

Table 4.1 Existing Saskatchewan Water Licences Along NSR

Purpose	Type	Annual Allocation (Mm³)	% of Total
Domestic	General	0.2	0.20%
Industrial	Int. Livestock	0.2	
	Manufacturing	76.5	
	Oil Recovery	3.1	
	Total	79.8	80.70%
Irrigation	Agriculture	8.4	
	Commercial	0.1	
	Park	0.6	
	Total	9.1	9.10%
Municipal	Rural	6.4	
	Urban	2.7	
	Total	9.1	9.20%
Other	General	0.9	
TOTAL	Annual	99	100%
	Summer	46.7	

Source: Saskatchewan Watershed Authority (June 2007)

Table 4.2 Estimated water availability

Potential water allocations:	Storage	Minimum measured flow	Maximum allocation		Existing licences		Available water			
		(m ³ /s)	(Mm ³)	(m ³ /s)	(Mm ³)	(m ³ /s)	(Mm ³)	(m ³ /s)	(MLD)	(USgpm)
1. Maximum	Large storage (greater than 1 year supply)	136.5	1,076	34.1	99	3.1	977	31.0	2,677	491,176
2. Year-round withdrawals (daily minimum based on zero storage)	None	25.6	202	6.4	99	3.1	103	3.3	282	51,684
3. Summer withdrawals (daily minimum based on zero storage)	None	70.5	233	17.6	47	3.6	186	14.1	1,216	223,007

Notes:

1. Water allocation is approximately 100% secure, based on existing Sask Water allocation rules and 96 years of record at Prince Albert.
2. Summer is assumed to be 153 days between May 15 and October 15.
3. Daily minimum rate for year-round withdrawals based on 25.6 cms minimum flow in November (since 1970).
4. Daily minimum rate for summer withdrawals based on 70.5 cms minimum flow in October (since 1970).
5. Lowest recorded flow year = 1941 at Prince Albert (136.5 m³/s).
6. Apportionment of water to Saskatchewan based on 25% of total natural flow.
7. Existing licences as reported in May 2007 by Saskatchewan Water Authority.

Table 4.3 Water Resource Maximum Development Limits

Industrial development	Industrial production		Water requirements (typical)		Portion of water (% of available)	
	Rate	Units	Mm ³ /yr	L/s	w/o storage	w storage
Dairy products	100	ML/yr	0.25	8	0.2%	0.0%
Distillery	17	ML/yr	0.5	16	0.5%	0.1%
Ethanol	50	ML/yr	0.4	13	0.4%	0.0%
Recreation facility	400	kc/yr	0.07	2	0.1%	0.0%
Hotel	500	rooms	0.16	5	0.2%	0.0%
Meat packing (large)	4000	hpd	2.85	90	2.7%	0.3%
Nuclear power	4000	MW	185	5,866	177.8%	20.0%
Petrochemical	Typical (Strathcona County)		5.03	160	4.8%	0.5%

Water use	Application rate (gpd/head)	Maximum development (millions of animals)	
		no storage	storage
Cattle	12	6	56
Dairy	35	2	19
Hog	4	19	168
Chicken	0.1	753	6,711
Goat/sheep	2	38	336
Irrigation	(ft/yr)	(1000s acres)	
	1	183	381
Municipal	(Lpd)	(population, millions)	
	400	0.7	6.4

Notes:

1. Municipal water requirements per person assume very efficient water usage for domestic and commercial use.
2. Livestock water requirements based on Idaho Department of Water Resources Water Law Handbook.
3. Maximum development with storage requires large storage.

Table 6.1 Benefit / Cost summary

Category	Units	Selected options					
		No investment	Non-structural investment	Off-channel storage	N. Sask. Weirs	Highgate Dam	
		Status quo	Small farm irrigation	8-Mile Lake +irrigation	P&H Weir +industry	with finance charges	without finance charges
Costs:							
Capital cost (infrastructure plus on-farm costs)	2007 \$millions	0	36	57	12	3,043	2,497
Annual charges (interest charges + O&M)	NPC \$millions	0	28.4	45.5	9.5	2,361	110
Total costs	NPC \$millions	0	64	103	22	5,404	2,607
Benefits:							
Ethanol industry benefits	NPV \$millions	0	0	0	71	71	71
Irrigation net benefits, mixed crops	NPV \$millions	0	46	65	0	248	248
Hydropower benefits	NPV \$millions	0	0	0	0	1,046	1,046
Flood control benefits (Prince Albert)	2007 \$millions	0	0	0	0	150	150
Recreational property development	2007 \$millions	0	0	0	0	268	268
Recreation property tax base	NPV \$millions	0	0	0	0	8	8
Indirect GDP net benefits	NPV \$millions	0	19	48	79	336	336
Total benefits	NPV \$millions	0	65	113	149	2,126	2,126
Net:							
Total net benefits	NPV \$millions	0	1	10	128	-3,278	-481
B/C ratio		n/a	1.01	1.09	6.91	0.39	0.82
B/C ratio excluding indirect GDP benefits		n/a	0.72	0.63	3.27	0.33	0.69

Notes:

1. Indirect GDP net benefits assumed due primarily to construction, reporting for initial 4 years only.
2. Assuming Highgate dam construction period of 4 years.
3. Hydropower benefits based on \$0.10 per kWh initial selling price (net of transmission losses).
4. Status quo option assumes no investment will result in no new industry and limited recreation property development.
5. Non-structural investment assumes 6 farms of 3 sections each irrigation development directly from the NSR.
6. Off-channel storage assumes water supply to irrigation only (i.e. no additional industry development).
7. N. Sask. Weirs assumes water supply to new industry only (i.e. no additional irrigation development).
8. N. Sask. Dam assumes benefits derived from irrigation, hydropower, recreation, flood control, industry.
9. Industry assumed to be an ethanol plant (50 ML/yr x \$0.60 sale price x 15% net revenue).
10. Recreation property development benefits report the net benefits of private property development.
11. All GDP benefits discounted to 2007.
12. All other NP costs and benefits reported for initial year of construction.
13. Dam decommissioning cost assumed to be \$1B in 2007, or \$20B in 100 years (at 3% inflation).
14. Industry initial capital investment costs have been excluded (assumed private investment).
15. Benefits due to sale of hydropower, ethanol, irrigated crops, and tax collection assume inflation at the stated inflation rate.

Assumptions:

- 2015 initial construction for Highgate dam
- 2012 year construction of other options
- 50 year repayment of capital investment
- 6% cost of capital
- 9% investment expected rate of return
- 3% inflation
- \$66.7 million annual hydropower benefit
- \$4.5 million annual ethanol net revenue

Table 6.2 Typical Value of Water for Various Uses

	Non-structural investment	Off-channel storage	
Irrigation (including infrastructure)	Small farm irrigation	Water storage for irrigation only	
Irrigated area	9,360	13,130	acres
Water application depth	1	1	ft
Water withdrawal period	153	250	days
Average licensed rate	0.87	0.75	m ³ /s
Annual volume	11.6	16.2	Mm ³
Total net benefits	1	10	NPV \$millions
Value of water	0.1	0.6	(NPV \$)/(m ³ /yr)
Hydropower (excl. infrastructure costs)	Highgate dam option		
Average power production	666.9	GWh/yr	
Average sale price	0.1	\$/kWh	
Net value of power production	65.1	M	
Average evaporation losses	1.53	m ³ /s	
Annual water loss	48	Mm ³	
Value of water	1.35	\$(m ³ /yr)	
Ethanol plant	Water storage for industry only		
Ethanol production	50	ML/yr	
Average sale price	0.6	\$/L	
Average water usage	8.0	L/L	
Total water use	0.4	Mm ³ /yr	
Average water use	0.01	m ³ /s	
Value of water	75.00	\$/m ³	
Typical values for other uses			
Livestock	about	0.009	\$/m ³
Residential	about	1.5	\$/m ³
Commercial	about	1.7	\$/m ³
Industry		varies	\$/m ³
Recreation	up to	1.1	\$/m ³

Notes:

1. Typical values for other uses from Kulshreshtha (2001), and from "Monitoring the Value of Natural Capital" (Environment Canada and Statistics Canada, 2002).

Table 6.3 Key Socio-Economic Issues

Key Issue	Non-Structural	Off-channel Storage	NSR Weirs	Highgate Dam
Direct, indirect and induced employment	1	2(+)	2(+)	4(+)
Impacts on population, social and physical infrastructure	1	2(+)	1(+)	3(+)
Loss of land	1	1	1	4
Impacts from loss of infrastructure (roads, bridges, transmission lines, water wells)	1	1	1	4
Losses to oil and gas production through the shut in of producing wells in the inundation zone	1	2	1	4
Loss of reserve lands for the Little Thunderchild First Nations or others	2	3	2	5

Note: Rating indicates relative potential or significance to affect the viability of a project.

Table 6.4 Key Environmental Issues

Key Environmental Issue	Non-Structural	Off-channel Storage	NSR Weirs	Highgate Dam
Change in water physical and chemical properties	2	3	3	4
Changes in physical channel processes	2	3	3	4
Changes in aquatic ecosystem habitats/specific sturgeon SARA issue	2/1	1/2	2/3	4/5
Direct effects to fish mortality	1	3	2	3
Loss or alteration of terrestrial habitat and fragmentation	1/2	2	2	4
Direct disturbance of wildlife	1	2	2	2
Disturbance to listed species	2	4	2	2
Changes to groundwater quality and groundwater regime	1(+)	2(+)	1(+)	3(+)
Alteration of hydrologic (flow) regime and river morphology	2	2	2	4
Land use, protected areas and heritage resource associated issues	1	2	2	4

Note: Rating indicates relative potential or significance to affect the viability of a project.

Table 7.1 Canadian and Saskatchewan Legislation Common to the Options

Canadian Acts and Regulations	Saskatchewan Acts and Regulations
<i>Canadian Environmental Assessment Act</i>	<i>Environmental Assessment Act</i>
Comprehensive Study List Regulations	
<i>Fisheries Act</i> and Regulations	<i>Environmental Management and Protection Act</i>
	Environmental Spill Control Regulations;
	Water Regulations
<i>Migratory Birds Convention Act</i>	<i>Heritage Property Act</i>
<i>Navigable Waters Protection Act</i>	<i>Watershed Authority Act</i>
<i>Species at Risk Act and Regulations</i>	<i>Wildlife Act and Wildlife Habitat Protection Act</i>
<i>Canadian Water Act</i> ·	<i>Provincial Lands Act</i>
Guidelines for Canadian Drinking Water Quality	
<i>Canadian Wildlife Act</i>	<i>Litter Control Act</i>
<i>Pest Control Products Acts</i> and Regulations	<i>Pest Control Act</i>
<i>Transportation of Dangerous Goods Act</i> and Regulations	<i>Dangerous Goods Transportation Act</i> and Regulations
<i>Hazardous Products Acts</i> and Regulations	

Table 7.2 Summary of Saskatchewan Acts and Regulations that Typically Require Attention Prior to Construction

Act	Applicable Section or Associated Regulations	Permit or Approval Required	Primary Contact Agency
<i>Environmental Assessment Act</i>	n/a	See text	Saskatchewan Ministry of Environment
<i>Provincial Lands Act</i>	n/a	Permission to restrict access to any waterbody or water course must be included in the land disposition; otherwise, these areas must remain publicly accessible.	Saskatchewan Ministry of Environment
<i>Saskatchewan Watershed Authority Act</i>	Section 28	Water rights licence.	Saskatchewan Watershed Authority
	Section 50	Approval to construct, extend, alter or operate any works that will require the diversion of water.	Saskatchewan Watershed Authority
<i>The Wildlife Act</i>	n/a	Field survey should be conducted to determine the presence of any designated species prior to construction.	Saskatchewan Ministry of Environment
<i>The Heritage Property Act</i>	n/a	Heritage Resources Impact Assessment (HRIA) required for any areas with moderate to high heritage potential.	Culture and Heritage Branch