

## 6.5 Discussion on Specific Study Areas

As per the Request for Proposal, Cypress County requested that comments be made, where possible, on the following study areas and issues. The issue is stated at the beginning of each of the following sections.

### 6.5.1 Dunmore Gravels Aquifer Area

**What is the approximate extent and potential (yield and water quality) of this Aquifer? Can the primary recharge areas for this Aquifer be identified?**

The presence of sand and gravel occurring within one metre of the land surface can be expected in the Dunmore area in the eastern and southwestern parts of township 012, range 05, W4M. The thickness of the first sand and gravel is mainly less than five metres. Westgate shows that kame<sup>18</sup> deposits of limited areal extent can be expected north, northeast and northwest of Dunmore and are primarily associated with the hills and knobs. The importance of these hills and knobs is mainly related to how they may restrict recharge to the near-surface glacial gravel unit (PFRA, 1998 Memorandum Communication).

Both the Upper and Lower Sand and Gravel aquifers are present in parts of the Dunmore area. In township 012, range 05, W4M, the Lower Sand and Gravel Aquifer is the main Aquifer in surficial deposits present. Apparent yields of more than 100 m<sup>3</sup>/day in the southwestern part of township 012, range 05, W4M are not uncommon (see page A-29). In township 012, range 04, W4M, the Upper Sand and Gravel Aquifer is the main Aquifer in surficial deposits present, with apparent yields mainly in the range from 10 to 100 m<sup>3</sup>/day.

Groundwater from water wells completed in SW 04-012-05 W4M in the aquifers in the surficial deposits are expected to have TDS concentrations of approximately 1,815 mg/L, as shown in the adjacent table containing an abbreviated version of the Groundwater Query Results.

The apparent yield for individual water wells completed in SW 04-012-05 W4M through the Lower Sand and Gravel Aquifer is estimated to be 167 m<sup>3</sup>/day.

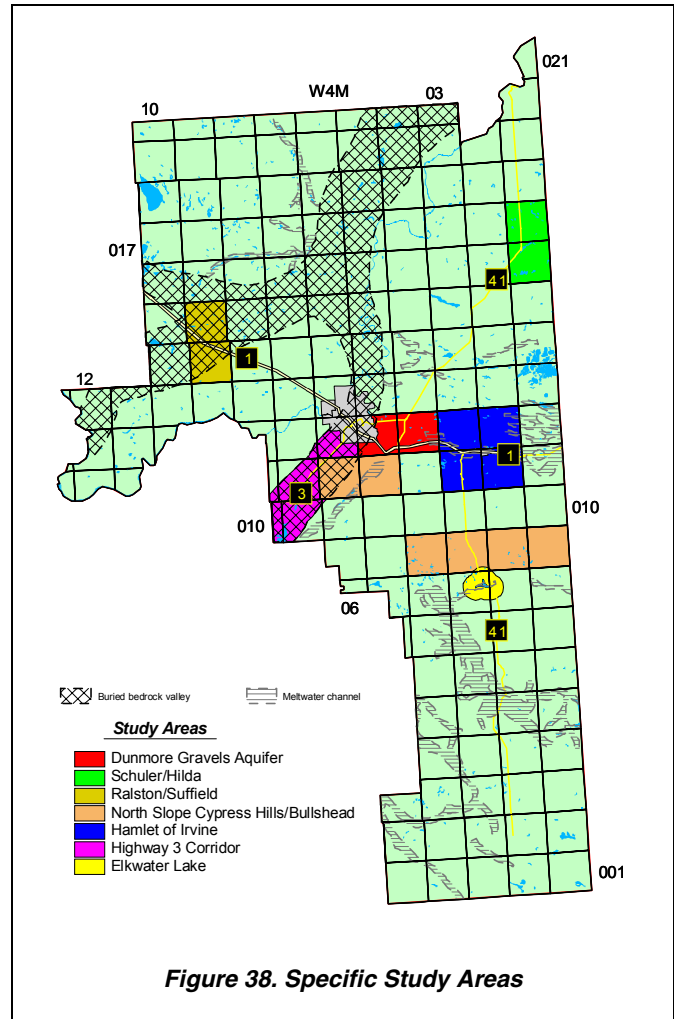


Figure 38. Specific Study Areas

**Dunmore Area**  
Mow-Tech Ltd. gwQuery Results (metric)  
**SW 04-012-05 W4M**

<b>Detailed Results</b>						
Formation Name	Top metre	Yield m <sup>3</sup> /day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
Upper Surficial Deposits	--	--	--	1815	1097	23
Lower Surficial Deposits	0	167	5	1815	1097	23
Bedrock Surface	11					
Oldman Formation	11	34	8	1021	394	24
Foremost Formation	41	20	13	2018	1786	355

**Table 9. Groundwater Query Results –  
Dunmore Area**

<sup>18</sup> See glossary

### 6.5.2 Schuler/Hilda Area

What is the groundwater potential of this general area and where would be a suitable location that would produce a yield of greater than or equal to 200 m<sup>3</sup>/day? What groundwater quality can be expected?

The Upper Sand and Gravel Aquifer is present in most of the Schuler/Hilda area; the Lower Sand and Gravel Aquifer is absent. Although surficial deposits are mostly between 50 and 100 metres thick in the Schuler/Hilda area, the Upper Sand and Gravel deposits are expected to be less than five metres thick below Schuler but could be between 10 and 30 metres thick below Hilda. Apparent yields of less than 50 m<sup>3</sup>/day can be expected, although an apparent yield of 110 m<sup>3</sup>/day was calculated in NW 16-017-01 W4M from a bored water well completed at a depth of 15.2 metres below ground surface. There is one licensed groundwater user in the Schuler/Hilda area and the water well is completed in the Upper Sand and Gravel Aquifer. The M.D. of Cypress is licensed to divert 60.2 m<sup>3</sup>/day from a water supply well in 04-36-017-01 W4M for municipal purposes.

The upper bedrock in the Schuler/Hilda area is both Bearpaw and Oldman formations. The upper bedrock below Hilda and Schuler is the Oldman Formation. A water supply well was completed for Alberta Housing & Public Works at the Hilda Maintenance Garage in 16-32-017-01 W4M. The water supply well was completed from 94.2 to 116.4 metres below ground surface in the Oldman Aquifer. An extended aquifer test conducted with this water supply well indicated a long-term yield of 52 m<sup>3</sup>/day. Groundwater from this water supply well has TDS concentrations of 4,060 mg/L, sulfate of 2,067, chloride of 105 mg/L, sodium of 1,194 mg/L, and a total hardness of 365 mg/L (HCL, 1981).

Groundwater from water wells completed in 16-32-017-01 W4M in the Oldman Aquifer are expected to have TDS concentrations of approximately 3,449 mg/L, as shown in the adjacent table containing an abbreviated version of the Groundwater Query Results. The apparent yield for individual water wells completed in 16-32-017-01 W4M through the Oldman Aquifer is estimated to be 51 m<sup>3</sup>/day. In order to obtain the potentially higher yields and lower TDS concentrations associated with the Foremost Aquifer, a water well would need to be completed more than 150 metres below ground surface at this location.

Schuler/Hilda Area						
Mow-Tech Ltd. gwQuery Results (metric)						
16-32-017-01 W4M						
Detailed Results						
Formation Name	Top metre	Yield m <sup>3</sup> /day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
Upper Surficial Deposits	--	10	6	2130	1088	52
Bedrock Surface	60					
Oldman Formation	60	51	21	3449	1874	210
Foremost Formation	150	553	63	1255	156	120

**Table 10. Groundwater Query Results – Schuler/Hilda Area**

In 1962, the Hamlet of Hilda completed a water well in NW 35-017-01 W4M, in the depth interval from 190.5 to 198.1 metres below ground surface in the Foremost Aquifer. An apparent yield of more than 500 m<sup>3</sup>/day has been calculated at this location. Groundwater quality data are not available for this water well.

The Hamlet of Schuler has one water well completed in the Oldman Aquifer in NW 09-016-01 W4M that was completed from 146 to 184.4 metres below ground surface. Four aquifer tests were conducted with this water well in September 1962. Apparent yields ranging from 31.3 to 77.2 m<sup>3</sup>/day have been calculated from the resulting data. Groundwater quality data are not available for this water well.

### 6.5.3 Ralston/Suffield Area

What is the approximate extent and development potential of the groundwater in this general area? Based on the available water-level data, is there any evidence of depletion?

Although the Upper Sand and Gravel Aquifer is present in most of the Ralston/Suffield area, it is the Lower Sand and Gravel Aquifer that is being utilized for groundwater purposes (see Page A-29 for extent). There are no water wells with apparent yield data in the Ralston/Suffield area that are completed in the Upper Sand and Gravel Aquifer. The closest water well completed in the Upper Sand and Gravel Aquifer with apparent yield data is in 08-24-016-10 W4M, having an apparent yield of 130 m<sup>3</sup>/day.

In the Ralston/Suffield Area, there are nine water wells with apparent yield data that are completed in the Lower Sand and Gravel Aquifer, including four that have been licensed by AENV. The National Defence is licensed to divert more than 4,100 m<sup>3</sup>/day from three water wells for municipal and commercial purposes. The fourth licensed user in the area is the Suffield Co-op. The Suffield Co-op water supply well in NW 34-014-09 W4M is completed in the depth interval from 106.7 to 109.7 metres below ground surface in the Lower Sand and Gravel Aquifer and is licensed to divert 196 m<sup>3</sup>/day. Based on an aquifer test conducted with the Suffield Co-op water supply well, Marciniuk (1975) determined that the buried valley gravels at Suffield were capable of producing an estimate of between 650 and 6,500 m<sup>3</sup>/day.

An extended aquifer test conducted with a National Defence water supply well and two observation water wells completed in the Lower Sand and Gravel Aquifer in SW 34-014-09 W4M indicated a long-term sustainable pumping rate of more than 25,000 m<sup>3</sup>/day (CH<sub>2</sub>MHILL, 1990).

Groundwater from water wells completed in SW 34-014-09 W4M in the aquifers in the surficial deposits are expected to have TDS concentrations of approximately 925 mg/L, as shown in the adjacent table containing an abbreviated version of the Groundwater Query Results. The apparent yield for individual water wells completed in SW 34-014-09 W4M through the Lower Sand and Gravel Aquifer is estimated to be 447 m<sup>3</sup>/day.

Ralston/Suffield Area						
Mow-Tech Ltd. gwQuery Results (metric)						
SW 34-014-09 W4M						
Detailed Results						
Formation Name	Top metre	Yield m <sup>3</sup> /day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
Upper Surficial Deposits	--	58	11	925	242	11
Lower Surficial Deposits	76	447	44	925	242	11
Bedrock Surface	111					
Foremost Formation	111	333	44	1669	55	520

**Table 11. Groundwater Query Results – Ralston/Suffield Area**

The upper bedrock in the Ralston/Suffield Area is mainly the Foremost Formation; however, in parts of townships 014 and 015, range 09, W4M, the Oldman Formation is present. In township 014, range 09, W4M, there are five water wells completed in the Foremost Aquifer with apparent yield data. Apparent yields of more than 200 m<sup>3</sup>/day may be encountered. There is one water well completed in bedrock in township 015, range 09, W4M with apparent yield data. This water well, completed in the Foremost Aquifer, has an apparent yield of less than ten m<sup>3</sup>/day.

There are two inactive AENV Obs WWs in 07-05-015-09 W4M completed in the surficial deposits. AENV Obs WW No. 118 is completed in the Lower Sand and Gravel Aquifer associated with the Buried Lethbridge Valley and AENV Obs WW No. 119 is completed in the Upper Sand and Gravel Aquifer. AENV Obs WW No. 118 has a water-level record from 1985 to 1992 and AENV Obs WW No. 119 has a water-level record from 1985 to 1995. The water level in AENV Obs WW No. 119 has declined in the order of 1.8 metres, with the decline occurring from 1986 to 1990, and from 1993 to 1995. The water level in AENV Obs WW No. 118 has also declined; however, between mid-1988 and late 1989, no water levels were recorded. When water-level measurements were recorded again in late 1989, the water level was nearly 0.5 metres lower. It is possible that a new recorder was installed and the reference point had changed. Given this assumption, the water-level decline measured in the Lower Sand and Gravel Aquifer at the site of AENV Obs WW No. 118 would be approximately 0.5 metres from 1985 to 1992.

### 6.5.4 North Slope Cypress Hills/Bullshead Area

What is the development potential and quality of the groundwater in this general area? Are there any aquifers capable of producing more than 200 m<sup>3</sup>/day that would be suitable for the construction of a regional pipeline system? Could the upslope springs around an elevation of 1,130 m AMSL be a potential source for a regional pipeline?

The Lower Sand and Gravel Aquifer is the primary Aquifer in the surficial deposits that underlie the Bullshead area of township 011, ranges 05 and 06, W4M. There are 67 water wells with apparent yield data that are completed in the Lower Sand and Gravel Aquifer in the Bullshead area. The average apparent yield from these 67 water wells is 75 m<sup>3</sup>/day. The yields that are greater than 100 m<sup>3</sup>/day are mainly in water wells that are located in the Buried Medicine Hat Valley in township 011, range 06, W4M or in the meltwater channel in township 011, range 05, W4M. There are less than ten water wells that have apparent yields that are greater than 200 m<sup>3</sup>/day. There are no licensed groundwater users in the Bullshead area.

Groundwater from water wells completed in NW 16-011-06 W4M in the aquifers in the surficial deposits are expected to have TDS concentrations of approximately 1,623 mg/L, as shown in the adjacent table containing an abbreviated version of the Groundwater Query Results. The apparent yield for individual water wells completed in NW 16-011-06 W4M through the Lower Sand and Gravel Aquifer is estimated to be 82 m<sup>3</sup>/day.

North Slope Cypress Hills/Bullshead Area						
Mow-Tech Ltd. gwQuery Results (metric)						
NW 16-011-06 W4M						
Detailed Results						
Formation Name	Top metre	Yield m <sup>3</sup> /day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
Upper Surficial Deposits	--	--	--	1623	889	32
Lower Surficial Deposits	0	82	17	1623	889	32
Bedrock Surface	49					
Foremost Formation	49	171	41	1983	812	53

**Table 12. Groundwater Query Results – North Slope Cypress Hills/Bullshead Area**

There are 15 water wells with apparent yield data that are completed in bedrock in the Bullshead area, eleven in township 011, range 04, W4M and four in township 011, range 05, W4M. Of the 15 water wells, seven are completed in the Oldman Aquifer and eight are in the Foremost Aquifer. Apparent yields from water wells completed in bedrock aquifers in the Bullshead area are expected to mainly range from 10 to 100 m<sup>3</sup>/day. There are ten water wells with apparent yield data that are completed in township 009, ranges 01 to 04, W4M. The seven surficial water wells are in ranges 03 and 04, W4M, with higher yields occurring in the Lower Sand and Gravel Aquifer in range 03, W4M. Of the three bedrock water wells, one is completed in the Bearpaw Aquifer and two are in the Oldman Aquifer. Apparent yields from water wells completed in bedrock aquifers are higher than 10 m<sup>3</sup>/day, with the two highest yields occurring in ranges 03 and 04, W4M, as shown in Table 13.

Water Wells in Township 009, Ranges 01 to 04, W4M					
Aquifer	No. of Water Wells with Values for Apparent Yield	Number of Water Wells with Apparent Yields			TDS mg/L
		<10 m <sup>3</sup> /day	10 to 100 m <sup>3</sup> /day	>100 m <sup>3</sup> /day	
Upper Sand and Gravel	2	0	2	0	#N/A
Lower Sand and Gravel	5	1	2	2	350
Bearpaw	1	0	1	0	1464
Oldman	2	0	1	1	#N/A

**Table 13. Water Wells in Tp 009, Rg 01 to 04, W4M**

In the groundwater database, there are 35 springs located in township 009, ranges 01 to 03, W4M, of which eight are at an elevation of between 1,100 and 1,150 metres AMSL. The measured flow rate is available for only one of the 35 springs; a spring in 16-09-009-03 W4M at an elevation of 770 metres AMSL has a flow rate of 1.51 lpm. There are two known licensed spring users in Cypress County: one at NW 07-009-02 W4M at an elevation of 1,130 metres AMSL and one at SE 13-009-03 W4M at an elevation of 1,115 m AMSL. The Hutterian Brethren Church of Elkwater is licensed to divert 142 m<sup>3</sup>/day from the spring in NW 07-009-02 W4M. Fawn Springs Water Company and the Ross Creek Water Co-op Ltd. are licensed to divert 277 m<sup>3</sup>/day from the spring in SE 13-009-03 W4M. Both springs had TDS concentrations of approximately 770 mg/L, sulfate concentrations of mainly less than 170 mg/L, chloride concentrations of less than 5 mg/L, and a total hardness concentration of less than 300 (Groundwater Exploration & Research Ltd., 1997). One example where a spring has been monitored over time is at the Paetku (Lick) Spring in NW 14-043-28 W4M, in Ponoka County. This spring was monitored by Mow-Tech Ltd. from 1989 to 1998. The hydrograph shows that during the ten-year interval, the 1989-1990 flow rate of around 200 lpm had more than doubled by 1991 to more than 500 lpm, and had also declined by half to less than 100 lpm in 1996-1997 (page A-69).

### 6.5.5 Hamlet of Irvine Area

**What is the likely extent and groundwater development potential of the aquifer into which the Hamlet of Irvine water supply wells are installed?**

The Hamlet of Irvine occupies section 31, township 011, range 02, W4M and the NE ¼ of section 36, township 011, range 02, W4M (M.D. of Cypress No. 1, Ownership Map, March 1996). The area of interest for the County includes townships 011 and 012, ranges 02 and 03, W4M. The Hamlet of Irvine is located on a meltwater channel that extends east from Dunmore near section 06, township 012, range 03, W4M to east of Irvine near section 03, township 012, range 02, W4M, as shown on the west-east cross-section D-D' (pages 14 and A-15). The cross-section shows that upper surficial deposits can be more than 40 metres thick, and lower surficial deposits are not only limited to within a few kilometres of NE 36-011-03 W4M but are less than ten metres thick. The lower sand and gravel deposits are generally less than five metres near Irvine (see CD-ROM).

In July 1973, the Groundwater Branch of Alberta Environment drilled seven water test holes in the Irvine area in an attempt to provide Irvine with a new water supply well. Of the seven water test holes drilled, only one was completed as a water well; the remaining six were abandoned. Of the seven water test holes drilled, only three encountered lower sand and gravel deposits of at least three metres in thickness. Water Test Hole 998E in 10-36-011-03 W4M encountered three metres of lower sand and gravel, WTH 1000E located closest to Irvine in 15-36-011-03 W4M encountered 7.3 metres of lower sand and gravel, and WTH 995E in 14-36-011-03 W4M encountered 7.6 metres of lower sand and gravel deposits. Water Test Hole 996E in 16-36-011-03 had encountered 1.5 metres of lower sand and gravel deposits, but due to drilling difficulties the test hole had to be abandoned before bedrock was reached (Lorberg, 1973). Because the AENV drill rig was unable to pull the casing from the water well (test hole 1000E), the water well was completed without a screen and was now to be used as an observation water well (HCL, 1975). A two-hour recovery-only aquifer test was conducted by AENV with WTH 1000E. Based on a maximum apparent transmissivity value of 39.5 m<sup>2</sup>/day, a maximum apparent yield of 1,100 m<sup>3</sup>/day was calculated (Lorberg, 1973).

In May 1975, a water supply well was drilled for the Hamlet of Irvine in 16-36-011-03 W4M, approximately 35 metres east of WTH 1000E. During the drilling of the new water supply well, 5.5 metres of lower sand and gravel deposits was encountered. This water supply well was drilled to a depth of 59.1 metres, but did not encounter bedrock. The water supply well was completed from 55.8 to 59.1 metres below ground surface. An extended pumping and recovery aquifer test with the new water supply well, using WTH 1000E as the observation water well, indicated an apparent yield of more than 1,300 m<sup>3</sup>/day.

Two new water supply wells were drilled for the Hamlet of Irvine in 1988 in 15-36-011-03 W4M after the casing collapsed in the 1975 water supply well. The drilling records show that 4.8 metres of lower sand and gravel were encountered during the drilling of each of the two water supply wells. PFRA (1990) reports that the expected long-term safe yield of more than 770 m<sup>3</sup>/day is limited by the water well screens. It is estimated that up to 1,300 m<sup>3</sup>/day could be obtained from the Lower Sand and Gravel Aquifer.

The apparent yield for individual water wells completed in NW 15-36-011-03 W4M through the Lower Sand and Gravel Aquifer is estimated to be 351 m<sup>3</sup>/day, as shown in the adjacent table containing an abbreviated version of the Groundwater Query Results.

**Irvine Area**  
Mow-Tech Ltd. gwQuery Results (metric)  
15-36-011-03 W4M

<b>Detailed Results</b>						
Formation Name	Top metre	Yield m <sup>3</sup> /day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
Upper Surficial Deposits	--	6	3	1719	686	14
Lower Surficial Deposits	44	351	15	1719	686	14
Bedrock Surface	49					
Oldman Formation	49	--	50	1369	296	98
Foremost Formation	114	281	-23	1211	--	--

**Table 14. Groundwater Query Results –  
Hamlet of Irvine Area**



### 6.5.6 Highway 3 Corridor – Medicine Hat to Seven Persons

What is the groundwater development potential of this area? Based on the available water-level data and current withdrawals, is there a risk of depletion?

The Highway 3 Corridor, underlain by the Buried Medicine Hat Valley, is the area where there are the largest number of water wells completed in the lower surficial deposits (Figure 13, page 18). There are more than 90 water wells with apparent yield data that are completed in the Lower Sand and Gravel Aquifer in this Area. The average apparent yield from these 90 water wells is 110 m<sup>3</sup>/day, with 86% having an apparent yield of less than 200 m<sup>3</sup>/day. There are eight records that indicate dry, or abandoned with “insufficient water”. There is only one licensed groundwater user in the Highway 3 Corridor. This groundwater user in 04-05-012-06 W4M is licensed to divert 40 m<sup>3</sup>/day for stock purposes. Within the Medicine Hat city limits, there are 13 groundwater users licensed to divert a total of 13,400 m<sup>3</sup>/day, or an average of 1,030 m<sup>3</sup>/day per user.

Groundwater from water wells completed in 04-01-011-07 W4M in the aquifers in the surficial deposits are expected to have TDS concentrations of approximately 1,534 mg/L, as shown in the adjacent table containing an abbreviated version of the Groundwater Query Results. The apparent yield for individual water wells completed through the Lower Sand and Gravel Aquifer is estimated to be 110 m<sup>3</sup>/day.

Of the 244 effective transmissivity values that were added to the groundwater database, more than 70 were from aquifer test results from water wells in the Highway 3 Corridor area. The flow through the Lower Sand and Gravel Aquifer is calculated to be 2,500 m<sup>3</sup>/day.

There are 28 water wells with apparent yield data that are completed in the Foremost Aquifer in the Highway 3 Corridor. More than 75% of the apparent yields from water wells completed in bedrock aquifers in the Highway 3 Corridor range from 10 to 100 m<sup>3</sup>/day.

The closest AENV observation water well to the Highway 3 Corridor is the inactive AENV Obs WW No. 116. This AENV Obs WW, completed in the Lower Sand and Gravel Aquifer, is located in 10-32-012-05 W4M in the east-central part of the City of Medicine Hat. The hydrograph for this Obs WW shows an overall water-level decline of approximately 0.5 metres from 1959 to 1995.

**Highway 3 Corridor**  
Mow-Tech Ltd. gwQuery Results (metric)  
**04-01-011-07 W4M**

Detailed Results	Top	Yield	NPWL	TDS	Sulfate	Chloride
Formation Name	metre	m <sup>3</sup> /day	metre	mg/L	mg/L	mg/L
Upper Surficial Deposits	--	--	--	1534	1058	38
Lower Surficial Deposits	0	110	16	1534	1058	38
Bedrock Surface	68					
Foremost Formation	68	74	38	2277	1039	50

**Table 15. Groundwater Query Results –  
Highway 3 Corridor – Medicine Hat to Seven Persons**

### 6.5.7 Elkwater Lake

What is the reliability of springs feeding Elkwater Lake and the potential impact of further residential development outside the park to the north and west.

Water levels have been measured at Elkwater Lake since 1917; however, it has only been since 1972 that consistent measurements have been recorded by Environment Canada. The water-level data were obtained by HCL and the available mean monthly water levels have been compared to annual precipitation measured at the Cypress Hills, Saskatchewan weather station. The graph below shows that a good correlation exists between the lowest annual water level measured and the total annual precipitation. In order to determine the reliability of the spring(s) feeding Elkwater Lake, the flow rate would need to be monitored and the relationship between the flow rate of the spring(s) and Elkwater Lake water level be investigated.

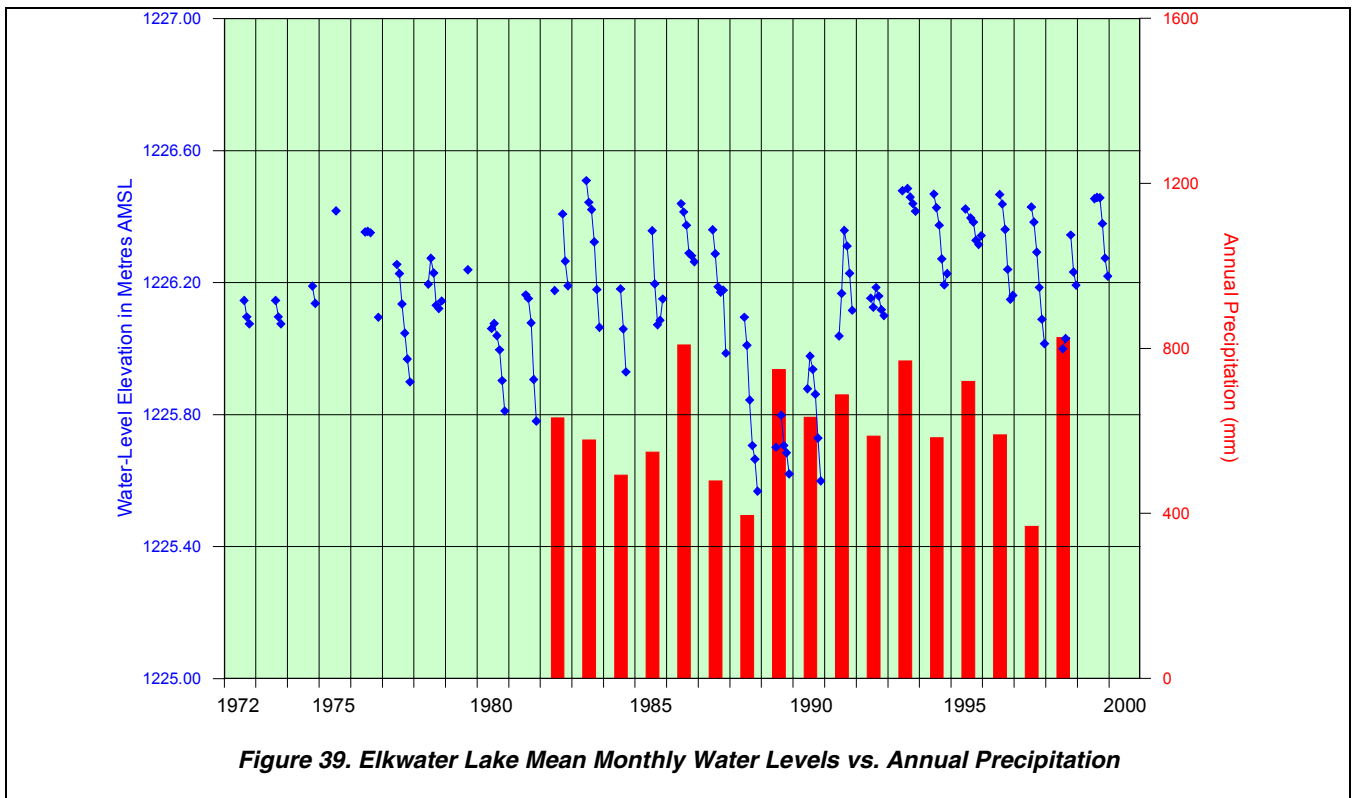


Figure 39. Elkwater Lake Mean Monthly Water Levels vs. Annual Precipitation

Because of the correlation between precipitation and the lake level, it could be concluded that either the spring discharge is directly related to precipitation and there is no apparent effect of development, or the spring discharge is insignificant relative to the water received from precipitation.