Starland County

Part of the Red Deer River Basin
Parts of Tp 028 to 034, R 15 to 22, W4M
Regional Groundwater Assessment

Prepared for

STARLAND COUNTY

In conjunction with

Agriculture and Agri-Food Canada
Prairie Farm Rehabilitation Administration

Agriculture et Agroalimentaire Canada
Administration du rétablisseme agricole des Prairies

Canada

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HYDROGEOLOGICAL CONSULTANTS LTD.
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The Association of Professional Engineers, Geologists and Geophysicists of Alberta

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1 PROJECT OVERVIEW

"Water is the lifeblood of the earth." - Anonymous

How a County takes care of one of its most precious resources - groundwater - reflects the future wealth and health of its people. Good environmental practices are not an accident. They must include genuine foresight with knowledgeable planning. Implementation of strong practices not only commits to a better quality of life for future generations, but also creates a solid base for increased economic activity. **This report, even though it is regional in nature, is the first step in fulfilling a commitment by Starland County toward the management of the groundwater resource, which is a key component toward the well-being of the County, and is a guide for future groundwater-related projects.**

1.1 About This Report

This report provides an overview of (a) the groundwater resources of Starland County, (b) the processes used for the present project and (c) the groundwater characteristics in the County.

Additional technical details are available from files on the CD-ROM provided with this report. The files include the geo-referenced electronic groundwater database, maps showing distribution of various hydrogeological parameters, the groundwater query, and ArcView files. Likewise, all of the illustrations and maps from the present report, plus additional maps, figures and cross-sections, are available on the CD-ROM. For convenience, poster-size maps and cross-sections have been prepared as a visual summary of the results presented in this report. Copies of these poster-size drawings have been forwarded with this report, and are included as page-size drawings in Appendix D.

Appendix A features page-size copies of the figures within the report plus additional maps and cross-sections. An index of the page-size maps and figures is given at the beginning of Appendix A.

Appendix B provides a complete list of maps and figures included on the CD-ROM.

Appendix C includes the following:

1) a procedure for conducting aquifer tests with water wells;
2) a table of contents for the Water Well Regulation under the Environmental Protection and Enhancement Act; and
3) additional information.

The Water Well Regulation deals with the wellhead completion requirement (no more water-well pits), the proper procedure for abandoning unused water wells and the correct procedure for installing a pump in a water well.

Appendix E provides a list of water wells recommended for field verification.

1.2 The Project

It must be noted that the present project is a regional study and as such the results are to be used only as a guide. Detailed local studies are required to verify hydrogeological conditions at given locations.

The present project is made up of five parts as follows:

Module 1 - Data Collection and Synthesis
Module 2 - Hydrogeological Maps
Module 3 - Covering Report
Module 4 - Groundwater Query
Module 5 - Training Session

This report and the accompanying maps represent Modules 2 and 3.

1.3 Purpose

This project is a regional groundwater assessment of Starland County. The regional groundwater assessment provides the information to assist in the management of the groundwater resource within the County. Groundwater resource management involves determining the suitability of various areas in the County for particular activities. These activities can vary from the development of groundwater for agricultural or industrial purposes, to the siting of waste storage. **Proper management ensures protection and utilization of the groundwater resource for the maximum benefit of the people of the County.**

The regional groundwater assessment includes:

- identification of the aquifers[1] within the surficial deposits[2] and the upper bedrock;
- spatial definition of the main aquifers;
- quantity and quality of the groundwater associated with each aquifer;
- hydraulic relationship between aquifers; and
- identification of the first sand and gravel deposits below ground level.

Under the present program, the groundwater-related data for the County have been assembled. Where practical, the data have been digitized. These data are then being used in the regional groundwater assessment for the County.

[1] See glossary
[2] See glossary

2 INTRODUCTION

2.1 Setting

Starland County is situated in south-central Alberta. This area is part of the Alberta Plains region. The County exists within the Red Deer River Basin. The western boundary is the Red Deer River. The other boundaries follow township or section lines. The area includes some or all of townships 028 to 034, ranges 15 to 22, west of the 4th Meridian.

Regionally, the topographic surface varies between 600 and 1,100 metres above mean sea level (AMSL), with the lowest elevation occurring in the Red Deer River Valley in the western part of the County as shown in Figure 1.

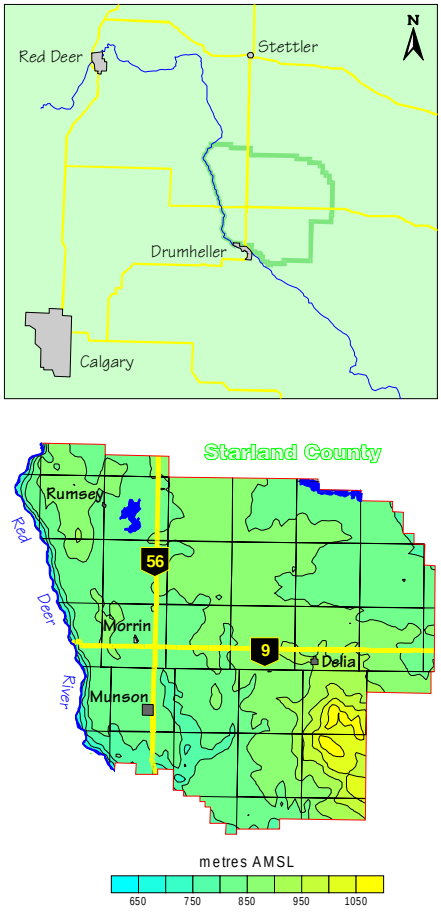

Figure 1. Index Map

2.2 Climate

Starland County lies within a semiarid Bsk climate. This classification is based on potential evapotranspiration values determined using the Thornthwaite method (Thornthwaite and Mather, 1957), combined with the distribution of natural ecoregions in the area. The ecoregions map (Strong and Legatt, 1981) shows that the County is located in the Mixed Grass region, a transition between Aspen Parkland and Dry Mixed Grass Ecoregions.

A Bsk climate is characterized by its moisture deficiency, where mean annual potential evapotranspiration exceeds the mean annual precipitation.

The mean annual precipitation averaged from four meteorological stations within the County measured 360 millimetres (mm), based on data from 1938 to 1993. The mean annual temperature averaged 3.6 °C, with the mean monthly temperature reaching a high of 18.2 °C in July, and dropping to a low of -12.9 °C in January. The calculated annual potential evapotranspiration is 546 millimetres.

2.3 Background Information

There are currently records for 1,616 water wells in the groundwater database for the County. Of the 1,616 water wells, 1,349 are for domestic/stock purposes. The remaining 267 water wells were completed for a variety of uses, including municipal, investigation, observation and industrial purposes. Based on a rural population of 2,075, there are 2.6 domestic/stock water wells per family of four. The domestic or stock water wells vary in depth from 2.4 metres to 426.7 metres below ground level. Lithologic details are available for 840 water wells.

Data for casing diameters are provided on 658 records, with 636 having a diameter of less than 350 mm and 22 having a diameter of more than 550 mm. The casing diameters of greater than 550 mm are mainly bored water wells and those with a surface casing of less than 350 mm are drilled water wells.

Steel, plastic and galvanized steel represent 99% of the materials that have been used for surface casing in drilled water wells over the last 40 years in water wells completed in the County. From before 1955 to the mid-1960s, the type of surface casing used was unknown in a significant number of the drilled water wells. Steel casing has been the dominant type of surface casing used over the last 40 years. The use of steel casing has declined since plastic casing was used for the first time in August 1978. Galvanized steel surface casing has been used in only 4% of the drilled water wells over the last 40 years and has not been used since November 1981.

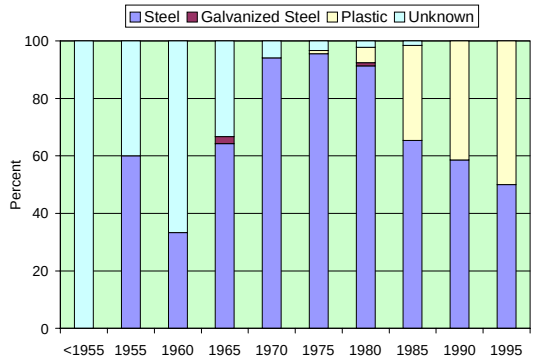

Figure 2. Surface Casing Types used in Drilled Water Wells

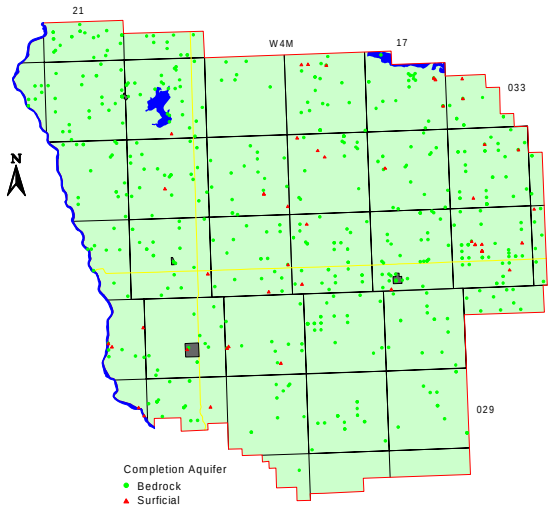

Figure 3. Location of Water Wells

There are 629 water well records with sufficient information to identify the aquifer in which the water wells are completed. The water wells that were not drilled deep enough to encounter the bedrock surface plus water wells that have the bottom of their completion interval above the bedrock surface are water wells completed in surficial aquifers. The number of water wells completed in aquifers in the surficial deposits is 51. The adjacent map shows that these water wells occur sporadically over most of the County. Approximately 85% of the water wells completed in the surficial aquifers have a completion depth of less than 30 metres.

The remaining 578 water wells have the top of their completion interval deeper than the depth to the bedrock surface. From Figure 3, it can be seen that the water wells completed in bedrock aquifers also occur over most of the County.

Water wells not used for domestic needs must be licensed. At the end of 1996, 61 groundwater diversions were licensed in the County. Of the 61 licensed groundwater users, 38 are for agricultural purposes, 22 are for municipal purposes and 1 is for industrial purposes. The total maximum authorized diversion from the water wells associated with these licences is 1,893.4 cubic metres per day (m^3/day); 50% of the authorized groundwater diversion is allotted for industrial use. The largest licensed industrial groundwater diversion within the County is for a saline water source well in 08-31-032-20 W4M licensed to Anderson Oil & Gas Inc. This saline water source well is completed at a depth of more than 1,750 metres below ground surface.