

MAR 20130009: MUSKEG RIVER WEST

Muskeg River West- A report on limestone exploration near Fort McMurray, North East Alberta.

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MAR 13 2013
20130009

GRAYMONT WESTERN CANADA INC.
877384 ALBERTA LTD.

2013 EXPLORATION WITHIN THE MUSKEG RIVER WEST
METALLIC AND INDUSTRIAL MINERALS PERMIT
NORTH OF FORT MCMURRAY, NORTHEAST ALBERTA

PART B

Metallic and Industrial Mineral Permit
9309020192

Geographic Coordinates

57°07'48 N to 57°07'80 N
111°32' W to 111°33' W

NTS Sheet 74 E/04

Owner: 877384 Alberta Ltd.
18, 10509 - 81 Avenue
Edmonton, Alberta T6E 1X7

Operator: Graymont Western Canada Inc.
260, 4311 - 12 Street N.E.
Calgary, Alberta T2E 4P9

Consultant: Dahrouge Geological Consulting Ltd.
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K. Krueger, B.Sc., Geo.I.T.

Date: March 13, 2013

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1. SUMMARY

On March 6th, 2013, Metallic and Industrial Minerals (MAIM) permit 9309020192 was explored for high-quality carbonate rocks. The permit is informally named Muskeg River West.

Access routes were mapped and prospects to revisit during future exploration periods were identified, but no outcrops were identified on or near the property.

2. INTRODUCTION

The 2013 exploration within the Muskeg River West permit was conducted by Dahrouge Geological Consulting Ltd. (Dahrouge), on behalf of Graymont Western Canada Inc. (Graymont). This assessment report describes the exploration conducted within MAIM permit 9309020192, north of Fort McMurray. Bob Robison, exploration manager for Graymont Western U.S. Inc., authorized this work.

The objectives of the 2013 exploration were to map access routes and identify outcrops. This report includes information on the access routes near and within the permit area.

3. GEOGRAPHIC SETTING AND ACCESS

3.1 LOCATION AND ACCESS

MAIM permit 9309020192 is located north of Fort McMurray and within National Topographic System Map Sheet 74 E/4 (Fig. 3.1).

Access to the Muskeg River West permit is from Fort McMurray, by traveling approximately 55 km north along Highway 63 to Fort MacKay, and then approximately 8 km southeast (Fig. 3.2). The permit can be accessed from the all-season Canterra Road south of Albian Sands Mine and Hammerstone Quarry (Fig. 3.2). Within the permit, travel is by ATV, snowmobile or hiking.

3.2 INFRASTRUCTURE

Accommodations, food, fuel and other necessary services are available in Fort McMurray. The local economy is almost completely reliant on energy-based industries.

Fort McMurray is a community of more than 60,000 and is the supply and services centre for the Alberta oil sands. It is located at the confluence of Athabasca and Clearwater rivers in northeastern Alberta, about 437 km by paved highway from Edmonton.

3.3 TOPOGRAPHY, VEGETATION AND CLIMATE

Along Athabasca River, the dominant vegetation is a mix of deciduous and coniferous trees, with occasional accumulations of dense alder and willows. Above the river valley, the vegetation is typified by boreal forest and muskeg.

At Fort McMurray, mean annual snowfall is 47.2 inches, and mean annual precipitation is 16.32 inches. River breakup generally occurs in the third week of April. On rare occasions, ice-jam floods can occur; there have been 10 recorded floods since 1985.

3.4 FIELD OPERATIONS

Field operations were conducted by a two-person geological crew from Dahrouge, based in a hotel in Fort McMurray.

Transportation to and from the property was by four-wheel-drive truck. Access throughout the property was by snowshoeing.

Garmin GPSmap 60CSx instruments were used to mark outcrop locations and record access information. Compasses were set at a magnetic declination of 15°49' east.

4. PROPERTY, EXPLORATION AND EXPENDITURES

4.1 PROPERTY SUMMARY

In early 2009, 877384 Alberta Ltd. acquired MAIM Permit 9309020192 to cover high-calcium limestones north of Fort McMurray (Fig. 4.1). The total permit area is 96 hectares.

The entirety of the MAIM Permit will be retained.

4.2 2013 EXPLORATION SUMMARY

On March 6th, 2013, Dahrouge, on behalf of Graymont, conducted exploration for carbonate lithotypes within northeastern Alberta. The work was undertaken to determine the location and extent of carbonate units in the permit areas.

The northeastern slope on the edge of the permit area was focused on, as this was considered a zone with high potential for outcrops due to its relief (Fig. 3.2). Although no carbonate outcrops were identified on the Muskeg River West permit, detailed access routes were noted for future exploration periods. Access routes that were previously unknown to Dahrouge or Graymont were mapped and are presented in Fig. 3.2. One location of relatively high relief was identified for future exploration periods (Fig. 4.2).

Field maps were completed on 1:20,000 and 1:25,000 scale map sheets and concentrated on areas adjacent to Highway 63 and Canterra Road, north of Fort McMurray.

4.3 EXPLORATION EXPENDITURES

Expenditures for 2013 totalled \$2,226.54. The entirety of MAIM Permit 9309020192 will be retained. Excess expenditures are to be assigned to future exploration periods.

Assessment Period MAIM Permit 9309020192	Expiry Date	Requirement Expenditures	Assigned Expenditures
Yrs 3-4	Feb. 10, 2015	\$960.00	\$960.00
Yrs 5-6	Feb. 10, 2017	\$960.00	\$960.00
Yrs 7-8	Feb. 10, 2019	\$1440.00	\$306.54

5. REGIONAL GEOLOGY

The geology and stratigraphy of northeastern Alberta has previously been described by Carrigy (1959), Norris (1963), Holter (1976), and Cotterill and Hamilton (1995).

The sedimentary cover of northeastern Alberta consists primarily of Paleozoic carbonates, evaporites and clastics, overlain unconformably by Mesozoic siliciclastics (Table 5.1; Fig. 5.1). Near Fort McMurray the Precambrian basement is at depths of between 250 to 300 m and has a southeasterly regional slope of about 5½ m per km (Halferdahl, 1985). The Precambrian basement is overlain by middle Devonian strata of the Elk Point Group, followed by the Beaverhill Lake Group, and further west, the Woodbend Group. In turn, the Devonian is unconformably overlain by Cretaceous sediments of the Mannville, La Biche and Smoky groups. The oil-sands of the McMurray Formation are within the lowest part of the Mannville Group.

Above the Cretaceous siliciclastics is a variety of unconsolidated Quaternary sediments. Near Fort McMurray there is a basal diamicton derived from the Laurentide Ice Sheet, which is overlain by gravel, sand and clay from glacial Lake McMurray (Fisher and Smith, 1993). Within Athabasca river valley, near Fort McMurray, is a complex mixture of spillway deposits. The spillway deposits consist of poorly sorted boulder-gravel-sand, with blocks of oil-sands and glacio-lacustrine sediments. Smith and Fisher (1993) interpret the spillway deposits as a result of a high-velocity flood, sourced from Glacial Lake Agassiz in northern Saskatchewan.

5.1 STRATIGRAPHY

The sedimentary succession of northeastern Alberta comprises a lithologically diverse suite of Devonian carbonates, clastics and evaporites, which are unconformably overlain by Cretaceous siliciclastics. Of the stratigraphic units in Table 5.1, carbonates are present within the Methy Formation, the Slave Point Formation, the Waterways Formation, and the Woodbend Group.

5.1.1 Methy Formation

The Methy Formation is within the upper Elk Point Group of the Middle Devonian. The formation is described as a reefal to non-reefal unit containing massive to bedded dolostone, dolomitic limestone and minor anhydrite and gypsum (Cotterill and Hamilton, 1995). The Methy outcrops along Clearwater River valley, and sparsely along Firebag and Marguerite rivers. It is generally a dolomitic unit with interbedded anhydrite that has been described as calcareous or strongly calcareous (Norris, 1963).

5.1.2 Slave Point Formation

The age of the Slave Point Formation has been debated in the past, placed within the Middle (Norris, 1963; Halferdahl, 1985) and Upper Devonian (Carrigy, 1973; Cotterill and Hamilton, 1995). Upper and lower contacts of the unit are defined by paraconformities. The Slave Point generally consists of limestone, siltstone and dolomitic limestone. It is characterized by brownish-grey, skeletal wackestones and argillaceous lime mudstones with interbedded dark brown shale laminations (Cotterill and Hamilton, 1995). The Slave Point Formation is generally less than several metres thick near Fort McMurray.

5.1.3 Waterways Formation

Members within the Waterways Formation consist of the Firebag, Calumet, Christina, Moberly, and Mildred. The carbonates of the Waterways Formation reach a thickness of over 250 m in western Alberta, and thin toward the Precambrian exposure. The Firebag Member is at the base of the Waterways Formation, and consists of an olive-green calcareous shale. Sequences of interbedded olive-green limestone, argillaceous limestone and shale are also present; Norris (1963) notes several thin brachiopod-rich beds throughout. The Firebag maintains a relatively uniform thickness of about 50 m in the Fort McMurray area.

TABLE 5.1 GENERALIZED PALEOZOIC STRATIGRAPHY
OF THE FORT McMURRAY AREA, NORTHEASTERN ALBERTA*

Age	Group	Formation	Member	
Quaternary				
Upper Cretaceous	Smoky			
	La Biche	La Biche		
		Shaftesbury		
Lower Cretaceous	Mannville	Grand Rapids		
		Clearwater	Wabiskaw	
		McMurray		
Upper Devonian	Woodbend	Grosmont		
		Ireton		
		Cooking Lake		
	Beaverhill Lake	Waterways		Mildred
				Moberly
				Christina
				Calumet
		Firebag		
Middle Devonian	Upper Elk Point	Slave Point/ Fort Vermillion		
		Watt Mountain		
		Prairie Evaporite		
		Methy/Winnipegosis		
	Lower Elk Point	Meadow Lake/ McLean River/ Contact Rapids		
Lower Paleozoic		La Loche/ Granite Wash		
Precambrian				

* Modified after Halferdahl (1985); Cotterill and Hamilton (1995)

~~~~~ Erosional Unconformity

--- Paraconformity

----- Paraconformity?

The Calumet Member conformably overlies the Firebag Member, and consists dominantly of limestone. Other units within the member include variable amounts of argillaceous, skeletal nodular lime mudstones and wackestones interbedded with grey-green calcareous shale (Cotterill and Hamilton, 1995). Norris (1963) notes significant brachiopod-rich beds in the Calumet Member. In the Fort McMurray area, the Calumet Member maintains a thickness of about 30 m.

The Christina Member consists dominantly of green-grey calcareous shale and conformably overlies the Calumet Member. Other lithologies within the upper section of the Christina Member include minor interbeds of argillaceous lime mudstone and occasional thin, skeletal wackestone and

packstone beds. In the Fort McMurray area, the Christina Member attains a thickness of approximately 25 m.

Conformably overlying the Christina is the Moberly Member. The lower third of the Moberly Member, labelled units 28 to 37 by Norris (1963), consists of an alternating sequence of light olive-green, rubbly, thinly-interbedded, variably argillaceous limestones and shales, and hard beds of pale brown, cryptocrystalline limestones. The upper two-thirds, units 38 to 57, consists of thicker units of light to dark olive-green, variably calcareous shale, and thinner units of rubbly, variably argillaceous fragmental limestone. The Moberly Member attains a thickness of about 60 m in the Fort McMurray area.

The uppermost member of the Waterways Formation is the Mildred Member. This unit is characterized by variably argillaceous, nodular lime mudstone and calcareous shales. A thickness of 40 to 45 m is maintained by the Mildred Member.

#### **5.1.4 Woodbend Group**

The Woodbend Group consists of limestones from the Grosmont, Ireton, and Cooking Lake formations. The majority of examined Grosmont Formation limestones in the Fort McMurray area are dolomitic with minor anhydrite (Halferdahl, 1985). The underlying Ireton Formation has been described as an argillaceous, medium- to coarse-grained limestone accompanied by limey shale. Some limestones of the Cooking Lake Formation have been noted as dolomitic and argillaceous (Halferdahl, 1985).

## **5.2 STRUCTURE**

Within northeastern Alberta, the Devonian and Cretaceous sedimentary sequences onlap onto the Precambrian cratonic platform, forming two eastwardly converging sedimentary wedges. The southwest regional dip of the Devonian strata follows the contour of the underlying Precambrian basement, which has an apparent northwest strike and southwest dip. Near Fort McMurray the Precambrian basement is at depths of between 250 to 300 m and has a southwesterly regional slope of about 5.5 m per km (Halferdahl, 1985).

The westward dipping wedge of Devonian and underlying sediments rest unconformably on the Precambrian basement. The Devonian sediments young to the west. The top of the wedge is marked by an erosional surface that is overlain by Lower Cretaceous strata (Table 5.1). Structural complexities within the sedimentary succession are thought to be due to salt dissolution of the Lower Devonian evaporites. The result is a set of small scale domes, basins, and folds, with amplitudes of between 15 and 30 m. Topographic structures of the sub-Cretaceous unconformity are due to

differential erosion of the underlying Devonian sediments. The result is a generally northward-trending set of ridges and valleys.

6.

## RESULTS

On March 6<sup>th</sup>, 2013, one day was spent checking road and trail access to and throughout the property. Several new access routes were identified, which will assist future exploration programs (Fig. 3.2). Although no outcrop was identified, an area of relatively high relief on the northeastern slope adjacent to the permit area has been identified for future exploration (Fig. 4.2).

7.

## CONCLUSIONS

Exploration of the northeastern edge of MAIM Permit 9309020192 revealed a lack of exposed carbonate outcrops. While no outcrops were identified, time was spent checking access routes to and throughout the permit for future exploration. Based on the early stage of exploration on the permit and the locations identified as possible outcrops, the entirety of MAIM Permit 9309020192 will be retained.

Future exploration will consist of detailed mapping and sampling of any identified outcrops and further exploration of high-relief areas. A review of available core from the ERCB Core Research Centre in Calgary would also be beneficial.

## 8.

## REFERENCES

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- Smith, D.G. and Fisher, T.G. (1993) Glacial Lake Agassiz: The northwestern outlet and paleoflood. Geology, v. 21, p. 9-12

9.

**STATEMENT OF QUALIFICATIONS**

I, Patrick Kluczny, residing at [REDACTED] Edmonton, Alberta, do hereby certify that:

- I am a geologist of Dahrouge Geological Consulting Ltd., Suite 18, 10509 - 81 Ave., Edmonton, Alberta, T6E 1X7.
- I am a 2006 graduate of the University of Alberta, Edmonton, Alberta with a B.Sc. in Geology.
- I have practiced my profession as a geologist continuously since 2006.
- I am a registered Professional Geologist with the Association of Professional Engineers and Geoscientists of Alberta, member M81985.
- I hereby consent to the copying or reproduction of this Assessment Report following the one-year confidentiality period.
- I am the author of the report entitled "2013 Exploration Within the Muskeg River West Metallic and Industrial Minerals Permit North of Fort McMurray, Northeast Alberta" and accept responsibility for the veracity of technical data and results.

Dated this 13<sup>th</sup> day of March, 2013.



Patrick Kluczny, B.Sc., P.Geol.  
APEGA M81985

**APPENDIX 1: COST STATEMENT FOR THE 2013 EXPLORATION WITHIN THE  
MUSKEG RIVER WEST PERMIT**

|                                  |     |                    |
|----------------------------------|-----|--------------------|
| a) <u>Personnel</u>              |     | \$ 1,370.83        |
| b) <u>Food and Accommodation</u> |     | \$ 331.47          |
| c) <u>Transportation</u>         |     | \$ 296.16          |
| d) <u>Instrument Rental</u>      |     | \$ 25.67           |
| e) <u>Drilling</u>               | n/a | \$ -               |
| f) <u>Analyses</u>               |     | \$ -               |
| <u>Total</u>                     |     | <u>\$ 2,024.13</u> |
| <u>Administration (10%)</u>      |     | \$ 202.41          |
| <u>Total + Administration</u>    |     | <u>\$ 2,226.54</u> |

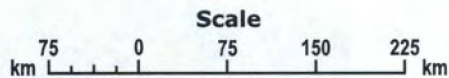
C



Location of  
MAM Permit  
9309020192

**LEGEND**

- Provincial capital
- Other populated places
- ◆— Trans-Canada Highway
- Major road
- - - - International boundary
- ..... Provincial boundary



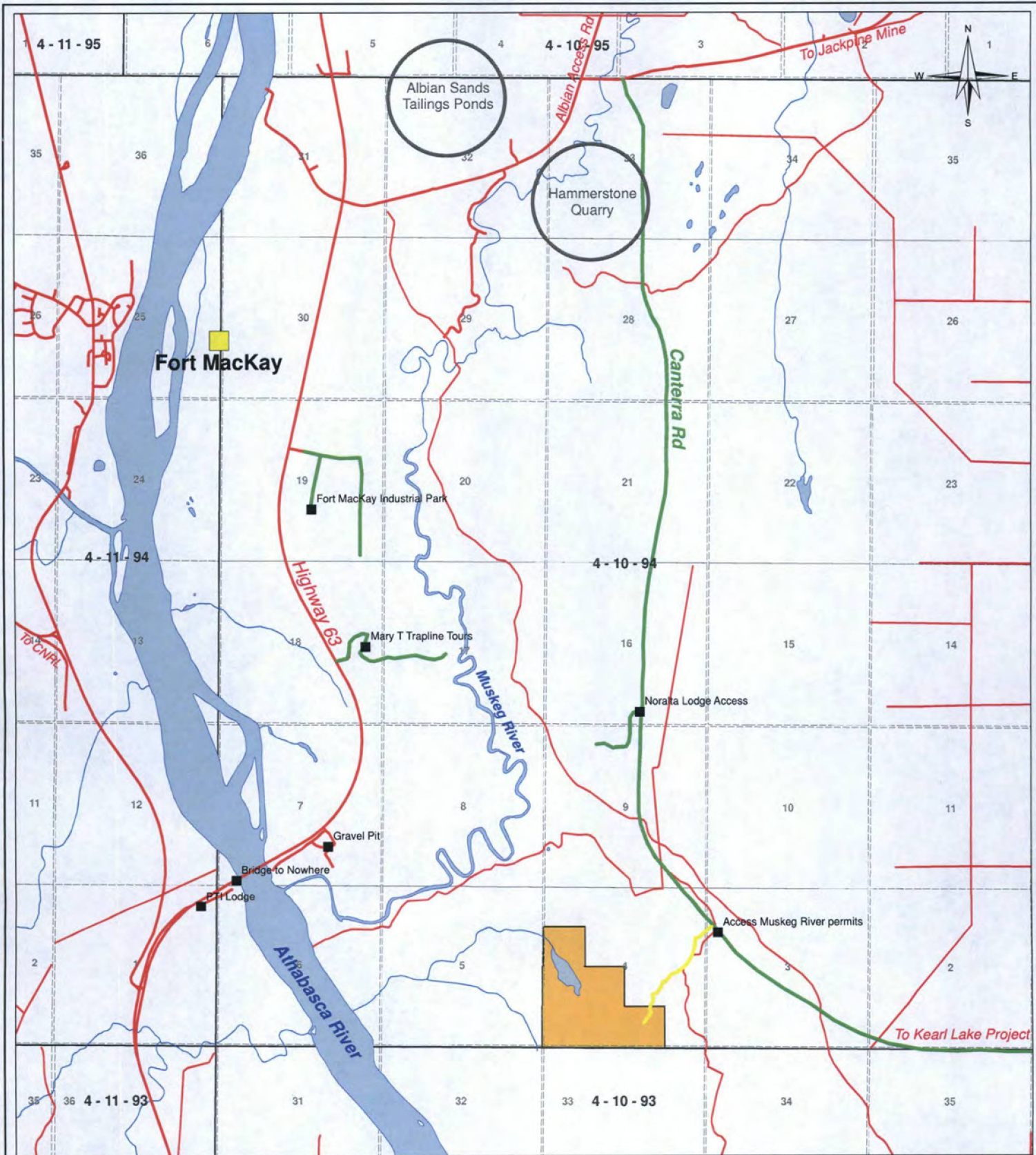
**GRAYMONT WESTERN CANADA INC.**

**DG Dahrouge Geological Consulting Ltd.**

Edmonton, Alberta  
ALBERTA, CANADA

**Fig. 3.1**  
Property Location





**Legend**

- 2013 Waypoints
- 2013 Access**
- All-Season Truck Access
- 2013 Traverse
- Cutline
- Muskeg River West

Kilometres

0 0.5 1 2 3

1:50,000

Coordinate System: UTM NAD83, Zone 12

**GRAYMONT WESTERN CANADA INC.**

**DG DAHROUGE GEOLOGICAL CONSULTING LTD.**  
Edmonton, Alberta



MUSKEG RIVER WEST PROPERTY  
NEAR FORT MCMURRAY, ALBERTA

Fig. 3.2  
Access Map

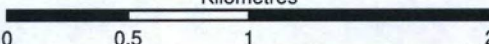
KK 2013.03



**Legend**

-  Permit # 9309020192 (96 ha)
-  Other Claims

Kilometres



0 0.5 1 2

1:30,000

Coordinate System: UTM NAD83, Zone 12

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Edmonton, Alberta

MUSKEG RIVER WEST PROPERTY  
NEAR FORT McMURRAY, ALBERTA

Fig. 4.1  
Permit Map

KK 2013.03



**Legend**

- 2013 Waypoints
- 2013 Access**
- All-Season Truck Access
- - - 2013 Traverse
- Cutline
- Topo Contours (10 m)
- ▭ Muskeg River West
- Bedrock Geology**
- Clearwater Fm. - Mesozoic
- McMurray Fm. - Mesozoic
- Waterways Fm. - Paleozoic - Devonian

Kilometres

0      0.5      1

**1:20,000**

Coordinate System: UTM NAD83, Zone 12

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Edmonton, Alberta

MUSKEG RIVER WEST PROPERTY  
NEAR FORT MCMURRAY, ALBERTA

Fig. 4.2  
2013 Exploration & Geology

KK 2013.03