

Acknowledgements

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Mr. Frank Misura – M.D. of Rocky View

1. Project Overview

“Water is the lifeblood of the earth.” - Anonymous

How a Municipal District (M.D.) 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. **Though this report’s scope is regional, it is a first step for the M.D. of Rocky View in managing their groundwater. It is also a guide for future groundwater-related projects.**

1.1 Purpose

This project is a regional groundwater assessment of the M.D. of Rocky View prepared by Hydrogeological Consultants Ltd. (HCL) with financial and technical assistance from the Prairie Farm Rehabilitation Administration arm of Agriculture and Agri-Food Canada (AAFC-PFRA). The regional groundwater assessment provides the information to assist in the management of the groundwater resource within the M.D. Groundwater resource management involves determining the suitability of various areas in the M.D. 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 M.D.**

The regional groundwater assessment will:

- identify the aquifers¹ within the surficial deposits² and the upper bedrock
- spatially identify the main aquifers
- describe the quantity and quality of the groundwater associated with each aquifer
- identify the hydraulic relationship between aquifers
- identify possible groundwater depletion areas associated with each upper bedrock aquifer.

Under the present program, the groundwater-related data for the M.D. have been assembled. Where practical, the data have been digitized. These data are then used in the regional groundwater assessment for the M.D. of Rocky View.

¹ See glossary

² See glossary

1.2 The Project

This regional study should only be used as a guide. Detailed local studies are required to verify hydrogeological conditions at given locations.

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

- Task 1 - Data Collection and Review
- Task 2 - Hydrogeological Maps, Figures, Digital Data Files
- Task 3 – Hydrogeological Evaluation and Preparation of Report
- Task 4 - Groundwater Information Query Software
- Task 5 – Review of Draft Report and GIS Data Files
- Task 6 – Report Presentation and Familiarization Session
- Task 7 – Provision of Report, Maps, Data Layers and Query
- Task 8 – Provision of Compact Disk for Sale to General Public.

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

1.3 About This Report

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

Additional technical details are available from files on the CD-ROM to be provided with the final version of this report. The files include the geo-referenced electronic groundwater database, maps showing distribution of various hydrogeological parameters, the groundwater query, ArcView files and ArcExplorer 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. A plastic M.D. map outline is provided to overlay the maps, and contains information such as towns, main rivers, etc.

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 wells³
- 2) a table of contents for the Water (Ministerial) Regulation under the new Water Act
- 3) a flow chart showing the licensing of a groundwater diversion under the new Water Act
- 4) interpretation of chemical analysis of drinking water
- 5) additional information.

The Water (Ministerial) 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. The new Water Act was proclaimed 10 Jan 1999.

Appendix D includes page-size copies of the poster-size figures provided with this report.

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

³ See glossary

2. Introduction

2.1 Setting

The M.D. of Rocky View is situated in south-central Alberta. Most of this area is part of the western Alberta Plains region, with the western part of the M.D. being part of the Foothills Belt. The M.D. is within the South Saskatchewan River basin; a small part of the southern boundary is the Bow River. The City of Calgary forms the south-central boundaries. The other M.D. boundaries follow township or section lines. The area includes parts of the area bounded by township 023, range 05, W5M in the southwest and township 028, range 24, W4M in the northeast. There are two tribal lands in the area.

Regionally, the topographic surface varies between 850 and 1,450 metres above mean sea level (AMSL). The lowest elevations occur mainly in the northeastern part of the M.D. and the highest are in the western parts of the M.D. as shown on Figure 1 and page A-3. The area is well drained by numerous streams, the main ones being the Bow and Elbow rivers.

2.2 Climate

The M.D. of Rocky View lies within the Dfb⁴ climate boundary. This classification is based on potential evapotranspiration⁵ 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 Leggatt, 1981) shows that the M.D. is located in both the Low Boreal Mixedwood region and the Aspen Parkland region. Increased precipitation and cooler temperatures, resulting in additional moisture availability, influence this vegetation change.

A Dfb climate consists of long, cool summers, severe winters and no dry season. The mean monthly temperature drops below -3° C in the coolest month, and exceeds 10° C in the warmest month.

The mean annual precipitation averaged from four meteorological stations within the M.D. measured 441 millimetres (mm), based on data from 1961 to 1993. The mean annual temperature averaged 4.0° C, with the mean monthly temperature reaching a high of 16.0° C in July, and dropping to a low of -8.6° C in January. The calculated annual potential evapotranspiration is 494 millimetres.

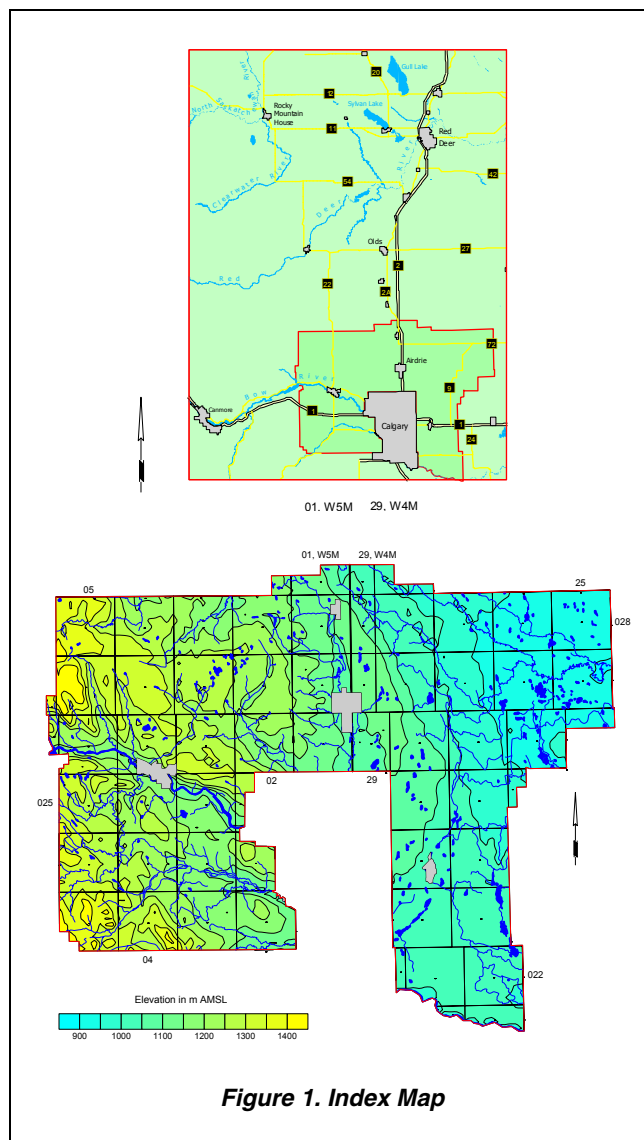


Figure 1. Index Map

⁴ See glossary

⁵ See glossary

2.3 Background Information

2.3.1 Number, Type and Depth of Water Wells

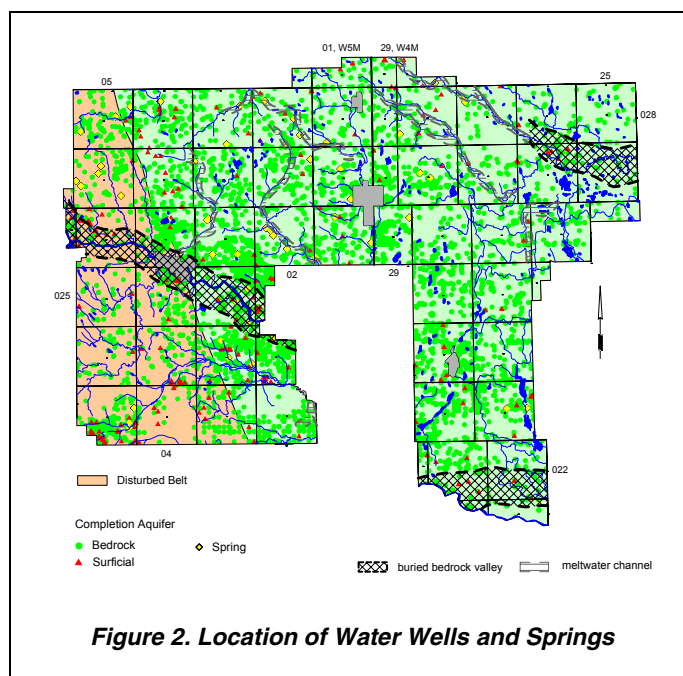
There are currently records for 11,578 water wells in the groundwater database for the M.D. Of the 11,578 water wells, 10,856 are for domestic/stock purposes. The remaining 722 water wells were completed for a variety of uses, including municipal, industrial, observation, irrigation, investigation and monitoring. Based on a rural population of 23,326 (Phinney, 2001), there are 1.9 domestic/stock water wells per family of four. [It should be noted that the Alberta List population figure for the M.D. (Phinney, 2001) differs from the April 2000 census conducted by the M.D. by approximately 5,000 people.] It is unknown how many of these water wells may still be active (especially in areas where rural pipelines have been constructed in recent years). Of the 10,335 domestic or stock water wells with a completed depth, 8,003 are completed at depths of less than 60 metres below ground level. Details for lithology⁶ are available for 8,449 water wells.

2.3.2 Number of Water Wells in Surficial and Bedrock Aquifers

There are 7,263 water well records with completion interval and lithologic information, such that the aquifer in which the water wells are completed can be identified. The water wells that were not drilled deep enough to encounter the bedrock plus water wells that have the bottom of their completion interval above the top of the bedrock are water wells completed in **surficial aquifers**. Of the 7,263 water wells for which aquifers could be defined, 222 are completed in surficial aquifers, with 183 (82%) having a completion depth of less than 40 metres below ground level. Only one of the 222 water wells completed in surficial aquifers with casing size is a bored or dug water well. The adjacent map shows that the water wells completed in the surficial deposits occur mainly along the Elbow River, especially near Bragg Creek, and in linear bedrock lows.

The data for 7,041 water wells show that the top of the water well completion interval is below the bedrock surface, indicating that the water wells are completed in at least one bedrock aquifer. From Figure 2, it can be seen that water wells completed in **bedrock aquifers** occur throughout the M.D. Within the M.D., casing-diameter information is available for 6,885 of the 7,041 water wells completed below the top of bedrock. Of these 6,885 water wells, 99% have surface-casing diameters of less than 275 mm and these bedrock water wells have been mainly completed with either a perforated liner or as open hole; there are 19 bedrock water wells completed with a water well screen.

There are currently records for 64 springs in the groundwater database, including three springs that were documented by Borneuf (1983). Of the 30 springs having total dissolved solids (TDS) values, 20 have TDS concentrations of less than 500 milligrams per litre (mg/L). The spring groundwaters with TDS concentrations of more than 500 mg/L are in townships 027 to 029, range 28, W4M (see CD-ROM). Of the 30 available total hardness values, 87% have total hardness concentrations of less than 500 mg/L. The four available flow rates for springs within the M.D. range from less than 20 to 1,600 litres per minute (lpm), with the highest flow rates at three springs in Big Hill Springs Park in 14-29-026-03 W5M.



⁶ See glossary

2.3.3 Casing Diameter and Type

Data for casing diameters are available for 8,070 water wells, with 8,049 (99%) indicated as having a diameter of less than 275 mm and 21 water wells having a surface-casing diameter of more than 275 mm. The casing diameters of greater than 275 mm are mainly bored or dug water wells and those with a surface-casing diameter of less than 275 mm are drilled water wells. In addition to the 8,070 water wells that have been designated as either bored or drilled water wells based on casing diameter, another 1,289 water wells have been designated as bored or drilled water wells based on the drilling method only, with no casing size indicated on the water well record. Of the 1,289 water wells having no casing size, 1,233 are drilled water wells and 56 are bored water wells. Forty percent of the bored water well locations are mainly along the Elbow River, especially near Bragg Creek. Most of the bored water wells are located in areas of generally lower groundwater development potential.

In the M.D., steel, galvanized steel and plastic surface casing materials have been used in 99% of the drilled water wells over the last 40 years. Until the mid-1960s, the type of surface casing used in drilled water wells was mainly undocumented. Steel casing was in use in the 1950s and is still used in 93% of the water wells being drilled in the M.D. in the late 1990s. Similar to Mountain View County, galvanized steel and plastic surface casing have been used in less than 3% of the new water wells; galvanized steel was last used in April 1996 for the completion of a dug water well.

Steel casing has been dominant in the M.D. probably because it has resisted corrosion and also because water well drillers may be reluctant to use PVC if there have been no documented problems with steel casing in the area.

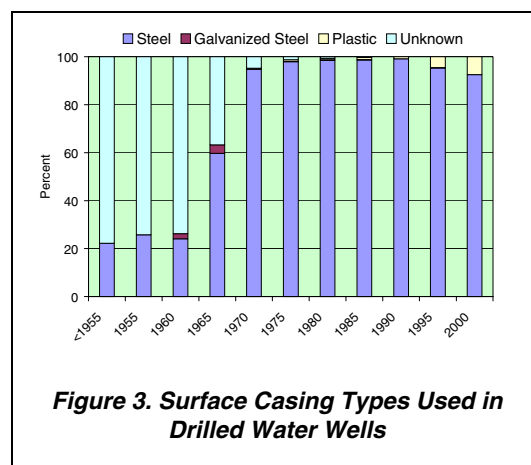


Figure 3. Surface Casing Types Used in Drilled Water Wells

2.3.4 Dry Water Test Holes

In the M.D., there are 13,502 records in the groundwater database. Of these 13,502 records, 131 (less than 1% of the total number of test holes drilled) are indicated as being dry or abandoned with “insufficient water”. Also included in these dry test holes is any record that includes comments that state the water well goes dry in dry years. The 131 “dry” test hole records located throughout the M.D., and clustered near the communities of Cochrane and Chestermere, were drilled or completed in the bedrock.

2.3.5 Requirements for Licensing

Water wells used for household needs in excess of 1,250 cubic metres per year (748 imperial gallons per day⁷) and all other groundwater use must be licensed. The only groundwater users that do not need licensing are (1) household use of up to 1,250 m³/year and (2) groundwater with total dissolved solids in excess of 4,000 mg/L. In the last update from the Alberta Environment (AENV) groundwater database in September 2001, 398 groundwater allocations were shown to be within the M.D., with the most recent groundwater user being licensed in July 2000. Of the 398 licensed groundwater users, 275 (**which is 69% of all licensed water wells**) could be linked to the AENV groundwater database. Of the 398 licensed groundwater users, 236 are for agricultural purposes, 115 are for municipal purposes, 19 are for commercial purposes, 19 are for recreational, and the remaining nine are for dewatering, industrial, exploration or management purposes. The total maximum authorized diversion from the water wells associated with these licences is 29,039 cubic metres per day (m³/day), although actual use could be less. Of the 29,039 m³/day, 19,614 m³/day (68%) is authorized for dewatering purposes from four water wells. The remaining 9,425 m³/day (32%) is allotted for municipal, agricultural, commercial, exploration or management use as shown in Table 1 on the following page. A figure showing the locations of the licensed users is in Appendix A (page A-6) and on the CD-ROM. Table 1 also shows a breakdown of the 398 licensed groundwater allocations by the aquifer in which the water well is completed. The

⁷ see conversion table on page 54