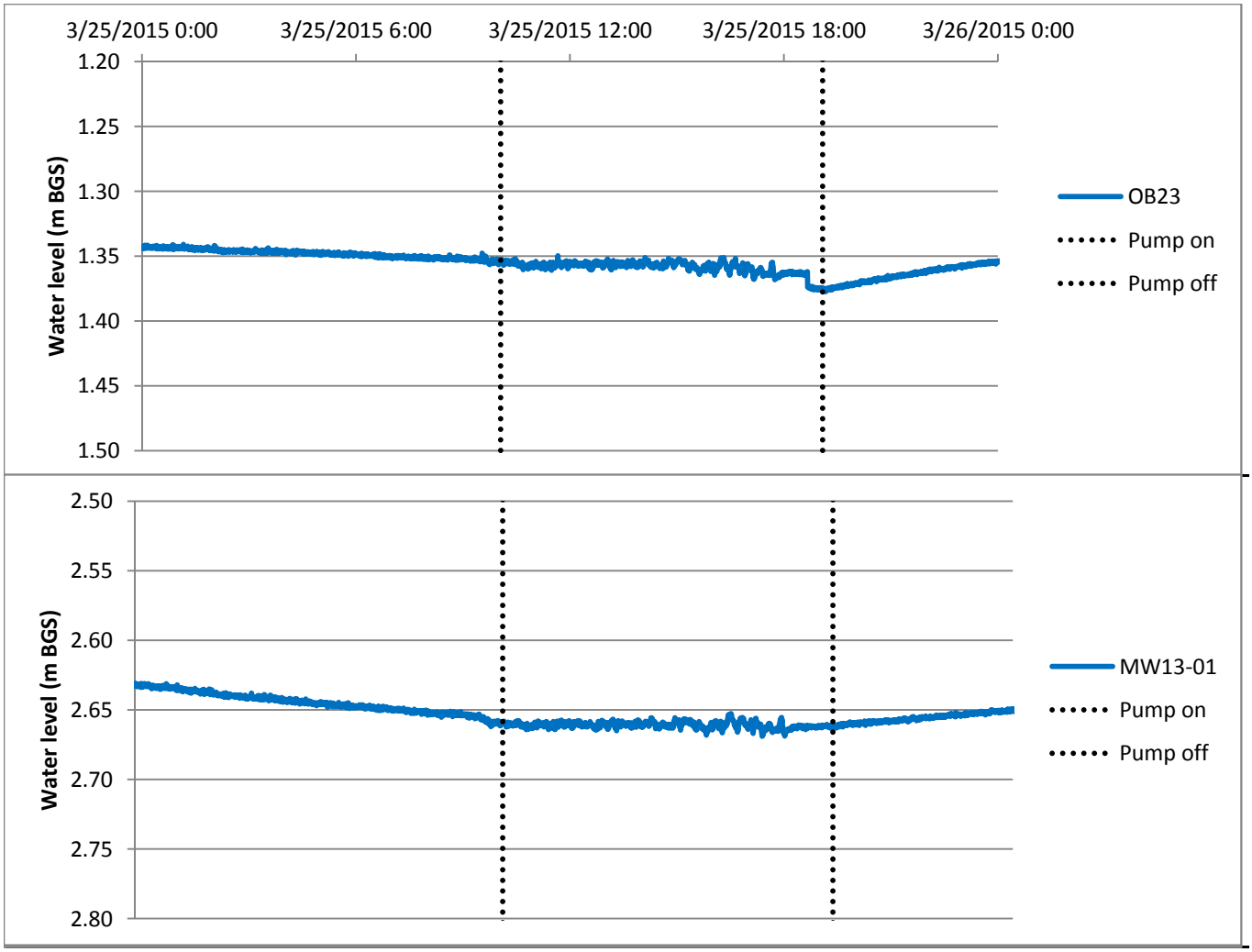
Figure No.

2

Title

Pumping Test Hydrograph
Collins Farm

Stantec



Notes:

Distance to Pumping well:
OB23 (204 m)
MW13-01 (206 m)

Client/Project

2015 Pump Test

Collins Farm Ltd.

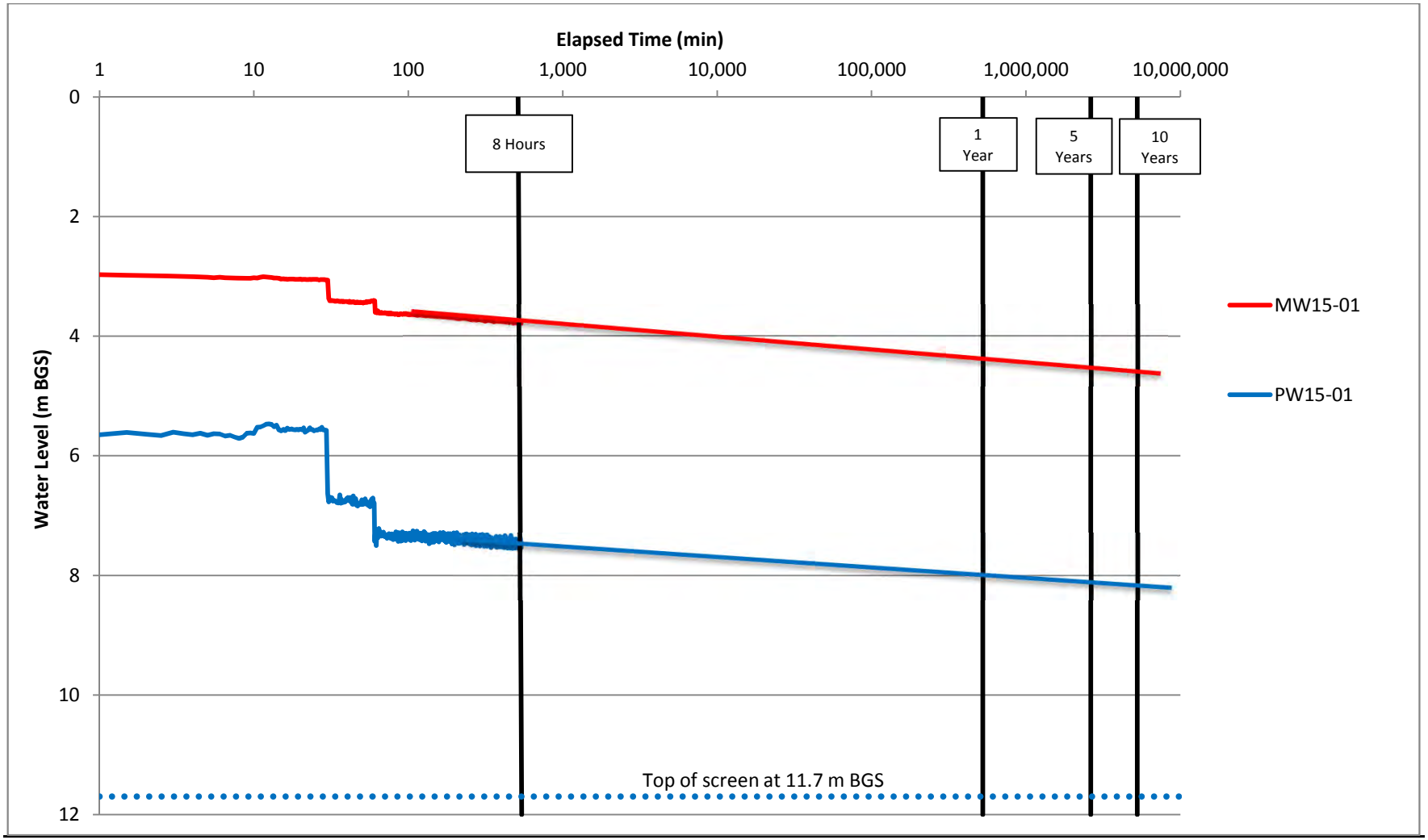
Figure No.

3

Title

Pumping Test Hydrograph
Collins Farm

Stantec



Notes:

Distance to Pumping well:
MW15-01 (4 m)

Client/Project

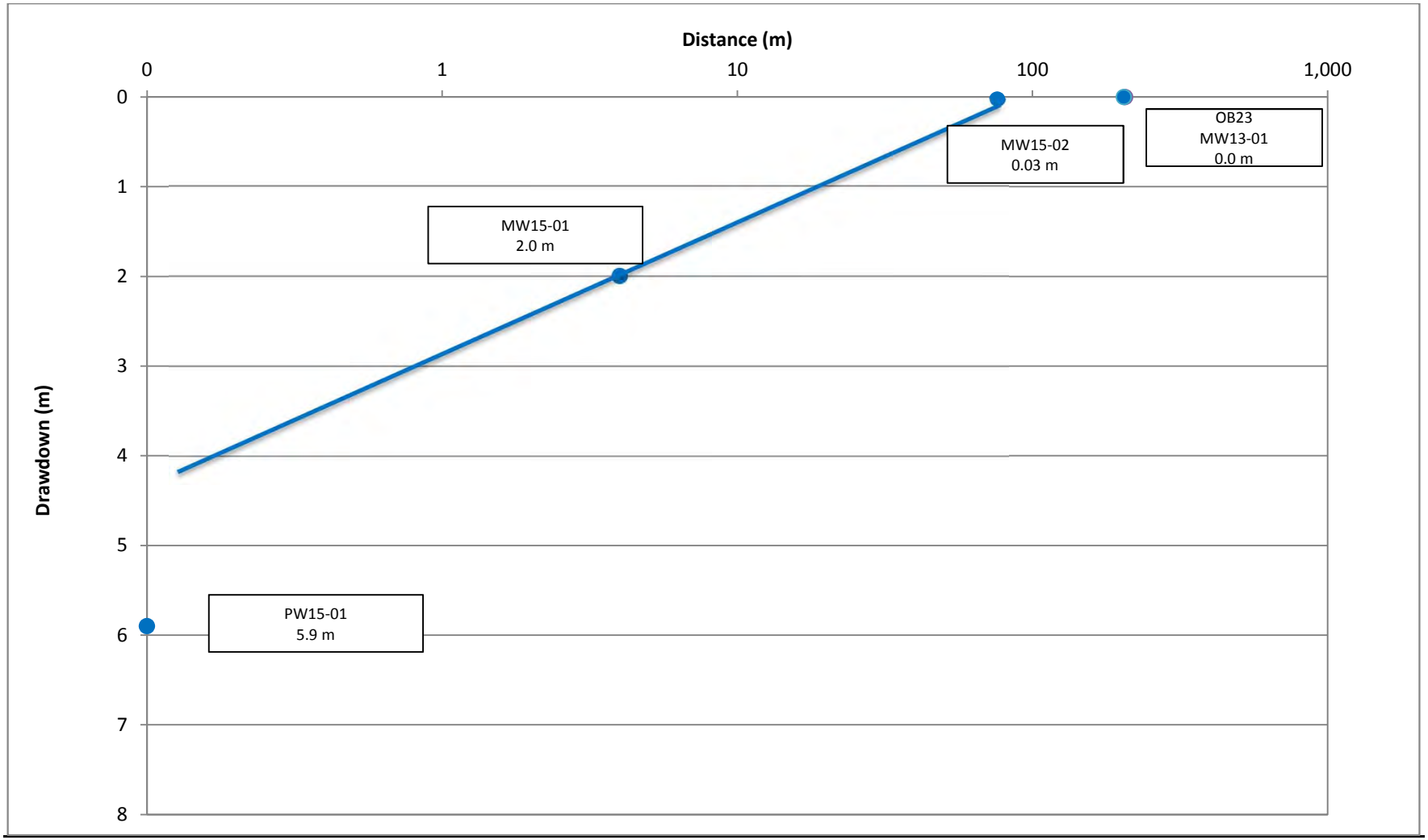
2015 Pump Test
Collins Farm Ltd.

Figure No.

4

Title **Projected Drawdown**
Collins Farm

Stantec



Notes:

Observed drawdown after 9 hours of pumping PW15-01
Distance to Pumping well:
MW15-01 (4 m), MW15-02 (76 m), OB23 (204 m) and MW13-01 (206 m)

Client/Project

2015 Pump Test
Collins Farm Ltd.

Figure No.

5

Title **Distance- Drawdown Plot**
Collins Farm

Stantec

Stantec Consulting Ltd.
500–311 Portage Avenue
Winnipeg MB R3B 2B9
Phone: 204-489-5000
Fax: 204-453-9012

Attachment B: Borehole Logs

Monitoring Well: MW15-01

Project:	Phase II - 8" Pump Well and Monitoring Well Installation	**Drilling method:**	Mud Rotary
Client:	Collins Farm	**Date started/completed:**	09-Mar-2015
Location:	RM of Louise, NE-19-3-12-W1	**Ground surface elevation:**	n/a
Number:	111440257	**Top of casing elevation:**	n/a
Field investigator:	B. Ezzard	**Easting:**	495193
Contractor:	Watkins and Argue	**Northing:**	5453547

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
	-1		Ground Surface	
0	0		Silty Clay -brown	0.00
4	1		Sand and Gravel -coarse	1.20
12	3			
14	4		Shale, Sand and Gravel -coarse	4.00
34	10		Shale and Gravel -coarse	10.50
48	14		End of Borehole	14.70

INSTALLATION DETAILS

Diagram

Description

- above ground casing
- Groundwater Level: 2.49 m BGS 11-Mar-15
- 50 mm PVC pipe with bentonite backfill
- 50 mm slotted PVC pipe with silica sand backfill
- end cap

Screen Interval: 10.50 - 14.65 m BGS
Sand Pack Interval: 7.60 - 14.65 m BGS
Well Seal Interval: 0.00 - 7.60 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Stantec

Drawn By/Checked By: S. Coughtrey

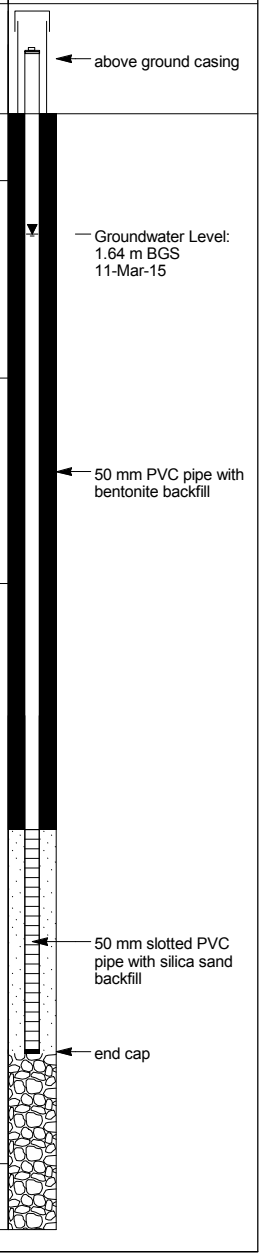
STANTEC BOREHOLE AND WELL V2 GINT.GPJ STANTEC - DATA TEMPLATE.GDT 3/13/15 BEZZARD

Monitoring Well: MW15-02

Project:	Phase II - 8" Pump Well and Monitoring Well Installation	**Drilling method:**	Mud Rotary
Client:	Collins Farm	**Date started/completed:**	09-Mar-2015
Location:	RM of Louise, NE-19-3-12-W1	**Ground surface elevation:**	n/a
Number:	111440257	**Top of casing elevation:**	n/a
Field investigator:	B. Ezzard	**Easting:**	495197
Contractor:	Watkins and Argue	**Northing:**	5453621

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		Silty Clay -brown	0.00
2				
4	1		Sand and Gravel -coarse	0.91
6				
8	2			
10	3			
12			Shale and Gravel	3.60
14	4			
16	5			
18				
20	6			
22			Shale and Gravel -coarse	6.40
24	7			
26				
28	8			
30	9			
32				
34	10			
36	11			
38				
40	12			
42	13			
44				
46	14			
48			Shale -loose, blue	14.30
50	15		End of Borehole	15.20



Screen Interval: 9.75 - 12.80 m BGS
Sand Pack Interval: 8.20 - 12.80 m BGS
Well Seal Interval: 0.00 - 9.75 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Stantec

Drawn By/Checked By: S. Coughtrey

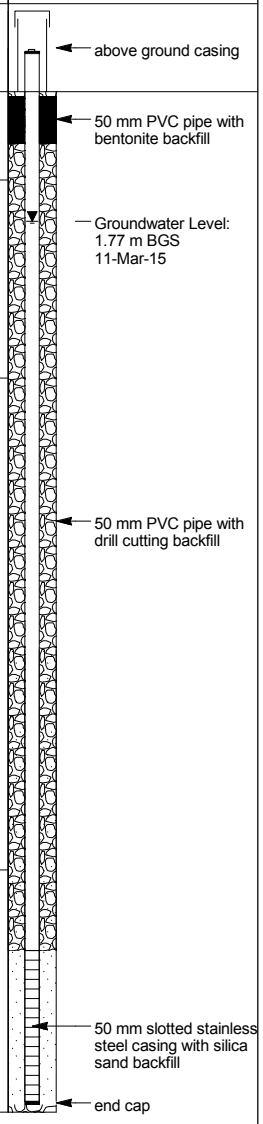
STANTEC BOREHOLE AND WELL V2 GINT.GPJ STANTEC - DATA TEMPLATE.GDT 3/13/15 BEZZARD

Pump Well: PW15-01

Project:	Phase II - 8" Pump Well and Monitoring Well Installation	**Drilling method:**	Mud Rotary
Client:	Collins Farm	**Date started/completed:**	09-Mar-2015
Location:	RM of Louise, NE-19-3-12-W1	**Ground surface elevation:**	n/a
Number:	111440257	**Top of casing elevation:**	n/a
Field investigator:	B. Ezzard	**Easting:**	495194
Contractor:	Watkins and Argue	**Northing:**	5453546

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		Silty Clay -brown	0.00
4	1		Sand and Gravel -coarse	1.20
14	4		Shale, Sand and Gravel -coarse	3.90
36	11		Shale and Gravel -coarse	10.60
46	14		End of Borehole	13.90



Screen Interval: 11.70 - 13.75 m BGS
Sand Pack Interval: 7.60 - 13.75 m BGS
Well Seal Interval: 0.05 - 0.70 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

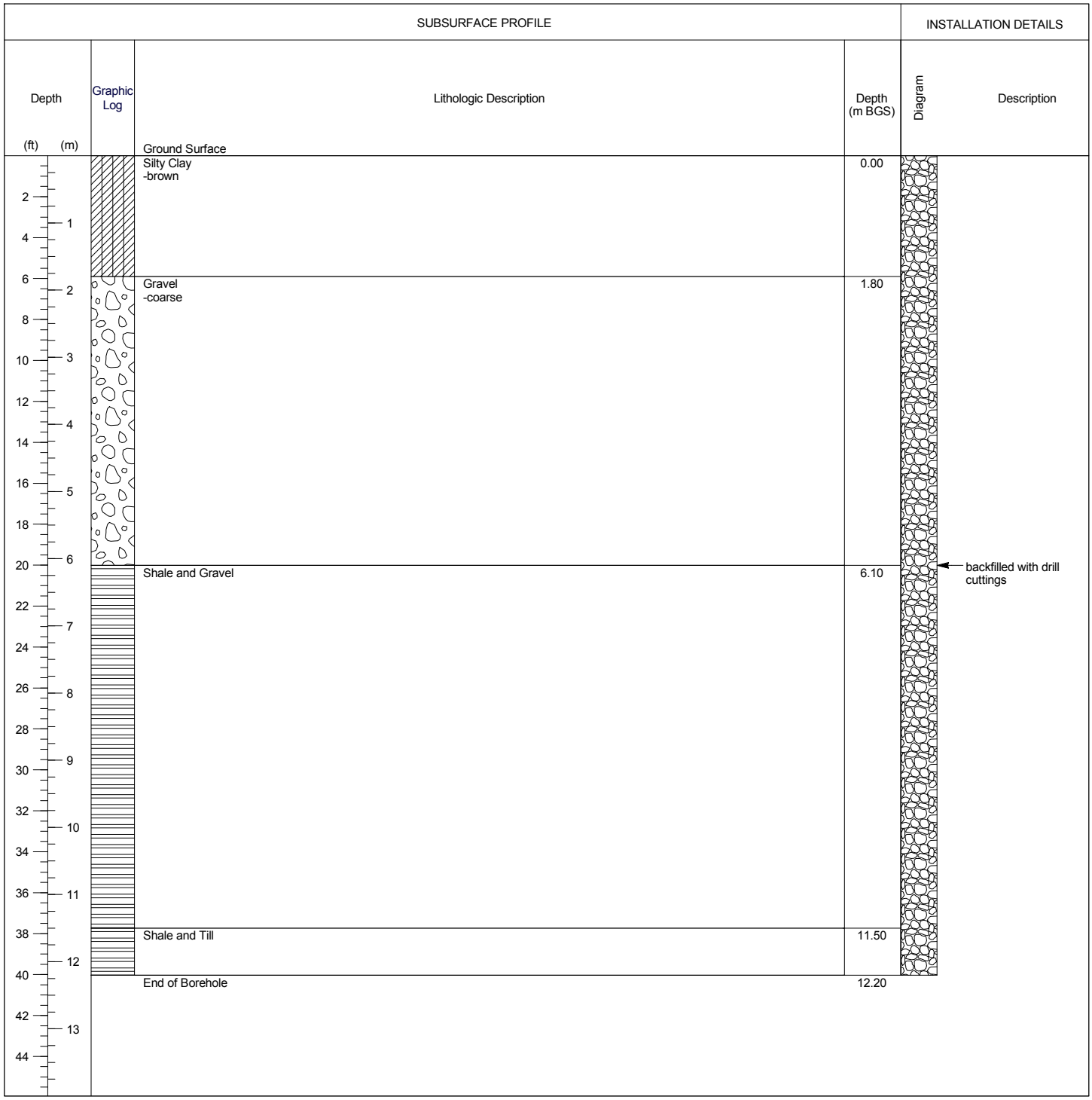
Stantec

Drawn By/Checked By: S. Coughtrey

STANTEC BOREHOLE AND WELL V2 GINT.GPJ STANTEC - DATA TEMPLATE.GDT 3/13/15 BEZZARD

Test Hole: TH15-01

Project:	Phase II - 8" Pump Well and Monitoring Well Installation	**Drilling method:**	Mud Rotary
Client:	Collins Farm	**Date started/completed:**	09-Mar-2015
Location:	RM of Louise, NE-19-3-12-W1	**Ground surface elevation:**	n/a
Number:	111440257	**Top of casing elevation:**	n/a
Field investigator:	B. Ezzard	**Easting:**	495192
Contractor:	Watkins and Argue	**Northing:**	5453363



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Stantec

Drawn By/Checked By: S. Coughtrey

STANTEC BOREHOLE AND WELL V2 GINT.GPJ STANTEC - DATA TEMPLATE.GDT 3/13/15 BEZZARD

Test Hole: TH15-02

Project:	Phase II - 8" Pump Well and Monitoring Well Installation	**Drilling method:**	Mud Rotary
Client:	Collins Farm	**Date started/completed:**	09-Mar-2015
Location:	RM of Louise, NE-19-3-12-W1	**Ground surface elevation:**	n/a
Number:	111440257	**Top of casing elevation:**	n/a
Field investigator:	B. Ezzard	**Easting:**	495197
Contractor:	Watkins and Argue	**Northing:**	5453454

SUBSURFACE PROFILE				INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Diagram / Description
			Ground Surface		
0	0		Silty Clay -brown	0.00	
6	2		Gravel -medium, brown	1.80	backfilled with drill cuttings
26	8		Clay with Till -gray	8.20	
32	10		Shale -loose	9.70	
40	12		End of Borehole	12.20	

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Stantec

Drawn By/Checked By: S. Coughtrey

Test Hole: TH15-03

Project:	Phase II - 8" Pump Well and Monitoring Well Installation	**Drilling method:**	Mud Rotary
Client:	Collins Farm	**Date started/completed:**	09-Mar-2015
Location:	RM of Louise, NE-19-3-12-W1	**Ground surface elevation:**	n/a
Number:	111440257	**Top of casing elevation:**	n/a
Field investigator:	B. Ezzard	**Easting:**	495197
Contractor:	Watkins and Argue	**Northing:**	5453513

SUBSURFACE PROFILE				INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Diagram / Description
			Ground Surface		
0	0		Silty Clay -brown	0.00	
4	1		Gravel -coarse	1.20	
20	6		Shale and Gravel -coarse	6.10	backfilled with drill cuttings
36	11		Shale -coarse, loose	11.30	
40	12		Shale	12.50	
46	14		End of Borehole	13.70	

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Stantec

Drawn By/Checked By: S. Coughtrey

STANTEC BOREHOLE AND WELL V2 GINT.GPJ STANTEC - DATA TEMPLATE.GDT 3/13/15 BEZZARD

Driller's Report

MANITOBA
WATER STEWARDSHIP

WELL LOCATION	QTR. SE_ SEC. 30_ TWP. 3__ RGE. 12__ W1.___ R. LOT _____ PARISH _____ REMARKS: 0495166 5453744
WELL OWNER	NAME: Town of Pilot Mound ADDRESS: Pilot Mound PHONE:
WELL ID.	MW 13-01
WELL USE	Monitoring Well
WATER USE	Municipal
DATE	July 29, 2013

Location Sketch of Well

WELL LOG

Depth Below Ground In Feet From	To	DESCRIPTION	Water Record (Kind of Water)
0	3	Clay, brown	
3	25	Sand, fine to medium	
	25	End of hole in clay layer	

WELL CONSTRUCTION

Depth Below Ground Level In Feet From	To	CASING	OPEN HOLE	PERFORATIONS	GRAVEL PACK	CASING GROUT	PITLESS UNIT	INSIDE DIAMETER INCHES	OUTSIDE DIAMETER INCHES	SCREEN SLOT SIZE NO. OR INCH	TYPE		MATERIAL		MAKE
0	15	X						2			Sched 40		PVC		
15	25			X				2		15	Stainless		Steel		
12	25				X						#50		Filter Sand		Red Flint
0	12					X					Bentonite &		Cuttings		

Top Of Casing Or Pitless Adapter: 3 Feet Above ____ Below _____ Ground Level

Remarks: 20 meters east of test well TW 13-01, 50 meters west of N-S road allowance. Lockable steel above Ground cover installed. Elevation of top of casing = 448.904

PUMPING TEST

Date Of Test: (y/mm/d) No Tests
Pumping / Flowing Rate: I.G.P.M.
Water Level _____ ft. Above _____ Ground Before Pumping: Below _____ Level
Pumping Level _____ ft. Above _____ Ground At End Of Test: Below _____ Level
Duration Of Test: (Hrs:Min)
Water Temperature: _____. Conductivity: _____.
Recommended Pumping Rate: With Pump Intake At: ft. Below Ground Level

CONTRACTOR

Licence No.:
Name: Watkins & Argue
Address: Clearwater, MB Phone
Drill Operator:
(Signature of Contractor)