

## **2.0 STATUS AND ACTIVITIES OF ATHABASCA OIL SANDS DEVELOPMENTS IN 2005**

This section provides a synthesis of information related to development pressures that may be influencing aquatic environmental resources within the RAMP Focus Study Area (FSA) and Regional Study Area (RSA), and specifically describes the activities of:

- Each of the oil sands projects being developed by RAMP member companies that occurred in 2005 within the RAMP RSA;
- Oil sands projects being developed by companies that are not members of RAMP that occurred in 2005 within the RAMP RSA; and
- Other developments in the Regional Municipality of Wood Buffalo (RMWB).

### **2.1 BACKGROUND**

Each year, oil sands development activities in the Athabasca oil sands area continue to increase and change. From a monitoring perspective, it is important to have a complete record and understanding of oil sands development activities that have occurred in a given monitoring year. This information is needed to accurately interpret monitoring results within the context of actual development activities operations and the potential influence of these activities on the surrounding environment.

For RAMP, oil sands development activities that may alter or influence local aquatic environments are of specific importance. Activities such as land clearing and construction, muskeg dewatering, alteration of drainage patterns, air emissions (i.e., potential acid deposition), water discharges and water withdrawals all have the potential to affect water quality and/or quantity in nearby receiving waters.

The following sections provide a summary of activities known to have occurred within the RAMP FSA during the 2005 monitoring year. Much of the information has been obtained from the Alberta Economic Development (AED) oil sands update report (AED 2005), Alberta Energy and Utilities Board (EUB) publications on active oil sands schemes (EUB 2005), field observations during RAMP monitoring surveys, information provided by industry representatives of RAMP, and an analysis of spring 2005 satellite imagery for estimation of land changes in the RAMP FSA.

### **2.2 OIL SANDS PROJECTS**

#### **2.2.1 RAMP-Member Projects**

RAMP has been designed largely in response to the monitoring needs of the various industry members for specific oil sands projects. In 2005, ten companies with activities in the Athabasca oil sands area participated in RAMP. Table 2.2-1 summarizes the current status of each active oil sands development project within the RAMP FSA as of the end of 2005 being undertaken by companies that were members of RAMP in 2005. The date of initial environmental disturbance of each project has also been included where possible because this represents the first activity that has the potential to affect local aquatic systems (i.e., conservative approach).

**Table 2.2-1 Current status of approved RAMP-member Athabasca oil sands development projects within the RAMP FSA, as of 2005.**

Oil Sands Development		Location	Type of Operation	Capacity		Date of Application	Date of First Disturbance	2005 Status
				Bitumen	Synthetic			
Suncor Energy Inc.								
	Lease 86/17	30 km N of Fort McMurray	open-pit	280,000		1964	1967	Operational
	Steepbank Mine	30 km N of Fort McMurray	open-pit			1996	1997	Operational
	Millennium Mine and Upgrader	30 km N of Fort McMurray	open-pit, processing		110,000	1998	2000	Operational
	Fixed Plant Expansion	30 km N of Fort McMurray	processing		220,000	1996	existing area	Operational
	Firebag	40 km NE of Mildred Lake	<i>in situ</i>	140,000		2000	2002	Operational
	South Tailings Pond	25 km N of Fort McMurray	tailings pond	n/a	n/a	2003	2005	Approved
Syncrude Canada Ltd.								
	Mildred Lake (Base Mine)	45 km N of Fort McMurray	open-pit	90,000		1973	1973	Operational
	Mildred Lake Upgrader	45 km N of Fort McMurray	processing		250,000	1998	existing area	Operational
	North Mine	60 km N of Fort McMurray	open-pit	160,000		1995	1996	Operational
	Aurora North	east side of Athabasca River	open-pit	200,000		1996	1996	Operational
	Mildred Lake Upgrader Expansion	45 km N of Fort McMurray	processing		300,000	1995	2003	Construction
Albian Sands Energy Inc.								
	Muskeg River Mine	75 km N of Fort McMurray	open-pit	155,000		1997	2000	Operational
Shell Canada Ltd.								
	Jackpine Mine (Phase 1)	East portion of lease 13	open-pit	200,000		2002	2008	Approved
CNRL								
	Horizon	80 km N of Fort McMurray	open-pit	270,000		2002	2004	Construction
Imperial Oil Resources								
	Kearl	70 km NE of Fort McMurray	open-pit	300,000		2005 (expected)	2007	Planning <sup>c</sup>
Petro-Canada Oil and Gas								
	Dover	55 km NW of Fort McMurray	<i>in situ</i>	900		unknown	unknown	Operational
	Fort Hills	90 km N of Fort McMurray	mine	190,000		2001	2005	Approved
	MacKay River	60 km NW of Fort McMurray	<i>in situ</i>	30,000		1998	2000	Operational
	Meadow Creek	45 km S of Fort McMurray	<i>in situ</i>	80,000		2001	--	Approved
OPTI Canada Ltd. /Nexen Inc.								
	Long Lake Pilot	40 km SE of Fort McMurray	<i>in situ</i>	3,000		unknown	2003	Operational
	Long Lake Project (Phase 1, Upgrader)	40 km SE of Fort McMurray	<i>in situ</i>	70,000	60,000	2003	2004	Construction
Total E&P Canada Ltd.								
	Joslyn, SAGD Phase I	60 km SE of Fort McMurray	<i>in situ</i>	600		unknown	2003	Operational
	Joslyn, SAGD Phase II	60 km SE of Fort McMurray	<i>in situ</i>	10,000		2004	2005	Construction
Husky Energy								
	Sunrise	70 km NE of Fort McMurray	<i>in situ</i>	200,000		2004	2006	Approved

<sup>a</sup> any one or more of Mills Creek, Poplar Creek, McLean Creek, and Beaver Creek

<sup>b</sup> any one or more of Isadore's Lake, Shipyard Lake, McClelland Lake, or Kearl Lake

<sup>c</sup> included because it is the only project in the Athabasca oil sands area wholly-owned by the RAMP member.

### 2.2.1.1 Suncor Energy Inc., Oil Sands

Suncor's approved Athabasca oil sands projects that were in construction or operation stages of implementation in 2005 were the Lease 86/17 Upgrader and storage pond operations; the Steepbank Mine; the Millennium Mine and Upgrader; the South Tailings Pond; and the Firebag Project.

#### ***Suncor Lease 86/17 and Steepbank Mine/Project Millennium***

Suncor continued to operate the Steepbank and Millennium surface mines, existing associated upgrader facilities, and various storage pond facilities in 2005. Bitumen production in the second quarter of 2005 was about 56% of levels for the same period in 2004 due to a fire in January 2005 which damaged the oil sands plant. The plant has since been repaired and bitumen production has returned to full production capacity. Bitumen production from these facilities averaged 171,300 b/d in 2005. Specific activities conducted by Suncor in 2005 in regards to Lease 86/17 and Steepbank Mine/Project Millennium in 2005 included:

- Continued exploratory drilling;
- Land clearing and project construction in the McLean Creek watershed, Unnamed Creek in the Steepbank River watershed, and in minor tributaries of the Athabasca River;
- Replacing of rip-rap under the Suncor Bridge in February 2005 and dredging of the Athabasca River Forebay in August 2005;
- 677 ha of muskeg and overburden dewatering in the Unnamed Creek drainage near Shipyard Lake from April to November;
- Alteration of drainage patterns in the McLean Creek watershed commencing in March as part of the construction of the South Tailings Pond;
- SO<sub>2</sub> emissions totaling 25,680 t;
- Water withdrawal from the Athabasca River totaling 48.03 million m<sup>3</sup>, and water discharge to the Athabasca River totaling 8.36 million m<sup>3</sup>; and
- Groundwater withdrawal totaling 169,000 m<sup>3</sup>.

#### ***Suncor Firebag***

Production of bitumen from Phase 1 of the Suncor *in situ* Firebag Project continued throughout 2005 and construction on Phase 2 of the project was complete by the end of 2005.

### 2.2.1.2 Syncrude Canada Ltd.

Syncrude's approved Athabasca oil sands projects that were in construction or operation stages of implementation in 2005 were the Mildred Lake Base Mine, the North Mine, the Mildred Lake Upgrader, Mildred Lake Upgrader Expansion, and the Aurora North Mine. Combined production from all Syncrude operations amounted to approximately 250,000 b/d in 2005.

### ***Syncrude Mildred Lake Mine and Upgrader***

The Mildred Lake operation includes an open-pit oil sands mine, extraction and upgrading facilities. The mine obtains water via a water intake facility on the Athabasca River; however, there are no point source discharges to local waterbodies. Both the North and East Mines, as well as the Mildred Lake Upgrader facilities, continued operation in 2005. Construction of the Mildred Lake Upgrader expansion was almost complete by the end of 2005. Syncrude's intake from the Athabasca River in 2005 was 28.2 million m<sup>3</sup>.

### ***Syncrude Aurora North Mine***

The Aurora North Mine is located north of the Albion Sands Muskeg River Mine and is within the Muskeg River watershed. The mine, which began production in 2000, consists of an open-pit mine and extraction operations. Specific activities conducted by Syncrude in 2005 in regards to the Aurora North Mine included:

- Continued exploratory drilling;
- Land clearing and project construction in Muskeg River and Beaver Creek, with in-stream works in Stanley Creek in October; and
- As part of the Aurora Clean Water Diversion system, diversion of 4.36 million m<sup>3</sup> of water to Stanley Creek and the Muskeg River from muskeg dewatering activities as well as site drainage.

#### **2.2.1.3 Albion Sands Energy Inc.**

Albion Sands operates the Muskeg River Mine on the eastern side of the Athabasca River immediately to the northeast of Fort McKay. The Muskeg River Mine is located adjacent to the Muskeg River, south of the Aurora North Mine, and consists of an open-pit mine and extraction plant. Diluted bitumen from the mine is transported via pipeline to the Scotford Upgrader located in Fort Saskatchewan, Alberta. Bitumen production from these facilities averaged 168,371 b/d in 2005. In 2005, Albion Sands' Muskeg River Mine facility was a zero-discharge operation, with tailings water and local drainage being recycled. Specific activities conducted by Albion Sands in 2005 in regards to the Muskeg River Mine in 2005 included:

- Continued exploratory drilling;
- Land clearing and project construction in the Muskeg River drainage; and
- Water withdrawal from the Athabasca River totaling 21.33 million m<sup>3</sup>.

#### **2.2.1.4 Shell Canada Ltd.**

While Shell's Jackpine Mine Phase 1 was approved in 2004, little or no development activity occurred in 2005 for this project; the Jackpine Mine is intended to follow expansion of the Muskeg River Mine.

### 2.2.1.5 Canadian Natural Resources Ltd.

Construction activities continued in 2005 on the CNRL Horizon mining project on Lease 18; these activities included:

- Continued exploratory drilling and land clearing;
- In-stream work from January to March 2005 in three tributaries to the Tar River (TRT2, TRT3, and TRT4);
- Approximately 1,000 ha of muskeg and overburden dewatering in a number of minor drainages of the Tar River (TRT3, TRT4, TRT5, TRT6, TRT7, TRT7.5a, TRT7.5b, W9);
- Alteration of the drainage pattern in one minor drainage (TRT3) of the Tar River beginning in March 2005; and
- A water withdrawal of slightly more than 3.94 million m<sup>3</sup> from the Athabasca River beginning in August 2005.

### 2.2.1.6 Imperial Oil Resources

Imperial Oil is planning to develop an open-pit mining operation near Kearn Lake, located 70 km northeast of Fort McMurray on Oil Sands Leases 6, 87, the eastern portion of Oil Sands Leases 36 and 31A, and the northeast portion of Oil Sands Lease 88. The application was submitted in July 2005. Exploratory drilling was the only on-site activity that occurred in 2005.

### 2.2.1.7 Petro-Canada Oil and Gas

Petro-Canada's approved Athabasca oil sands projects that were in construction or operation stages of implementation in 2005 were the *in situ* Dover Project, the Fort Hills Project, the *in situ* MacKay River Project; and the *in situ* Meadow Creek Project.

#### ***Petro-Canada Dover***

The following are the main activities conducted in regards to the Petro-Canada *in situ* Dover Project in 2005:

- Bitumen production averaged approximately 900 b/d;
- A total of approximately 1,500 m<sup>3</sup> of stormwater was discharged;
- 10 exploratory wells were drilled on the Dover lease;
- A total of 64.9 t of SO<sub>2</sub> was released; and
- Groundwater was withdrawn from the buried Birch Channel.

#### ***Petro-Canada Fort Hills***

In 2005, planning for the Petro-Canada Fort Hills Project continued, following EUB and AENV approval in 2004. The following are the main activities conducted in regards to the Fort Hills Project in 2005:

- Bitumen production averaged less than 1,200 b/d;
- A temporary water supply pump was installed in the Athabasca River for supply to the BITMIN Demonstration Plant. The in-stream work for this facility occurred in May and June 2005;
- Withdrawal of water from the Athabasca River totaled approximately 271,000 m<sup>3</sup>. This withdrawal occurred at Township and Range NW 36-096-011-W4;
- Discharge to the Athabasca River was minimal and consisted of surface runoff via minor Athabasca River tributaries at Townships and Ranges W1/2 30 and W1/2 31-096-10-W4, and E1/2 25 and 36-096-11-W4; and
- NO<sub>x</sub>/SO<sub>x</sub> emissions were minimal.

### ***Petro-Canada MacKay River***

The following are the main activities conducted in regards to the Petro-Canada *in situ* MacKay River Project in 2005:

- Bitumen production averaged approximately 25,000 b/d;
- Three additional well pads were constructed on land that was cleared in 2004;
- A total of approximately 2,000 m<sup>3</sup> of stormwater was discharged; and
- Groundwater was withdrawn from the buried Birch Channel.

### ***Petro-Canada Meadow Creek***

Petro-Canada received regulatory approval for an 80,000 bpd *in situ* project in the Meadow Creek area in 2001 and is currently continuing to evaluate the development potential of the oil sands leases within the Meadow Creek area. The potential to operate a smaller facility, rather than the facility already approved, is being evaluated. Activities in 2005 consisted largely of exploratory and delineation drilling.

#### **2.2.1.8 OPTI Canada Ltd./Nexen Inc.**

OPTI Canada Ltd. and Nexen Inc. are jointly developing the *in situ* Long Lake Project located near Anzac and the Gregoire River. The Long Lake Pilot Project continued operation in 2005, while construction of Phase 1 of the Long Lake Project continued throughout 2005.

#### **2.2.1.9 Total E&P Canada Ltd.**

Total E&P's approved Athabasca oil sands projects that were in construction or operation stages of implementation in 2005 were the *in situ* Joslyn Phase I and Phase II Projects on Lease 24 (formerly owned by Deer Creek Energy Ltd.). The Joslyn Phase I Project continued operation in 2005, with an average production of 220 b/d. Construction of the Joslyn Phase II project neared completion by the end of 2005.

#### **2.2.1.10 Husky Energy**

Husky received regulatory approval for the *in situ* Sunrise Thermal Project in 2005. Exploratory drilling was the only on-site activity that occurred in 2005.

## 2.2.2 Other Oil Sands Projects

There were nine approved oil sands development projects active in the RAMP study area in 2005, and whose operators were not members of RAMP in 2005. A brief summary of those operations has been provided in Table 2.2-2.

**Table 2.2-2 Approved Athabasca oil sands development projects within the RAMP study area operated by non-RAMP members, as of 2005.**

Operator	Effective Date	Field or Area	Location (Township and Range)	Recovery Method
EnCana	3 Apr 2000	Christina Lake	11 to 16, E17, 24-76-6W4M, 1, 2-20-76-6W4M, 1 to 4-21-76-6W4M, 1 to 4-22-76-6W4M, 1 to 4-23-76-6W4M	SAGD
Japan Canada	2 Apr 1998	Hangingstone	NW26, N27, N28, 33, 34, W35-84-11W4M	SAGD
ConocoPhillips	15 May 2003	Athabasca	81-6W4M, 1, 2, 11 to 14, 23 to 29, 32 to 36-81-7W4M, NW 82-5W4M, 82-6W4M, 82-7W4M, SW 83-5W4M, 83-6W4M, 83-7W4M	SAGD
ConocoPhillips	4 Jun 2003	Surmont	24-83-7W4M	Steam Stimulation
Devon	18 Nov 2004	Jackfish	19 to 21, 28 to 33-75-6W4M, 4 to 6-76-6W4M	SAGD
MEG Energy	01 Feb 2005	Christina Lake	7 to 9, 16 to 18, N19 to N21-77-5W4, E12, E13, E24-77-6W4	SAGD
Devon	25 Feb 1998	Panny	07-07-096-06W5M, 12-01-096-07W5M, 13-01-096-07W5M, 14-09-096-07W5M, 16-04-096-07W5M, 09-14-095-06W5M	Primary Production
EnCana	19 Sep 2003	Christina Lake	03/10-16-76-6W4M, 06/10-16-76-6W4M, 07/10-16-76-6W4M, 08/10-16-76-6W4M	Solvent Addition
Whitesands	20 Feb 2004	Whitesands	12, 13-77-9W4M	Toe to Heel Air Injection

## 2.3 OTHER DEVELOPMENTS IN THE REGIONAL MUNICIPALITY OF WOOD BUFFALO

Other developments outside of oil sands operations occur within the RMWB and surrounding area which utilize the Athabasca River and its basin. Some of the most apparent developments within the RMWB are municipal growth and infrastructure development. Others include conventional oil and gas exploration, pipeline construction, forestry operations (pulp and paper, logging), drilling activities, and mining (aggregate, coal) activity.

### 2.3.1 Forestry

Within the RMWB, the forestry is one of the most dominant non-oil-sands-related industries. Alberta-Pacific Forest Industries Inc. (ALPAC) operates a Forest Management Agreement (FMA) area of approximately 5.8 million ha; 290,408 ha of which are within the RMWB (D. Cheyne, ALPAC, *pers.comm.*). The FMA extends from Lesser Slave Lake east to the Saskatchewan border, with its southern boundary starting just north of the

towns of Athabasca and Lac La Biche (i.e., the “white zone”) and its northern border in the Birch Mountains positioned north of Fort McMurray, but south Wood Buffalo National Park. Approximately 37% of the FMA is considered productive forest with tree species and sites suitable for timber harvesting. Forest companies operating within the FMA area (ALPAC and conifer quota holders such as Northlands) harvest approximately 10,000 ha each year (ALPAC 2005).

Upstream of the RMWB there are other developments such as, market pulp mills and one newsprint pulp and paper operation. There are six pulp and paper mills and numerous sawmills within the Athabasca River Basin. One of the downstream mills, Northlands Forest Products, is located within the RMWB, approximately 20 km north of Fort McMurray on the Athabasca River.

### **2.3.2 Other Mining Operations**

Other mining activities in the area include extraction of coal, sand, gravel, vanadium, peat and uranium. Deposits of salt, limestone, granite, gypsum and silica also have mining potential.

Birch Mountain Resources Ltd. (Birch Mountain) Hammerstone Project is an example of this development. The quarry contains limestone suitable for producing construction and concrete aggregate. The company also plans to produce quicklime from the high-quality limestone. Regulatory approval for the dual-purpose limestone quarry near Fort McKay was initiated in October 2002. In March of 2004, Birch Mountain submitted their Application and Environmental Impact Assessment to the Natural Resources Conservation Board and Alberta Environment. Birch Mountain plans to discharge non-industrial wastewater into the Muskeg River (Birch Mountain, 2004).

Coal is also very prominent south of the RMWB; there are approximately twelve coalmines operating in the Athabasca River basin.

#### **Oil and Gas**

Alberta's petroleum industry includes conventional oil and gas fields, heavy oil, oil sands deposits and numerous oil and gas processing plants with extensive pipeline infrastructure made up of 332,464 km of pipeline. At Fort McMurray, the Athabasca River is joined by the Clearwater River that flows across the border from Saskatchewan. The Clearwater River's major tributary, the Christina River, drains an area with extensive oil and gas development (NRBS 1997).

### **2.3.2.1 Municipal Growth**

The RMWB is undergoing rapid population growth accompanying the growth of the Athabasca oil sands developments. A census conducted in 2005, indicated a total population of 73,176 for the RMWB, and represents an increase of 6,071 residents (9%) since the municipal census in 2004 ([www.woodbuffalo.ab.ca](http://www.woodbuffalo.ab.ca)). Within the municipality there are twenty-six native reservations and ten communities with Fort Smith being the most northerly community and Conklin the most southerly. By 2010, the RMWB plans to invest 220 million dollars for upgrades to water and sewage treatment facilities (L. Wright, RMWB, 2006, *pers.comm.*).



The southern communities of Conklin, Janvier, and Anzac depend on the Christina River and Gregoire Lake to supply them with water, and the surrounding wetlands are used to polish the once per year release from sewage lagoons. Upgrades to the Conklin water treatment plant are in the pre-design phase, with decommissioning and connection to the Fort McMurray facility scheduled for Anzac, and the first nation community at Gregoire Lake (468 Band) by 2007. Similarly, upgrades or reviews of community sewage lagoons are scheduled for 2006-2008.

Fort McMurray acquires water from the Athabasca River, and with expansion of the treatment facility treats 40,000 m<sup>3</sup>/d. Fort McMurray also is home to the only secondary treatment facility in the RMWB with a continuous release into the Athabasca River. Capacity expansion of the facility is progressing in phases. The initial phase will be based on a population of 85,000 and in phase 2 a population of 133,000 people at completion in 2009. Fort McKay also releases into the Athabasca River, but like smaller southern communities only one release per year into a drainage ditch is permitted. Water from the Ells River is utilized in the community's water treatment plant.

The area of Fort Chipewyan is serviced by two water treatment plants, which obtain water from Lake Athabasca and discharge wastewater to two sewage lagoons. The sewage lagoon located in Allison Bay has an annual discharge upstream of the water intake in Fort Chipewyan, and the second lagoon in Fort Chipewyan is under review for upgrade.

Landfill sites are located in Conklin, Fort McMurray and Fort Chipewyan. A new landfill site in Fort McMurray located on the west side of the Hangingstone River is in process, and once complete the landfill will consist of lined cells, surrounded by 26 ground water monitoring wells. The old landfill in Fort Chipewyan, is scheduled for closure and replacement by a new landfill resulting from a joint venture between the RMWB, the province and First Nations.

## **2.4 FIRST-ORDER EFFECTS OF DEVELOPMENT ACTIVITIES IN 2005**

### **2.4.1 Land Change**

Land change was estimated with satellite imagery in conjunction with more detailed maps of Athabasca oil sands operations provided by a number of RAMP industry members. These sources of data were used to estimate the amount of land changed for a number of land change classes in each of the main RAMP FSA watersheds in 2005.

A set of 30 m resolution Landsat TM and Landsat MSS (TM: Thematic Mapper, MSS: Multi-Spectral Scanner) images taken 30 May 2005 were obtained, along with a set of Landsat images from earlier periods to serve as reference imagery to screen out areas with land change caused by natural processes. A land change classification protocol was developed and applied to the imagery to identify and delineate the following types of land change:

- Cleared – logged areas;
- Bare – areas with little or no trace of vegetation remaining;
- Developed – areas on which various infrastructure facilities have been developed but which may remain connected with the surrounding hydrology;

- Enclosed – areas from which runoff to the natural hydrologic system has likely been prevented (e.g., mines, tailings ponds, etc.); and
- Reclaimed.

The first three of these classes are further subdivided into whether or not the land change was a direct result of oil sands development activities, rather than, say, logging as part of an FMA, quarry development, or other non-oil sands development activity.

Because of the resolution of the satellite imagery, it was not possible to efficiently delineate roads and small, very localized anthropogenic land changes, such as seismic lines and exploratory wells. SAGD well pads were about the smallest oil sands development entity that was delineated, while an individual cut-block was approximately the smallest logging area that was delineated. Details of the land change estimation procedure are provided in Appendix A.

Table 2.4-1 and Table 2.4-2 provide tabular summaries of the land changes in each of the main watersheds by each land change type. These areas are also shown in Figure 2.4-1 and Figure 2.4-2 for the area north and south of Fort McMurray, respectively. Estimated land change as of 2005 within the RAMP FSA is estimated at approximately 92,000 ha, of which about 57,000 ha is directly oil sands development related, and the remainder (about 35,000 ha) due to other human activities, primarily logging. The percentage of the area of watersheds with land change from oil sands development activities varies from less than 1% for many watersheds (Steepbank, MacKay, Ells, Christina, Firebag, Horse, Hangingstone, and Calumet), to 5% to 10% for the Poplar, Muskeg, and all the smaller Athabasca River tributaries from Fort McMurray to the mouth of the Firebag River, to more than 10% for the Beaver, McLean, and Tar watersheds.

## **2.4.2 Surface Water Withdrawals and Discharges**

Total water intake from the Athabasca River by the significant oil sands users of Athabasca River water (Suncor, Syncrude and Albion Sands) averaged approximately 3.14 m<sup>3</sup>/s in 2005 (Figure 2.4-3); this is very similar to withdrawals from 2000 to 2004, in which the average intake from the Athabasca River was 3.1 m<sup>3</sup>/s (RAMP 2005a). Average discharge to the Athabasca River in 2005 was about 8% of the intake, at 0.27 m<sup>3</sup>/s. The net 2005 intake (withdrawal less discharge) was 0.37% of the average discharge of the Athabasca River in 2005. The highest net intake, as a percentage of Athabasca River flow, was slightly more than 2%, which occurred in mid-February of 2005.

**Table 2.4-1 Area of watersheds with land change, summarized by land change type.**

Watershed	Watershed Area with Land Change (ha)										
	Land Change – Oil Sands						Land Change – Other				Total – Oil Sands Plus Other
	Cleared	Bare	Developed	Enclosed	Reclaimed	Total	Cleared	Bare	Developed	Total	
Ath. R. Tribs <sup>1</sup>	1,404	3,652	363	4,126		9,545	121	149	23	293	9,838
Beaver	275	933	159	13,580	802	15,749				-	15,749
Calumet	0	156				156	820	2,714		3,534	3,690
Christina	3,395	5,229	1,338			9,962	3,586	19,178	235	22,999	32,961
Ells	15	123				138		25		25	163
Firebag	955	34	115			1,104		690		690	1,794
Hangingstone			227			227				-	227
Horse			214			214				-	214
MacKay		66	148	23		237	458	1,814	12	2,284	2,521
McLean		737	43	72		852				-	852
Muskeg	2,202	743	179	5,420		8,544	1,887	554	17	2,458	11,003
Poplar	142	378	731	1,726	370	3,347	588	1,736		2,324	5,671
Steepbank	27	94	79	160		360	379	230		609	971
Tar	116	5,069	905			6,090	6	434		440	6,530
<b>Total</b>	<b>8,531</b>	<b>17,214</b>	<b>4,502</b>	<b>25,108</b>	<b>1,171</b>	<b>56,525</b>	<b>7,845</b>	<b>27,524</b>	<b>286</b>	<b>35,656</b>	<b>92,183</b>

Only land changes within the RAMP FSA were delineated.

<sup>1</sup> Refers to Athabasca River tributaries from Fort McMurray to the mouth of the Firebag River excluding Poplar, Beaver, and McLean Creeks.

**Table 2.4-2 Percent of total watershed areas with land change, summarized by type of land change.**

Watershed	% Watershed Area with Land Change										
	Land Change – Oil Sands						Land Change – Other				Total – Oil Sands Plus Other
	Cleared	Bare	Developed	Enclosed	Reclaimed	Total	Cleared	Bare	Developed	Total	
Ath. R. Tribs <sup>1</sup>	1.01	2.63	0.26	2.97		6.87	0.09	0.11	0.02	0.22	7.09
Beaver	1.09	3.69	0.63	53.6	1.90	61.0				0	61.0
Calumet	0	0.9				0.9	4.7	15.4		20.1	21.0
Christina	0.26	0.40	0.10			0.76	0.28	1.47	0.02	1.77	2.53
Ells	0.01	0.05				0.06		0.01		0.01	0.07
Firebag	0.17	0.01	0.02			0.2		0.12		0.12	0.32
Hangingstone			0.21			0.21				0	0.21
Horse			0.10			0.1				0	0.10
MacKay		0.01	0.03	0		0.04	0.08	0.33	0	0.41	0.45
McLean		15.6	0.91	1.52		18.1				0	18.15
Muskeg	1.54	0.52	0.13	3.78		5.97	1.32	0.39	0.01	1.72	7.69
Poplar	0.30	0.8	1.55	3.65	0.47	6.77	1.25	3.67		4.92	11.7
Steepbank	0.02	0.07	0.06	0.12		0.27	0.28	0.17		0.45	0.72
Tar	0.3	15.2	2.7			18.3		1.3		1.3	19.6
<b>Total</b>	<b>0.24</b>	<b>0.49</b>	<b>0.13</b>	<b>0.71</b>	<b>0.03</b>	<b>1.60</b>	<b>0.22</b>	<b>0.78</b>	<b>0.01</b>	<b>1.01</b>	<b>2.60</b>

Only land changes within the RAMP FSA were delineated.

<sup>1</sup> Refers to Athabasca River tributaries from Fort McMurray to the mouth of the Firebag River excluding Poplar, Beaver, and McLean Creeks.

Figure 2.4-1 Land change areas for the RAMP FSA north of Fort McMurray, derived from Landsat-5 TM imagery of 30 May 2005.

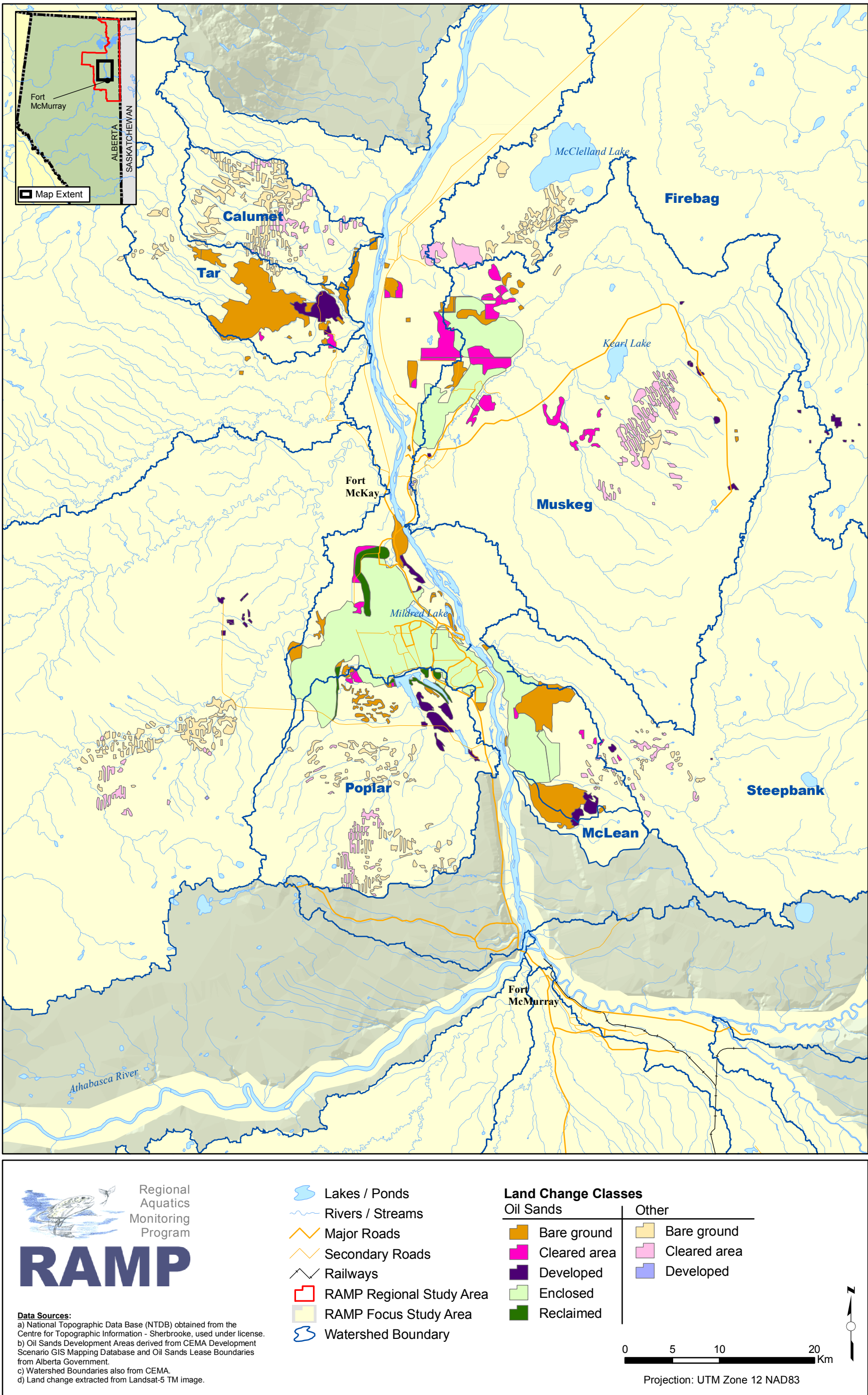
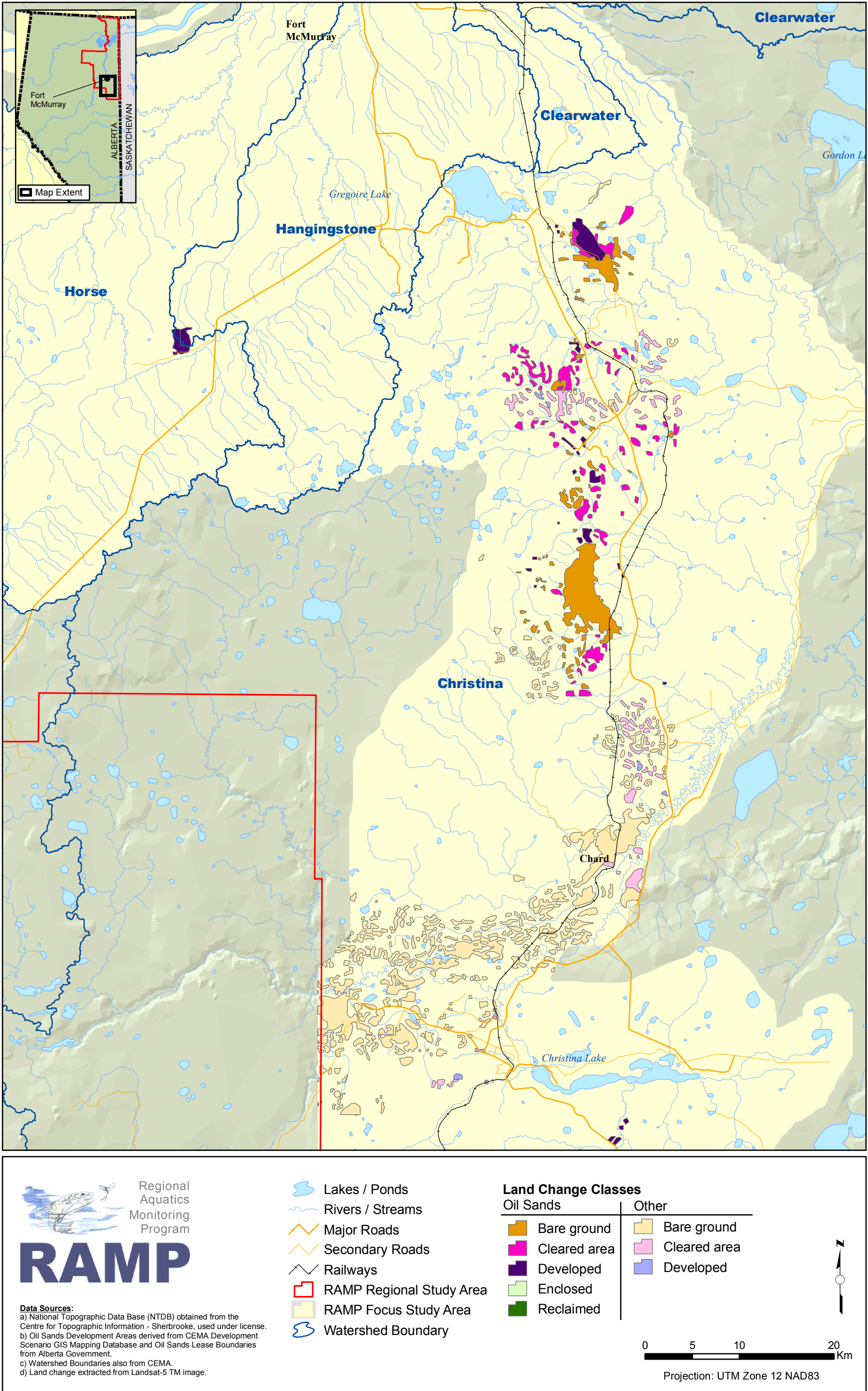






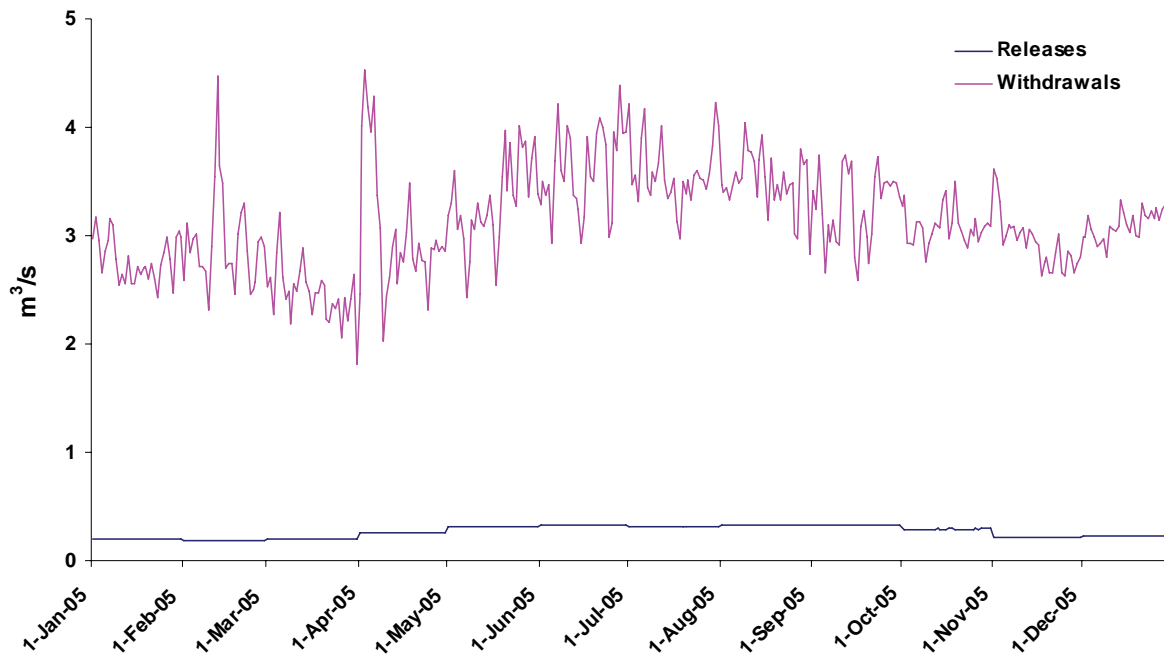
Figure 2.4-2 Land change areas for the RAMP FSA south of Fort McMurray, derived from Landsat-5 TM imagery of 30 May 2005.







**Figure 2.4-3 Major Athabasca River withdrawals and discharges for 2005.**



Note: Intake and allocation data are for Suncor, Syncrude, and Albion Sands combined. Annual intake and discharge figures provided by operators were prorated to daily values using 2004 daily data.

## 2.5 DESIGNATION OF REFERENCE AND POTENTIALLY-INFLUENCED AREAS

The information presented above on the status and activities of Athabasca oil sands developments in 2005 was used to designate particular parts of watersheds in the RAMP FSA, including all RAMP aquatic resources and sampling locations contained in those areas, as either *reference*, *potentially influenced-other*, or *potentially influenced-oil sands*. As indicated in Section 1, the use of these terms does not imply or presume that effects of oil sands developments are occurring or have occurred in any given area. For the purposes of this report, the term *potentially influenced-oil sands* means that data collected from locations so designated are considered as operational for the purposes of data analysis. Similarly, the term *reference* or *potentially influenced-other* means that data collected from locations so designated are considered as baseline. Table 2.5-1 contains the designations used in the remainder of this 2005 report. In addition, Mills Creek, Poplar Creek, McLean Creek, Beaver River, Isadore's Lake, and Shipyard Lake are designated as *potentially influenced-oil sands* aquatic systems for 2005; McClelland Lake and Kearl Lake are designated as *potentially influenced-other* aquatic systems for 2005 because of logging activities in upstream areas; and Fort Creek is designated as a *reference* aquatic system for 2005.

**Table 2.5-1 Watershed designations for 2005.**

<b>Watershed</b>	<b>Designation and Rationale</b>
Athabasca River mainstem	Confluence of McLean Creek designated as division between <b>reference</b> (upstream) and <b>potentially influenced-oil sands</b> (downstream).
Athabasca River Delta	Entire Athabasca River Delta designated as <b>potentially influenced-oil sands</b> . Athabasca River Delta is downstream of all oil sands development activities.
Muskeg River	Muskeg River downstream of its confluence with Stanley Creek, as well as all parts of the Stanley Creek drainage and all lands within the Muskeg River and Aurora North mine leases are designated as <b>potentially influenced-oil sands</b> . Muskeg Creek and Wapasu Creek drainages are designated as <b>potentially influenced-other</b> because of the logging activities that have taken place in the upper parts of both these drainages. Remainder of the watershed is designated as <b>reference</b> .
Steepbank River	< 1% of watershed area with land change from oil sands-related activities. Watershed downstream of the Suncor Steepbank and Millennium oil sands developments designated as <b>potentially influenced-oil sands</b> . Watershed between the Suncor Steepbank and Millennium oil sands developments and confluence of the North Steepbank River with the Steepbank River is designated as <b>potentially influenced-other</b> . Remainder of watershed designated as <b>reference</b> .
Tar River	18% of Tar River watershed with land change from oil sands operations, and 90% of this land change area lies within the lower Tar River drainage. Lower Tar River drainage is designated as <b>potentially influenced-oil sands</b> , westernmost ¼ of Oil Sands Lease 18 and all areas of the Tar River drainage upstream are designated as <b>reference</b> .
Calumet River	watershed downstream of the last major northerly bend in the Calumet River is designated as <b>potentially influenced-oil sands</b> as most of the areas with land change from oil sands activities as of 2005 were in this area. Remainder of watershed designated as <b>potentially influenced-other</b> , because of heavy influence of logging activities.
MacKay River	All areas downstream of Petro-Canada MacKay River, Petro-Canada Dover, and that part of Syncrude's Mildred Lake operations in the MacKay River watershed designated as <b>potentially influenced-oil sands</b> , with remaining area designated as <b>reference</b> , as per last year, although < 0.05% of watershed area has land change from oil sands related activities.
Firebag River	Entire watershed designated as <b>reference</b> ; < 1% of watershed area with land change from oil sands related activities.
Ells River	Entire watershed designated as <b>reference</b> ; oil sands development to date in this watershed has been extremely limited and < 0.1% of watershed area with land change from oil sands related activities.
Clearwater-Christina Rivers	Entire watershed designated as <b>reference</b> ; < 1% of Christina River watershed area with land change from oil sands related activities.
Hangingstone River	Entire watershed designated as <b>reference</b> ; oil sands development to date is limited to the JACOS Hangingstone SAGD Project in the upper watershed and < 0.5% of watershed area designated as with land change from oil sands related activities.