

## Strathcona County

Part of the North Saskatchewan River Basin  
Parts of Tp 050 to 057, R 20 to 24, W4M  
Regional Groundwater Assessment

Prepared for

**Strathcona**  
County

In conjunction with



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

Prairie Farm Rehabilitation  
Administration

Administration du rétablissement  
agricole des Prairies

Canada 

Prepared by  
hydrogeological consultants ltd.  
1-800-661-7972  
Our File No.: **00-179**

March 2001

### PERMIT TO PRACTICE

HYDROGEOLOGICAL CONSULTANTS LTD.

Signature \_\_\_\_\_

Date \_\_\_\_\_

### PERMIT NUMBER P 385

The Association of Professional Engineers,  
Geologists and Geophysicists of Alberta

© 2001 Strathcona County

## Table of Contents

1.	Project Overview .....	1
1.1	Purpose .....	1
1.2	The Project .....	2
1.3	About This Report .....	2
2.	Introduction .....	3
2.1	Setting .....	3
2.2	Climate .....	3
2.3	Background Information .....	4
2.3.1	Number, Type and Depth of Water Wells .....	4
2.3.2	Number of Water Wells in Surficial and Bedrock Aquifers .....	4
2.3.3	Casing Diameter and Type .....	5
2.3.4	Requirements for Licensing .....	5
2.3.5	Groundwater Chemistry and Base of Groundwater Protection .....	6
3.	Terms .....	8
4.	Methodology .....	9
4.1	Data Collection and Synthesis .....	9
4.2	Spatial Distribution of Aquifers .....	11
4.3	Hydrogeological Parameters .....	11
4.4	Maps and Cross-Sections .....	12
4.5	Software .....	12
5.	Aquifers .....	13
5.1	Background .....	13
5.1.1	Surficial Aquifers .....	13
5.1.2	Bedrock Aquifers .....	14
5.2	Aquifers in Surficial Deposits .....	15
5.2.1	Geological Characteristics of Surficial Deposits .....	15
5.2.2	Sand and Gravel Aquifer(s) .....	17
5.2.2.1	Chemical Quality of Groundwater from Surficial Deposits .....	18
5.2.3	Upper Sand and Gravel Aquifer .....	19
5.2.3.1	Aquifer Thickness .....	19
5.2.3.2	Apparent Yield .....	19
5.2.4	Lower Sand and Gravel Aquifer .....	20
5.2.4.1	Aquifer Thickness .....	20
5.2.4.2	Apparent Yield .....	20
5.3	Bedrock .....	21

5.3.1	Geological Characteristics .....	21
5.3.2	Aquifers .....	23
5.3.3	Chemical Quality of Groundwater .....	24
5.3.4	Lower Horseshoe Canyon Aquifer .....	25
5.3.4.1	Depth to Top .....	25
5.3.4.2	Apparent Yield .....	25
5.3.4.3	Quality .....	25
5.3.5	Bearpaw Aquifer .....	26
5.3.5.1	Depth to Top .....	26
5.3.5.2	Apparent Yield .....	26
5.3.5.3	Quality .....	26
5.3.6	Oldman Aquifer .....	27
5.3.6.1	Depth to Top .....	27
5.3.6.2	Apparent Yield .....	27
5.3.6.3	Quality .....	27
5.3.7	Birch Lake Aquifer .....	28
5.3.7.1	Depth to Top .....	28
5.3.7.2	Apparent Yield .....	28
5.3.7.3	Quality .....	28
6.	Groundwater Budget .....	29
6.1	Hydrographs .....	29
6.2	Estimated Water Use from Unlicensed Groundwater Users .....	31
6.3	Groundwater Flow .....	33
6.3.1	Quantity of Groundwater .....	34
6.3.2	Recharge/Discharge .....	34
6.3.2.1	Surficial Deposits/Bedrock Aquifers .....	34
6.3.2.2	Bedrock Aquifers .....	35
6.4	Areas of Groundwater Decline .....	36
7.	Recommendations .....	38
8.	References .....	40
9.	Conversions .....	44
10.	Glossary .....	45

## List of Figures

Figure 1. Index Map.....	3
Figure 2. Location of Water Wells and Springs.....	4
Figure 3. Surface Casing Types Used in Drilled Water Wells.....	5
Figure 4. Depth to Base of Groundwater Protection (modified after EUB, 1995).....	7
Figure 5. Generalized Cross-Section (for terminology only).....	8
Figure 6. Geologic Column.....	8
Figure 7. Hydrogeological Map.....	10
Figure 8. Cross-Section A - A'.....	13
Figure 9. Cross-Section B - B'.....	14
Figure 10. Bedrock Topography.....	15
Figure 11. Thickness of Sand and Gravel Deposits.....	16
Figure 12. Water Wells Completed in Surficial Deposits.....	17
Figure 13. Apparent Yield for Water Wells Completed in Sand and Gravel Aquifer(s).....	17
Figure 14. Total Dissolved Solids in Groundwater from Surficial Deposits.....	18
Figure 15. Apparent Yield for Water Wells Completed through Upper Sand and Gravel Aquifer.....	19
Figure 16. Apparent Yield for Water Wells Completed through Lower Sand and Gravel Aquifer.....	20
Figure 17. Bedrock Geology.....	21
Figure 18. E-Log showing Base of Foremost Formation.....	22
Figure 19. Apparent Yield for Water Wells Completed in Upper Bedrock Aquifer(s).....	23
Figure 20. Total Dissolved Solids in Groundwater from Upper Bedrock Aquifer(s).....	24
Figure 21. Apparent Yield for Water Wells Completed through Lower Horseshoe Canyon Aquifer.....	25
Figure 22. Apparent Yield for Water Wells Completed through Bearpaw Aquifer.....	26
Figure 23. Apparent Yield for Water Wells Completed through Oldman Aquifer.....	27
Figure 24. Depth to Top of Birch Lake Aquifer.....	28
Figure 25. Annual Precipitation vs Water Levels in AENV Obs WW No. 157.....	29
Figure 26. Annual Precipitation vs Water Levels in AENV Obs WW No. 158.....	29
Figure 27. AENV Obs WW No. 157 vs Cooking Lake Water-Level Fluctuations.....	30
Figure 28. Estimated Water Well Use Per Section.....	32
Figure 29. Non-Pumping Water-Level Surface in Surficial Deposits Based on Water Wells Less than 20 Metres Deep.....	34
Figure 30. Recharge/Discharge Areas between Surficial Deposits and Upper Bedrock Aquifer(s).....	35
Figure 31. Recharge/Discharge Areas between Surficial Deposits and Bearpaw Aquifer.....	35
Figure 32. Changes in Water Levels in Sand and Gravel Aquifer(s).....	36
Figure 33. Changes in Water Levels in Upper Bedrock Aquifer(s).....	37

## List of Tables

Table 1. Licensed Groundwater Diversions .....	6
Table 2. Concentrations of Constituents in Groundwaters from Upper Bedrock Aquifer(s) .....	6
Table 3. Concentrations of Constituents in Groundwaters from Surficial Aquifers.....	18
Table 4. Completion Aquifer .....	23
Table 5. Apparent Yields of Bedrock Aquifers .....	23
Table 6. Unlicensed and Licensed Groundwater Diversions.....	31
Table 7. Total Groundwater Diversions .....	32
Table 8. Groundwater Budget.....	33

## Appendices

- A. Hydrogeological Maps and Figures
- B. Maps and Figures on CD-ROM
- C. General Water Well Information
- D. Maps and Figures Included as Large Plots
- E. Water Wells Recommended for Field Verification

## **Acknowledgements**

Hydrogeological Consultants Ltd. would like to thank the following people for their excellent cooperation and helpful suggestions on this project:

Mr. Tony Cowen – PFRA

Mr. Keith Schick – PFRA

Mr. Timothy Lau – Strathcona County

Mr. Dave Dubauskas – Strathcona County