ALBERTA ENVIRONMENT
WATER MANAGEMENT OPERATIONS –
LETHBRIDGE AREA

WATER Measurement Workshop 2008

PRESENTED BY: Dennis Matis
Oldman River Basin Water Operations Specialist

Alberta Environment

AENV is responsible for managing water resources in the province

Water Management Operation (WMO) operates and maintains the provincial infrastructure

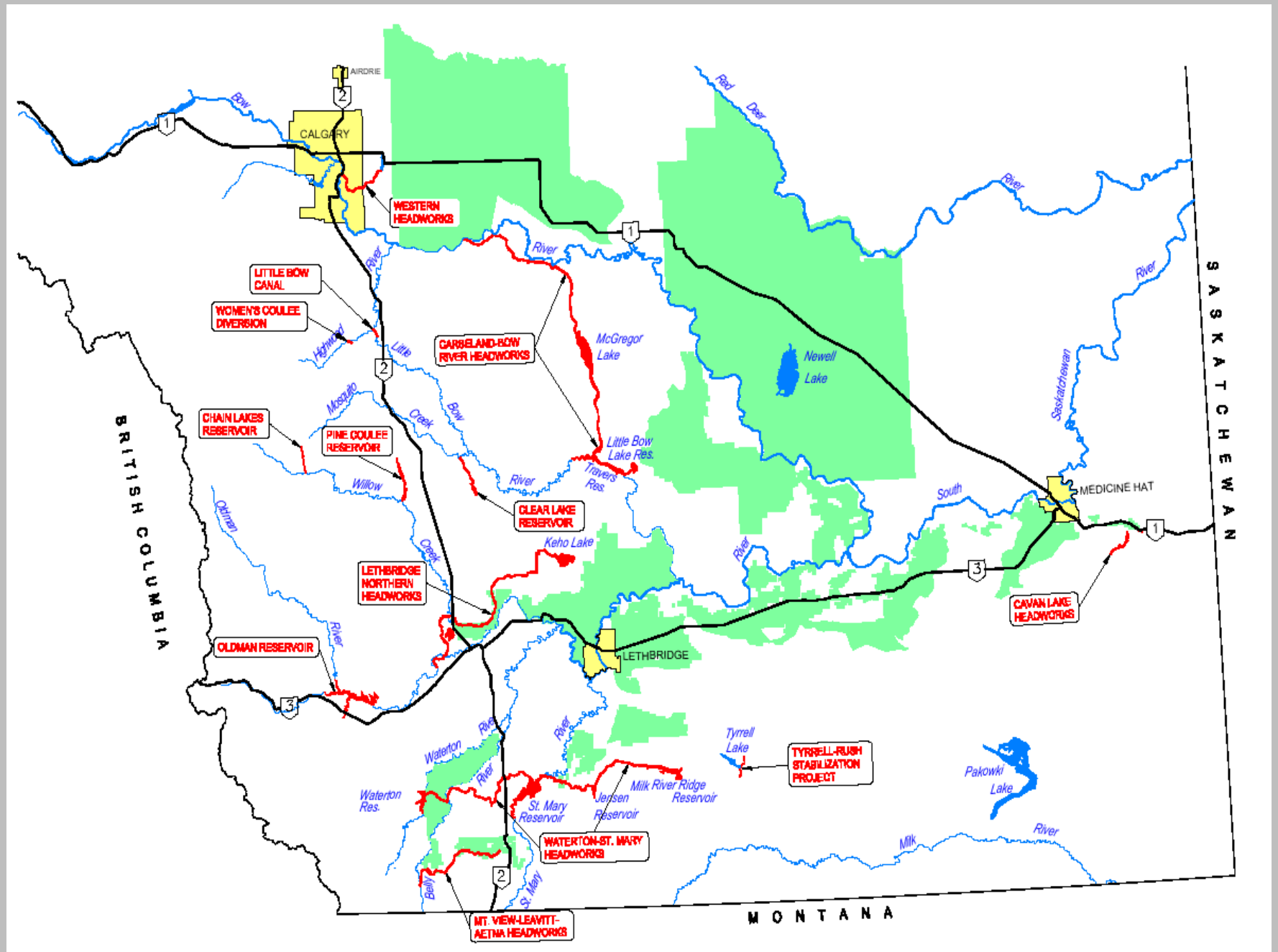
Alberta Environment

The provincial water management infrastructure

- Valued at $4.7 billion of which 75% is in Southern Region
- Annual operation and maintenance budget is about $3 million

Water Management Clients/Uses

- Irrigated agriculture – SMRID/RID/TID, MVLA, LNID, WID, EID, RID, Private
- Aquatic and riparian environment (IFNs)
- Towns, villages, industrial users
- Recreational and wildlife facilities
- Hydroelectric power generation
- Apportionment with Saskatchewan


AIRDRIE
CALGARY
Bow River
Red Deer River
WESTERN HEADWORKS
LITTLE BOW CANAL
WOMEN'S COULEE DIVERSION
Highwood River
Little Bow River
CARSELAND-BOW RIVER HEADWORKS
McGregor Lake
Newell Lake
Saskatchewan River
CHAIN LAKES RESERVOIR
PINE COULEE RESERVOIR
Mosquito Creek
Bow River
Little Bow Lake Res.
Travers Res.
CLEAR LAKE RESERVOIR
Willow Creek
Oldman River
Keho Lake
South Saskatchewan River
MEDICINE HAT
CAVAN LAKE HEADWORKS
LETHBRIDGE NORTHERN HEADWORKS
OLDMAN RESERVOIR
LETHBRIDGE
Waterton River
Waterton Res.
St. Mary River
St. Mary Reservoir
Jensen Reservoir
Milk River Ridge Reservoir
WATERTON-ST. MARY HEADWORKS
Tyrrell Lake
TYRRELL-RUSH STABILIZATION PROJECT
Pakowki Lake
Milk River
Belly River
St. Mary River
MT. VIEW-LEAVITT-AETNA HEADWORKS
BRITISH COLUMBIA
SASKATCHEWAN
MONTANA

WMO – Oldman BASIN Operations Team

Oldman Operations Team Leader:
Terrence Lazarus

Water Operations Specialist:

Dennis Matis

Ft. Macleod Operations Team:

John Hawryluk– Operations Supervisor

Raymond Conway – Operations Technologist

Bob Frank – Operations Technologist

Oldman Dam Operations Team:

Piet Oosterlee – Team Leader

Robert Plant – Operations Supervisor
Scott Gerber – Operations Technologist
Trevor Curran -- Operations Technologist

St. Mary Dam Operations Team:

Lawrence Wegwitz – Team Leader

Tom Scott – Operations Supervisor

Paul Conrad – Operations Technologist

Clint Hillmer - Operations Technologist

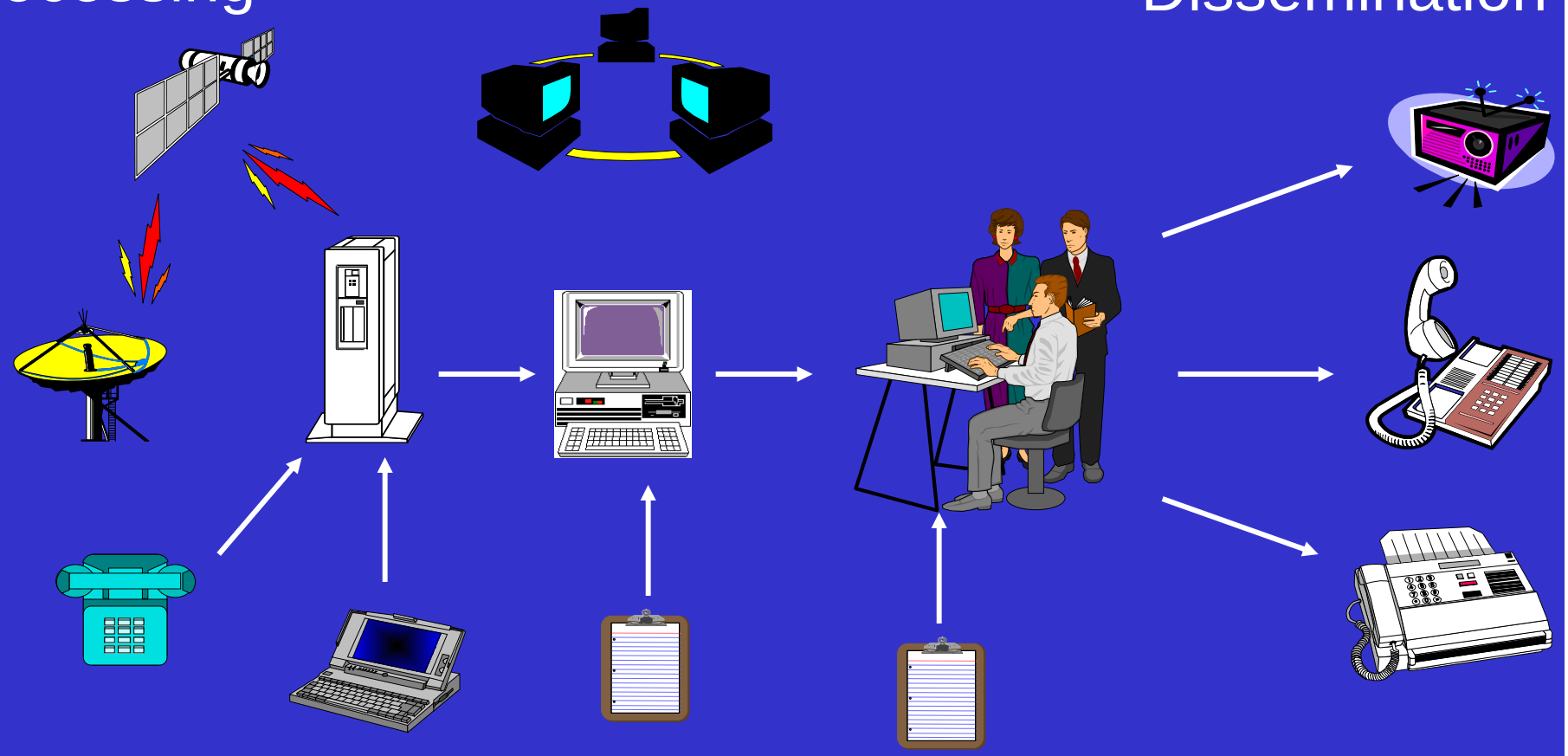
Don McCorriston - Operations Technologist

Background: Forecasting Process

Data Gathering & Processing

Data Analysis:

Information Dissemination



Note – Data Collection “expertise” provided by the Data Management Group in the Edmonton Office

Use of Real-Time **Hydrological** Data

- OpsModel Daily\Weekly Projections
- Flood Forecast
- Water Supply Forecast
- Reservoir Regulations
- Irrigation Water Management
- Ice Jam Monitoring
- Water Quality Monitoring
- Low Flow Management – Fish Rule Curve (IFN)
- Inter-Provincial Apportionment
- Recreational Planning

Background: Gauging Network for Model Input

Alberta Hydrometric Stations

- Real-Time Stream Gauges in Alberta
- Approximately 380 stations
- SCADA Network
- Of these stations, over 200 are in the SSRB, which are polled daily to assist in making water management adjustments

Background contd . . .
Snow Data Provides Basis for Forecast Modeling

SNOW PILLOWS

- 12 MOUNTAIN SITES
- 3 PLAINS AREA SITES

USES:

- SNOW ON GROUND
- SNOW/RAIN INDICATORS
- MELT RATES

Note – Pillows maintained by Water Monitoring

HYDROLOGY / FORECASTING

Eastern Slopes Snow Surveys:

Allison Pass – “we” measured above average Snow Water

Unloading our skis and snow samplers – Allison Pass

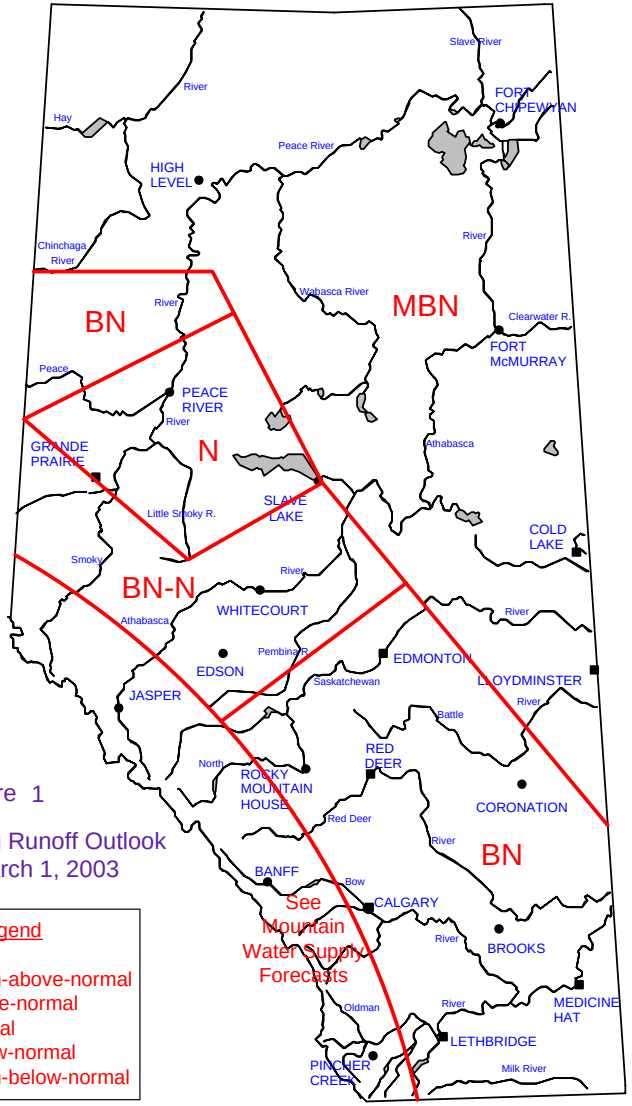


Figure 1

Plains Spring Runoff Outlook
as of March 1, 2003

Legend

MAN = Much-above-normal
AN = Above-normal
N = Normal
BN = Below-normal
MBN = Much-below-normal

PUBLIC SAFETY

FORECAST & ISSUE ADVISORIES AND WARNINGS (Bank Full Considerations)

- HIGH STREAM FLOWS
- FLOODS
- ICE JAMS

Public Presentations with Stakeholders/Clients

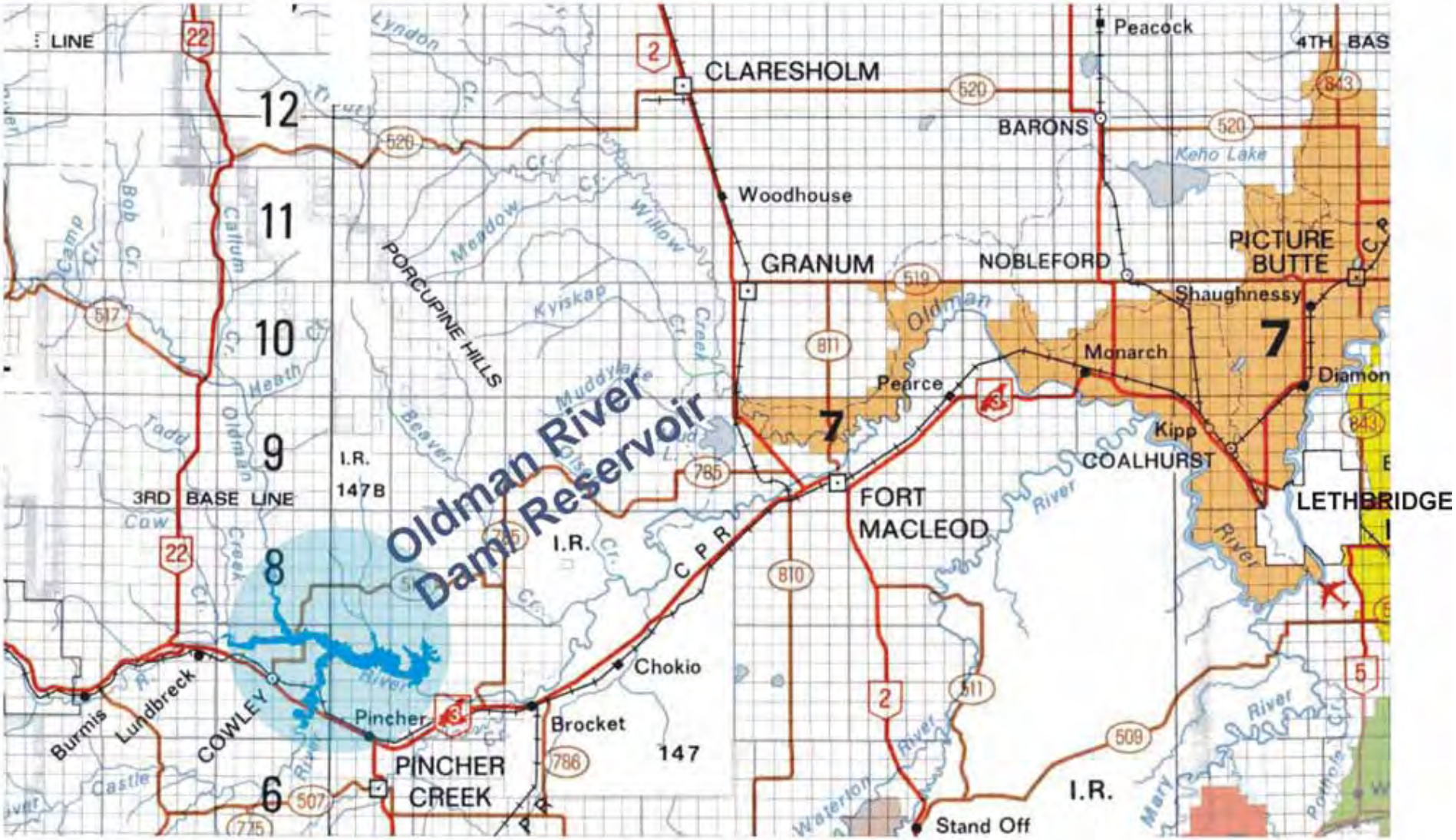
(“open lines of communication” on current Water Operations)

- **During the Irrigation Season WMO Water Managers meet weekly with Irrigation District Clients to go over the water supply situation**

- **Meetings provide an informal platform for reviewing reservoir operations and discussion for any concerns and/or operational changes**

- **Provide Clients with projections for the next week(s) OR long range forecasts to the end of the operating season**

NOTE - OpsModel will be a USEFUL Tool in Providing Meaningful/Empirical Projections to the IDs

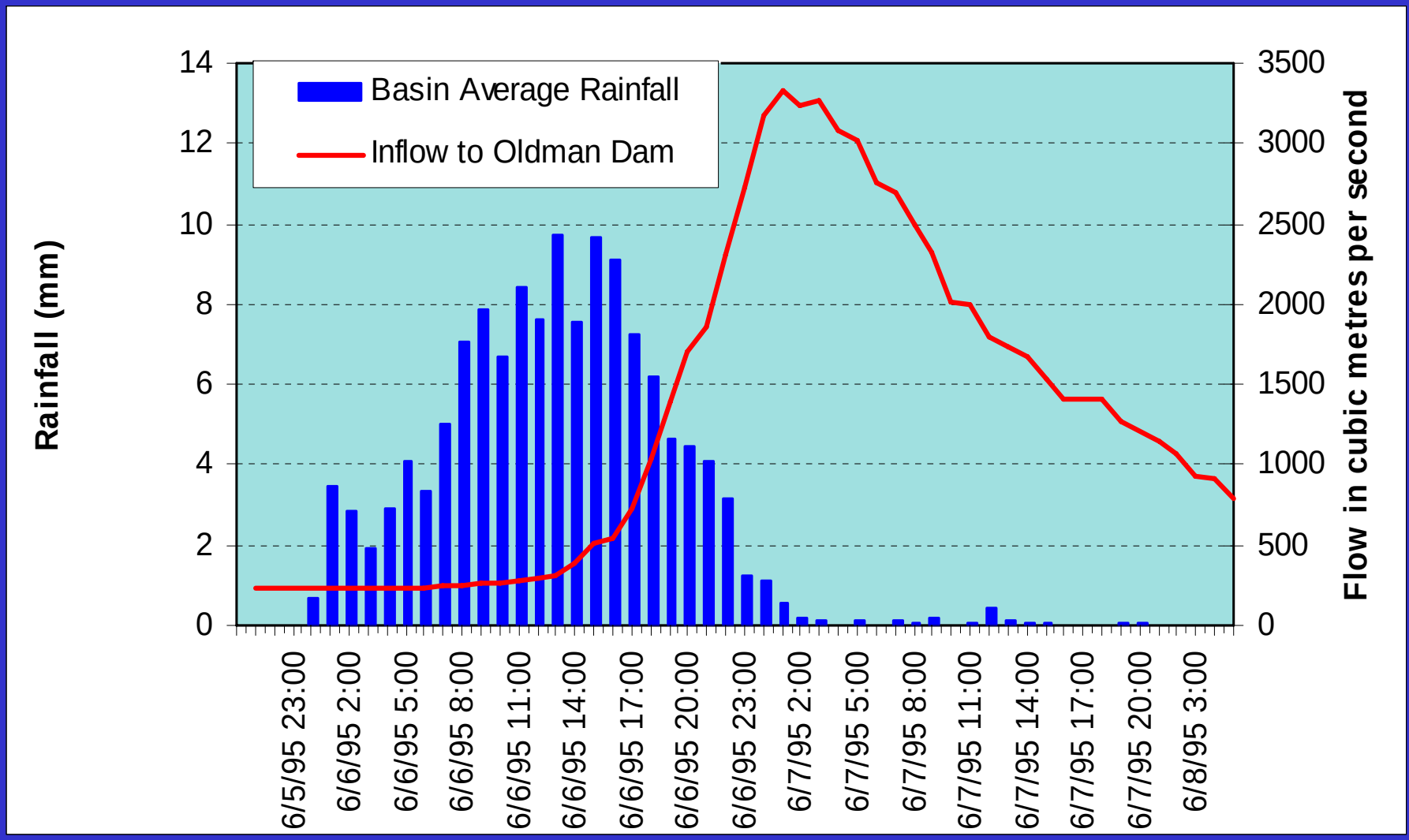


Oldman River Dam and Reservoir

The Oldman River Reservoir

Example Hydrograph Analysis . . .

Correlating Precipitation Data to ORD Inflow



Background . . .

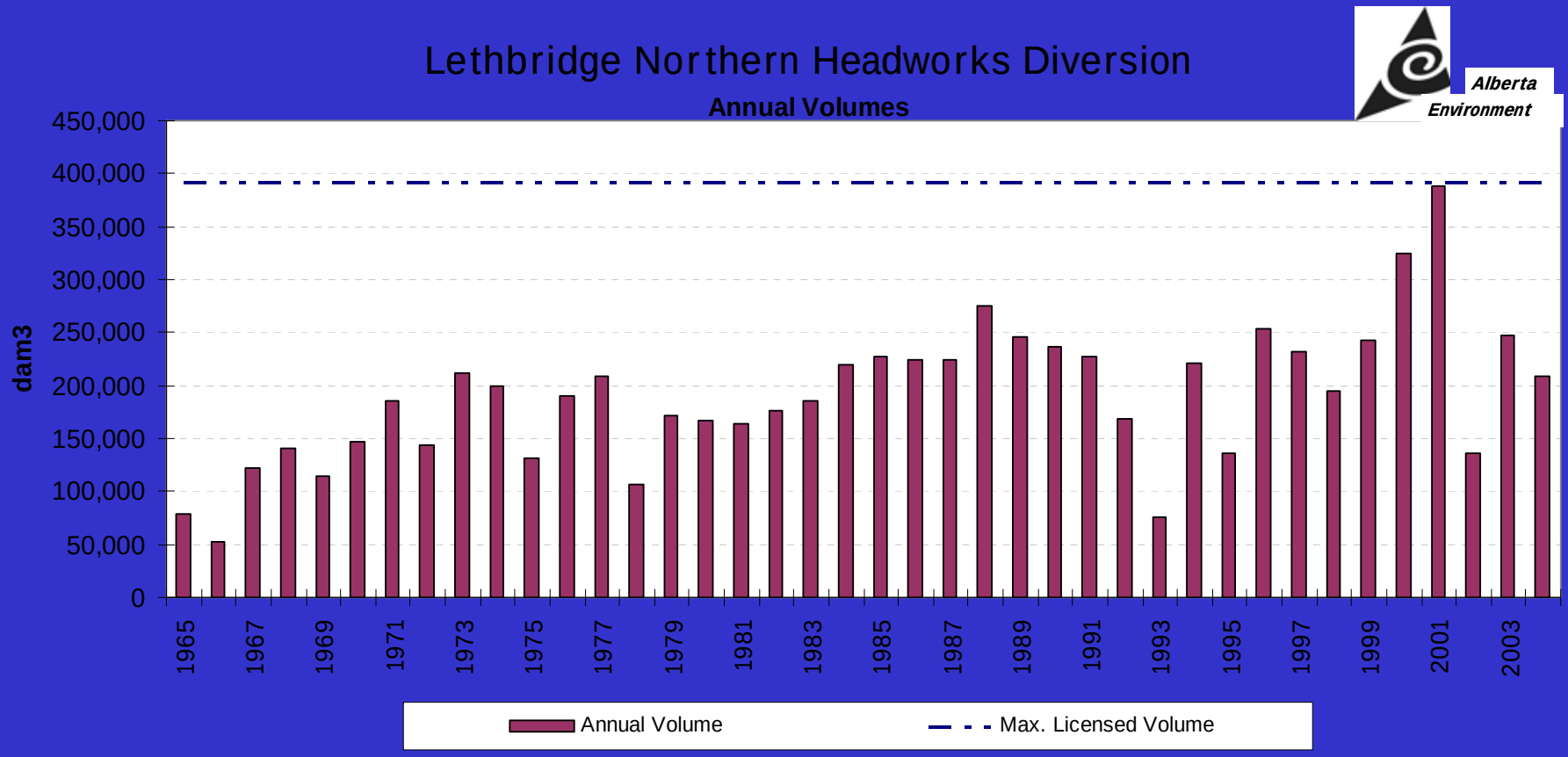
Sample DataSet indicating the Variability in the DEMANDS the OpsModel will have to Simulate

12” – 25”

Lethbridge Northern Irrigation District

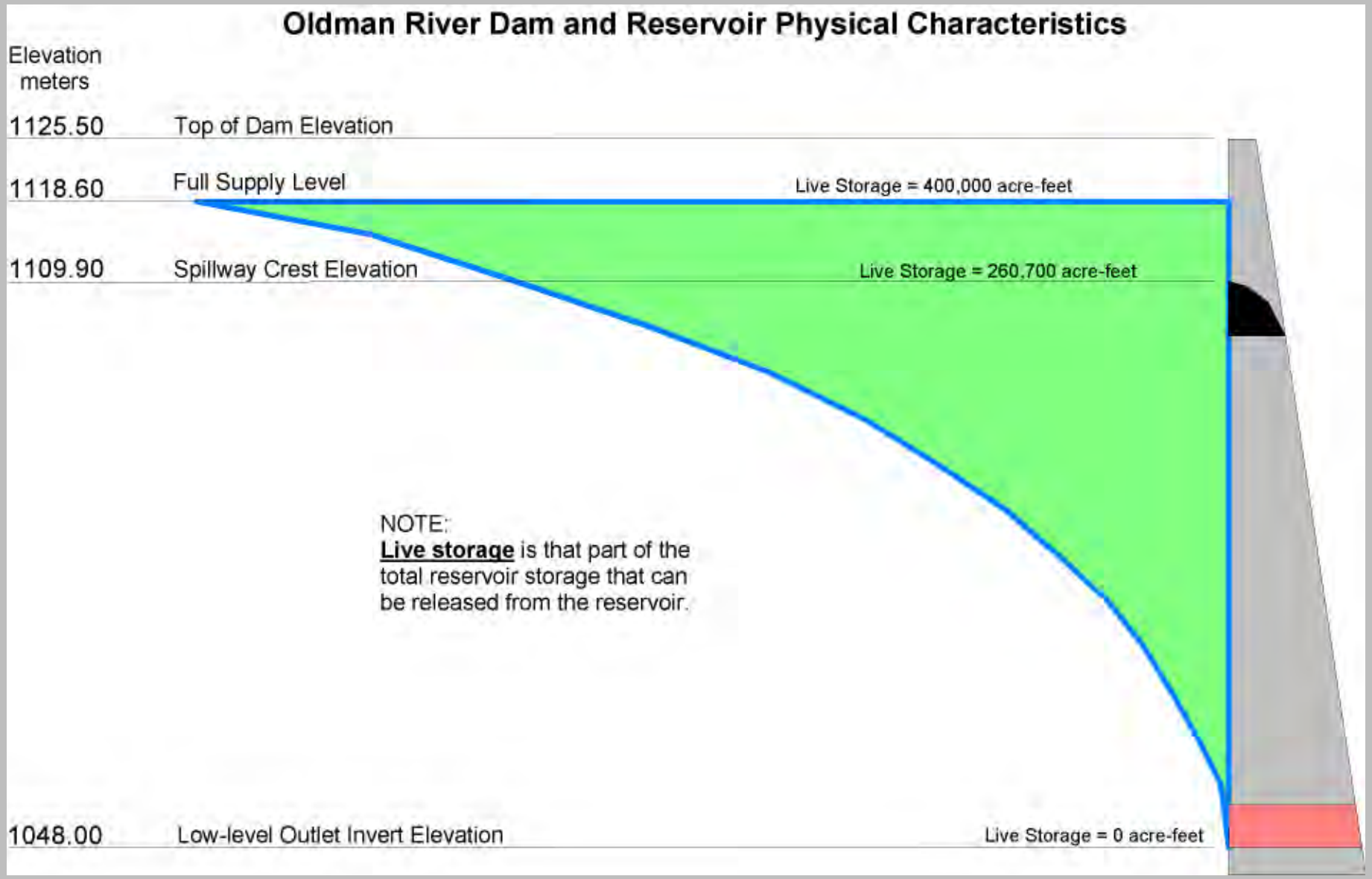
Historical Annual Water Use (1976-2001)

Year	River Diversion (Acre Feet)	Keho Reservoir Plus/Minus (Acre Feet)	Acreage Actually Irrigated	Acre Foot/ Acre	Inches/Acre
1976	154,700	20,500	96,661	1.81	21.75
1977	169,400	17,750	97,829	1.91	22.96
1978	85,900	8,360	93,562	1.01	12.10
1979	138,700	-1,990	100,487	1.36	16.33
1980	134,900	5,350	95,979	1.46	17.54
1981	132,900	-2,500	90,552	1.44	17.28
1982	142,700	3,260	104,533	1.40	16.76
1983	150,700	16,600	108,141	1.55	18.56
1984	177,700	-4,150	102,300	1.70	20.36
1985	183,800	-28,400	114,635	1.36	16.27
1986	182,200	-10,700	113,663	1.51	18.11
1987	181,900	-12,800	119,562	1.41	16.97
1988	222,900	23,800	124,555	1.98	23.77
1989	198,700	-31,300	127,330	1.31	15.78
1990	191,900	5,450	127,439	1.55	18.58
1991	184,700	-5,250	130,989	1.37	16.44
1992	136,900	-2,600	131,300	1.02	12.27
1993	61,700	-1,130	67,585	0.90	10.75
1994	179,850	4,500	133,803	1.38	16.53
1995	110,200	-9,650	100,589	1.00	12.00
1996	209,600	4,300	143,152	1.49	17.93
1997	188,400	2,483	145,061	1.32	15.79
1998	157,750	-3,100	122,379	1.26	15.16
1999	196,900	2,200	145,782	1.37	16.39
2000	263,400	-2,600	152,000	1.72	20.59
2001	314,750	500	152,000	2.07	24.89
Avg	156,118		109,075	1.45	17.38



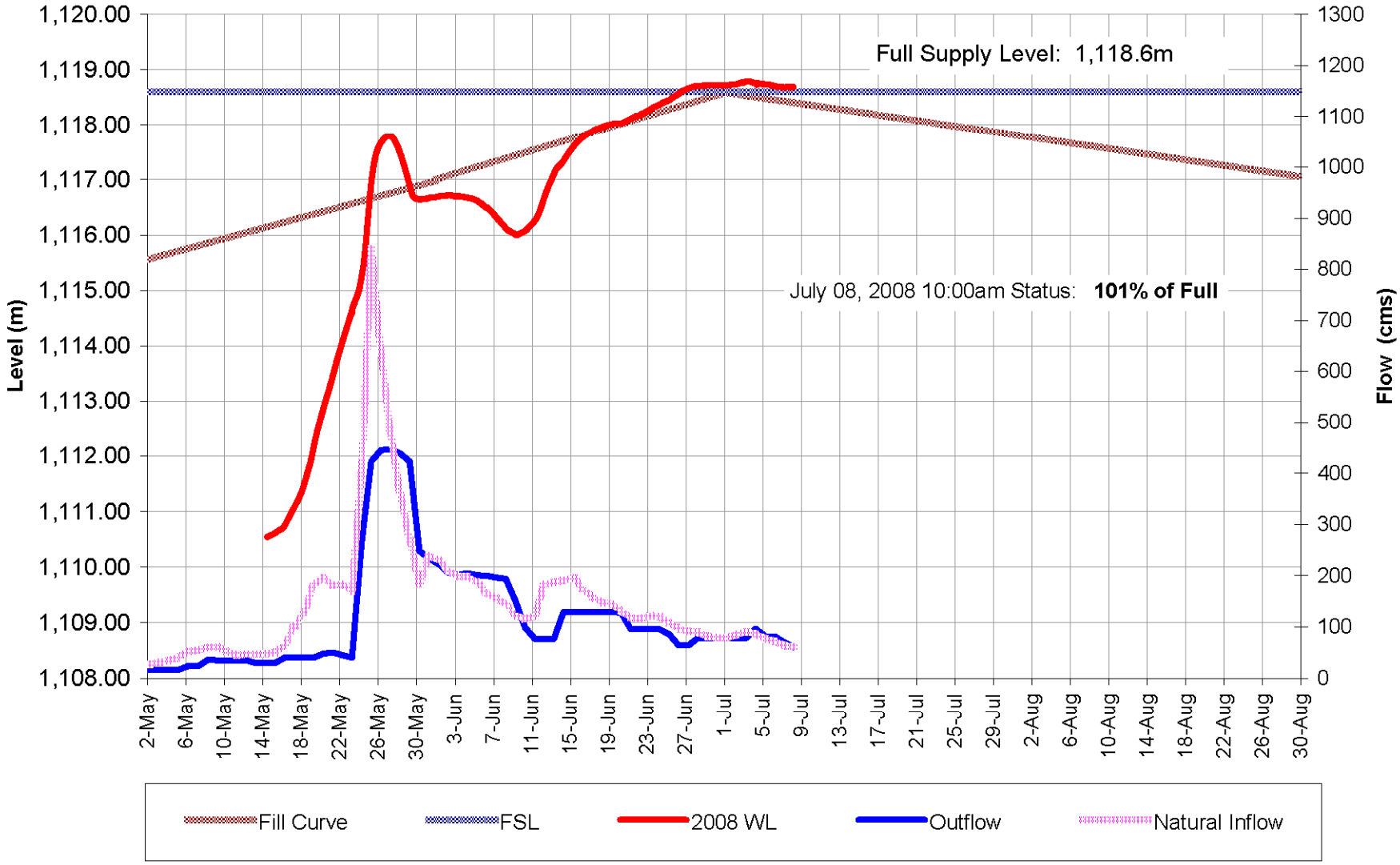
Maximum Licensed Volume Monitoring
Leth. Northern Headworks

Oldman River Dam and Reservoir Physical Characteristics



Oldman Reservoir

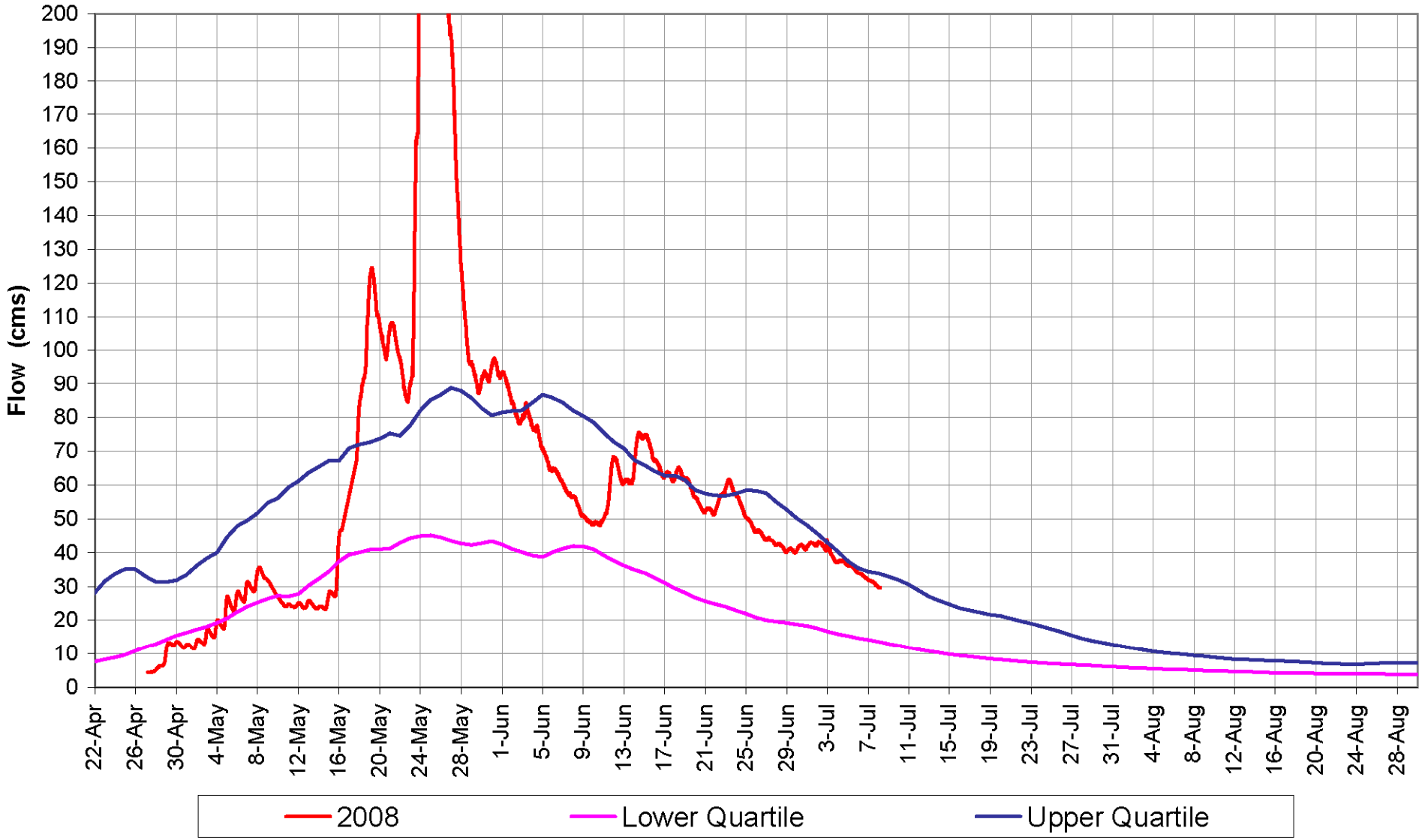
2008 - Inflows, Outflows and Water Level



Published by:
Oldman Operations Team
Water Management Operations

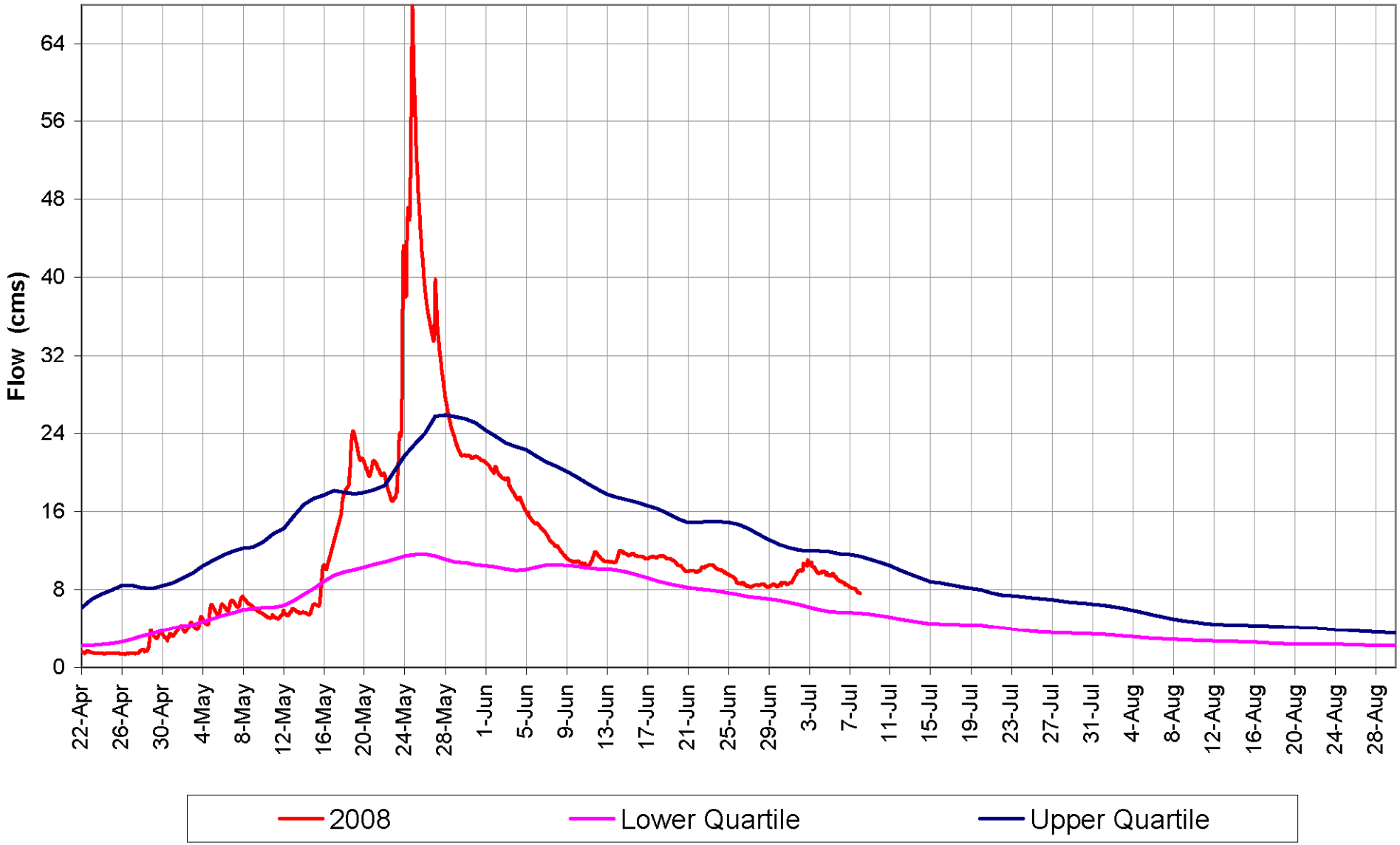
Publication Date:

Castle River near Beaver Mines
2008 compared to Historical



Published by:
Oldman River Basin Operations Team

Crowsnest River near Frank
2008 compared to Historical



Published by:
Oldman River Basin Operations Team

Lethbridge Northern Headworks System

Critical Issues in Reservoir Operation:

i) Use of Flood Storage – Whether flood inflows should be stored to reduce current damages or released to provide additional storage space in case new rains produce even greater flows

ii) Release of Stored Water – Whether water stored within the reservoir should be released for present use or retained for use during possible future droughts

iii) Use of Available Water – How the water released from the reservoir should be divided among potential users (Senior License versus Junior License)

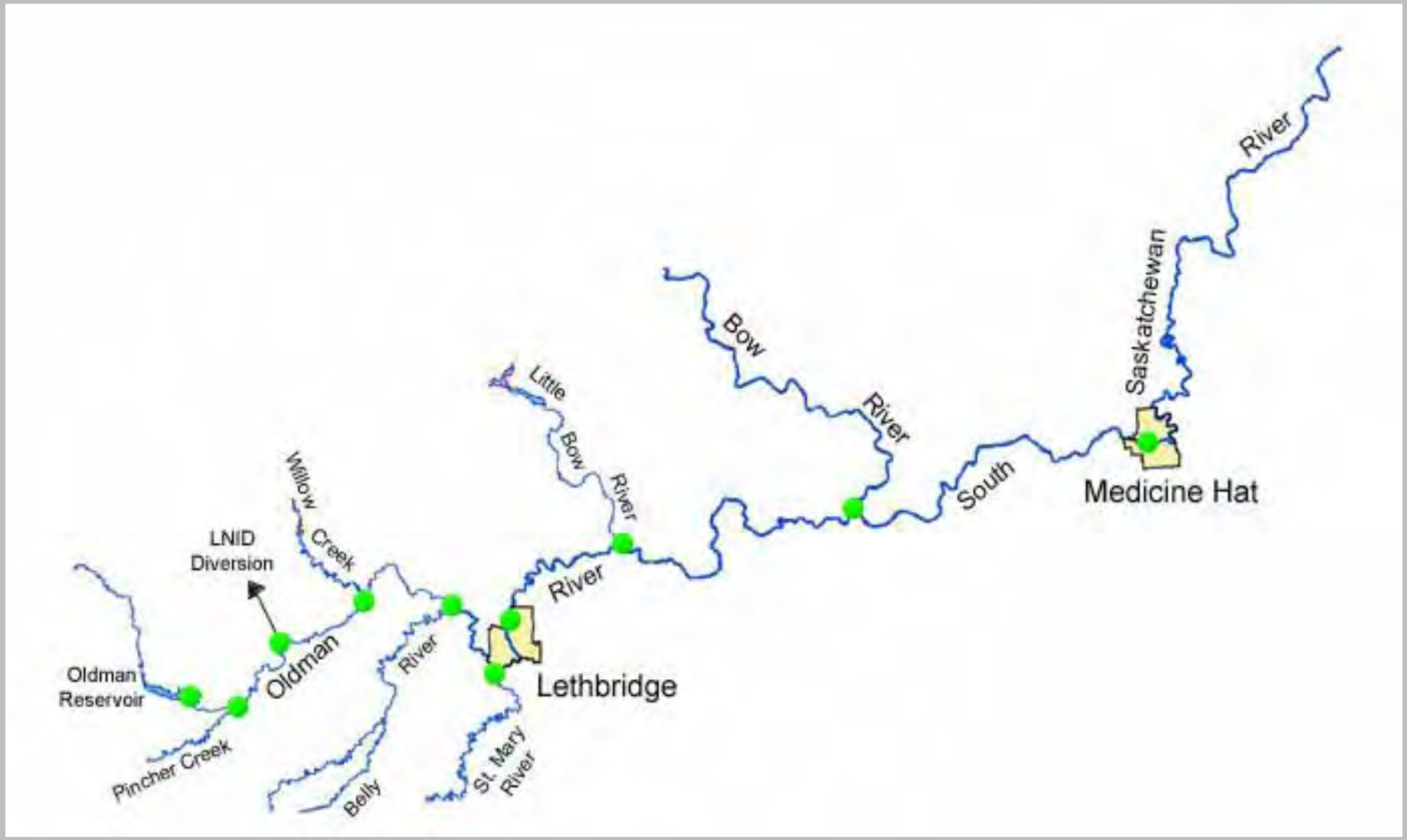
iv) Use of Total Storage – Whether storage space should be filled to save water for beneficial use or emptied to contain potential floods

The Oldman River Operations Model

- Water needs in the Oldman Basin are met by releases from the Oldman reservoir and flows from Oldman River tributaries
- Water needs in the South Saskatchewan Basin are met from Oldman and Bow Rivers flow

Water needs have specific legal priorities and must be met daily

The Oldman /S.Sask. Rivers system



Decision Support Tool

WRMM has been developed to determine appropriate releases to meet all water needs.

WRMM incorporates:

- Channel flow routing
- Meets Flow Objectives and consumptive demands on legal priority basis
- Predicts reservoir , instream and consumptive conditions every 6 hours, 7 days ahead

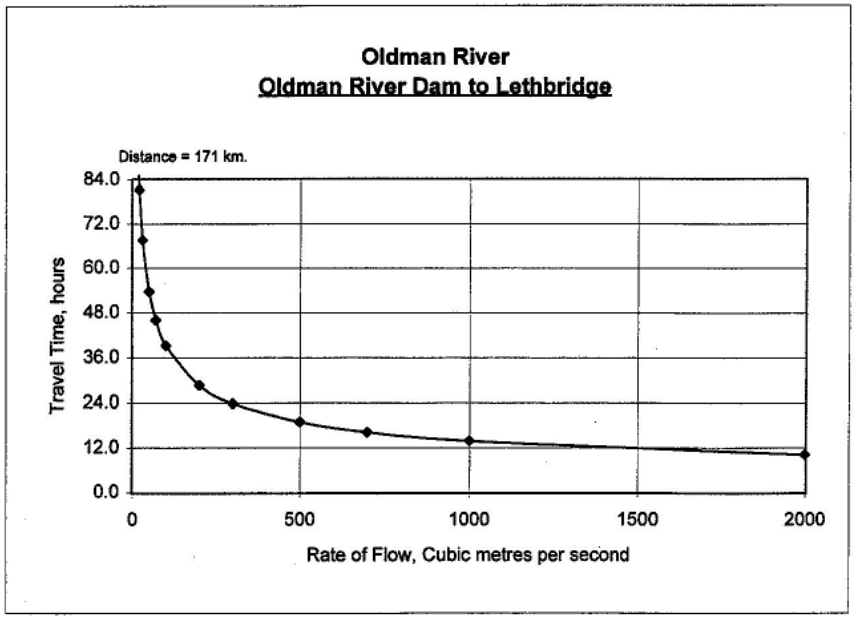
Stream flow travel times
(Generalized Times)

Oldman Reservoir releases take:

- **1-2 days to reach Lethbridge**
- **3-4 days to reach the mouth**
- **5 days to reach Medicine Hat**

Actual travel time depends on flow rate

Time of Travel : ORD to Lethbridge



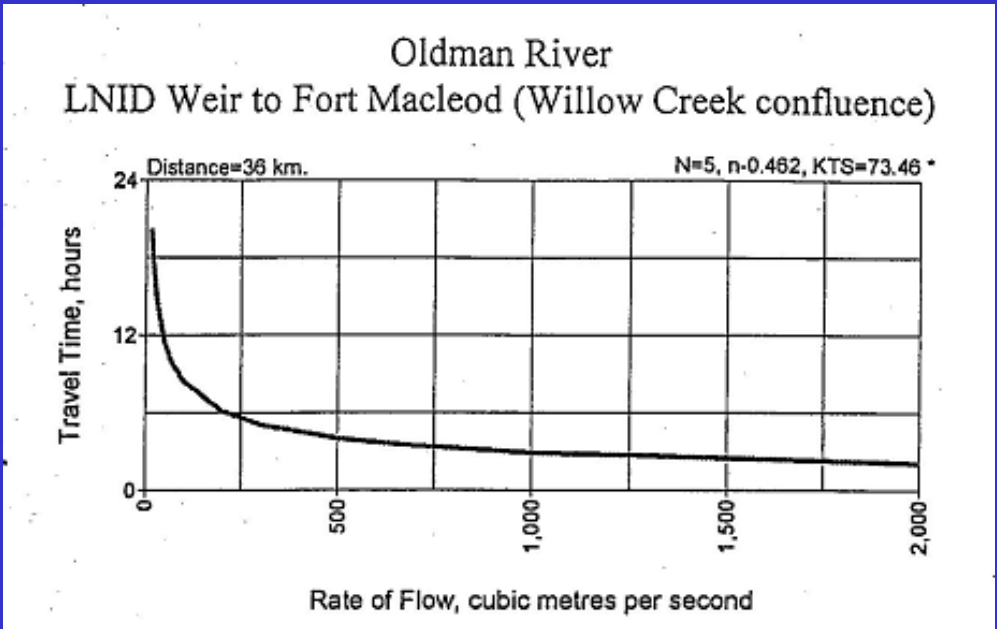
* SSARR channel routing equation parameters corresponding to travel times which are estimated from flow measurement data.

* SSARR channel routing equation parameters corresponding to travel times which are estimated from flow measurement data.

Discharge cms	Travel Time Hours	Travel Time Days	Speed km/hr	Discharge cfs
3	192.0	8.0	0.9	106.00
5	152.3	6.3	1.1	177.00
10	111.2	4.6	1.5	353.00
15	92.6	3.9	1.8	530.00
20	81.2	3.4	2.1	706.00
30	67.6	2.8	2.5	1,059.00
50	53.6	2.2	3.2	1,765.00
70	46.0	1.9	3.7	2,471.00
100	39.2	1.6	4.4	3,530.00
200	28.6	1.2	6.0	7,060.00
300	23.8	1.0	7.2	10,590.00
500	18.9	0.8	9.0	17,650.00
700	16.2	0.7	10.5	24,710.00
1000	13.8	0.6	12.4	35,300.00
2000	10.1	0.4	17.0	70,600.00

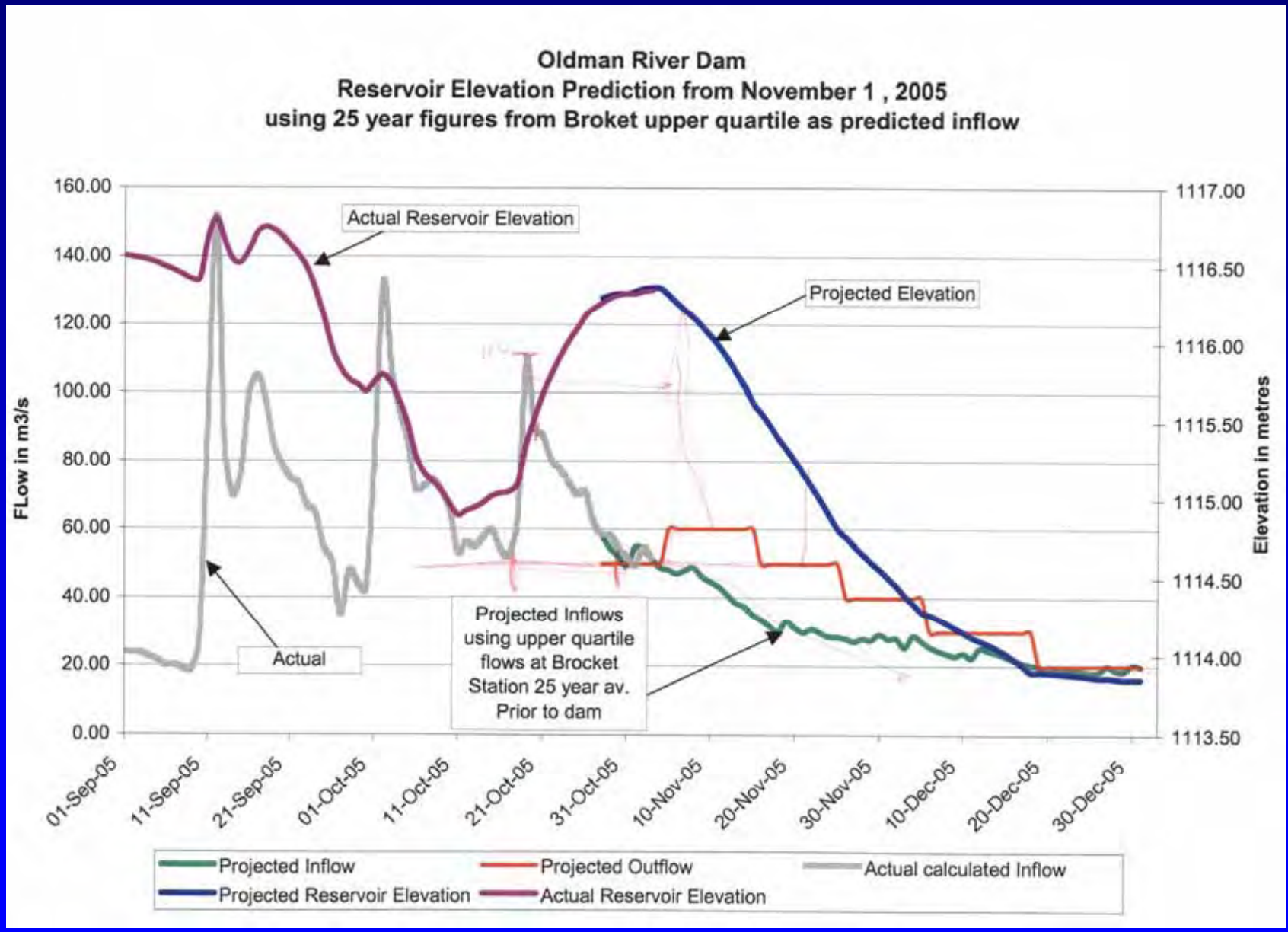
Time of Travel :

LNID Weir to Willow Cr Confluence



Travel Time Data

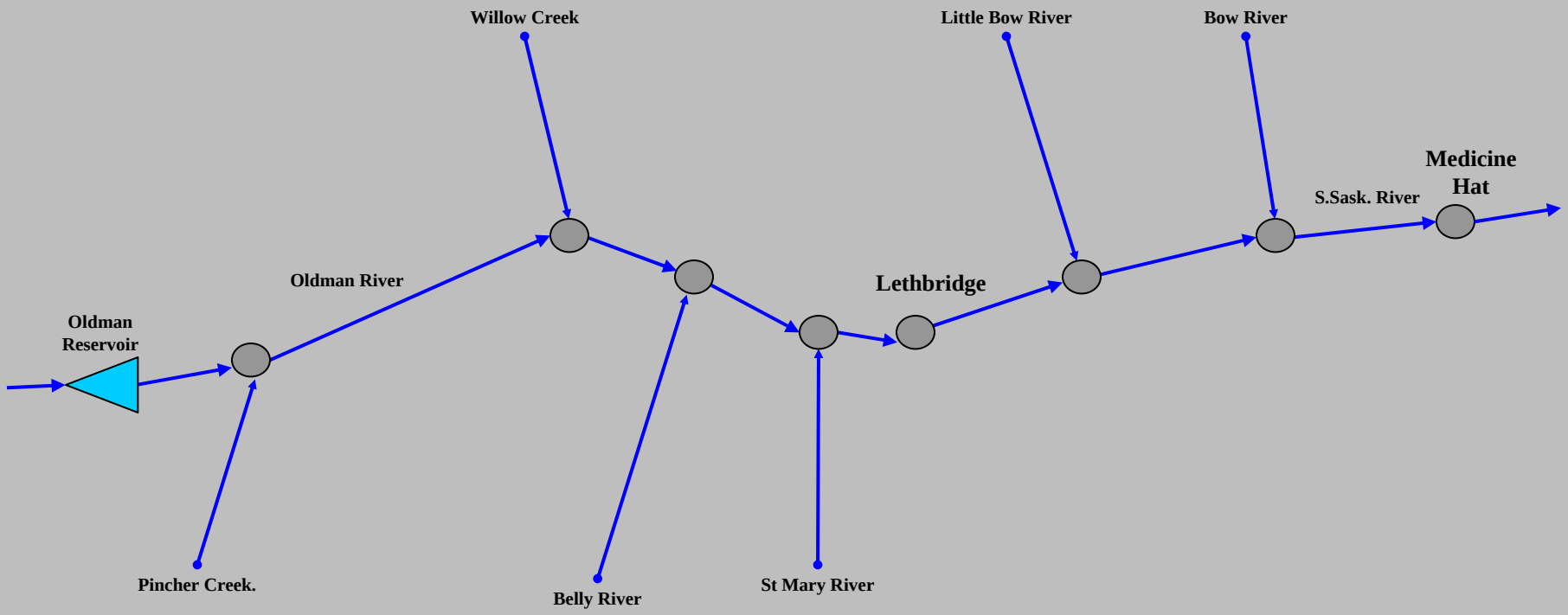
Discharge cms	Travel Time hours	Speed km/hr	Discharge cfs
1	70.8	0.5	35
3	42.6	0.8	106
5	33.7	1.1	177
10	24.4	1.5	353
15	20.3	1.8	530
20	17.7	2.0	706
30	14.7	2.4	1,059
50	11.6	3.1	1,765
70	9.9	3.6	2,471
100	8.4	4.3	3,530
200	6.1	5.9	7,060
300	5.1	7.1	10,590
500	4.0	9.0	17,650
700	3.4	10.5	24,710
1,000	2.9	12.4	35,300
2,000	2.1	17.0	70,600


Oldman River Dam
Reservoir Elevation Prediction from November 1 , 2005
using 25 year figures from Broket upper quartile as predicted inflow
FLow in m3/s
Elevation in metres
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1117.00
1116.50
1116.00
1115.50
1115.00
1114.50
1114.00
1113.50
Actual Reservoir Elevation
Projected Elevation
Actual
Projected Inflows using upper quartile flows at Brocket Station 25 year av. Prior to dam
01-Sep-05
11-Sep-05
21-Sep-05
01-Oct-05
11-Oct-05
21-Oct-05
31-Oct-05
10-Nov-05
20-Nov-05
30-Nov-05
10-Dec-05
20-Dec-05
30-Dec-05
Projected Inflow
Projected Outflow
Actual calculated Inflow
Projected Reservoir Elevation
Actual Reservoir Elevation

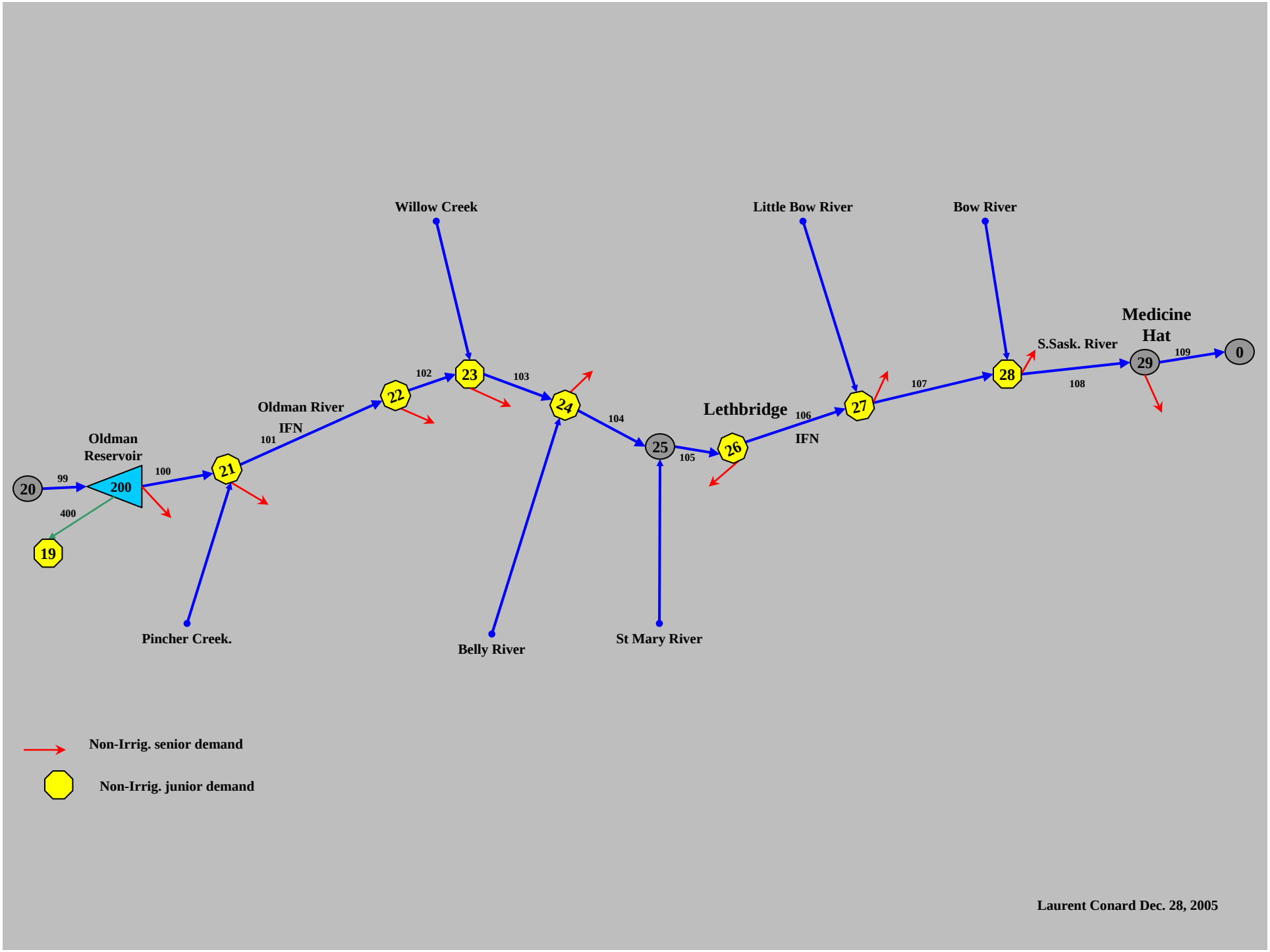
Oldman Operations Model Demonstration

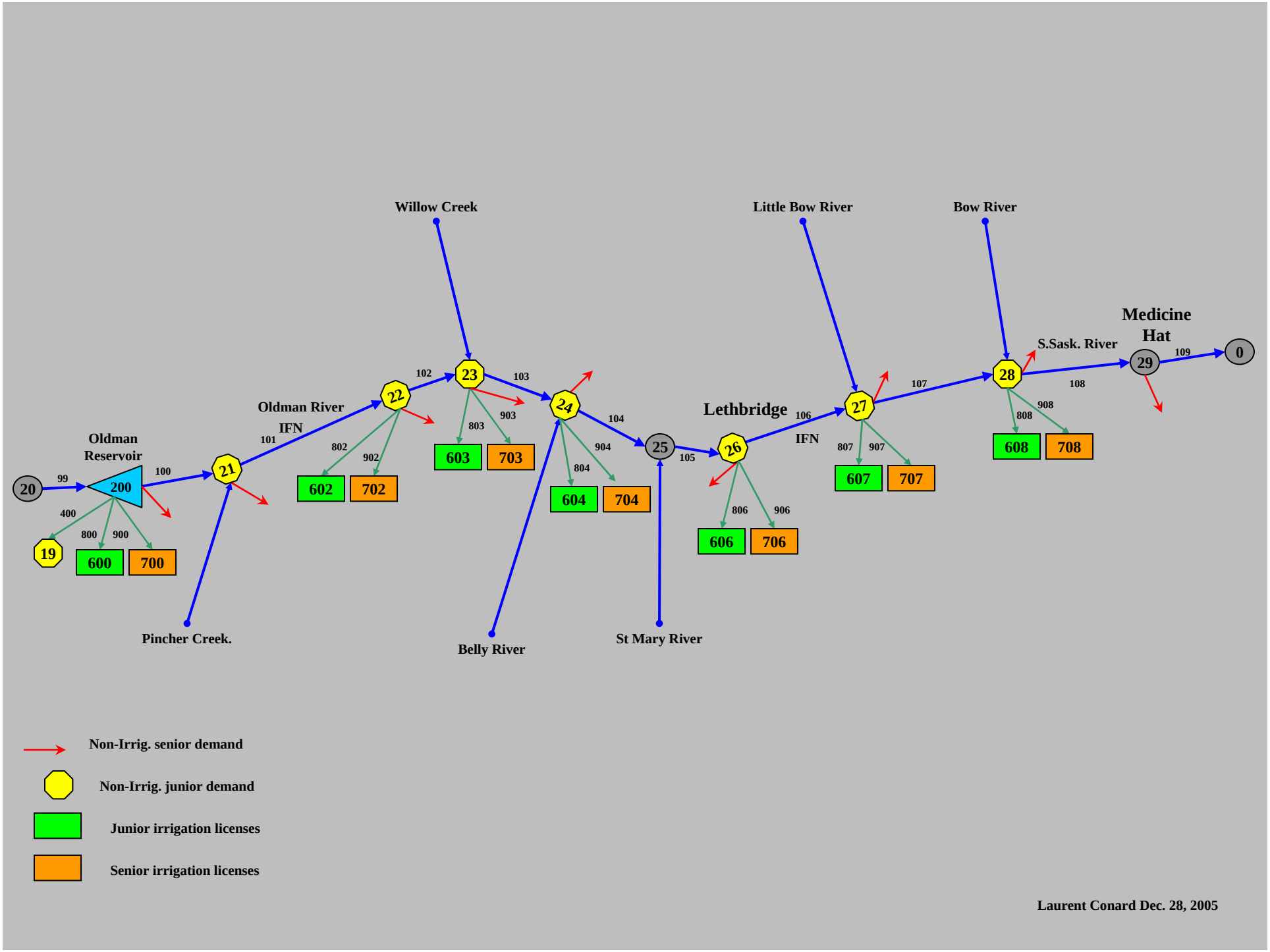
- Description of an actual model run

The Oldman River system model schematic



Laurent Conard Dec. 28, 2005


Willow Creek
Little Bow River
Bow River
Medicine Hat
S.Sask. River
Oldman River IFN
Oldman Reservoir
Lethbridge
IFN
Pincher Creek.
Belly River
St Mary River
20
99
200
100
21
101
22
102
23
103
24
104
25
105
26
106
27
107
28
108
29
109
0
400
19
Non-Irrig. senior demand
Non-Irrig. junior demand
Laurent Conard Dec. 28, 2005


Willow Creek
Little Bow River
Bow River
Medicine Hat
S.Sask. River
Oldman River IFN
Oldman Reservoir
Lethbridge IFN
Pincher Creek.
Belly River
St Mary River
20
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103
104
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108
109
400
800
900
802
902
803
903
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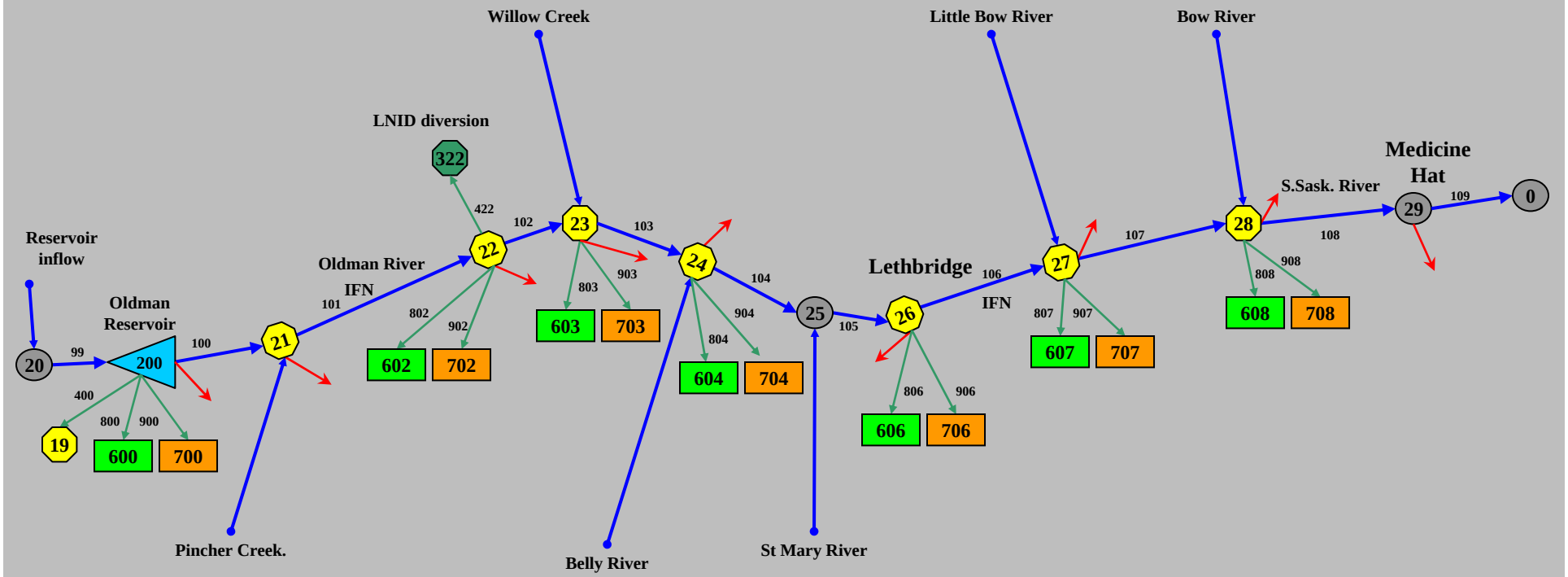
904
806
906
807
907
808
908
600
700
602
702
603
703
604
704
606
706
607
707
608
708
Non-Irrig. senior demand
Non-Irrig. junior demand
Junior irrigation licenses
Senior irrigation licenses
Laurent Conard Dec. 28, 2005

The Oldman River Operations Model



Non-Irrig. senior demand

Non-Irrig. junior demand

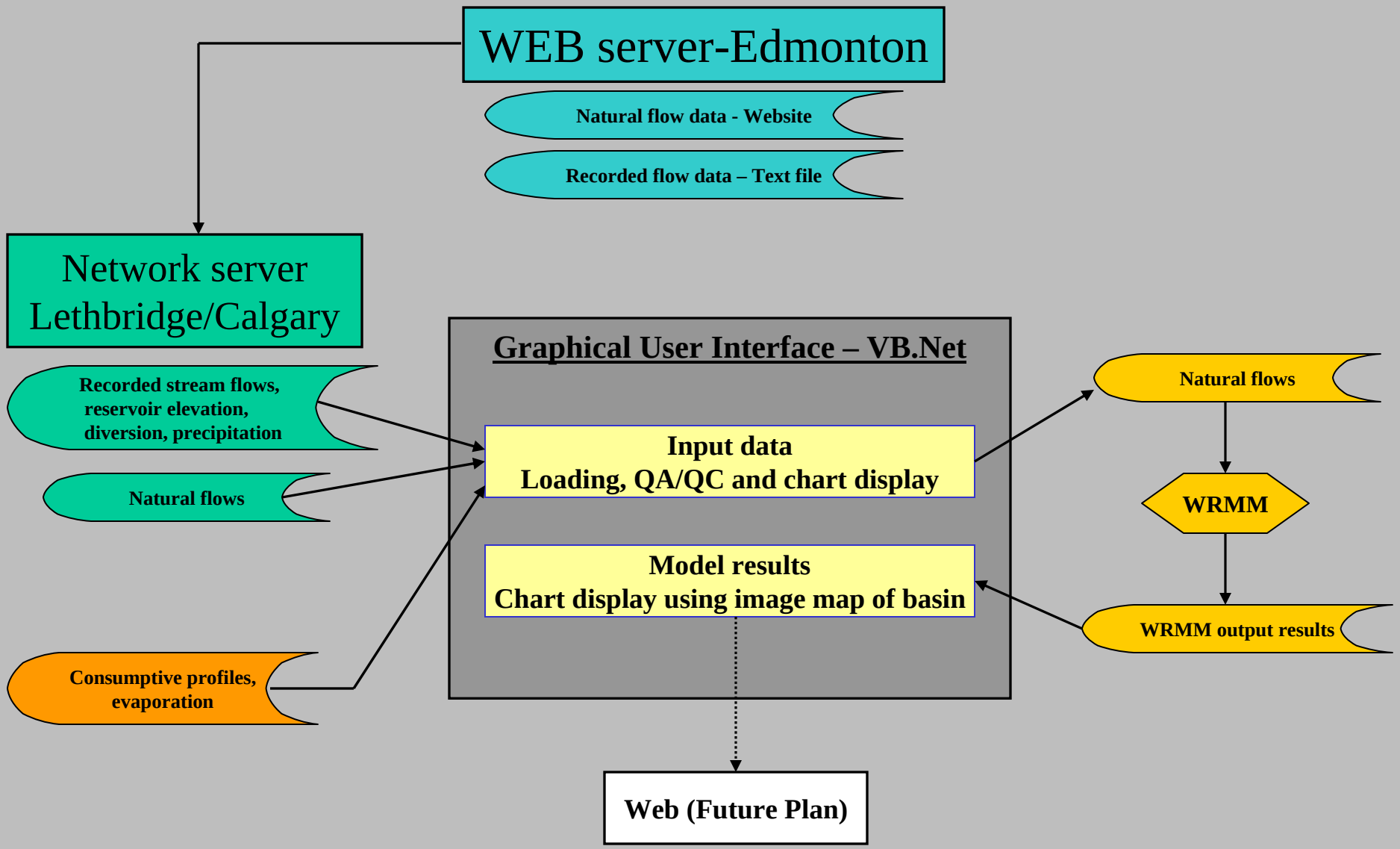
Junior irrigation licenses

Senior irrigation licenses

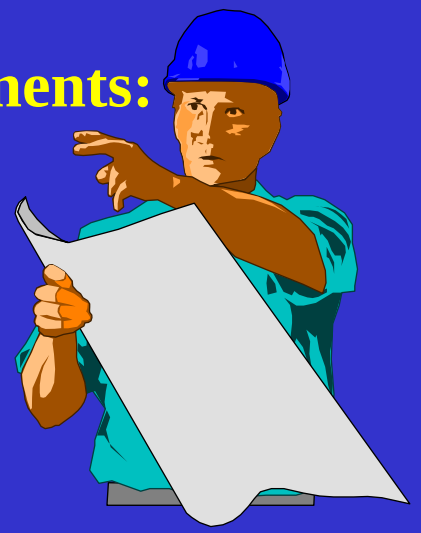
LNID diversion

Laurent Conard Dec. 28, 2005

System and data flow diagram



Instream Flow Needs (IFN) for Aquatic Environment - 4 Components:



- Fish Habitat
- Riparian Vegetation (Cottonwood)
- Water Quality
- Channel Maintenance

WMO manages the Oldman River Dam to take advantage of high flow conditions when they do occur to benefit the aquatic environment. During certain times of the year, **there may be opportunities** for flow management to provide benefits to the Aquatic Environment.

The OLDMAN RIVER DAM, is a multi purpose facility. It releases stored water to help licensed water users avoid shortages, to help meet apportionment, and to maintain flows for the AQUATIC ENVIRONMENT.

2002: Lower Oldman River Instream Flow Report

water

Oldman River - Ft. Macleod Reach (cms)				
Date	Natural Q	Upper Target	Minimum Target	Recorded Q
7/30/2002	37.4	22.7	20.5	26.6
7/31/2002	35.7	23.1	21.4	30.4
8/1/2002	33.4	23.8	21.8	31.1
8/2/2002	30.9	23.5	21.1	
8/3/2002				

Oldman River - Lethbridge Reach (cms)				
Date	Natural Q	Upper Target	Minimum Target	Recorded Q
7/30/2002	140.8	26.3	25.6	39.3
7/31/2002	134.5	26.3	25.6	32.9
8/1/2002	130.0	26.3	25.6	33.2
8/2/2002	125.2	26.3	25.2	
8/3/2002	120.6	26.1	24.7	

Note: If the computed I/O flow is less than the Water Quality(WQ) Minimum, then the target flow becomes the WQ minimum

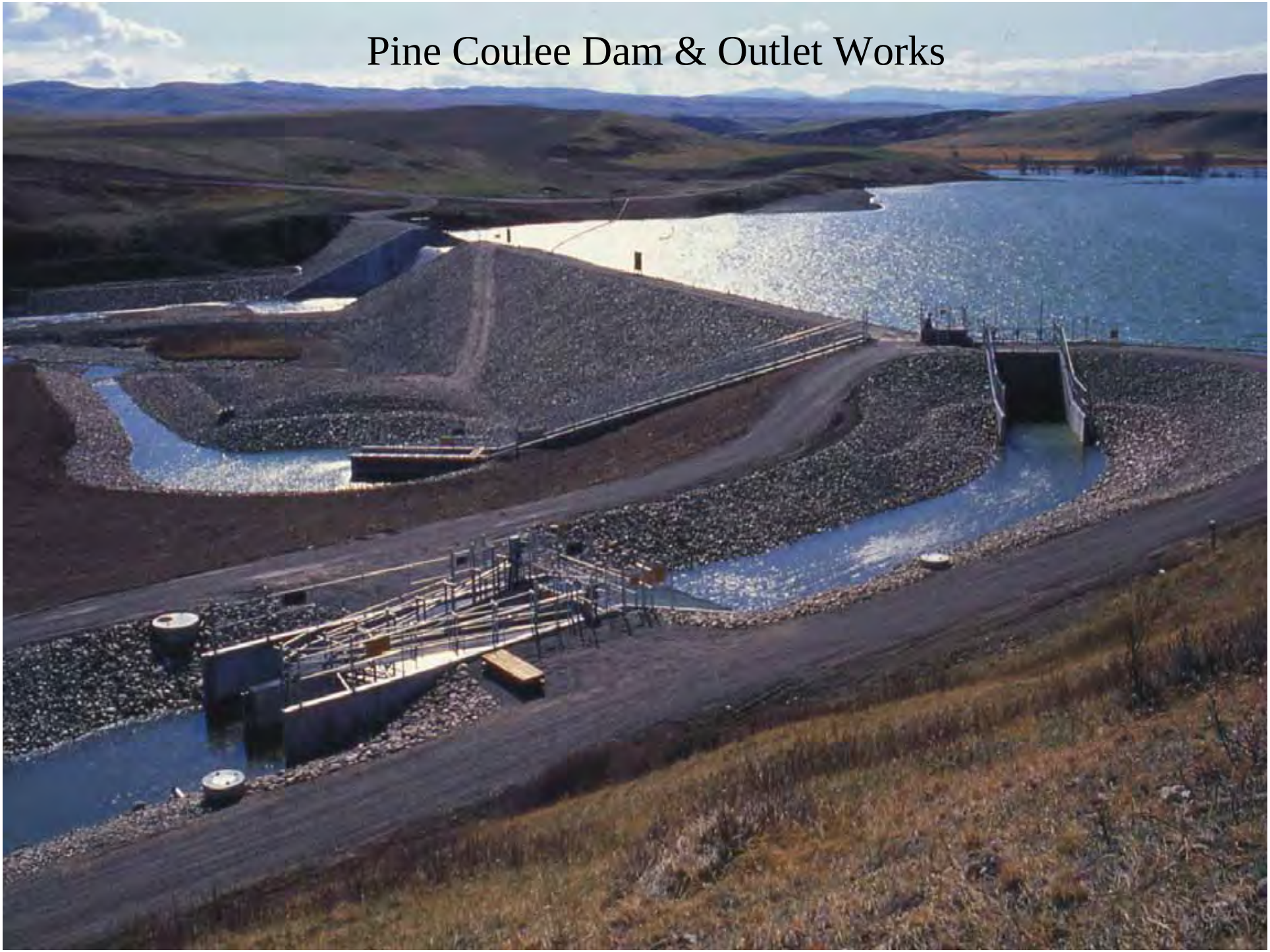
Species of Interest in the Oldman River Basin	
Common Fish in ORB	Spawning Period
Brown Trout	Fall
Rainbow Trout	Spring
Bull Trout	Fall
Mtn Whitefish	Fall
CutThroat Trout	Spring
Walleye	Spring
Northern Pike	Spring
Note - the competing times of spawning for the various species	

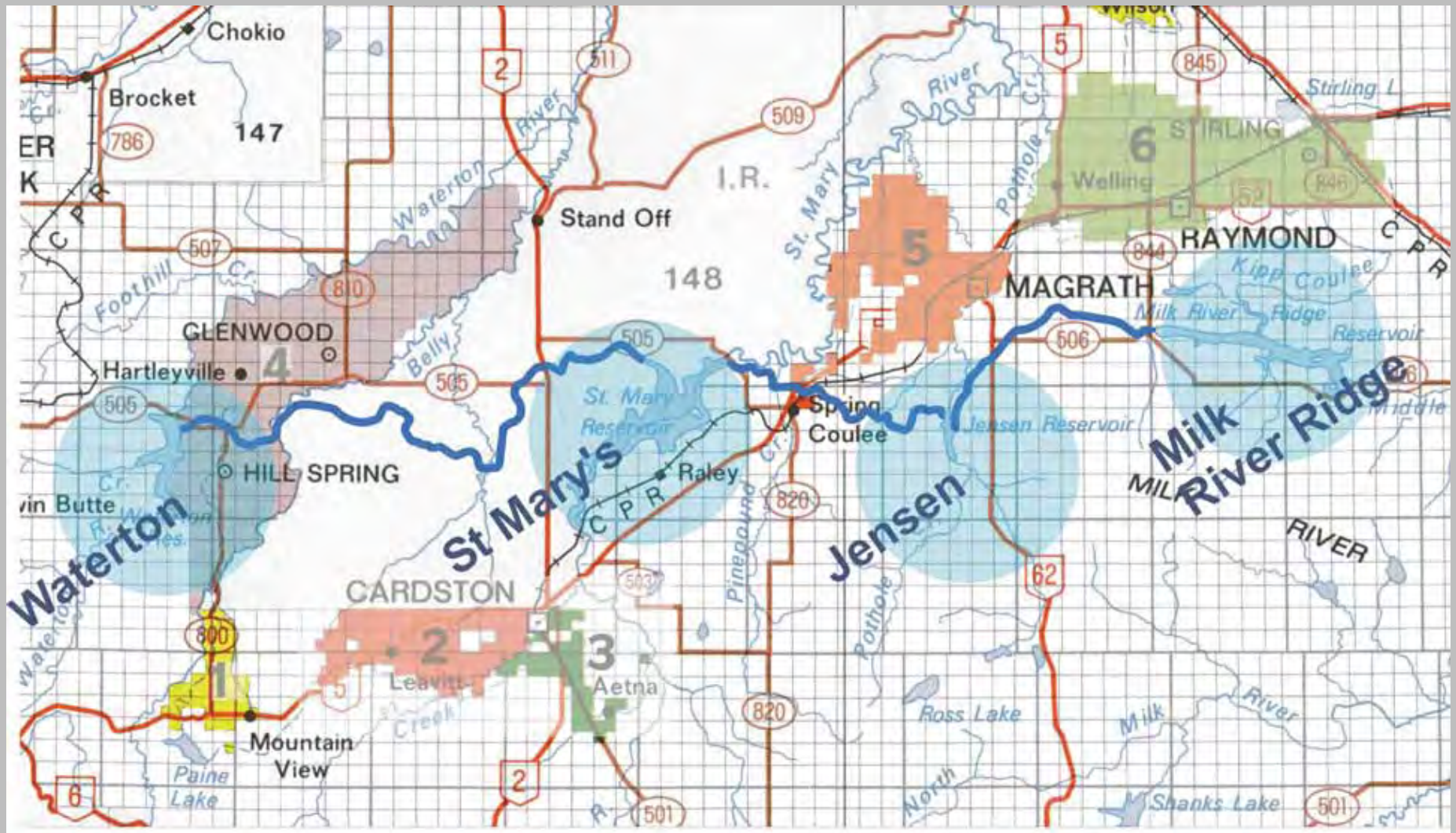
Goals of *Water for Life*

1. Safe, secure drinking water supply
2. Healthy aquatic ecosystems
3. Reliable, quality water supplies for a sustainable economy

Chain Lakes Reservoir

Pine Coulee Dam & Outlet Works

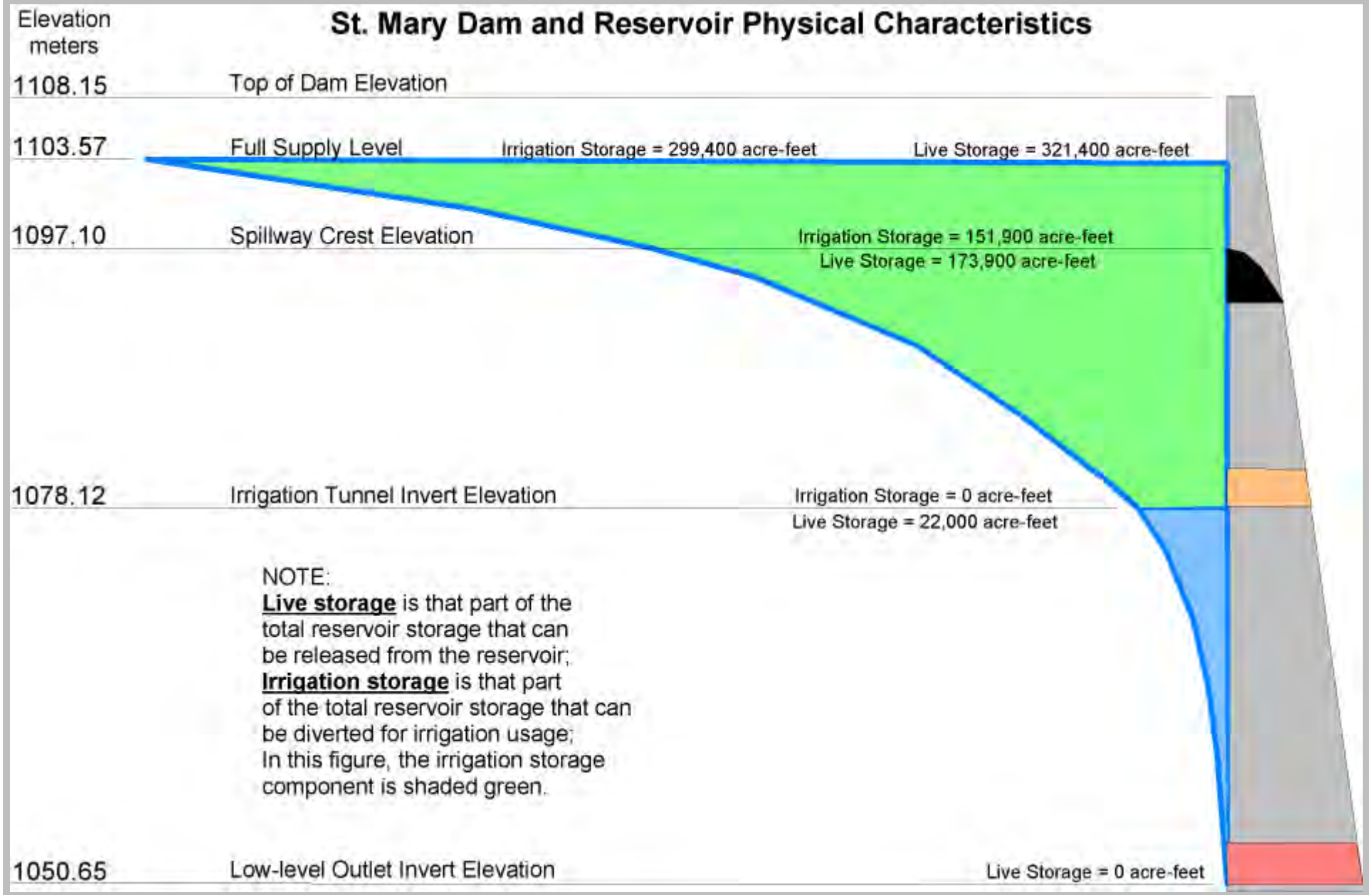




Waterton St. Mary's Headworks System


St.Mary Dam & Spillway

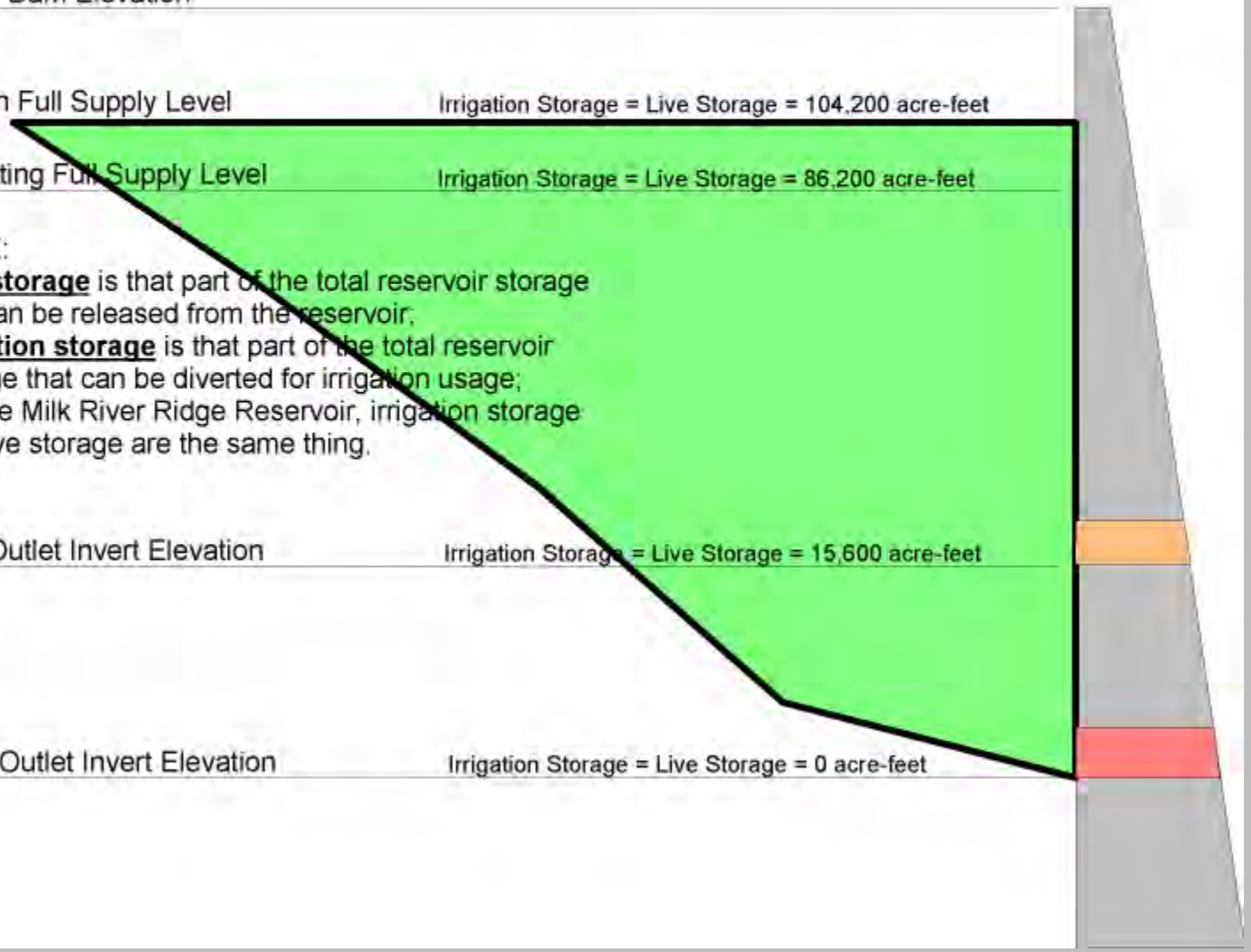
St. Mary Dam and Reservoir Physical Characteristics



Milk River Ridge North Dam and Reservoir Physical Characteristics

Elevation meters		
1036.30	Top of Dam Elevation	
1033.57	Design Full Supply Level	Irrigation Storage = Live Storage = 104,200 acre-feet
1032.00	Operating Full Supply Level	Irrigation Storage = Live Storage = 86,200 acre-feet
1023.20	East Outlet Invert Elevation	Irrigation Storage = Live Storage = 15,600 acre-feet
1018.17	North Outlet Invert Elevation	Irrigation Storage = Live Storage = 0 acre-feet

NOTE:
Live storage is that part of the total reservoir storage that can be released from the reservoir;
Irrigation storage is that part of the total reservoir storage that can be diverted for irrigation usage;
For the Milk River Ridge Reservoir, irrigation storage and live storage are the same thing.



4.3 St. Mary Reservoir Storage Zones

The storage zones associated for the St. Mary Reservoir are presented below. For zones relevant to flood routing, the corresponding elevations defined in this report are labelled.

Figure 4.4-1: Schematic of St. Mary Reservoir Storage Zones

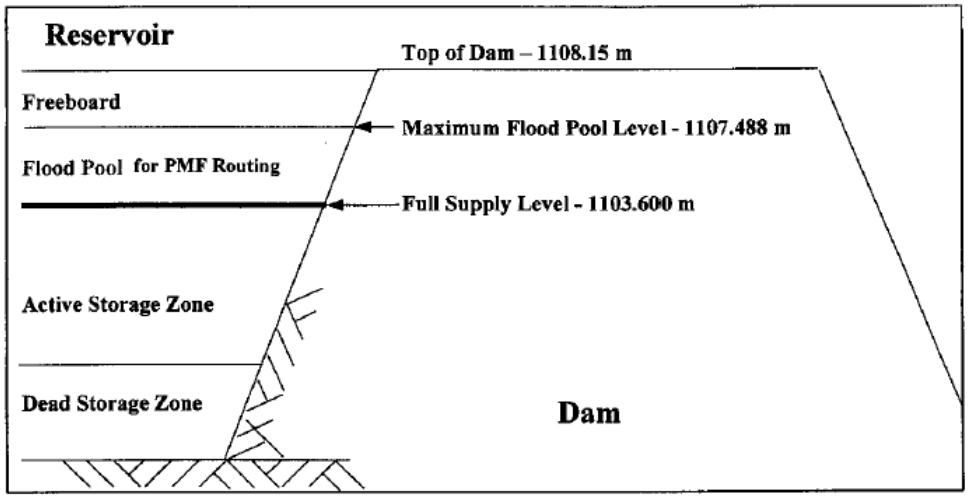


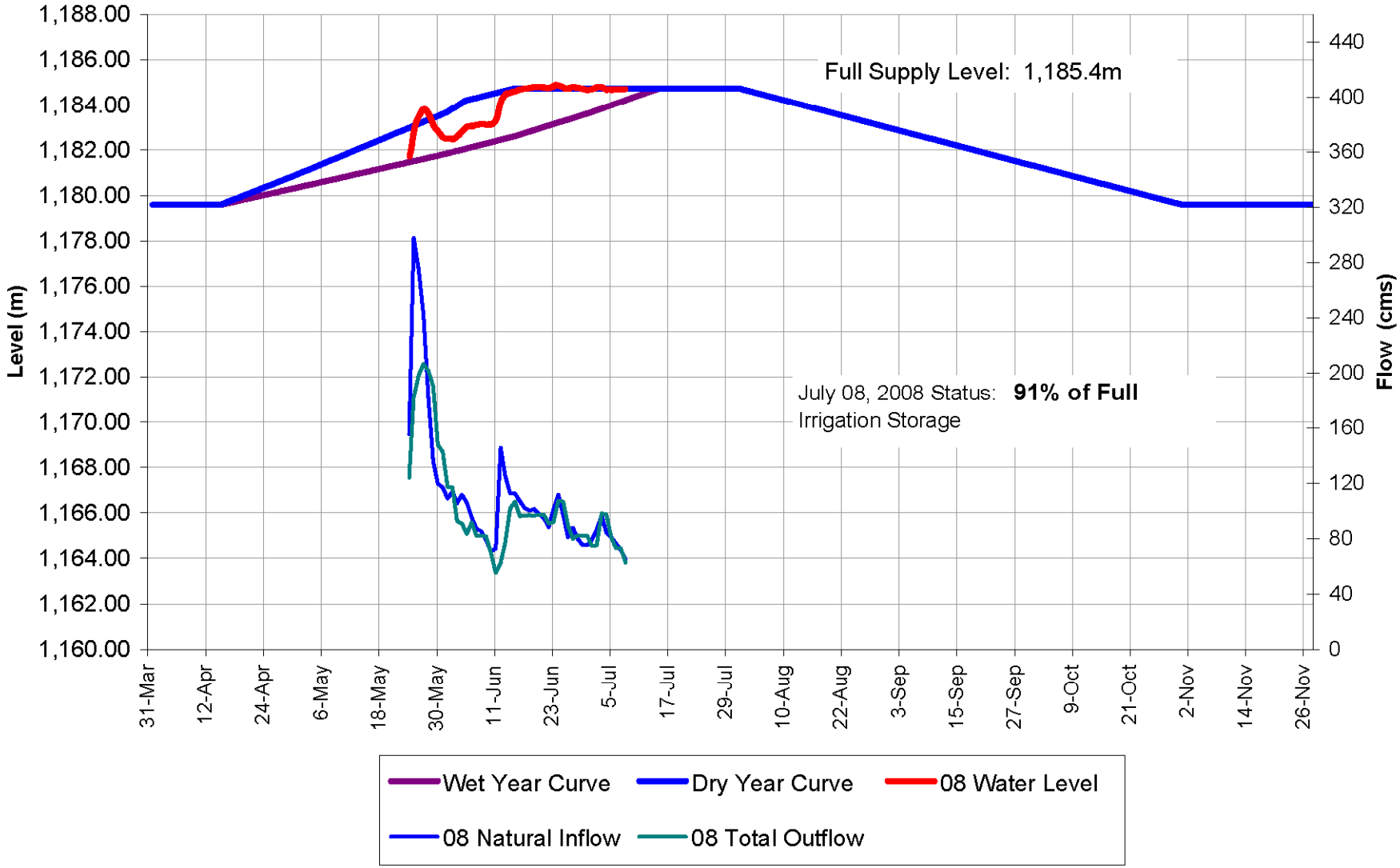
Table 4.4-1: Summaries of Reservoir Operating Levels and Storage Zones

Terminology	Definition	Reservoir Elevations
Freeboard	Provides sufficient height above the flood pool to prevent the dam from being overtopped by wave action and/or wind setup	1107.488 m to 1108.15 m
Flood Pool	Maximum elevation reservoir is permitted to reach while routing the PMF. It is defined by the requirements of the freeboard. Storage required to safely pass the PMF through the reservoir	1103.600 m to 1107.488 m
Flood Control Pool	Storage required to control floods.	Currently no mitigation of flood peaks
Full Supply Level	Top of normal operating elevation of a reservoir.	1103.600 m

Waterton Reservoir

2008 compared to Operating Rule Curves

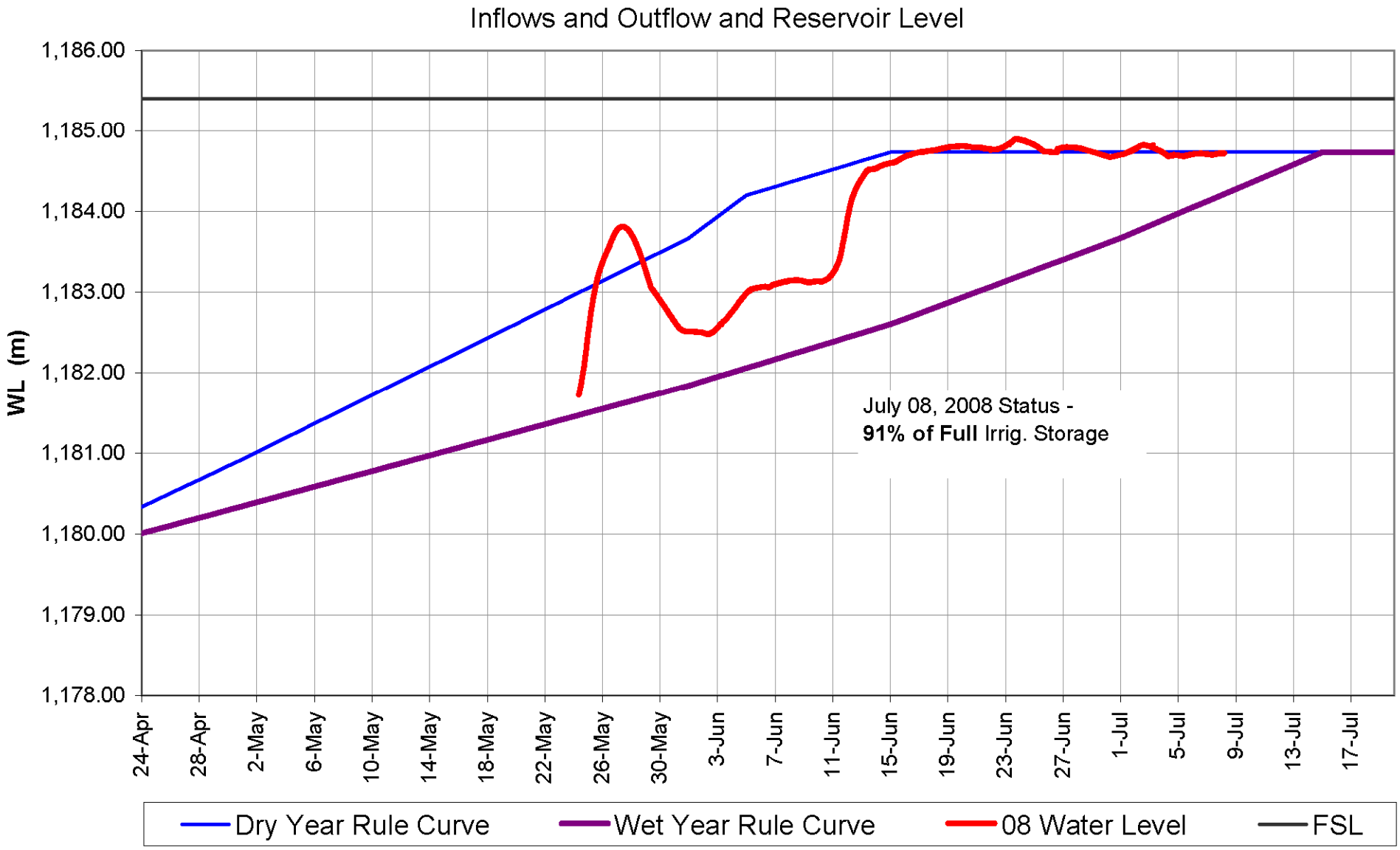
Inflows and Outflow and Reservoir Level



Published by:
Oldman Operations Team
Water Management Operations

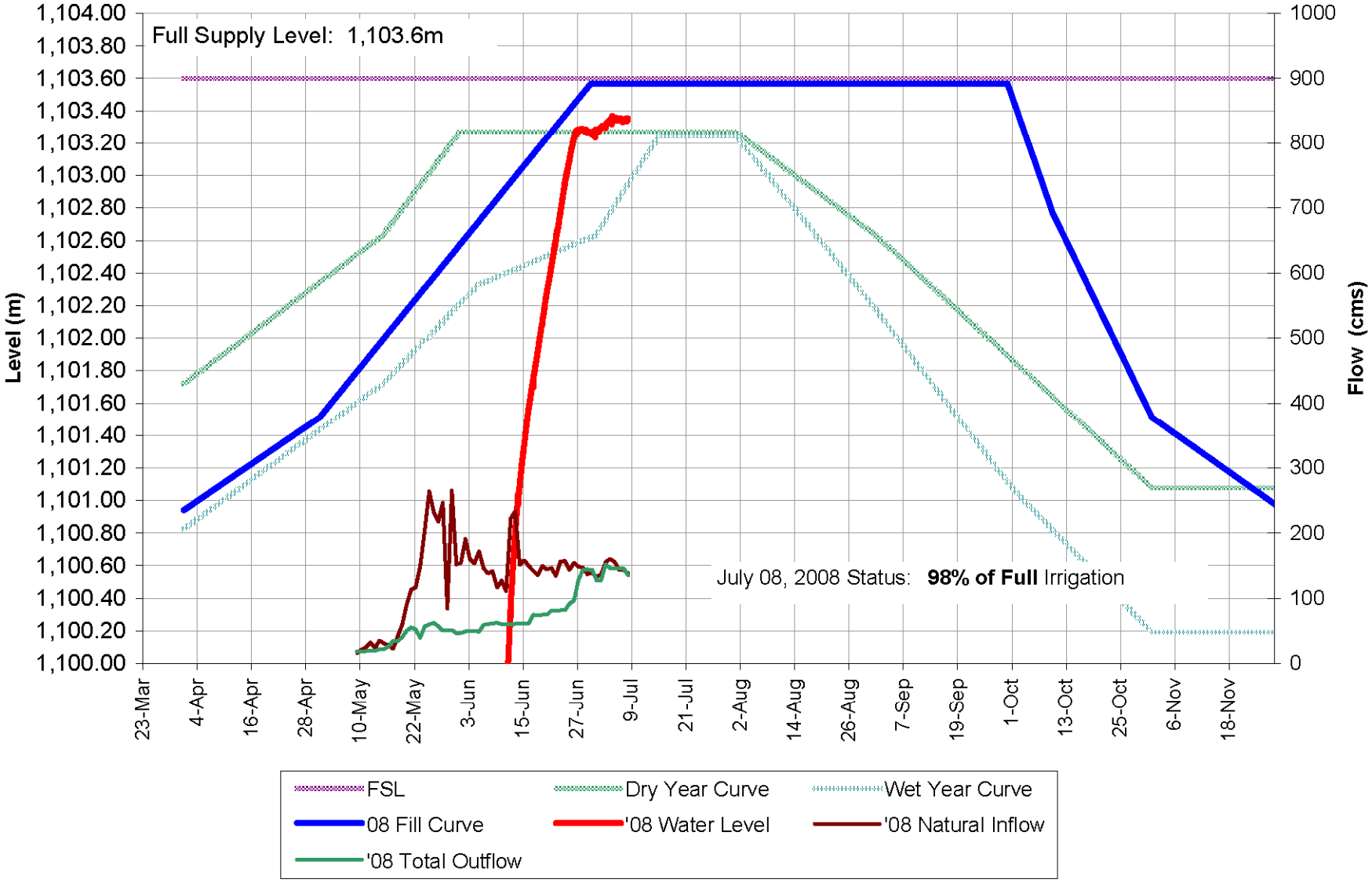
Publication Date:

Waterton Reservoir
compared to Operating Rule Curves



Published by:
Oldman River Basin Operations Team

St. Mary Reservoir
compared to 2008 Operating Rule Curve Guide
Inflows, Outflows and Water Level



Published by:
Oldman Operations Team
Water Management Operations

Publication Date:

September 13, 2006 Preliminary Forecast - SCENARIO I (Median DEMAND with LQ Supply)

CIRCULATION:

T.Lazarus - Oldman Operations Team Leader
S.Gnanakumar - Senior Manager
L.Wegwitz - WSM Site Superintendent
J. Tamminga - SMRID Operations Manager

Publication Date: 13-Sep-06

WATERTON - ST. MARY HEADWORKS:
OPERATIONS FORECAST (Sept 13 - October 31, 2006)
WATERTON, ST. MARY, MILK RIVER RIDGE RESERVOIRS

I) FORECAST RIVER(S) SUPPLY:

RIVERS	jun 01 -30		july 01 -31		aug 01 -31		sept 13 - 30		oct 01 -31		total (Sept 13 - Oct 31)	
	cfs/day	acre feet	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3	acre feet	dam3
WATERTON RIVER		n/a		n/a		n/a	3.2	4,977	2.9	7,767	**10,332**	**12,744**
DRYWOOD CREEK		n/a		n/a		n/a	0.7	1,089	0.6	1,607	**2,185**	**2,696**
ST. MARY RIVER		n/a		n/a		n/a	5.5	0,554	5.0	10,092	**17,791**	**21,946**
LEE CREEK		n/a		n/a		n/a	0.3	467	0.3	804	**1,030**	**1,270**
BELLY RIVER		n/a		n/a		n/a	1.5	2,333	1.2	3,214	**4,497**	**5,547**
TOTAL(S)		n/a		n/a		n/a	11.2	17,418	10.0	26,784	**35,835**	**44,202**

1) The Lee Creek Volume is incorporated into the St Mary River Volume (if Forecasting Volumes are used)
2) The Drywood Creek Volume is incorporated into the Waterton River Volume (if Forecasting Volumes are used)

3) American share on the St. Mary River has been removed (approx. 150,000 dam3 for the May-Sept period)

II) FORECAST INSTREAM DEMAND:

	jun 01 -30		july 01 -31		aug 01 -31		sept 13 - 30		oct 01 -31		total (Sept 13 - Oct 31)	
	cfs/day	acre feet	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3	acre feet	dam3
WATERTON DAM		n/a		n/a		n/a	2.5	3,888	2.5	6,696	**8,580**	**10,584**
BELLY RIVER WEIR		n/a		n/a		n/a	1.2	1,866	1.2	3,214	**4,119**	**5,080**
ST. MARY DAM		n/a		n/a		n/a	2.9	4,510	2.9	7,767	**9,953**	**12,277**
TOTAL(S)		n/a		n/a		n/a	6.6	10,264	6.6	17,677	**22,652**	**27,942**

September 13, 2006 Preliminary Forecast - SCENARIO I (Median DEMAND with LQ Supply)

III) FORECAST IRRIGATION DEMAND:

	jun 01 -30		july 01 -31		aug 01 -31		sept 13 - 30		oct 01 -31		total (Sept 13 - Oct 31)	
	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3	acre feet	dam3
UNITED I.D.		n/a		n/a		n/a	1.2	1,866	1.0	2,678	**3,684**	**4,545**
BLOOD TRIBE		n/a		n/a		n/a	0.8	1,166	0.5	1,339	**2,031**	**2,506**
MAGRATH I.D.		n/a		n/a		n/a	0.8	1,244	0.1	268	**1,226**	**1,512**
N. RIDGE & IRRICAN - *St. Mary, Swift, Kennedy*		n/a		n/a		n/a	20.0	31,104	8.0	21,427	**42,587**	**52,531**
E. RIDGE		n/a		n/a		n/a	1.0	1,555	1.0	2,678	**3,432**	**4,234**
TOTAL(S)		n/a		n/a		n/a	23.8	36,936	10.6	28,391	**52,961**	**65,327**

SUMMARY of FORECAST (September 13/2006 - October 31/2006):

	(dam3)
RIVER SUPPLY (from table I):	44,202
(subtract) RIVER DEMAND (from table II):	27,942
NET RIVER SUPPLY:	16,260
(subtract) IRRIGATION DEMAND (from table III):	65,327
Difference between demand and supply:	-49,067

	(dam3)
HEADWORKS TOTAL STORAGE (WatRes, SmyRes, RidRes) as of September 13, 2006:	329,000
Add difference between supply and demand:	-49,067
ESTIMATED TOTAL STORAGE as of October 31, 2006	279,933

% of TOTAL STORAGE based on above FORECAST:
(October 31st, 2006 FORECASTED STATUS) 45.7 %

Note: The total combined full supply storage of Waterton, St Mary and Ridge Reservoirs is 612,050 dam3

Note: Evaporative losses have not been taken into account. After reviewing forecast evaporative data used in the department's WRMM Model, the evaporative losses would be probably less tha 10,000 acre feet, which wc

Volumetric Storage for WINTER Targets

for the

Waterton - St. Mary Headworks System

2006 Operating Season

Project	Desired Winter Target (m)	Total Storage (dam3)	Conversion Factor to Irrigation Storage (dam3)	Irrigation Storage (dam3)	AENV Operating Curve WET of DRY
St. Mary Reservoir	1,099.00	256,800	27,100	229,700	WET
Waterton Reservoir	1,179.85	119,085	58,600	60,485	Above Spillway Crest
Milk River Ridge Reservoir	1,031.30	96,650	n/a	96,650	n/a
TOTALS	n/a	472,535	n/a	**386,835**	n/a

386,835 dam3 is 63% of FULL
612,000 dam3 is 100% of FULL

September 13, 2006 Projection Summary compared to Winter Target:

	October 31st Estimate:	
i) Median Demand with Lower Quartile Supply	Combined Volume: **279,933** dam3	Percent of FULL: **45.7** % of FULL
i) Difference in Oct 31/06 Projection vs. Winter TOTAL Storage Target "Shortfall from Winter Cumulative Storage Total"	Combined Volume: **106,902** dam3	Percent of Total Storage: **17.5** % of FULL

How is water managed? (Cont'd)

April 1-Oct 31 (irrigation season)

Canada entitled to 75% of St. Mary R. for Q < 666 cfs
+50% of St. Mary Flow above 666 cfs

U.S. entitled to 75% of Milk River Q < 666 cfs
+50% of Milk R. Flow above 666 cfs

Nov 1 – March 31 (non-irrigation season)

U.S. & Canada each entitled to 50% of Milk & St. Mary

Computation Procedure

Daily Accounting

Balance Period (currently semi-monthly)

Use it or Lose it (no banking of water)

South Saskatchewan River Below Red Deer River

2007 Apportionment Balance

Month	RECORDED	NATURAL	Monthly Recorded	Monthly Natural	Monthly % Delivered of Natural Volume	Monthly Volume Surplus	Accumulated Recorded Volume	Accumulated Natural Volume	Accumulated % Delivered	Accumulated Surplus Volum
	dam3	dam3	1000 dam3	1000 dam3	to Saskatchewan	1000 dam3	1000 dam3	1000 dam3	to Saskatchewan	1000 dam3
JAN	268,000	188,000	268	188	142.6	174.0	268	188	142.6	17
FEB	250,000	159,000	250	159	157.2	170.5	518	347	149.3	34
MAR	525,000	495,000	525	495	106.1	277.5	1,043	842	123.9	62
APR	847,000	788,000	847	788	107.5	453.0	1,890	1,630	116.0	1,07
MAY	1,308,000	1,549,000	1,308	1,549	84.4	533.5	3,198	3,179	100.6	1,60
JUN	2,056,000	2,641,000	2,056	2,641	77.8	735.5	5,254	5,820	90.3	2,34
JUL	789,000	1,326,000	789	1,326	59.5	126.0	6,043	7,146	84.6	2,47
AUG	356,000	598,000	356	598	59.5	57.0	6,399	7,744	82.6	2,52
SEP	420,000	454,000	420	454	92.5	193.0	6,819	8,198	83.2	2,72
OCT	389,000	371,000	389	371	104.9	203.5	7,208	8,569	84.1	2,92
NOV	312,000	277,000	312	277	112.6	173.5	7,520	8,846	85.0	3,09
DEC	217,000	130,000	217	130	166.9	152.0	7,737	8,976	86.2	3,24

1320.5

Mountain View-Leavitt-Aetna Headworks System

Before signing off . . .

WMO Operations can be accessed by anyone with internet access at the following department web site - click Water Manage. Reports

Oldman Operations Team

Internet Web Postings on a Daily Basis:
(double click address)

http://environment.alberta.ca/apps/basins/default.aspx

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Oldman River Basin
Upper Oldman Basin & Reservoir Operations Data

Water Management Operations Report

Notes:

i. Data is collected real time and subject to revision at any time
ii. All flow values are in cubic meters/second or cms (35.314475 cubic feet/second = 1 cms)
iii. All water level readings are in meters
iv. All storage readings are in cubic decameters or dam^3 (.8107 acre feet = 1 dam^3)
v. All Water Management Reports are created and produced by the Oldman River Basin Operations Team - Lethbridge Office
vi. WSC - Water Survey of Canada

	Upstream					Oldman Reservoir				Downstream		
Date	Estimate Reservoir Natural Inflow	Castle River at Beaver Mines	Crowsnest River at Frank	Oldman River at Waldron's Corner	Total of three WSC Upstream stations	FSL: 1,118.60 m Capacity: 495,000 dam^3			Tunnels	Spillway	Total Release	Oldman River near Brocket
						Level	Storage	% full				
Jun 29, 2008	81.1	41.1	8.5	23.3	72.9	1,118.72	497,903	100.6	79	0	79	79.1
Jun 30, 2008	79.4	41.8	8.5	22.6	72.9	1,118.72	497,977	100.6	79	0	79	79.1
Jul 1, 2008	79.2	42.5	8.7	21.4	72.6	1,118.72	498,001	100.6	79	0	79	79.2
Jul 2, 2008	85.2	42.8	10.0	29.8	82.6	1,118.74	498,441	100.7	79	0	79	78.9
Jul 3, 2008	91.3	40.8	10.8	33.0	84.6	1,118.78	499,511	100.9	79	0	79	79.1
Jul 4, 2008	86.9	37.5	9.8	26.8	74.1	1,118.75	498,804	100.8	96	0	96	98.3

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Southern Tributaries
St. Mary River Operations Data

Water Management Operations Report

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	Sherburne Reservoir, MT	Upstream			St.Mary Reservoir				Downstream				
Date	FSL: 1,459.4m Live Storage: 87,700 dam^3	US - St. Mary Diversion	St. Mary River at Boundary	Lee Creek at Cardston	Estimated Reservoir Natural Inflow	FSL: 1,103.60 m Irr. Capacity: 370,095 dam^3			Tunnel	Spillway	Hydro	Total River Release	St. Mary River near Lethbridge	Total Reservoir Outflow
	Storage					Level	Storage	% full						
Jun 29, 2008	82,811	16.8	57.0	5.0	137.1	1,103.27	357,345	96.6	0.0	51.8	5.11	57.0	53.6	144.2
Jun 30, 2008	83,215	16.8	52.8	4.8	139.5	1,103.26	357,128	96.5	0.0	51.8	5.14	56.9	55.7	144.0
Jul 1, 2008	83,578	16.8	60.0	5.0	132.6	1,103.27	357,385	96.6	0.0	35.4	5.10	40.4	41.1	127.7
Jul 2, 2008	84,003	16.8	61.8	5.9	137.1	1,103.29	358,221	96.8	0.0	35.4	5.11	40.6	41.1	127.6
Jul 3, 2008	84,045	16.8	69.4	6.2	155.7	1,103.31	358,806	96.9	0.0	60.0	5.13	65.1	62.5	152.3

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Southern Tributaries
Waterton River Operations Data

Water Management Operations Report

Notes:

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	Upstream		Waterton Reservoir				Downstream				
Date	Waterton River at the Nat. Park	Drywood Creek near the mouth	Estimated Reservoir Natural Inflow	FSL: 1,185.67 m Capacity: 114,334 dam^3			Tunnel	Spillway	Hydro	Total River Release	Waterton River at Glenwood	Total Reservoir Outflow
				Level	Storage	% full						
Jun 29, 2008	75.1	7.7	75.7	1,184.72	104,149	91.1	0.0	29.4	6.95	36.4	37.0	82.2
Jun 30, 2008	75.3	7.9	75.2	1,184.67	103,689	90.7	0.0	29.3	6.96	36.2	36.9	81.9
Jul 1, 2008	77.8	8.2	79.7	1,184.71	104,039	91.0	0.0	22.1	6.94	29.1	27.2	74.7
Jul 2, 2008	86.7	9.7	86.5	1,184.80	104,829	91.7	0.0	22.3	7.12	29.4	27.5	75.3
Jul 3, 2008	85.7	9.9	96.8	1,184.82	105,045	91.9	0.0	34.8	7.11	41.9	41.9	98.2
Jul 4, 2008	78.2	9.7	94.1	1,184.69	103,729	90.7	0.0	34.5	7.09	41.6	42.2	97.2

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Southern Tributaries
Belly River Operations Data

Water Management Operations Report

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	Payne Lake				Downstream Stations					
Date	MVLA Diversion	FSL: 1,343.56 m Capacity: 8,687 dam^3			Belly River near Mtn View	UID Canal at Hillspring	Waterton Belly Canal	Belly - St.Mary Diversion	Belly River near Glenwood	Belly River at Moon River Road
		Diversion	Level	Storage						
Jun 29, 2008	0.05	1,343.44	8,432	95.1	17.0	3.25	45.7	69.6	6.4	44.7
Jun 30, 2008	0.04	1,343.42	8,384	94.5	17.9	3.25	45.7	69.7	6.3	43.9
Jul 1, 2008	0.18	1,343.43	8,386	94.6	20.5	4.31	45.8	69.7	6.9	40.6
Jul 2, 2008	0.07	1,343.41	8,345	94.1	28.6	4.47	45.9	70.9	9.6	37.7
Jul 3, 2008	0.06	1,343.39	8,304	93.7	39.4	4.68	56.2	72.3	16.0	42.0
Jul 4, 2008	1.55	1,343.39	8,297	93.6	30.8	4.54	55.7	71.2	16.3	52.0
Jul 5, 2008	1.53	1,343.42	8,360	94.3	29.6	4.85	46.0	68.9	8.8	43.0

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Oldman River Basin
Upper Oldman Basin & Reservoir Operations Data

Water Management Operations Report

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Jul 4, 2008	86.9	37.5	9.8	26.8	74.1	1,118.75	498,804	100.8	96	0	96	98.3

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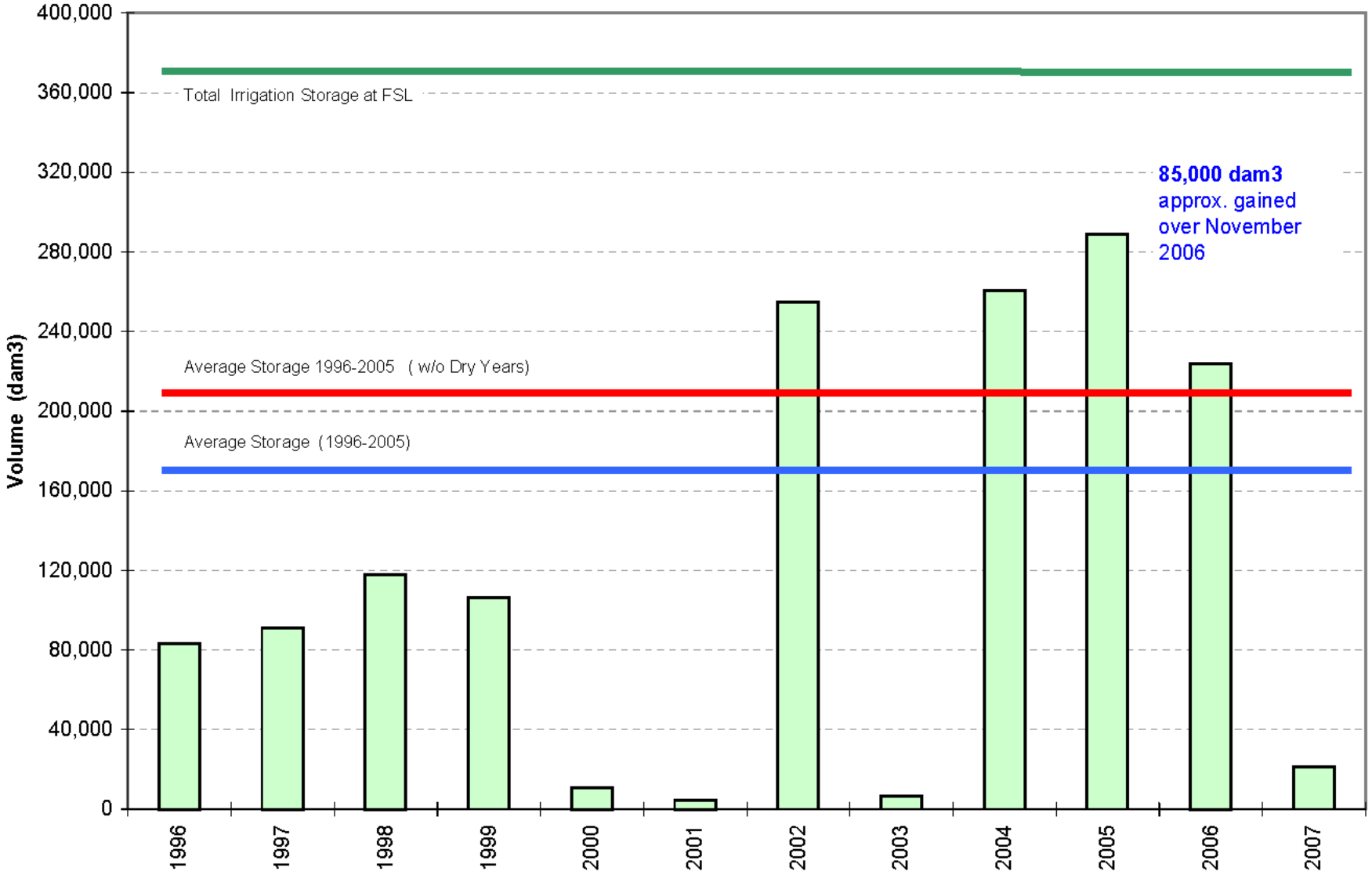
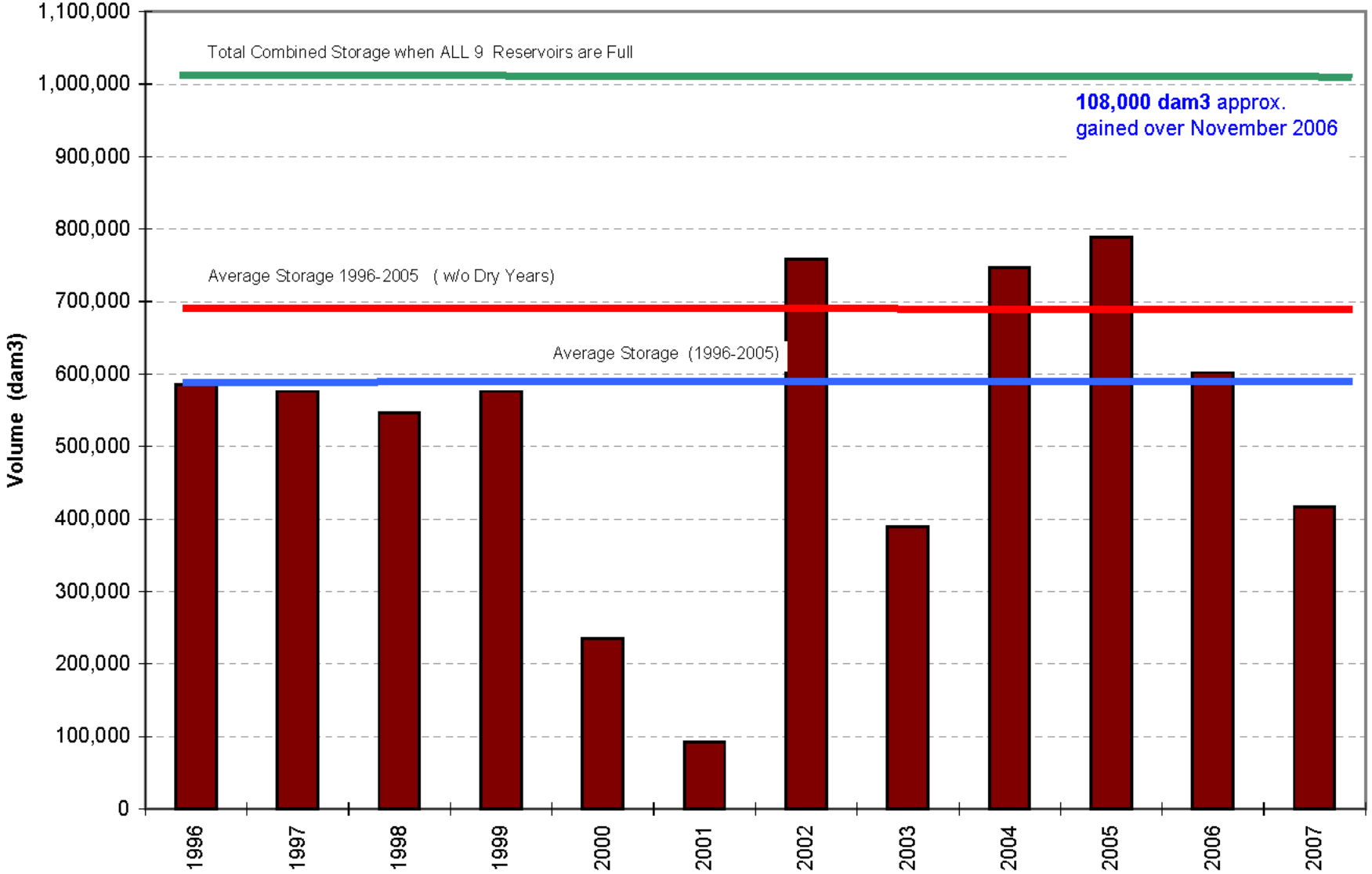
Year END Irrigation Storage for St. Mary Reservoir
1996 - 2007



Dry Years that were removed from Red Line Avg: 2000, 2001, 2003

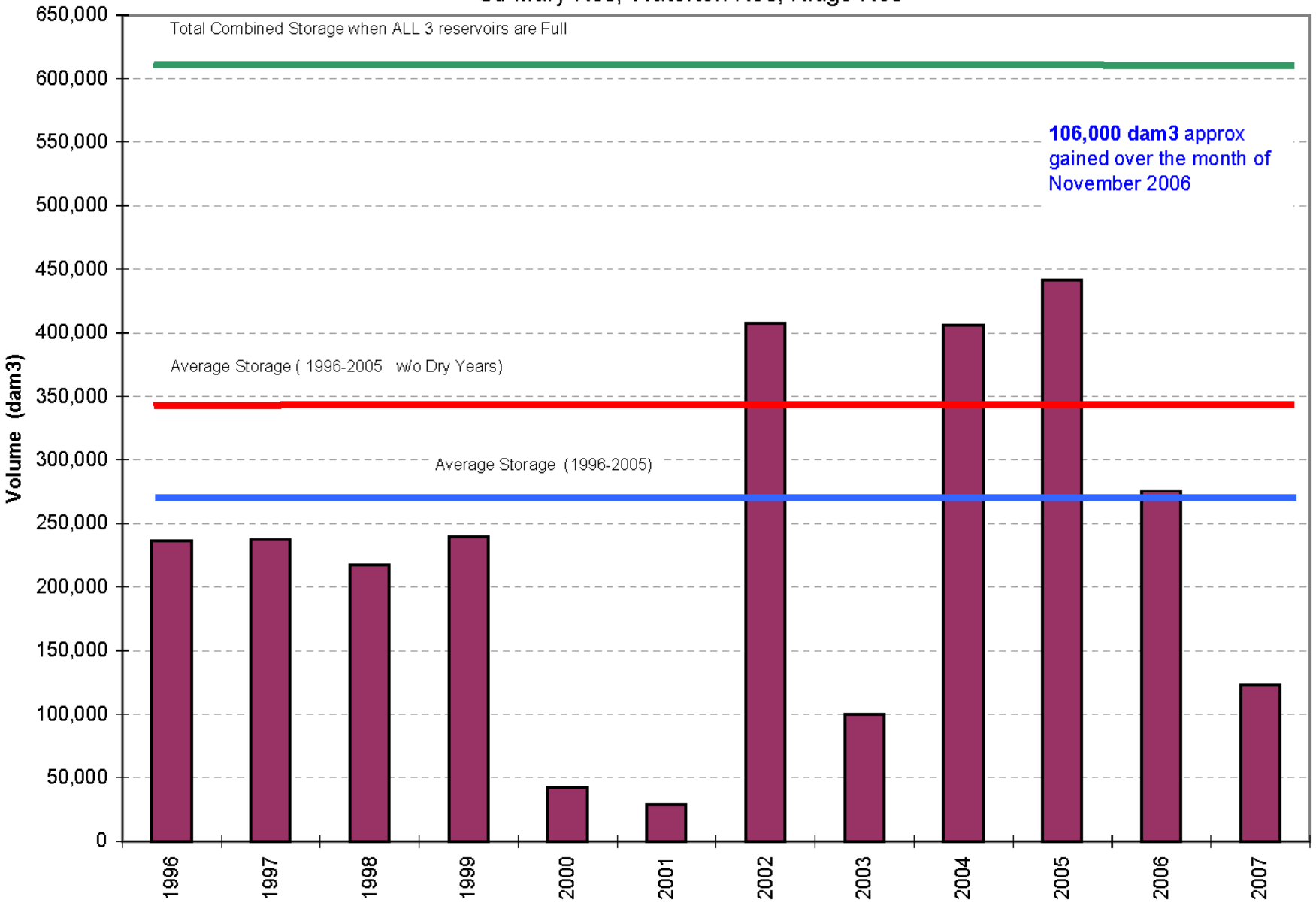
Year End Combined Irrigation Storage
AENV and SMRID Reservoirs
1976 - 2007



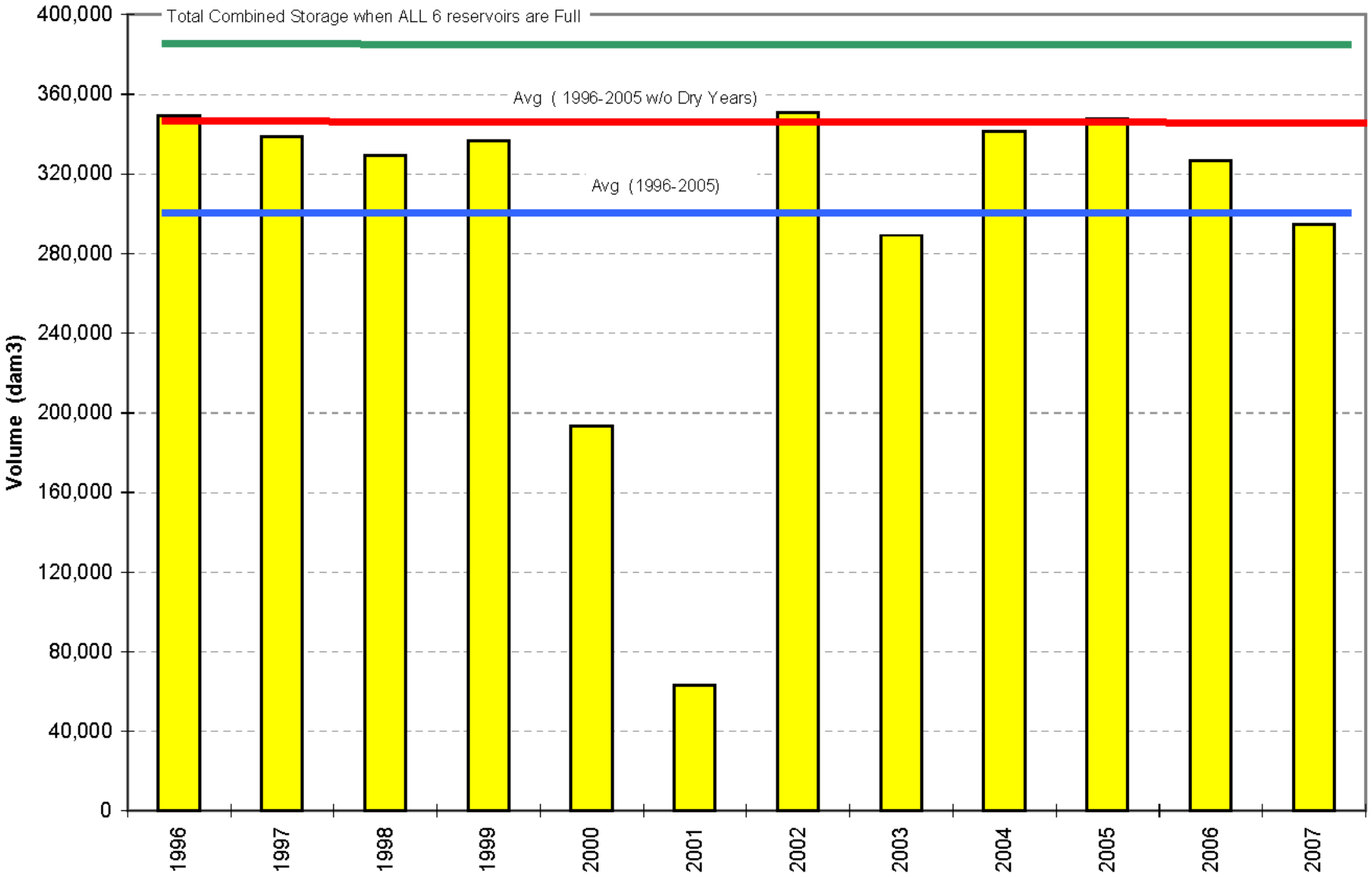
Dry Years that were removed from Red Line Avg: 2000, 2001, 2003

Year END Combined Storage for AENV Reservoirs 1996 - 2007

St. Mary Res, Waterton Res, Ridge Res



Year END Combined Storage for SMRID Reservoirs



Dry Years that were removed from Red Line Avg: 2000, 2001, 2003

New Stations List:

Lethbridge Northern System Additions ?

ROLDMAC (curve extension NEEDS to be resolved if Operators are to use this site) Oldman River at Ft Macleod

Monarch Diversion WL Station/Flow

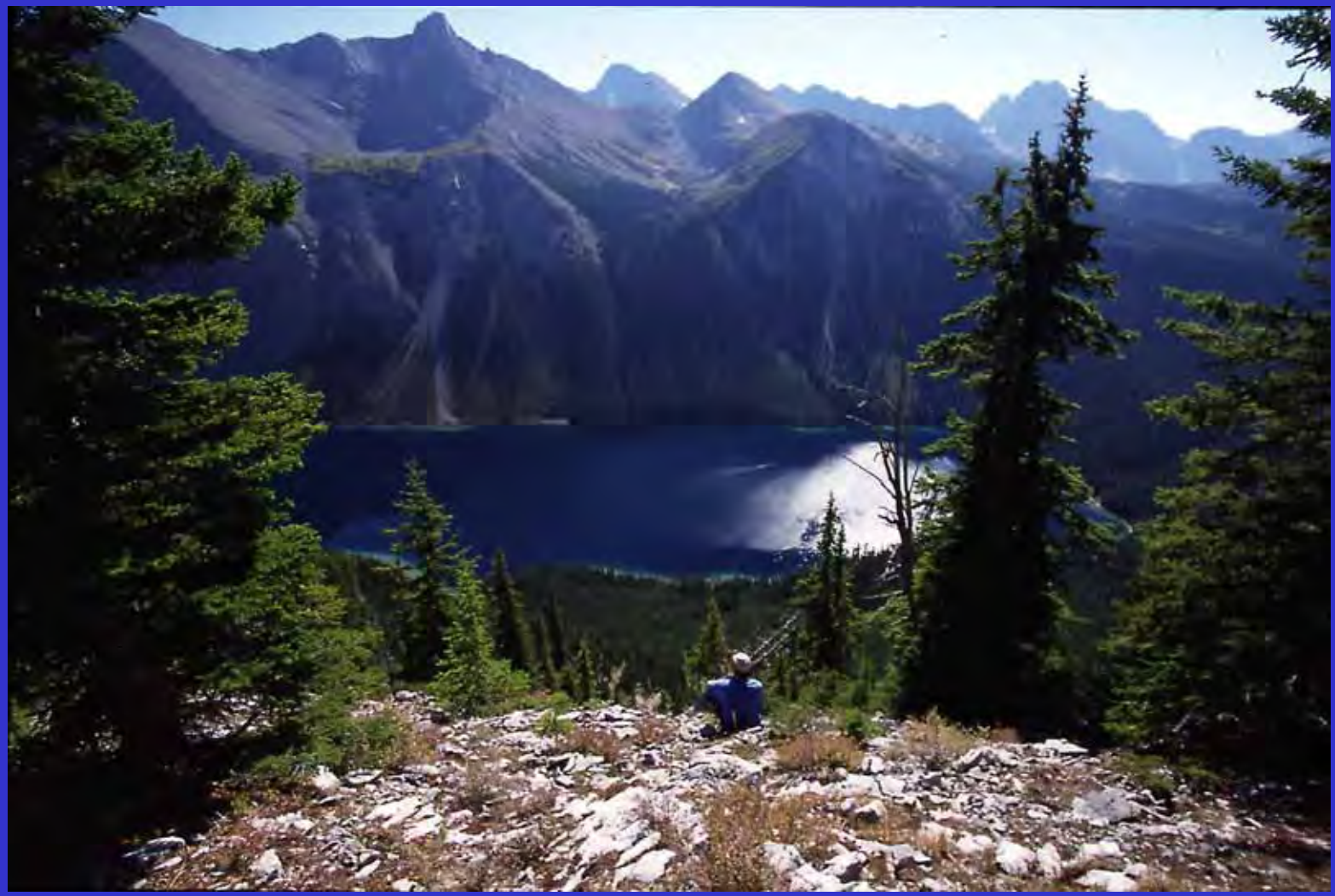
Quantify delivery to LNID

Keho Reservoir Inflow

Reservoir balancing required and delivery to LNID

Keho Reservoir Outflow

Needed for Fall Drawdown to Target Level



Just thought I’d add in this beauty shot – how everything looks when the snow has gone.

Thank You