

# **Mountain Snow Conditions and Water Supply Forecasts for Alberta**

**October 2001**



**Notes**

Alberta Environment publishes the "Mountain Snow Conditions and Water Supply Forecasts for Alberta" monthly, usually from February to August. These reports are prepared by the Hydrology Branch, Forecasting Section of the Department's Environmental Operations Division.

Alberta Environment is grateful for the assistance of Environment Canada's Climatological Services Unit and Water Resources Branch in providing weather, precipitation and streamflow data. Snow survey data are also provided by the United States, Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks. The

assistance of a number of private citizens who diligently report observations of precipitation and other data is also appreciated.

Alberta Environment and the National Resources Conservation Service (NRCS) from Portland, Oregon are collaborating on the Water Supply Forecasts for the Milk and St. Mary Rivers. Water Supply forecasts for the Western United States are available through the NRCS web page:

[http://www.wcc.nrcs.usda.gov/water/w\\_qnty.html](http://www.wcc.nrcs.usda.gov/water/w_qnty.html)

All data summarized in this publication are preliminary and subject to revision.

Data used in this report are available on request from: Alberta Environment, Hydrology Branch, 10th Fl, Oxbridge Place, 9820 -106 Street, Edmonton, Alberta, T5K 2J6, Fax: (780) 422-8606

This report is also available through Alberta Environment's automated streamflow information/fax-on-demand service. To access this service toll-free, please call the Alberta Government RITE Operator at 310-0000, available 24 hours a day from anywhere in the province. At the prompt, enter the phone number **207-2718** for our streamflow information/fax on demand service.

**Historical Streamflow Information: Environment Canada, Calgary, (403) 292-5317**

**Equivalents of Measure**

| Parameter        | Metric Unit                         | Conversion to Imperial Units                                |
|------------------|-------------------------------------|---|
| Snow depth       | centimetres                         | 2.54 cm = 1 inch  |
| Water Equivalent | millimetres                         | 25.4 mm = 1 inch  |
| Elevation        | metres                              | 1 m = 3.2808 feet   |
| Streamflow       | cubic metres per second             | 1 cms = 35.3 cfs  |
| Volume           | cubic decametre (dam <sup>3</sup> ) | 1 dam <sup>3</sup> = 1000 m <sup>3</sup> = 0.8107 acre-feet |

**Explanation of Descriptions**

|                    |  |
|--------------------|--|
| Much-above-average | In the upper 15% of recorded values              |
| Above-average      | Between the upper 15% and 35% of recorded values |
| Below-average      | Between the lower 15% and 35% of recorded values |
| Much-below-average | In the lower 15% of recorded values              |

## **Overview**

### **Current Conditions**

Precipitation during the month of September was below-normal to much-below-normal in the majority of the province, except the extreme northern portions, which recorded above-normal precipitation. Most of the province recorded below-normal to much-below-normal precipitation over the May to September period.

Environment Canada's long-lead precipitation forecast for the October to November period indicates above-normal precipitation in the northern third of the province, normal precipitation in central areas, and below-normal in the southern third of the province. The same precipitation pattern is forecast for the December to February period. The National Oceanic and Atmospheric Administration (NOAA) is forecasting normal precipitation for the province during the fall.

Water storage as of October 1, 2001 in the major irrigation and hydroelectric reservoirs in the Bow and Oldman River basins is below-normal for this time of the season, with the exception of Keho Lake, which is normal. Storage conditions in the Oldman and Bow River basins are less than last year at this time. Water storage in the Red Deer and North Saskatchewan River basins are normal for this time of the season.

The Water Supply report will continue throughout the winter and will focus on the reporting of current conditions. In February, the Plains Runoff Outlook will be added to provide insight on runoff conditions for the plains area.

### **Water Supply Forecasts - Year in Review**

Recorded March to September 2001 natural runoff volume was much-below-average in the headwaters of the Milk, Oldman, Bow, Red Deer, and North Saskatchewan River basins. Recorded natural volume at all forecast locations (except the Elbow River) ranked in the lowest 10 years on record and there were new historical low natural volume records set in some locations. Forecasts that were prepared monthly, beginning in March (January for the Milk River) for the March to September runoff period performed very well at most locations. The difference between recorded natural runoff volumes and the forecasted values was less than 7.5% for 17 of the 20 forecast points. A detailed analysis for each forecast location is provided in the main report, summarizing this year's streamflow, precipitation and forecasts.

## **September Climatic Conditions**

Precipitation during the month of September was below-normal to much-below-normal in the majority of the province, except the extreme northern portions, which recorded above-normal precipitation (Figures 1 and 2). Most of the province recorded below-normal to much-below-normal precipitation over the May to September period (Figures 3 and 4).

## **Long-Lead Precipitation Outlook**

Environment Canada's long-lead precipitation forecast for the October to November period indicates above-normal precipitation in the northern third of the province, normal precipitation in central areas, and below-normal in the southern third of the province. The same precipitation pattern is forecast for the December to February period. The National Oceanic and Atmospheric Administration (NOAA) is forecasting normal precipitation for the province during the fall (October to November) and winter (December to February) periods.

## **Streamflow Conditions**

The March to September recorded natural volumes were much-below-average across the province in 2001 (Table 1). This year has seen very dry conditions in the majority of the province and has resulted in some new historical minimum volumes being recorded.

**Table 1 Recorded Natural Streamflow Volumes as of October 1, 2001**

| Location                             | March to September 2001<br>Recorded Natural<br>Streamflow Volumes<br>as a percent of Average |
|--------------------------------------|--|
| Milk River at Milk River*            | 24*  |
| Oldman River at Lethbridge           | 48   |
| Bow River at Calgary                 | 66   |
| Red Deer River at Red Deer           | 51   |
| North Saskatchewan River at Edmonton | 67   |

\* The value for Milk River is compared to the median

## **Reservoir Storage Conditions**

Water storage in the major irrigation reservoirs of the Oldman River basin is below-normal for this time of the season, with the exception of Keho Lake, which is normal (Table 2).

*Mountain Snow Conditions and Water Supply Forecasts for Alberta – October 2001*

**Table 2 Status of Major Water Storage Reservoirs as of October 1, 2001 – Oldman River Basin**

| Reservoirs           | Current Live Storage       |                     |                         | Remarks      | October 1, 2000 Live Storage |           |
|----------------------|----------------------------|---------------------|-------------------------|--------------|------------------------------|-----------|
|                      | Volume in dam <sup>3</sup> | Volume in acre-feet | Volume as % of Capacity |              | dam <sup>3</sup>             | acre-feet |
| Keho Lake            | 79,900                     | 64,800              | 84                      | normal       | 84,100                       | 68,200    |
| Waterton Reservoir   | 68,000                     | 55,100              | 40                      | below-normal | 68,200                       | 55,300    |
| St. Mary Reservoir   | 36,000                     | 29,200              | 9                       | below-normal | 41,000                       | 33,300    |
| Ridge Reservoir      | 24,500                     | 19,900              | 19                      | below-normal | 39,100                       | 31,700    |
| <b>Total</b>         | 129,000                    | 104,000             | 19                      | below-normal | 148,000                      | 120,000   |
| Chin Reservoir       | 26,300                     | 21,300              | 14                      | below-normal | 74,100                       | 60,100    |
| Forty Mile Reservoir | 9,330                      | 7,570               | 11                      | below-normal | 43,000                       | 34,900    |
| <b>Total</b>         | 35,600                     | 28,900              | 13                      | below-normal | 117,000                      | 95,000    |
| Oldman Reservoir     | 144,000                    | 117,000             | 29                      | below-normal | 298,000                      | 241,000   |

Water storage in most of the major hydroelectric and irrigation reservoirs in the Bow River basin is below-normal for the season (Table 3).

**Table 3 Status of Major Water Storage Reservoirs as of October 1, 2001 - Bow River Basin**

| Reservoirs                | Current Live Storage       |                     |                           | Remarks      | October 1, 2000 Live Storage |           |
|---------------------------|----------------------------|---------------------|---------------------------|--------------|------------------------------|-----------|
|                           | Volume in dam <sup>3</sup> | Volume in acre-feet | Volume as a % of Capacity |              | dam <sup>3</sup>             | acre-feet |
| Lake Minnewanka           | 157,000                    | 127,000             | 70                        | below-normal | 163,000                      | 132,000   |
| Spray Lake                | 113,000                    | 92,000              | 64                        | below-normal | 168,000                      | 136,000   |
| Upper Kananaskis Lake     | 71,000                     | 57,600              | 69                        | below-normal | 86,200                       | 69,900    |
| Lower Kananaskis Lake     | 46,300                     | 37,500              | 73                        | below-normal | 51,100                       | 41,400    |
| <b>Total</b>              | 388,000                    | 314,000             | 68                        | below-normal | 468,000                      | 380,000   |
| Lake McGregor             | 160,000                    | 129,000             | 44                        | below-normal | 280,000                      | 227,000   |
| Travers Reservoir         | 40,000                     | 32,400              | 38                        | below-normal | 60,600                       | 49,100    |
| <b>Total</b>              | 200,000                    | 162,000             | 43                        | below-normal | 341,000                      | 276,000   |
| Lake Newell               | 102,000                    | 82,800              | 57                        | below-normal | 146,000                      | 118,000   |
| Crawling Valley Reservoir | 69,400                     | 56,200              | 62                        | below-normal | 100,000                      | 81,100    |
| <b>Total</b>              | 172,000                    | 139,000             | 59                        | below-normal | 246,000                      | 199,000   |

*Mountain Snow Conditions and Water Supply Forecasts for Alberta – October 2001*

Water storage in Glennifer Lake (Red Deer River basin) is normal for this time of the season (Table 4).

**Table 4 Status of Major Water Storage Reservoirs as of October 1, 2001 – Red Deer River Basin**

| Reservoirs     | Current Live Storage       |                     |                           | Remarks | October 1, 2000 Live Storage |           |
|----------------|----------------------------|---------------------|---------------------------|---------|------------------------------|-----------|
|                | Volume in dam <sup>3</sup> | Volume in acre-feet | Volume as a % of Capacity |         | dam <sup>3</sup>             | acre-feet |
| Glennifer Lake | 192,000                    | 156,000             | 95                        | normal  | 200,000                      | 162,000   |

Water storage in the North Saskatchewan River basin major hydroelectric reservoirs is normal for this time of the year (Table 5).

**Table 5 Status of Major Water Storage Reservoirs as of October 1, 2001  
North Saskatchewan River Basin**

| Reservoirs        | Current Live Storage       |                     |                           | Remarks | October 1, 2000 Live Storage |           |
|-------------------|----------------------------|---------------------|---------------------------|---------|------------------------------|-----------|
|                   | Volume in dam <sup>3</sup> | Volume in acre-feet | Volume as a % of Capacity |         | dam <sup>3</sup>             | acre-feet |
| Lake Abraham      | 1,165,000                  | 945,000             | 83                        | normal  | 1,218,000                    | 988,000   |
| Brazeau Reservoir | 387,000                    | 314,000             | 80                        | normal  | 470,000                      | 381,000   |
| <b>Total</b>      | 1,553,000                  | 1,259,000           | 82                        | normal  | 1,689,000                    | 1,369,000 |

**Groundwater Conditions**

As of October 1, 2001 groundwater levels in observation wells were predominantly much-below-normal to below-normal throughout the province (Table 6). In Southern Alberta, the Milk River and Medicine Hat areas conditions were much-below-normal with the exception of two deep wells. In the Pincher Creek to Calgary Area the levels were above-normal with one well below-normal. In eastern Alberta, from Brooks to Coronation regions, water levels were much-below-normal with one deep well being much-above-normal, another being normal and a third being below-normal. In the Edmonton to northeastern parts of the province, conditions were much-below-normal with exception of the well at Killam, which was normal and two wells were below-normal. In the Athabasca-Peace region, water levels were much-below-normal, with the exception of the shallow well at Grimshaw-Kerndale, which was below-normal. Shallow wells are less than 30 metres deep.

**Table 6 Groundwater Conditions as of October 1, 2001**

| AREA                         | WELL NAME             | AQUIFER | OBSERVATION WELL GROUNDWATER LEVEL |
|------------------------------|-----------------------|---------|------------------------------------|
| Milk River                   | Del Bonita 70-3       | Deep    | much-below-normal                  |
| Milk River                   | Milk River 2479E      | Shallow | much-below-normal                  |
| Milk River                   | Cressday              | Deep    | above-normal                       |
| Cypress Hills                | Cypress               | Shallow | much-below-normal                  |
| Lethbridge – Medicine Hat    | Pakowki               | Deep    | much-above-normal                  |
| Medicine Hat                 | Ross Creek 2288E      | Deep    | much-below-normal                  |
| Lethbridge                   | Barons 615E           | Shallow | much-below-normal                  |
| Pincher Creek                | Oldman Dam            | Shallow | above-normal                       |
| Calgary                      | Okotoks 2378E         | Deep    | above-normal                       |
| Calgary                      | Cluny 85-2 (South)    | Shallow | above-normal                       |
| Bowden                       | Dickson Dam 4015A     | Shallow | below-normal                       |
| Brooks                       | Cavendish             | Shallow | much-below-normal                  |
| Brooks                       | Duchess 2564E         | Shallow | much-below-normal                  |
| Brooks                       | Buffalo North 85-2    | Deep    | much-above-normal                  |
| Coronation-Brooks            | Big Stone             | Deep    | normal                             |
| Coronation-Brooks            | Sibbald 85-2          | Deep    | much-below-normal                  |
| Coronation-Brooks            | Sounding Creek        | Deep    | below-normal                       |
| Coronation                   | Kirkpatrick Lake 86-3 | Shallow | much-below-normal                  |
| Provost                      | Metiskow 88-3         | Shallow | much-below-normal                  |
| Camrose – Lloydminster       | Killam                | Shallow | normal                             |
| Lloydminster                 | Innisfree 2403E       | Shallow | below-normal                       |
| Vegreville                   | Vegreville            | Deep    | below-normal                       |
| Edmonton                     | Devon #2 (North)      | Shallow | much-below-normal                  |
| Elk Point                    | Derwent 2408E         | Shallow | much-below-normal                  |
| Whitecourt – Athabasca       | Barrhead              | Deep    | much-below-normal                  |
| Athabasca                    | Narrow Lake 2229E     | Shallow | much-below-normal                  |
| Grande Prairie – Peace River | Watino 2353E          | Shallow | much-below-normal                  |
| Peace River                  | Grimshaw Kerndale     | Shallow | below-normal                       |
| La Crete                     | La Crete              | Shallow | much-below-normal                  |
| La Crete                     | La Crete              | Shallow | much-below-normal                  |

## **Water Supply Volume Forecasts – Year in Review**

The remainder of this report will report on current conditions and analyze the recorded volumes for this past water year and put in perspective how this summer compares with other years for each forecast location. Also, this report will evaluate and compare the recorded natural volumes to the forecasts produced for this past summer.

During the past year, forecasts of natural runoff volume were produced monthly for the March to September period beginning in March (January in the Milk River basin) and last forecast was produced in August. Due to the dry conditions this past winter, a special March to June forecast was produced for the South Saskatchewan River basin at the beginning of February, March and April.

The monthly Water Supply forecasts use current conditions and assumes normal precipitation for the months remaining in the period. For example, the March forecast used the current information (snow conditions, precipitation, water levels, etc.) and assumed normal precipitation for the remainder of the period (in this case – March, April, May, June, July, August and September were assumed to have normal precipitation). Therefore, if the precipitation was below-normal for a month, the forecast would overestimate the runoff that actually occurred.

With each forecast, a probable range is calculated (blue shaded area in graphs). The probable range (lower and upper limits) means there is a 50% probability that the actual natural flow will fall within the probable range: a 25% probability that the actual flow will be less than the lower bound (red dashed line in graph), and a 25% probability that the actual flow will be greater than the upper bound (orange dashed line in graph) of the probable range. The reasonable minimum (green dashed line) means that there is a 10% chance that the actual natural flow will be less than the reasonable minimum. The area between the reasonable minimum and lower bound of the probable range is shaded yellow.

Each forecast location has a graph, which contains the forecast, probable range and reasonable minimum for all forecasts produced for the past year. The March to September recorded volume (blue line with diamonds for monthly totals) will be plotted against the forecasts to see how the forecasts performed. The difference between the recorded and forecast values will be discussed.



## **Milk River Basin**

Recorded March to September 2001 natural runoff volume in the Milk River basin was much-below-average (Table 7). Despite the low runoff this year, the recorded March to September natural volume were on average, within 4.3% of forecasted values produced for the Milk River basin.

**Table 7 Recorded Natural Streamflow Volumes for March 1 to September 30, 2001  
Milk River Basin**

| <b>Locations</b>               | <b>Volume in dam<sup>3</sup></b> | <b>Volume as a % of Median</b> | <b>Ranking in 1912-95 data (lowest to highest)</b> | <b>Average difference between Mar-Sept Forecasts and Recorded natural volumes</b> |
|--------------------------------|----------------------------------|--------------------------------|--|---|
| Milk River at Western Crossing | 13,500                           | 24                             | 6  | 4.4%  |
| Milk River at Milk River       | 23,300                           | 24                             | 5  | 3.9%  |
| Milk River at Eastern Crossing | 24,900                           | 21                             | 1  | 4.5%  |

\* Information is based on preliminary data  
Median is calculated for the period from 1912 to 1995

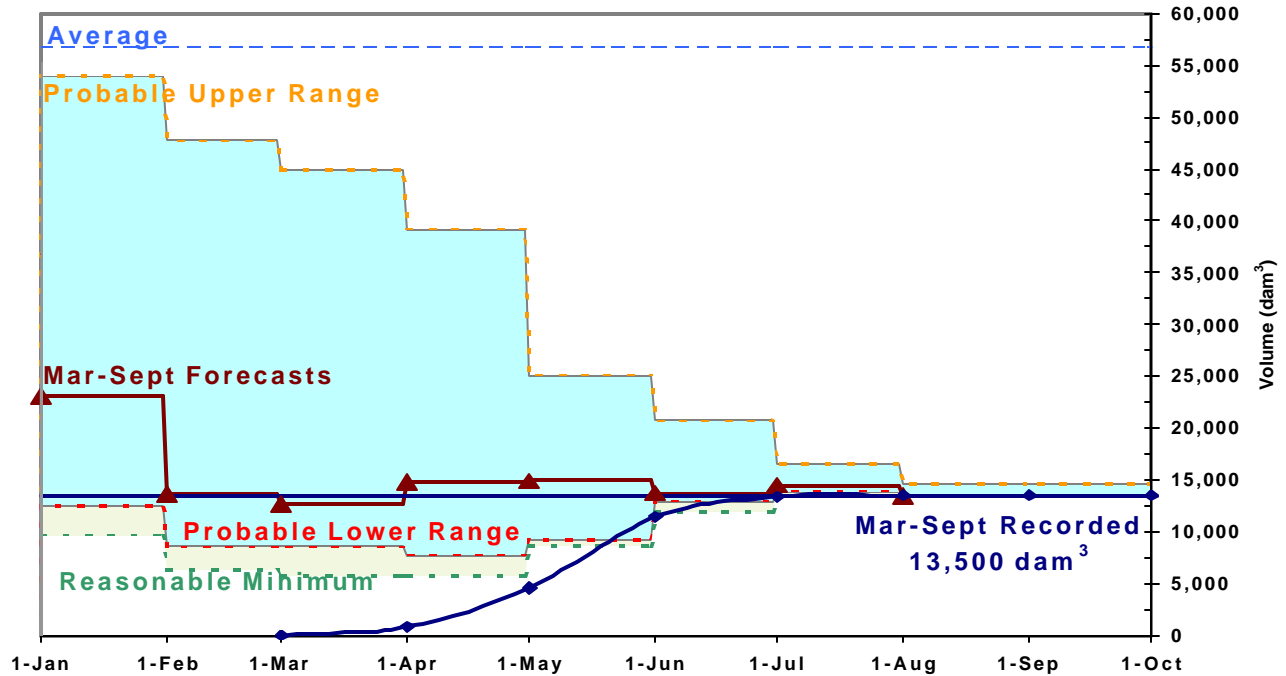
Precipitation in the headwaters of the Milk River basin was much-below-normal for the March to September period (Figures 5 and 6). Winter precipitation (November 2000 to March 2001) was much-below-normal. Since spring, most months recorded much-below-normal to below-normal precipitation with the exception of April, where the headwaters received above-normal precipitation. Since April, precipitation in the May to September period remains much-below-normal (Figures 3 and 4). Very little precipitation was recorded in the basin during September (10% of normal) (Figures 1 and 2).

### **Milk River at Western Crossing**

The March to September 2001 recorded natural volume for the Milk River at Western Crossing was 13,500 dam<sup>3</sup> or 24% of median and ranks sixth lowest on record (based on the 1912-95 data) (Table 7). There was no flow at Western Crossing in August or September (a new historical low).

Eight (January to August) monthly natural volume forecasts were produced for Western Crossing for the March to September period. The recorded March to September natural volume at Western Crossing (blue line) was, on average, within 4.4% of the forecasted values for the season. The recorded volume was within the probable range seven of the eight forecasts (except July forecast) with all eight forecasts greater than the reasonable minimum (all forecasts

Figure 7 Water Supply Forecasts for the Milk River at Western Crossing



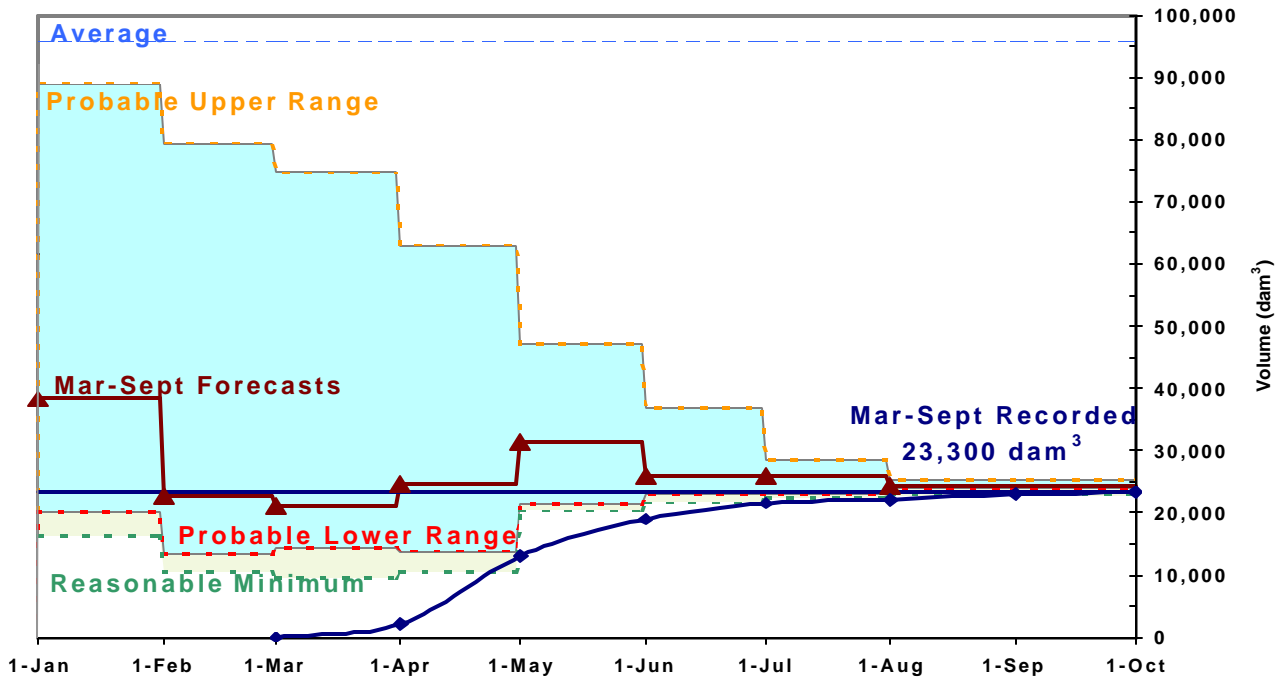
are shown in Figure 7 (brown triangles)). Forecasts ranged from 0.3% to 17.3% of the recorded volumes, of which, six of the forecasts were within five percent of the recorded values (difference between brown triangles and blue straight line in Figure 7)). Only the January forecast (17.3% difference from recorded values) was not within 8% of the recorded volume. The closest forecast to the recorded natural volume was produced in February (0.3%). The forecasted values remained fairly steady beginning with February's forecast.

**Milk River at Milk River**

The March to September 2001 recorded natural volume for the Milk River at Milk River was 23,300 dam<sup>3</sup> or 24% of median and ranks fifth lowest on record (based on the 1912-95 data) (Table 7).

Eight (January to August) monthly forecasts were produced for Milk River for the March to September period. Recorded March to September natural volume at Milk River (blue line) was, on average, within 3.9% of the forecasted values for the season. The recorded volume was within the probable range and greater than the reasonable minimum on all eight forecasts (all forecasts are shown in Figure 8 (brown triangles)). Forecasts ranged from 0.3% to 15.7% of the recorded volumes, of which, six of the forecasts were within 2.9% of the recorded values (Figure 8). Only the January (15.7%) and the May (6.6%) forecasts were not within 2.9% of the recorded volume. The closest forecast to the recorded natural volume was produced in February (0.3%).

Figure 8 Water Supply Forecasts for the Milk River at Milk River



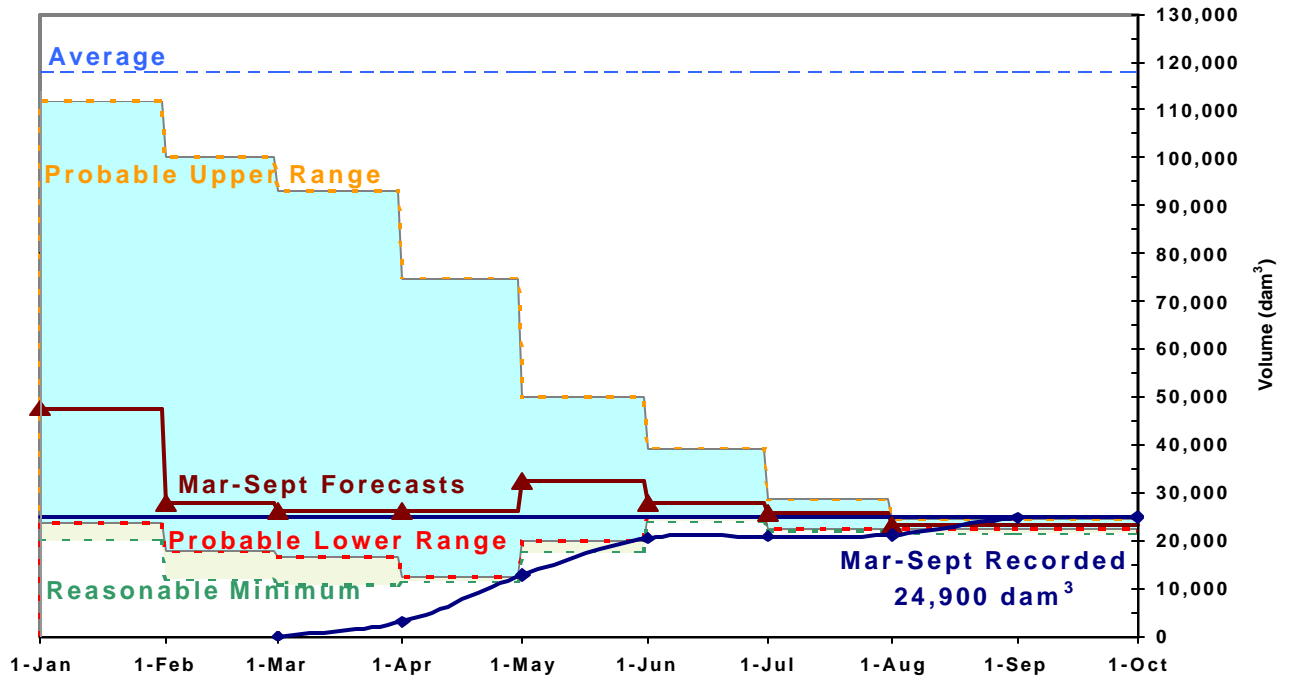
The forecasted values remained fairly steady beginning in February. The only significant increase was in the May forecast which was caused by the above-normal precipitation in April.

### **Milk River at Eastern Crossing**

The March to September 2001 recorded natural volume for the Milk River at Eastern Crossing was 24,900 dam<sup>3</sup> or 21% of median and ranks the lowest on record (based on the 1912-95 data) (Table 7).

Eight (January to August) monthly forecasts were produced for Milk River at Eastern Crossing for the March to September period. Recorded March to September natural volume at Eastern Crossing (blue line) was, on average, within 4.5% of the forecasted values for the season. The recorded volume was within the probable range for six of the eight forecasts and greater than the reasonable minimum for all eight forecasts (all forecasts are shown in Figure 9 (brown triangles)). Forecasts ranged from 0.7% to 19.8% of the recorded volumes, of which, six of the forecasts were within 2.8% of the recorded values (Figure 9). Only the January (19.8%) and the May (6.5%) forecasts were not within 2.8% of the recorded volume. The closest forecast to the recorded natural volume was produced in July (0.7%). The forecasted values remained fairly steady beginning in February. The only significant increase was in the May forecast which was caused by the above-normal precipitation in April.

Figure 9 Water Supply Forecasts for the Milk River at Eastern Crossing



## **Oldman River Basin**

Recorded March to September 2001 natural runoff volume in the Oldman River basin was much-below-average (Table 8). Despite the low runoff this year, the natural volume forecasts produced for the Oldman River basin were within 4.5% of recorded values, on average.

**Table 8 Recorded Natural Streamflow Volumes for March 1 to September 30, 2001  
Oldman River Basin**

| <b>Locations</b>           | <b>Volume in dam<sup>3</sup></b> | <b>Volume as a % of Average</b> | <b>Ranking in 1912-95 data (lowest to highest)</b> | <b>Average difference between Mar-Sept Forecasts and Recorded natural volumes</b> |
|----------------------------|----------------------------------|---------------------------------|--|---|
| St. Mary River             | 410,000                          | 54                              | 5  | 5.5%  |
| Belly River                | 172,000                          | 70                              | 9  | 3.7%  |
| Waterton River             | 399,000                          | 60                              | 9  | 4.7%  |
| Oldman River near Brocket  | 528,000                          | 48                              | 5  | 2.6%  |
| Oldman River at Lethbridge | 1,425,000                        | 48                              | 6  | 5.9%  |

\* Information is based on preliminary data  
Average is calculated for the period from 1912 to 1995

Precipitation in the headwaters of the Oldman River basin was much-below-normal for the March to September period (Figures 5 and 6). Most months recorded much-below-normal to below-normal precipitation with the exception of April and June, which recorded above-normal precipitation. Precipitation was much-below-normal in September (Figures 1 and 2). The latter portion of the summer (July through September) recorded much-below-normal precipitation in the basin, setting new records at some locations. As a result, precipitation in the May-September period was much-below-normal (Figures 3 and 4). The headwaters (especially the Waterton and St. Mary Rivers) received above-normal precipitation in April due to a major snowstorm in the first few days of the month. Heavy precipitation was recorded in the southwestern corner of the province during the first few days of June, however the rest of the month was relatively dry. Mountain snowpack was near record low values in the spring, particularly north of the Castle River headwaters in the Oldman River basin.

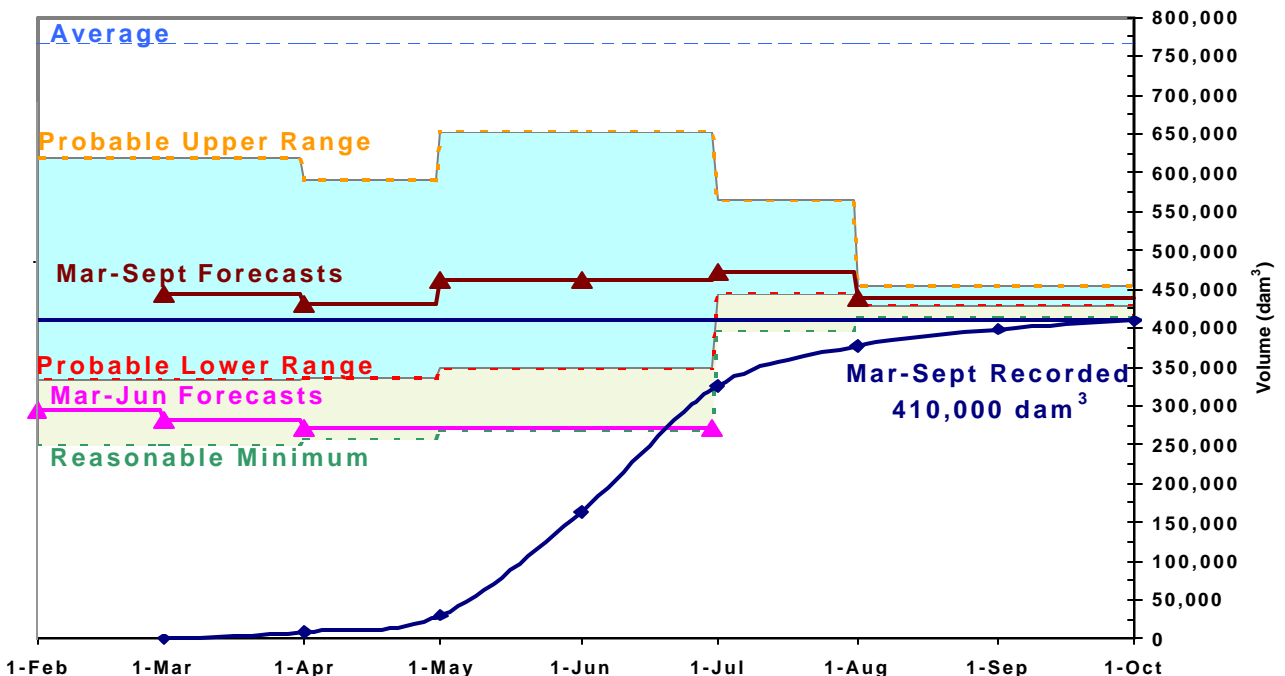
### **St. Mary River at St. Mary Reservoir**

The March to September 2001 recorded natural volume for the St. Mary River at St. Mary Reservoir was 410,000 dam<sup>3</sup> or 54% of average and ranks fifth lowest on record (based on the 1912-95 data) (Table 8). The March to June 2001 recorded natural volume for the St. Mary River

at St. Mary Reservoir was 325,000 dam<sup>3</sup> or 62% of average and ranked ninth lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for the St. Mary River at St. Mary Reservoir for the March to September period. Recorded March to September natural volume for the St. Mary River (blue line) was on average within 5.5% of the forecasted values for the season. The recorded volume was within the probable range four out of six forecasts and all forecasts were greater than the reasonable minimum (all forecasts are shown in Figure 10 (brown triangles)). Forecasts ranged within 2.8% to 8.3% of the recorded volumes, of which, five of the forecasts were within seven percent of the recorded values (difference between brown triangles and blue line in Figure 10). All six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in April (2.8%). Forecasted values remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable increase occurred in the May 1 forecast, as precipitation in the headwaters was above-normal. The August 1 forecast dropped due to below-normal precipitation in the headwaters during July. The recorded volumes for the July to September (July forecast) and the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values recorded during that period. The recorded July to September natural volumes for the St. Mary River were the second lowest on record.

Figure 10 Water Supply Forecasts for the St. Mary River



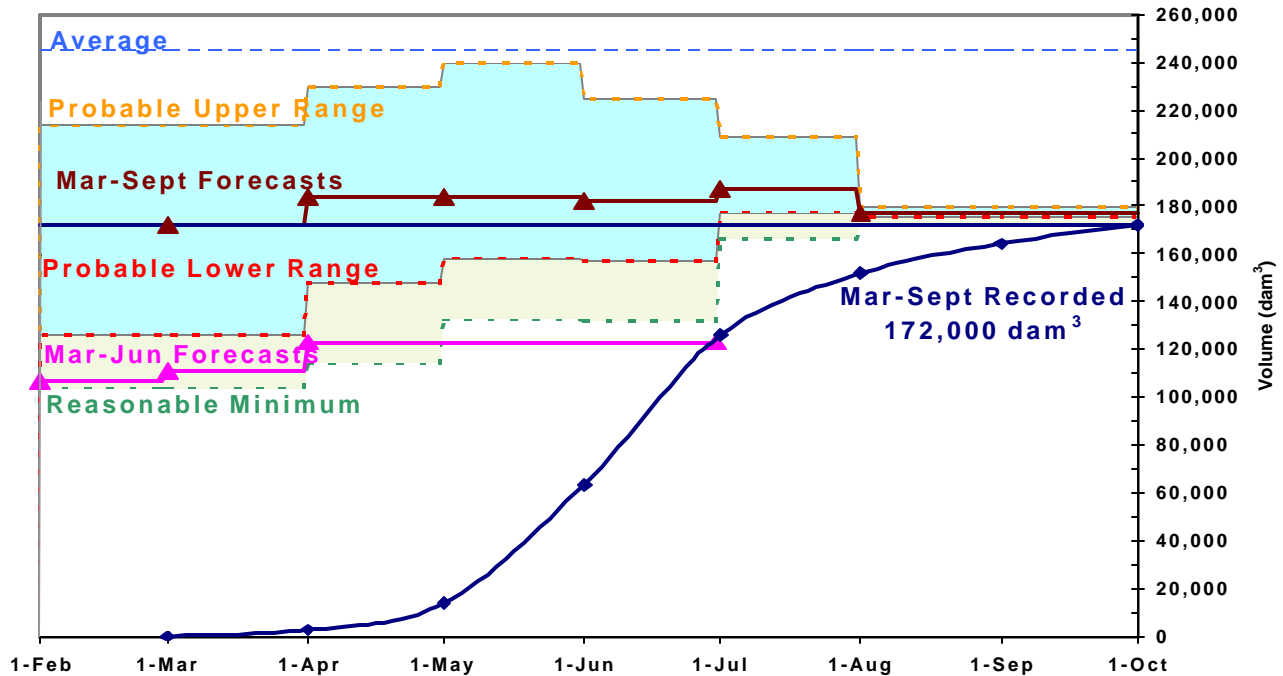
March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 10). Forecasts, on average, underestimated the recorded flow by 9.2% for the period (difference between pink triangle and blue diamond on July 1). Recorded volume for the period fell within the probable range of all three forecasts. The large difference in the forecasts is attributed to the major snowstorm that hit the basin in early April, which significantly changed the forecasts.

### **Belly River near Mountainview**

The March to September 2001 recorded natural volume for the Belly River near Mountainview was 172,000 dam<sup>3</sup> or 70% of average and ranks ninth lowest on record (based on the 1912-95 data) (Table 8). The March to June 2001 recorded natural volume for the Belly River near Mountainview was 126,000 dam<sup>3</sup> or 78% of average and ranked 14th lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for the Belly River for the March to September period. Recorded March to September natural volume for the Belly River (blue line) was relatively close to the forecasted values, on average within 3.7% for the season. The recorded volume was within the probable range four out of six forecasts and all forecasts were greater than the reasonable minimum (all forecasts are shown in Figure 11 (brown triangles)). Forecasts ranged within 6.2% of the recorded volumes, of which, three of the forecasts were within four percent of the recorded values. Five of the six forecasted volumes were higher than the actual recorded value (blue solid line) as a result of the below-normal precipitation. The best forecast was the March 1 forecast, which matched the recorded volume exactly! The forecasts remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable increase occurred in the April 1 forecast, as precipitation in the headwaters was above-normal. The August 1 forecast dropped due to below-normal precipitation in the headwaters during July. The recorded volumes for the July to September (July forecast) and the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values recorded during that period. The recorded July to September natural volumes for the Belly River were the fourth lowest on record.

Figure 11 Water Supply Forecasts for the Belly River



March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 11). Forecasts, on average, underestimated the recorded flow by 5.5% for the period (difference between pink triangle and blue diamond on July 1). Recorded volume for the period fell within the probable range of all three forecasts. The difference in the forecasts is attributed to the major snowstorm that hit the basin in early April as the previous forecasts assumed normal precipitation over the forecast period.

### Waterton River at Waterton Reservoir

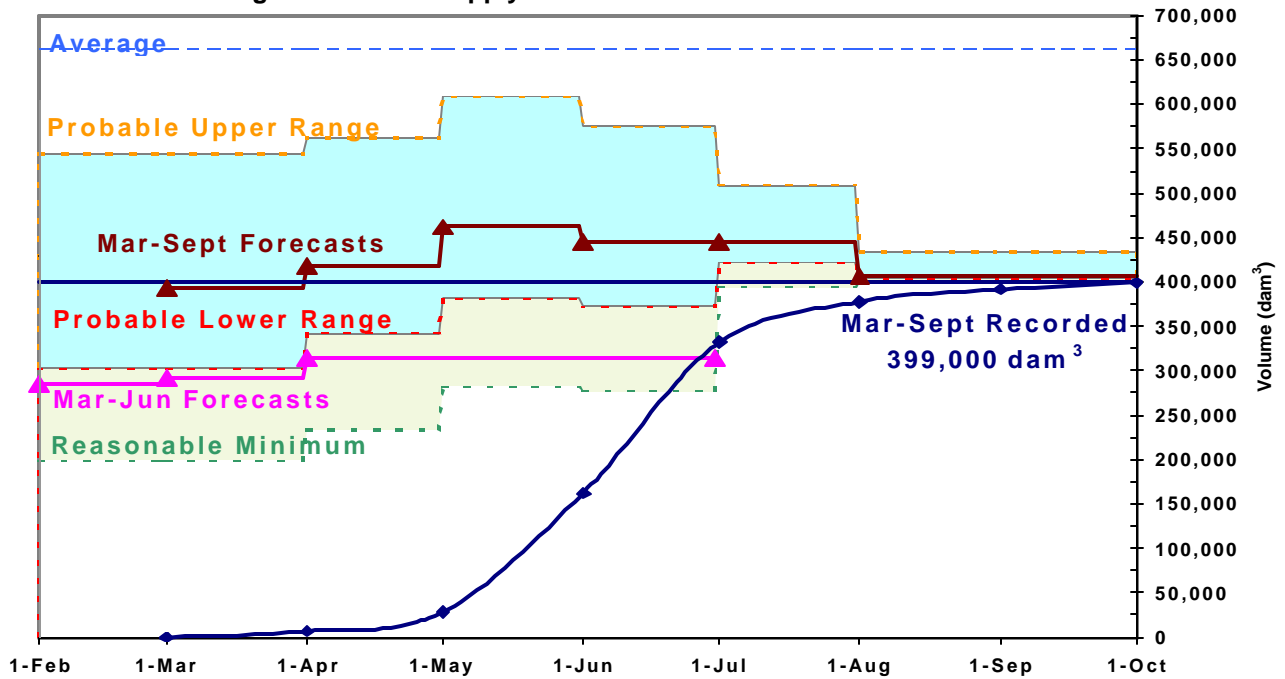
The March to September 2001 recorded natural volume for the Waterton River at Waterton Reservoir was 399,000 dam<sup>3</sup> or 60% of average and ranks ninth lowest on record (based on the 1912-95 data) (Table 8). The March to June 2001 recorded natural volume for the Waterton River at Waterton Reservoir was 332,000 dam<sup>3</sup> or 69% of average and ranked 14th lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for the Waterton River for the March to September period. Recorded March to September natural volume for the Waterton River (blue line) was on average within 4.7% of the forecasted values for the season. The recorded volume was within the probable range four out of six forecasts and greater than the reasonable minimum in five of the six forecasts (all forecasts are shown in Figure 12 (brown triangles)). Forecasts ranged within 0.7 to 9.5% of the recorded volumes, of which, three of the forecasts were within three percent of the recorded values. Five of the six forecasted volumes



(except March forecast) were higher than the actual recorded value (blue line) as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in March (0.7%). The forecasts remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable increase occurred in the May 1 forecast, as precipitation in the headwaters was above-normal. The August 1 forecast dropped due to below-normal precipitation in the headwaters during July. The recorded volumes for the July to September (July forecast) and the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values recorded during that period. The recorded August to September natural volumes for the Waterton River were the lowest on record while the July to September natural volumes ranked second lowest on record.

**Figure 12 Water Supply Forecasts for the Waterton River**

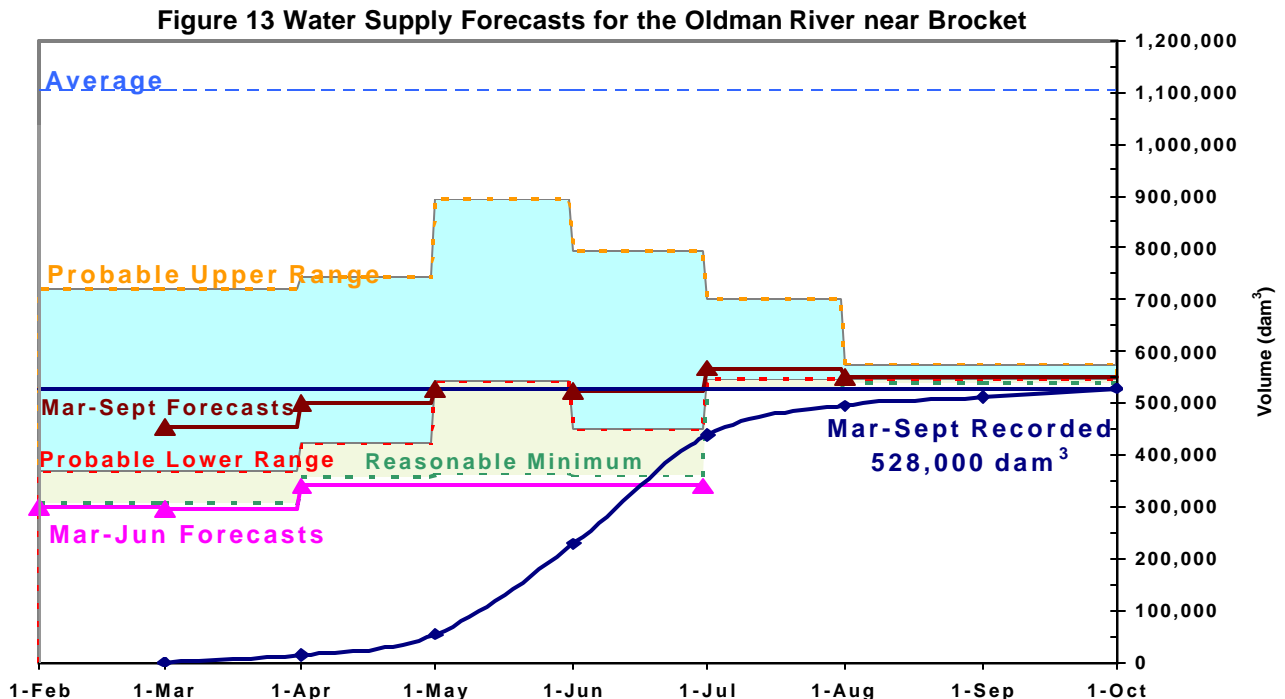


March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 12). Forecasts, on average, underestimated the recorded flow by 6.1% for the period (difference between pink triangle and blue diamond on July 1). Recorded volume for the period fell within the probable range of all three forecasts. The large difference in the forecasts is attributed to the major snowstorm that hit the basin in early April, which significantly changed the forecasts.

**Oldman River near Brocket**

The March to September 2001 recorded natural volume for the Oldman River near Brocket was 528,000 dam<sup>3</sup> or 48% of average and ranks fifth lowest on record (based on the 1912-95 data) (Table 8). The March to June 2001 recorded natural volume for the Oldman River near Brocket was 439,000 dam<sup>3</sup> or 52% of average and ranked eighth lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for the Oldman River near Brocket for the March to September period. Recorded March to September natural volume for the Oldman River near Brocket (blue line) was on average within 2.6% of the forecasted values for the season. The recorded volume was within the probable range and greater than the reasonable minimum for five out of six forecasts (all forecasts are shown in Figure 13 (brown triangles)). Forecasts ranged within 6.7% of the recorded volumes, of which, five of the forecasts were within five percent of the recorded values. The July and August forecasts overestimated the recorded volume (blue line) due to the extremely dry conditions over that period. The best forecast was produced on May 1, as the forecasted value matched the recorded natural volume. The forecasted volume increased steadily from the March forecast with the largest increases observed in the April and May forecasts due to above-normal precipitation in the basin during the previous month. From the June forecast onward, forecasts remained fairly steady with minor fluctuations from month to month depending on recorded



precipitation. The recorded volumes for the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values recorded during that period. The recorded August to September natural volumes for the Oldman River near Brocket were the lowest on record (24% lower than the previous historical low).

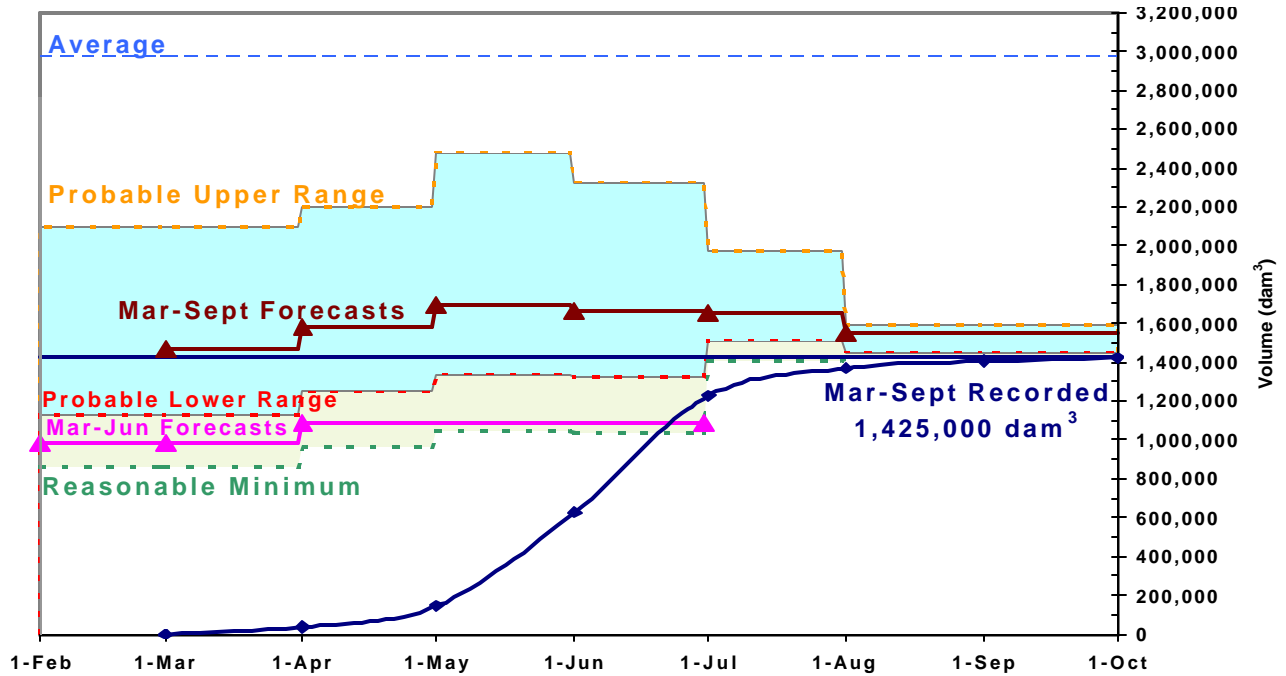
March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 13). Forecasts, on average, underestimated the recorded flow by 14.4% for the period (difference between the pink triangle and the blue diamond on July 1). Recorded volume for the period fell within the probable range of all three forecasts. The large difference in the forecasts is attributed to the major snowstorm that hit the basin in early April, which significantly changed the forecasts.

### **Oldman River at Lethbridge**

The March to September 2001 recorded natural volume for the Oldman River at Lethbridge was 1,425,000 dam<sup>3</sup> or 48% of average and ranks sixth lowest on record (based on the 1912-95 data) (Table 8). The March to June 2001 recorded natural volume for the Oldman River at Lethbridge was 1,226,000 dam<sup>3</sup> or 57% of average and ranked tenth lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for the Oldman River at Lethbridge for the March to September period. Recorded March to September natural volume for the Oldman River at Lethbridge (blue line) was on average within 5.9% of the forecasted values for the season. The recorded values were within the probable range four out of six forecasts and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 14 (brown triangles)). Forecasts ranged within 1.3% to 9.0% of the recorded volumes, of which, three of the forecasts were within six percent of the recorded values. The July and August forecasts overestimated the recorded volume due to the extremely dry conditions over that period. Five of the six forecasted volumes (except March forecast) were higher than the actual recorded value (blue line) as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in March (1.3%). The forecasts increased steadily from the March forecast with the largest increases observed in the April and May forecasts due to above-normal precipitation in the basin during the previous month. From the June forecast onward, forecasts dropped slightly due to below-normal precipitation in the basin. The recorded volumes for the July to September and the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values

Figure 14 Water Supply Forecasts for the Oldman River at Lethbridge



recorded during that period. The recorded July to September and the August to September natural volumes for the Oldman River at Lethbridge were the lowest on record.

March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 14). Forecasts, on average, underestimated the recorded flow by 9.0% for the period (difference between the pink triangle and blue diamond on July 1). Recorded volume for the period fell within the probable range of all three forecasts. The large difference in the forecasts is attributed to the major snowstorm that hit the headwater portion of the basin in early April, which significantly changed the forecasts.

## **Bow River Basin**

Recorded March to September 2001 natural runoff volume in the Bow River basin was much-below-average (Table 9). Despite the low runoff this year, the natural volume forecasts produced for the Bow River basin were within 7.8% of recorded values, on average.

**Table 9 Recorded Natural Streamflow Volumes for March 1 to September 30, 2001  
Bow River Basin**

| <b>Locations</b>       | <b>Volume in dam<sup>3</sup></b> | <b>Volume as a % of Average</b> | <b>Ranking in 1912-95 data (lowest to highest)</b> | <b>Average difference between Mar-Sept Forecasts and Recorded natural volumes</b> |
|------------------------|----------------------------------|---------------------------------|--|---|
| Bow River at Banff     | 752,000                          | 70                              | 2  | 9.4%  |
| Lake Minnewanka Inflow | 127,000                          | 67                              | 7  | 4.8%  |
| Spray Lake near Banff  | 203,000                          | 55                              | 1  | 13.1%   |
| Kananaskis River       | 275,000                          | 66                              | 2  | 6.6%  |
| Bow River at Calgary   | 1,621,000                        | 66                              | 3  | 7.4%  |
| Elbow River            | 144,000                          | 65                              | 12   | 8.0%  |
| Highwood River         | 314,000                          | 50                              | 8  | 5.3%  |

\* Information is based on preliminary data  
Average is calculated for the period from 1912 to 1995

Precipitation in the headwaters of the Bow River basin was much-below-normal for the March to September period (Figures 5 and 6). Most months recorded much-below-normal to below-normal precipitation with the exception of April and June, which recorded above-normal precipitation. A major snowstorm in early April produced much-above-normal precipitation, with the heaviest amounts in the Kananaskis, Elbow and Highwood River headwaters. Previous to this storm, mountain snowpack at a majority of the sites within the basin set new historical minimums. During the summer, the May-September period recorded much-below-normal precipitation and with the exception of a storm in early June, precipitation values were extremely low (Figures 3 and 4). Precipitation remained much-below-normal in September (Figures 1 and 2).

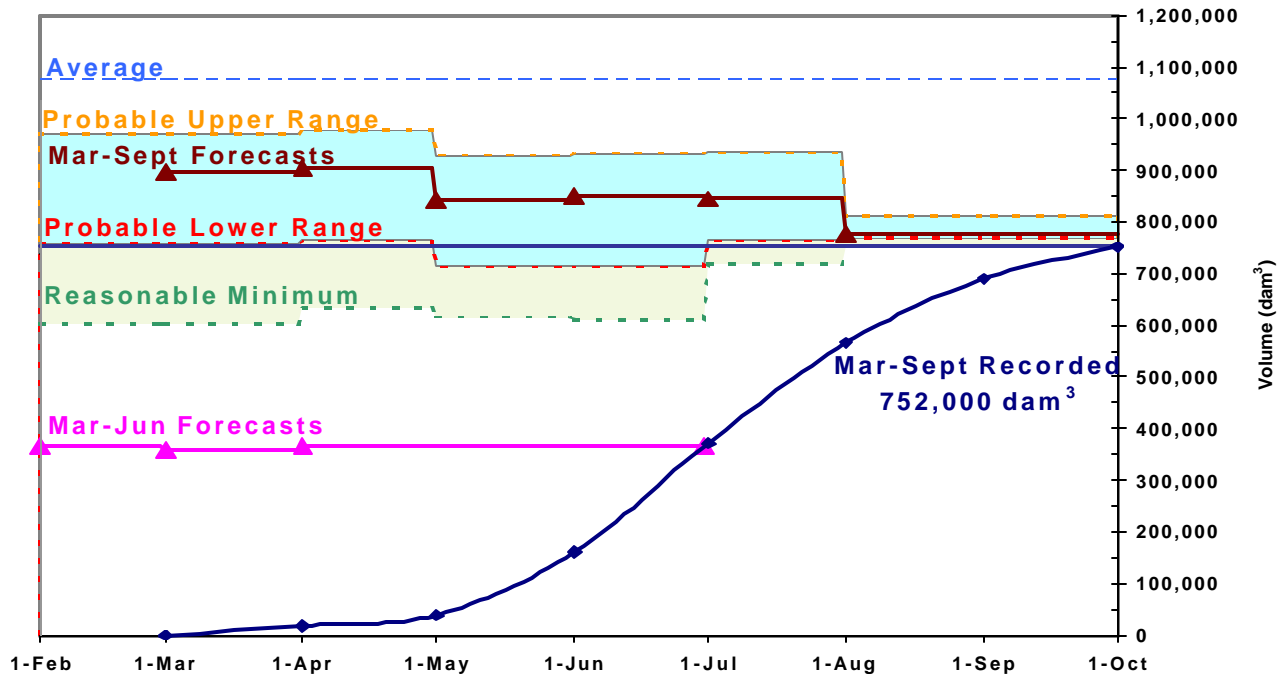
### **Bow River at Banff**

The March to September 2001 recorded natural volume for the Bow River at Banff was 752,000 dam<sup>3</sup> or 70% of average and ranks second lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Bow River at Banff

was 372,000 dam<sup>3</sup> or 73% of average and ranked seventh lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for Banff for the March to September period. Recorded March to September natural volume for Banff (blue line) was on average within 9.4% of the forecasted values for the season. The recorded volume was within the probable range three out of six forecasts and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 15 (brown triangles)). Forecasts ranged within 2.3% to 14.2% of the recorded volumes, of which, four of the forecasts were within nine percent of the recorded values. All six forecasted volumes were higher than the actual recorded value (blue line) as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in August (2.3%). The forecasted values dropped steadily (the most noticeable decreases in the May 1 and August 1 forecasts) throughout the forecast period, as precipitation in the headwaters was below-normal. The recorded volumes from the April, July and August forecasts did not fall within the probable range due to the extremely low precipitation values recorded during that period. The recorded August to September natural volumes for Banff were the lowest on record.

Figure 15 Water Supply Forecasts for the Bow River at Banff



March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 15). Forecasts were very good for this period as they were, on average,

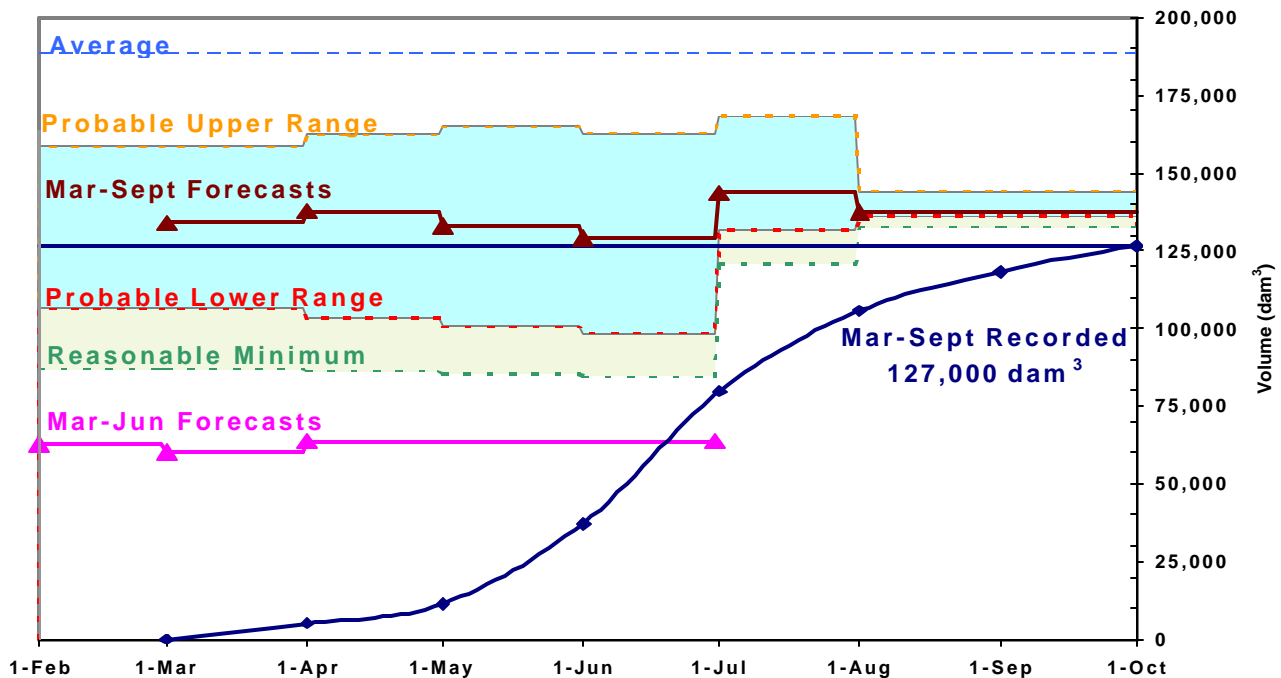
within 1.5% of the recorded flow (difference between the pink triangle and the blue diamond on July 1). Recorded volume for the period fell within the probable range of all three forecasts.

**Lake Minnewanka Inflow**

The March to September 2001 recorded natural volume for the inflow to Lake Minnewanka was 127,000 dam<sup>3</sup> or 67% of average and ranks seventh lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Lake Minnewanka was 79,800 dam<sup>3</sup> or 80% of average and ranked 21st lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for Lake Minnewanka for the March to September period. Recorded March to September natural volume for the inflow to Lake Minnewanka (blue line) was on average within 4.8% of the forecasted values for the season. The recorded volume was within the probable range four out of six forecasts and greater than the reasonable minimum in five of the six forecasts (all forecasts are shown in Figure 16 (brown triangles)). Forecasts ranged within 1.2% to 9.0% of the recorded volumes, of which, five of the forecasts were within six percent of the recorded values. The forecasted values remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable increase occurred in the July 1 forecast, as precipitation in the headwaters was above-normal. The July and August

**Figure 16 Water Supply Forecasts for Lake Minnewanka**



forecasts overestimated the recorded volume due to the extremely dry conditions over that period. The closest forecast to the recorded natural volume was produced in June (1.2%). The recorded volumes for the July to September (July forecast) and the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values recorded during that period. The recorded July to September and the August to September natural volumes for Lake Minnewanka were the third lowest on record.

March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 16). Forecasts, on average, underestimated the recorded flow by 18.0% for the period (difference between the pink triangle and blue diamond on July 1). Recorded volume for the period fell above the probable upper range on all three forecasts. The large difference in the forecasts is attributed to the major snowstorm that hit the basin in early April, which significantly changed the forecasts.

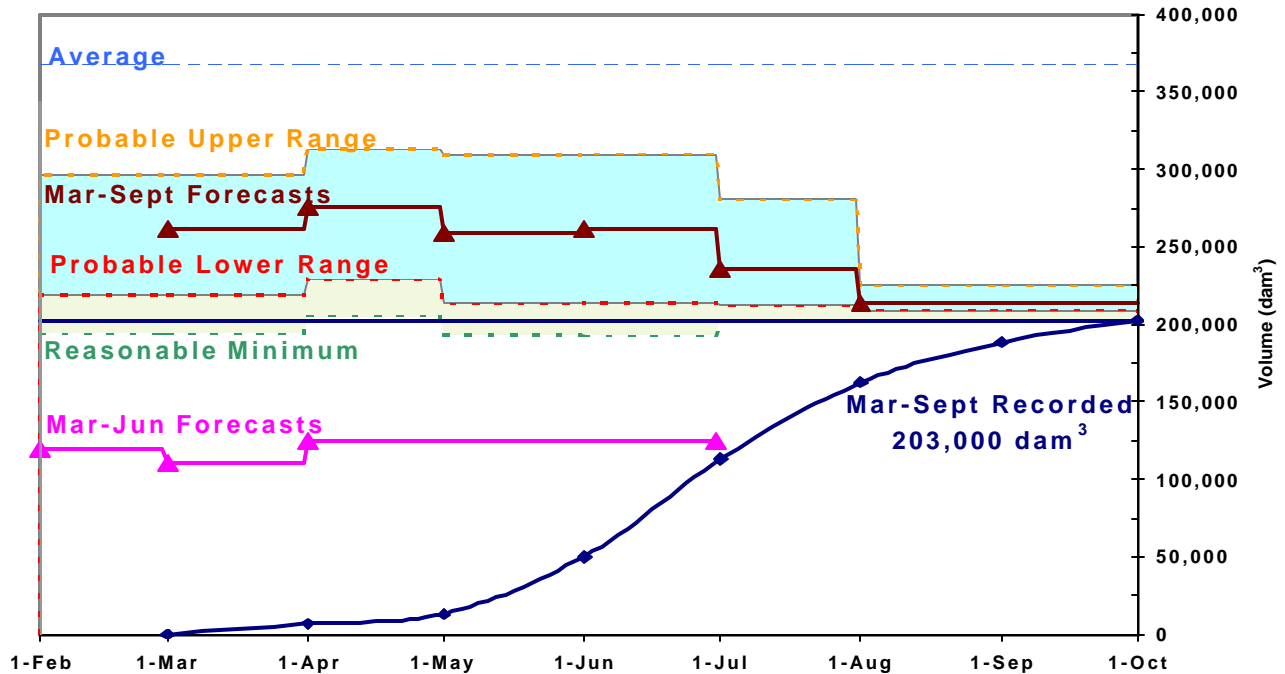
### **Spray Lake near Banff**

The March to September 2001 recorded natural volume for the Spray River near Banff was 203,000 dam<sup>3</sup> or 55% of average and is the lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Spray River near Banff was 113,000 dam<sup>3</sup> or 73% of average and is the lowest on record (based on the 1912-95 data).

Six (March to August) monthly natural volume forecasts were produced for the Spray River for the March to September period. Recorded March to September natural volume for the Spray River (blue line) was on average within 13.1% of the forecasted values for the season. The recorded volume was within the probable range on none of six forecasts but was greater than the reasonable minimum in five of the six forecasts (all forecasts are shown in Figure 17 (brown triangles)). Forecasts ranged within 3.0% to 19.7% of the recorded volumes, of which, only two of the forecasts were within nine percent of the recorded values. All six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The difference between the forecast and the recorded volume was the greatest of any forecast point in the province. Forecasts did not perform that well for this location because the precipitation in this area was extremely low. As a result, the recorded volumes followed very closely to the reasonable minimum that was forecast. The recorded volume for the period was within 2.6% of forecast reasonable minimum values. The closest forecast to the recorded natural volume was produced in August (3.0%). The forecasted values dropped steadily throughout the forecast season based on the recorded below-normal precipitation with the most noticeable decreases



Figure 17 Water Supply Forecasts for the Spray River



occurring in the July 1 and August 1 forecasts, as precipitation in the headwaters was below-normal.

March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 17). Forecasts for this period performed much better, as they were on average within 3.6% of the recorded flow (difference between the pink triangles and the blue diamond on July 1). Recorded volume for the period fell within the probable range on all three forecasts.

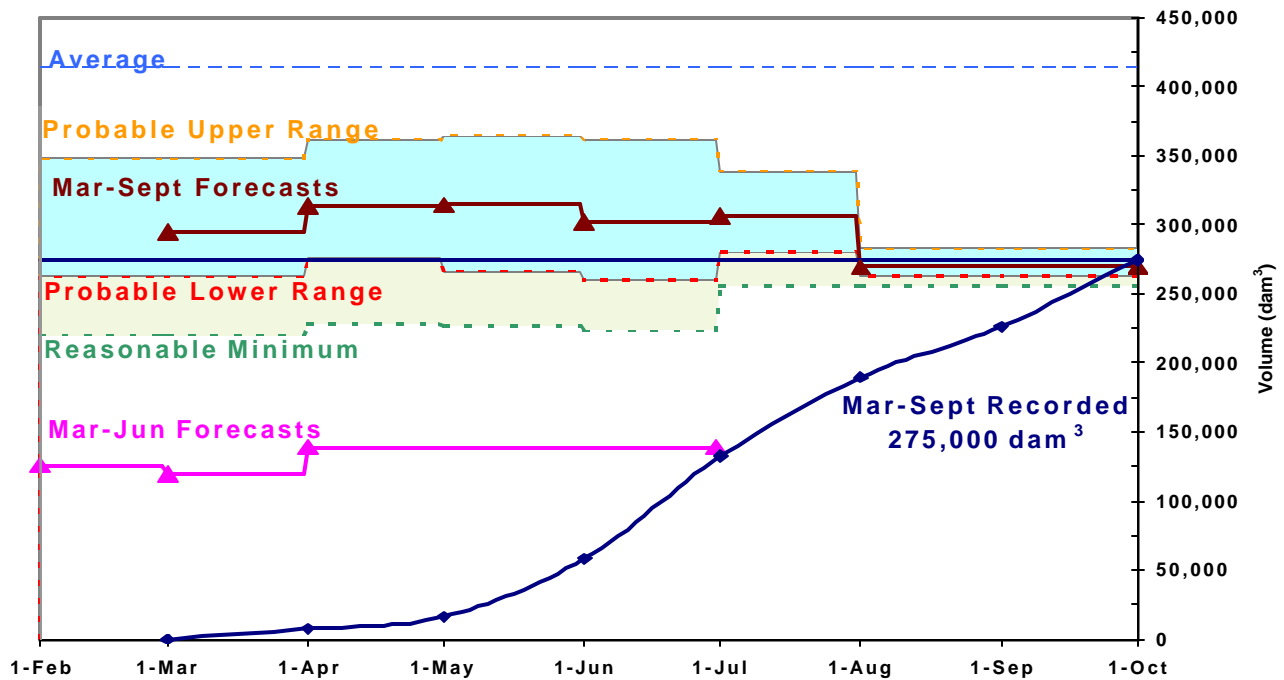
**Kananaskis River**

The March to September 2001 recorded natural volume for the Kananaskis River was 275,000 dam<sup>3</sup> or 66% of average and ranks second lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Kananaskis River was 132,000 dam<sup>3</sup> or 64% of average and ranked fourth lowest on record (based on the 1912-95 data).

Six monthly (March to August) natural volume forecasts were produced for the Kananaskis River for the March to September period. Recorded March to September natural volume for the Kananaskis River (blue line) was on average within 6.6% of the forecasted values for the season. The recorded volume was within the probable range four out of six forecasts and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 18 (brown triangles)). Forecasts ranged within 1.2% to 9.6% of the recorded volumes, of which,

three of the forecasts were within seven percent of the recorded values. The earlier forecasts (particularly April and May) overestimated the recorded volume because of the extremely dry conditions in the latter part of the summer. The closest forecast to the recorded natural volume was produced in August (1.2%). The forecasts remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable increase occurred in the April 1 forecast, as precipitation in the headwaters was above-normal. The August 1 forecast dropped significantly due to the very dry conditions in July. The April and July forecasts did not fall in the probable range due in part, to the extremely low precipitation values recorded during that period. The recorded August to September natural volumes for the Kananaskis River were the lowest on record. March to June natural volume forecasts were produced in February, March and April (shown as

Figure 18 Water Supply Forecasts for the Kananaskis River



pink triangles in Figure 18). Forecasts, on average, were within 4.6% of the recorded volume for the period (difference between the pink triangle and the blue diamond on July 1). Recorded volume for the period fell in the probable upper range on all three forecasts.

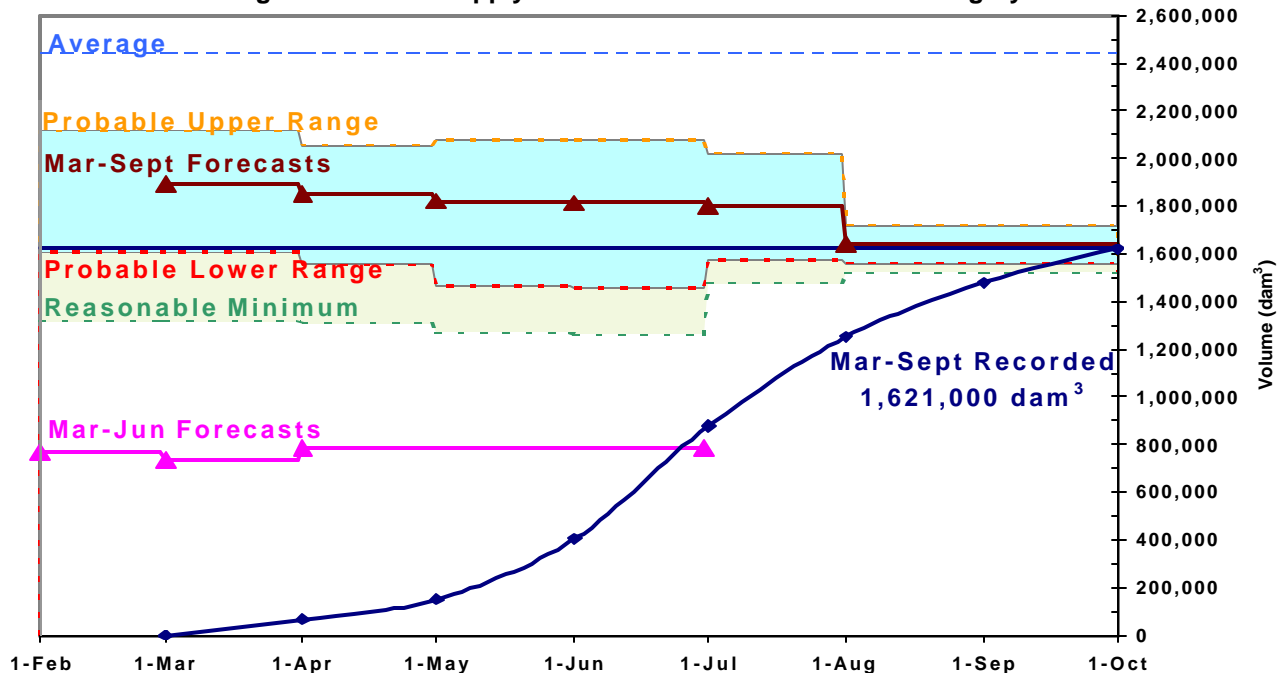
**Bow River at Calgary**

The March to September 2001 recorded natural volume for the Bow River at Calgary was 1,621,000 dam<sup>3</sup> or 66% of average and ranks third lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Bow River at Calgary was

879,000 dam<sup>3</sup> or 73% of average and ranked ninth lowest on record (based on the 1912-95 data).

Six monthly (March to August) natural volume forecasts were produced for the Bow River at Calgary for the March to September period. Recorded March to September natural volume for Calgary (blue line) was on average within 7.4% of the forecasted values for the season. The recorded volume was within the probable range and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 19 (brown triangles)). Forecasts ranged within 0.9% to 11.1% of the recorded volumes, of which, four of the forecasts were within eight percent of the recorded values. All six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in August (0.9%). The forecasted values dropped slightly throughout the forecast season based on the recorded below-normal precipitation. The most noticeable decrease occurred in the August 1 forecast as a result of the precipitation in the headwaters being much-below-normal. The recorded August to September natural volumes for Calgary were the lowest on record and the July to September recorded volumes second lowest on record.

Figure 19 Water Supply Forecasts for the Bow River at Calgary



March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 19). Forecasts, on average, underestimated the recorded flow by 9.6% for the period (difference between the pink triangle and the blue diamond on July 1). Recorded volume for the period fell within the probable range in two out the three forecasts (except March

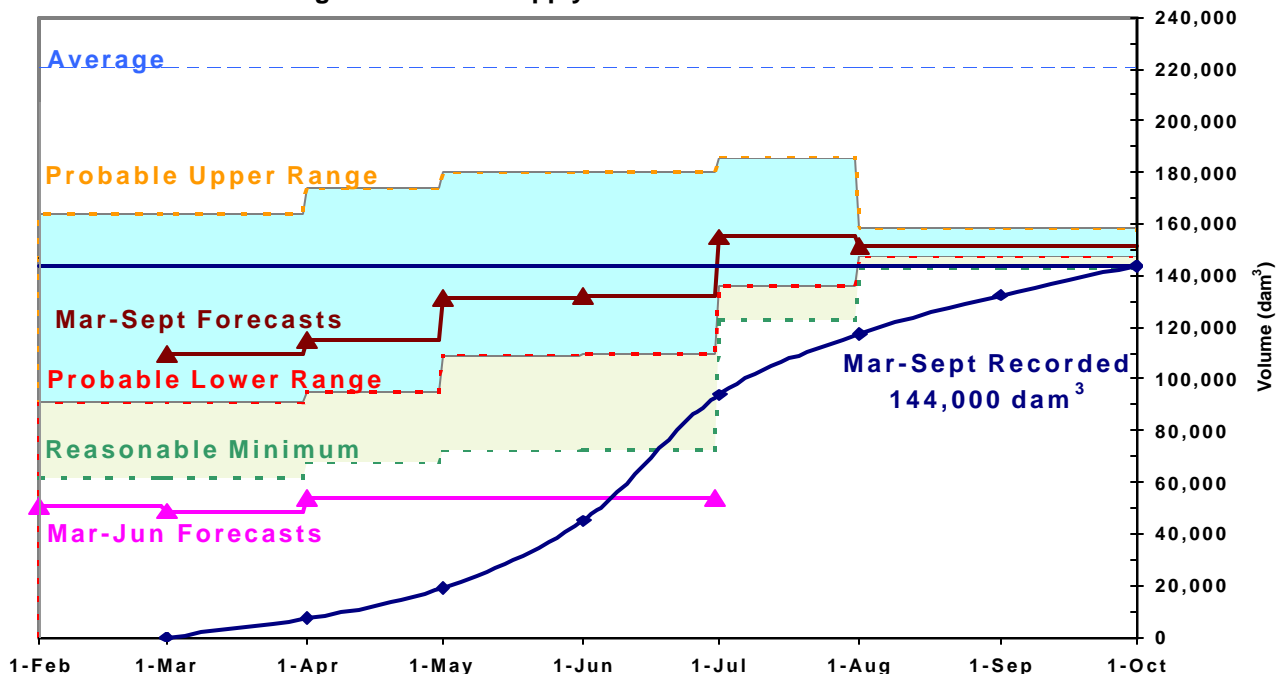
forecast). The large difference in the forecasts is attributed to the major snowstorm that hit the headwater portion of the basin in early April and the earlier than normal mountain snowmelt, which produced more volume than forecast.

### Elbow River at Bragg Creek

The March to September 2001 recorded natural volume for Elbow River was 144,000 dam<sup>3</sup> or 65% of average and ranks twelfth lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Elbow River was 94,000 dam<sup>3</sup> or 73% of average and ranked 24th lowest on record (based on the 1912-95 data).

Six monthly (March to August) natural volume forecasts were produced for the Elbow River for the March to September period. Recorded March to September natural volume for the Elbow River (blue line) was on average within 8.0% of the forecasted values for the season. The recorded volume was within the probable range five out of six forecasts and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 20 (brown triangles)). Forecasts ranged within 3.5% to 15.4% of the recorded volumes, of which, four of the forecasts were within six percent of the recorded values. The July and August forecasts overestimated the recorded volume due to the extremely dry conditions over that period. The closest forecast to the recorded natural volume was produced in August (3.5%). The early forecasts (March and April) underestimated the recorded flow by a large margin (14%). The large difference was

Figure 20 Water Supply Forecasts for the Elbow River



caused by the early April snowstorm that hit the area, producing heavy snowfall. The Elbow River basin was the hardest hit from the storm and significantly changed the forecasts beginning in May (Figure 20). The other noticeable increase occurred in the July 1 forecast, as precipitation in the headwaters was above-normal. The recorded volumes for the August to September (August forecast) period did not fall in the probable range due to the extremely low precipitation values recorded during that period. The recorded August to September natural volumes for the Elbow River were the fourth lowest on record.

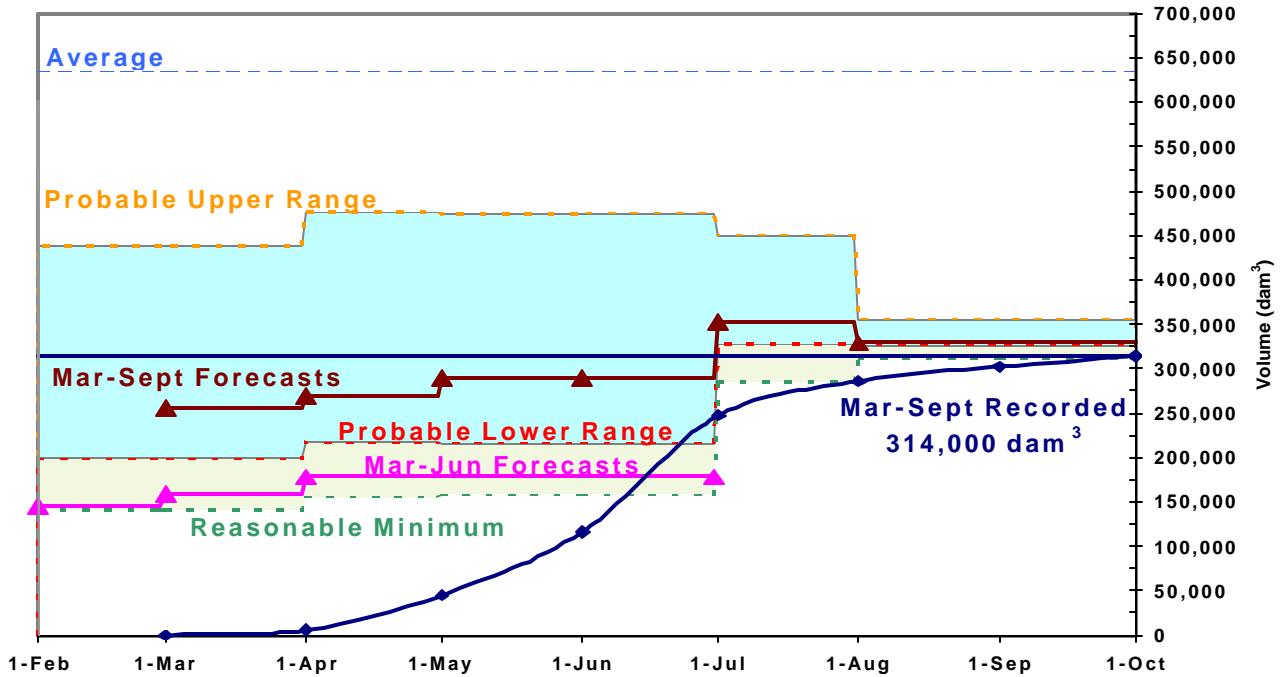
March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 20). Forecasts, on average, underestimated the recorded flow by 18.0% for the period (difference between the pink triangle and blue diamond on July 1). Recorded volume for the period fell above the probable upper range on all three forecasts. The large difference in the forecasts is attributed to the major snowstorm that hit the basin in early April, which significantly changed the forecasts.

### **Highwood River**

The March to September 2001 recorded natural volume for the Highwood River was 314,000 dam<sup>3</sup> or 50% of average and ranks eighth lowest on record (based on the 1912-95 data) (Table 9). The March to June 2001 recorded natural volume for the Highwood River was 247,000 dam<sup>3</sup> or 57% of average and ranked 14th lowest on record (based on the 1912-95 data).

Six monthly (March to August) natural volume forecasts were produced for the Highwood River for the March to September period. Recorded March to September natural volume for the Highwood River (blue line) was on average within 5.3% of the forecasted values for the season. The recorded volume was within the probable range four of the six forecasts and greater than the reasonable minimum in five of six forecasts (all forecasts are shown in Figure 21 (brown triangles)). Forecasts ranged within 2.4% to 9.1% of the recorded volumes, of which, four of the forecasts were within six percent of the recorded values. The first four forecast volumes (March, April, May and June) were lower than the actual recorded value as a result of the above-normal precipitation in the spring and early summer. The closest forecast to the recorded natural volume was produced in August (2.4%). The forecasts generally rose slightly throughout the forecast season until August based on the recorded precipitation. The most noticeable increase occurred in the July 1 forecast as a result of above-normal precipitation in June. The recorded volumes from the July and August forecasts did not fall within the probable range due to the extremely low precipitation values recorded during that period. The recorded August to September natural volumes for the Highwood River were the second lowest on record.

Figure 21 Water Supply Forecasts for the Highwood River



March to June natural volume forecasts were produced in February, March and April (shown as pink triangles in Figure 21). Forecasts, on average, underestimated the recorded flow by 22.1% for the period (difference between the pink triangle and blue diamond on July 1). Recorded volume for the period fell in the probable range on two of the three forecasts. The large difference between the forecast and recorded volumes is attributed to the major snowstorm that hit the basin in early April, which significantly changed the forecasts after they were produced.

## **Red Deer River Basin**

Recorded March to September 2001 natural runoff volume in the Red Deer River basin was much-below-average (Table 10). Despite the low runoff this year, the natural volume forecasts produced for the Red Deer River basin were within 5.5% of recorded values, on average.

**Table 10 Recorded Natural Streamflow Volumes for March 1 to September 30, 2001  
Red Deer River Basin**

| <b>Locations</b>           | <b>Volume in dam<sup>3</sup></b> | <b>Volume as a % of Average</b> | <b>Ranking in 1912-95 data (lowest to highest)</b> | <b>Average difference between Mar-Sept Forecasts and Recorded natural volumes</b> |
|----------------------------|----------------------------------|---------------------------------|--|---|
| Glennifer Lake             | 584,000                          | 62                              | 8  | 5.8%  |
| Red Deer River at Red Deer | 674,000                          | 51                              | 5  | 5.5%  |

\* Information is based on preliminary data  
Average is calculated for the period from 1912 to 1995

Precipitation in the headwaters of the Red Deer River basin was much-below-normal for the March to September period (Figures 5 and 6). The headwaters of the Red Deer River basin recorded much-below-normal precipitation in September (Figures 1 and 2). Precipitation totals for the May-September period are below-normal to much-below-normal in the Red Deer River basin (Figures 3 and 4). Most months recorded much-below-normal to below-normal precipitation with the exception of June, where the headwaters received above-normal precipitation. Mountain snowpack was near record low values in the spring except for the northern edge of the basin, where near record high snowpack was recorded. The lack of runoff from the spring snowpack and summer precipitation in the plains area (between Dickson Dam and Red Deer) is clearly evident when comparing the natural volumes as a percent of average (Table 10).

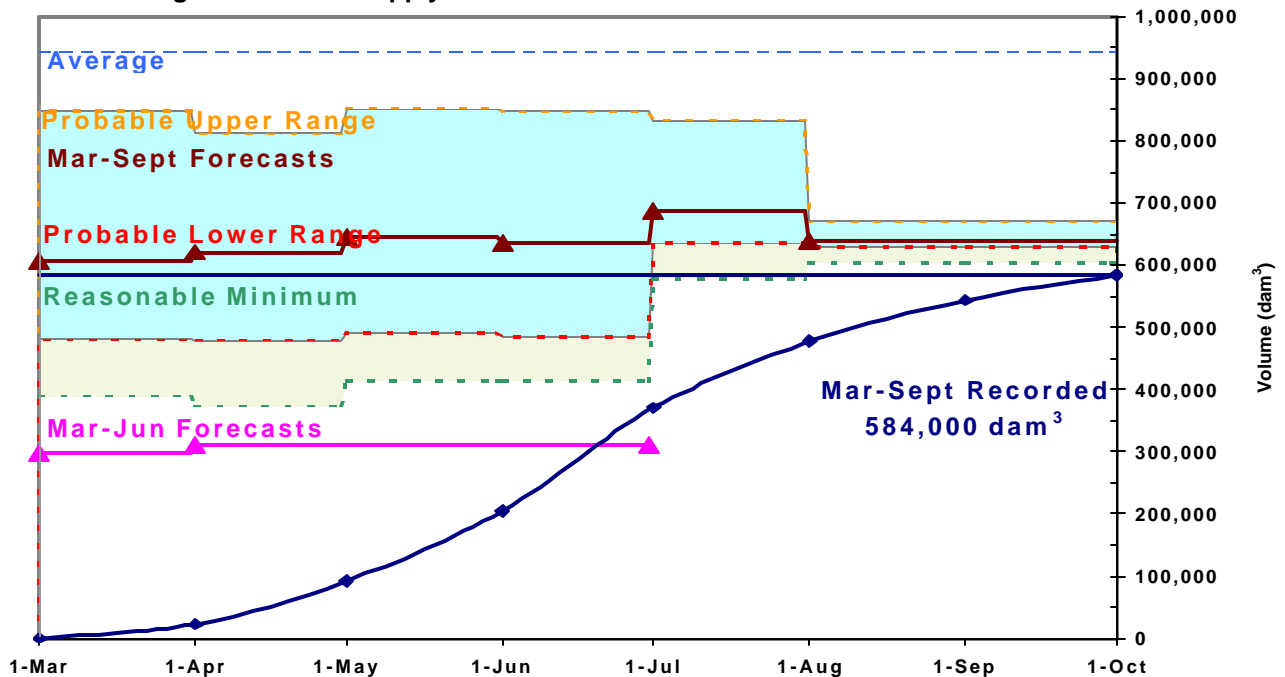
### **Red Deer River at Dickson Dam (Glennifer Lake)**

The March to September 2001 recorded natural volume for the Red Deer River at Dickson Dam was 584,000 dam<sup>3</sup> or 62% of average and ranks eighth lowest on record (based on the 1912-95 data) (Table 10). The March to June 2001 recorded natural volume for the Red Deer River at Dickson Dam was 370,000 dam<sup>3</sup> or 76% of average and ranked 21st lowest on record (based on the 1912-95 data).

Six monthly (March to August) natural volume forecasts were produced for Dickson Dam for the March to September period. Recorded March to September natural volume at Dickson Dam

(blue line) was relatively close to the forecasted values, on average within 5.8% for the season. The recorded volume was within the probable range five out of six forecasts and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 22 (brown triangles)). Forecasts ranged within 2.4% to 11% of the recorded volumes, of which, four of the forecasts were within six percent of the recorded values. All six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in March (2.4%). The forecasts remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable increase occurred in the July 1 forecast, as precipitation in the headwaters was above-normal. The August 1 forecast dropped due to below-normal precipitation in the headwaters during July. The recorded natural volume for the August to September period did not fall in the probable range in the August forecast. The recorded August to September natural volumes at Dickson Dam were the lowest on record.

Figure 22 Water Supply Forecasts for the Red Deer at Dickson Dam



March to June natural volume forecasts were produced in March and April (shown as pink triangles in Figure 22). Forecasts, on average, underestimated the recorded flow by 13.5% for the period (difference between the pink triangle and blue diamond on July 1) and only one of two forecasts had the recorded natural volume within the probable range. The large difference in the forecasts is attributed to earlier than normal mountain snowmelt, which peaked in the basin in late May.

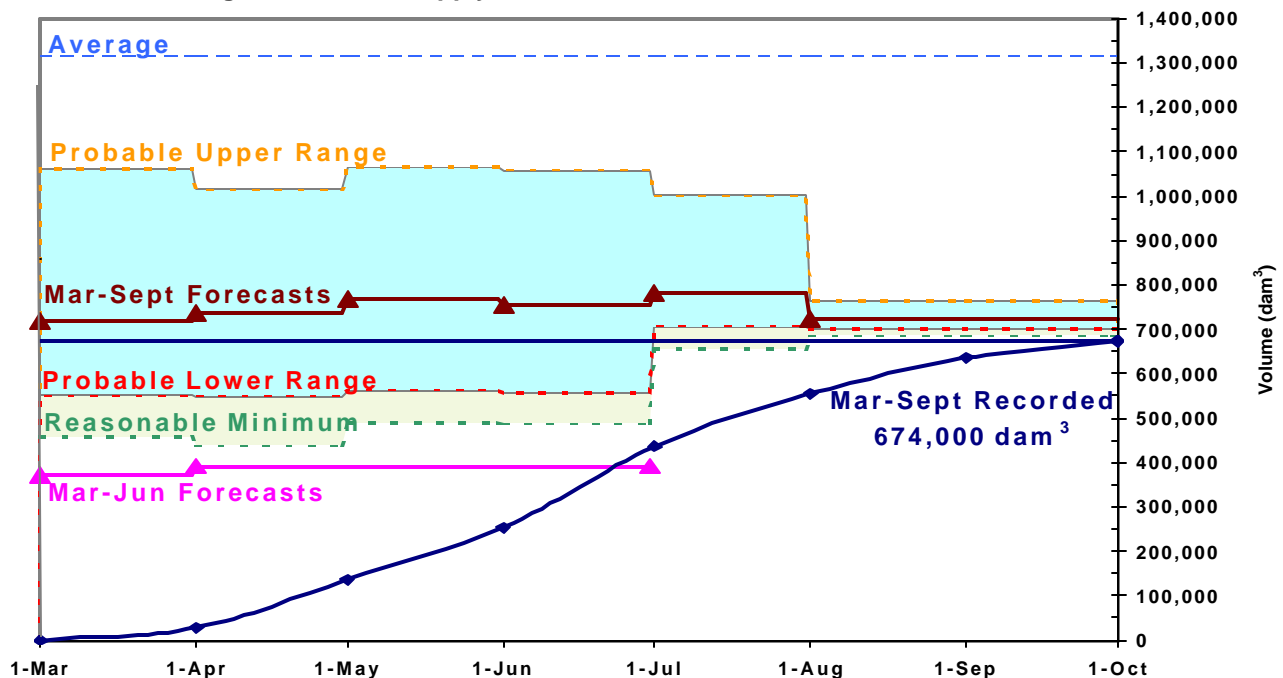


**Red Deer River at Red Deer**

The March to September 2001 recorded natural volume for the Red Deer River at Red Deer was 674,000 dam<sup>3</sup> or 51% of average and ranks fifth lowest on record (based on the 1912-95 data) (Table 10). The March to June 2001 recorded natural volume for the Red Deer River at Red Deer was 436,000 dam<sup>3</sup> or 58% of average and ranked 15th lowest on record (based on the 1912-95 data).

Six monthly (March to August) natural volume forecasts were produced for Red Deer River at Red Deer for the March to September period. Recorded March to September natural volume at Red Deer (blue line) was relatively close to the forecasted values, on average within 5.5% for the season. The recorded volume was within the probable range four out of six forecasts and greater than the reasonable minimum in all six forecasts (all forecasts are shown in Figure 23 (brown triangles)). Forecasts ranged within 3.3% to 8.1% of the recorded volumes, three were within six percent of the recorded values. The closest forecast to the recorded natural volume was produced in March (3.3%). All six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The forecasted values remained fairly steady throughout the forecast season, with minor fluctuations from month to month resulting from recorded precipitation. The most noticeable change occurred with the August 1 forecast dropped due to below-normal precipitation in the headwaters during July. The two forecasts where the recorded values did not fall in the probable range were the July and August forecasts

**Figure 23 Water Supply Forecasts for the Red Deer River at Red Deer**



*Mountain Snow Conditions and Water Supply Forecasts for Alberta – October 2001*

as a result of much-below-normal precipitation in August and September period. The recorded August to September natural volumes at Red Deer were the lowest on record.

March to June natural volume forecasts were produced in March and April (shown as pink line in Figure 23). Forecasts, on average, were within 7.1% of the recorded volume for the period (difference between the pink triangle and blue diamond on July 1). Both forecasts had the recorded natural volume within the probable range.

## **North Saskatchewan River Basin**

Recorded March to September 2001 natural runoff volume in the North Saskatchewan River basin was much-below-average (Table 11). Despite the low runoff this year, the natural volume forecasts produced for the North Saskatchewan River basin were within 3.4% of recorded values, on average.

**Table 11 Recorded Natural Streamflow Volumes for March 1 to September 30, 2001  
North Saskatchewan River Basin**

| <b>Locations</b>                     | <b>Volume in dam<sup>3</sup></b> | <b>Volume as a % of Average</b> | <b>Ranking in 1912-95 data (lowest to highest)</b> | <b>Average difference between Mar-Sept Forecasts and Recorded natural volumes</b> |
|--------------------------------------|----------------------------------|---------------------------------|--|---|
| Lake Abraham Inflow                  | 1,843,000                        | 83                              | 3*   | 2.8%  |
| Brazeau Reservoir Inflow             | 973,000                          | 68                              | 4**  | 2.7%  |
| North Saskatchewan River at Edmonton | 3,969,000                        | 67                              | 4  | 4.7%  |

Information is based on preliminary data

\* Lake Abraham ranking based on 18 years of record

\*\* Brazeau Reservoir ranking based on 29 years of record

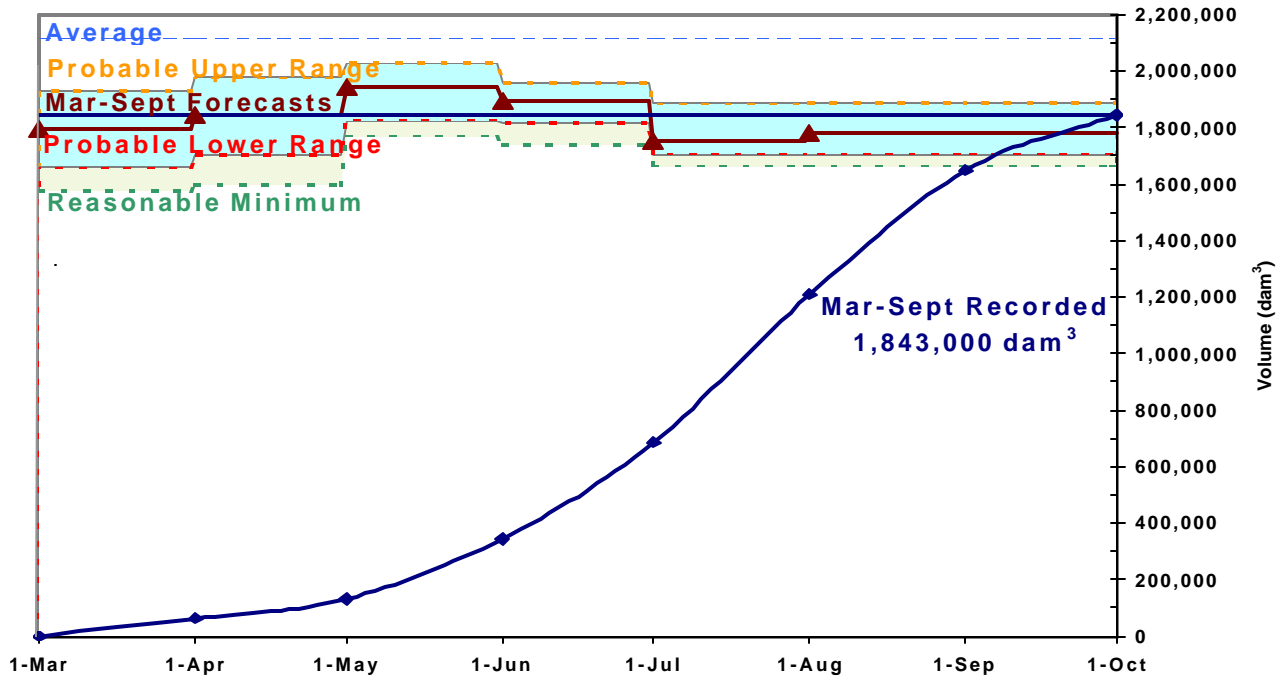
Average is calculated for the period from 1912 to 1995

Precipitation in the headwaters of the North Saskatchewan River basin was below-normal for the March to September period (Figures 5 and 6). Precipitation during September ranged from below-normal to much-below-normal in the North Saskatchewan River basin (Figures 1 and 2). May to September precipitation values range from below-normal in the headwaters to near normal in the Edmonton region (Figures 3 and 4). Most months recorded much-below-normal to below-normal precipitation with the exception of June, where the headwaters received above-normal precipitation. In late July, a major storm around the Edmonton resulted in much-above-normal precipitation for that month. Mountain snowpack was near record low values in the spring except for the Rocky Mountain House area, where above-average snowpack was observed. The lack of runoff from the spring snowpack and summer precipitation in the plains area (between Bighorn Dam and Edmonton) is clearly evident when comparing the natural volumes as a percent of average (Table 11).

### **North Saskatchewan River at Bighorn Dam (Lake Abraham)**

The March to September 2001 recorded natural volume for the North Saskatchewan River at Bighorn Dam was 1,843,000 dam<sup>3</sup> or 83% of average and ranks third lowest on record (based on the 1973-90 data) (Table 11).

Figure 24 Water Supply Forecasts for the North Saskatchewan River at Bighorn Dam



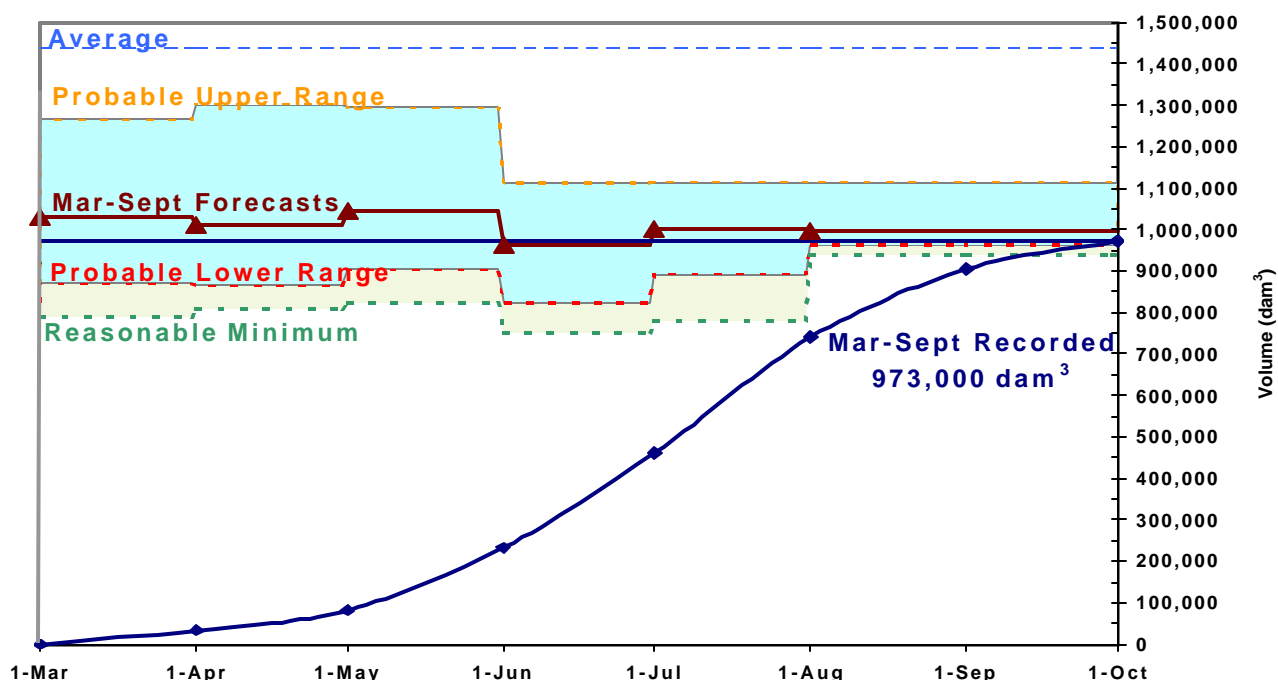
Six monthly (March to August) natural volume forecasts were produced for North Saskatchewan River at Bighorn Dam for the March to September period. Recorded March to September natural volume at Bighorn Dam (blue line) was very close to the forecasted values, on average within 2.8% for the season (Table 11). The recorded volume was within the probable range and greater than the reasonable minimum for all six forecast (all forecasts are shown in Figure 24 (brown triangles)). Forecasts ranged within 0.1% to 4.2% of the recorded volumes. Five of the six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in April (0.1%). The forecasts increased slightly through the May forecast before falling sharply in the July forecast. These changes were a result of the precipitation observed in the basin over the period.

**Brazeau River at Brazeau Dam**

The March to September 2001 recorded natural volume for the Brazeau River at Brazeau Dam was 973,000 dam<sup>3</sup> or 68% of average and ranks fourth lowest on record (based on the 1962-90 data) (Table 11).

Six monthly (March to August) natural volume forecasts were produced for the Brazeau River at Brazeau Dam for the March to September period. Recorded March to September natural volume (blue line) at Brazeau Dam was very close to the forecasted values, on average within 2.7% for the season (Table 11). The recorded volume was within the probable range and

Figure 25 Water Supply Forecasts for Brazeau River at Brazeau Dam



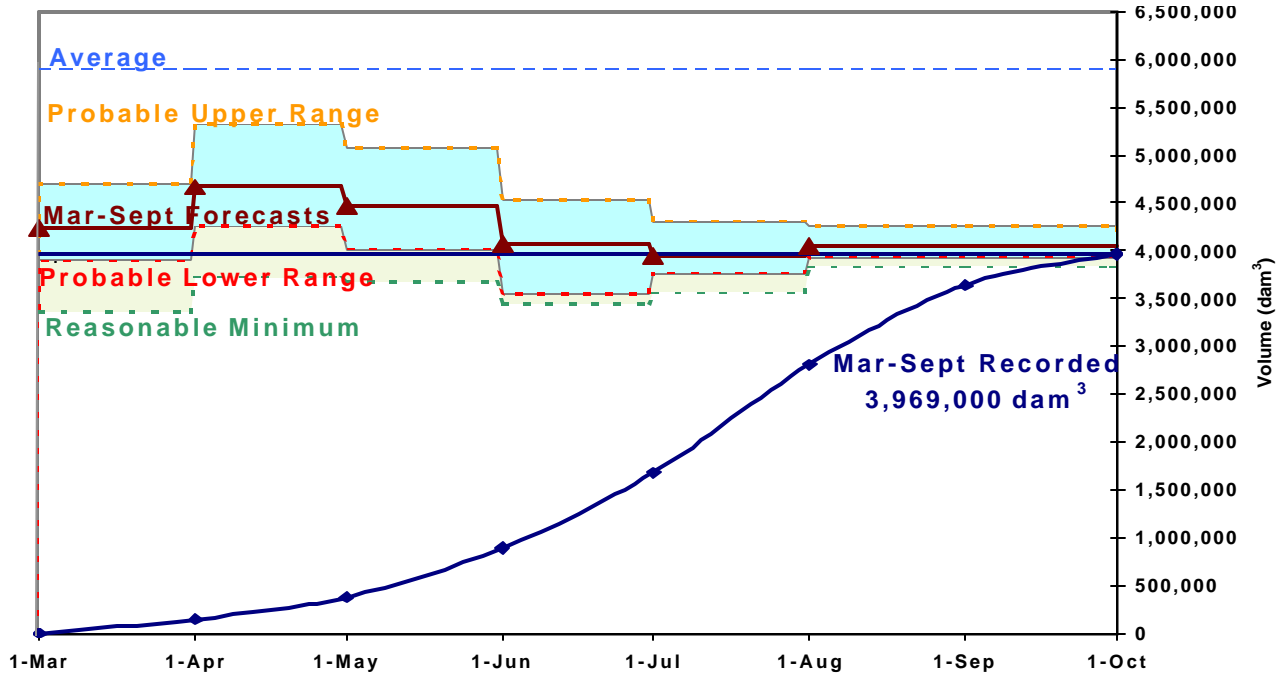
greater than the reasonable minimum for all six forecasts (all forecasts are shown in Figure 25 (brown triangles)). Forecasts ranged within 0.6% to 5.1% of the recorded volumes, of which, four of the forecasts were within two percent of the recorded values. Five of the six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in June (0.6%). The forecasts remained fairly steady throughout the forecast season, with minor fluctuations from month to month depending on recorded precipitation. The most noticeable decrease occurred in the June forecast, as precipitation in the headwaters was below-normal.

### North Saskatchewan River at Edmonton

The March to September 2001 recorded natural volume for the North Saskatchewan River at Edmonton was 3,969,000 dam<sup>3</sup> or 67% of average and ranks fourth lowest on record (based on the 1912-95 data) (Table 10).

Six monthly (March to August) natural volume forecasts were produced for the North Saskatchewan River at Edmonton for the March to September period. Recorded March to September natural volume at Edmonton (blue line) was relatively close to the forecasted values, on average within 4.7% for the season (Table 11). The recorded volume was within the probable range on four out of six forecasts and greater than the reasonable minimum for all six forecasts (all forecasts are shown in Figure 26 (brown triangles)). Forecasts ranged within 0.6% to 11.8% of the recorded volumes, of which, three of the forecasts were within two percent of the recorded

Figure 26 Water Supply Forecasts for the North Saskatchewan River at Edmonton



values. Five of the six forecasted volumes were higher than the actual recorded value as a result of the below-normal precipitation. The closest forecast to the recorded natural volume was produced in July (0.6%). The forecasts fell slowly throughout the forecast season based on the majority of the months recording below-normal precipitation. The most noticeable increase occurred in the April forecast, which was a result of precipitation in the headwaters in an early April snowfall. The recorded volume did not fall in the probable range from the April and May forecasts.

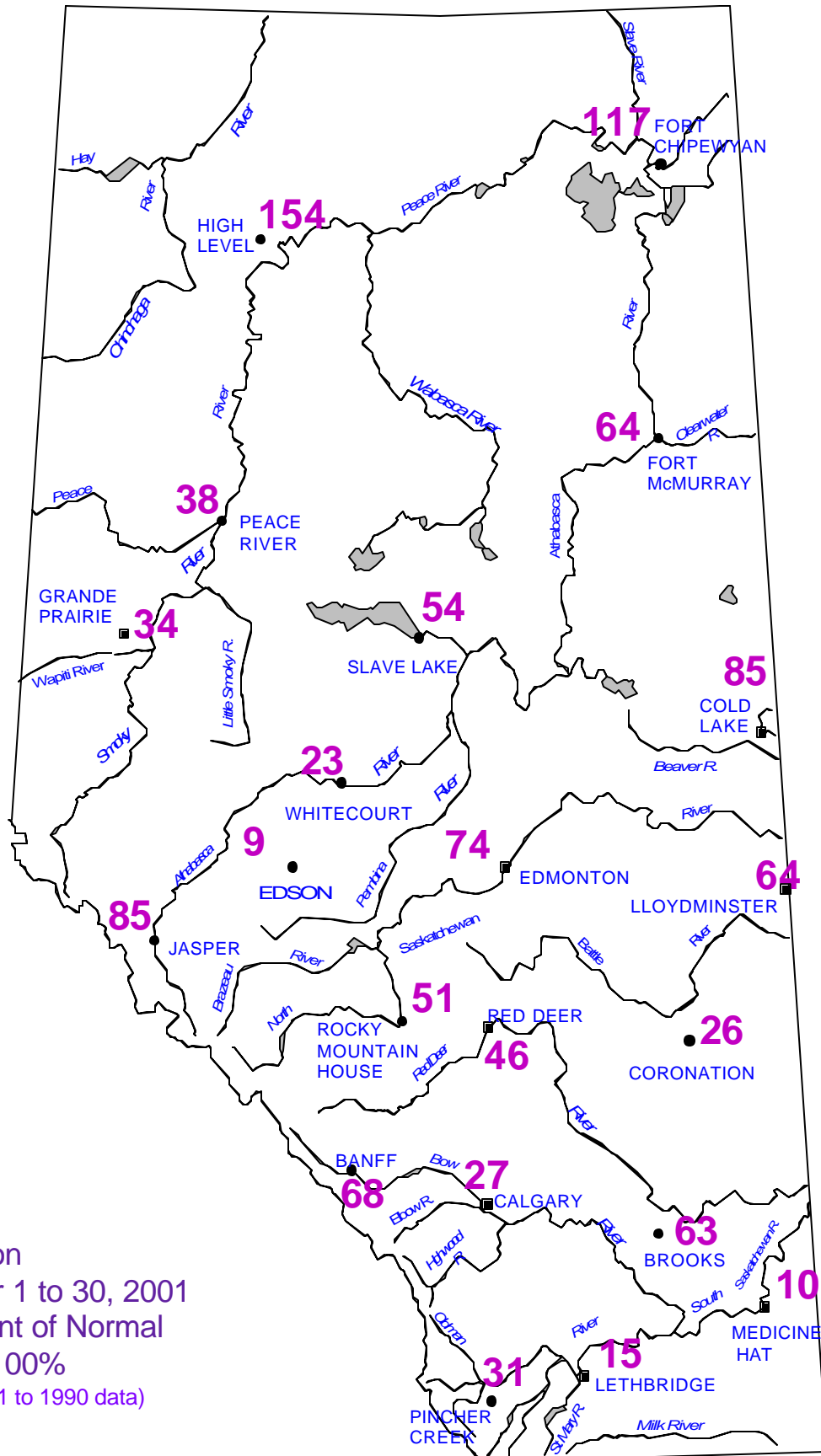
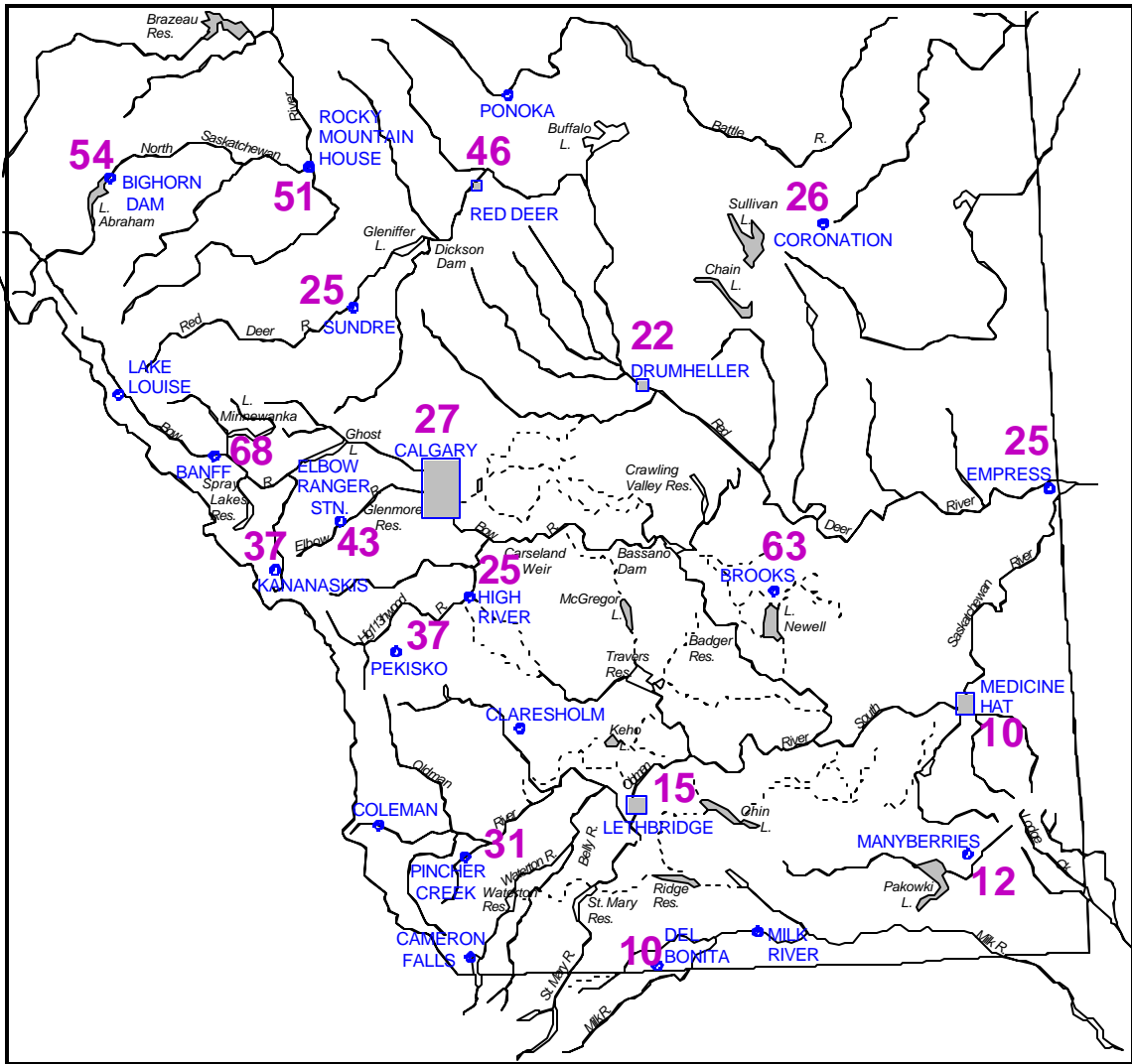


Figure 1  
 Precipitation  
 September 1 to 30, 2001  
 as a percent of Normal  
 Normal = 100%  
 (based on 1961 to 1990 data)



**Figure 2**  
**Precipitation**  
**Southern Alberta**  
**September 1 to 30, 2001**  
**as a percent of Normal**  
**Normal = 100%**  
 (based on 1961 to 1990 data)



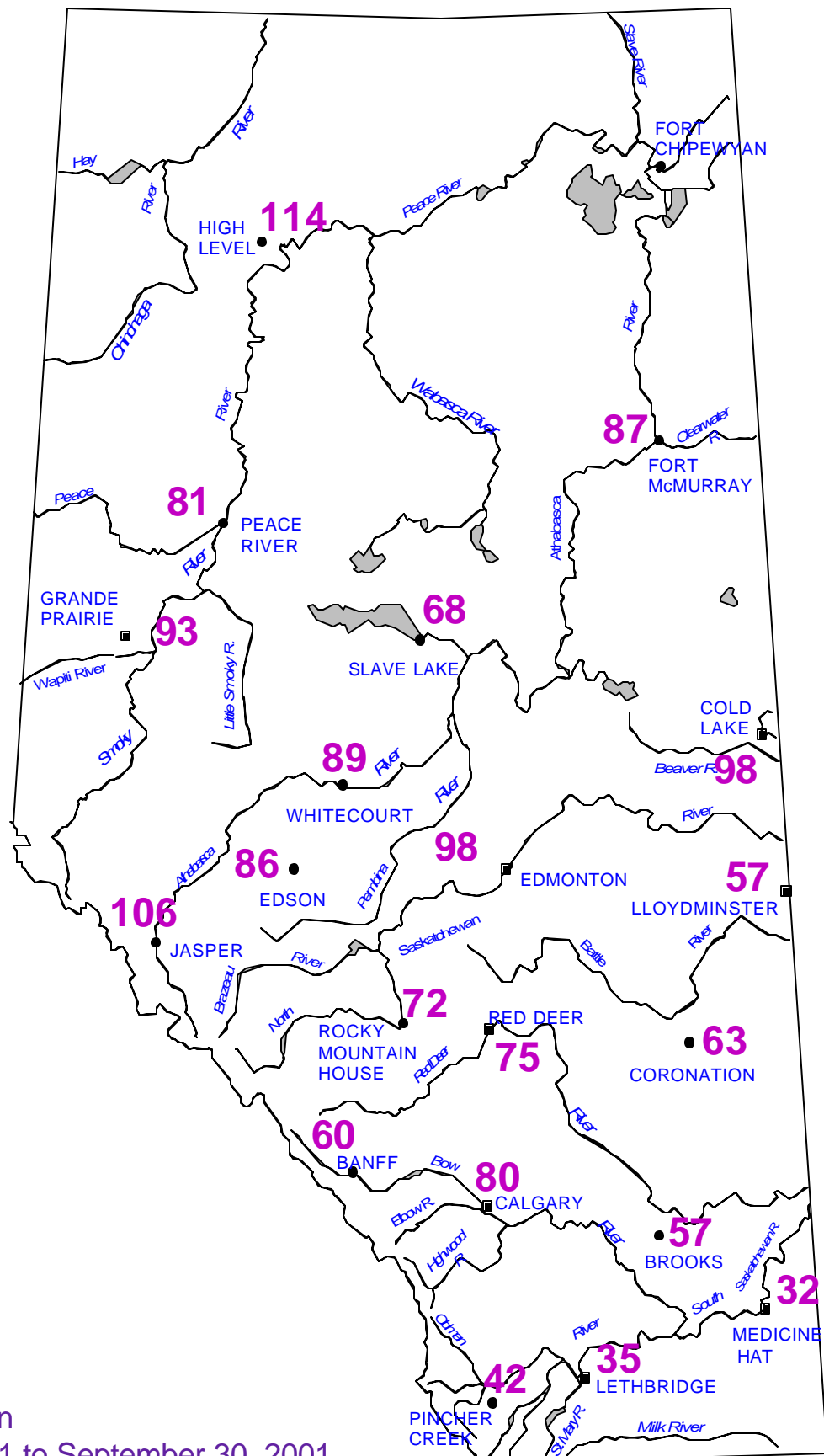
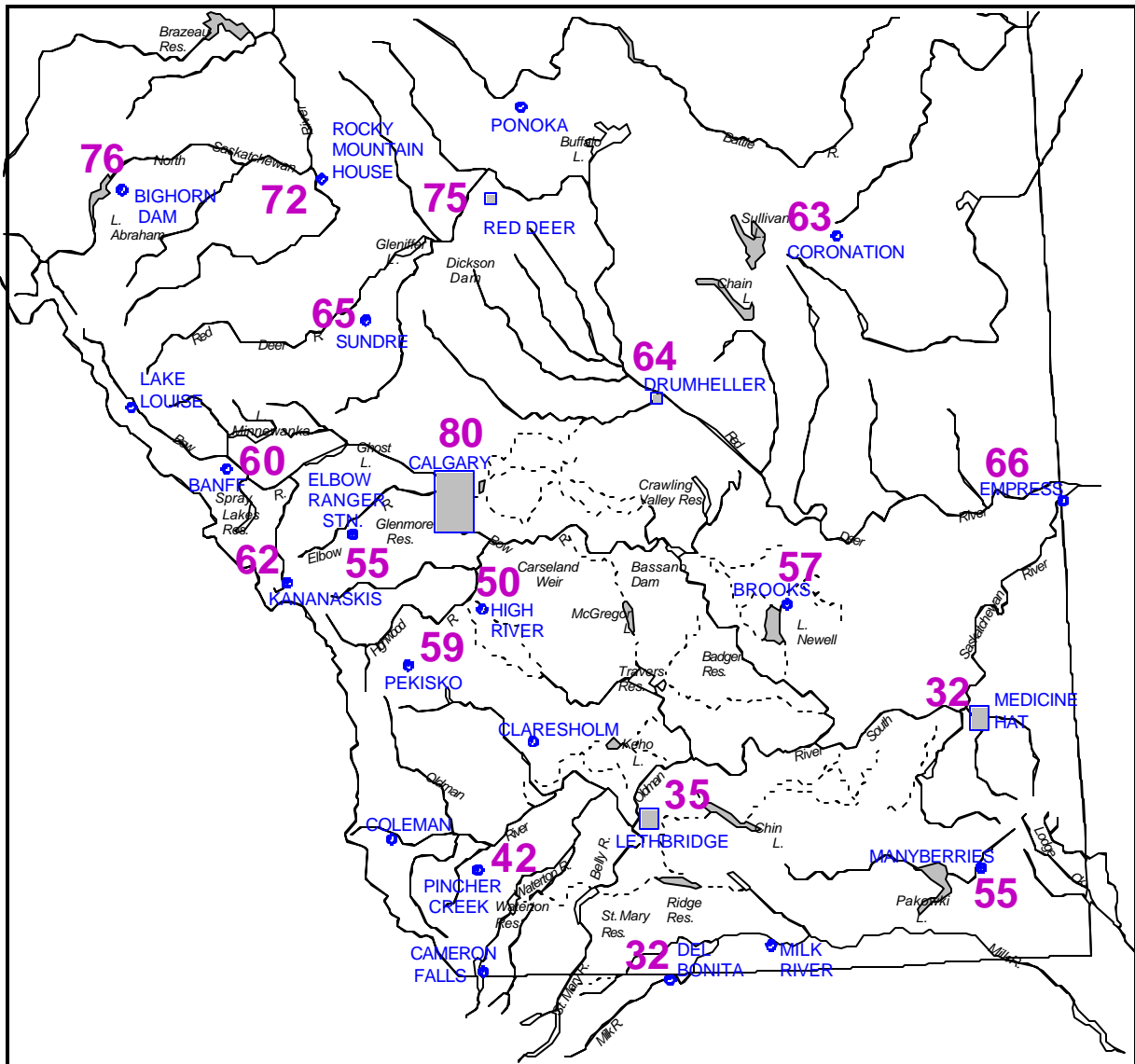


Figure 3  
 Precipitation  
 May 1, 2001 to September 30, 2001  
 as a percent of Normal  
 Normal = 100%  
 (based on 1961 to 1990 data)



**Figure 4**  
**Precipitation**  
**Southern Alberta**  
**May 1, 2001 to September 30, 2001**  
**as a percent of Normal**  
**Normal = 100%**  
 (based on 1961 to 1990 data)

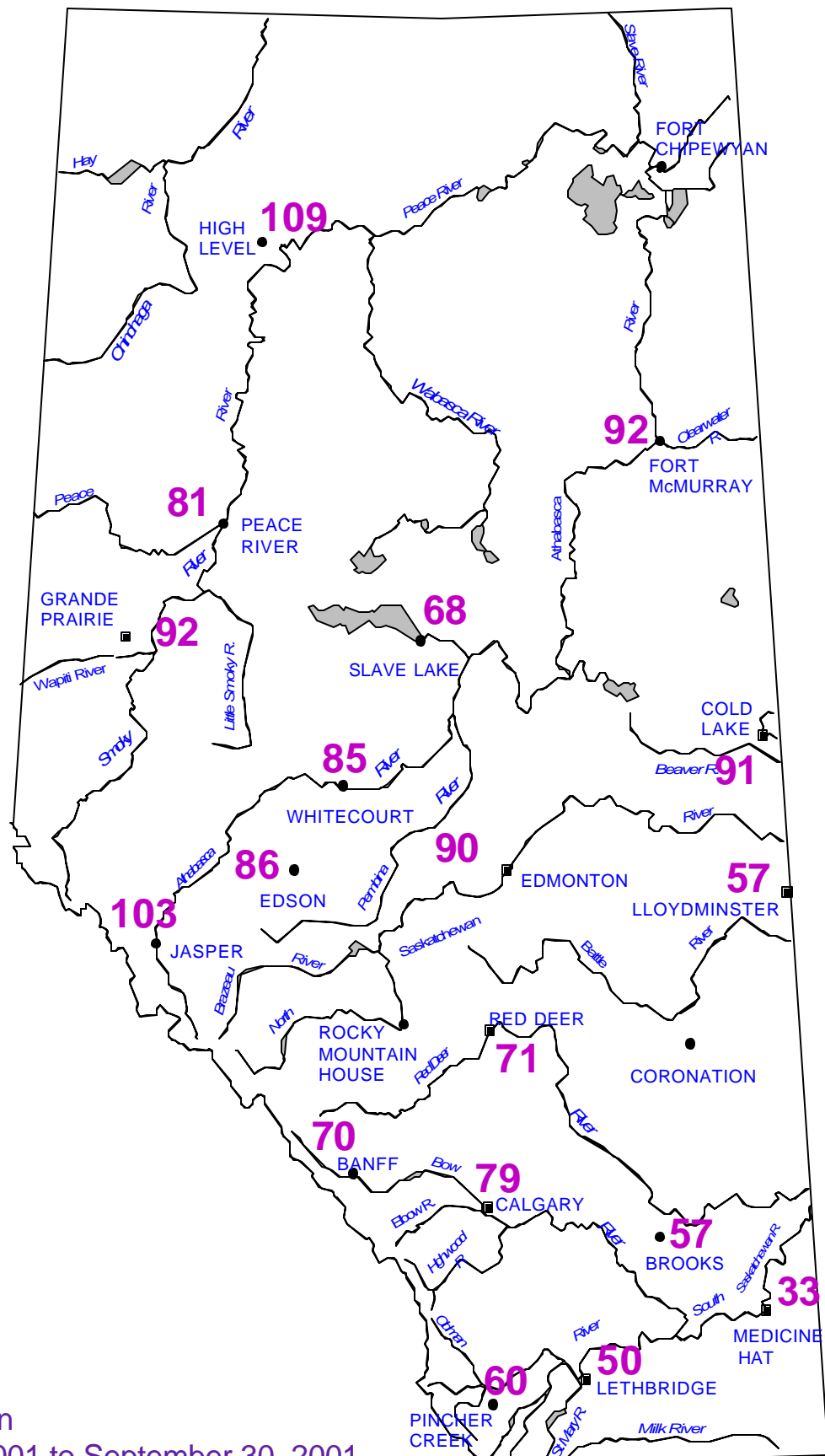
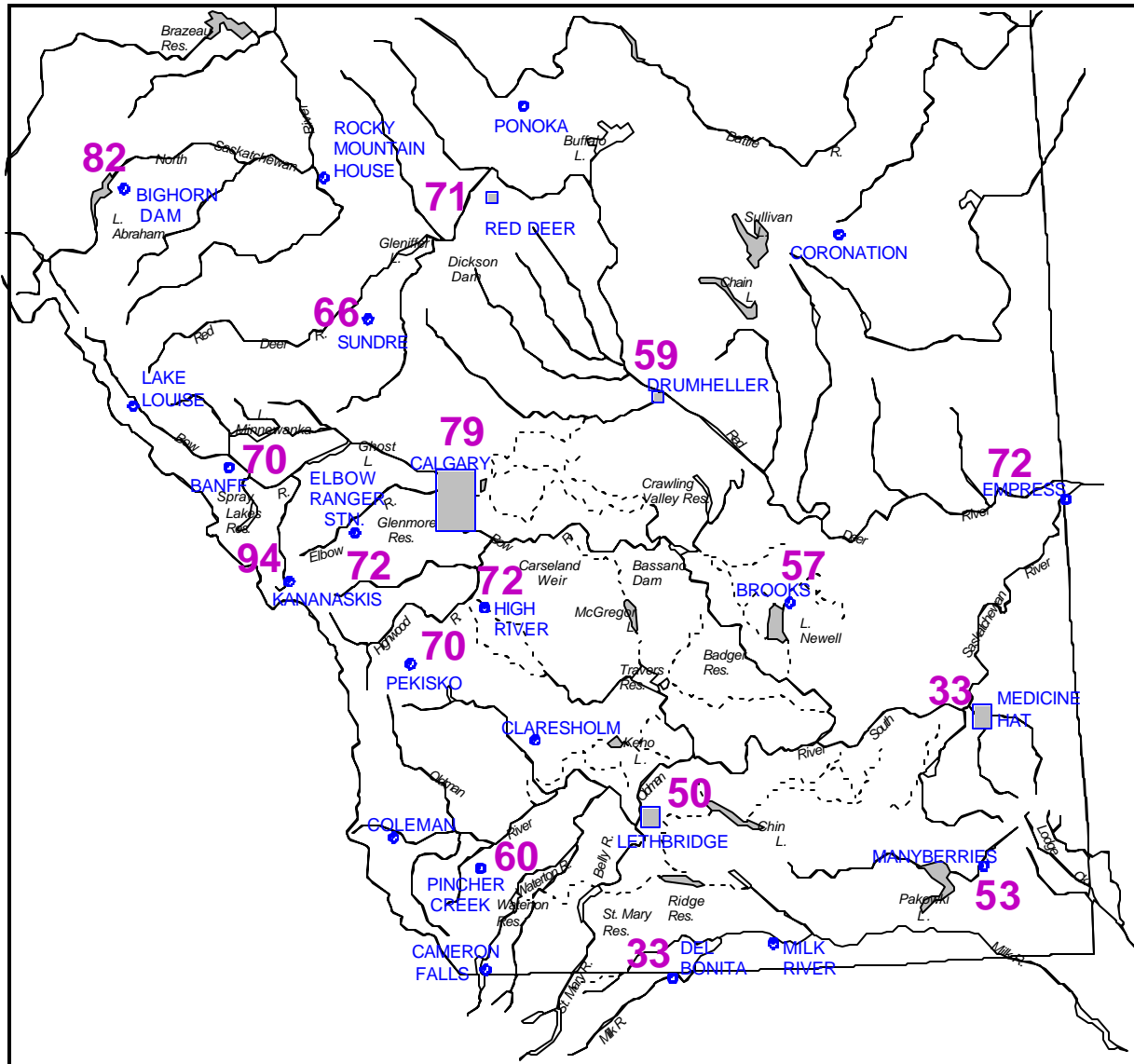


Figure 5  
 Precipitation  
 March 1, 2001 to September 30, 2001  
 as a percent of Normal  
 Normal = 100%  
 (based on 1961 to 1990 data)



**Figure 6**  
**Precipitation**  
**Southern Alberta**  
**March 1, 2001 to September 30, 2001**  
**as a percent of Normal**  
**Normal = 100%**  
 (based on 1961 to 1990 data)