2017 Operations Season Summary

"Year of Record Demands"

"Projections for Spring 2018"

Prepared by: Dennis Matis, BSc, CET Acting Operations Infrastructure Manager Operations Division - Oldman River Basin

HYDROMETRIC MONITORING

- Federal / Provincial Hydrometric Agreement
 - 456 stations
 - Water Survey of Canada is main operator
 - 45 stations operated by AEP
 - 280 with telemetry
 - recorders, data loggers, staff gauges



AUTOMATED SNOW MONITORING

- Snow pillow measures weight of snow pack
 - measured parameter: snow water equivalent
- Snow pillows with telemetry
 - 10 mountain sites
 - 3 prairie sites
 - hourly measurements
 - continuous chart recording for backup



Snow Survey at Gardiner Creek Headwaters



2017 Summer Fire Storm in WNP destroyed the Akamina Pillow

April 01, 2017 - 125% of Normal



Pillow is Higher than Last Year (mid January) 2018: 125% of Normal 2017: 100% of Normal



Pillow is Lower than Last Year (mid January) 2018: 80% of Normal 2017: 100% of Normal



Pillow is Higher than Last Year (mid January) 2018: 120% of Normal 2017: 50% of Normal



Pillow is Higher than Last Year (mid January) 2018: 120% of Normal 2017: 80% of Normal



Pillow is Higher than Last Year (mid January) 2018: 130% of Normal 2017: 100% of Normal



Pillow is Lower than Last Year (mid January) 2018: 100% of Normal 2017: 120% of Normal



May 2017 Forecast Volume Prediction: Southern Tributary and Upper Oldman (100% - 140%) Bow\Elbow Upper Basin (90% - 120%)

Water Supply Outlook for Alberta May 2017

Water Supply Forecast as of May 1, 2017 - Oldman River Basin (Natural Flows)

	Vo	lume Forecast f	7			
Locations	Volume in dam ³	Volume as a % of Average	Probable Range as a % of Average	obable nge as a % of werage		Recorded March- September 2016 Volume as a % of Average
St. Mary River	850,000*	127	117-142	109	75/99	84
Belly River	280,000	121	112-132	105	78/99	88
Waterton River	647,000	118	109-127	101	63/99	90
Oldman River near Brocket	1,266,000	129	118-152	108	70/99	66
Oldman River at Lethbridge	3,653,000	129	118-141	107	76/99	66

Precipitation in SE Slopes ?

႕ack of Precip	oatation <mark>(</mark> South	Eastern Slopes	;)
Station	2017 June Rainfall Millimeters	Avg June Rainfall (1990 - 2016) Millimeters	June 2017 compared to % of Avg for June
Gardiner	78.0	152.9	51.0
S Racehorse	57.4	129.7	44.3
West Castle	75.0	146.6	51.2
Red Rock	79.5	153.3	51.9
Chief Border Xing	54.7	143.5	38.1
Spionkop - WNPark	95.4	194.2	49.1
Average		153.4	47.6

Flood Routing – Nothing in 2017 on any of our on-stream reservoirs (highly unusual)

2017 Volumetric Projections as Season Progresses

III) FORECAST IRRIG	ATION DEM	AND:	2001 DEMA	AND Volum	es							
	jun 17 - 3	jun 17 - 30		y01-31 aug01-31 se		sept 0	01 - 30 oct 01 -31		1 -31	total (Sept 01 - Oct 31)		
	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3	cms/day	dam3
UNITED I.D.					2.0	4,838	1.2	3,110	1.0	2,678	4	10,627
BLOOD TRIBE					3.0	7,258	1.0	2,592	0.8	2,143	5	11,992
MAGRATH I.D.					3.0	7,258	1.5	3,888	1.0	2,678	6	13,824
IRRICAN					55.0	33,056	45.0	116,640	2.5	6,696	103	256,392
N.RIDGE					25.0	60,480	3.0	7,776	2.5	6,696	31	74,952
E. RIDGE					1.5	3,629	0.7	1,814	0.5	1,339	3	6,782
TOTAL(S)					89.5	216,518	52.4	135,821	8.3	22,231	150	374,570
SUMMARY of FORECA	ST (Aug 03/ (dam3)	2017 -	Oct 31/2 Combined:	1017): Headwor	KS IRRIGA		AGE (WatR	es, SmyRes	, RidRes)		(dam3)	
RIVER SUPPLY:	131,820		as of Augus	st 03, 2017:							426,000	
Subtract RIVER DEMAND: (from table II)	61,733		Add difference between supply and demar								-304,482	
NET RIVER SUPPLY:	70,088		ESTIMAT	ED TOTA	LSTORA	GE (as of Oc	t 31, 2017)				121,518	
Subtract IRRIGATION DEMAND (from table III):	374,570											
				% of TOTA	L STORAGE	based on a	above FORE	CAST:				
Difference between demand	-304,482			(Oct 31, 20	17 FORECA	STED STAT	US)		19.9	%		
and supply:]			Note: The total combined full supply storage of Waterton, St Mary and Ridge Reservoirs is 612,054 dam3								

Actual End of Season Combined Storage was 12% of Full

Record Irrigation Deliveries . . . (2017 was the 5th highest demand in the last 31 years – 760,000 dam3)



2017

Lethbridge Northern Headworks Annual Diversion Volumes

Upstream of the Oldman Flume: Water Survey of Canada Station #: 05AB019 Compared to the Last 30 Years: 1986 - 2016



2017 Delivery: 150% of Average (last 30 years)

2017 – "never have we operated the Oldman Flume at Full on Capacity for 2.5 months"



2017 - Challenges on meeting Instream Flow Objectives for Willow Creek (Pine Coulee Reservoir) (all private irrigators pumping majority of the season)

	Flow (ofo)
	Elow (ofe)
Flow (cms)	FIOW (CIS)
Willow Creek d/s Chain Lakes 01-Jan 0.283	10
25-Mar 0.085	3
30-Jun 0.142	5
15-Aug 0.085	3
31-Oct 0.283	10
Willow Creek (Park Reach) 01-Jan 0.283	10
19-May 1.000	35
30-Jun 2.000	71
07-Sep 0.400	14
15-Oct 0.283	10
31-Oct 0.425	15
Willow Creek at mouth 01-Jan 0.283	10
14-Jun 0.400	14
30-Jun 0.800	28
31-Aug 0.400	14
15-Oct 0.283	10
31-Oct 0.425	15

2017 Carseland Bow River Headworks **Irrigation District** (to BRID) •‡≵

compared to Historical Annual Diversion Volumes

Last 20 Years: 1986 - 2016



2017: Delivered in excess of 180,000 dam3 above Average

2017 Eastern Irrigation District Diversion

1,200,000 Max Limit Diversion: 1,120,000 938,000 dam3 1,040,000 960,000 880,000 Average Volume: 800,000 540,000 dam3 Dam3 720,000 640,000 560,000 480,000 400,000 320,000 240,000 160,000 80,000 0 2005 2008 2010 2013 2016 1996 1997 1998 1999 2000 2002 2003 2004 2006 2007 2009 2011 2012 2014 2015 2017 2001

•‡₹

compared to Historical Annual Diversion Volumes Last 20 Years: 1996 - 2016

2017 Annual Volumes



Ascending Order





2017 Recession Limb for each Hydrograph: Below Normal (Jun – Aug) on every upstream station



As of October 31 76% of Natural Flows have been passed on to Saskatchewan

1,959,000 dam3 Excess

				2017 South Sa	askatchewan	River Below the	e Red Deer Rive	er (dam3)		
		Total	Apportionable	50 of	Excess (+)	Cummulative	Cumulative	Cumulative	% Delivery	% Delivery
		Recorded	Flow	Apportionable	or Deficit (-)	Excess (+) or	Apportionable	Recorded	for Month	Cumulative
		Discharge		Flow	Delivery	Deficit (-)	Flow			
					-	Delivery				
_	Jan	323,000	272,000	136,000	187,000	187,000	272,000	323,000	119%	119%
	Feb	361,000	314,000	157,000	204,000	391,000	586,000	684,000	115%	117%
	Mar	637,000	611,000	305,500	331,500	722,500	1,197,000	1,321,000	104%	110%
	Apr	828,000	797,000	398,500	429,500	1,152,000	1,994,000	2,149,000	104%	108%
	May	1,057,000	1,526,000	763,000	294,000	1,446,000	3,520,000	3,206,000	69%	91%
	Jun	1,718,000	2,422,000	1,211,000	507,000	1,953,000	5,942,000	4,924,000	71%	83%
	Jul	438,000	970,000	485,000	-47,000	1,906,000	6,912,000	5,362,000	45%	78%
	Aug	217,000	437,000	218,500	-1,500	1,904,500	7,349,000	5,579,000	50%	76%
	Sep	177,000	245,000	122,500	54,500	1,959,000	7,594,000	5,756,000	72%	76%
	Oct									
	Nov									
	Dec									
	TOTALS	5,756,000	7,594,000	3,797,000	1,959,000	0			76%	

Even in a Year of Record Demands, we are able to Meet the Annual Natural Volume (50%) with Excess



8 meters below the spillway crest at the end of the Irrigation Season

Delivered in EXCESS of 350,000 dam3 from St. Mary Reservoir 14,000 dam3 left at end of Irrigation Season (FSL: 369,300 dam3)



20 meters below the spillway crest at the end of the Irrigation season – October 15, 2017

Milk River Ridge Reservoir (MRRR) 2017 compared to Historical Statistical Levels



SMRID Internal Storage – much better shape at 72% of Full (moved water further down the system for 2018 early demand)



Oldman Reservoir was making up needed flows at Lethbridge, due to Minimum Releases from St. Mary and Watertton

Pine Coulee Reservoir 2017 compared to Historical Levels



2017 – Precedent Year for Pine Coulee Never finished this low due to Private Irrigation Demand

Contrary to the Oldman Basin, Carseland – Bow River System Reservoirs at the end of the irrigation season were at desired winter levels

Carseland - Bow River Headworks - October Season Ending 2017 Storage									
C									
ч 	Storage at Full (dam3)	Storage as of October 31 (dam3)	Oct 31 PerCent of Full						
Lake McGregor	351,200	297,500	84.7						
Travers Reservoir	104,600	60,700	58.1						
Little Bow Reservoir	43,200	28,600	66.2						
Total Combined Storage	499,000	386,800	77.5						

Eastern Irrigation District - October Season Ending 2017 Storage									
	Storage at Full (dam3)	Storage as of October 31 (dam3)	Oct 31 PerCent of Full						
Crawling Valley Res	114,200	98,800	86.5						
Lake Newell	ጭ 177,600	151,200	86.0						
Snake Valley Res	18,500	13,700	74.0						
Total Combined Storage	310,300	263,700	85.2						

Record Season Ending Storage

Year END Irrigation Storage for St. Mary Reservoir 1996 - 2017



Record Season Ending Storage

Year END Irrigation Storage for Waterton Reservoir 1996 - 2017



Oldman Reservoir

2017 compared to Historical Season Ending Storage (Winter Carryover)



Finished 100,000 dam3 BELOW Historical Winter Carry Over Average

Spring 2018 ??



Certainty: aggressive capture rate will be enforced
Snow and precipitation are a Guess

2018 Projection . . .

Southern Tributaries: 89% of Full as of mid June 2018

Southern Tributaries Projection for June 15,	2018 (Average Runoff)	
Station	Oct 25 - Jun 15 Supply (dam3)	
ωάτωατ	295.000	
DRYMOU + local	59,302	
BELLMV	140,000	
SMYBDY2	310,000	
LEECARD + local	45,866	
τοται δυρριγ	850 168	
	000,100	
TOTAL Downstream Releases (Belly, Waterton, St. Mary)	149,040	
TOTAL SUPPLY (less d/s Releases)	701,128	
North Outlet from Ridge Reservoir	45.000	
East Outlets from Ridge Reservoir	5,000	
Irrican	190,000	
ВТАР	4,000	
MID Turnouts	5,500	
UID	6,000	
TOTAL DEMAND	255.500	
Balance after Irrigation Demand and In-Stream	445,628	
Combined Storage as of Oct 25, 2017 (WatRes, RidRes, SmyRe	es) 85,000	
Predicted Storage on Jun 15, 2018	530,628	
(Full Storage for RidRes, WatRes, SmyRes = 595,000 dam3)	89.2	% of FULL (on June 15, 2018)

Good News !! We have gained 95,000 dam3 (16% of Total Combined Storage for WSM) since late October until January

Southern Tributaries Waterton - St. Mary - Milk River Ridge Reservoirs Operations Data

Water Management Operations Report

Notes:

- i. All readings displayed are at 6:00 a:m or the closest reading collected to 6:00 a:m
- ii. Data is collected real time and subject to revision at any time
- iii. All flow values are in cubic meters/second or cms (35.314475 cubic feet/second = 1 cms)
- iv. All water level readings are in meters
- All storage readings are irrigation live storage in cubic decameters o dam³ (.8107 acre feet = 1 dam³). If the level of the reservoir is lower than the irrigation invert elevation, a negative storage value will be displayed.
- vi. All Water Management Reports are created and produced by the Oldman River Basin Operations Team - Lethbridge Office

	6	
tana S	555	
		CTAN
r	and the second	

	Watert	on Reserv	St. Mary Reservoir			<u>Milk River Ridge</u> <u>Reservoir</u>			Combined Total		
Data	FSL: 1185.7 m Capacity: 114,418 dam ³			FSL: 1103.6 m Capacity: 369,304 dam ³			FSL: 1032.4 m Capacity: 111,500 dam ³			Capacity:	Percent
Date	Level	Storage	% Full	Level	Storage	% Full	Level	Storage	% Full	595,220 dam ³	Full
Dec 29	1,178.129	47,189	41.2	1,087.891	58,879	15.9	1,028.542	64,340	57.7	170,408	28.6
Dec 30	1,178.176	47,538	41.5	1,087.915	59,100	16.0	1,028.542	64,340	57.7	170,978	28.7
Dec 31	1,178.210	47,791	41.8	1,087.919	59,137	16.0	1,028.542	64,340	57.7	171,268	28.8
Jan 01	1,178.252	48,104	42.0	1,087.929	59,230	16.0	1,028.542	64,340	57.7	171,674	28.8
Jan 02	1,178.293	48,411	42.3	1,087.960	59,516	16.1	1,028.542	64,340	57.7	172,267	28.9
Jan 03	1,178.316	48,583	42.5	1,087.983	59,729	16.2	1,028.542	64,340	57.7	172,652	29.0
Jan 04	1,178.339	48,755	42.6	1,088.021	60,082	16.3	1,028.542	64,340	57.7	173,177	29.1
Jan 05	1,178.394	49,168	43.0	1,088.063	60,474	16.4	1,028.542	64,340	57.7	173,981	29.2
Jan 06	1,178.454	49,620	43.4	1,088.100	60,818	16.5	1,028.542	64,340	57.7	174,778	29.4

St. Mary Reservoir Winter Gain 50,000 dam3 and climbing (8 meter gain) Combined Storage (29% of Full as of January 15,2018)



Waterton Reservoir Winter Gain 45,000 dam3 and climbing (7 meter gain)



National Oceanic Atmospheric Administration (Jan - March 2018) **Temperature (Below Normal) Precipitation** (Above)



2

New Additions to Headworks in 2017-2018

Taylor Wasteway replaced (2010 Rainfall Event triggered replacement)

Rehab Project: Lethbridge Northern Weir (built in 1934)

Constraints during LOW FLOWS in 2017

Weir Cross Section

Marias Pass – Montana Continental Divide 2018 New Years Day Questions ?

