

From: Freeze and Cherry 1979. p.366

**NORTH SASKATCHEWAN RIVER BASIN
OVERVIEW OF GROUNDWATER CONDITIONS
CONCEPTUAL DIAGRAM OF RELATIONS BETWEEN RECHARGE, DISCHARGE, AND
GROUNDWATER EXTRACTION**



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resources & energy

Infrastructure & Environment

20-MAR-09 date

edited by

J.Q.

drawn by

app. by

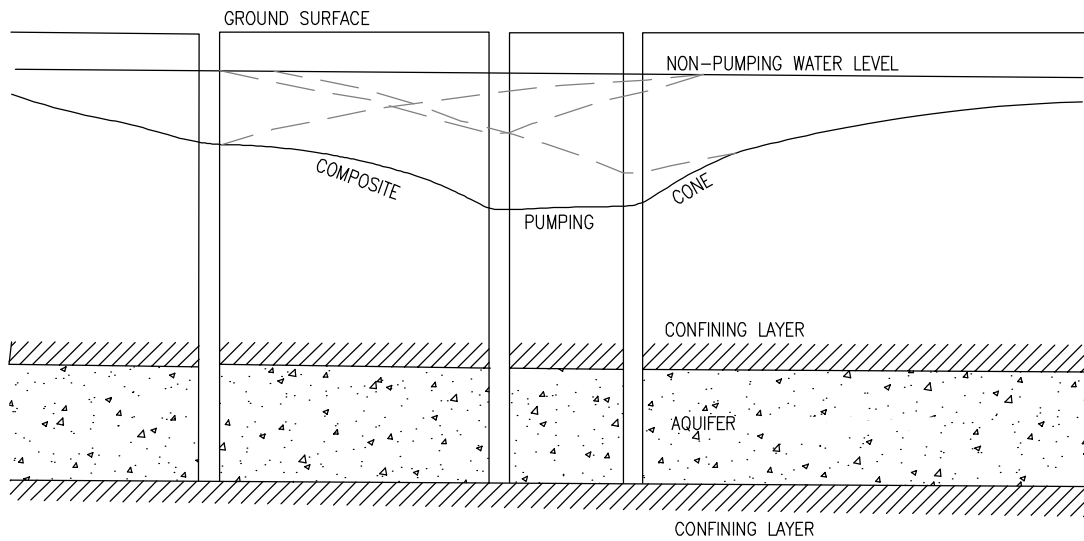
PROJECT NUMBER:

E00088100

FIGURE:

19

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SOURCE: FROM FETTER (2001) PAGE 207

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**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

WELL INTERFERENCE



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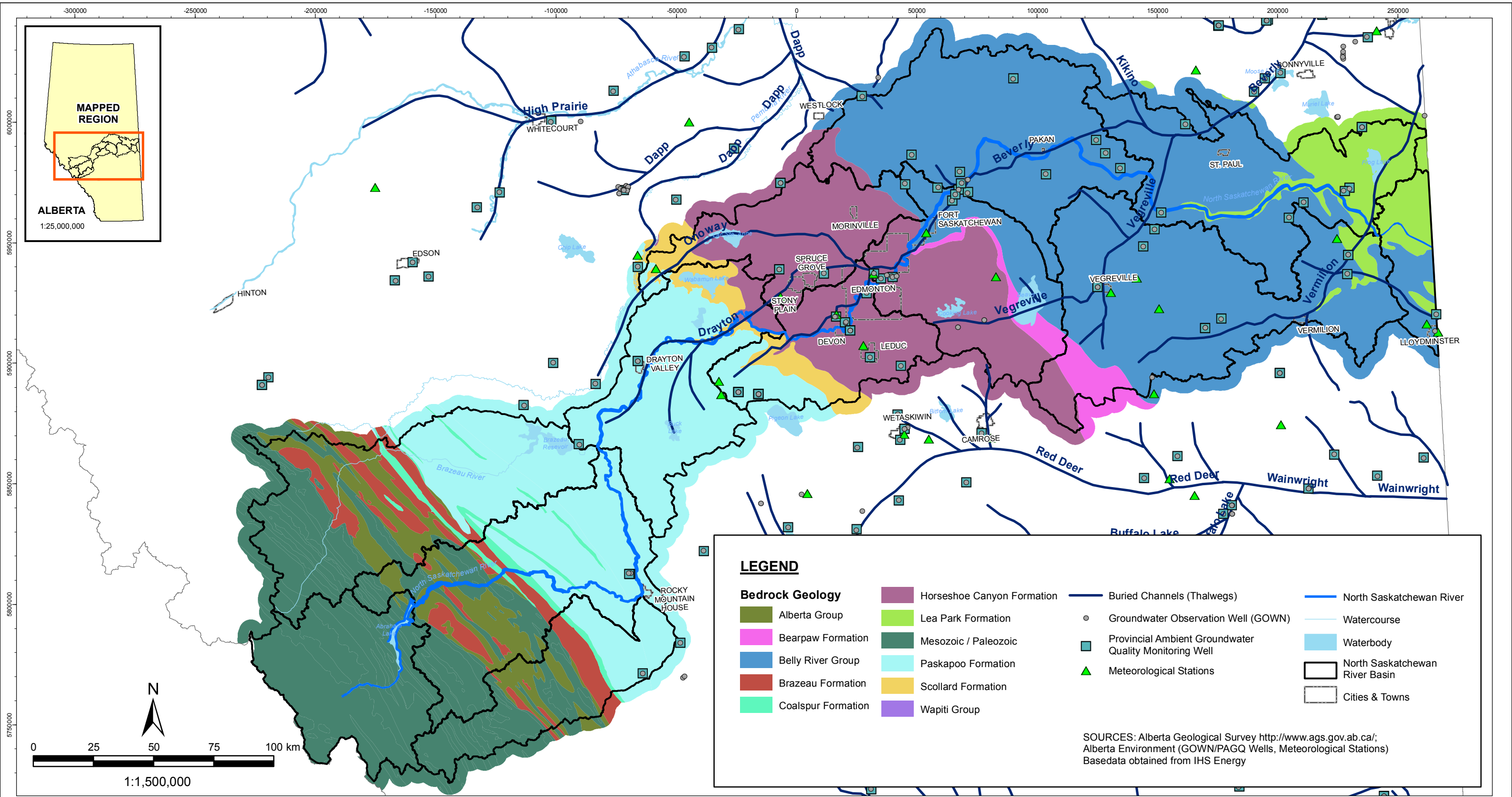
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FIGURE:

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20

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**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

LOCATIONS OF PROVINCIAL GROUNDWATER OBSERVATION WELLS

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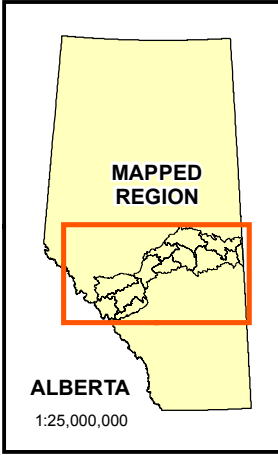
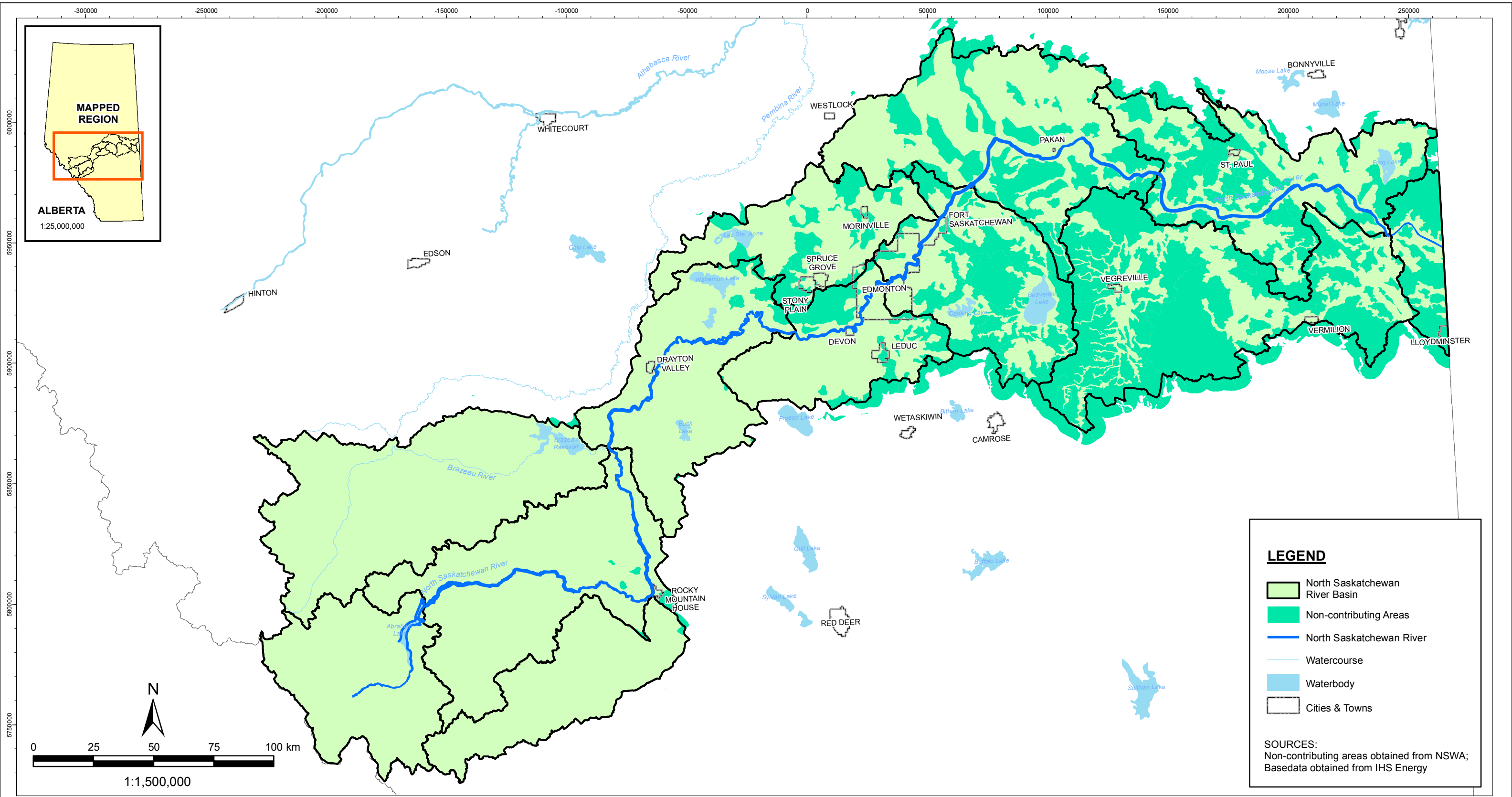


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FIGURE:
21

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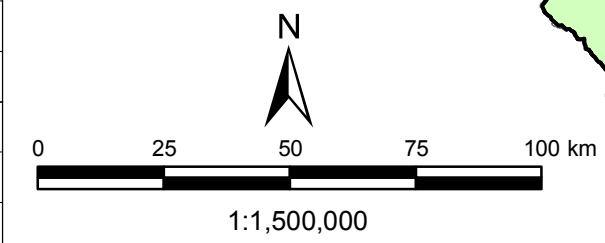


ALBERTA
1:25,000,000

LEGEND

- North Saskatchewan River Basin
- Non-contributing Areas
- North Saskatchewan River
- Watercourse
- Waterbody
- Cities & Towns

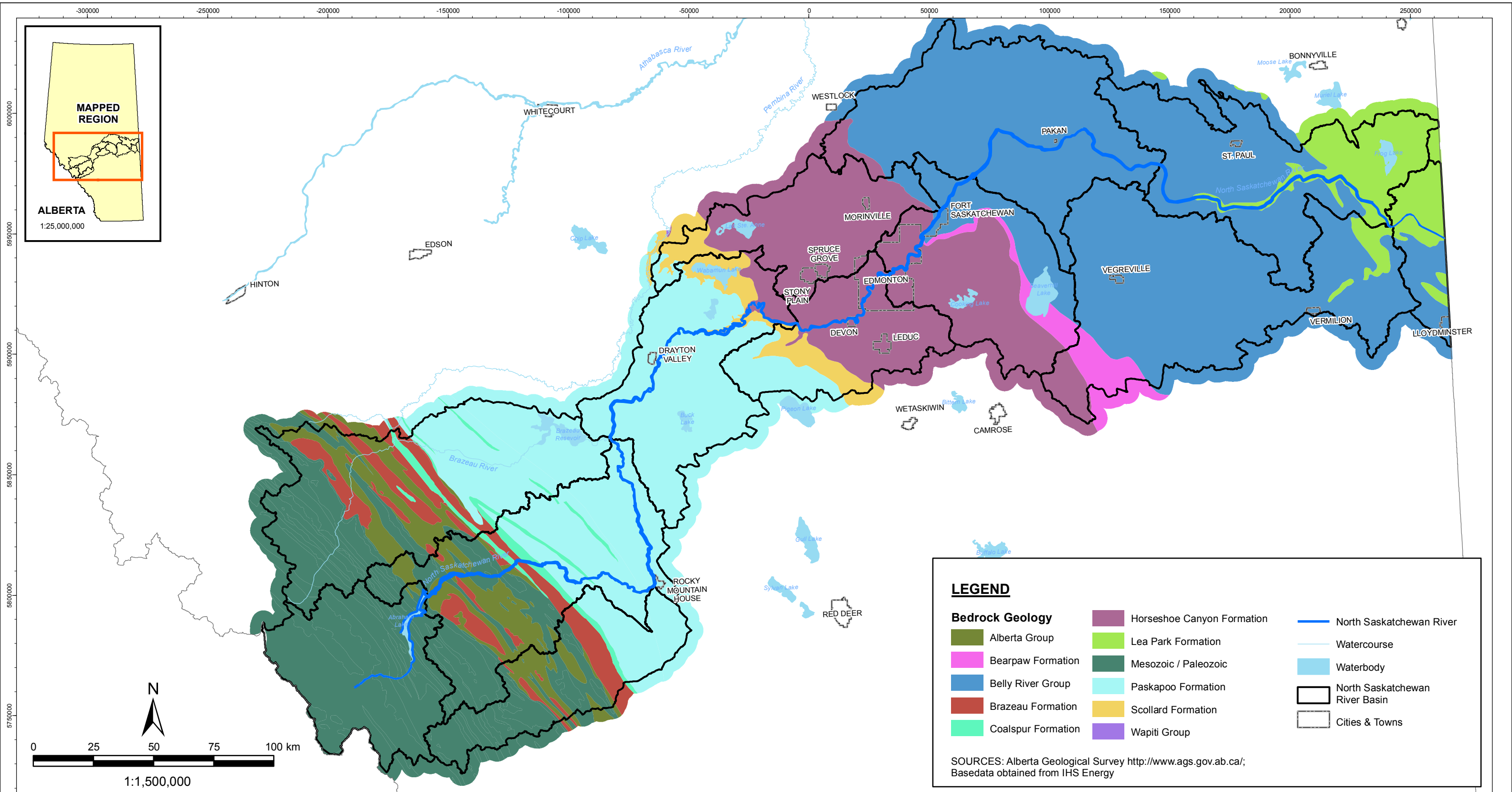
SOURCES:
Non-contributing areas obtained from NSWA;
Basedata obtained from IHS Energy



NOTE:
“Non-contributing” refers to areas that do not drain to the main receiving stream but instead drain to local surface water features.

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NORTH SASKATCHEWAN WATERSHED ALLIANCE OVERVIEW OF GROUNDWATER CONDITIONS		NON-CONTRIBUTING AREAS	
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FILE: Q:\E00088100\ArgGIS_NSWA\MapDocs\NonContributingAreas.mxd Issued By: Edmonton GIS




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**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

BEDROCK GEOLOGY

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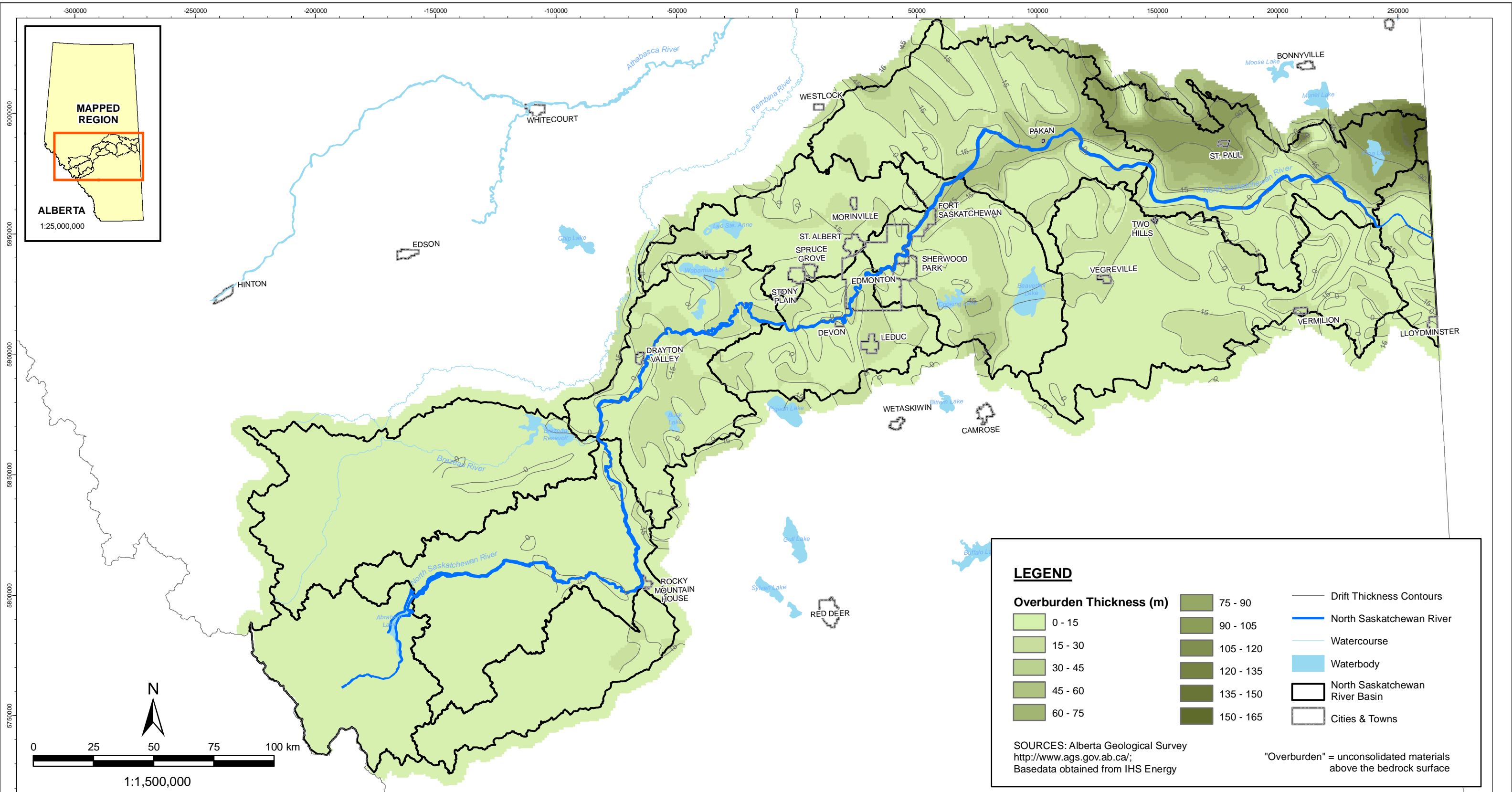
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FILE: Q:\E00088100\ArgGIS_NSWA\MXD\BedrockGeology.mxd Issued By: Edmonton GIS

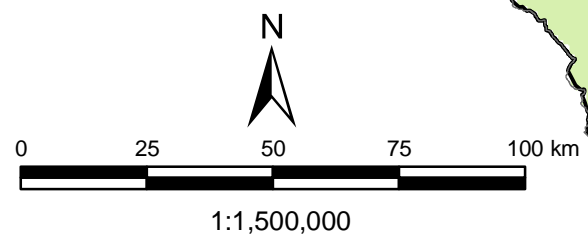


LEGEND

	0 - 15		75 - 90		Drift Thickness Contours
	15 - 30		90 - 105		North Saskatchewan River
	30 - 45		105 - 120		Watercourse
	45 - 60		120 - 135		Waterbody
	60 - 75		135 - 150		North Saskatchewan River Basin
			150 - 165		Cities & Towns

SOURCES: Alberta Geological Survey
<http://www.ag.s.gov.ab.ca/>;
 Basedata obtained from IHS Energy

"Overburden" = unconsolidated materials above the bedrock surface



**NORTH SASKATCHEWAN WATERSHED ALLIANCE
 OVERVIEW OF GROUNDWATER CONDITIONS**



OVERBURDEN THICKNESS

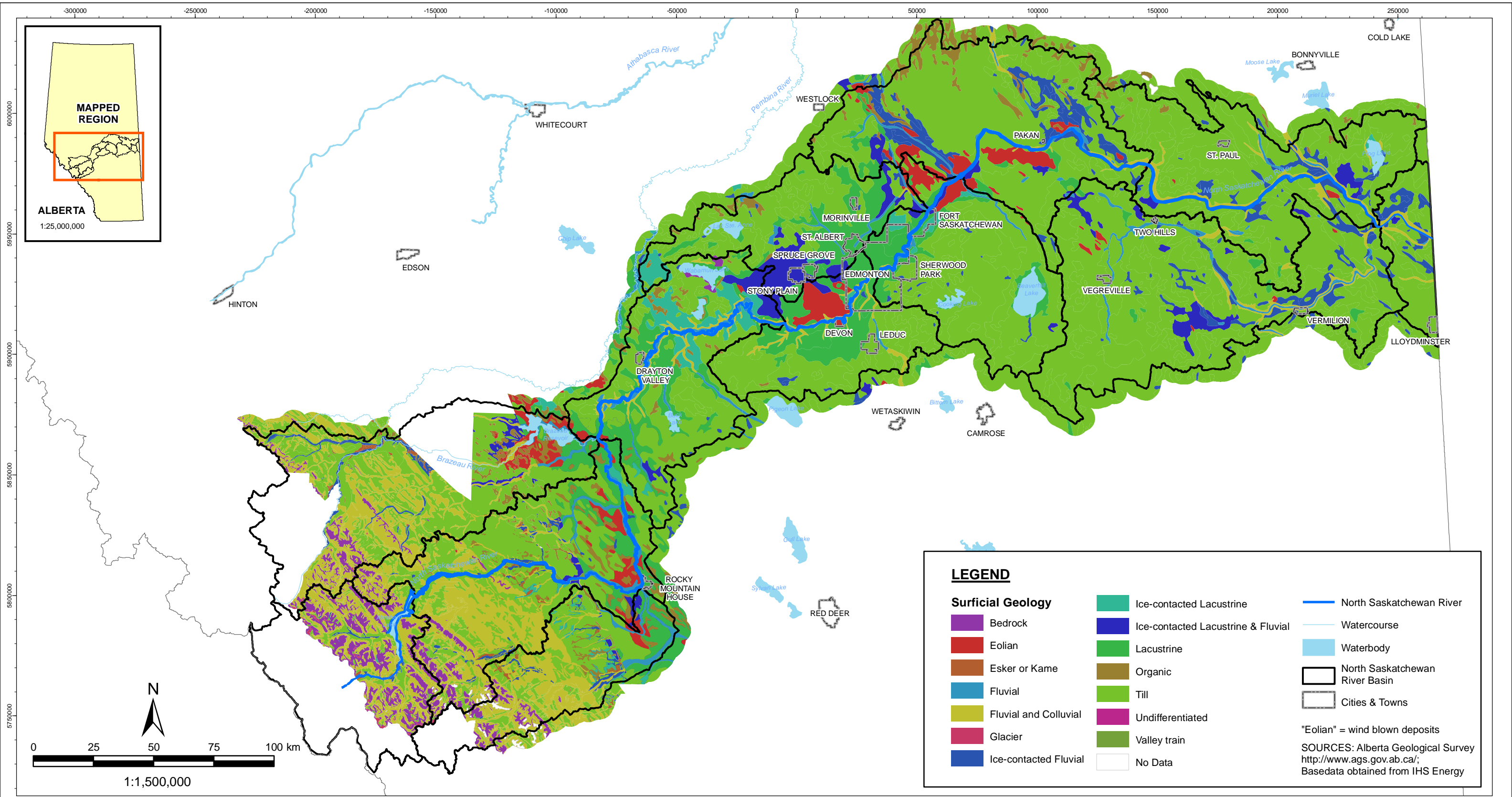
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PROJECT NUMBER:	FIGURE:
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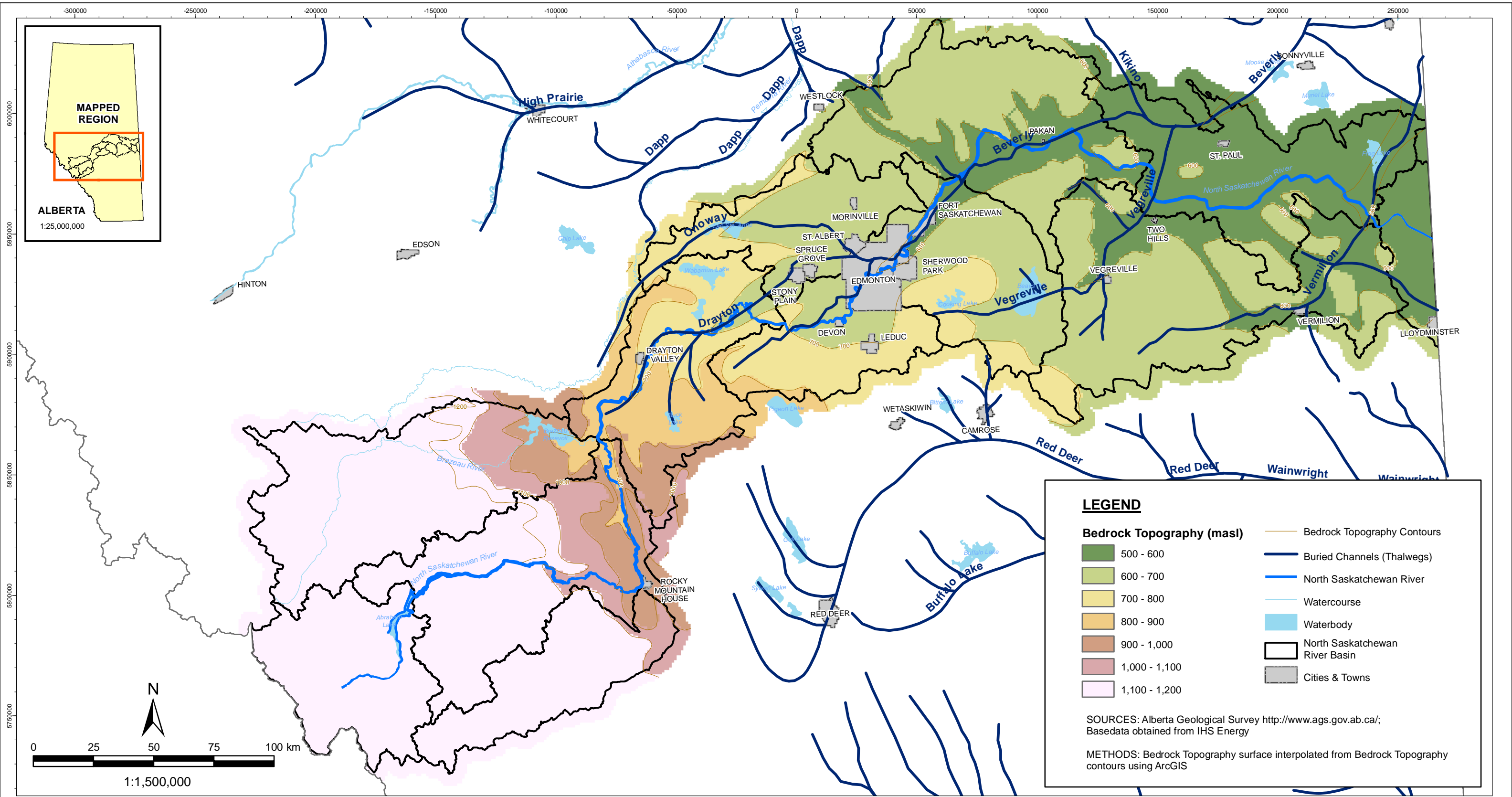
E00088100 **24**

FILE: Q:\E00088100\AgGIS_NSWWMD\OverburdenThickness.mxd Issued By: Edmonton GIS



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SURFICIAL GEOLOGY					
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				PROJECT NUMBER:	FIGURE:
				E00088100	25
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FILE: Q:\E00088100\AgGIS_NSWA\MXD\SurficialGeology.mxd Issued By: Edmonton GIS



LEGEND

Bedrock Topography (masl)

- 500 - 600
- 600 - 700
- 700 - 800
- 800 - 900
- 900 - 1,000
- 1,000 - 1,100
- 1,100 - 1,200

- Bedrock Topography Contours
- Buried Channels (Thalwegs)
- North Saskatchewan River
- Watercourse
- Waterbody
- North Saskatchewan River Basin
- Cities & Towns

SOURCES: Alberta Geological Survey <http://www.ags.gov.ab.ca/>;
 Basedata obtained from IHS Energy

METHODS: Bedrock Topography surface interpolated from Bedrock Topography contours using ArcGIS

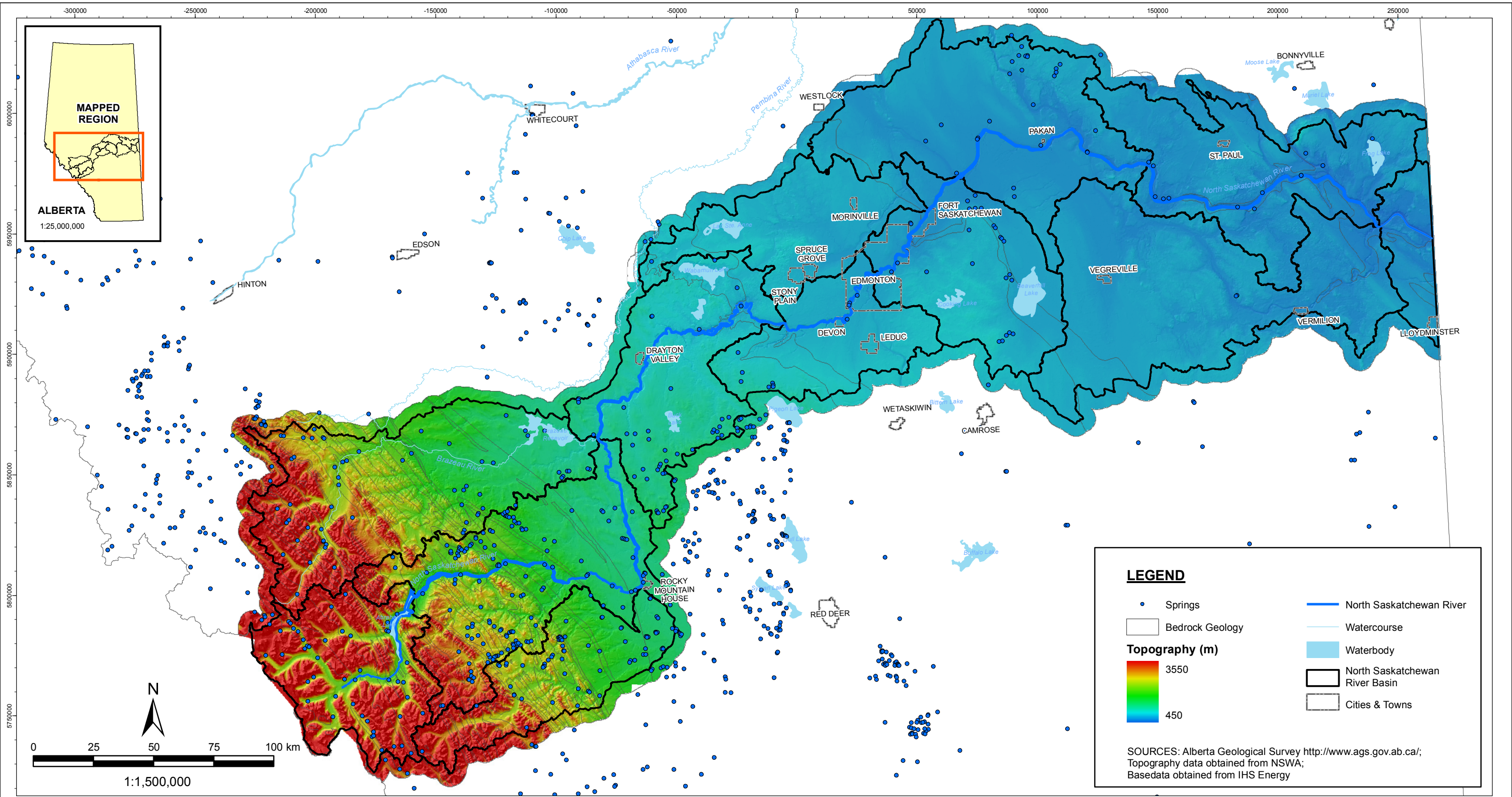
**NORTH SASKATCHEWAN WATERSHED ALLIANCE
 OVERVIEW OF GROUNDWATER CONDITIONS
 BEDROCK TOPOGRAPHY AND BURIED VALLEYS**



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PROJECT NUMBER:	FIGURE:
E00088100	26

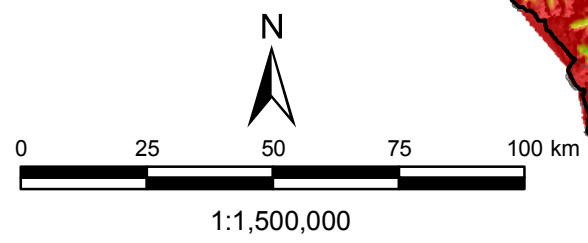
FILE: Q:\E00088100\ArcGIS_NSW\WMA\3\BedrockTopo\Thalwegs.mxd Issued By: Edmonton GIS



LEGEND

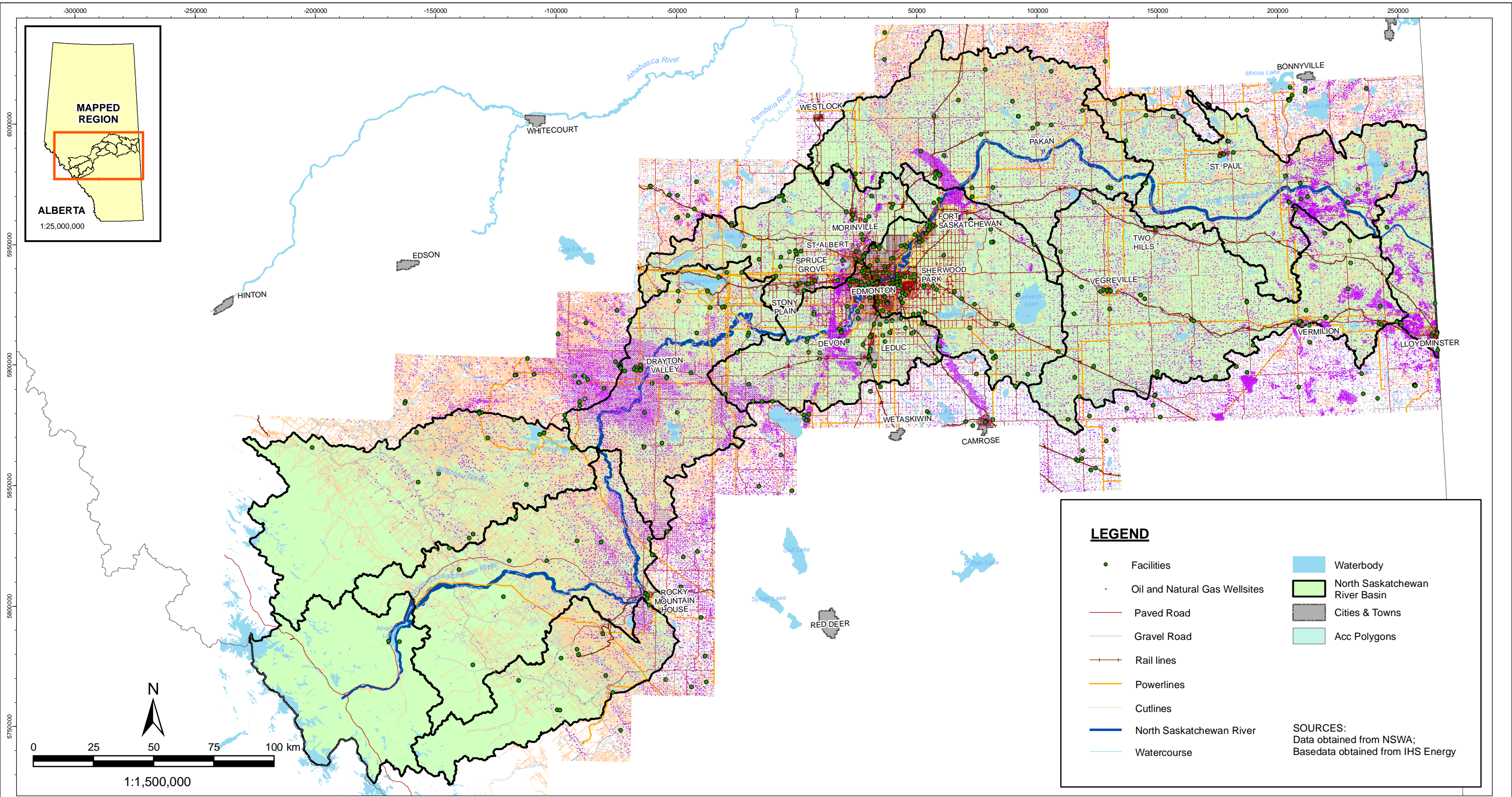
- Springs
- Bedrock Geology
- Topography (m)
 - 3550
 - 450
- North Saskatchewan River
- Watercourse
- Waterbody
- North Saskatchewan River Basin
- Cities & Towns

SOURCES: Alberta Geological Survey <http://www.ags.gov.ab.ca/>;
 Topography data obtained from NSWA;
 Basedata obtained from IHS Energy



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NORTH SASKATCHEWAN WATERSHED ALLIANCE OVERVIEW OF GROUNDWATER CONDITIONS		WorleyParsons <small>resources & energy</small>	
LOCATIONS OF SPRINGS			
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LEGEND

- Facilities
- Oil and Natural Gas Wellsites
- Paved Road
- Gravel Road
- Rail lines
- Powerlines
- Cutlines
- North Saskatchewan River
- Watercourse
- Waterbody
- North Saskatchewan River Basin
- Cities & Towns
- Acc Polygons

SOURCES:
Data obtained from NSWA;
Basedata obtained from IHS Energy

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**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

SURFACE ACTIVITY

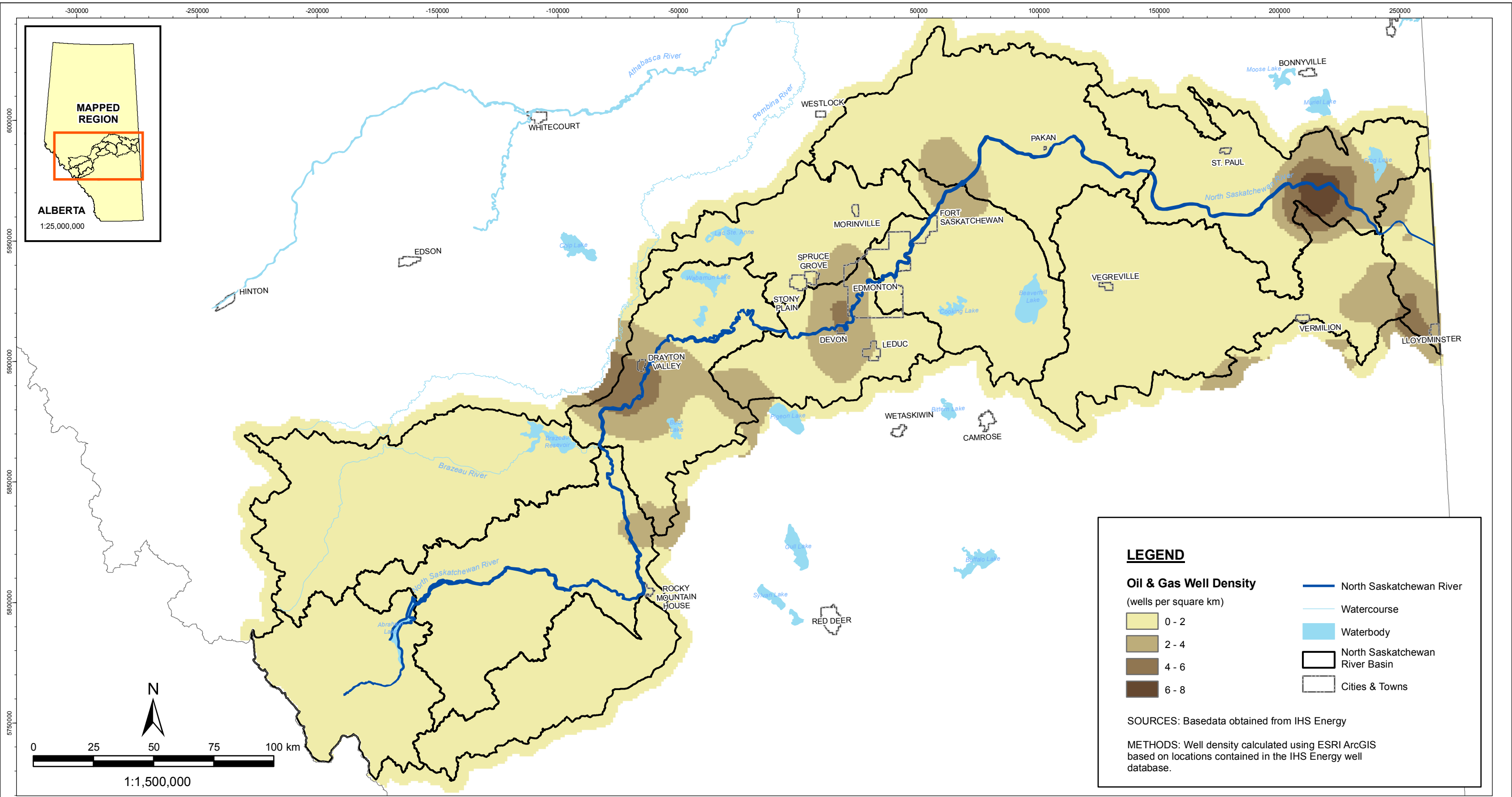
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PROJECT NUMBER: E00088100	FIGURE: 28
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FILE: Q:\E00088100\AgGIS_NSWA\MXD\SurfaceActivity.mxd Issued By: Edmonton GIS



LEGEND

Oil & Gas Well Density
(wells per square km)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8

- North Saskatchewan River
- Watercourse
- Waterbody
- North Saskatchewan River Basin
- Cities & Towns

SOURCES: Basedata obtained from IHS Energy

METHODS: Well density calculated using ESRI ArcGIS based on locations contained in the IHS Energy well database.

**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

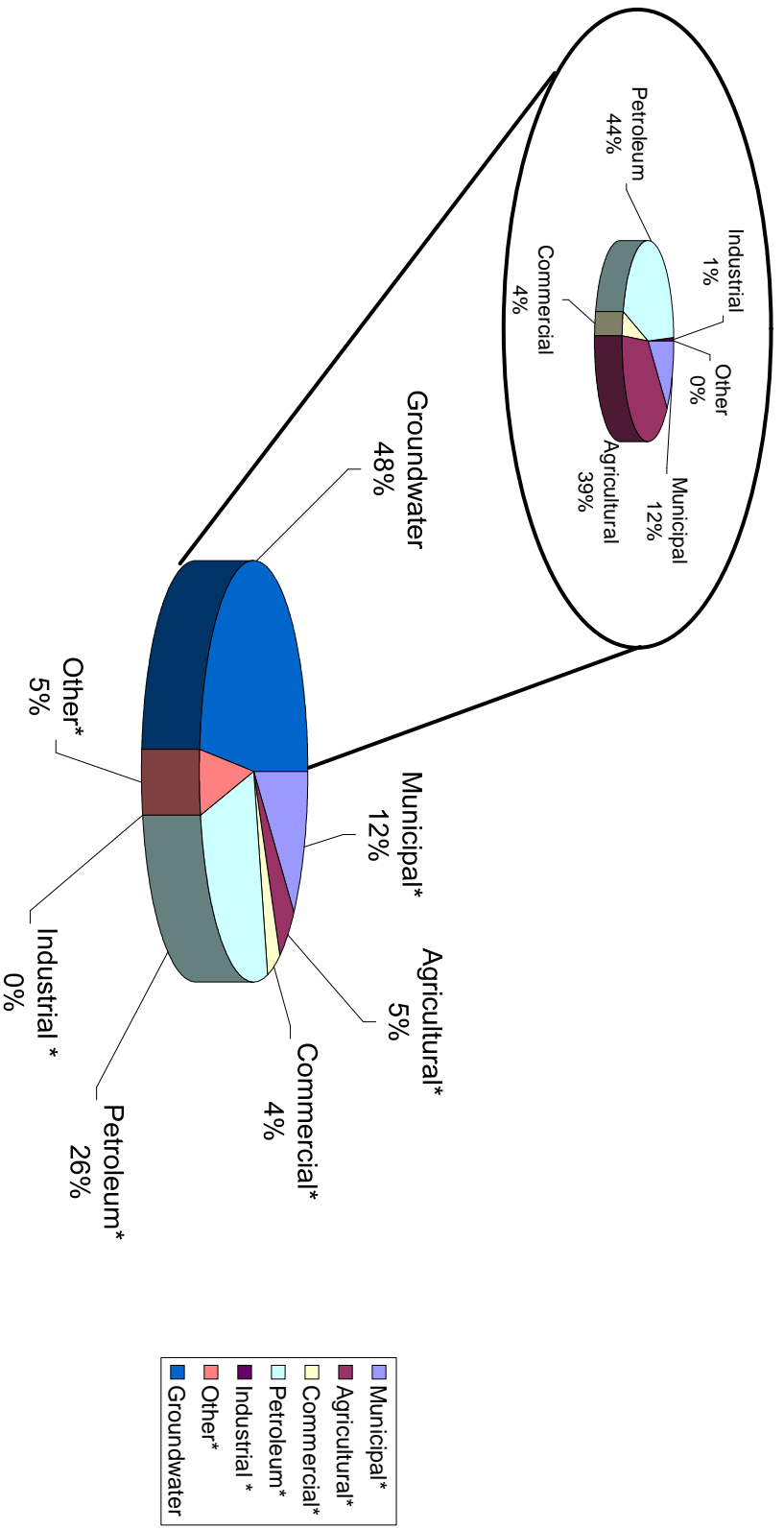
AREAL DENSITY OF OIL AND GAS WELLS


resources & energy

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FILE: Q:\E00088100\ArcGIS_NSW\MXD\OGWellDensity.mxd Issued By: Edmonton GIS



Estimated total surface water use (2005): 2,543 dam³ (52%)
 Estimated total groundwater use (2005): 2,390 dam³ (48%)
 Estimated total water use (2005): 4,993 dam³

Notes:
 * denotes surface water use
 source: AMEC (2007)

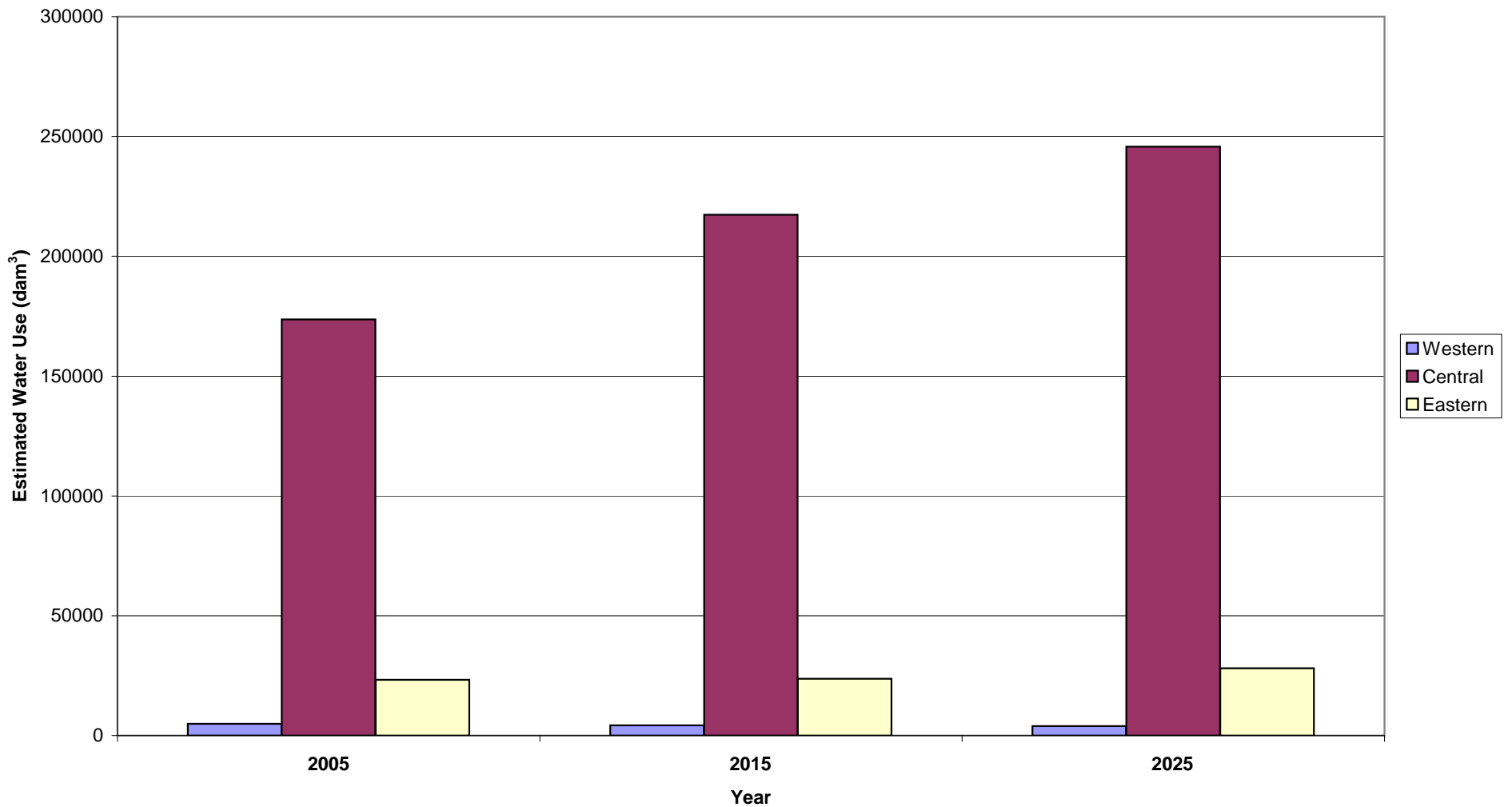
**NORTH SASKATCHEWAN WATERSHED ALLIANCE
 OVERVIEW OF GROUNDWATER CONDITIONS
 ESTIMATED WATER USE - WESTERN BASINS**




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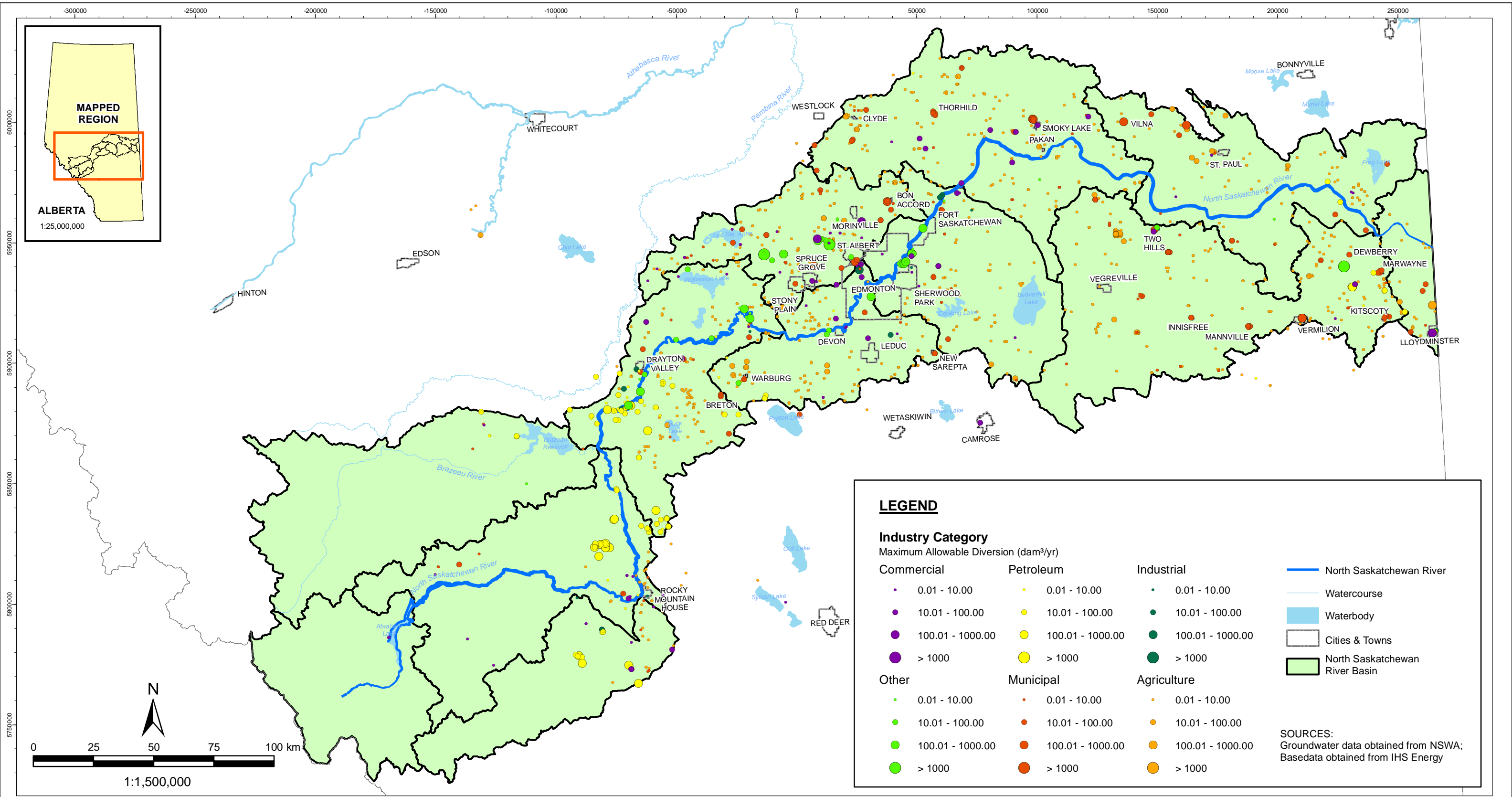
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PROJECT NUMBER:	E00088100	FIGURE:	30
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data source: AMEC (2007)

Environment & Water Resources					
NORTH SASKATCHEWAN WATERSHED ALLIANCE OVERVIEW OF GROUNDWATER CONDITIONS			 WorleyParsons resources & energy		
ESTIMATED PRESENT AND FUTURE WATER USE - WESTERN, CENTRAL, AND EASTERN BASINS			PROJECT NUMBER: E00088100		FIGURE: 31
16-MAR-09	date	mm	edited by	mm	drawn by
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**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

LICENSED GROUNDWATER USE

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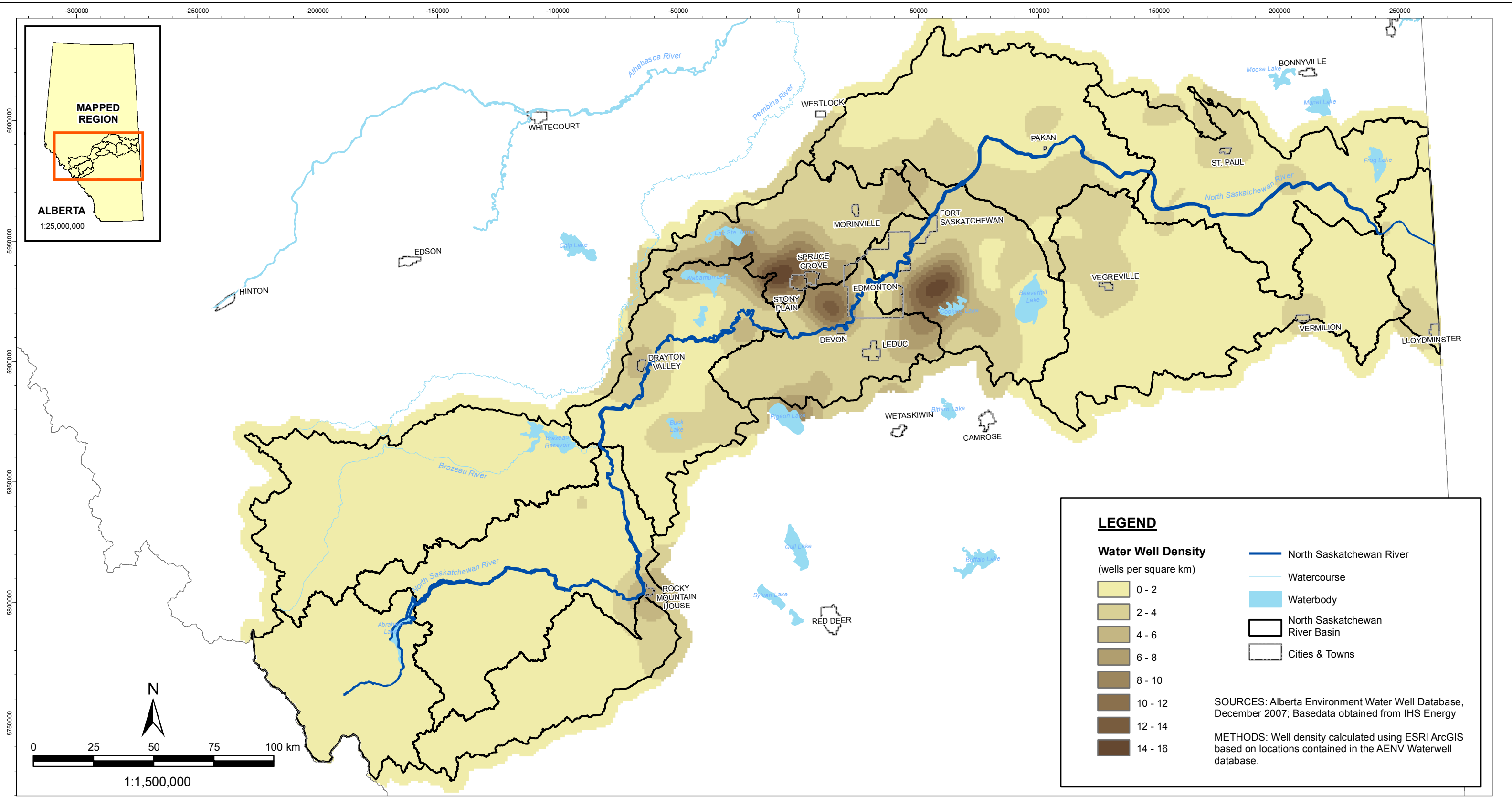


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PROJECT NUMBER:
E00088100

FIGURE:
32

FILE: Q:\E00088100\ArgGIS_NSWA\MXD\GroundWaterUse.mxd Issued By: Edmonton GIS



LEGEND

Water Well Density
(wells per square km)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 14
- 14 - 16

- North Saskatchewan River
- Watercourse
- Waterbody
- North Saskatchewan River Basin
- Cities & Towns

SOURCES: Alberta Environment Water Well Database, December 2007; Basedata obtained from IHS Energy

METHODS: Well density calculated using ESRI ArcGIS based on locations contained in the AENV Waterwell database.

**NORTH SASKATCHEWAN WATERSHED ALLIANCE
OVERVIEW OF GROUNDWATER CONDITIONS**

AREAL DENSITY OF GROUNDWATER WELLS



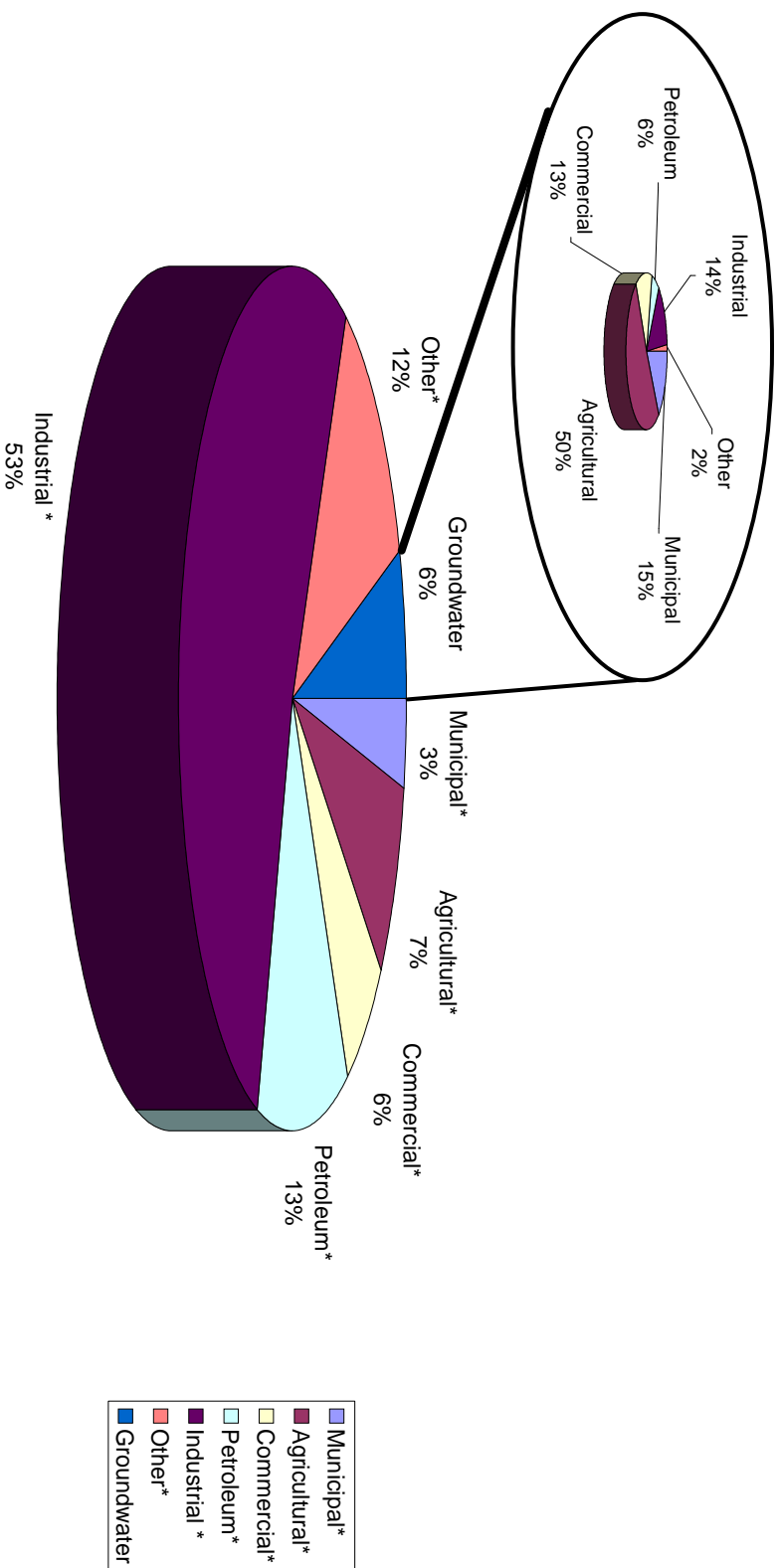
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FIGURE: 33

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Estimated total surface water use (2005): 163,927 dam³ (94%)
 Estimated total groundwater use (2005): 9,701 dam³ (6%)
 Estimated total water use (2005): 173,628 dam³

Notes:
 * denotes surface water use
 source: AMEC (2007)

**NORTH SASKATCHEWAN WATERSHED ALLIANCE
 OVERVIEW OF GROUNDWATER CONDITIONS**

ESTIMATED WATER USE - CENTRAL BASINS

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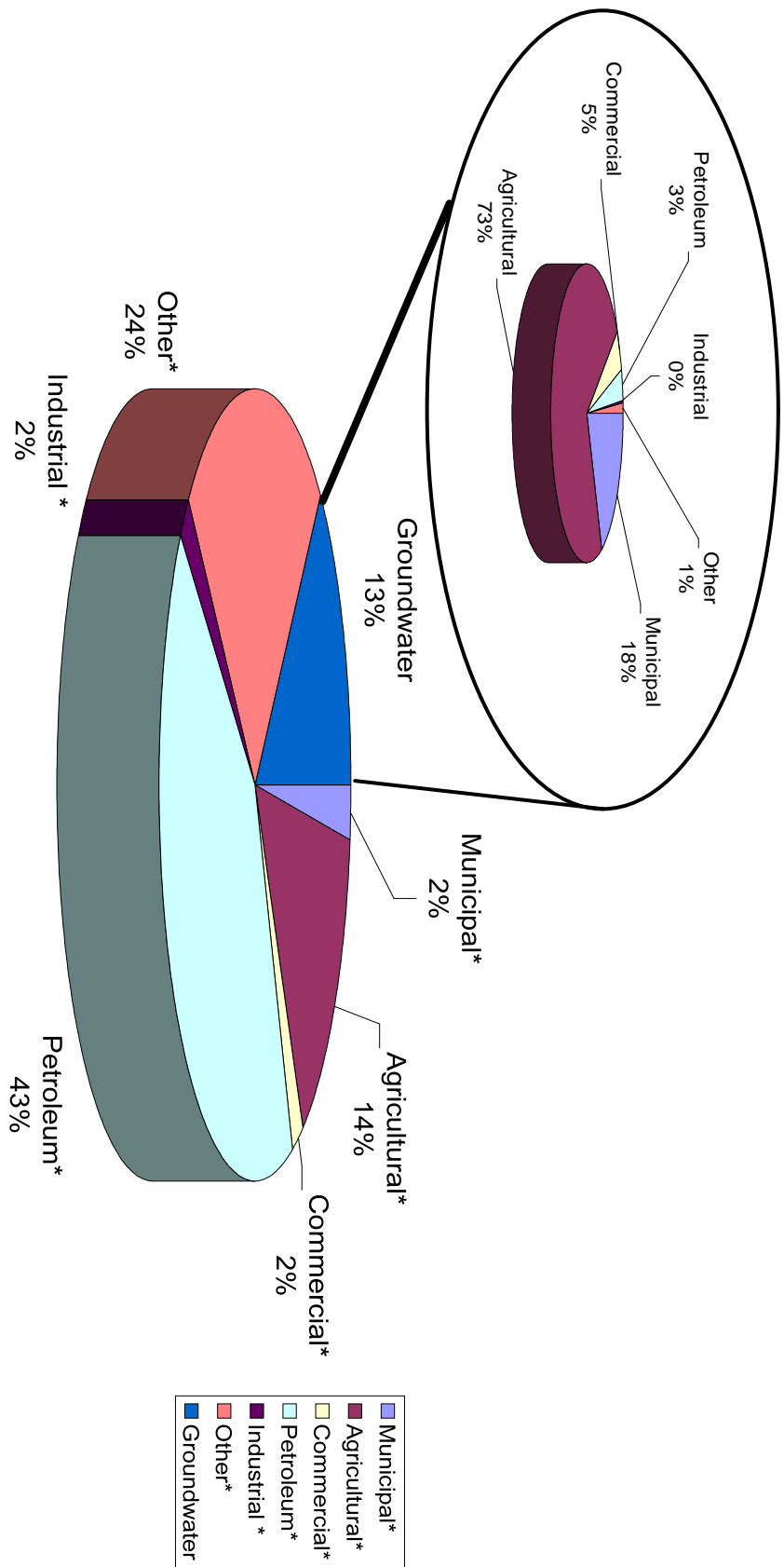
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FIGURE:

34

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Estimated total surface water use (2005): 20,274 dam³ (87%)
 Estimated total groundwater use (2005): 3,011 dam³ (7%)
 Estimated total water use (2005): 23,285 dam³
 Notes:
 * denotes surface water use
 source: AMEC (2007)

**NORTH SASKATCHEWAN WATERSHED ALLIANCE
 OVERVIEW OF GROUNDWATER CONDITIONS**

ESTIMATED WATER USE - EASTERN BASINS

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FIGURE:

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