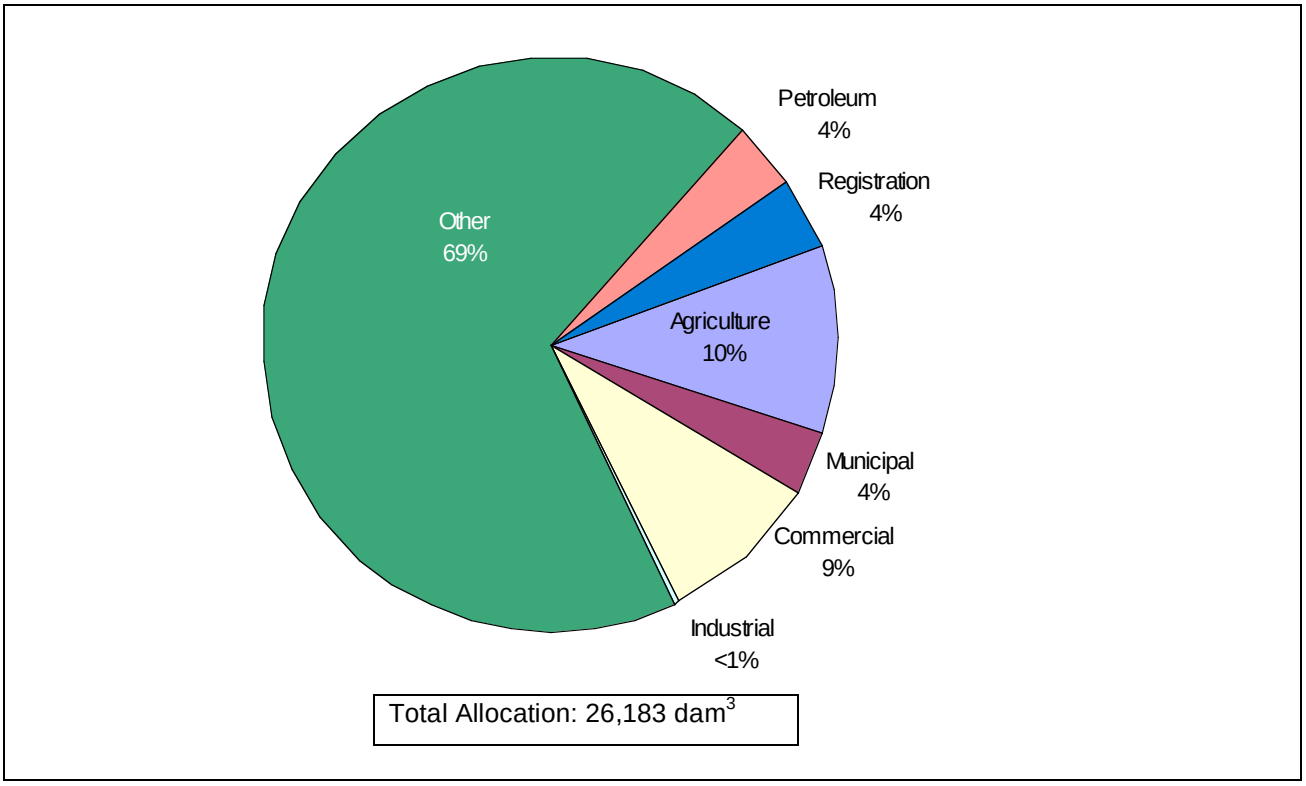
9.0 STURGEON

The Sturgeon Sub-basin is about 3,300 km^2 in area and occupies approximately 6 percent of the North Saskatchewan Basin. In 2005, the sub-basin had a population of about 134,400 people, which represents about 12 percent of the Basin population, with a population density of about 40.5 people per square kilometer. The Sturgeon Sub-basin consists all or parts of 19 urban municipalities, five rural municipalities and two Aboriginal Settlements.

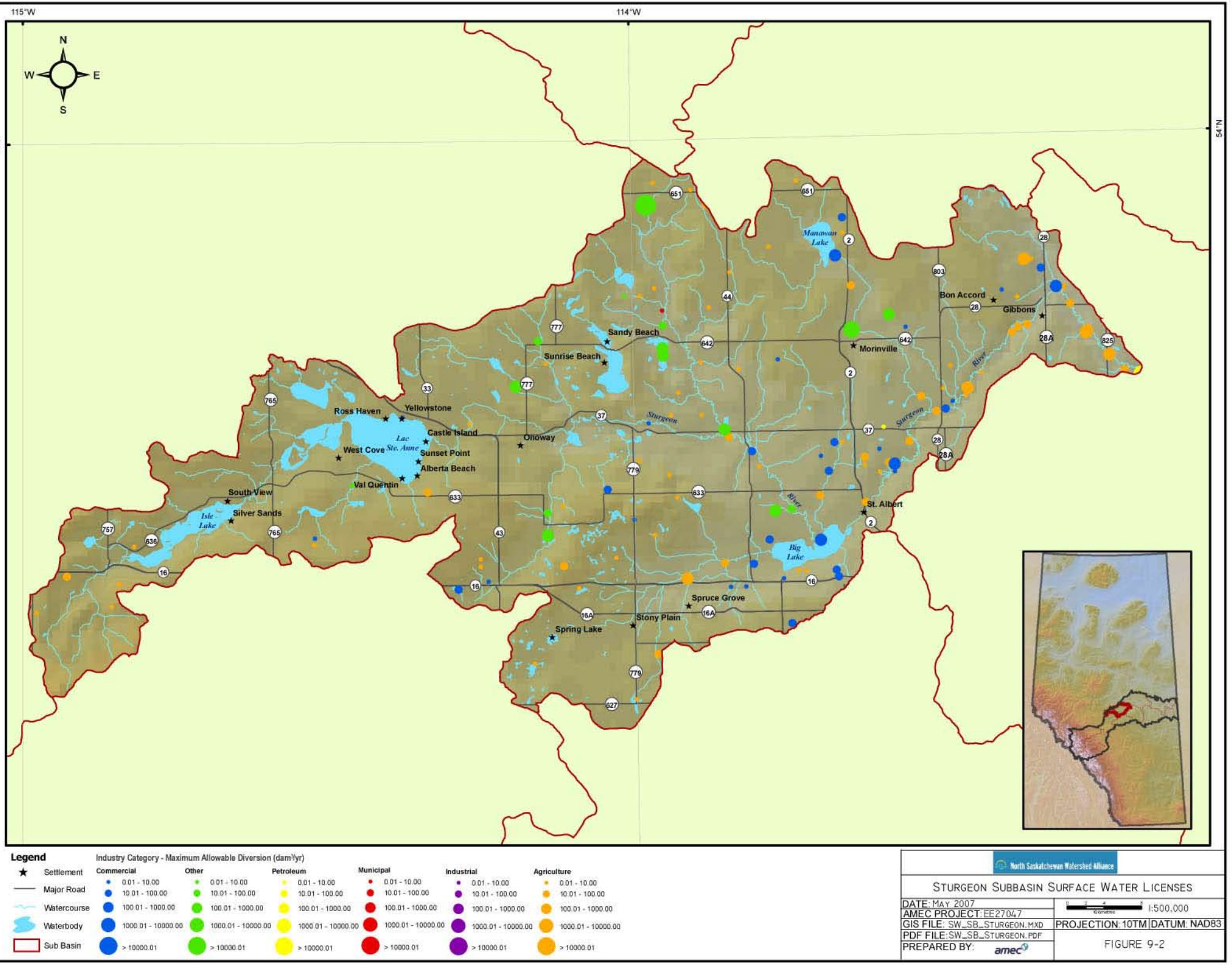
An overview of current surface and groundwater allocations is provided in Figure 9-1. It shows that the other sector accounts for 68 percent of total allocations or 18,024 dam^3 while the agricultural sector, including the registrations, accounts for 14 percent of total allocations or 3,763 dam^3. The remaining allocations are for commercial, municipal, petroleum and industrial sectors. Total allocations in the sub-basin in 2005 were 26,183 dam^3, and groundwater allocations (4,099 dam^3) accounted for 16 percent of the total.

Figure 9-1 Distribution of Active Water Allocations in the Sturgeon Sub-basin



Figures 9-2 and 9-3 show the location, allocation and sector of all active water licences in the Sturgeon Sub-basin. The locations of registrations issued in this sub-basin are provided in Figure 9-4.

Figure 9-2 Sturgeon Sub-basin Surface Water Licences



Legend

- Settlement
- Major Road
- Watercourse
- Waterbody
- Sub Basin

Industry Category - Maximum Allowable Diversion (dam³/yr)

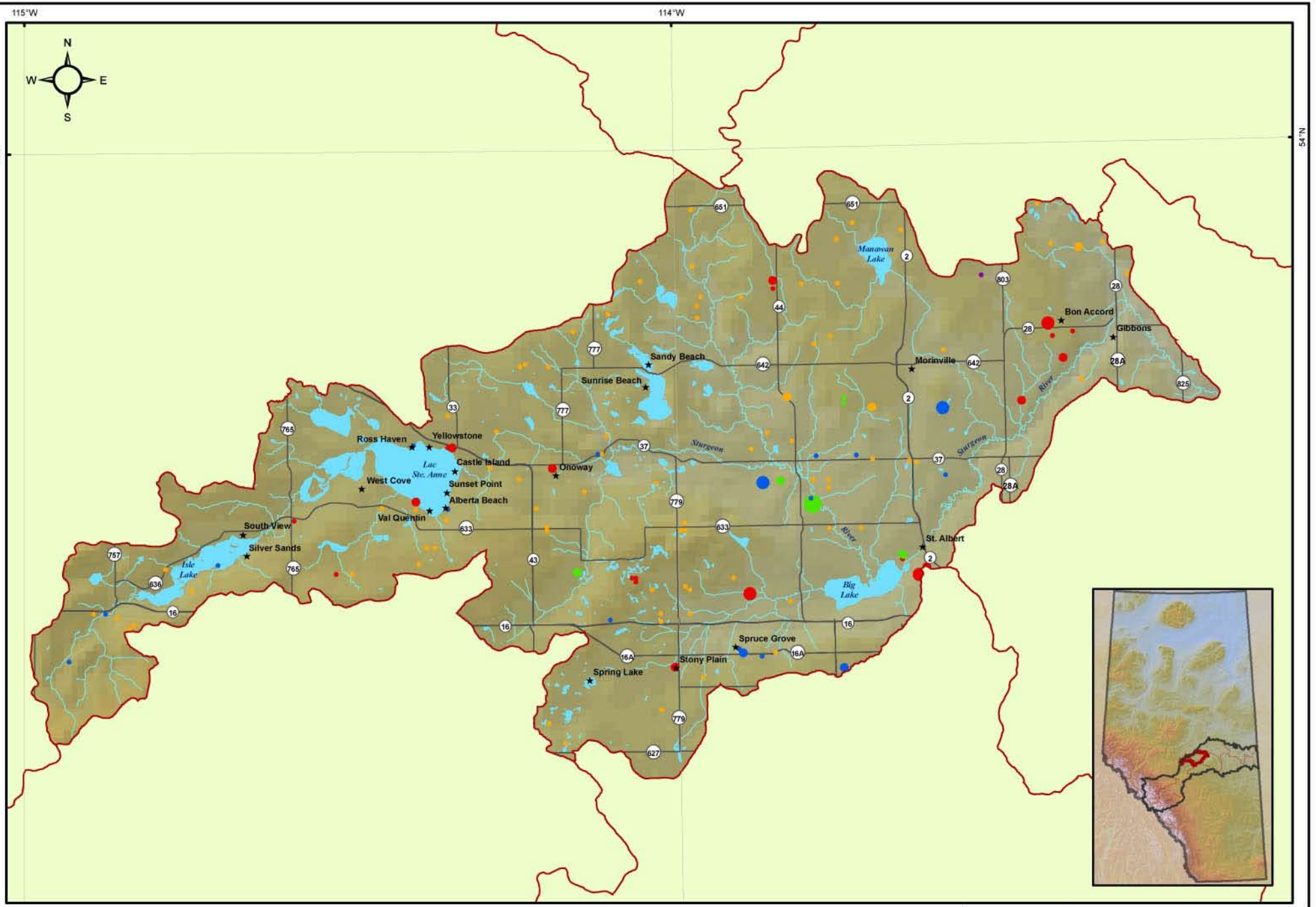
Commercial	Other	Petroleum	Municipal	Industrial	Agriculture
0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00
10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00
100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00
1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00
> 10000.01	> 10000.01	> 10000.01	> 10000.01	> 10000.01	> 10000.01

North Saskatchewan Watershed Alliance

Sturgeon Subbasin Surface Water Licenses

DATE: May 2007	0 2 4 8 Kilometres 1:500,000
AMEC PROJECT: EE27047	
GIS FILE: SW_SB_Sturgeon.mxd	PROJECTION: 10TM | DATUM: NAD83
PDF FILE: SW_SB_Sturgeon.pdf	
PREPARED BY: amec	FIGURE 9-2

Figure 9-3 Sturgeon Sub-basin Groundwater Licences



Legend

- Settlement
- Major Road
- Watercourse
- Waterbody
- Sub Basin

Industry Category - Maximum Allowable Diversion (dam³/yr)

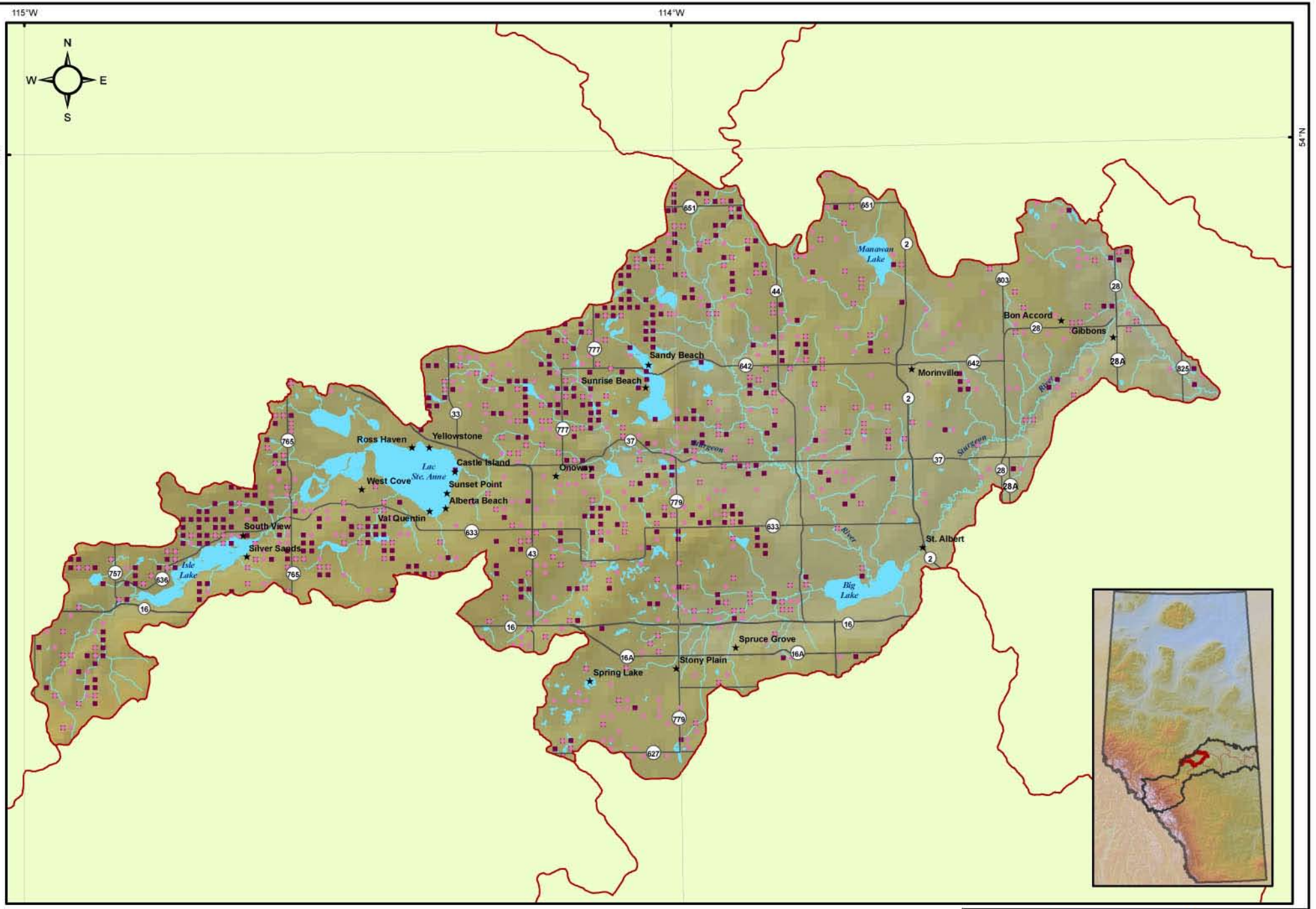
Commercial	Other	Petroleum	Municipal	Industrial	Agriculture
0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00
10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00
100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00
1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00
> 10000.01	> 10000.01	> 10000.01	> 10000.01	> 10000.01	> 10000.01

North Saskatchewan Watershed Alliance

Sturgeon Subbasin Groundwater Licenses

DATE: May 2007	1:500,000
AMEC PROJECT: EE27047	
GIS FILE: GW_SB_Sturgeon.mxd	PROJECTION: 10TM | DATUM: NAD83
PDF FILE: GW_SB_Sturgeon.pdf	
PREPARED BY: amec	FIGURE 9-3

Figure 9-4 Sturgeon Sub-basin Registrations



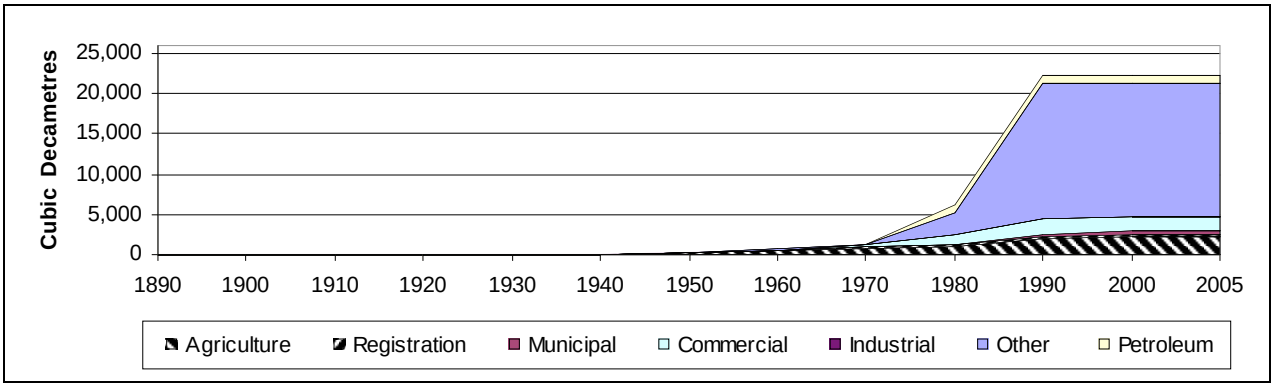
North Saskatchewan Watershed Alliance

Sturgeon Subbasin Registrations

DATE: May 2007	1:500,000
AMEC PROJECT: EE27047	
GIS FILE: RG_SB_Sturgeon.mxd	PROJECTION: 10TM | DATUM: NAD83
PDF FILE: RG_SB_Sturgeon.pdf	
PREPARED BY: amec	FIGURE 9-4

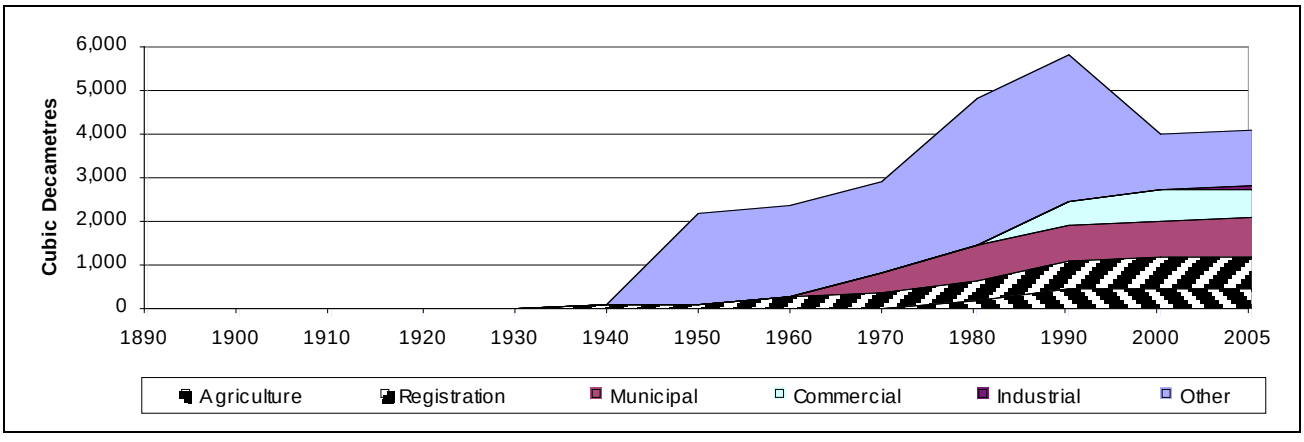
An historical perspective on water allocations among the sectors is provided in Figure 9-5 (surface water) and Figure 9-6 (groundwater). The two largest allocations for surface water in the Sturgeon Sub-basin are for the agriculture and the other sectors. Allocations for the agriculture sector were first issued in the 1920s and increased through to the 1990s but since that time the allocations have remained relatively stable. Allocations for the other sector were first issued in the 1910s but remained relatively unchanged until the 1970s when the allocations increased substantially. Since the 1980s allocations for the other sector have remained unchanged.

Figure 9-5 Historical Trends in Surface Water Allocation in the Sturgeon Sub-basin



The largest allocations for groundwater are for the other and the municipal sectors. The other sector allocations were first issued in the 1940s and increased substantially up to the 1990s. Since that time the allocations have decreased and have remained unchanged since 2000. Municipal sector allocations commenced in the 1960s and increased up to the 1990s but since that time the allocations have remained unchanged. There are also groundwater allocations for the agriculture (including registrations), commercial and industrial sectors in the Sturgeon Sub-basin. Increases in allocations for these sectors have occurred since the 1960s.

Figure 9-6 Historical Trends in Groundwater Allocation in the Sturgeon Sub-basin



9.1 Municipal and Residential Sector

9.1.1 Population

The population of Sturgeon Sub-basin is predominantly urban, as shown in Table 9-1. Seventy-eight percent of the population live in urban municipalities, most of which are around the northern and western edges of Edmonton. Rural municipalities contain 20 percent of the sub-basin population, whereas sub-basin's two First Nations comprise just over 1 percent of the population. Urban municipalities had the highest growth rate from 2001 to 2006 at almost 13 percent. Rural municipalities grew by almost five percent, while the Aboriginal settlements grew by less than 3 percent over the inter-censal period.

Table 9-1 Population Distribution and Growth in the Sturgeon Sub-basin

	2006		2001	2001 to 2006 Population Change
	Population	Percent	Population	Percent
Urban Municipality	105,244	78.3%	93,346	12.7%
Rural Municipality	27,453	20.4%	26,185	4.8%
First Nations and Métis Settlements	1,696	1.3%	1,648	2.9%
Total	**134,393**	**100.0%**	**121,179**	**10.9%**

Table 9-2 lists all municipalities situated in the Sturgeon Sub-basin, their estimated 2006 sub-basin populations, and a summary of their water licence information. The major population centres are the City of St. Albert (57,563 residents), the City of Spruce Grove (19,496) and the Town of Stony Plain (12,363). Sturgeon County has the largest population of the rural municipalities (15,775), and Alexander First Nation (962) is the larger of the Aboriginal settlements.

It should be noted that most of the largest municipalities in the Sturgeon Sub-basin receive their water from the Edmonton Capital Region sand therefore do not have their own water licences. Overall, it is estimated that only about 16,300 residents of the Sub-basin (or 12 percent of the total) rely on sources other that the Edmonton Capital Region.

9.1.2 Allocations

As noted in Section 2.2, the majority of the population of the Sturgeon Sub-basin (88 percent) is located in the Edmonton Capital Region and draws its water from the North Saskatchewan River from a source in the Strawberry Sub-basin (Section 8.1). However, the balance of the population draws its water from various surface and groundwater sources in the basin. As of 2005, 28 municipal water licences had been issued to 18 licensees in Sturgeon Sub-basin. These licences allow maximum withdrawals of 958 dam^3 per year. As shown in Figure 9-1, municipal water uses account for 5 percent of total water allocations in the basin. Other

residents of the region obtain their water without licences, taking their water for household purposes.

Table 9-2 Municipal Populations and Water allocations within Sturgeon Sub-basin

Municipal Name		2006 Population	Source	2005 Allocation (dam^3)
Urban	CITY OF ST. ALBERT	57,563	GROUNDWATER	169.6
	CITY OF SPRUCE GROVE	19,496		
	TOWN OF STONY PLAIN	12,363	GROUNDWATER	50.1
	TOWN OF MORINVILLE	6,775		
	TOWN OF GIBBONS	2,642		
	TOWN OF BON ACCORD	1,534	GROUNDWATER	219.6
	CITY OF EDMONTON	954		
	SUMMER VILLAGE OF ALBERTA BEACH	884		
	TOWN OF ONOWAY	875	GROUNDWATER	80.0
	VILLAGE OF SPRING LAKE	501		
	SUMMER VILLAGE OF SUNSET POINT	242		
	SUMMER VILLAGE OF SANDY BEACH	239		
	SUMMER VILLAGE OF ROSS HAVEN	198		
	SUMMER VILLAGE OF VAL QUENTIN	181		
	SUMMER VILLAGE OF SILVER SANDS	173		
	SUMMER VILLAGE OF SUNRISE BEACH	170		
	SUMMER VILLAGE OF YELLOWSTONE	170		
	SUMMER VILLAGE OF WEST COVE	169		
	SUMMER VILLAGE OF SOUTH VIEW	115		
Rural	STURGEON COUNTY	15,775	GROUNDWATER	85.1
	PARKLAND COUNTY	9,986		
	LAC STE. ANNE COUNTY	1,686		
	WESTLOCK COUNTY	5		
	COUNTY OF BARRHEAD NO. 11	1		
Aboriginal	ALEXANDER FIRST NATION	962		
	ALEXIS BAND	734		

There is only one surface water licence in the sub-basin and it accounts for less than 1 percent of total municipal water allocations. The maximum amount of surface water that can be withdrawn in Sturgeon Sub-basin by the municipal sector is only 2 dam^3. The sole municipal surface water licence is for rural use. Groundwater licences represent nearly all of municipal water allocations in the sub-basin. Licences allow withdrawals of up to 956 dam^3, of which urban users can withdraw up to 558 dam^3. Rural users can withdraw up to 203 dam^3 of groundwater and other users are allocated withdrawals of 195 dam^3.

Licensees that are not municipalities but have municipal water use licences within the Sturgeon Sub-basin are shown in Table 9-3.

Table 9-3 Additional Municipal Water Use Licensees in the Sturgeon Sub-basin

Licensee	Water Source	Allocation (dam^3)
PARKLAND VILLAGE COMMUNITIES INC.	GROUNDWATER	192.4
WINDMILL ESTATES LTD.	GROUNDWATER	64.0
BERUBE, MOE	GROUNDWATER	23.9
ALCOMDALE LOCAL DEVELOPMENT CO-OPERATIVE LTD.	GROUNDWATER	16.0
HUTTERIAN BRETHREN CHURCH OF MORINVILLE	GROUNDWATER	13.6
SURFACEISS VALLEY FARMS INC.	GROUNDWATER	12.3
ALBERTA INFRASTRUCTURE AND TRANSPORTATION, ST. ALBERT	GROUNDWATER	12.3
ALBERTA MORTGAGE & HOUSING CORPORATION	GROUNDWATER	6.9
OAK HILL FOUNDATION	GROUNDWATER	3.7
INDIAN & NORTHERN AFFAIRS	SURFACE	2.5
ARNDT, HERB	GROUNDWATER	2.5
HORNE & PITFIELD INC.	GROUNDWATER	2.5
LEWIS, ROBERT	GROUNDWATER	1.2

9.1.3 Licensed Water Use

Under the terms of these licences, a maximum of 530 dam^3 is expected to be used (i.e. 55 percent of allocations will be consumed and/or lost) with the remainder (45 percent or 428 dam^3) being returned after use. The expected return flow in municipal licences varies from 74 percent of allocated urban groundwater allocations to 7 percent of other groundwater allocations. All other municipal licences have no return flow component.

Table 9-4 Licensed Municipal Allocations and Use and Estimated Actual Use, Sturgeon Sub-basin (Outside Capital Region System)

Water Use	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Estimated Actual Water Use (dam^3)		
			Allocation	Water Use	Return Flow	Diversion	Estimated Use	Return Flow
Urban*	Surface	0	0	0	0	0	0	0
	Groundwater	7	558	144	414	1,648	109	1,539
	Subtotal	**7**	**558**	**144**	**414**	**1,648**	**109**	**1,539**
Rural**	Surface	1	2	2	0	6	6	0
	Groundwater	12	203	203	0	600	600	0
	Subtotal	**13**	**205**	**205**	**0**	**606**	**606**	**0**
Other***	Surface	0	0	0	0	0	0	0
	Groundwater	8	195	181	14	576	524	52
	Subtotal	**8**	**195**	**181**	**14**	**576**	**524**	**52**
Total	Surface	1	2	2	0	6	6	0
	Groundwater	27	956	528	428	2,824	1,233	1,591
	Total	**28**	**958**	**530**	**428**	**2,830**	**1,239**	**1,591**

* Urban includes villages, summer villages, towns, cities, hamlets;
** Rural includes condominiums / townhouses / mobile homes / complexes, hotels / motels, cooperatives, farmsteads, single-multi homes, colonies and subdivisions
*** Other includes camps, institutions, senior/correctional centres, nursing/children's homes, hospitals

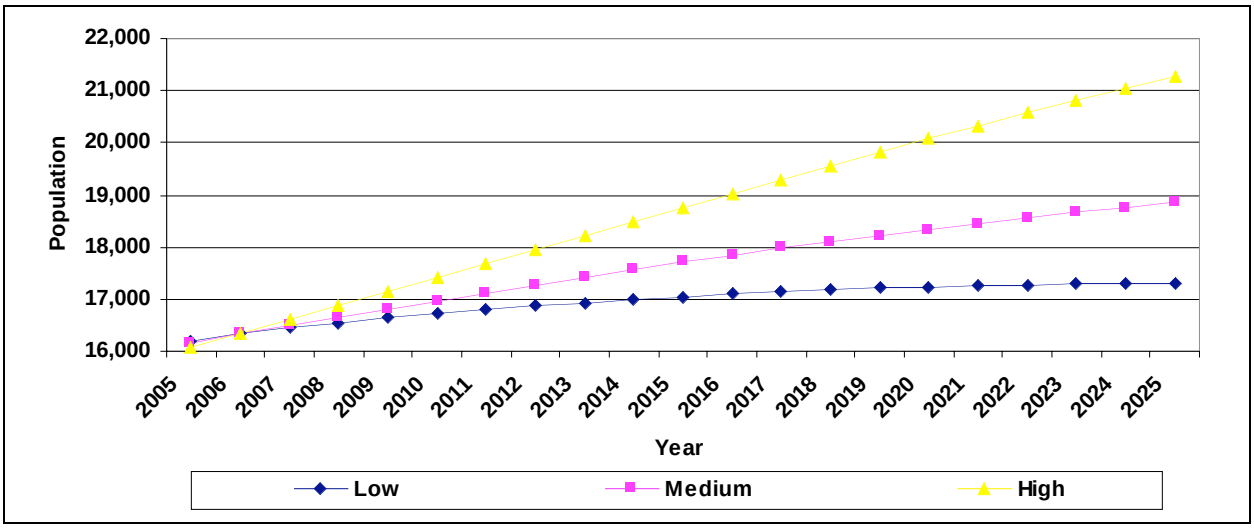
9.1.4 Actual Water Use

Total water use by residents of the Surgeon Sub-basin residing outside the Edmonton Capital region is estimated to be 1,239 dam^3 in 2005, consisting of 6 dam^3 of surface water and 1,233 dam^3 of groundwater. This estimate was calculated based on Parkland County MWWS flow data, the only municipality for which data was available in the sub-basin. Parkland Country MWWS data indicates per capita water use of 76 m^3. Total water use estimates were determined by combining this per capita water use with regional population estimates. The estimated municipal water use exceeds licensed use by 134 percent, and results from the large portion of rural and sub-urban residents of the region that draw water as household users and do not obtain their water from licenced sources.

9.1.5 Future Water Use

Figure 9-7 shows low, medium and high population projection scenarios for the portion of the Sturgeon Sub-basin outside the Edmonton Capital Region based on Alberta Finance Census Division projections. The population forecasts in Figure 9-7 have been used to predict future municipal surface and groundwater use. The resulting forecasts of water use are provided in Table 9-5, and are based on the estimated per capita water use in 2005.

Figure 9-7 Sturgeon Sub-basin Population Growth Forecasts



Based on population growth, municipal water use in 2025 is expected to be 17 percent higher than at present under the Medium Growth scenario. Under the Low Growth forecast, municipal water use will increase by only 7 percent over the forecast period, but would increase by 32 percent under the High Growth scenario

Table 9-5 Projected Municipal Water Use in the Sturgeon Sub-basin
(dam^3)

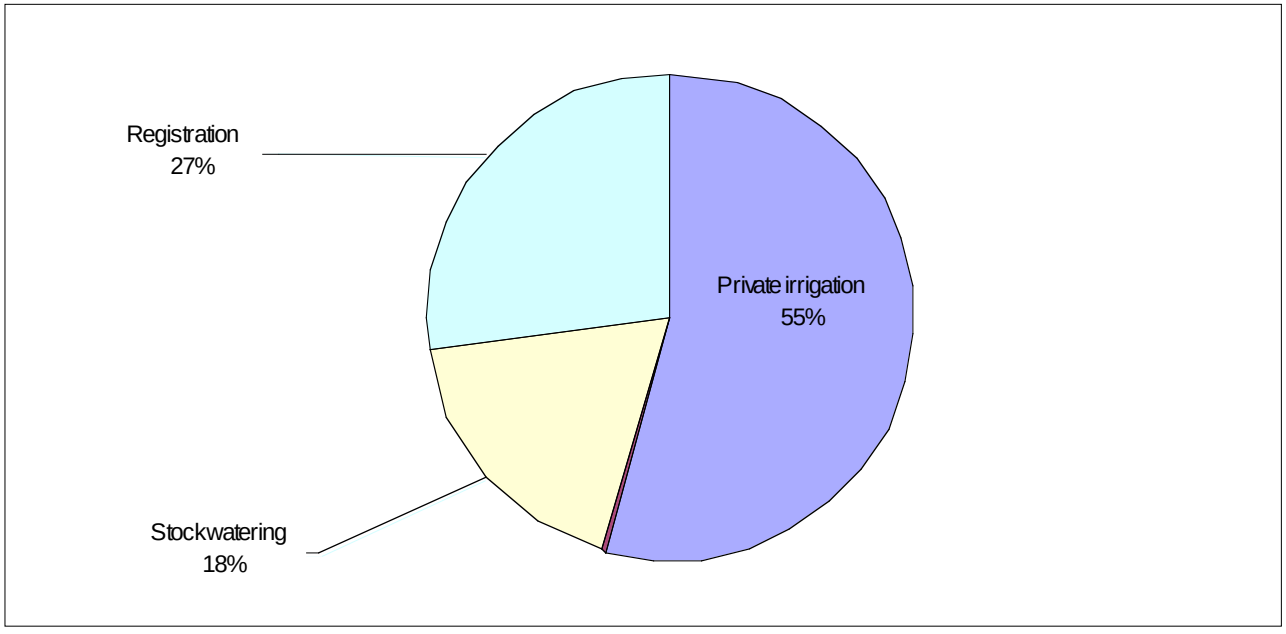
Scenario	Source	2005	2010	2015	2020	2025
Low Population Growth	Surface	6	6	6	6	6
	Groundwater	1,233	1,273	1,297	1,312	1,317
	Total	**1,239**	**1,279**	**1,303**	**1,318**	**1,323**
Medium Population Growth	Surface	6	6	6	7	7
	Groundwater	1,233	1,295	1,351	1,400	1,439
	Total	**1,239**	**1,301**	**1,358**	**1,406**	**1,446**
High Population Growth	Surface	6	6	7	7	8
	Groundwater	1,233	1,335	1,440	1,540	1,632
	Total	**1,239**	**1,342**	**1,447**	**1,547**	**1,640**

9.2 Agriculture Sector

As of December 2005 a total of 3,763 dam^3 had been allocated to the agricultural sector in the Sturgeon Sub-basin. This includes 1,600 registrations with an allocation of 1,028 dam^3 and 225 licences that allow withdrawals of 2,735 dam^3 of water. Water allocated to agriculture accounts for 14 percent of all allocations in the Sturgeon Sub-basin.

Figure 9-8 shows how this water is distributed among the different agricultural activities in the sub-basin. The largest allocation is for private irrigation (55 percent). Registrations account for 27 percent and stockwatering accounts for 8 percent of total allocations.

Figure 9-8 Water Allocation for Agricultural Activities in the Sturgeon Sub-basin, 2005



A total of 840 registrations and 82 licences allow withdrawal of up to 2,583 dam^3 of surface water; this accounts for 69 percent of water allocations for the agricultural sector. Groundwater

accounts for the other 31 percent of allocations, with 1,180 dam^3 being allocated through 760 licences and 143 registrations.

9.2.1 Overview of Agriculture

Based on information from the 2001 Census of Agriculture, there were about 1,344 farms in the Sturgeon Sub-basin (11 percent of North Saskatchewan total) with an average size of 473 acres. At the North Saskatchewan Basin level there are about 12,300 farms with an average size of 625 acres. Farms in the Sturgeon Sub-basin cover an area of nearly 635,000 acres; this is equivalent to about 2,572 km^2 or about 78 percent of the sub-basin. As shown in Table 9-6, 59 percent of the land in the basin is used to raise crops. About 30 percent of agricultural land is pasture. The rest of the lands are in summer fallow or other uses.

Table 9-6 Agricultural Land Use in the Sturgeon Sub-basin, 2001

Land Use	Acres	Percent
Crop Land	377,481	59.4%
Summerfallow	16,204	2.5%
Tame/Seeded Pasture	99,868	15.7%
Natural Pasture	94,989	14.9%
Other	47,003	7.4%
Total	635,545	**100.0%**

The types of farming activity vary within the sub-basin. Table 9-7 shows the classification of farms based on the commodity groups that accounted for 51 percent or more of total gross farm receipts.

Table 9-7 Classifications of Farms in the Sturgeon Sub-basin and North Saskatchewan, 2001

Farm Type (Farms with Gross Receipts >$2,500)	Percent of Farms in the Sub-basin	Percent Share of North Saskatchewan	North Saskatchewan Farm Type (Percent)
Dairy Farms	1.7%	9.7%	1.9%
Cattle (beef) Farms	42.7%	10.0%	45.8%
Hog Farms	2.3%	16.9%	1.4%
Poultry & Egg Farms	2.0%	19.8%	1.1%
Wheat Farms	4.0%	10.2%	4.2%
Grain & Oilseed Farms	15.7%	8.6%	19.6%
Field Crop Farms	10.6%	13.2%	8.6%
Fruit Farms	0.4%	23.1%	0.2%
Misc. Specialty Farms	16.9%	14.1%	12.9%
Sum of Livestock Comb. Farms	2.3%	9.6%	2.6%
Sum of Vegetable Farms	0.1%	8.6%	0.1%
Sum of Other Comb Farms	1.4%	10.0%	1.5%
Total	**100%**	**10.9%**	**100%**

The table shows that the Sturgeon Sub-basin accounts for 11 percent of total farms in the North Saskatchewan. About 43 percent of the farms in the sub-basin raise beef cattle and about 17 percent are speciality farms. Grain and oilseed farms make up about 16 percent of the farms. Like the North Saskatchewan, cattle (beef) farms are the most common type of farm in the sub-basin. The general mix of other types of farms is similar for both Sturgeon and North Saskatchewan.

9.2.2 Stockwatering

As noted in Table 9-7 about 45 percent of farms in the Sturgeon Sub-basin were classified as livestock operations, primarily cattle. Estimated livestock populations for major species are provided in Table 9-8. The table shows that there are about 100,000 cattle and calves which, together, accounted for about 30 percent of the livestock population. Other livestock in the sub-basin included poultry, pigs, sheep and lamb, horses and ponies, bison, deer and elk.

9.2.2.1 Water Allocation

Overall, 1,786 licences and registrations have been issued for livestock watering with total allocation amounting to 1,729 dam^3. In addition to these allocations, farmers are able to obtain up to 1,250 m^3 of water for household purposes. The numbers of such households in the sub-basin is not known. Furthermore, the numbers of "exempted agricultural" users are also not known in the sub-basin.

Table 9-8 Estimated Livestock Populations in the Sturgeon Sub-basin, 2001

Livestock Species	Sturgeon	North Saskatchewan	% North Saskatchewan
Hens and Chicken	219,280	3,090,930	7.1%
Turkey	2,011	41,519	4.8%
Cattle	73,944	990,169	7.5%
Calves	27,618	365,725	7.6%
Pigs	15,963	232,169	6.9%
Sheep and Lamb	4,765	55,204	8.6%
Horse and Ponies	3,215	35,172	9.1%
Bison	1,692	18,906	8.9%
Deer	44	2,864	1.5%
Elk	801	6,426	12.5%

Table 9-9 summarizes current water licences and registrations issued for livestock according to the water source. It shows that surface water accounts for about 32 percent of allowable diversions for livestock and that registrations account for 60 percent of the allocations.

9.2.2.2 Licensed Water Use

Table 9-9 shows that licences and registrations issued for livestock watering assume that all water withdrawals will be used and the there will be no return flow.

Table 9-9 Summary of Water Licences and Registrations Issued for Livestock Watering in the Sturgeon Sub-basin,

Activity	Source	Number of Licences/ Registrations	Licensed Allocation and Use (dam^3)			Reported Actual Water Use	
			Allocation	Water Use	Return	Licensees Reporting	Reported Use (dam^3)
Feedlot	Surface	0	0.0	0.0	0.0	0	N/A
	Groundwater	2	12.1	12.1	0.0	0	N/A
	Subtotal	**2**	**12.1**	**12.1**	**0.0**	**0**	**N/A**
Registration	Surface	840	328.7	328.7	0.0	0	N/A
	Groundwater	760	699.5	699.5	0.0	0	N/A
	Subtotal	**1,600**	**1,028.2**	**1,028.2**	**0.0**	**0**	**N/A**
Stockwatering	Surface	**45**	**231.6**	**231.6**	**0.0**	0	N/A
	Groundwater	139	457.2	457.2	0.0	0	N/A
	Subtotal	**184**	**688.8**	**688.8**	**0.0**	**0**	**N/A**
Total	Surface	885	560.3	560.3	0.0	0	N/A
	Groundwater	901	1,168.7	1,168.7	0.0	0	N/A
	Total	**1,786**	**1,729.1**	**1,729.1**	**0.0**	**0**	**N/A**

9.2.2.3 Actual Water Use

There is no information in Alberta Environment's WURS that indicates the extent to which water allocations are actually used in the Sturgeon Sub-basin. However, a reasonable estimate of water use can be derived using the actual animal populations in the basin as shown in Table 9-8. Based on livestock populations for the Sturgeon Sub-basin in 2001, the total water required for livestock was estimated to be 985 dam^3, or about 57 percent of the licensed allocation.[1] The calculations for this estimate are provided in Table 9-10 which shows livestock populations in the basin and the daily water requirements for various livestock species as provided by Alberta Environment in its "Guide to Calculate Quantities for Water for Raising Animals".[2] In terms of water requirements by species, cattle accounts for about 77 percent of the total, about 8 percent is required by pigs, 5 percent is required by poultry and all other species accounted for the remaining 10 percent.

Table 9-10 Estimated Livestock Water Requirements for 2001

Livestock Species	Animal Population	Daily Consumption (gallons)	Annual Use (dam^3)
Hens and Chickens	677,516	0.045	50.6
Turkey	1,190	0.15	0.3
Bulls	1,343	9.0	20.0
Milk Cows	1,584	30.0	78.8
Beef Cows	26,754	9.0	399.3
Heifers	8,546	6.0	85.0
Steers	4,128	6.0	41.1
Calves	26,192	3.0	130.3
Boars	163	6.5	1.8
Sows and Gilts - Breeding	2,537	6.5	27.3
Nursing and Weaner Pigs	8,522	0.5	7.1
Grower and Finishing Pigs	18,626	1.5	46.3
Sheep and Lambs	7,112	2.0	23.6
Horse and Ponies	2,958	10.0	49.1
Bison	1,561	2.0	5.2
Deer	942	10.0	15.6
Elk	626	3.5	3.6
Total			**985.0**

The estimated actual consumption (985 dam^3) based on livestock populations shown in Table 9-10 however, do not include an allowance for the evaporative and seepage losses associated with storing water for livestock use. Typically, licensed consumption accounts for only 35 percent of surface water allocated for livestock use while losses account for 65 percent (Watrecon 2005).

Since 68 percent of livestock water consumption comes from groundwater (no losses) and the balance comes from surface water with 65 percent losses, a total allocation of 1,157 dam^3 would be required to support the animal populations in Table 9-10. This water requirement is about 67 percent of the water allocation through licences and registrations.

[1] This approach to estimating water use for stockwatering was employed in the 1986 Battle River Basin water use study undertaken by Stanley Associates in 1985.

[2] http://www3.gov.ab.ca/env/water/Legislation/Approvals_Licences/CalculationChart.doc.

9.2.2.4 Forecasts of Future Stockwatering Water Use

Future water use is dependent on future livestock population in the sub-basin. Information from the NRCB indicates that, as of December 31, 2005, there had been no applications from farmers throughout the sub-basin for major new or expanded cattle and dairy operations. A study undertaken by Alberta Agriculture in the late 1990s also provides some insights regarding the potential for expansion of cattle. Figures 2-3 and 2-4 in Section 2.3 show areas where there is capability of supporting a 5,000-head back grounding operation and a 20,000-head operation. The figures show that there are some townships that meet all of the criteria for backgrounding and finishing operations. For townships that meet some of the criteria limiting factors include groundwater and landscape for backgrounding operations and groundwater for finishing operations. Based on Alberta Agriculture's assessment, it would appear that there are more opportunities for backgrounding operations in the Sturgeon Sub-basin. Table 9-11 shows water use projections to 2025. By 2025, relative to 2005, water use is expected to 11 percent, 30 percent and 60 percent higher under Low, Medium and High Growth scenarios, respectively**.**

Table 9-11 Projected Water Use for Livestock in the Sturgeon Sub-basin, (dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	491	503	517	531	545
	Groundwater	666	682	701	720	740
	Total	**1,157**	**1,185**	**1,217**	**1,251**	**1,285**
Medium Growth	Surface	491	522	557	593	633
	Groundwater	666	708	755	805	858
	Total	**1,157**	**1,230**	**1,312**	**1,399**	**1,490**
High Growth	Surface	491	550	619	694	779
	Groundwater	666	747	839	942	1,057
	Total	**1,157**	**1,297**	**1,458**	**1,636**	**1,836**

9.2.3 Irrigation

The other major use of water for agricultural purposes is irrigation or crop watering. Irrigation in this basin is done by private irrigators who have their own water licences and divert water using their own pumps and water distribution equipment.

When aggregate information from the 2001 Census of Agriculture for individual counties and municipal districts is modified to reflect river basin boundaries, the resulting estimates suggest that about 1,865 acres of land in the Sturgeon Sub-basin were irrigated in 2001. Another approach for estimating irrigated acres involves dividing water allocations by irrigation water requirement of about 450 mm (18 inches) per acre. Based on this method it is estimated that water allocations are sufficient to support irrigation on about 1,672 acres. There is no information on the mix of crops grown by private irrigators; however, AAFRD has indicated that most private irrigation in Alberta is used to raise supplemental forages to feed livestock.

Table 9-12 Irrigation Allocations and Use and Reported Actual Water Use, Sturgeon Sub-basin

Activity	Source	Number of Licences/ Registrations	Licensed Allocation and Use (dam^3)			Reported Actual Water Use (dam^3)	
			Allocation	Water Use	Return	Licensees Reporting	Reported Use
Private irrigation	Surface	37	2,022.6	2,022.6	0.0	0	N/A
	Groundwater	2	11.2	11.2	0.0	0	N/A
	Subtotal	**39**	**2,033.8**	2,033.8	**0.0**	**0**	**N/A**
Total	**Surface**	**37**	**2,022.6**	**2,022.6**	**0.0**	**0**	**N/A**
	Groundwater	**2**	**11.2**	**11.2**	**0.0**	**0**	**N/A**
	Total	**39**	**2,033.8**	**2,033.8**	**0.0**	**0**	**N/A**

9.2.3.1 Water Allocation

There are 39 licences that allocate approximately 2,034 dam^3 for irrigation purposes. Over 99 percent this allocation is from surface water.

9.2.3.2 Licensed Use

Table 9-12 shows that licences issued for irrigation assume that all withdrawals will be consumed or lost and there will be no return flow.

9.2.3.3 Actual Water Use

Neither Alberta Agriculture nor Alberta Environment has any information on actual water use by private irrigators. For the purposes of this study it is assumed that actual use is equal to licensed water use. However, actual water use in any given year will depend on how much of the crop water demand can be satisfied by natural precipitation. It is noteworthy that the amount of water used for crop watering is twice the actual stockwatering use (1,157 dam^3) in the sub-basin.

9.2.3.4 Forecasts of Future Irrigation Water Use

With expansion of livestock, additional demand for livestock forage is expected. However, due to climatic conditions and poor returns on forage production additional forage production is not expected. It is assumed that available forage will be able to support modest increases in livestock populations. Irrigation water use is projected remain at 2,034 dam^3 over the forecast period.

9.2.4 Summary

In summary, current agricultural water use in the Sturgeon Sub-basin is estimated to be about 3,191 dam^3, of which 36 percent is for stockwatering and 64 percent is for irrigation. In the future, agricultural water demand in the basin is expected to increase as a result of expansion of livestock populations. Irrigation water use is expected to remain constant. Table 9-13 shows a summary of future agricultural water use.

Table 9-13 Projected Water Use for Agriculture in the Strawberry Sub-basin
(dam^3)

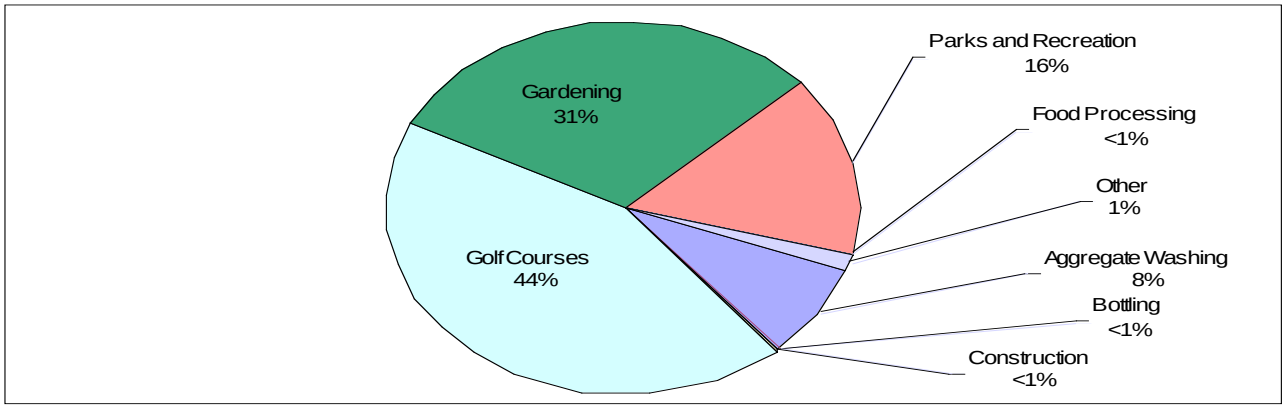
Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	2,514	2,526	2,540	2,554	2,568
	Groundwater	677	693	712	731	751
	Total	**3,191**	**3,219**	**3,251**	**3,285**	**3,319**
Medium Growth	Surface	2,514	2,545	2,580	2,616	2,656
	Groundwater	677	719	766	816	869
	Total	**3,191**	**3,264**	**3,346**	**3,433**	**3,524**
High Growth	Surface	2,514	2,573	2,642	2,717	2,802
	Groundwater	677	758	850	953	1,068
	Total	**3,191**	**3,331**	**3,492**	**3,670**	**3,870**

Agricultural water use in 2025 would be about 3,319 dam^3 (an increase of 4 percent from 2005) under the Low Growth. Under High Growth, water use is projected to be 3,870 dam^3 by 2025; this represents (an increase of 21 percent from 2005). For the Medium Growth, agricultural water use in 2025 is expected to increase by 11 percent over current levels.

9.3 Commercial Sector

There are 69 licences that allow diversion of 2,372 dam^3 of water in the Sturgeon sub-basin. This allocation accounts for about 9 percent of total allocations in the sub-basin.

Figure 9-9 Water Allocation for Commercial Activities in the Sturgeon Sub-basin



9.3.1 Water Allocations

Figure 9-9 shows how this allocation is distributed among the various commercial sector activities, including golf courses (44 percent), gardening (31 percent), parks and recreation (16 percent) and, aggregate washing (8 percent). Bottling, construction, food processing and other activities together account for about 1 percent of the total allocations. Surface water accounts for 73 percent of allocations and the largest allocation is for golf courses. Groundwater accounts for the remaining 27 percent of allocations and the largest allocation is also for golf courses.

9.3.2 Licensed Water Use

Table 9-14 provides a summary of licensed allocations, use and return for various activities within the commercial sector in the Sturgeon sub-basin. The table shows that all of the allocations are expected to be used and there will be no return flow.

Table 9-14 Licensed Commercial Allocations, Reported and Actual Water Use, Sturgeon Sub-basin

Activity	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Reported Actual Water Use (dam^3)		
			Allocation	Water Use	Return	Licensees Reporting	Reported Use	Percent of Allocation
Aggregate Washing	Surface	0	0.0	0.0	0.0	0	0	N/A
	Groundwater	2	190.0	190.0	0.0	0	0	N/A
	Subtotal	**2**	**190.0**	190.0	**0.0**	**0**	**0**	**N/A**
Bottling	Surface	0	0.0	0.0	0.0	0	N/A	N/A
	Groundwater	1	0.9	0.9	0.0	0	N/A	N/A
	Subtotal	**1**	**0.9**	0.9	**0.0**	**0**	**N/A**	**N/A**
Construction	Surface	1	3.8	3.8	0.0	0	N/A	N/A
	Groundwater	1	0.6	0.6	0.0	0	N/A	N/A
	Subtotal	**2**	**4.4**	4.4	**0.0**	**0**	**N/A**	**N/A**
Food Processing	Surface	0	0.0	0.0	**0.0**	0	N/A	N/A
	Groundwater	1	8.3	8.3	**0.0**	0	N/A	N/A
	Subtotal	**1**	**8.3**	8.3	**0.0**	**0**	**N/A**	**N/A**
Gardening	Surface	18	714.9	714.9	0.0	0	N/A	N/A
	Groundwater	6	13.6	13.6	0.0	0	N/A	N/A
	Subtotal	**24**	**728.4**	728.4	**0.0**	**0**	**N/A**	**N/A**
Golf Courses	Surface	12	747.0	747.0	0.0	0	N/A	N/A
	Groundwater	3	292.6	292.6	0.0	0	N/A	N/A
	Subtotal	**15**	**1,039.6**	1,039.6	**0.0**	**0**	**N/A**	**N/A**
Other	Surface	2	19.7	19.7	**0.0**	0	N/A	N/A
	Groundwater	2	10.4	10.4	**0.0**	0	N/A	N/A
	Subtotal	**4**	**30.1**	30.1	**0.0**	**0**	**N/A**	**N/A**
Parks and Recreation	Surface	11	243.0	243.0	**0.0**	0	N/A	N/A
	Groundwater	9	127.0	127.0	**0.0**	0	N/A	N/A
	Subtotal	**20**	**370.0**	370.0	**0.0**	**0**	**N/A**	**N/A**
Total	**Surface**	44	1,728.3	1,728.3	0.0	0	N/A	N/A
	Groundwater	25	643.3	643.3	0.0	0	N/A	N/A
	Total	**69**	**2,371.6**	**2,371.6**	**0.0**	**0**	**N/A**	**N/A**

9.3.3 Actual Water Use

At the present time Alberta Environment's Water Use Reporting System contains no information on actual water use in 2005 by any of the licensees in commercial sector in the Sturgeon sub-basin. Given the lack of information on actual water us, it is assumed that all licensees are withdrawing and using the full amount of water to which they are entitled. This assumption will likely overstate the actual commercial sector water use as well as the overall water use.

9.3.4 Future Water Use Forecasts

Since most of the allocation (91 percent) is for three activities – golf courses, gardening and parks and recreation, forecasts of future demand will be based on those activities.

9.3.4.1 Golf Courses

The water demand forecast for golf courses follows the approach outlined in Watrecon (2005) which assumes that water demand will increase based on expansion of golf courses as a result of population growth. However, the population growth must reach specified thresholds before an additional nine hole golf course is constructed (*i.e.* golf course expansion is not linearly related to population growth). Using this assumption, and given the population growth rate, some golf course expansion is likely to occur. For the Medium and High Growth scenarios, the population growth rate is enough to support additional golf course development over the entire forecast period. For the Low Growth scenario the growth rate is enough to support one expansion up to 2010, after which time water use is expected to remain unchanged. This method also assumes that the proportion of surface and groundwater will not change over the forecast period relative to 2005. The resulting projections in Table 9-15 show that water use under the Low Growth scenario is expected to increase to 1,080 dam^3 by 2025, a 4 percent increase from current use. Using the High Growth scenario, water demand for golf courses is projected to increase to 1,512 dam^3 by 2025, which is a 45 percent increase from current use. Water use is expected to be 25 percent higher by 2025 under Medium Growth.

Table 9-15 Projected Water Use for Golf Course, Sturgeon Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	747	778	778	778	778
	Groundwater	293	302	302	302	302
	Total	**1,040**	**1,080**	**1,080**	**1,080**	**1,080**
Medium Growth	Surface	747	778	829	881	933
	Groundwater	293	302	323	343	363
	Total	**1,040**	**1,080**	**1,152**	**1,224**	**1,296**
High Growth	Surface	747	829	933	1,037	1,089
	Groundwater	293	323	363	403	423
	Total	**1,040**	**1,152**	**1,296**	**1,440**	**1,512**

9.3.4.2 Gardening

There has been a very modest growth in greenhouse operations in the sub-basin over the last decade. Given the trends towards urbanization and a limited land base, a large scale increase in these operations is not expected. Future water use is projected assuming an average annual growth rate ranging from 0 percent (Low Growth) and 1 percent (High Growth). Under the Medium Growth scenario an annual increase of 0.3 percent is assumed; this is the average annual growth rate of greenhouse farms in the sub-basin between 1996 and 2001, as calculated using information in the Census of Agriculture. Projections using these assumptions are shown in Table 9-16.

Table 9-16 Projected Water Use for Gardening, Sturgeon Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	715	715	715	715	715
	Groundwater	14	14	14	14	14
	Total	**729**	**729**	**729**	**729**	**729**
Medium Growth	Surface	715	726	737	748	759
	Groundwater	14	14	14	15	15
	Total	**729**	**740**	**751**	**763**	**774**
High Growth	Surface	715	751	790	830	872
	Groundwater	14	15	15	16	17
	Total	**729**	**766**	**805**	**846**	**889**

Water use is expected to remain unchanged under Low Growth but will increase to 889 dam^3 under High Growth, which is a 22 percent increase from 2005. Water use is expected to be 6 percent higher by 2025 under Medium Growth.

9.3.4.3 Parks and Recreation

Future water use is expected to increase as a result of regional population growth. The Projections in Table 9-17 are based on 0.3 percent annual growth for the Low Growth scenario, 0.8 percent for the Medium Growth scenario and 1.6 percent for the High Growth scenario.

Table 9-17 Projected Water Use for Parks and Recreation, Sturgeon Sub-basin
dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	243	247	250	254	258
	Groundwater	127	129	131	133	135
	Total	**370**	**376**	**381**	**387**	**393**
Medium Growth	Surface	243	253	263	274	285
	Groundwater	127	132	138	143	149
	Total	**370**	**385**	**401**	**417**	**434**
High Growth	Surface	243	263	285	308	334
	Groundwater	127	137	149	161	174
	Total	**370**	**401**	**434**	**469**	**508**

Water use is expected to be 393 dam^3 by 2025 under Low Growth which is a 6 percent increase from current use. Under High Growth, water use is expected to be 508 dam^3 which is a 37 percent increase from 2005. Water use is expected to be 17 percent higher by 2025 under Medium Growth.

9.3.5 Summary

A summary of the projected water demand for the commercial sector in the Sturgeon Sub-basin is provided in Table 9-18. Note that this forecast combines the estimates for golf courses, gardening, and parks and recreation (which together account for 91 percent of allocation in the sub-basin), with the assumption that all other commercial licensees are using their full allocations.

Under the Low Growth scenario, water use is projected to rise to 2,434 dam^3, a 3 percent increase from current levels by 2025. Under the High Growth scenario, water use is projected to rise to 3,141 dam^3, a 33 percent increase by 2025. Water use is projected to increase by 15 percent from the current level by 2025 under Medium Growth.

Table 9-18 Projected Water Use for the Commercial Sector, Sturgeon Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	1,728	1,763	1,766	1,770	1,774
	Groundwater	643	654	656	658	660
	Total	**2,371**	**2,417**	**2,422**	**2,428**	**2,434**
Medium Growth	Surface	1,728	1,780	1,852	1,926	2,000
	Groundwater	643	657	684	710	736
	Total	**2,371**	**2,437**	**2,536**	**2,636**	**2,736**
High Growth	Surface	1,728	1,866	2,031	2,198	2,318
	Groundwater	643	684	736	789	823
	Total	**2,371**	**2,551**	**2,767**	**2,987**	**3,141**

9.4 Petroleum Sector

In the Sturgeon Sub-basin, there are two active surface water licences that allocate 999 dam^3 of water to the petroleum sector. Petroleum allocations account for almost 4 percent of total allocations in the sub-basin.

9.4.1 Injection

One surface water licence has been issued In the Sturgeon Sub-basin for injection activities. The single surface water licence was issued in the 1990s and allows for withdrawals of less than 4 dam^3 of surface water. The licensee is expected to consume all of the water it withdraws.

Table 9-19 Licensed Allocations, Estimated Actual Water Use for the Petroleum Sector, Sturgeon Sub-basin

Water Use	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Estimated Water Use (dam^3)		
			Allocation	Water Use	Return	Water Use	Percent of Licensed Use	Percent of Allocation
Injection	Surface	1	3.7	3.7	0.0	0	0%	0%
	Groundwater	0	0.0	0.0	0.0	0		
	Subtotal	**1**	**3.7**	**3.7**	**0.0**	**0***	**0%**	**0%**
Gas/ Petrochemical Plant	Surface	1	995.4	995.4	0.0	252	25%	25%
	Groundwater	0	0.0	0.0	0.0	0	0%	0%
	Subtotal	**1**	**995.4**	**995.4**	**0.0**	**252****	**25%**	**25%**
Total	Surface	2	999.1	999.1	0.0	252	25%	25%
	Groundwater	0	0.0	0.0	0.0	0		
	Total	**2**	**999.1**	**999.1**	**0.0**	**252**	**25%**	**25%**

* EUB water use data provided by Geowa.
** Estimates based on WURS data.

A detailed summary of reported water used for injection in the Sturgeon Sub-basin has been prepared by Geowa based on EUB data and the results are presented in Table 9-19. According to the reports submitted to the EUB, no water was diverted for injection purposes in 2005 and the licence holder is assumed to not require water during the forecast period.

9.4.2 Gas/Petrochemical Plants

In the Sturgeon Sub-basin, one surface water licence has been issued for gas and petrochemical plants. The licence was issued in the 1980s and allows withdrawals of up to 995 dam^3 of surface water. The licensee is expected to consume all of the water it withdraws. The surface water licence holder reported using 252 dam^3 in 2005, about 25 percent of its allocation.

In the absence of information about this component of the petroleum sector, it is assumed that water used by gas and petrochemical plants in the Sturgeon Sub-basin will remain constant for the forecast period.

9.4.3 Summary

Relatively little water has been allocated to the petroleum sector in the Sturgeon Sub-basin. The majority of allocations to the petroleum sector is for gas and petrochemical plants which account for almost all allocations and all actual water use in 2005. Water use data shows that although water licences allow up to 999 dam^3 of water to be consumed for petroleum purposes, licensees reported using only 25 percent of this amount.

Water requirements for petroleum activities in the Sturgeon Sub-basin are not expected to change during the forecast period (Table 9-20).

Table 9-20 Forecast of Water Use for the Petroleum Sector in the Sturgeon Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
	Surface	252	252	252	252	252
	Groundwater	0	0	0	0	0
	Total	**252**	**252**	**252**	**252**	**252**

9.5 Industrial Sector

In the Sturgeon Sub-basin, three licences allocated 66 dam^3 of surface water and there is one groundwater licence that allocates nearly 2 dam^3 of groundwater to the industrial sector (Table 9-21). Industrial allocations accounts for less than 1 percent of total allocations in the sub-basin.

Table 9-21 Licensed Allocations and Estimated Water Use for the Industrial Sector, Sturgeon Sub-basin

Water Use	Source	Number of licences	Licensed Allocation and Use (dam^3)			Estimated Water Use (dam^3)		
			Allocation	Water Use	Return	Water Use	Percent of Licensed Use	Percent of Allocation
Cooling	Surface	1	1.7	1.7	0.0	2	100%	100%
	Groundwater	1	4.9	4.9	0.0	5	100%	100%
	Subtotal	**2**	**6.6**	**6.6**	**0.0**	**6***	**100%**	**100%**
Manufacturing	Surface	0	0.0	0.0	0.0	0	100%	100%
	Groundwater	1	59.7	59.7	0.0	60	100%	100%
	Subtotal	**1**	**59.7**	**59.7**	**0.0**	**60***	**100%**	**100%**
Mine-other	Surface	0	0.0	0.0	0.0	0	100%	100%
	Groundwater	1	1.2	1.2	0.0	1	100%	100%
	Subtotal	**1**	**1.2**	**1.2**	**0.0**	**1***	**100%**	**100%**
Total	Surface	1	1.7	1.7	0.0	2	100%	100%
	Groundwater	3	65.8	65.8	0.0	66	100%	100%
	Total	**4**	**67.5**	**67.5**	**0.0**	**68**	**100%**	**100%**

* Actual water use is estimated assuming 100 percent of licensed consumption

Two water licences have been issued for cooling purposes and they allow withdrawals of less than 2 dam^3 of surface water and 5 dam^3 of groundwater. Manufacturing has one groundwater licence that allocates 60 dam^3. Mining other than coal has one groundwater licence that allocates just over 1 dam^3. All four licences have been issued since the 1990s and assume that all withdrawals will be consumed.

There is no information on actual water use diversions or consumption for the industrial water licences in the Sturgeon Sub-basin. For the purposes of this analysis, it is assumed that these licensees are using their full entitlement and will continue to do so for the forecast period (Table 9-22). While two bitumen upgraders have be proposed for the Sturgeon sub-basin, these would draw water from the North Saskatchewan River and are described in Section 10.5.

Table 9-22 Forecast of Water Use for the Petroleum Sector in the Sturgeon Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
	Surface	252	252	252	252	252
	Groundwater	0	0	0	0	0
	Total	**252**	**252**	**252**	**252**	**252**

9.6 Other Sector

In the Sturgeon Sub-basin there are 24 active licences which allocate 18,024 dam^3 of water to the other sector. These licences expect 84 percent of withdrawals to be consume or lost and 16 percent to be returned. The other sector activities account for 68 percent of licensed water use in the Sturgeon Sub-basin. Almost all of the water allocated is for surface water (16,770 dam^3). Other sector uses include water management for flood control and lake stabilization, fish, wildlife and habitat enhancement, and other specified use by director (Figure 9-10).

Figure 9-10 Other Sector Water Allocation by Use in the Sturgeon Sub-basin

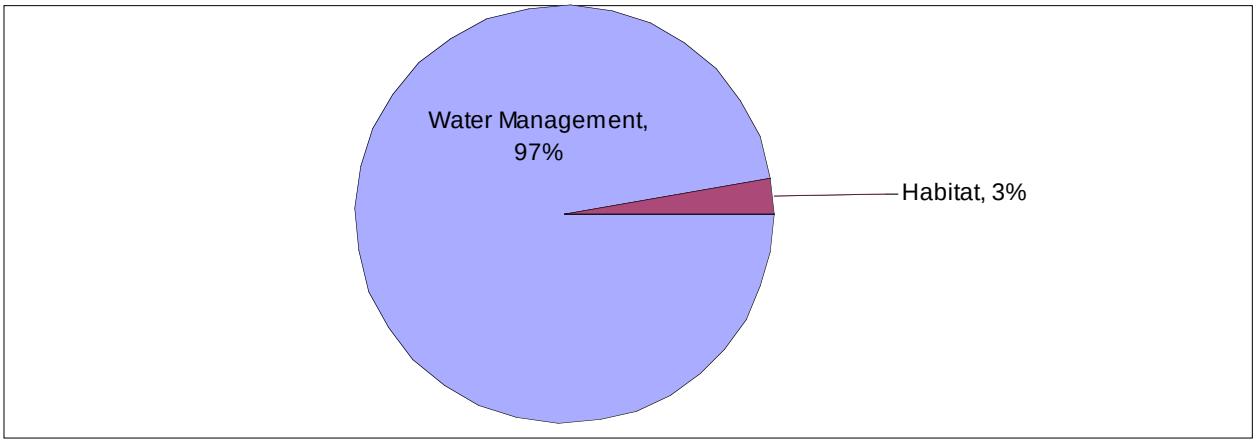


Table 9-23 Licensed Allocations and Estimated Actual Water Use for the Other Sector, Sturgeon Sub-basin

Water Use	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Estimated Water Use (dam^3)		
			Allocation	Water Use	Return	Water Use	Percent of Licensed Use	Percent of Allocation
Water Management	Surface	11	16,263.4	14,509.4	1,753.9	14,509	100%	89%
	Groundwater	4	1,227.3	124.6	1,102.7	1245	100%	10%
	Subtotal	**15**	**17,490.7**	**14,634.1**	**2,856.6**	**14,634**	**100%**	**84%**
Habitat	Surface	3	460.1	460.1	0.0	460	100%	100%
	Groundwater	5	26.3	10.5	15.8	11	100%	40%
	Subtotal	**8**	**486.4**	**470.6**	**15.8**	**471**	**100%**	**97%**
Specified	Surface	1	46.6	46.6	0.0	47	100%	100%
	Groundwater	0	0.0	0.0	0.0	0		
	Subtotal	**1**	**46.6**	**46.6**	**0.0**	**47**	**100%**	**100%**
Total	Surface	15	16,770.1	15,016.1	1,753.9	15,016	100%	90%
	Groundwater	9	1,253.6	135.1	1,118.5	135	100%	11%
	Total	**24**	**18,023.7**	**15,151.3**	**2,872.4**	**15,151**	**100%**	**84%**

Water licences have been issued to Canadian Concrete (two), City of St. Alberta (one), Consolidated Concrete Ltd (three), Ducks Unlimited (seven), Lac Ste. Anne County (three), LaFarge Canada Inc (one), Sturgeon County (two), Westlock County (one), and private individuals (four). The County of Westlock's licence is substantial (13,900 dam^3) and it accounts for 92 percent of the Sturgeon Sub-basin's licensed other sector allocations in the Sturgeon Sub-basin and 53 percent of allocations to the other sector in the North Saskatchewan Basin.

Table 9-22 summarizes the water allocation, use, and return associated with the licences for each activity in the Sturgeon Sub-basin.

9.6.1 Water Management

In the Sturgeon Sub-basin, 11 surface water licences and four groundwater licences have been issued for water management activities. The licences allow for withdrawals of up to 16,263 dam^3 of surface water and 1,227 dam^3 of groundwater. Water management allocations commenced in the 1940s for surface water and the 1950s for groundwater; allocations of both have increased over time. Surface water licences assume that up to 14,634 dam^3 of water will be consumed that that 2,857 dam^3 will be returned. Groundwater licences expect that up to 125 dam^3 will be used and 1,103 dam^3 will be returned. Some of these licences have been issued for the de-watering of gravel pits.

There is no information on the actual water diversions and consumption for water management licences. For purposes of this analysis, it is assumed that the licence holder is using their full entitlement.

In the absence of information about this component of the other sector, it is assumed that water used for water management projects in the Sturgeon Sub-basin will remain constant over the forecast period. Although one groundwater licence is scheduled to expire by 2010, one surface water licence by 2015, and three surface water licences by 2020, it is assumed that these licences will be renewed so water use for water management will remain constant over the forecast period (Table 9-23).

Table 9-24 Forecast of Water Management Water Use in the Sturgeon Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
	Surface	14,509	14,509	14,509	14,509	14,509
	Groundwater	125	125	125	125	125
	Total	**14,634**	**14,634**	**14,634**	**14,634**	**14,634**

9.6.2 Habitat Enhancement

In the Sturgeon Sub-basin, three surface water licences and five groundwater licence that have been issued for wildlife and habitat enhancement projects. The licences allow withdrawals of up to 460 dam^3 of surface water and 26 dam^3 of groundwater. Habitat enhancement allocations commenced in the 1980s, and have increased over time. Licences assume licensees will consume all the surface water they withdraw. However, groundwater licences assume that 60 percent of water withdrawals 16 dam^3 will be returned.

There is no information on the actual water diversions and consumption for habitat enhancement licences and, for purposes of this analysis, it is assumed that the licence holder is using their full entitlement.

In the absence of information about this component of the other sector, it is assumed that water used for habitat enhancement projects in the Sturgeon Sub-basin will remain constant for the forecast period.

9.6.3 Specified Use

In the Sturgeon Sub-basin, there is one surface water licence that has been issued to a private individual for specified use by the director. The licence allows for withdrawals of up to 47 dam^3 and was issued in the 1910s. The single licence holder is expected to consume all of the water it withdraws.

There is no information on the actual water diversions and consumption for specified use licence. For purposes of this analysis, it is assumed that the licence holder is using their full entitlement. In the absence of information about this component of the other sector, it is assumed that water used by specified use projects in the Sturgeon Sub-basin will remain constant for the forecast period.

9.6.4 Summary

The other sector in the Sturgeon Sub-basin is dominated by allocations for water management. These projects account for 97 percent of the water allocation and licensed water use.

In the absence of information about the other sector, it is assumed that water used for these projects in the Sturgeon Sub-basin will remain constant for the forecast period. Although a number of licences are schedule to expire prior to 2025, it is assumed that these will be renewed so water use will remain constant over time (Table 9-24).

Table 9-25 Forecast of Other Sector Water Use in the Sturgeon Sub-basin

(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
	Surface	15,016	15,016	15,016	15,016	15,016
	Groundwater	135	135	135	135	135
	Total	**15,151**	**15,151**	**15,151**	**15,151**	**15,151**

9.7 Summary

Table 9-25 provides a summary of licensed allocations and estimated water use for each of the water use sectors in the Sturgeon Sub-basin. In total, existing licences and registrations allow a maximum of 26,183 dam^3 of water to be withdrawn. Of this total 63 percent (22,882 dam^3) is expected to be used and the balance is to be returned after use. Figure 9-11 shows the allocations, licensed use and actual use for the different sectors. Actual use (22,272 dam^3) is about 87 percent of licensed use. The largest water user is the other sector, which accounts for 66 percent of licenced use. Figure 9-12 shows the forecasts to 2025 for all of the sectors under

Medium Growth. By 2025 water use is expected to increase by about 1 percent under Low Growth (Table 9-26), about 4 percent under Medium Growth (Table 9-27), and about 8 percent under High Growth (Table 9-28).

Figure 9-11 Water Allocations and Actual Use, by Sector, Sturgeon Sub-basin Basin

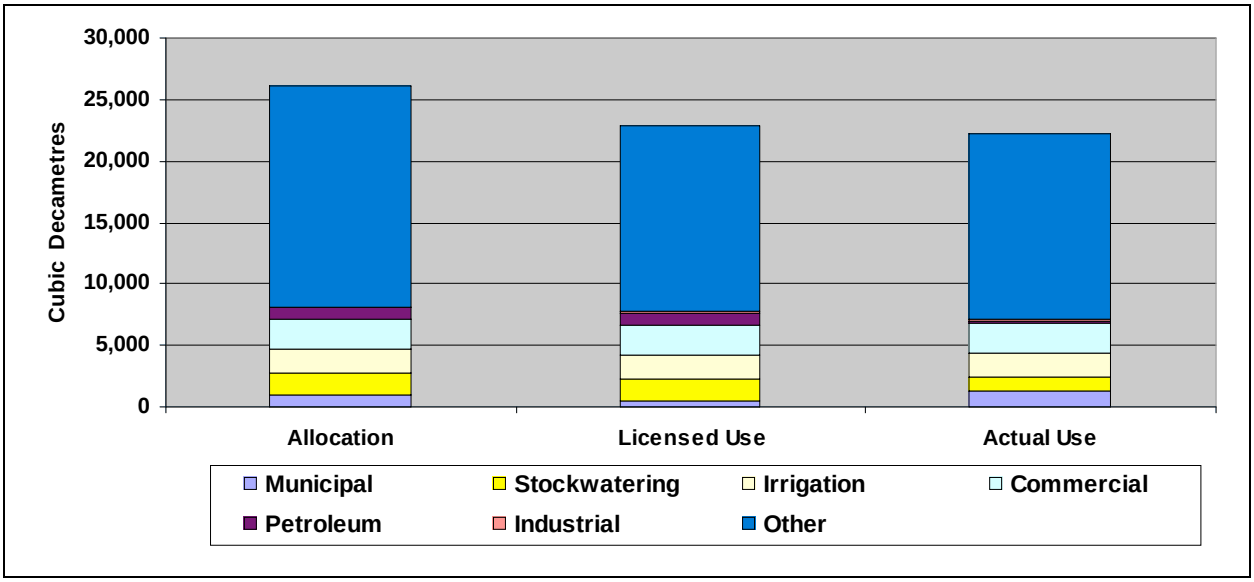


Figure 9-12 Forecast Water Use in Sturgeon Sub-basin: Medium Scenario

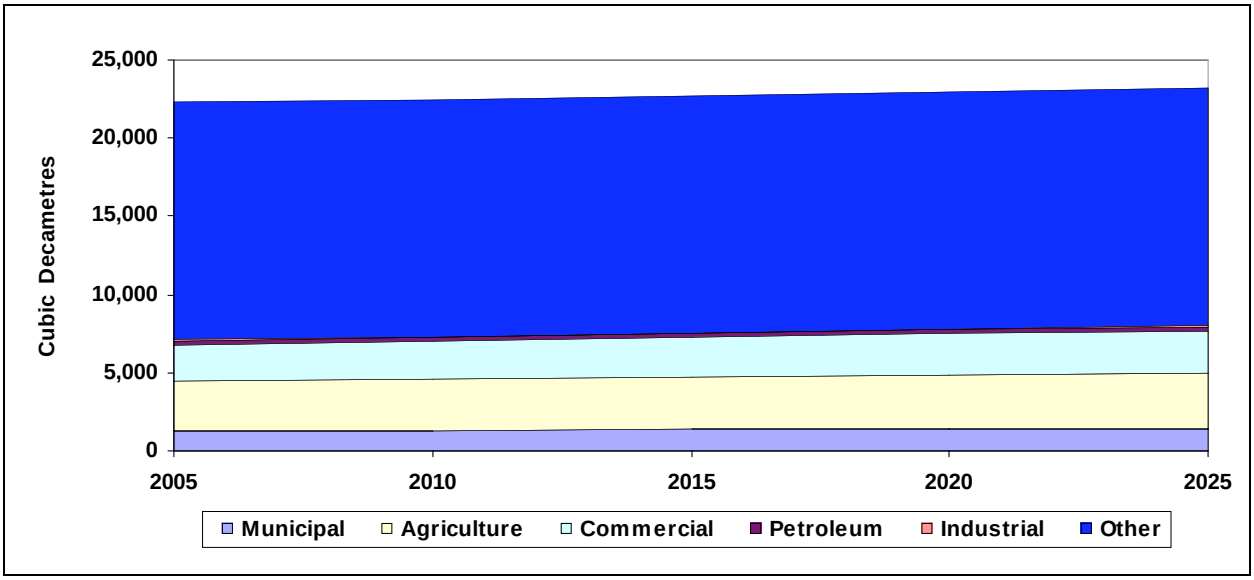


Table 9-26 Summary of Allocations and Estimated Water Use, Sturgeon Sub-basin

Sector		Licensed Allocation and Use (dam^3)				Estimated Water Use (dam^3)		
		Allocation	Water Use	Return	Percent of Total Use	Use	Percent of Licensed Use	Percent of Total Use
Municipal		958	530	428	2%	1,239	234%	6%
Agricultural	Stockwatering	1,729	1,729	0	8%	1,157	67%	5%
	Irrigation	2,034	2,034	0	9%	2,034	100%	9%
Commercial		2,371	2,371	0	10%	2,371	100%	11%
Petroleum		999	999	0	4%	252	25%	1%
Industrial		68	68	0	0%	68	100%	0%
Other		18,024	15,151	2,873	66%	15,151	100%	68%
Total		**26,183**	**22,882**	**3,301**	**100%**	**22,272**	**97%**	**100%**

Table 9-27 Forecast Water Use, By Sector, Sturgeon Sub-basin: Low Scenario
(dam^3)

Source	Sector	2005	2010	2015	2020	2025
Surface Water	Municipal	6	6	6	6	6
	Agricultural	2,514	2,526	2,540	2,554	2,568
	Commercial	1,728	1,763	1,766	1,770	1,774
	Petroleum	252	252	252	252	252
	Industrial	2	2	2	2	2
	Other	15,016	15,016	15,016	15,016	15,016
	Total	**19,518**	**19,564**	**19,582**	**19,600**	**19,618**
Groundwater	Municipal	1,233	1,273	1,297	1,312	1,317
	Agricultural	677	693	712	731	751
	Commercial	643	654	656	658	660
	Petroleum	0	0	0	0	0
	Industrial	66	66	66	66	66
	Other	135	135	135	135	135
	Total	**2,754**	**2,821**	**2,866**	**2,902**	**2,929**
Total	Municipal	1,239	1,279	1,303	1,318	1,323
	Agricultural	3,191	3,219	3,252	3,285	3,319
	Commercial	2,371	2,417	2,422	2,428	2,434
	Petroleum	252	252	252	252	252
	Industrial	68	68	68	68	68
	Other	15,151	15,151	15,151	15,151	15,151
	Total	**22,272**	**22,385**	**22,448**	**22,502**	**22,547**

Table 9-28 Forecast Water Use, By Sector, Sub-basin Basin: Medium Scenario
(dam^3)

Source	Sector	2005	2010	2015	2020	2025
Surface Water	Municipal	6	6	6	7	7
	Agricultural	2,514	2,545	2,580	2,616	2,656
	Commercial	1,728	1,780	1,852	1,926	2,000
	Petroleum	252	252	252	252	252
	Industrial	2	2	2	2	2
	Other	15,016	15,016	15,016	15,016	15,016
	Total	**19,518**	**19,601**	**19,708**	**19,819**	**19,933**
Groundwater	Municipal	1,233	1,295	1,351	1,400	1,439
	Agricultural	677	719	766	816	869
	Commercial	643	657	684	710	736
	Petroleum	0	0	0	0	0
	Industrial	66	66	66	66	66
	Other	135	135	135	135	135
	Total	**2,754**	**2,872**	**3,002**	**3,127**	**3,245**
Total	Municipal	1,239	1,301	1,357	1,407	1,446
	Agricultural	3,191	3,264	3,346	3,432	3,525
	Commercial	2,371	2,437	2,536	2,636	2,736
	Petroleum	252	252	252	252	252
	Industrial	68	68	68	68	68
	Other	15,151	15,151	15,151	15,151	15,151
	Total	**22,272**	**22,473**	**22,709**	**22,946**	**23,178**

Table 9-29 Forecast Water Use, By Sector, Sub-basin Basin: High Scenario
(dam^3)

Source	Sector	2005	2010	2015	2020	2025
Surface Water	Municipal	6	6	7	7	8
	Agricultural	2,514	2,573	2,642	2,717	2,802
	Commercial	1,728	1,866	2,031	2,198	2,318
	Petroleum	252	252	252	252	252
	Industrial	2	2	2	2	2
	Other	15,016	15,016	15,016	15,016	15,016
	Total	**19,518**	**19,715**	**19,950**	**20,192**	**20,397**
Groundwater	Municipal	1,233	1,335	1,440	1,540	1,632
	Agricultural	677	758	850	953	1,068
	Commercial	643	684	736	789	823
	Petroleum	0	0	0	0	0
	Industrial	66	66	66	66	66
	Other	135	135	135	135	135
	Total	**2,754**	**2,978**	**3,227**	**3,483**	**3,724**
Total	Municipal	1,239	1,341	1,447	1,547	1,640
	Agricultural	3,191	3,331	3,492	3,670	3,870
	Commercial	2,371	2,551	2,767	2,987	3,141
	Petroleum	252	252	252	252	252
	Industrial	68	68	68	68	68
	Other	15,151	15,151	15,151	15,151	15,151
	Total	**22,272**	**22,693**	**23,176**	**23,675**	**24,122**