

Of the 1,154 water well records with apparent yield values, 1,118 have been assigned to aquifers associated with specific geologic units. Sixty-eight percent of the water wells completed in the bedrock aquifers have apparent yields that range from ten to 100 m<sup>3</sup>/day, and 24% have apparent yields that are more than 100 m<sup>3</sup>/day, as shown in the adjacent table.

Aquifer	No. of Water Wells with Values for Apparent Yield	Number of Water Wells with Apparent Yields		
		<10 m <sup>3</sup> /day	10 to 100 m <sup>3</sup> /day	>100 m <sup>3</sup> /day
Oldman	2	1	0	1
Birch Lake	116	8	84	24
Ribstone Creek	817	49	568	200
Victoria	175	23	109	43
Brosseau	8	2	5	1
Totals	1,118	83	766	269

**Table 6. Apparent Yields of Bedrock Aquifers**

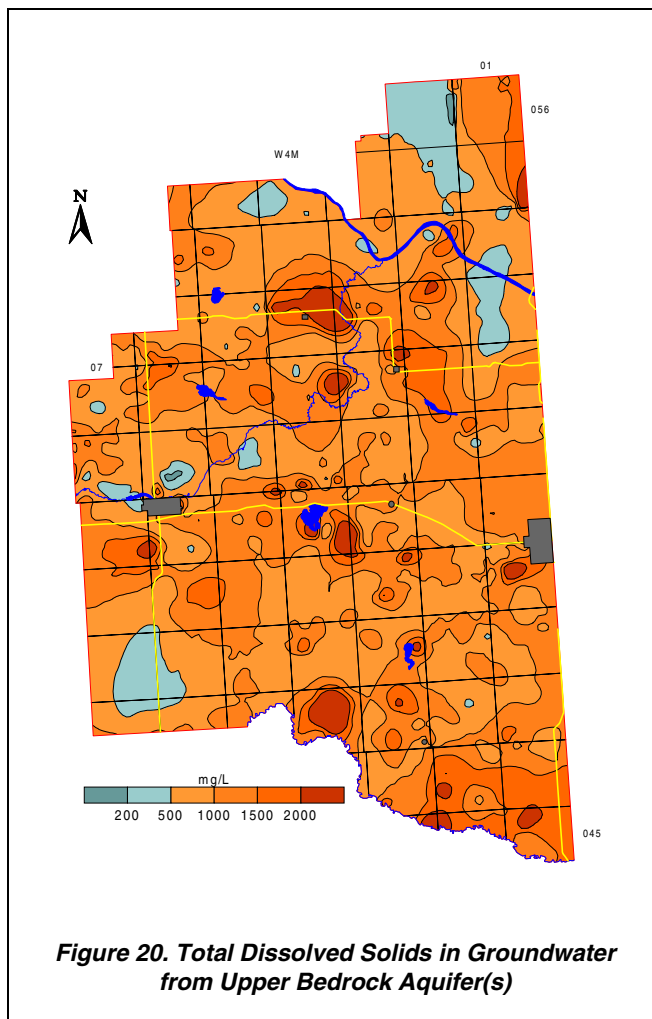
### 5.3.3 Chemical Quality of Groundwater

The TDS concentrations in the groundwaters from the upper bedrock aquifer(s) range from less than 200 to more than 2,000 mg/L.

The relationship between TDS and sulfate concentrations shows that when TDS values in the groundwater from the upper bedrock aquifer(s) exceed 1,200 mg/L, the sulfate concentrations exceed 400 mg/L. The chloride concentrations in the groundwaters from the upper bedrock aquifer(s) are less than 100 mg/L in more than 90% of the County. The higher values can be expected mainly south of township 051, W4M, with 86% of the water wells having completion depths of greater than 70 metres.

In 90% of the County, the fluoride ion concentrations in the groundwaters from the upper bedrock aquifer(s) are less than 0.5 mg/L.

The Piper tri-linear diagrams <sup>13</sup> (see Appendix A) show that all chemical types of groundwater occur in the bedrock aquifers. However, the majority of the groundwaters are sodium-bicarbonate or sodium-sulfate types.



**Figure 20. Total Dissolved Solids in Groundwater from Upper Bedrock Aquifer(s)**

<sup>13</sup> See glossary

### 5.3.4 Oldman Aquifer

The Oldman Aquifer comprises the porous and permeable parts of the Oldman Formation. The Oldman Formation subcrops in the extreme western part of the County, mainly in townships 048 and 049, range 07, W4M. The Oldman Formation also subcrops in a small area of the south-central part of the County, mainly in townships 049 and 050, ranges 02 to 04, W4M. The thickness of the Oldman Formation is generally less than 30 metres, where present; in most of the County, the Oldman Formation has been eroded.

#### 5.3.4.1 Depth to Top

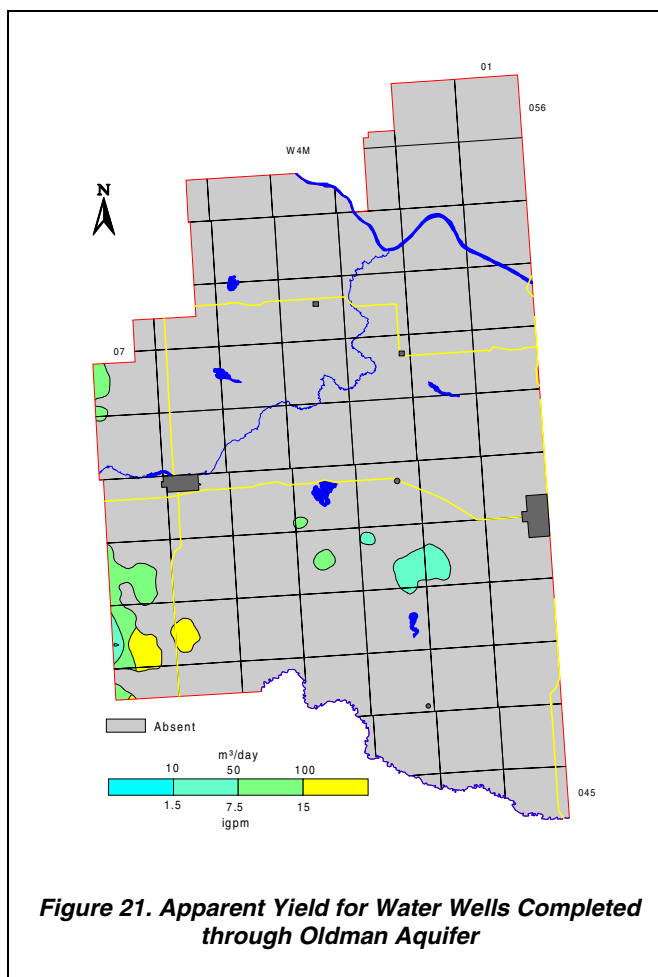
The depth to the top of the Oldman Formation is mainly less than 40 metres below ground level and is a reflection of the thickness of the surficial deposits.

#### 5.3.4.2 Apparent Yield

There are only two water well records in the database with sufficient information to determine the apparent yields for individual water wells completed through the Oldman Aquifer. The data from the adjacent municipality, the County of Minburn, indicate that the groundwaters from the Oldman can be expected to have apparent yields of less than 100 m<sup>3</sup>/day. The adjacent map shows the expected variation in apparent yields for water wells completed in the Oldman Aquifer.

#### 5.3.4.3 Quality

There is only one water well record in the database with sufficient information to determine the chemical type of groundwater from the Oldman Aquifer. The groundwater is a sodium-bicarbonate type (see CD-ROM). The data from the County of Minburn indicate that the groundwaters from the Oldman Aquifer are mainly sodium-bicarbonate or sodium-sulfate-type waters. In the County of Vermilion River (using County of Minburn data), TDS concentrations in the groundwaters from the Oldman Aquifer are expected to be mainly less than 1,000 mg/L. The sulfate concentrations are expected to be mainly less than 250 mg/L and chloride concentrations from the Oldman Aquifer in the County are expected to be mainly less than 100 mg/L, based on data from the County of Minburn.



**Figure 21. Apparent Yield for Water Wells Completed through Oldman Aquifer**

### 5.3.5 Birch Lake Aquifer

The Birch Lake Aquifer comprises the porous and permeable parts of the Birch Lake Member, as defined for the present program. Structure contours have been prepared for the top and bottom of the Member, which underlies most of the southern half of the County. The structure contours show the Member ranging from less than 20 metres thick at its edge to more than 60 metres thick in parts of townships 046 and 047, range 01, W4M.

#### 5.3.5.1 Depth to Top

The depth to the top of the Birch Lake Member is mainly less than 40 metres below ground level and is a reflection of the thickness of the surficial deposits.

#### 5.3.5.2 Apparent Yield

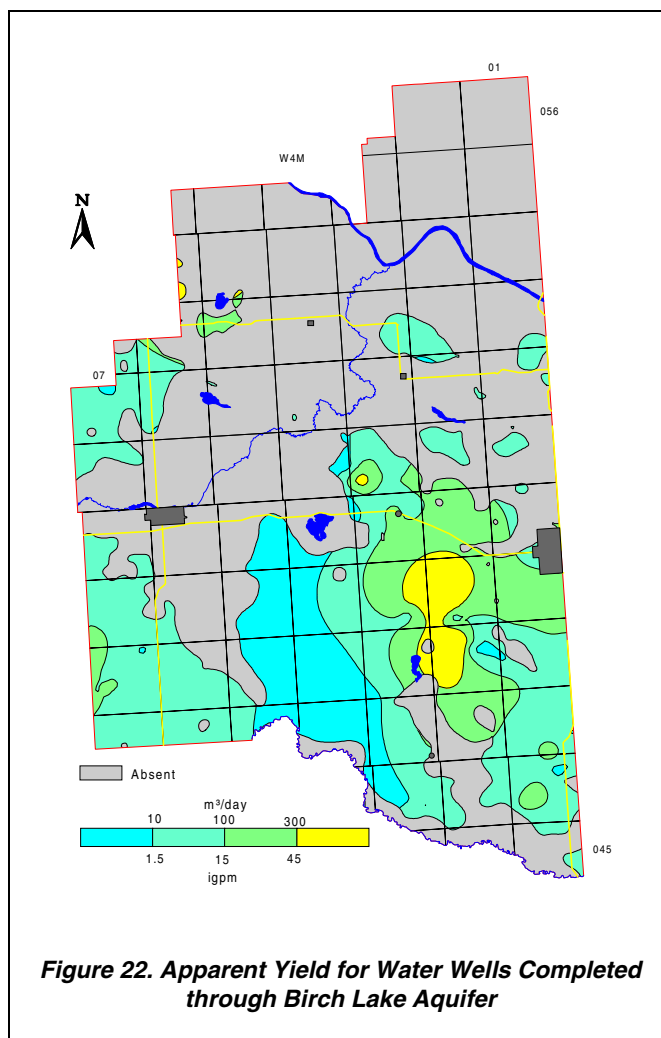
The apparent yields for individual water wells completed through the Birch Lake Aquifer are mainly in the range of 10 to 100 m<sup>3</sup>/day. The areas where water wells with higher yields are expected are mainly in the southeastern part of the County.

The Mount Joy Ski Club is licensed to divert an average of 27 m<sup>3</sup>/day at a maximum pumping rate of 130 m<sup>3</sup>/day from a water supply well completed in the Birch Lake Aquifer in NE 36-047-02 W4M (HCL, August 1998).

#### 5.3.5.3 Quality

The groundwaters from the Birch Lake Aquifer have no dominant chemical type; however, sodium and calcium are the main cations and bicarbonate and sulfate are the main anions (see CD-ROM). The TDS concentrations for groundwaters from the Birch Lake Aquifer range from less than 500 to more than 1,500 mg/L. The lower values of TDS occur mainly in townships 047 and 048, ranges 06 and 07, W4M. When TDS values in the groundwaters from the Birch Lake Aquifer exceed 1,200 mg/L, the sulfate concentrations exceed 400 mg/L.

The chloride concentrations of the groundwaters from the Birch Lake Aquifer can be expected to be mainly less than 50 mg/L.



**Figure 22. Apparent Yield for Water Wells Completed through Birch Lake Aquifer**

### 5.3.6 Ribstone Creek Aquifer

The Ribstone Creek Aquifer comprises the porous and permeable parts of the Ribstone Creek Member. Structure contours have been prepared for the top and bottom of the Member, which underlies most of the southern two-thirds of the County. The structure contours show the Member being mostly less than 50 metres thick.

#### 5.3.6.1 Depth to Top

The depth to the top of the Ribstone Creek Member is mainly less than 60 metres below ground level but can be more than 100 metres where the Oldman Formation is the upper bedrock.

#### 5.3.6.2 Apparent Yield

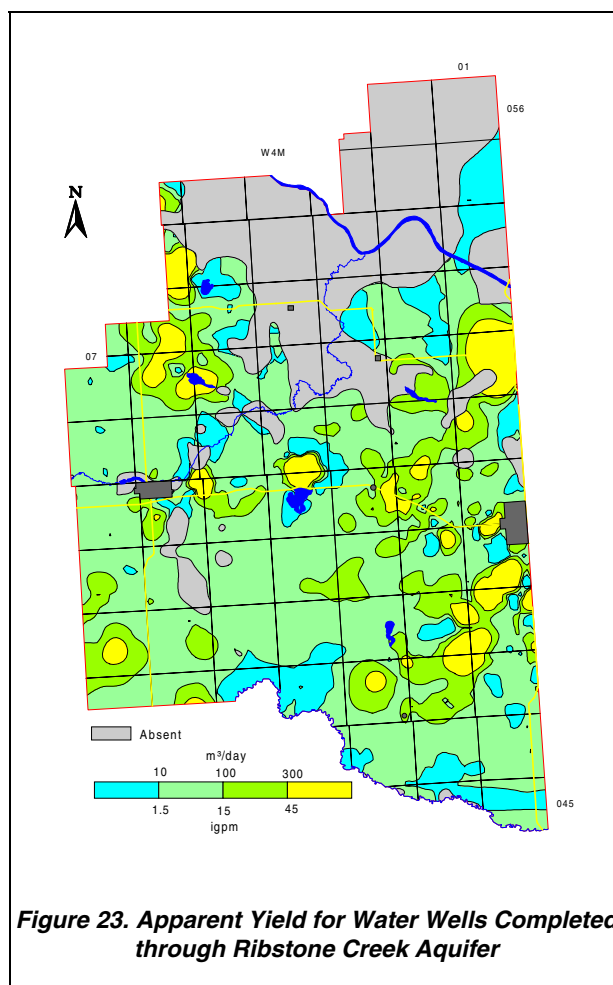
The apparent yields for individual water wells completed through the Ribstone Creek Aquifer are mainly in the range of 10 to 100 m<sup>3</sup>/day, with 25% of the values being more than 100 m<sup>3</sup>/day. The areas where water wells with higher yields are expected are mainly in the northwestern part and eastern third of the County.

Examples of water wells in the eastern part of the County with apparent yields of between 100 and 300 m<sup>3</sup>/day are water supply wells drilled for the Village of Kitscoty (Epec, 1981), the Village of Paradise Valley (HCL, January 1971) and the Hamlet of Blackfoot (HCL, March 1976). An additional example of a high-yielding water well in the eastern part of the County is for a Husky Blackfoot-area water source well in 11d-30-050-01 W4M. This water source well is indicated as having a long-term yield of more than 200 m<sup>3</sup>/day. The Husky 11d-30 water source well was licensed to divert 224 m<sup>3</sup>/day (HCL, November 1977).

#### 5.3.6.3 Quality

The groundwaters from the Ribstone Creek Aquifer have no dominant chemical type; however, sodium and calcium are the main cations and bicarbonate and sulfate are the main anions (see Piper diagram on CD-ROM). The TDS concentrations range from less than 500 to more than 2,000 mg/L. The sulfate concentrations are mainly less than 500 mg/L. Chloride concentrations in the groundwaters from the Ribstone Creek Aquifer are mainly less than 100 mg/L.

The TDS concentrations were in the order of 800 to 1,000 mg/L in the groundwaters from the water wells completed for the Village of Paradise Valley, the Hamlet of Blackfoot and for Husky Blackfoot; the TDS concentration was 1,455 mg/L in the groundwater from Pumping Well (PW) 4 completed for the Village of Kitscoty. The sulfate concentrations were less than 250 mg/L in the water supply wells completed for the Village of Paradise Valley and the Hamlet of Blackfoot; the sulfate concentrations of the groundwaters from the water wells completed for Husky Blackfoot and for the Village of Kitscoty exceeded 500 mg/L. The chloride concentrations in the groundwaters from all four water wells were less than 30 mg/L.



### 5.3.7 Victoria Aquifer

The Victoria Aquifer comprises the porous and permeable parts of the Victoria Member. Structure contours have been prepared for the top of the Member, which underlies 85% of the County. The structure contours show the Member being mostly less than 50 metres thick.

#### 5.3.7.1 Depth to Top

The depth to the top of the Victoria Member is mainly less than 100 metres below ground level but can be more than 140 metres in parts of the southern third of the County. In the western part of the County, the Base of Groundwater Protection extends into the Victoria Member. A map showing the depth to the Base of Groundwater Protection is given on page 6 of this report, in Appendix A, and on the CD-ROM.

#### 5.3.7.2 Apparent Yield

The apparent yields for individual water wells completed through the Victoria Aquifer are mainly less than 150 m<sup>3</sup>/day. However, the lower yields presented in ranges 01 and 02, W4M may be a reflection of the limited amount of data rather than the hydraulic properties of the Aquifer. The adjacent map indicates that water wells with apparent yields of more than 150 m<sup>3</sup>/day are expected in the western two-thirds of the County. There are little or no data for the Aquifer in the eastern third of the County. In this area, the Victoria Aquifer would be at a depth of more than 100 metres.

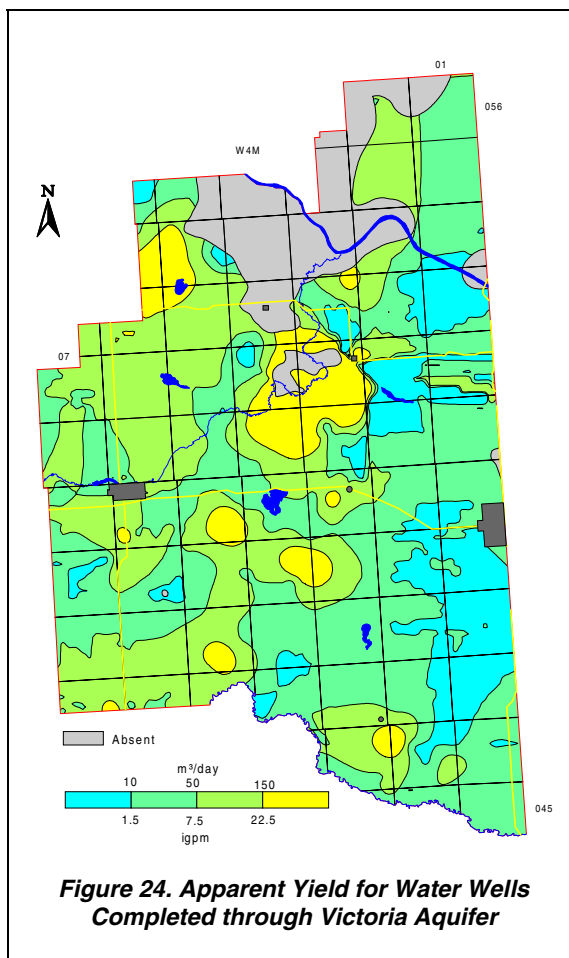
Two of the four water supply wells used by the Village of Marwayne are completed in the Victoria Aquifer. Water Supply Well (WSW) No. 1 is licensed to divert 50 m<sup>3</sup>/day and WSW No. 3 is licensed to divert 78.5 m<sup>3</sup>/day (HCL, January 1999).

#### 5.3.7.3 Quality

The groundwaters from the Victoria Aquifer have no dominant chemical type; however, sodium and calcium are the main cations and bicarbonate and sulfate are the main anions (see Piper diagram on CD-ROM). Total dissolved solids concentrations are expected to be mainly less than 1,000 to more than 2,500 mg/L, although there is a paucity of data in townships 047 to 050, ranges 01 and 02, W4M. However, since most of the Victoria Member is above the Base of Groundwater Protection in townships 047 to 050, ranges 01 and 02, W4M, the TDS would still be expected to be less than 4,000 mg/L.

Sulfate concentrations of more than 250 mg/L in the groundwaters from the Victoria Aquifer can be expected in the northern half of the County where the Victoria Aquifer is present, and sulfate concentrations of less than 250 mg/L can be expected in the southern half of the County. The indications are that in the northern two-thirds of the County, the chloride concentrations are expected to be less than 250 mg/L.

The groundwater from the Village of Marwayne WSW No. 3 has a TDS concentration of 1,107 mg/L, a sulfate concentration of 303 mg/L and a chloride concentration of 28 mg/L (HCL, June 1992).



**Figure 24. Apparent Yield for Water Wells Completed through Victoria Aquifer**