



REPORT

TransAlta Corporation

TransAlta Keephills 1 and Sundance 5 Repowering Units

Air Quality Assessment – Revision 1

April 9, 2026

CA0060761.5444_TransAlta_K1 & S5 Repowering_AQA_Rev1



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Table of Contents

1	INTRODUCTION	1
2	REGULATORY SETTING.....	2
2.1	Ambient Air Quality Criteria.....	2
2.1.1	Alberta Ambient Air Quality Objectives	2
2.2	Air Emission Standards	3
3	ASSESSMENT APPROACH	4
3.1	Assessment Cases	4
3.2	Air Dispersion Modelling	4
3.2.1	Study Area	4
3.2.2	Receptors.....	6
3.2.3	Background Concentrations.....	8
3.2.4	Building Downwash.....	10
3.2.5	NO _x to NO ₂ Conversion	10
4	EXISTING ENVIRONMENT	11
4.1	Topography	11
4.2	Meteorology.....	13
4.3	Existing Air Quality	15
5	AIR EMISSIONS	16
5.1	Project Emissions and Approved Keephills and Sundance Emissions.....	16
5.2	Regional Emissions.....	21
6	DISPERSION MODELLING PREDICTIONS.....	23
6.1	Predicted Ground-Level NO ₂ Concentrations	23
6.2	Predicted Ground-Level CO Concentrations	24
6.3	Predicted Ground-Level PM _{2.5} Concentrations	25
7	CONCLUSIONS.....	27
8	REFERENCES	29

TABLES

Table 2-1: Alberta Ambient Air Quality Objectives and Guidelines	2
Table 3-1: Background Concentrations	8
Table 4-1: NO ₂ Concentrations Within the Study Area	15
Table 5-1: Project Emission Summary	17
Table 5-2: Regional Development Emission Summary	21
Table 6-1: Maximum Predicted Total Conversion Method Ground-Level NO ₂ Concentrations	24
Table 6-2: Maximum Predicted Ozone Limited Method Ground-Level NO ₂ Concentrations	24
Table 6-3: Maximum Predicted CO Concentrations	25
Table 6-4: Maximum Predicted Ground-Level PM _{2.5} Concentrations	26

FIGURES

Figure 3-1: Air Quality Study Area and Development Areas	5
Figure 3-2: Receptors	7
Figure 3-3: WCAS Air Monitoring Stations	9
Figure 4-1: Study Area Terrain Elevations	12
Figure 4-2: 2022-2024 Windrose at WCAS Meadows Station	13
Figure 4-3: 2022-2024 Windrose at WCAS Wagner2 Station	14
Figure 5-1: Keephills Emission Sources and Buildings	19
Figure 5-2: Sundance Emission Sources and Buildings	20
Figure 5-3: Regional Emission Sources	22

ATTACHMENT

ATTACHMENT A

CALMET and CALPUFF Model Settings

ATTACHMENT B

Emission Inventory

ATTACHMENT C

Model Prediction Contour Figures

1 INTRODUCTION

TransAlta Corporation (TransAlta) currently operates the Keephills Thermal Electric Power Plant (Keephills) and Sundance Thermal Electric Power Plant (Sundance), located approximately 50 km west of Edmonton and 5 km south of Wabamun Lake, Alberta. Keephills and Sundance operate under the Environmental Protection and Enhancement Act (EPEA) Approvals 10324-03 and 9830-03 as well as Alberta Utilities Commission (AUC) approvals 26946-D02-2021 and 25239-D02-2020, respectively.

In December 2019, TransAlta proposed and submitted regulatory applications for the Sundance and Keephills Repowering Project, which would involve replacing the steam sources for Keephills Generating Unit 1 (K1) and Sundance Generating Unit 5 (S5) with natural gas-fired turbine generators and heat recovery steam generator (HRSG) units. In 2020, TransAlta received both EPEA approvals and AUC approvals for the Repowering Project.

Since receiving AUC approval, TransAlta has continuously evaluated the construction of the Repowering Project. As a result of market fundamentals shifting, TransAlta is now proposing to develop an updated version of the Repowering Project (the Project), which has the same design at S5 as the original Repowering Project, but an updated design for K1. In the Project, the K1 design will change from a one natural gas-fired combustion turbine (CT), one HRSG and one steam turbine generator (STG) configuration to a two CTs, two HRSGs and one STG configuration.

WSP Canada Inc. (WSP) was retained by TransAlta to complete an air quality assessment to quantify the potential air emission changes due to the K1 and S5 repowering units and to conduct air dispersion modelling to assess the potential changes to the maximum ground-level concentrations for selected compounds of interest. The compounds of interest for this assessment are nitrogen oxides (NO_x) expressed as nitrogen dioxide (NO₂), carbon monoxide (CO) and particulate matter with a diameter of 2.5 microns or less (PM_{2.5}).

This air quality assessment report is structured as follows:

- Section 2 describes the relevant ambient air quality criteria and air emission standards.
- Section 3 outlines the assessment approach.
- Section 4 provides a summary of the topography, meteorology, and existing air quality in the study area.
- Section 5 provides a summary of the Project and regional air emissions modelled in the assessment.
- Section 6 presents the air dispersion modelling results, including predicted maximum ground-level concentrations of the selected compounds and comparison with applicable air quality criteria.
- Section 7 provides the conclusions of the air quality assessment.

2 REGULATORY SETTING

Legislative and regulatory frameworks have been established by regional, provincial, and federal authorities to manage and protect air quality within their respective jurisdictions. Standards, limits, triggers, objectives, and guidelines (known collectively as “criteria”) applicable to specific air quality parameters are established through these frameworks. The air criteria applicable to the Project are categorized as follows:

- Ambient air quality criteria: Establish concentration levels for the determination of acceptability, management, and investigative actions to evaluate the protection of ambient air quality.
- Air emission standards: Place design target and compliance limit on acceptable emissions from new gas turbines and thermal power generating units.

2.1 Ambient Air Quality Criteria

A range of effects may result from air emissions introduced into the atmosphere by industrial activities. The emissions can have direct and indirect effects on humans, animals, vegetation, soil, and water; therefore, air quality criteria have been established for the protection of these elements. Air quality criteria are used to evaluate ground-level concentrations.

2.1.1 Alberta Ambient Air Quality Objectives

Alberta Environment and Protected Areas (AEPA) has developed air quality objectives and guidelines to be used to determine design and performance adequacy for industrial facilities in the province of Alberta. The Alberta Ambient Air Quality Objectives and Guidelines (AAQOs, [AAAQG](#); AEPA 2024a) are based on an evaluation of scientific, social, technical, and economic factors. Objectives are used to determine the adequacy of the facility and stack design, as well as to assess compliance and evaluate facility performance (AEPA 2024a). The AAQOs and [AAAQG](#) used in the evaluation of the air quality effects from the Project are presented in Table 2-1.

Table 2-1: Alberta Ambient Air Quality Objectives for NO₂

Averaging Period	Concentration (µg/m ³)
1-hour	300
Annual	45

Table 2-1: Alberta Ambient Air Quality Objectives and Guidelines

Compound	Averaging Period	Concentration (µg/m ³)	
		Alberta Ambient Air Quality Objective	Alberta Ambient Air Quality Guideline
NO ₂	1-hour	300	:-
	Annual	45	:-
CO	1-hour	15,000	:-
	8-hour	6,000	:-
PM _{2.5}	1-hour	:-	80
	24-hour	29	:-

2.2 Air Emission Standards

In addition to AAAQOs, numerous regulatory agencies have developed criteria designed to place limits on acceptable emissions or guidelines to reduce emissions from thermal power generating units. There are both federal and provincial emission standards and guidelines that are applicable to the K1 and S5 repowering units. They are:

- *Federal Guidelines for Reduction of Nitrogen Oxide Emissions from Natural Gas-fuelled Stationary Combustion Turbines* (ECCC 2017);
- *Alberta Emission Standards for Electricity Generation and Alberta Air Emission Guidelines for Electricity Generation* (AEPA 2005); and
- *2018 CASA Electricity Framework Review: Perspectives on a NO_x Emission Standard for Natural Gas-Fired Turbines* (CASA 2018).

The current Sundance's EPEA approval (No. 9730-03-02) sets a NO_x emission limit of 40.5 kg/hr based on a 720-hour rolling average at each of the S5 repowering unit's two HRSG stacks. This NO_x emission limit was derived based on a NO_x emission intensity 0.1 kilograms per megawatt hour (kg/MWh) power output, which is based on both Proposal A's and Proposal B's NO_x emission standard for non-peaking units over 150 MW in the *2018 CASA Electricity Framework Review* (CASA 2018).

The redesigned K1 is expected to meet the NO_x emission guideline of 85 grams per gigajoules (g/GJ) energy output, equivalent to 0.3 kg/MWh, for non-peaking units over 70 MW in the *Federal Guidelines for Reduction of Nitrogen Oxide Emissions from Natural Gas-fuelled Stationary Combustion Turbines* (ECCC 2017).

3 ASSESSMENT APPROACH

3.1 Assessment Cases

The following assessment cases are evaluated in this study:

- **Project Only Case:** The purpose of this case is to show the ground-level concentrations that will result from emissions from Keephills and Sundance plants with the proposed K1 and S5 repowering units, in isolation from emissions from other industrial facilities within the study area.
- **Application Case:** The purpose of this case is to show the cumulative ground-level concentrations resulting from emissions from the approved emission sources at Keephills and Sundance, the Project (K1 and S5 repowering units), and other industrial facilities within the study area. Background concentrations, which represent contributions from distant and natural sources not included in the air dispersion model are added to the model-predicted ground-level concentrations as required by the Alberta Air Quality Model Guidelines (AQMG, AEPA 2021).

3.2 Air Dispersion Modelling

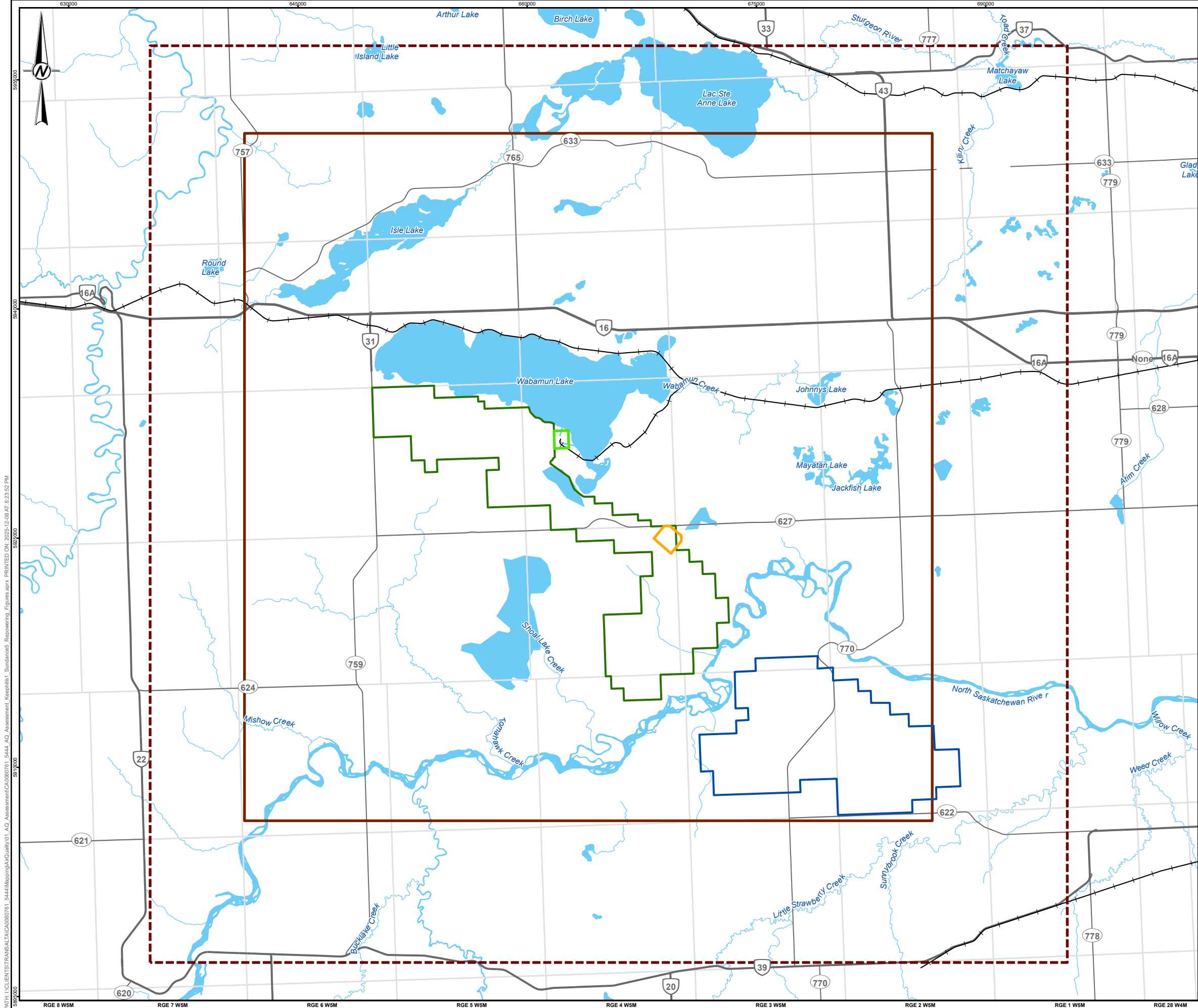
The CALPUFF (Version 7.2.1) air dispersion model and a 5-year (2015-2019) CALMET meteorological dataset were used to predict the ground-level concentrations of the compounds of interest. The dispersion modelling was conducted in accordance with Alberta's Air Quality Model Guideline (AQMG, AEPA 2021). Attachment A provides more details on the CALPUFF and CALMET model settings.

3.2.1 Study Area

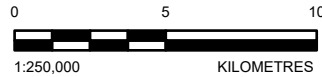
The air quality assessment considers the following spatial domains or boundaries for consideration in the discussion of air quality predictions:

- The study area is defined as an area over which air dispersion modelling is conducted, and the potential air quality changes resulting from the Project emissions are evaluated. The study area is defined as a 45 km by 45 km square and is large enough to encompass the effects of emissions from the Project (i.e., encompasses the area in which the effects of the Project are at or above 10% of any applicable AAAQO per the AQMG).
- The Keephills Plant Boundary (Keephills boundary) defines the boundary of a footprint that encompasses the existing Keephills plant and the proposed K1 repowering unit. The K1 repowering unit will be located inside the existing boundary for Keephills. The Keephills boundary will not change because of the Project.
- The Sundance Plant Boundary (Sundance boundary) defines the boundary of a footprint that encompasses the existing Sundance plant and the S5 repowering unit. The S5 repowering unit will be located inside the existing boundary for Sundance. The Sundance boundary will not change because of the Project.
- The developed areas are defined as areas within the permit boundaries of existing and approved industrial facilities and operations located within the study area. Air criteria are applicable outside of developed areas, where public access is not restricted (AEPA 2021). The developed areas included in this assessment are areas within the Keephills boundary, Sundance boundary, as well as the neighbouring developments to the southeast of the Project such as Capital Power Corporation (Capital Power) Genesee mine permit boundary and Capital Power Genesee thermal electric power plant.

Figure 3-1 presents the study area, the boundaries, and the developed areas used in the air quality assessment.



- LEGEND**
- PRIMARY HIGHWAY
 - SECONDARY HIGHWAY
 - RAILROAD
 - WATERCOURSE
 - WATERBODY
 - AIR QUALITY ASSESSMENT MODELLING DOMAIN
 - GENESEE MINE PERMIT BOUNDARY
 - HIGHVALE MINE PERMIT BOUNDARY
 - KEEPPHILLS PLANT BOUNDARY
 - STUDY AREA
 - SUNDANCE PLANT BOUNDARY



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CLIENT
transalta

PROJECT
KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE
AIR QUALITY STUDY AREA AND DEVELOPED AREAS

CONSULTANT	YYYY-MM-DD	2025-12-08
DESIGNED	DC	
PREPARED	BS / PRR	
REVIEWED	TJ	
APPROVED	DC	

PROJECT NO. CONTROL
CA0060761.5444

REV. 0

FIGURE 3-1

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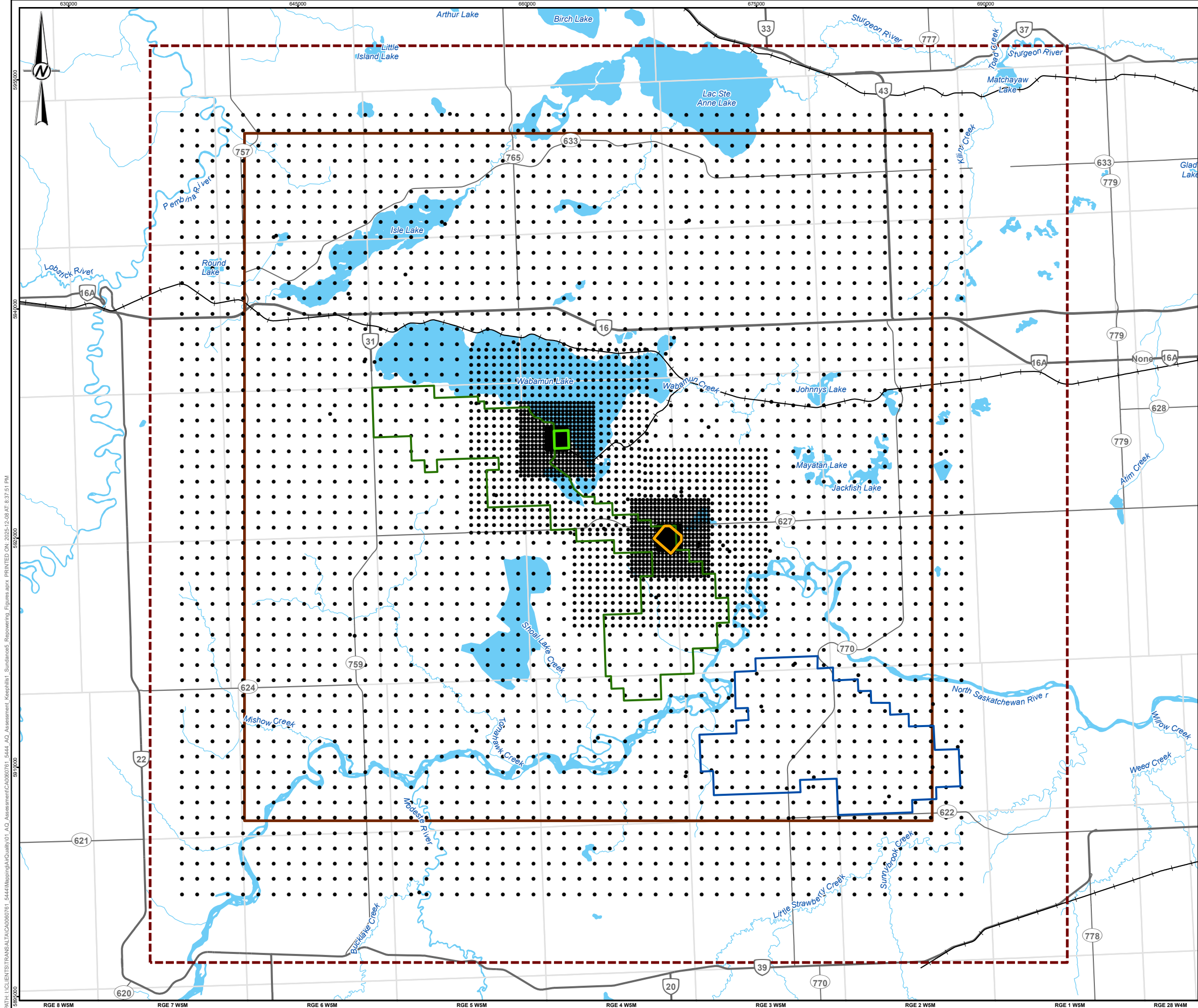
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3.2.2 Receptors

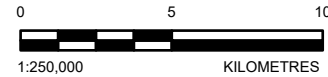
Receptors are locations where the dispersion model provides predictions (e.g., ground-level concentrations). The receptors are placed in a Cartesian grid pattern with specific spacing between the receptors. The gridded receptors were generally placed based on the recommendations in the AQMG (AEPA 2021) as follows:

- spacing of 20 m along the Keephills boundary and the Sundance boundary
- spacing of 50 m within 0.5 km of the Project stacks
- spacing of 250 m within 2 km of the Project stacks
- spacing of 500 m within 5 km of the Project stacks
- spacing of 1,000 m beyond 5 km of the Project stacks, extending to the edge of the study area

The receptor scheme is presented on Figure 3-2.



- LEGEND**
- PRIMARY HIGHWAY
 - SECONDARY HIGHWAY
 - RAILROAD
 - WATERCOURSE
 - WATERBODY
 - RECEPTOR
 - AIR QUALITY ASSESSMENT MODELLING DOMAIN
 - GENESSEE MINE PERMIT BOUNDARY
 - HIGHVALE MINE PERMIT BOUNDARY
 - KEEPPHILLS PLANT BOUNDARY
 - STUDY AREA
 - SUNDANCE PLANT BOUNDARY



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PROJECT
KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE
RECEPTORS

CONSULTANT	YYYY-MM-DD	2025-12-08
	DESIGNED	DC
	PREPARED	BS / PRR
	REVIEWED	TJ
	APPROVED	DC

PROJECT NO. CA0060761.5444 **CONTROL** **REV.** 0 **FIGURE** 3-2

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3.2.3 Background Concentrations

The AQMG specifies that when conducting a refined air quality assessment, a background concentration value for each assessed compound must be added to the model-predicted value before a comparison to air quality criteria (e.g., AAAQO) can be made (AEPA 2021). The background concentrations are added to represent contributions from natural sources, nearby sources and unidentified, possibly distant sources that weren't included in the dispersion modelling.

The Project is located within the West Central Airshed, which spans from the western boundary of the City of Edmonton to the British Columbia border. The West Central Airshed Society (WCAS) collects air quality data through a combination of 11 continuous monitoring stations through the airshed, as shown on Figure 3-3. The background concentrations for each compound were derived from measurements taken between 2022 and 2024 within the WCAS boundary and were calculated based on the approach specified in Section 7.2 of the AQMG (e.g., a reduced hourly dataset with values above the 90th percentile non-blank ambient data removed from the most recent year of monitoring data, provided it meets the 75% completeness criteria).

The background NO₂ concentrations selected for this assessment were based on measurements at the WCAS Carrot Creek station. Although there are other stations closer to Keephills and Sundance (i.e., Meadow and Wagner 2 stations), they are either directly adjacent to these plants or in the downwind of these plants. Therefore, the measurements collected at these stations are influenced by the emissions from these plants. The prevailing wind pattern within the study area is from the northwest and the west (see Figures 4-2 and 4-3). The WCAS Carrot Creek station is located upwind of the study area and measurements collected at this station are not expected to be influenced by the emissions from sources within the study area.

[The background CO concentrations were based on measurements at WCAS Steeper station. Steeper station is the only WCAS station that measures CO concentrations on a continuous basis.](#)

[The background PM_{2.5} concentrations were based on measurements at WCAS Power station. Unlike background concentrations for NO₂ and CO, the PM_{2.5} background concentrations were derived based on an average of 2021, 2022 and 2024 measurements. 2023 measurements were substantially higher than measurements from other recent years due to higher wild fire activities in 2023. Therefore, the 2023 measurements were not used in the background concentration calculations.](#)

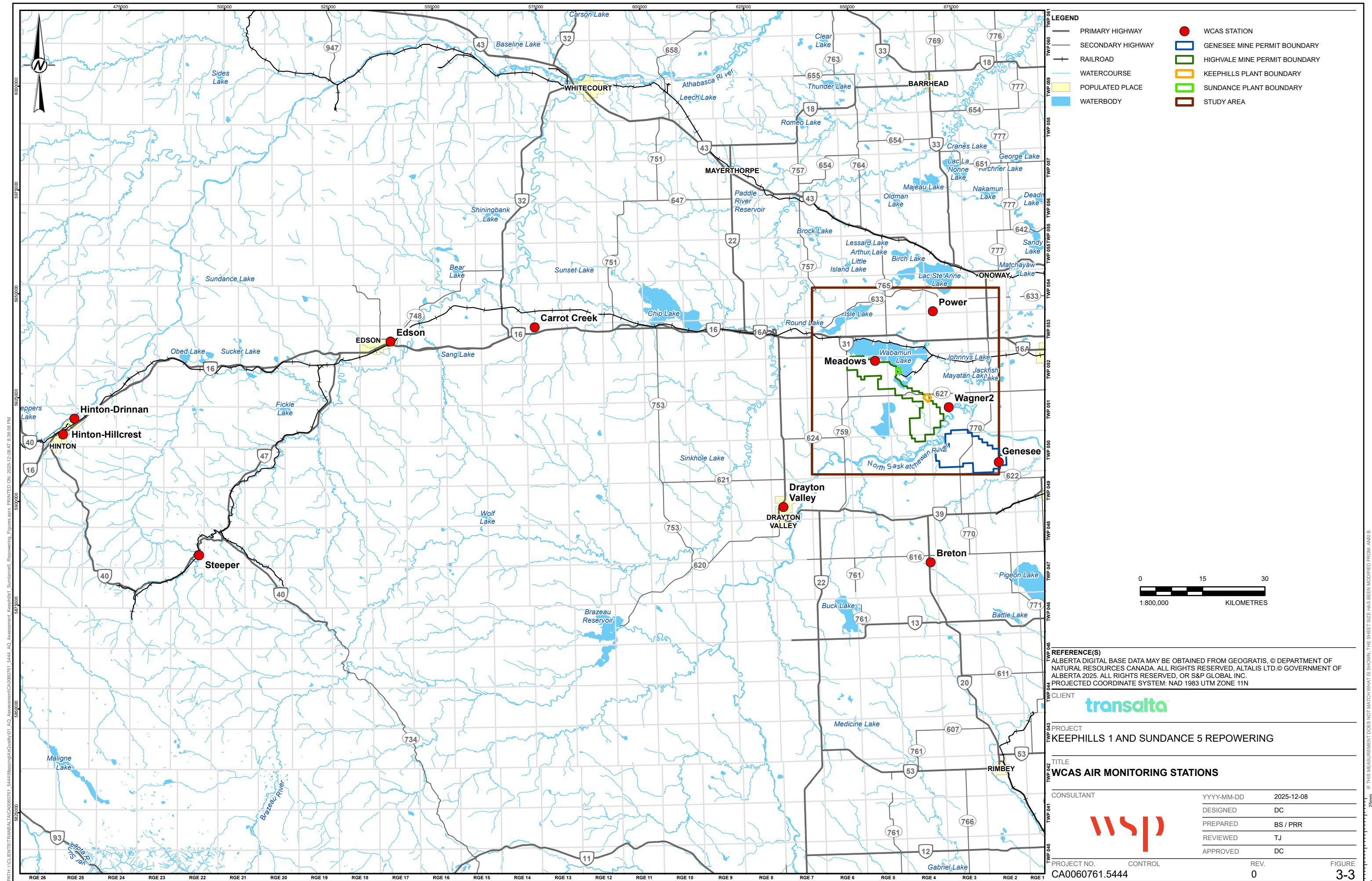
The station chosen is consistent with the stations chosen for background concentrations in previous air quality assessments for Keephills and Sundance reviewed by the AEPA (TransAlta 2019, 2024).

The background concentrations ~~of NO₂~~ are presented in Table 3 1.

Table 3-1: Background Concentrations

Compound	Averaging Period	Measured Concentration (µg/m ³)				Selected Background Concentration (µg/m ³) ^(a)
		2021	2022	2023	2024	
NO ₂	1-hour	Not Used	18.0	19.9	16.7	18.2
	Annual	Not Used	5.1	6.4	5.4	5.7
CO	1-hour	Not Used	246.2	366.4	195.8	269.4
	8-hour	Not Used	245.8	362.9	195.8	268.2
PM_{2.5}	1-hour	12.0	11.3	Not Used	15.2	12.8
	24-hour	11.2	10.7	Not Used	14.6	12.2

(a) Three-year average as per the AQMG (AEPA 2021).



3.2.4 Building Downwash

Buildings or solid structures may affect the flow of air in the vicinity of an emission source and cause eddies to form on the downwind side of a building. This building downwash effect may result in elevated ground-level concentration predictions closer to the emission source. According to the AQMG (AEPA 2021), the effects of local buildings should be considered when conducting a dispersion modelling assessment.

Building downwash was considered for the new and existing structures associated with the Keephills and Sundance plants. The consideration of building downwash effects from the facility is expected to result in conservative local predictions. The Building Profile Input Program (BPIP) was used to evaluate the effect of buildings in the vicinity of the nearby sources on plume dispersion. BPIP was run in Plume Rise Model Enhancement (PRIME) algorithm mode to provide an output for integration and use in the CALPUFF model. The stack locations and the buildings surrounding the stacks at Keephills and Sundance are shown in Figures 5-1 and 5-2, respectively.

3.2.5 NO_x to NO₂ Conversion

NO_x is a by-product of fuel combustion. When NO_x is emitted from a combustion source, it is in the form of nitric oxide (NO) and NO₂, with the majority of the NO_x being emitted as NO. In the atmosphere, the highly unstable NO is quickly converted to NO₂. The AQMG recommends four methods for determining the amount of NO₂ formed from NO_x. They are:

- the total conversion method (TCM)
- the ambient ratio method (ARM)
- the plume volume molar ratio method (PVMRM)
- the ozone limiting method (OLM)

In this assessment, the predicted NO₂ concentrations were derived from model-predicted NO_x concentrations using the OLM. The OLM estimates the NO₂ ground-level concentration by considering the available ambient O₃ that can titrate NO to NO₂, as well as the thermal NO₂ produced at the stack (as measured by the stack in-stack ratio [ISR]). The OLM was implemented following the AQMG-provided equations and the rural hourly ozone concentrations from Appendix E of the AQMG. As per the AQMG, the NO₂ predictions based on the total conversion method are also provided in this assessment for information purposes only.

ISR values were used in OLM for NO to NO₂ conversion, including:

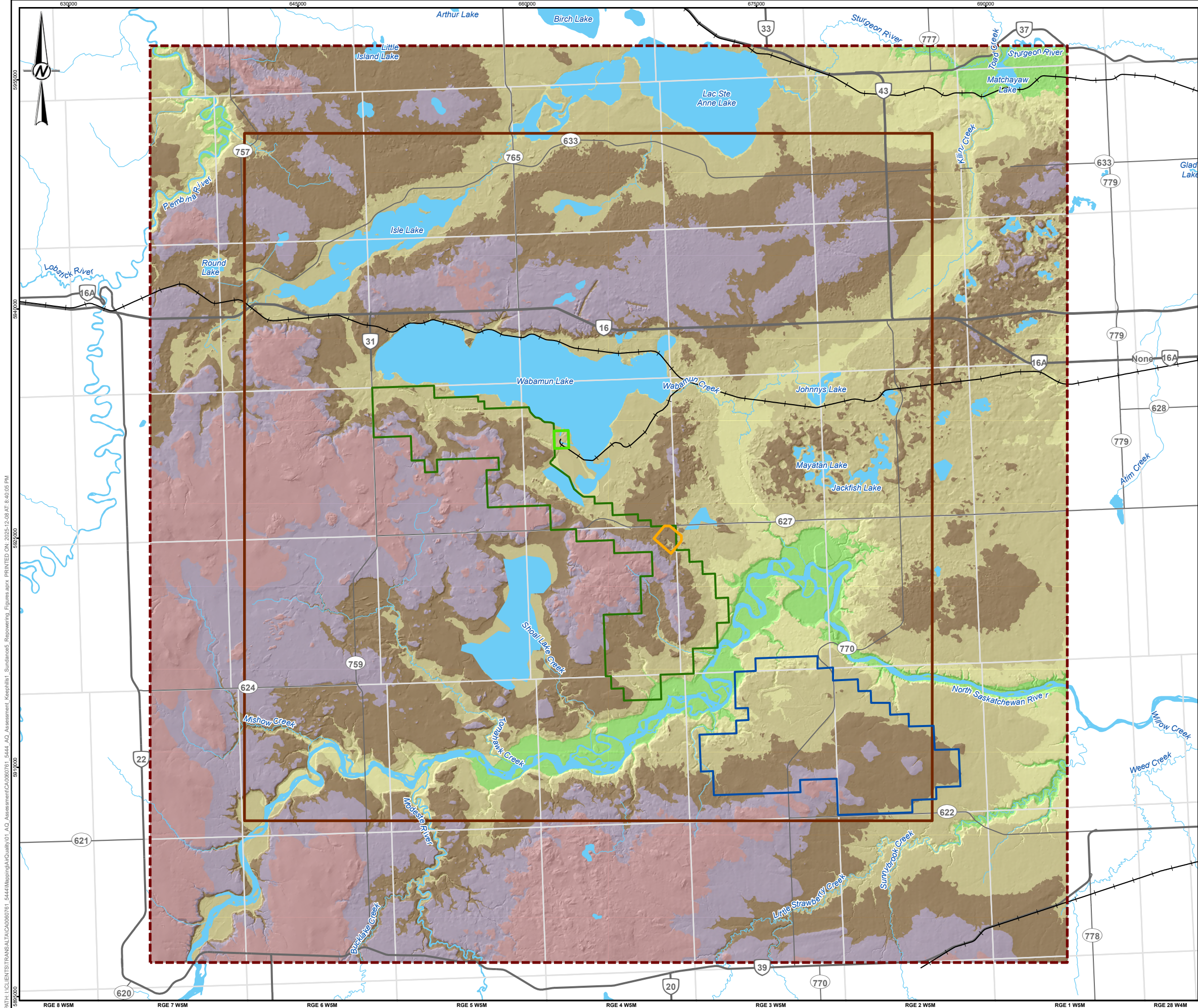
- The ISR for the Project stacks were assumed to be 0.2.
- The ISR for regional emissions sources is assumed to be 0.2 as per recommendations in the AQMG.

4 EXISTING ENVIRONMENT

The existing environmental conditions, including topography, meteorology, and air quality, are summarized in this section.

4.1 Topography

The terrain in the study area is fairly flat and ranges from 649 metres above sea level (masl) to 895 masl. The Sundance plant is located on the southern shore of Wabamun Lake, which is the predominant feature in the study area. The north Saskatchewan River valley runs west to east along the southeastern quadrant of the study area. The terrain elevations within the study area is shown in Figure 4-1.



LEGEND

PRIMARY HIGHWAY

SECONDARY HIGHWAY

RAILROAD

WATERCOURSE

WATERBODY

AIR QUALITY ASSESSMENT MODELLING DOMAIN

GENESEE MINE PERMIT BOUNDARY

HIGHVALE MINE PERMIT BOUNDARY

KEEPPHILLS PLANT BOUNDARY

STUDY AREA

SUNDANCE PLANT BOUNDARY

TERRAIN ELEVATIONS AT 25 MASL INTERVALS

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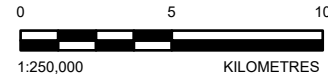
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725 - 750

750 - 775

775 - 800

> 800



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transalta

PROJECT

KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

STUDY AREA TERRAIN ELEVATIONS

CONSULTANT



YYYY-MM-DD

2025-12-08

DESIGNED

DC

PREPARED

BS / PRR

REVIEWED

TJ

APPROVED

DC

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4-1

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4.2 Meteorology

The local wind speed and direction are monitored at the WCAS Meadows and Wagner2 stations located approximately 8 km west of Sundance and 6 km southeast of Keephills, respectively. Figures 4-2 and 4-3 show the wind rose for these stations from 2022 to 2024, measured at 10 m above ground. The Meadows station observed winds mostly from south-southwest, with significant portions of winds also from southwest and east. The Wagner2 station observed winds mostly frequently from the northwest, with a tendency to blow along the northwest-southeast axis. A significant portion of winds were also observed from the north-northwest and west-northwest at these stations.

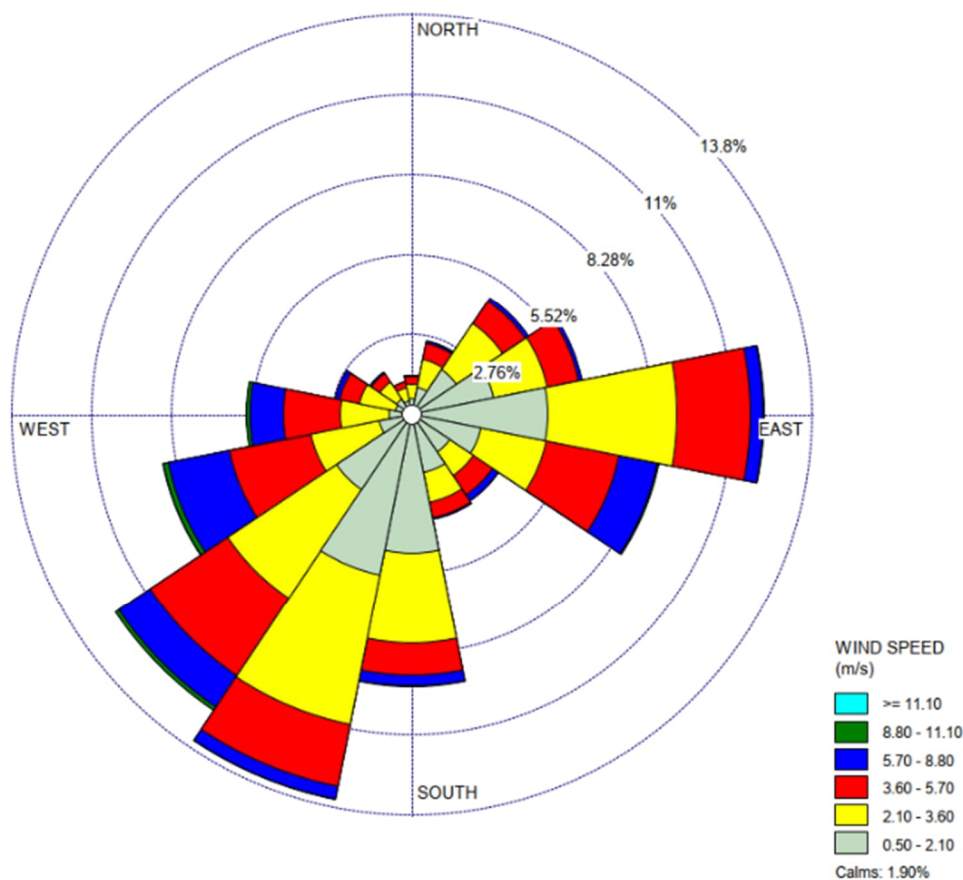


Figure 4-2: 2022-2024 Windrose at WCAS Meadows Station

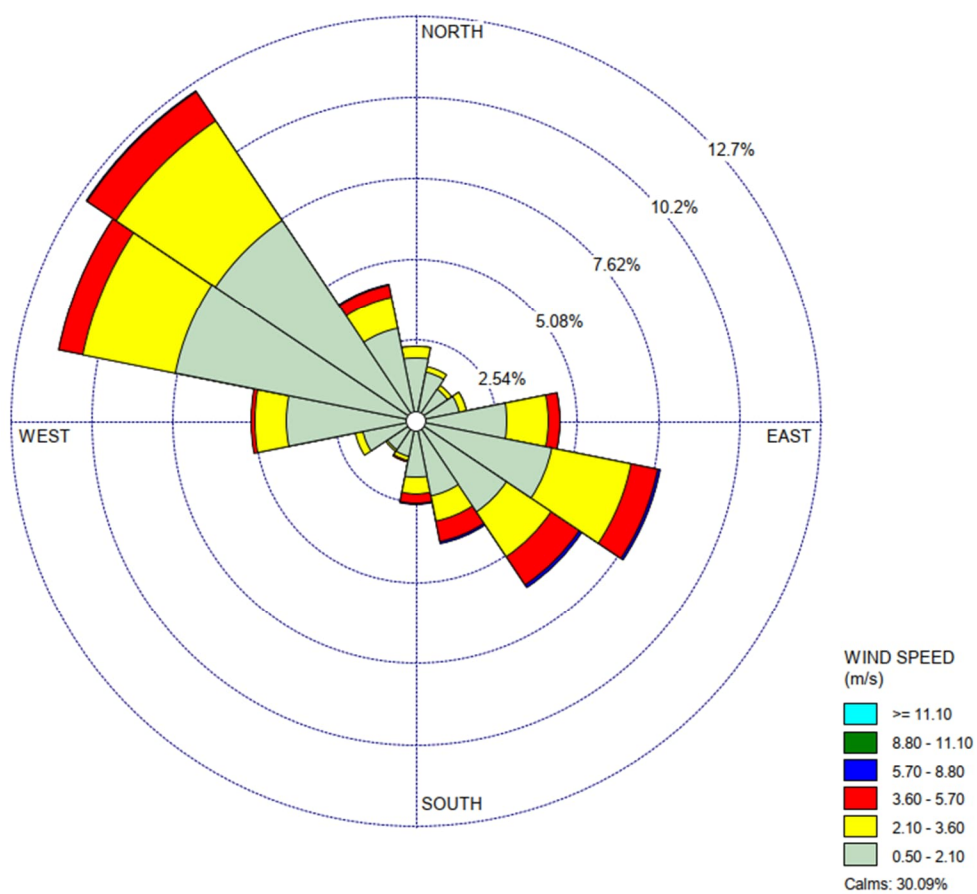


Figure 4-3: 2022-2024 Windrose at WCAS Wagner2 Station

4.3 Existing Air Quality

The WCAS Meadows and Wagner2 stations are both located near Sundance and Keephills, their data can be used to describe air quality surrounding these plants and in the study area. [NO₂ is measured at both stations; however, CO is only measured at WCAS Steeper station and PM_{2.5} is measured at WCAS Power station but not Wagners station.](#) The NO₂, CO and PM_{2.5} concentrations measured at [Meadows and Wagner2](#) these stations during the past five years (2020-2024) are presented in Table 4-1.

[Overall, there has been no exceedance of NO₂ AAAQOs in the last 5 years. There was no exceedance of the 1-hour AAAQO for CO, but the AAAQO for 8-hour CO was exceeded in 2023. There were exceedances of the PM_{2.5} AAAQG and AAAQO, majority of them were associated with local and regional wild fires.](#)

Table 4-1: NO₂ Concentrations Within the Study Area

Station	Year					5-year Average	5-year Maximum
	2020	2021	2022	2023	2024		
Maximum 1-hour NO ₂ Concentration (µg/m³)							
Meadows	71.771.68	58.258.16	50.150.11	60.760.67	66.366.31	61.461.39	71.771.68
Wagner2	93.093.01	78.978.86	51.451.41	73.073.03	71.771.69	73.673.60	93.093.01
AAAQO	300						
Annual NO ₂ Concentration (µg/m³)							
Meadows	5.45.39	5.45.37	5.45.40	6.56.52	6.26.19	5.85.78	6.56.52
Wagner2	4.84.84	6.66.55	5.35.30	7.57.54	7.87.80	6.46.41	7.87.80
AAAQO	45						
Maximum 1-hour CO Concentration (µg/m³)							
Steeper	745.4	2,514.3	1,345.3	7,686.0	3,256.2	3,109.4	7,686.0
AAAQO	15,000						
Maximum 8-hour CO Concentration (µg/m³)							
Steeper	719.9	1,773.5	464.5	6,028.4	1,698.1	2,136.9	6,028.4
AAAQO	6,000						
Maximum 1-hour PM_{2.5} Concentration (µg/m³)							
Power	39.1	165.6	52.8	327.1	227.0	162.3	327.1
AAAQG	80						
Maximum 24-hour PM_{2.5} Concentration (µg/m³)							
Power	28.6	93.6	32.4	247.3	141.5	108.7	247.3
AAAQO	29						

NOTES:

AAAQO = Alberta Ambient Air Quality Objective; NO₂ = nitrogen dioxide; µg/m³ = micrograms per cubic metre.

5 AIR EMISSIONS

5.1 Project Emissions and Approved Keephills and Sundance Emissions

The Project involves the construction and operation of new CT generators and HRSGs at the Keephills and Sundance plants. The generation units will be integrated with existing steam turbine generators and infrastructure for Keephills Unit 1 and Sundance Unit 5. The current design also includes the construction and operation of an auxiliary boiler unit at each repowering location (Keephills and Sundance) to support start-up and HRSG sparging activities. The Project will introduce the following new air emission sources at Keephills and Sundance, respectively:

Keephills Plant:

- two HRSG stacks
- one auxiliary boiler stack

Sundance Plant:

- two HRSG stacks for the CT generator and HRSG exhaust when power generation unit is operating in a combined cycle mode
- two bypass stacks for the CT generator exhaust when the power generation unit is operating in a single cycle mode (i.e., CT generators online and HRSGs offline)
- one auxiliary boiler stack

A summary of the Project's NO_x, [CO](#) and [PM_{2.5}](#) emissions under normal operating conditions (i.e., combined cycle mode) is presented in Table 5-1. Details on equipment specifications, stack parameters, emissions quantification methods, and sample calculations are presented in Attachment B.

The S5 HRSG stacks' NO_x emissions are modelled based on the NO_x emission limits (40.5 kg/hr based on a 720-hour rolling average) listed in the Sundance's EPEA approval (No. 9830-03-00). The S5 HRSG stacks' NO_x emission limits are based on 0.1 kg/MWh from the *2018 CASA Electricity Framework Review* (CASA 2018). The K1 HRSG stacks' NO_x emissions are modelled based on 85 kg/GJ (equivalent to 0.3 kg/MWh) from the *Federal Guidelines for Reduction of Nitrogen Oxide Emissions from Natural Gas-fuelled Stationary Combustion Turbines* (ECCC 2017). The auxiliary boilers do not have maximum NO_x emission limits in the EPEA approvals; therefore, the NO_x emissions modelled are based on vendor specifications.

Table 5-1: Project Emission Summary

Source	NO _x Emission Rates		CO Emission Rates		PM _{2.5} Emission Rates	
	(kg/hr)	(t/d)	(kg/hr)	(t/d)	(kg/hr)	(t/d)
Proposed Keephills 1 Repowering Unit						
Repowering Unit 1 HRSG Stack 1	126.89	3.05	<u>120.88</u>	<u>2.90</u>	<u>0.84</u>	<u>0.02</u>
Repowering Unit 1 HRSG Stack 2	126.89	3.05	<u>120.88</u>	<u>2.90</u>	<u>0.84</u>	<u>0.02</u>
Repowering Unit 1 Auxiliary Boiler Stack	0.12	0.003	<u>0.45</u>	<u>0.01</u>	<u>0.093</u>	<u>0.002</u>
Subtotal	253.91	6.09	<u>242.21</u>	<u>5.81</u>	<u>1.77</u>	<u>0.04</u>
Approved Keephills Sources						
Stack No. 1	430.92	10.34	<u>237.90</u>	<u>5.71</u>	<u>1.15</u>	<u>0.03</u>
Stack No. 2	310.00	7.44	<u>136.00</u>	<u>3.26</u>	<u>1.22</u>	<u>0.03</u>
Unit 3 Auxiliary Boiler Stack	3.11	0.07	<u>21.63</u>	<u>0.52</u>	<u>0.02</u>	<u>0.0004</u>
Subtotal	744.03	17.86	<u>395.53</u>	<u>9.49</u>	<u>2.39</u>	<u>0.06</u>
Keephills Total	997.94	23.95	<u>637.74</u>	<u>15.31</u>	<u>4.16</u>	<u>0.10</u>
Proposed Sundance 5 Repowering Unit						
Repowering Unit 1 HRSG Stack 1	40.50	0.97	<u>120.88</u>	<u>2.90</u>	<u>0.84</u>	<u>0.02</u>
Repowering Unit 1 HRSG Stack 2	40.50	0.97	<u>120.88</u>	<u>2.90</u>	<u>0.84</u>	<u>0.02</u>
Repowering Unit 1 Auxiliary Boiler Stack	0.12	0.003	<u>0.45</u>	<u>0.01</u>	<u>0.09</u>	<u>0.002</u>
Subtotal	81.12	1.95	<u>242.21</u>	<u>5.81</u>	<u>1.77</u>	<u>0.04</u>
Approved Sundance Sources						
Stack No. 2	635.04	15.24	<u>466.20</u>	<u>11.19</u>	<u>2.25</u>	<u>0.05</u>
Stack No. 3	301.68	7.24	<u>241.50</u>	<u>5.80</u>	<u>1.15</u>	<u>0.03</u>
Subtotal	936.72	22.48	<u>707.70</u>	<u>16.98</u>	<u>3.40</u>	<u>0.08</u>
Sundance Total	1,017.84	24.43	<u>949.91</u>	<u>22.80</u>	<u>5.17</u>	<u>0.12</u>

The other approved emission sources at the Keephills and Sundance plants will be unaffected by the Project. They are listed as follow:

Keephills Plant:

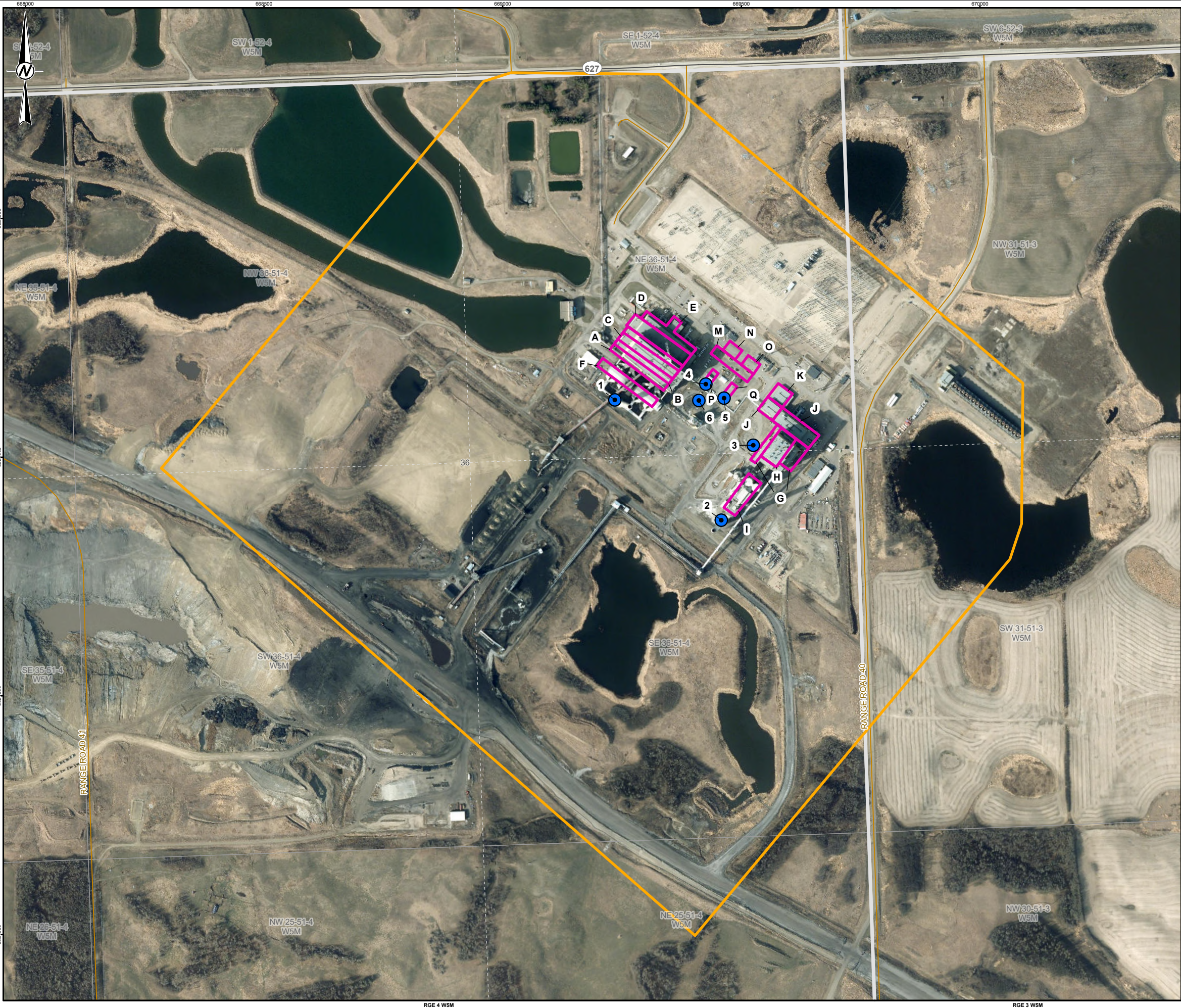
- Stack No. 1
- Stack No. 2
- Unit 3 Auxiliary Boiler Stack

Sundance Plant:

- Stack No. 2
- Stack No. 3

A summary of the approved emission sources' NO_x, CO and PM_{2.5} emissions at the Keephills and Sundance plants is presented in Table 5-1. Details on the emission rates and stack parameters of the approved Keephills and Sundance sources are presented in Attachment B. Overall, the Project will increase the NO_x emissions at Keephills and Sundance by 34.1% and 8.7%, respectively.

The stack and buildings at Keephills and Sundance are shown in Figures 5-1 and 5-2, respectively. The height of buildings at Keephills and Sundance included in the modelling are presented in these figures.



LEGEND

SECONDARY HIGHWAY

LOCAL ROAD

BUILDING

KEEPPHILLS PLANT BOUNDARY

POINT SOURCE

STACK

ID	Stack	Height (m)
1	Stack No.1	138.6
2	Stack No.2	138.0
3	Keephills 3 Auxiliary Boiler	35.1
4	Keephills 1 Repowering HRSG Stack 1	40.0
5	Keephills 1 Repowering HRSG Stack 2	40.0
6	Keephills 1 Repowering Auxiliary Boiler Stack	39.6

ID	Building	Tier	Height (m)
A	K1 & 2 Powerhouse	1	21.0
B	K1 & 2 Powerhouse	2	54.0
C	K1 & 2 Powerhouse	3	68.0
D	K1 & 2 Powerhouse	4	30.0
E	K1 & 2 Powerhouse	5	15.0
F	K1 & 2 Precipitator Building	1	21.0
G	K3 Boiler House	1	34.5
H	K3 Boiler House	2	73.1
I	K3 Scrbber Building	1	34.5
J	K3 Turbine Hall	1	34.5
K	K3 Building 3	1	16.0
L	K3 Building 4	1	8.0
M	K1 Repowering Turbine Building	1	25.2
N	K1 Repowering Turbine Building	2	13.4
O	K1 Repowering Turbine Building	3	13.4
P	K1 Repowering HRSG Building 1	1	25.2
Q	K1 Repowering HRSG Building 2	1	25.2

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PROJECTED COORDINATE SYSTEM: NAD 1983 UTM ZONE 11N

CLIENT

transalta

PROJECT

KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

KEEPPHILLS EMISSION SOURCES AND BUILDINGS

CONSULTANT



WSP

YYYY-MM-DD

2025-12-09

DESIGNED

DC

PREPARED

BS / PRR

REVIEWED

TJ

APPROVED

DC

PROJECT NO.

CONTROL

REV.

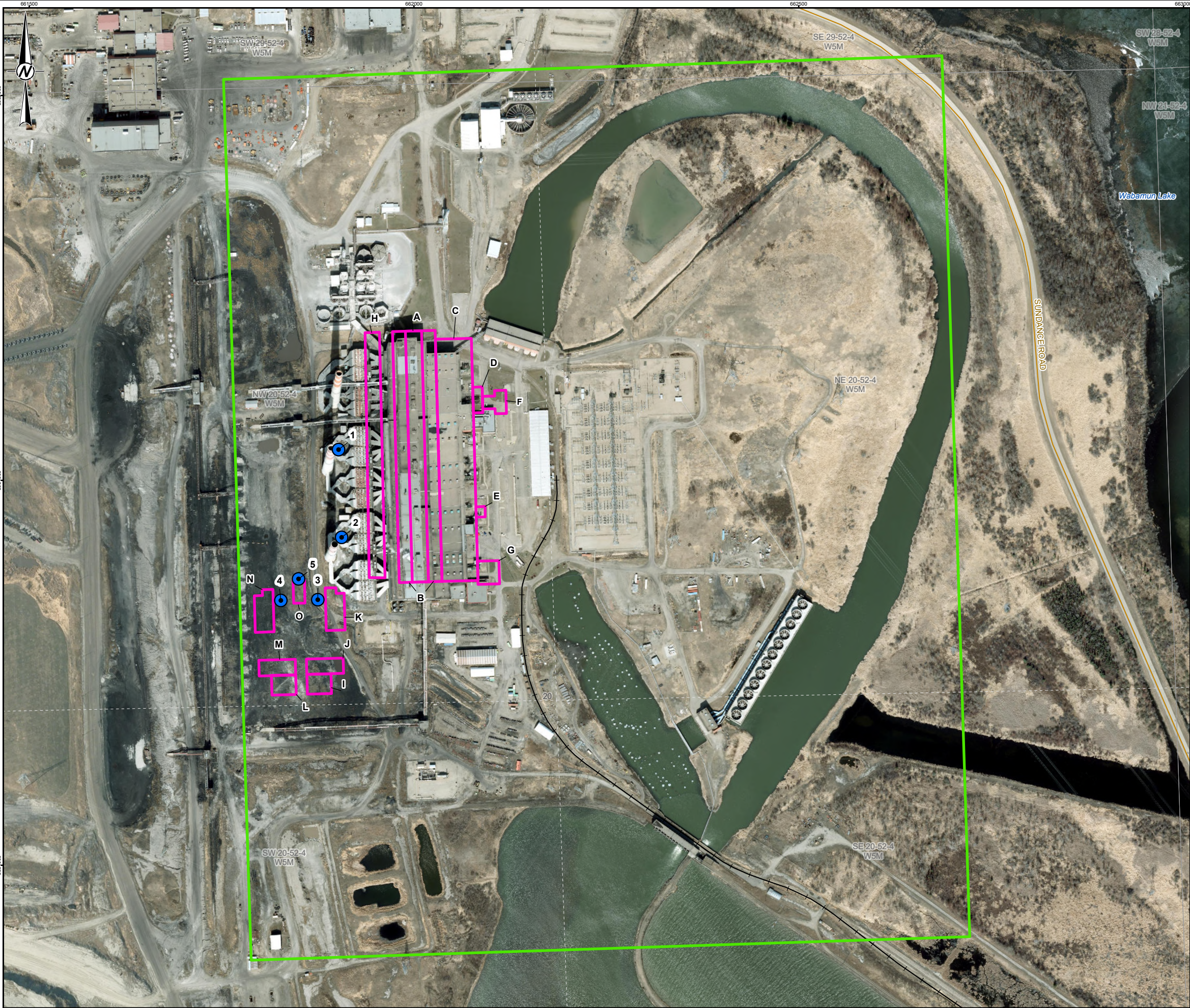
0

FIGURE

5-1

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LEGEND

RAILROAD

LOCAL ROAD

BUILDING

SUNDANCE PLANT BOUNDARY

POINT SOURCE

STACK

ID	Stack	Height (m)
1	Stack No.2	155.5
2	Stack No.3	155.5
3	Sundance 5 Repowering HRSG Stack 1	40.0
4	Sundance 5 Repowering HRSG Stack 2	40.0
5	Sundance 5 Repowering Auxiliaby Boiler Stack	39.6

ID	Building	Tier	Height (m)
A	Powerhouse	1	66.9
B	Powerhouse	2	53.5
C	Powerhouse	3	33.4
D	Powerhouse	4	20.1
E	Powerhouse	5	20.1
F	Powerhouse	6	8.9
G	Powerhouse	7	8.9
H	Precipitator Building	1	20.1
I	S5 Turbine Building 1	1	13.4
J	S5 Turbine Building 1	2	25.2
K	S5 HRSG Building 1	1	25.2
L	S5 Turbine Building 2	1	13.4
M	S5 Turbine Building 2	2	25.2
N	S5 HRSG Building 2	1	25.2
O	S5 Auxiliaby Boiler Building	1	10

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PROJECTED COORDINATE SYSTEM: NAD 1983 UTM ZONE 11N

CLIENT
transalta

PROJECT
KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE
SUNDANCE EMISSION SOURCES AND BUILDINGS

CONSULTANT	YYYY-MM-DD	2025-12-09
	DESIGNED	DC
	PREPARED	BS / PRR
	REVIEWED	TJ
	APPROVED	DC

PROJECT NO. CONTROL
CA0060761.5444

REV.
0

FIGURE
5-2

5.2 Regional Emissions

The AQMG specifies that all industrial emission sources within a minimum of 5 km from the assessed project must be included when conducting a cumulative modelling assessment (AEPA 2021). Given the large number of industrial emission sources in the region, industrial emissions sources located within approximately 35 km of the Project were considered for this assessment.

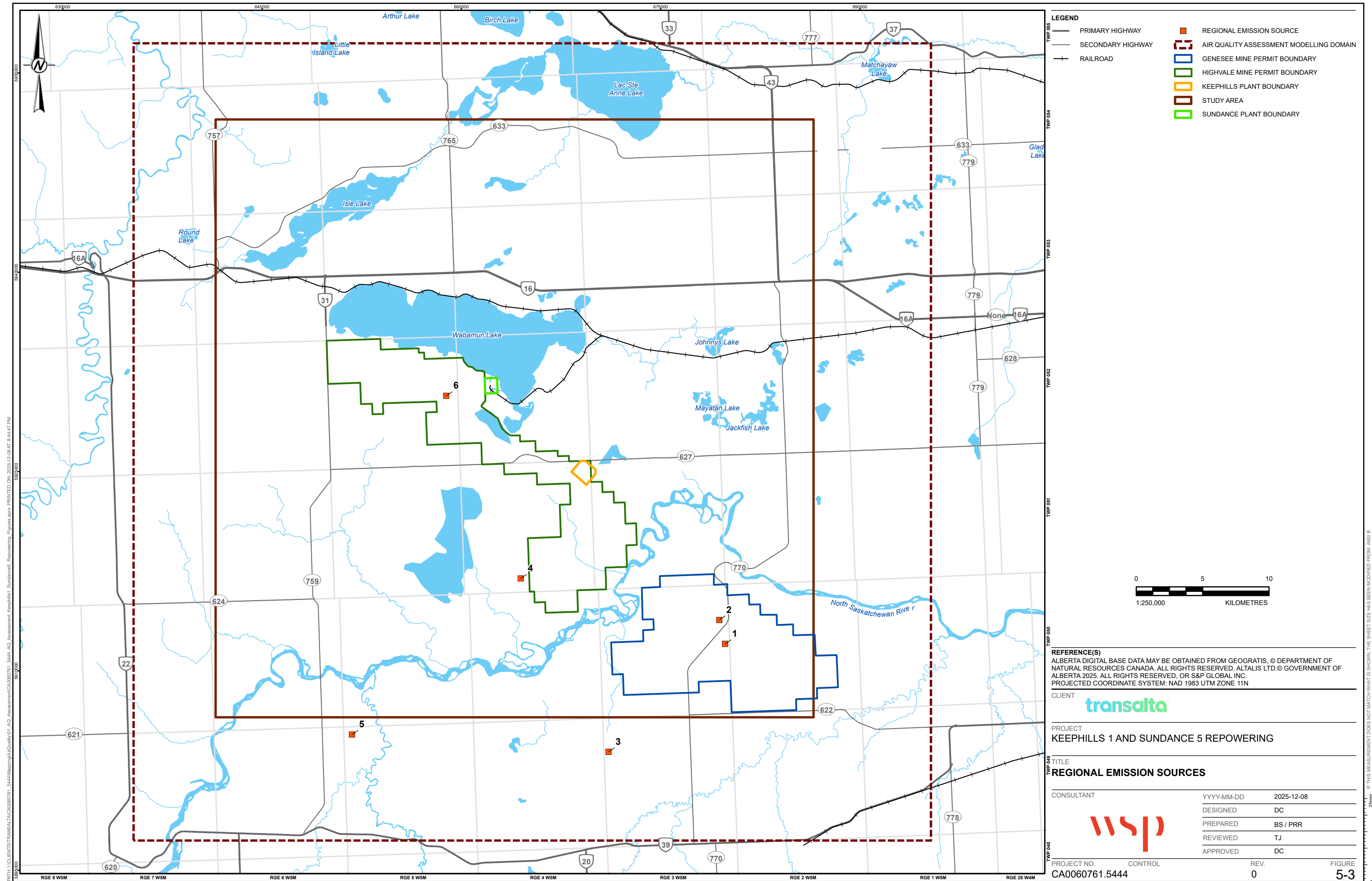
Regional emissions were obtained from Annual Emissions Inventory Report (AEIR) for 2022 Reporting Year published by AEPA (AEPA 2024b).

The regional emissions included in the dispersion modelling are listed in Table 5-2, and the general locations of these regional emission sources are presented on Figure 5-3.

Table 5-2: Regional Development Emission Summary

Figure 5-3 ID	Owner	Project Name	NO _x Emissions (t/d)		
			NO _x	CO	PM _{2.5}
1	Capital Power Generation Services Inc.	Genesee Coal Mine	0.819	<u>0.366</u>	<u>0.094</u>
2	Capital Power Generation Services Inc.	Genesee Generating Station Thermal Electric Power Plant	60.936	<u>66.353</u>	<u>3.337</u>
3	Journey Energy Inc.	Genesee Sour Gas Processing Plant	0.517	<u>0.372</u>	<u>0.024</u>
4	New Star Energy Ltd.	Highvale Sour Gas Plant	2.504	<u>1.281</u>	<u>0.071</u>
5	Ricochet Oil Corp.	Berrymoor Sour Gas Processing Plant	0.223	<u>0.147</u>	<u>0.002</u>
6	TransAlta Corporation	Highvale Coal Mine	0.181	<u>0.063</u>	<u>0.027</u>
		Total	65.181	<u>68.581</u>	<u>3.550</u>

All regional emission sources were modelled at maximum operational levels. A detailed emission breakdown for the regional sources is provided in Attachment B, Section B4.0.



6 DISPERSION MODELLING PREDICTIONS

This section presents the predicted maximum ground-level concentrations for the Project Only Case and the Application Case.

The following comments summarize the approach for processing and analyzing dispersion model outputs:

- Hourly concentrations output from the dispersion model results in 8,760 hourly predictions (8,784 hours for leap-year) for each of the five years in the modelling period. Annual concentrations are processed from all hourly predictions.
- For the 1-hour averaging period, predicted concentrations can be high because of extreme, rare, and transient meteorological conditions and are considered outliers (AEPA 2021). To account for these outlier events, the eight highest 1-hour model predictions should be excluded when comparing with air quality criteria as specified in the AQMG (AEPA 2021). Therefore, the maximum concentrations for the 1-hour averaging period reflect the ninth-highest predicted concentration. All hourly concentrations are considered for annual concentrations.
- For comparison with the air quality criteria, the highest predicted (maximum) concentrations over the 5-year modelling period for each averaging period are used.
- Predicted maximum concentrations are evaluated for three areas of interest:
 - Keephills Boundary: predicted maximum concentrations along the Keephills boundary provide an evaluation potential of localized effects due to the Keephills emissions.
 - Sundance Boundary: predicted maximum concentrations along the Sundance boundary provide an evaluation potential of localized effects due to the Sundance emissions.
 - Overall: predicted maximum concentrations within the study area but outside of the Keephills and Sundance Boundary and regional emission source developed area boundaries, where public access is not restricted, and the air quality criteria apply. The overall predicted maximum concentration is used for comparison with the AAAQOs.

6.1 Predicted Ground-Level NO₂ Concentrations

The Project Only Case and the Application Case Maximum ground-level NO₂ concentration predictions based on Total Conversion Method (TCM) and Ozone Limited Method (OLM) are presented in Tables 6-1 and 6-2, respectively. Compliance with the AAAQOs is based on the OLM NO₂ predictions only. The TCM NO₂ predictions are only provided for information purposes as per the AQMG (AEPA 2021).

The OLM predictions are shown graphically in contour figures in Attachment C, Figures C-1 to C-4. Overall, the maximum NO₂ predictions are all in compliance with the AAAQOs for 1-hour and annual NO₂.

Table 6-1: Maximum Predicted Total Conversion Method Ground-Level NO₂ Concentrations

Averaging Period/Location	AAAQO (µg/m³)	Background Concentration (µg/m³)	Maximum Predicted Concentration (µg/m³)	
			Project Only Case	Application Case ^(a)
1-hour				
Overall ^(b)	N/A	18.2	247.1	445.7
Sundance Boundary			93.4	111.6
Keephills Boundary			222.0	240.3
Annual				
Overall ^(b)	N/A	5.7	7.9	18.5
Sundance Boundary			3.0	9.3
Keephills Boundary			7.9	14.9

(a) Application Case predictions include background concentration.

(b) Maximum predictions within the study area exclude predictions with the developed areas.

Table 6-2: Maximum Predicted Ozone Limited Method Ground-Level NO₂ Concentrations

Averaging Period/Location	AAAQO (µg/m³)	Background Concentration (µg/m³)	Maximum Predicted Concentration (µg/m³)	
			Project Only Case	Application Case ^(a)
1-hour				
Overall ^(b)	300	18.2	105.2	187.4
Sundance Boundary			84.1	102.3
Keephills Boundary			111.2	129.4
Annual				
Overall ^(b)	45	5.7	6.3	13.2
Sundance Boundary			2.7	8.9
Keephills Boundary			6.4	13.2

(a) Application Case predictions include background concentration.

(b) Maximum predictions within the study area exclude predictions with the developed areas.

6.2 Predicted Ground-Level CO Concentrations

The Project Only Case and the Application Case Maximum ground-level CO concentration predictions are presented in Table 6-3. The CO predictions are shown graphically in contour figures in Attachment C, Figures C-5 to C-8. Overall, the maximum CO predictions are all in compliance with the AAAQOs for 1-hour and 8-hour CO.

Table 6-3: Maximum Predicted CO Concentrations

<u>Averaging Period/Location</u>	<u>AAAQO (µg/m³)</u>	<u>Background Concentration (µg/m³)</u>	<u>Maximum Predicted Concentration (µg/m³)</u>	
			<u>Project Only Case</u>	<u>Application Case^(a)</u>
<u>1-hour</u>				
<u>Overall^(b)</u>	<u>15,000</u>	<u>269.4</u>	<u>279.2</u>	<u>859.2</u>
<u>Sundance Boundary</u>			<u>279.2</u>	<u>548.7</u>
<u>Keephills Boundary</u>			<u>213.7</u>	<u>483.3</u>
<u>8-hour</u>				
<u>Overall^(b)</u>	<u>6,000</u>	<u>268.2</u>	<u>179.2</u>	<u>726.4</u>
<u>Sundance Boundary</u>			<u>181.7</u>	<u>449.9</u>
<u>Keephills Boundary</u>			<u>174.6</u>	<u>442.9</u>

(a) Application Case predictions include background concentration.

(b) Maximum predictions within the study area exclude predictions with the developed areas.

6.3 Predicted Ground-Level PM_{2.5} Concentrations

The Project Only Case and the Application Case Maximum ground-level PM_{2.5} concentration predictions are presented in Table 6-4. The PM_{2.5} predictions are shown graphically in contour figures in Attachment C, Figures C-9 to C-12. Overall, the maximum PM_{2.5} predictions are all in compliance with the AAAQG and AAAQO for PM_{2.5}.

Table 6-4: Maximum Predicted Ground-Level PM_{2.5} Concentrations

<u>Averaging Period/Location</u>	<u>AAAQG/AAAQO (µg/m³)</u>	<u>Background Concentration (µg/m³)</u>	<u>Maximum Predicted Concentration (µg/m³)</u>	
			<u>Project Only Case</u>	<u>Application Case^(a)</u>
<u>1-hour</u>				
<u>Overall^(b)</u>	<u>80</u>	<u>12.8</u>	<u>2.4</u>	<u>57.5</u>
<u>Sundance Boundary</u>			<u>2.4</u>	<u>15.4</u>
<u>Keephills Boundary</u>			<u>1.6</u>	<u>16.2</u>
<u>24-hour</u>				
<u>Overall^(b)</u>	<u>29</u>	<u>12.2</u>	<u>0.9</u>	<u>26.9</u>
<u>Sundance Boundary</u>			<u>0.9</u>	<u>13.1</u>
<u>Keephills Boundary</u>			<u>0.7</u>	<u>13.4</u>

(a) Application Case predictions include background concentration.

(b) Maximum predictions within the study area exclude predictions with the developed areas.

7 CONCLUSIONS

An air quality assessment was conducted to quantify the potential air emission and air quality changes associated the K1 and S5 repowering units. Air dispersion modelling was completed using CALPUFF model and a 5-year (2015-2019) meteorological dataset to predict the potential changes to the maximum ground-level NO₂, [CO](#) and [PM_{2.5}](#) concentrations. The maximum predictions were compared with the [applicable](#) AAAQOs [and](#) [AAAQG](#). The maximum ground concentrations predictions are in compliance with the [applicable](#) AAAQOs [and](#) [AAAQG](#).

Signature Page

WSP Canada Inc.

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TJ/DC/jlb

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ATTACHMENT A

CALMET and CALPUFF Model Settings

A1 INTRODUCTION

This attachment provides an overview of the air dispersion modelling approach and model input options used in the air quality assessment. CALPUFF dispersion model (Version 7.2.1) was selected for this assessment because it is an approved dispersion model under the AQMG, and it is also the model used in recent air quality assessments for Keephills (TransAlta 2019, 2024) and Sundance (TransAlta 2019).

The CALPUFF modelling system consists of three main components and a set of preprocessing and postprocessing programs. The main components of the modeling system are CALMET (a diagnostic 3-dimensional meteorological model), CALPUFF (an air dispersion model), and CALPOST (a postprocessing package).

A2 CALMET

The meteorological data used by the CALPUFF dispersion model in this air quality assessment were created using the CALMET model (Version 6.5), which was developed specifically for use with the CALPUFF model, and the MMEU2 tool provided by the AEPA. The CALMET modelling was completed over an area of 60 km by 60 km, as shown in Figure A1. The CALMET domain was selected to cover monitoring stations and communities of interest to the west and north and is therefore not centred on the Project. A grid spacing of 1 km was used to characterize the CALMET modelling domain.

Table B1 presents a detailed summary of the CALMET model input options used to generate the meteorological dataset to support the dispersion modelling completed for the assessment. The default modelling options used in the CALMET model are those required by the AQMG. The highlighted values in Table A-1 indicate non-default and/or alternate model options specified in Appendix D of the AQMG (AEPA 2021).

TERRAD, which is a CALMET Group 5 input parameter representing the radius of influence of terrain features, was set to 4 km. TERRAD can be estimated by taking the typical peak-to-valley distance for terrain features in the domain (RWDI 2008). A smaller TERRAD setting (4 km) will help capture the local terrain effects by giving more weight to localized changes in terrain.

Table A-1: CALMET Model Input Options

Input Group	Parameter	Default	Project	Description
Group 1 – General Run Control Parameters	IBYR	-	2015	starting year
	IBMO	-	1	starting month
	IBDY	-	1	starting day
	IBHR	-	0	starting hour
	IBSEC	-	0	starting second
	IEYR	-	2019	ending year
	IEMO	-	12	ending month
	IEDY	-	31	ending day
	IEHR	-	23	ending hour
	IESEC	-	3600	ending second
	ABTZ	-	UTC-0700	UTC time zone (Mountain Standard Time)
	NSECDT	3600	3600	length of modelling time step (seconds)
	IRTYPE	1	1	run type – computes wind fields and micrometeorological variables
	LCALGRD	T	T	do not compute special data fields required by CALGRID
	ITEST	2	2	continues with execution of computational phase after setup
	MREG	-	0	no checks for conformance with U.S. EPA guidance
Group 2 – Map Projection and Grid Control Parameters	PMAP	UTM	UTM	map projection = Universal Transverse Mercator
	FEAST	0	-	false easting at the projection origin - not used when PMAP = UTM
	FNORTH	0	-	false northing at the projection origin - not used when PMAP = UTM
	IUTMZN	-	11	UTM zone
	UTMHEM	N	N	northern hemisphere projection
	RLAT0	-	40N	latitude of projection origin – not used when PMAP = UTM
	RLON0	-	90W	longitude of projection origin – not used when PMAP = UTM
	XLAT1	-	30N	matching parallel(s) of latitude for projection – not used when PMAP = UTM
	XLAT2	-	60N	matching parallel(s) of latitude for projection – not used when PMAP = UTM
	DATUM	WGS-84	NAR-C	datum region for output coordinates = NAR-C North American 1983 GRS 80 Spheroid
	NX	-	56	number of X grid cells

Table A-1: CALMET Model Input Options

Input Group	Parameter	Default	Project	Description
Group 3 – Output Options	NY	-	51	number of Y grid cells
	DGRIDKM	-	1.0	grid spacing (km)
	XORIGKM	-	647.400	X coordinate of southwest corner of domain (km)
	YORIGKM	-	5891.830	Y coordinate of southwest corner of domain (km)
	NZ	-	12	number of vertical layers
	ZFACE	-	0.,20.,40.,80.,120., 280.,520.,880., 1320.,1820.,2380., 3000.,4000	cell face heights in vertical grid (m)
	LSAVE	T	T	save meteorological fields in an unformatted output file
	IFORMO	1	1	CALPUFF/CALGRID type of unformatted output file
	LPRINT	F	F	do not print meteorological fields
	IPRINF	1	1	print interval (hours)
	IUVOUT	NZ*0	NZ*0	layers of U, V wind component to print (0=no, 1=yes)
	IWOUT	NZ*0	NZ*0	levels of W wind component to print (0=no, 1=yes)
	ITOUT	NZ*0	NZ*0	I (0=no, 1=yes)
	STABILITY	0	0	do not print PGT stability class
	USTAR	0	0	do not print friction velocity
	MONIN	0	0	do not print Monin-Obukhov length
	MIXHT	0	0	do not print mixing height
	WSTAR	0	0	do not print convective velocity scale
	PRECIP	0	0	do not print precipitation rate
	SENSHEAT	0	0	do not print sensible heat flux
	CONVZI	0	0	do not print convective mixing height
	LDB	F	F	do not print input meteorological data and internal variables
	NN1	1	1	first time step for which debug data are printed
	NN2	1	1	last time step for which debug data are printed
	LDBCST	F	F	do not print distance to land internal variables
	IOUTD	0	0	control variable for writing the test/debug wind fields to disk files
	NZPRN2	1	0	number of levels to print
	IPR0 to IPR8	0	0	do not print wind field components after each adjustment

Table A-1: CALMET Model Input Options

Input Group	Parameter	Default	Project	Description
Group 4 – Meteorological Data Options	NOOBS	1	1	use NOOBS = 1 when blending ground data into ESRD provided meteorological data per AQMG
	NSSTA	-	8	number of surface stations
	NPSTA	-	7	use of precipitation data from available stations
	MCLOUD	0	4	gridded cloud cover from Prognostic Rel. Humidity at all levels (MM5toGrads algorithm)
	IFORMS	2	2	free-formatted user input for surface meteorological data file format
	IFORMP	2	2	free-formatted user input for precipitation data file format
	IFORMC	2	2	formatted - free-formatted CALMET output or user input for cloud data
Group 5 – Wind Field Options and Parameters	IWFCOD	1	1	diagnostic wind module
	IFRADJ	1	1	compute Froude number adjustment effects
	IKINE	0	0	do not compute kinematic effects
	IOBR	0	0	do not use O'Brien procedure for adjustment of the vertical velocity
	ISLOPE	1	1	compute slope flows
	IEXTRP	-4	-4	similarity theory used to extrapolate surface wind observations to upper layers except layer 1 data at upper air stations are ignored
	ICALM	0	0	do not extrapolate surface winds if calm
	BIAS	NZ*0	NZ*0	layer-dependent biases for modifying the weights of surface and upper air stations
	RMIN2	4	4	minimum distance from nearest upper air station to surface station for which extrapolation of surface winds at surface station will be allowed. Set to -1 when all surface stations should be extrapolated
	IPROG	0	14	winds from MM5/M3D.dat used as initial guess field
	ISTEPPG	3600	3600	timestep of the prognostic model input data (seconds)
	IGFMET	0	0	do not use CALMET fields as initial guess fields
	LVARV	F	F	use varying radius of influence
	RMAX1	-	8	maximum radius of influence over land in the surface layer (km), set to twice the resolution of the MM5 dataset.
	RMAX2	-	8	maximum radius of influence over land aloft (km), set to twice the resolution of the MM5 dataset.
	RMAX3	-	8	maximum radius of influence over water, set to twice the resolution of the MM5 dataset.
	RMIN	0.1	0.1	Minimum radius of influence used in the wind field interpolation
	TERRAD	-	4	radius of influence of terrain features, value based on approximate dimensions of key terrain features

Table A-1: CALMET Model Input Options

Input Group	Parameter	Default	Project	Description
Group 5 - continued	R1	-	2	relative weighting of the first guess field and observations in the surface layer (km), set to one half of the resolution of the MM5 dataset.
	R2	-	2	relative weighting of the first guess field observations in the layers aloft (km), set to one half of the resolution of the MM5 dataset.
	RPROG	-	0	relative weighting parameter of the prognostic wind field data (km). Used only if IPROG=1.
	DIVLIM	0.000005	0.000005	maximum acceptable divergence in the divergence minimization procedure
	NITER	50	50	maximum number of iterations in the divergence minimization procedure
	NSMTH	2, (mxnz-1)* 4	2,4,4,4,4,4,4,4,4, 4,4	number of passes in the smoothing procedure
	NINTR2	99	99, 99, 99, 99, 99, 99, 99, 99, 99, 99, 99, 99	maximum number of stations used in each layer for the interpolation of data to a grid point
	CRITFN	1	1	critical Froude number
	ALPHA	0.1	0.1	empirical factor controlling the influence of kinematic effects
	FEXTR2	NZ*0	NZ*0	multiplicative scaling factor for extrapolation of surface observations to upper layers. Used only if IEXTRP = 3 or -3.
	NBAR	0	0	number of barriers to interpolation of the wind fields
	XBBAR	-	0	X coordinate of BEGINNING of each barrier
	YBBAR	-	0	Y coordinate of BEGINNING of each barrier
	XEBAR	-	0	X coordinate of ENDING of each barrier
	YEBAR	-	0	Y coordinate of ENDING of each barrier
	IDIOPT1	0	0	compute surface temperature internally from hourly surface observations
	ISURFT	-1	-1	surface meteorological station to use for the surface temperature
	IDIOPT2	0	0	compute domain-averaged temperature lapse rate internally from twice-daily upper air observations
	IUPT	-1	-1	use a domain-average prognostic lapse rate
	ZUPT	200	200	depth through which the domain-scale lapse rate is computed
	IDIOPT3	0	0	compute domain-averaged wind components internally from twice-daily upper air observations
	IUPWIND	-1	-1	upper air station to use for the domain-scale winds
	ZUPWIND	1, 1000	1, 1000	bottom and top of layer through which the domain-scale winds are computed
	IDIOPT4	0	0	read wind speed and wind direction from a surface data file for observed surface wind components for wind field module

Table A-1: CALMET Model Input Options

Input Group	Parameter	Default	Project	Description
Group 5 - continued	IDIOPT5	0	0	read WS and WD from an upper air data file for observed upper air wind components for wind field module
	LLBREZE	F	F	do not use lake breeze module
	NBOX	0	0	Number of lake breeze regions
	XG1	0	0	X grid line 1 defining the region of interest
	XG2	0	0	X grid line 2 defining the region of interest
	YG1	0	0	Y grid line 1 defining the region of interest
	YG2	0	0	Y grid line 2 defining the region of interest
	XBCST	0	0	X point defining the coastline
	YBCST	0	0	Y point defining the coastline
	XECST	0	0	X point defining the coastline
	YECST	0	0	Y point defining the coastline
	NLB	0	0	Number of stations in the region
Group 6 – Mixing Height, Temperature and Precipitation Parameters	CONSTB	1.41	1.41	constant for neutral mechanical equation
	CONSTE	0.15	0.15	constant for convective mixing height equation
	CONSTN	2400	2,400	constant for stable mixing height equation
	CONSTW	0.16	0.16	constant for overwater mixing height equation
	FCORIOL	0.0001	0.0001	absolute value of Coriolis parameter
	IAVEZI	1	1	conduct spatial averaging of mixing heights
	MNMDAV	1	10	maximum search radius in averaging process (grid cells)
	HAFANG	30	30	half-angle of upwind looking cone for averaging
	ILEVZI	1	1	layer of winds used in upwind averaging
	IMIXH	1	1	convective mixing height option = Maul-Carson for land and water cells
	THRESHL	0	0	threshold buoyancy flux required to sustain convective mixing height growth overland (expressed as a heat flux per metre of boundary layer W/m ³)
	THRESHW	0.05	0.05	threshold buoyancy flux required to sustain convective mixing height growth overwater (expressed as a heat flux per metre of boundary layer W/m ³)
	ITWPROG	0	0	use SEA.DAT lapse rates and delta T or assume neutral conditions if missing
	ILUOC3D	16	16	land use category ocean in 3D.dat datasets
	DPTMIN	0.001	0.001	minimum potential temperature lapse rate in the stable layer above the current convective mixing height (K/m)
	DZZI	200	200	depth of layer above current convective mixing height through which lapse rate is computed
	ZIMIN	50	50	minimum overland mixing height (m)

Table A-1: CALMET Model Input Options

Input Group	Parameter	Default	Project	Description
Group 6 - Continued	ZIMAX	3,000	3,000	maximum overland mixing height (m)
	ZIMINW	50	50	minimum overwater mixing height (m)
	ZIMAXW	3,000	3,000	maximum overwater mixing height (m)
	ICOARE	10	10	use COARE with no wave parameterization for overwater surface fluxes
	DSHELF	0	0	coastal/shallow water length scale (km) (COARE fluxes only)
	IWARM	0	0	COARE warm layer computation off
	ICOOL	0	0	COARE cool skin layer computation off
	IRHPROG	0	1	3D relative humidity from prognostic RH
	ITPROG	0	1	use Surface stations (no upper air observations), use MM5/M3D for upper air data
	IRAD	1	1	use 1/R for temperature interpolation
	TRADKM	500	8	radius of influence for temperature interpolation (km), set to twice the resolution of the MM5 dataset.
	NUMTS	5	5	maximum number of stations to include in temperature interpolation
	IAVET	1	1	conduct spatial averaging of temperatures
	TGDEFB	-0.0098	-0.0098	default temperature gradient below the mixing height over water (K/m)
	TGDEFA	-0.0045	-0.0045	default temperature gradient above the mixing height over water (K/m)
	JWAT1, JWAT2	-	999,999	beginning and ending land use categories for temperature interpolation over water
	NFLAGP	2	2	use 1/R2 for precipitation interpolation
	SIGMAP	100	100	radius of influence (km)
	CUTP	0.01	0.01	minimum precipitation rate cut-off (mm/hr)
Group 7 – Surface Meteorological Station Parameters	-	-	See Table A-2	surface meteorological station parameters
Group 8 – Upper Air Meteorological Station Parameters	-	-	-	upper air meteorological station parameters
Group 9 – Precipitation Station Parameters	-	-	-	precipitation station parameters

A2.1 CALMET Input

CALMET requires a variety of input data, and guidance on the required input data is provided in AQMG. Required input data includes:

- topography
- land use
- geophysical parameters and seasonality
- meteorological observation data

The MMEU2 tool makes use of the AEPA-provided topography data, land use data, and meteorological data to extract and create the seasonal geographical parameter data files (i.e., geo.dat), the meteorological input data files for CALMET and the template CALMET input files.

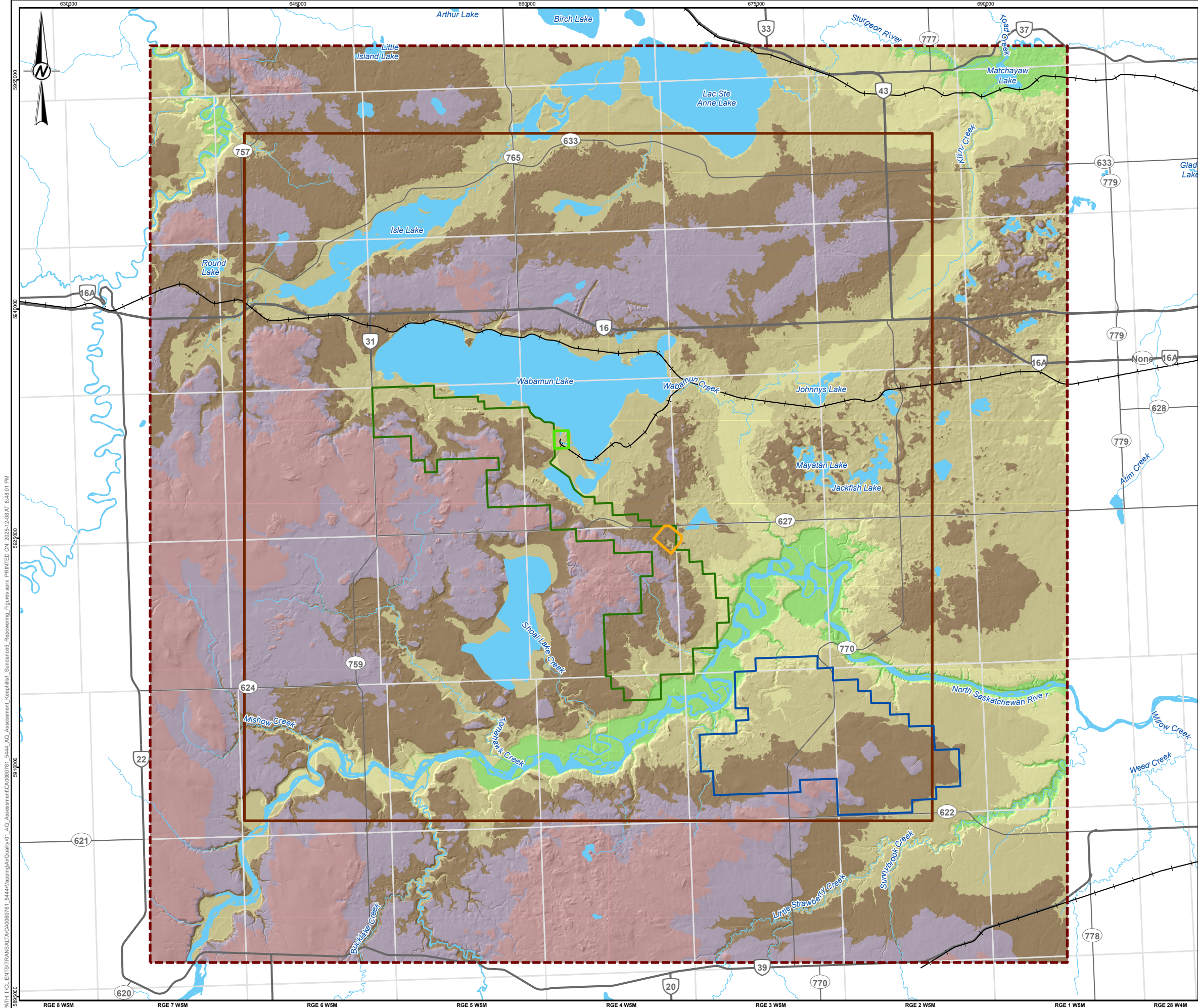
A2.1.1 Topography

The valleys and elevated terrain features in the CALMET domain can affect surface wind flow patterns. As shown in Figure A-1, the terrain in the CALMET domain is relatively flat and ranges from 650 to 850 masl. The North Saskatchewan River runs west to east along the southern half of the CALMET domain, and its valley is the lowest elevation within the domain. The highest elevations are on the western edge of the CALMET domain. The predominant waterbody lies within the CALMET domain, Wabamun Lake, northwest of the Project.

A2.1.2 Land Use

The CALMET model inputs include surface geophysical parameters such as surface roughness length, albedo, Bowen ratio, leaf area index (LAI), soil heat flux, and anthropogenic heat flux. These surface parameters are used to estimate parameters such as surface heat flux and mechanical turbulence. The surface geophysical parameters are determined by the surface land use.

Land-use in the CALMET domain is dominated by cropland use, as shown in Figure A-2. Based on the 1-km grid resolution data, the CALMET modelling domain is comprised of 57% cropland, 17% temperate or sub-polar broadleaf deciduous forest land, 8% water, 6% mixed forest land, 4% urban land, 4% temperate or sub-polar shrubland, 3% temperate or sub-polar needle leaf forest, 1% barren land and 1 % temperate or sub-polar grassland.



LEGEND

PRIMARY HIGHWAY

SECONDARY HIGHWAY

RAILROAD

WATERCOURSE

WATERBODY

AIR QUALITY ASSESSMENT MODELLING DOMAIN

GENESEE MINE PERMIT BOUNDARY

HIGHVALE MINE PERMIT BOUNDARY

KEEPPHILLS PLANT BOUNDARY

STUDY AREA

SUNDANCE PLANT BOUNDARY

TERRAIN ELEVATIONS AT 25 MASL INTERVALS

< 700

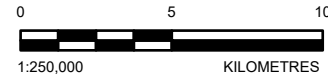
700 - 725

725 - 750

750 - 775

775 - 800

> 800



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PROJECTED COORDINATE SYSTEM: NAD 1983 UTM ZONE 11N

CLIENT

PROJECT
KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE
CALMET DOMAIN TERRAIN ELEVATIONS

CONSULTANT

YYYY-MM-DD	2025-12-08
DESIGNED	DC
PREPARED	BS / PRR
REVIEWED	TJ
APPROVED	DC

PROJECT NO.
CA0060761.5444

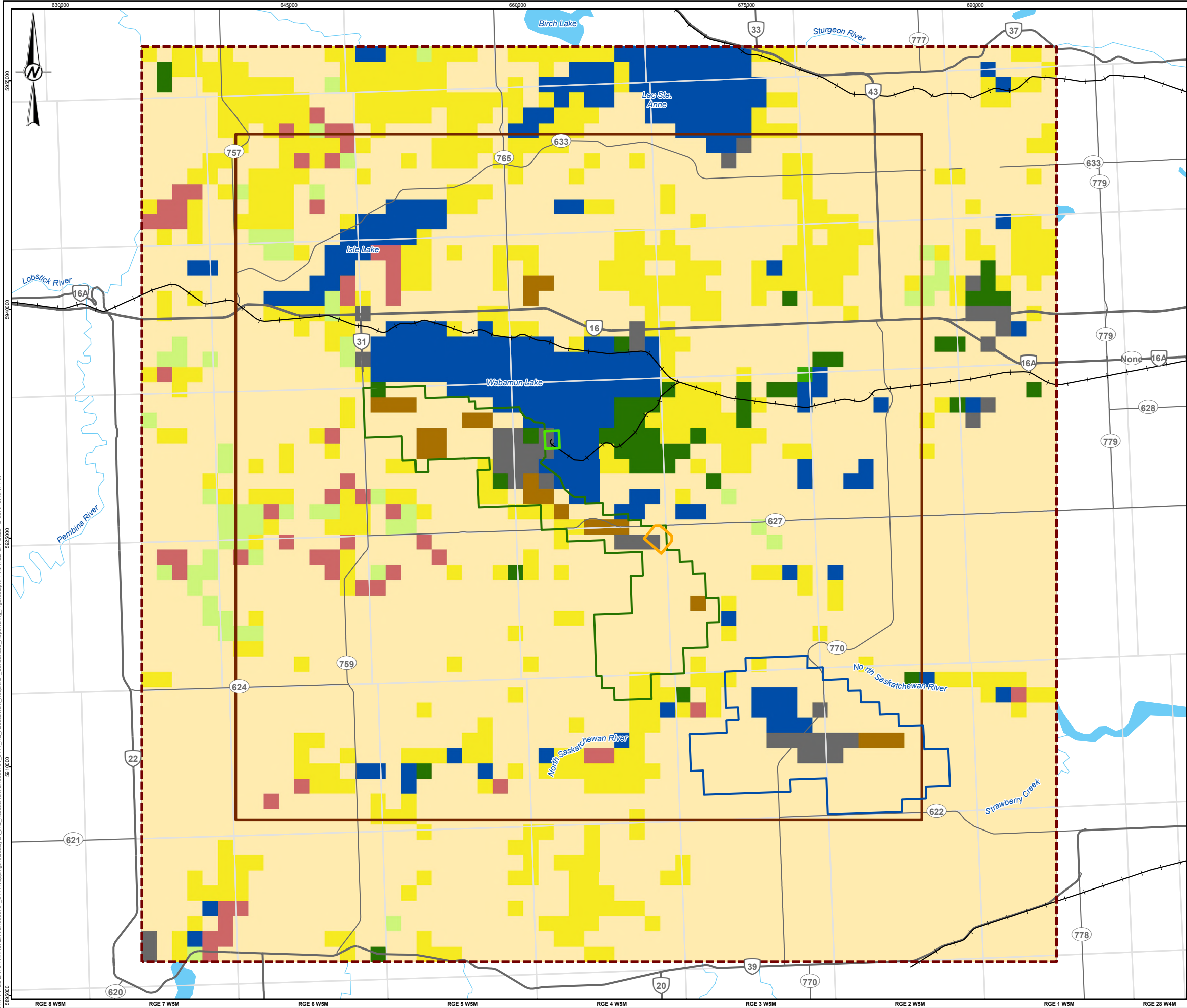
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REV.
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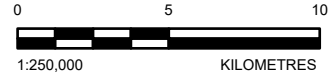
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A-1

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



- LEGEND**
- PRIMARY HIGHWAY
 - SECONDARY HIGHWAY
 - RAILROAD
 - WATERCOURSE
 - WATERBODY
 - AIR QUALITY ASSESSMENT MODELLING DOMAIN
 - GENESEE MINE PERMIT BOUNDARY
 - HIGHVALE MINE PERMIT BOUNDARY
 - KEEPHILLS PLANT BOUNDARY
 - STUDY AREA
 - SUNDANCE PLANT BOUNDARY
 - LAND USE CATEGORY**
 - BARREN
 - CROPLAND
 - MIXED FOREST
 - TEMPERATE OR SUB-POLAR BROADLEAF DECIDUOUS FOREST
 - TEMPERATE OR SUB-POLAR GRASSLAND
 - TEMPERATE OR SUB-POLAR NEEDLELEAF FOREST
 - TEMPERATE OR SUB-POLAR SHRUBLAND
 - URBAN
 - WATER



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PROJECTED COORDINATE SYSTEM: NAD 1983 UTM ZONE 11N

CLIENT
transalta

PROJECT
KEEPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE
CALMET DOMAIN LAND-USE CATEGORIES

CONSULTANT	YYYY-MM-DD	2025-12-08
DESIGNED	DC	
PREPARED	BS / PRR	
REVIEWED	TJ	
APPROVED	DC	

PROJECT NO. CONTROL
CA0060761.5444

REV. 0

FIGURE
A-2

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A2.1.3 Meteorological inputs

The CALMET model requires the input of surface, upper air, and precipitation meteorological data. Five 12-month meteorological data sets covering January 2015 through December 2019 were generated from AEPA's MMEU2 tool.

In addition, ECCC weather stations and local WCAS monitoring stations within or around the CALMET modelling domain were evaluated based on AQMG recommendations and the availability of temporally matching data for the modelling period (2015 to 2019). The stations listed in Table A-2 were selected for use in CALMET. All other stations were excluded due to inappropriate or missing data, e.g., no relative humidity data were available at Wagner2 station during the modelling period. No upper air and precipitation meteorological station data were used.

Table A-2: Surface Meteorological Station Parameters

Name	ID	X coordinate (km)	Y coordinate (km)	Time zone	Anem. Ht. (m)
EDSP	301001	691.452	5937.542	7	10
MDWS	175709	656.680	5933.831	7	10
TMHW	175822	648.445	5916.023	7	10

Anem. Ht. = Anemometer height; km = kilometer; m = meter; Coordinates are in Universal Transverse Mercator (UTM) NAD83 Zone 11.

A2.2 CALMET Output

Some of the main meteorological parameters from the CALMET output that influence air dispersion in CALPUFF are discussed in the following sections.

A2.2.1 Wind

The CALMET-derived winds for the Project sites are presented in Figures A-3 and A-4. The lengths of the bars on the windrose indicate the frequency and speed of wind and the direction from which the wind blows is illustrated by the orientation of the bar in one of 16 directions. Pre-dominant southwesterly winds were observed at Keephills (Figure A-3), followed by winds from north-northwest and northwest directions. Pre-dominant westerly winds were observed at Sundance (Figure A-4), with the most frequent winds blowing from a west-southwest direction, followed by winds from the west direction.

CALMET-derived winds for local air quality monitoring stations (Edmonton Stony Plain, Meadows, and Tomahawk stations) were also extracted and compared with the observed wind data (Figure A-5). The CALMET-derived windroses for the three locations are similar to the CALMET-derived windroses.

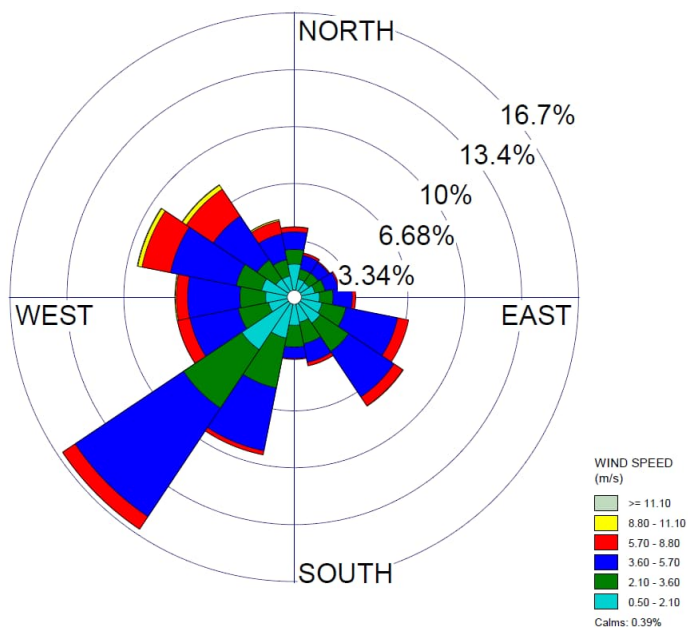


Figure A-3: CALMET-Derived Winds for the Keephills Site at 10 m Above Grade

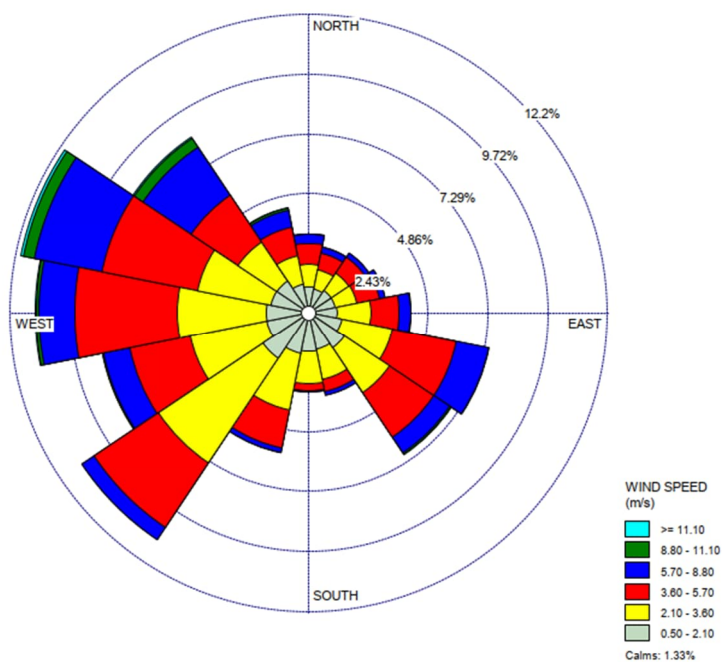


Figure A-4: CALMET-Derived Winds for the Sundance Site at 10 m Above Grade

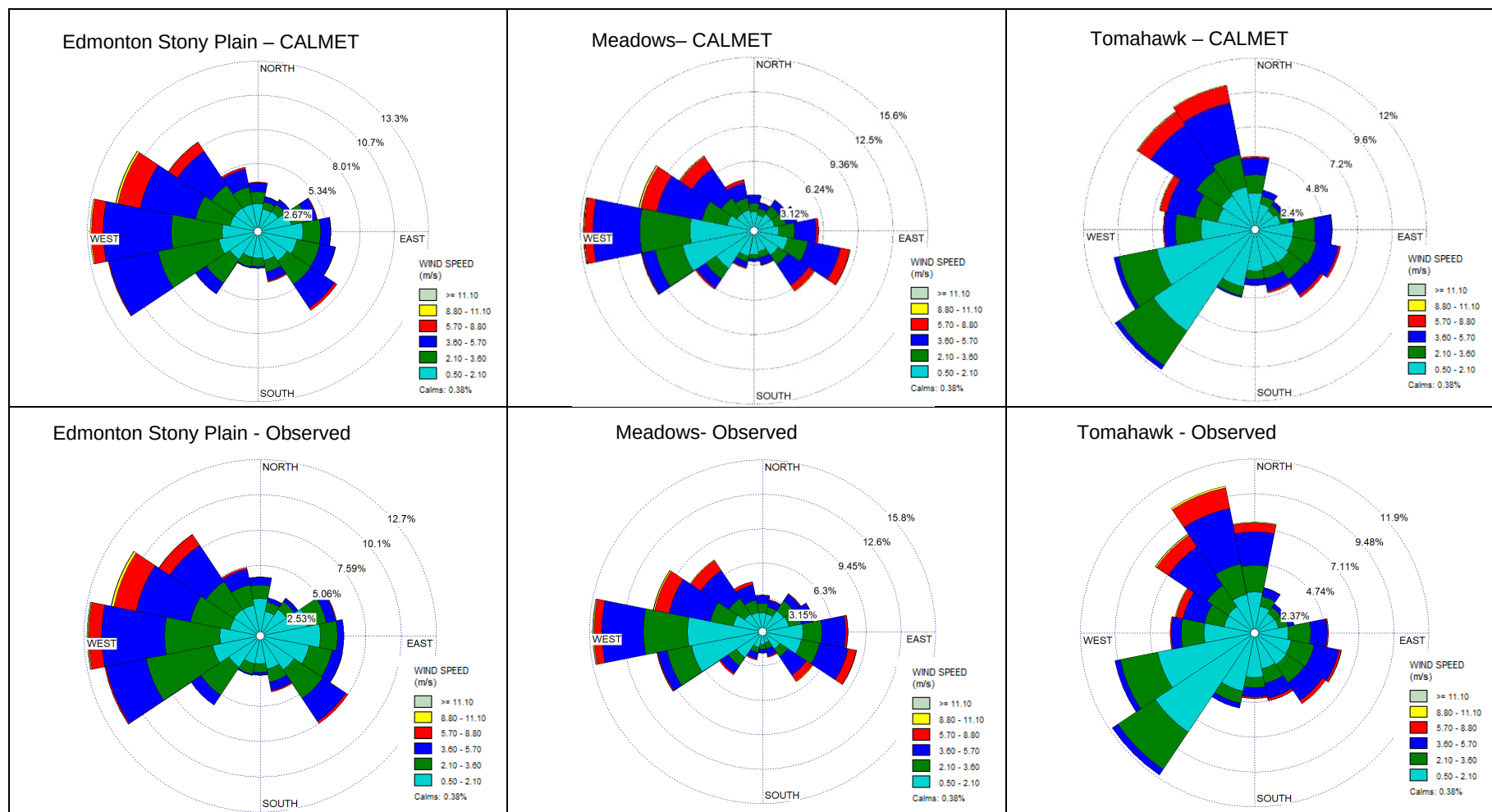


Figure A-5: CALMET-Derived Winds for and Observed Winds at Local Monitoring Stations

A2.2.2 Temperature

The CALMET-derived temperatures for the Project site (Keephills) are presented in Figure A-6. The daily average temperatures range from -9.8°C in February to +17.5°C in July.

Climate normals are used to describe the climate of a particular location. The closest meteorological station with climate data to the Project is the Edmonton Stony Plain station, located approximately 28 km northeast of the Project. The CALMET-derived temperatures are similar to the average climate conditions (climate normals) observed at Edmonton Stony Plain station (ECCC 2016).

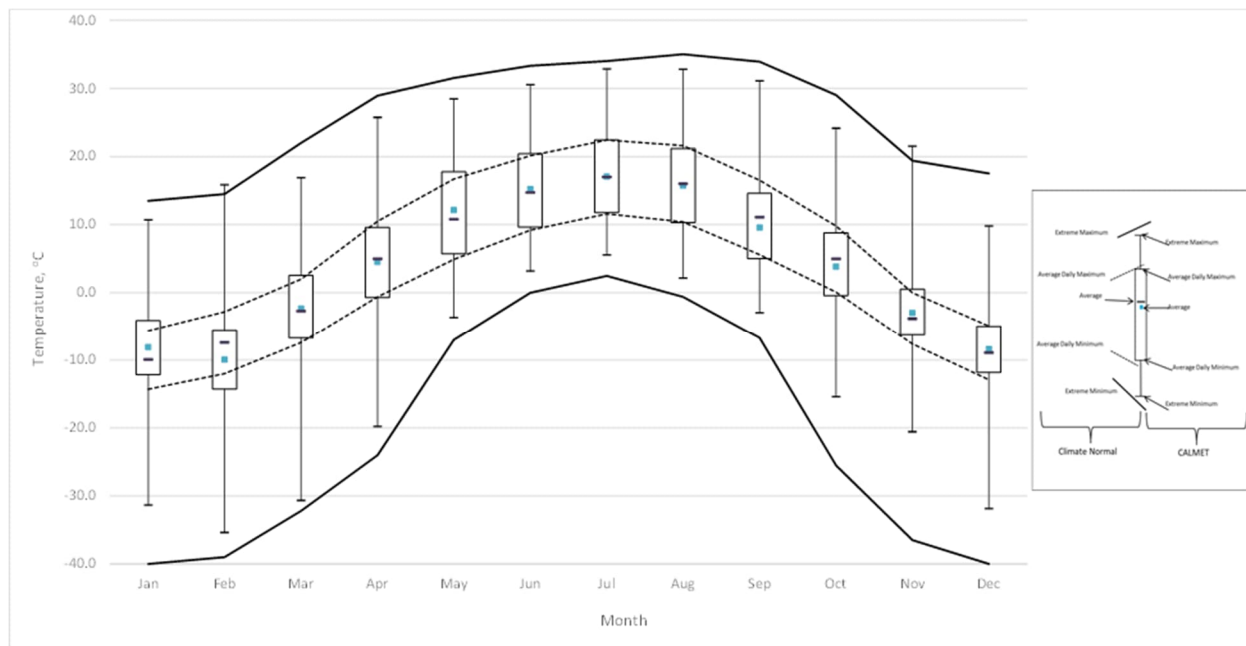


Figure A-6: CALMET-derived Temperature (2015-2019) and Climate Normal Temperature (1981-2010)

A2.2.3 Stability Class

Atmospheric stability can be viewed as a measure of the atmosphere's capability to disperse emissions. The amount of turbulence plays an important role in the dilution of a plume as it is transported by the wind. Turbulence can be generated by either thermal or mechanical mechanisms. Surface heating or cooling by radiation contributes to the generation or suppression of thermal turbulence, while high wind speeds contribute to the generation of mechanical turbulence.

The Pasquill-Gifford (PG) stability classification scheme is one classification of the atmosphere. The classification ranges from Unstable (Stability Classes A, B and C), Neutral (Stability Class D) to Stable (Stability Classes E and F). Unstable conditions are primarily associated with daytime heating conditions, which result in enhanced turbulence levels (enhanced dispersion). Stable conditions are associated primarily with nighttime cooling conditions, which result in suppressed turbulence levels (poorer dispersion). Neutral conditions are primarily associated with higher wind speeds or overcast conditions.

The stability conditions derived by CALMET at the Project site (Keephills) are summarized as follows:

- unstable (A, B and C) conditions occur 23% of the time
- neutral conditions (D) occur 40% of the time
- stable (E and F) conditions occur 37% of the time

As shown in Figure A-7, unstable classes follow a bell curve pattern where unstable conditions are more frequent during the day. Unstable conditions are less frequent at dawn because the heating of the surface has just begun to provide the necessary energy for the atmospheric conditions to be unstable. The solar heating peaks during mid-day, and the warmed air remains unstable. The heating declines in the late afternoon to evening, and the atmosphere starts to cool. This, in turn, changes the stability class from unstable to neutral to stable. At night, no solar radiation input is available, and the atmospheric condition is neutral or stable. Neutral conditions are most dominant at night between 19:00 and 05:00. Figure A-6 shows that the CALMET model prediction is consistent with what is expected of the stability class distribution from this region. This indicates that CALMET is predicting vertical movement as expected.

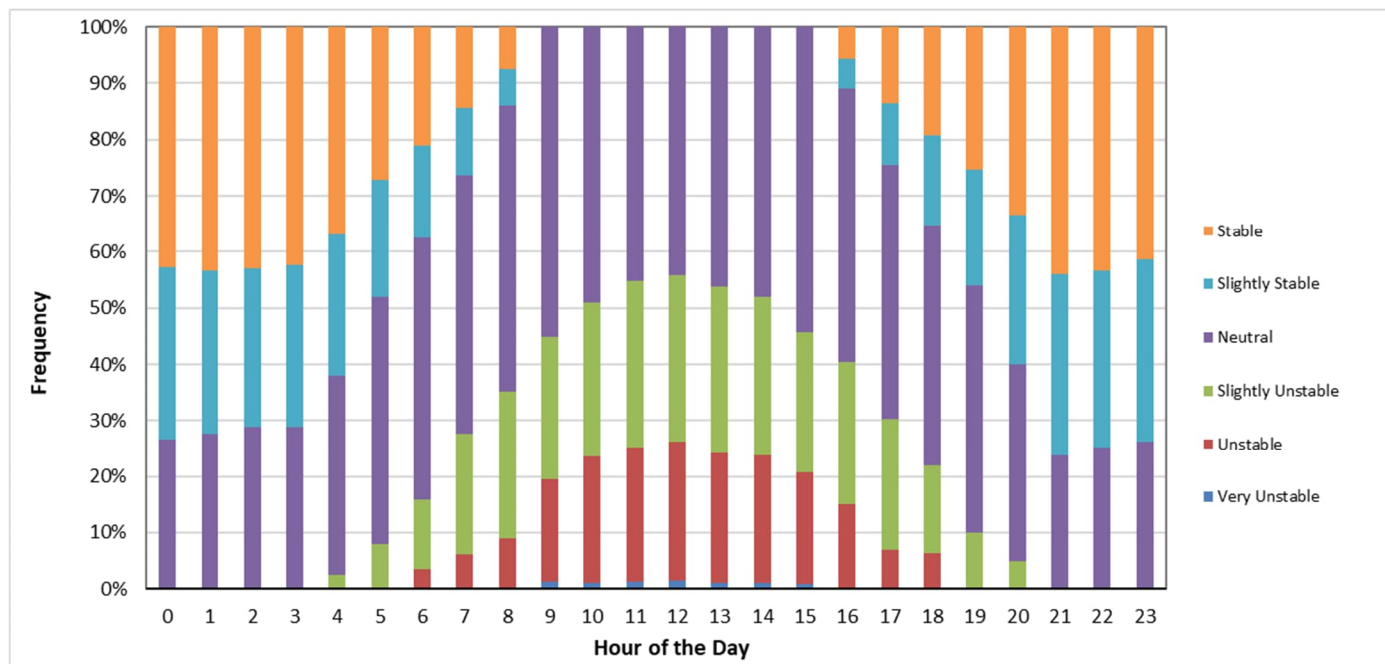


Figure A-7: Annual Frequencies of Occurrence of Unstable, Neutral, and Stable Conditions for Each Hour of the Day

A2.2.4 Mixing Height

Atmospheric events are driven by the heating and cooling of the earth's surface. The mixing layer is an important part of the dispersion meteorology because this zone of turbulence determines the vertical movement of air and the depth of this layer, referred to as the mixing height, bounds the upper limit of the vertical movement. The depth of mixed layer is a function of factors such as the heating and cooling of surface, sinking of cooled air, or surrounding terrain features. One strong driver of mixing height is the solar radiation energy. As the sun rises, the land is heated, and warm air rises, causing turbulence in air. As the day progresses, this continuous heating and the increase in intensity causes even more turbulence which expands the zone of turbulent air to expand, which also causes the mixing height to increase. The solar radiation energy peaks in the afternoon, but the heat input is still present at a weaker intensity. As the day progresses into evening, and night, the atmosphere begins to cool down, and the mixing height decreases. Therefore, the shallowest mixed depth is typically observed in the morning, right before dawn. This mixing height pattern described above matches the CALMET meteorological predictions, shown in Figure A-8.

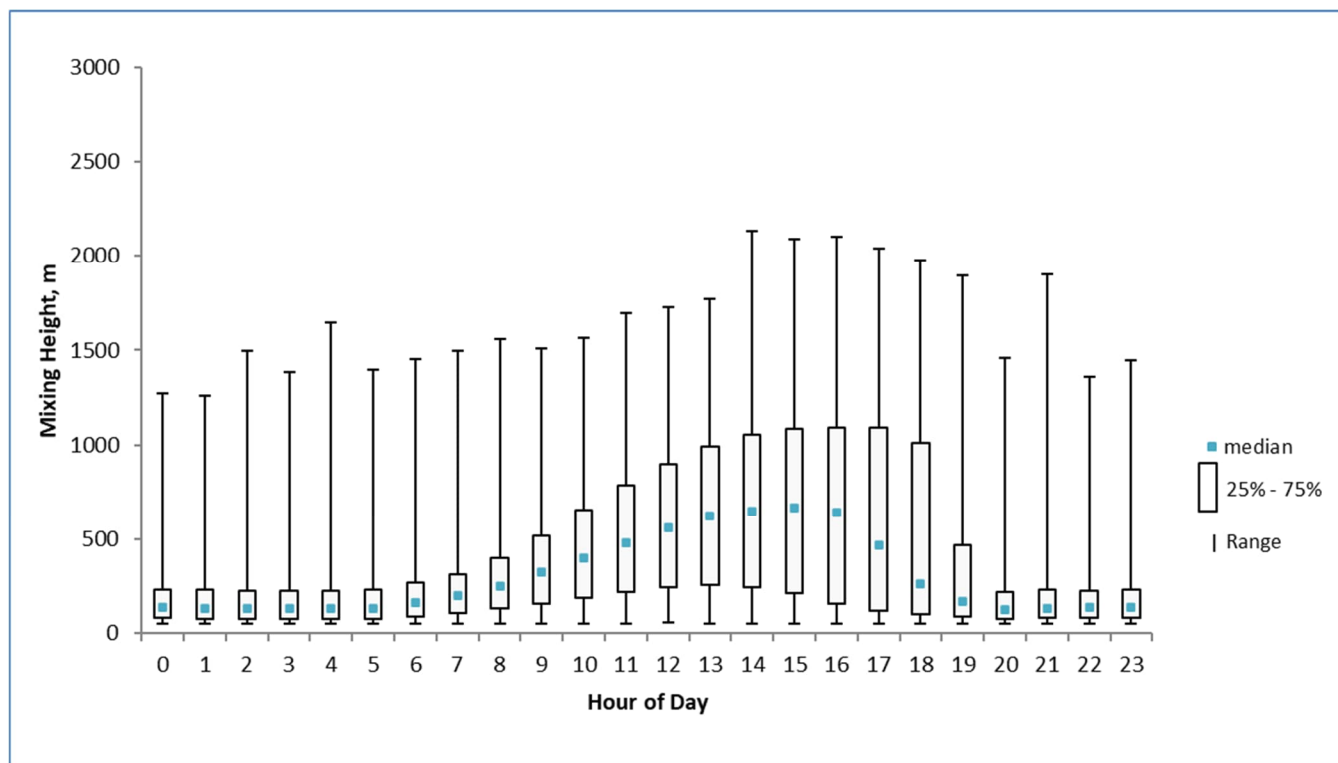


Figure A-8: Frequency of Mixing Height from the CALMET Model Data at the Project (2015-2019)

A3 CALPUFF

The CALPUFF dispersion model is a sophisticated tool that uses numerous regulatory and user-specified options. The modelling options used in the model are default CALPUFF model options as recommended by the AQMG. The highlighted values in Table A-3 indicate non-default and/or alternate model options specified in Appendix D of the AQMG.

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 1 – General Run Control Parameters	METRUN	—	0	run period explicitly defined below
	IBYR	—	2015	starting year for run if METRUN = 0
	IBMO	—	1	starting month for run if METRUN = 0
	IBDY	—	1	starting day for run if METRUN = 0
	IBHR	—	0	starting hour for run if METRUN = 0
	IBMIN	—	0	starting minute for run if METRUN = 0
	IBSEC	—	0	starting second for run if METRUN = 0
	IEYR	—	2019	ending year for run if METRUN = 0
	IEMO	—	12	ending month for run if METRUN = 0
	IEDY	—	31	ending day for run if METRUN = 0
	IEHR	—	23	ending hour for run if METRUN = 0
	IEMIN	—	0	ending minute for run if METRUN = 0
	IESEC	—	3,600	ending second for run if METRUN = 0
	ABTZ	—	7	base time zone (PST = 8, MST = 7, CST = 6, EST = 5)
	NSECDT	3600	3600	Length of modelling time-step (seconds)
	NSPEC	5	2	chemical species modelled: NO _x , NO _x or CO and PM _{2.5}
	NSE	3	2	chemical species emitted: NO _x , NO _x or CO and PM _{2.5}
	ITEST	2	2	program is executed after SETUP phase
	MRESTART	0	0	does not read or write a restart file
	NRESPD	0	0	restart file written only at last period
	METFM	1	1	CALMET binary file (CALMET.MET)
	MPRFFM	1	1	meteorological profile data format
Group 2 - Technical Options	AVET	60	60	Averaging time (minutes)
	PGTIME	60	60	PG Averaging Time (minutes)
	IOUTU	1	1	Output units for binary concentration and flux files written in Dataset v2.2 or later formats 1 = mass - g/m ³ (conc) or g/m ² /s (dep)
	MGAUSS	1	1	Gaussian distribution used in near field
	MCTADJ	3	3	partial plume path terrain adjustment
	MCTSG	0	0	subgrid-scale complex terrain not modelled
	MSLUG	0	0	near-field puffs not modelled as elongated
	MTRANS	1	1	transitional plume rise modelled
	MTIP	1	1	stack tip downwash used
	MBDW	1	2	method to simulate building downwash (PRIME method), as specified in Appendix D of AQMG.
	MRISE	1	1	Briggs plume rise used
	MSHEAR	0	0	vertical wind shear not modelled
	MSPLIT	0	0	puffs are not split
	MCHEM	1	0	Chemical transformation not modelled and modelling against AAAQOs

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 2 - Continued	MAQCHEM	0	0	aqueous phase transformation rates not modelled
	MLWC	1	1	liquid Water Content flag (MLWC) (Used only if MAQCHEM = 1)
	MWET	1	1	wet removal modelled
	MDRY	1	1	dry deposition modelled
	MTILT	0	0	Gravitational settling not modelled
	MDISP	3	2	dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (u*, w*, L, etc.), as specified in Appendix D of AQMG.
	MTURBVW	3	3	use both sigma-(v/theta) and sigma-w from PROFILE.DAT to compute sigma-y and sigma-z (valid for METFM = 1,2,3,4,5)
	MDISP2	3	3	PG dispersion coefficients for RURAL areas (computed using the ISCST multi-segment approximation) and MP coefficients in urban areas
	MTAULY	0	0	Method used for Lagrangian timescale for Sigma-y (used only if MDISP=1,2 or MDISP2=1,2) Draxler default 617.284 (s)
	MTAUADV	0	0	Method used for Advective-Decay timescale for Turbulence (used only if MDISP=2 or MDISP2=2) 0 = No turbulence advection
	MCTURB	1	1	Method used to compute turbulence sigma-v & sigma-w using micrometeorological variables (Used only if MDISP = 2 or MDISP2 = 2) Standard CALPUFF subroutines
	MROUGH	0	0	PG sigma-y and sigma-z not adjusted for roughness
	MPARTL	1	1	partial plume penetration of elevated inversion
	MPARTLBA	1	1	Partial plume penetration of elevated inversion modelled for buoyant area sources
	MTINV	0	0	strength of temperature inversion not computed from measured/default gradients
	MPDF	0	1	PDF used for dispersion under convective conditions, as specified in Appendix D of AQMG.
	MSGTIBL	0	0	sub-grid TIBL module not used for shoreline
	MBCON	0	0	boundary conditions not modelled
	MSOURCE	0	0	Individual source contributions are not saved
	MFOG	0	0	do not configure for FOG Model output
	MREG	1	0	do not test options specified to see if they conform to regulatory values, as specified in Appendix D of AQMG.
Group 3 - Species List	CSPEC	—	NO _x , NO	list of chemical species
			1	is compound modelled? (0=no, 1=yes)
			1	is compound emitted? (0=no, 1=yes)
			0	compound dry deposition method (0 = no, 1=computed-gas, 2=computed-particle)
			0	compound output group number

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 4 - Map Projection and Grid Control Parameters	PMAP	UTM	UTM	map projection
	FEAST	0	0	false Easting (km) at the projection origin
	FNORTH	0	0	false Northing (km) at the projection origin
	IUTMZN	—	11	UTM zone
	UTMHM	N	N	hemisphere for UTM projection (N = north, S = south)
	RLAT0	—	0N	latitude of projection origin (not used if PMAP = UTM)
	RLON0	—	0E	longitude of projection origin (not used if PMAP = UTM)
	XLAT1	—	0N	matching parallel(s) of latitude (decimal degrees) for projection (used only if PMAP = LCC or PS)
	XLAT2	—	0N	matching parallel(s) of latitude (decimal degrees) for projection (used only if PMAP = LCC or PS)
	DATUM	WGS-84	WGS-84	datum-region for output coordinates
	NX	—	60	number of X grid cells in meteorological grid
	NY	—	60	number of Y grid cells in meteorological grid
	NZ	—	12	number of vertical layers in meteorological grid
	DGRIDKM	—	1.0	grid spacing in kilometres
	ZFACE	—	0.,20.,40.,80., 120.,280.,520 .,880.,1320.,1 820.,2380.,30 00.,4000.	cell face heights in meteorological grid (m) – same as for CALMET
	XORIGKM	—	635.332	reference X coordinate for south-west corner of grid cell (1,1) of meteorological grid (km)
	YORIGKM	—	5897.230	reference Y coordinate for south-west corner of grid cell (1,1) of meteorological grid (kilometres)
	IBCOMP	—	1	X index of lower left corner of the computational grid
	JBCOMP	—	1	Y index of lower left corner of the computational grid
	IECOMP	—	60	X index of upper right corner of the computational grid
	JECOMP	—	60	Y index of upper right corner of the computational grid
	LSAMP	T	F	sampling grid is not used
	IBSAMP	—	1	X index of lower left corner of the sampling grid
	JBSAMP	—	1	Y index of lower left corner of the sampling grid
	IESAMP	—	99	X index of upper right corner of the sampling grid
	JESAMP	—	99	Y index of upper right corner of the sampling grid
	MESHDN	1	1	nesting factor of the sampling grid
Group 5 – Output Options	ICON	1	1	output file CONC.DAT containing concentration fields is created
	IDRY	1	0	output file DFLX.DAT containing dry flux fields is created
	IWET	1	0	output file WFLX.DAT containing wet flux fields is created
	IT2D	0	0	2D Temperature (IT2D)
	IRHO	0	0	2D Density (IRHO)
	IVIS	0	0	output file containing relative humidity data is not created
	LCOMPRS	T	T	use data compression in output files
	IQAPLOT	1	0	standard series of output files not created for plotting
	IPFTRAK	0	0	puff locations and properties not reported to PFTRAK.DAT file for postprocessing
	IMFLX	0	0	mass flux across specified boundaries for selected species not reported hourly
	IMBAL	0	0	mass balance for each species not reported hourly

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 5 – Continued	INRISE	0	0	file for plume properties for each rise increment, for each model timestep not created
	ICPRT	0	0	do not print concentration fields to the output list file
	IDPRT	0	0	do not print dry flux fields to the output list file
	IWPRT	0	0	do not print wet flux fields to the output list file
	ICFRQ	1	1	concentration fields are printed to output list file every 1 hour
	IDFRQ	1	1	dry flux fields are printed to output list file every 1 hour
	IWFRQ	1	1	wet flux fields are printed to output list file every 1 hour
	IPRTU	1	3	units for line printer output are in $\mu\text{g}/\text{m}^3$ for concentration and $\mu\text{g}/\text{m}^2/\text{s}$ for deposition
	IMESG	2	2	messages tracking the progress of run are written on screen
	Variable	—	0, 0, 0, 0, 0, 0, 0	concentrations printed to output list file (0 = no, 1 = yes)
				concentrations saved to disk (0=no, 1=yes)
				dry fluxes printed to output list file (0=no, 1=yes)
				dry fluxes saved to disk (0=no, 1=yes)
				wet fluxes printed to output list file (0=no, 1=yes)
				wet fluxes saved to disk (0=no, 1=yes)
				mass fluxes saved to disk (0=no, 1=yes)
	LDEBUG	F	F	logical value for debug output
	IPFDEB	1	1	first puff to track
	NPFDEB	1	1	number of puffs to track
	NN1	1	1	meteorological period to start output
	NN2	10	10	meteorological period to end output
Group 6 - Subgrid Scale Complex Terrain Inputs	NHILL	0	0	number of terrain features
	NCTREC	0	0	number of special complex terrain receptors
	MHILL	—	0	input terrain and receptor data for CTSG hills input in CTDM format not used
	XHILL2M	1	1	conversion factor for changing horizontal dimensions to metres
	ZHILL2M	1	1	conversion factor for changing vertical dimensions to metres
	XCTDMKM	—	0	X origin of CTDM system relative to CALPUFF coordinate system in kilometres
	YCTDMKM	—	0	Y origin of CTDM system relative to CALPUFF coordinate system in kilometres
Group 7 - Chemical Parameters for Dry Deposition of Gases	Varies	—	N/A	not applicable MCHM = 0
				alpha star
				reactivity
				mesophyll resistance (s/cm)
				Henry's Law coefficient
Group 8 - Size Parameters for Dry Deposition of Particles	Varies – See Table A-7	—	N/A	geometric mass mean diameter of compound (μm)
				geometric standard deviation of compound (μm)
Group 9 - Miscellaneous Dry Deposition Parameters	RCUTR	30	30	reference cuticle resistance in seconds/centimetre (s/cm)
	RGR	10	10	reference ground resistance in s/cm
	REACTR	8	8	reference pollutant reactivity
	NINT	9	9	number of particle size intervals used to evaluate effective particle deposition velocity
	IVEG	1	1	vegetation state in unirrigated areas for active and unstressed vegetation

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 10 – Wet Deposition Parameters	Varies – See Table A-7	—	N/A	the scavenging coefficient for liquid precipitation (1/second [1/s])
				the scavenging coefficient for frozen precipitation (1/s)
Group 11 – Chemistry Parameters	MOZ	1	1	ozone data input: read hourly ozone concentrations from the OZONE.DAT data file consistent with AQMG recommended ozone levels (rural)
	MNH ₃	0	0	use monthly background ammonia values (BCKNH ₃) - no vertical variation
	MAVGNH ₃	1	1	average NH ₃ values over vertical extent of puff
	BCKNH ₃	12*10	12*10	Default monthly ammonia concentrations in ppb
	RNITE1	0.2	0.2	nighttime SO ₂ loss rate in percent/hour
	RNITE2	2	2	nighttime NO _x loss rate in percent/hour
	RNITE3	2	2	nighttime HNO ₃ formation rate in percent/hour
	MH2O2	1	1	H ₂ O ₂ data input option. Option used only if MCHEM = 6 or 7 and MAQCHEM = 1
	BCKH2O2	12*1	12*1	monthly H ₂ O ₂ concentrations in ppb
	BCKPMF	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00	clean continental – characteristic of the air mass used when computing the formation of SOA from VOC emissions
	OFRAC	0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15	0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15	
	VCNX	50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00	50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00	
	NDECAY	0	0	number of half-life decay specification blocks
Group 12 - Miscellaneous Dispersion and Computational Parameters	SYTDEP	550	550	horizontal size of a puff in metres beyond which the time dependent Heffter dispersion equation is used
	MHFTSZ	0	0	do not use Heffter formulas for sigma z
	JSUP	5	5	stability class used to determine dispersion rates for puffs above boundary layer
	CONK1	0.01	0.01	vertical dispersion constant for stable conditions
	CONK2	0.1	0.1	vertical dispersion constant for neutral/unstable conditions
	TBD	0.5	0.5	use ISC transition point for determining the transition point between the Schulman-Scire to Huber-Snyder Building Downwash scheme
	IURB1	10	10	lower range of land use categories for which urban dispersion is assumed
	IURB2	19	19	upper range of land use categories for which urban dispersion is assumed
	ILANDUIN	20	20	land use category for CALMET domain
	ZOIN	0.25	0.25	roughness length in metres for CALMET domain

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 12 - Continued	XLAIIN	3	3	leaf area index for CALMET domain
	ELEVIN	0	0	elevation above sea level in (m)
	XLATIN	-999	-999	latitude of station in degrees (°)
	XLONIN	-999	-999	longitude of station in degrees (°)
	ANEMHT	10	10	anemometer height in (m)
	ISIGMAV	1	1	sigma-v is read for lateral turbulence data
	IMIXCTDM	0	0	predicted mixing heights are used
	XMULEN	1	1	maximum length of emitted slug in meteorological grid units
	XSAMLEN	1	1	maximum travel distance of slug or puff in meteorological grid units during one sampling unit
	MXNEW	99	99	maximum number of puffs or slugs released from one source during one time step
	MXSAM	99	99	maximum number of sampling steps during one time step for a puff or slug
	NCOUNT	2	2	number of iterations used when computing the transport wind for a sampling step that includes gradual rise
	SYMIN	1	1	minimum sigma y in metres for a new puff or slug
	SZMIN	1	1	minimum sigma z in metres for a new puff or slug
	SZCAP_M	5.0e06	5.0e06	maximum sigma z (m) allowed to avoid numerical problem in calculating virtual time or distance.
	SVMIN (land)	0.5	0.5	minimum turbulence (σ_v) velocity for stability class A (m/s)
		0.5	0.5	minimum turbulence (σ_v) velocity for stability class B (m/s)
		0.5	0.5	minimum turbulence (σ_v) velocity for stability class C (m/s)
		0.5	0.5	minimum turbulence (σ_v) velocity for stability class D (m/s)
		0.5	0.5	minimum turbulence (σ_v) velocity for stability class E (m/s)
		0.5	0.5	minimum turbulence (σ_v) velocity for stability class F (m/s)
	SVMIN (water)	0.37	0.37	minimum turbulence (σ_v) velocity for stability class A (m/s)
		0.37	0.37	minimum turbulence (σ_v) velocity for stability class B (m/s)
		0.37	0.37	minimum turbulence (σ_v) velocity for stability class C (m/s)
		0.37	0.37	minimum turbulence (σ_v) velocity for stability class D (m/s)
		0.37	0.37	minimum turbulence (σ_v) velocity for stability class E (m/s)
		0.37	0.37	minimum turbulence (σ_v) velocity for stability class F (m/s)
	SWMIN (land)	0.2	0.2	minimum turbulence (σ_w) velocity for stability class A (m/s)
		0.12	0.12	minimum turbulence (σ_w) velocity for stability class B (m/s)
		0.08	0.08	minimum turbulence (σ_w) velocity for stability class C (m/s)
		0.06	0.06	minimum turbulence (σ_w) velocity for stability class D (m/s)
		0.03	0.03	minimum turbulence (σ_w) velocity for stability class E (m/s)
		0.016	0.016	minimum turbulence (σ_w) velocity for stability class F (m/s)
	SWMIN (water)	0.2	0.2	minimum turbulence (σ_w) velocity for stability class A (m/s)
		0.12	0.12	minimum turbulence (σ_w) velocity for stability class B (m/s)
		0.08	0.08	minimum turbulence (σ_w) velocity for stability class C (m/s)
		0.06	0.06	minimum turbulence (σ_w) velocity for stability class D (m/s)
		0.03	0.03	minimum turbulence (σ_w) velocity for stability class E (m/s)
		0.016	0.016	minimum turbulence (σ_w) velocity for stability class F (m/s)
	CDIV	0.0, 0.0	0.0, 0.0	divergence criteria for dw/dz in met cells
	NLUTIBL	4	4	search radius (number of cells) for nearest land and water cells used in the subgrid TIBL module
	WSCALM	0.5	0.5	minimum wind speed allowed for non-calm conditions (m/s)
	XMAXZI	3,000	3,000	maximum mixing height (m)
	XMINZI	50	50	minimum mixing height (m)

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 12 - Continued	TKCAT	265., 270., 275., 280., 285., 290., 295., 300., 305., 310., 315	265., 270., 275., 280., 285., 290., 295., 300., 305., 310., 315	Temperatures (K) used for defining upper bound of categories for emissions scale-factors
	WSCAT	1.54	1.54	wind speed category 1 (m/s)
		3.09	3.09	wind speed category 2 (m/s)
		5.14	5.14	wind speed category 3 (m/s)
		8.23	8.23	wind speed category 4 (m/s)
		10.8	10.8	wind speed category 5 (m/s)
	PLX0	0.07	0.07	rural wind speed profile exponent for A stability
		0.07	0.07	rural wind speed profile exponent for B stability
		0.1	0.1	rural wind speed profile exponent for C stability
		0.15	0.15	rural wind speed profile exponent for D stability
		0.35	0.35	rural wind speed profile exponent for E stability
		0.55	0.55	rural wind speed profile exponent for F stability
	PTG0	0.02	0.02	potential temperature gradient for E stability (K/m)
		0.035	0.035	potential temperature gradient for F stability (K/m)
	PPC	0.5	0.5	plume path coefficient for A stability
		0.5	0.5	plume path coefficient for B stability
		0.5	0.5	plume path coefficient for C stability
		0.5	0.5	plume path coefficient for D stability
		0.35	0.35	plume path coefficient for E stability
		0.35	0.35	plume path coefficient for F stability
	SL2PF	10	10	slug-to-puff transition criterion factor equal to sigma y/length of slug
	NSPLIT	3	3	number of puffs that result every time a puff is split (not used since NSPLIT=0)
	IRESPLIT	0,0,0,0,0,0, 0,0,0,0,0,0, 0,0,0,0,0,1, 0,0,0,0,0,0	0,0,0,0,0,0,0, 0,0,0,0,0,0,0, 0,0,0,1,0,0,0, 0,0,0	time(s) of day when split puffs are eligible to be split once again
	ZISPLIT	100	100	minimum allowable last hour's mixing height for puff splitting (m)
	ROLDMAX	0.25	0.25	maximum allowable ratio of last hour's mixing height and maximum mixing height experienced by the puff for puff splitting
	NSPLITH	5	5	number of puffs that result every time a puff is split
	YSPLITH	1	1	minimum sigma-y (grid cells units) of puff before it may be split
	SHSPLITH	2	2	minimum puff elongation rate (YSPLITH/hr) due to wind shear before it may be split
	CNSPLITH	1.0E-07	1.0E-07	minimum concentration (g/m ³) of each species in puff before it may be split
	EPSSLUG	1.00E-04	1.00E-04	fractional convergence criterion for numerical SLUG sampling integration
	EPSAREA	1.00E-06	1.00E-06	fractional convergence criterion for numerical AREA source integration
	DSRISE	1	1	trajectory step-length (m) used for numerical rise integration
	HTMINBC	500.	500.	minimum height (m) to which BC puffs are mixed as they are emitted
	RSAMPBC	10.	10.	search radius (km) about a receptor for sampling nearest BC puff.
	MDEPBC	1	1	near-Surface depletion adjustment to concentration profile Adjust Concentration for depletion

Table A-3: CALPUFF Model Input Options

Input Group	Parameter	Default	Project	Description
Group 13 - Point Source Parameters	NPT1	—	Variable	number of point sources
	IPTU	1	1	units for point source emission rates is grams per second (g/s)
	NSPT1	0	Variable	number of source-species combinations with variable emissions scaling factors
	NPT2	—	0	number of point sources with variable emission parameters provided in external file
Group 14 - Area Source Parameters	NAR1	—	Variable	number of polygon area sources
	IARU	1	1	area source emission rates (g/m ² /s)
	NSAR1	0	Variable	number of source-species combinations with variable emissions scaling factors
	NAR2	—	0	number of buoyant polygon area sources with variable location and emission parameters
Group 15 - Line Source Parameters	NLN2	—	0	number of buoyant line sources with variable location and emission parameters
	NLINES	—	0	number of buoyant line sources
	ILNU	1	1	line source emission rates (g/s)
	NSLN1	0	0	number of source-species combinations with variable emissions scaling factors
	MXNSEG	7	7	maximum number of segments used to model each line
	NLRISE	6	6	number of distances at which transitional rise is computed
	XL	—	0	average line source length (m)
	HBL	—	0	average height of line source height (m)
	WBL	—	0	average building width (m)
	WML	—	0	average line source width (m)
	DXL	—	0	average separation between buildings (m)
	FPRIMEL	—	0	average buoyancy parameter
Group 16 - Volume Source Parameters	NVL1	—	Variable	number of volume sources
	IVLU	1	1	volume source emission rates (g/s)
	NSVL1	0	0	number of source-species combinations with variable emissions scaling factors
	NSVL2	—	0	number of volume sources with variable location and emission parameters
Group 17- Flare Source Parameters	NFL2	—	0	Number of flare sources defined in external file
Group 18- Road Emissions Parameters	NRD1	—	Variable	Number of road links with emission parameters
	NRD2	—	0	Number of road links with arbitrarily time-varying emission parameters
	NSFRDS	—	0	Number of road links and species combinations with variable emission-rate scale-factors
Group 19 – Emission Rate Scale Factor Tables	NSFTAB	—	0	Number of emission scale-factor tables
Group 20 - Non-Gridded Receptor Information	NREC	—	8621	number of non-gridded receptors
	NRGRP	0	0	number of receptor group names

Note: the highlighted values indicate non-default and/or alternate model options specified in Appendix D of the AQMG.

A4 REFERENCES

AEPA (Alberta Environment and Protected Areas, formerly Alberta Environment and Parks). 2021. Air Quality Model Guideline. Prepared by the Air Policy Section of AEP. Available at: <https://open.alberta.ca/dataset/air-quality-model-guideline-2021>.

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TransAlta (TransAlta Corporation). 2019. Keephills Thermal Electricity Power Plant Unit 1 Repowering Environmental Protection and Enhancement Act Amendment Application. December 2019.

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ATTACHMENT B

Emission Inventory

B1 INTRODUCTION

This attachment provides information on the emissions estimation methodologies for the Project emissions, other approved Keephills and Sundance emissions as well as the other regional emissions modelled in the air quality assessment.

In the air quality assessment, emission rates for the NO_x , CO and $\text{PM}_{2.5}$ were estimated. NO_x emissions associated with the Project are based on information provided by TransAlta in conjunction with the applicable federal regulatory emission limit for NO_x . CO and $\text{PM}_{2.5}$ emissions were estimated based on emission factors from Canadian Energy Partnership for Environmental Innovation (CEPEI; 2012) and United States Environmental Protection Agency (US EPA) AP-42 (US EPA 1998 and 2000), respectively.

B2 PROJECT EMISSIONS

The Project will consist of a redesigned K1 repowering unit with a total gross unit electricity output of 829.357 MW. The K1 HRSG stacks' NO_x emission rates were estimated based on the total gross unit electricity output and the NO_x emission guideline of 85 g/GJ output from *Federal Guidelines for Reduction of Nitrogen Oxide Emissions from Natural Gas-fuelled Stationary Combustion Turbines* (ECCC 2017). A sample calculation is shown below.

$$\text{NO}_x = 829,357 \text{ MW} \times \frac{\text{MJ}}{\text{MW} \cdot \text{s}} \times \frac{3600 \text{ s}}{\text{hr}} \times \frac{\text{GJ}}{1000 \text{ MJ}} \times 85 \frac{\text{g}}{\text{GJ}} \times \frac{\text{kg}}{1000 \text{ g}} \times \frac{1}{2 \text{ stack}} = 126.9 \frac{\text{kg}}{\text{hr} \cdot \text{stack}} \text{ or } 3.045 \frac{\text{t}}{\text{d} \cdot \text{stack}}$$

$$\begin{aligned} \text{CO} &= \left(2,425.2 \frac{\text{MMBtu}}{\text{hr}} \times 8.2 \times 10^{-2} \frac{\text{lb}}{\text{MMBtu}} + 821.2 \frac{\text{MMBtu}}{\text{hr}} \times 8.4 \times 10^{-1} \frac{\text{lb}}{\text{MMscf}} \div 1020 \frac{\text{MMBtu}}{\text{MMscf}} \right) \times \frac{0.4536 \text{ lb}}{\text{kg}} \\ &= 121 \frac{\text{kg}}{\text{hr}} \end{aligned}$$

$$\text{PM}_{2.5} = \left(2,557 \frac{\text{GJ}}{\text{hr}} \times 2.36 \times 10^{-4} \frac{\text{kg}}{\text{GJ}} + 865.8 \frac{\text{GJ}}{\text{hr}} \times 2.70 \times 10^{-4} \frac{\text{kg}}{\text{GJ}} \right) = 0.837 \frac{\text{kg}}{\text{hr}}$$

The K1 repowering unit's auxiliary boiler is identical to the S5 repowering unit's auxiliary boiler, and its NO_x emission rates ~~was were~~ based on vendor specification data (Sargent & Lundy 2019).

A summary of the repowering unit specifications, stack parameters, and maximum emissions are provided in Tables B-1 and B-2.

Table B-1: Redesigned Keephills 1 Repowering Unit Emissions

Parameter		Keephills 1 Repowering Unit		
		HRSG Stack 1	HRSG Stack 2	Auxiliary Boiler
Stack UTM Coordinates	Easting (m)	669,426	669,464	669,411
	Northing (m)	5,925,153	5,925,124	5,925,119
Stack Height (m)		40.0	40.0	39.6
Stack Diameter (m)		8.5	8.5	1.5
Stack Exit Velocity (m/s)		8.810	8.810	14.417
Stack Exit Temperature (K)		363.8	363.8	425.4
NO_x Emission Rate (kg/hr)		126.89	126.89	0.12
NO_x Emission Rate (t/d)		3.05	3.05	0.003
<u>CO Emission Rate (kg/hr)</u>		<u>120.88</u>	<u>120.88</u>	<u>0.45</u>

Parameter	Keephills 1 Repowering Unit		
	HRSG Stack 1	HRSG Stack 2	Auxiliary Boiler
<u>CO Emission Rate (t/d)</u>	<u>2.90</u>	<u>2.90</u>	<u>0.01</u>
<u>PM_{2.5} Emission Rate (kg/hr)</u>	<u>0.84</u>	<u>0.84</u>	<u>0.093</u>
<u>PM_{2.5} Emission Rate (t/d)</u>	<u>0.02</u>	<u>0.02</u>	<u>0.002</u>

UTM = Universal Transverse Mercator; m = metres; m/s = metres per second; K = degrees Kelvin;

kg/hr = kilograms per hour; t/d = tonnes per day; NO_x = nitrogen oxides; CO = carbon monoxide; PM_{2.5} = particulate matters with diameter of 2.5 microns or less.

Table B-2: Sundance 5 Repowering Unit Emissions

Parameter		Keephills 1 Repowering Unit		
		HRSG Stack 1	HRSG Stack 2	Auxiliary Boiler
Stack UTM Coordinates	Easting (m)	661,875	661,827	661,850
	Northing (m)	5,931,345	5,931,344	5,931,372
Stack Height (m)		40.0	40.0	39.6
Stack Diameter (m)		8.5	8.5	1.500
Stack Exit Velocity (m/s)		8.810	8.810	14.417
Stack Exit Temperature (K)		363.8	363.8	425.4
NO _x Emission Rate (kg/hr)		40.5	40.5	0.12
NO _x Emission Rate (t/d)		0.97	0.97	0.003
<u>CO Emission Rate (kg/hr)</u>		<u>120.88</u>	<u>120.88</u>	<u>0.45</u>
<u>CO Emission Rate (t/d)</u>		<u>2.90</u>	<u>2.90</u>	<u>0.01</u>
<u>PM_{2.5} Emission Rate (kg/hr)</u>		<u>0.84</u>	<u>0.84</u>	<u>0.093</u>
<u>PM_{2.5} Emission Rate (t/d)</u>		<u>0.02</u>	<u>0.02</u>	<u>0.002</u>

UTM = Universal Transverse Mercator; m = metres; m/s = metres per second; K = degrees Kelvin;

kg/hr = kilograms per hour; t/d = tonnes per day; NO_x = nitrogen oxides; CO = carbon monoxide; PM_{2.5} = particulate matters with diameter of 2.5 microns or less.

B3 APPROVED KEEPHILLS AND SUNDANCE EMISSIONS

Tables B-3 and B-4 presents a summary of the approved Keephills and Sundance emissions modelled in this assessment, respectively.

Table B-3: Approved Keephills Plant Emissions

Source		Stack No. 1	Stack No. 2	K3 Auxiliary Boiler Stack
Stack UTM Coordinates	Easting (m)	669,235	669,458	669,525
	Northing (m)	5,925,120	5,924,868	5,925,025
Stack Height (m)		138.6	138.0	35.1
Stack Diameter (m)		7.770	5.740	1.651
Stack Exit Velocity (m/s)		32.600	22.500	42.916
Stack Exit Temperature (K)		438.8	351.5	619.2
NO _x Emission Rate (kg/hr)		430.92	310.00	3.11
NO _x Emission Rate (t/d)		10.34	7.44	0.07
<u>CO Emission Rate (kg/hr)</u>		<u>237.90</u>	<u>136.00</u>	<u>21.63</u>
<u>CO Emission Rate (t/d)</u>		<u>5.71</u>	<u>3.26</u>	<u>0.52</u>
<u>PM_{2.5} Emission Rate (kg/hr)</u>		<u>1.15</u>	<u>1.22</u>	<u>0.02</u>
<u>PM_{2.5} Emission Rate (t/d)</u>		<u>0.03</u>	<u>0.03</u>	<u>0.0004</u>

UTM = Universal Transverse Mercator; m = metres; m/s = metres per second; K = degrees Kelvin; kg/hr = kilograms per hour; t/d = tonnes per day; NO_x = nitrogen oxides; CO = carbon monoxide; PM_{2.5} = particulate matters with diameter of 2.5 microns or less.

Table B-4: Approved Sundance Plant Emissions

Source		Stack No. 2	Stack No. 3
Stack UTM Coordinates	Easting (m)	661,902	661,906
	Northing (m)	5,931,540	5,931,426
Stack Height (m)		155.5	155.5
Stack Diameter (m)		7.320	7.320
Stack Exit Velocity (m/s)		35.570	34.310
Stack Exit Temperature (K)		439.7	441.5
NO _x Emission Rate (kg/hr)		635.04	301.68
NO _x Emission Rate (t/d)		15.24	7.24
<u>CO Emission Rate (kg/hr)</u>		<u>466.20</u>	<u>241.50</u>
<u>CO Emission Rate (t/d)</u>		<u>11.19</u>	<u>5.80</u>
<u>PM_{2.5} Emission Rate (kg/hr)</u>		<u>2.25</u>	<u>1.15</u>
<u>PM_{2.5} Emission Rate (t/d)</u>		<u>0.05</u>	<u>0.03</u>

UTM = Universal Transverse Mercator; m = metres; m/s = metres per second; K = degrees Kelvin; kg/hr = kilograms per hour; t/d = tonnes per day; NO_x = nitrogen oxides; CO = carbon monoxide; PM_{2.5} = particulate matters with diameter of 2.5 microns or less.

B4 REGIONAL EMISSION PROFILES

The regional developments' point, area and volume sources modelled in the Application Case are presented in Tables B-5, B-6 and B-7, respectively.

Table B-5: Regional Point Source Emissions

Source ID	Owner	Project Name	Source Description	UTM Coordinates (m)		Stack Height	Stack Diameter	Exit Velocity	Exit Temperature	NO _x -Emission Rate (t/d)		
				Easting	Northing	(m)	(m)	(m/s)	(K)	NO _x (t/d)	CO	PM _{2.5}
10133RP1	New Star Energy Ltd.	Highvale Sour Gas Plant	Gas Plant New Dual Emergency Flare Stack	664,458	5,916,956	32.5	0.26	205.0	1,016	1.47E+00	<u>3.67E-02</u>	<u>1.28E-02</u>
10133RP10	New Star Energy Ltd.	Highvale Sour Gas Plant	117 kW Refrig # 2 Dehydration Reboiler Exhaust Stack	664,385	5,916,922	11.1	0.15	7.9	593	1.38E-03	<u>2.57E-04</u>	<u>4.80E-06</u>
10133RP11	New Star Energy Ltd.	Highvale Sour Gas Plant	1,465 kW Amine Reboiler Exhaust Stack	664,428	5,916,892	9.6	0.51	8.8	593	1.68E-02	<u>6.12E-03</u>	<u>1.39E-04</u>
10133RP13	New Star Energy Ltd.	Highvale Sour Gas Plant	439 kW Utility Heater Exhaust Stack	664,515	5,916,857	6.2	0.41	3.4	427	5.10E-03	<u>1.55E-03</u>	<u>3.60E-05</u>
10133RP15	New Star Energy Ltd.	Highvale Sour Gas Plant	550 kW Compressor Engine Exhaust Stack	664,456	5,916,932	8.6	0.31	41.4	449	1.25E-01	<u>1.93E-01</u>	<u>5.23E-04</u>
10133RP17	New Star Energy Ltd.	Highvale Sour Gas Plant	73 kW Future Refrig Plant Dehydration Reboiler Exhaust Stack	664,407	5,916,886	5.2	0.15	5.0	593	8.64E-04	<u>1.32E-03</u>	<u>8.64E-06</u>
10133RP18	New Star Energy Ltd.	Highvale Sour Gas Plant	110 kW Future Refrig Plant DeC2 Reboiler Exhaust Stack	664,444	5,916,895	5.2	0.15	7.4	482	1.30E-03	<u>1.98E-03</u>	<u>1.30E-05</u>
10133RP19	New Star Energy Ltd.	Highvale Sour Gas Plant	Oil Battery High Pressure Flare Stack	664,423	5,916,924	12.2	0.30	205.0	1016	2.24E-01	<u>9.05E-03</u>	<u>3.17E-03</u>
10133RP2	New Star Energy Ltd.	Highvale Sour Gas Plant	1,252 kW Compressor Engine Exhaust Stack	664,439	5,916,938	13.4	0.31	23.4	637	3.80E-01	<u>6.39E-01</u>	<u>1.63E-03</u>
10133RP20	New Star Energy Ltd.	Highvale Sour Gas Plant	856 kW Compressor Engine 1 Exhaust Stack	664,459	5,916,925	8.9	0.31	41.4	449	4.14E-02	<u>6.33E-02</u>	<u>4.14E-04</u>
10133RP21	New Star Energy Ltd.	Highvale Sour Gas Plant	440 kW New Treater Exhaust Stack	664,483	5,916,929	8.9	0.50	3.0	570	5.10E-03	<u>7.80E-03</u>	<u>5.10E-05</u>
10133RP22	New Star Energy Ltd.	Highvale Sour Gas Plant	856 kW Compressor Engine 2 Exhaust Stack	664,519	5,916,929	8.9	1.31	41.4	449	4.14E-02	<u>6.33E-02</u>	<u>4.14E-04</u>
10133RP23	New Star Energy Ltd.	Highvale Sour Gas Plant	856 kW Compressor Engine 3 Exhaust Stack	664,552	5,916,929	8.4	0.31	41.4	449	4.14E-02	<u>6.33E-02</u>	<u>4.14E-04</u>
10133RP24	New Star Energy Ltd.	Highvale Sour Gas Plant	Oil Battery Low Pressure Flare Stack	664,423	5,916,925	12.2	0.20	8.3	1,316.15	8.13E-02	<u>1.24E-01</u>	<u>4.02E-02</u>
10133RP3	New Star Energy Ltd.	Highvale Sour Gas Plant	Gas Plant New Dual Acid Gas Flare Stack	664,356	5,916,946	32.5	0.15	103.9	1,000	1.58E-02	<u>3.02E-02</u>	<u>1.06E-02</u>
10133RP4	New Star Energy Ltd.	Highvale Sour Gas Plant	220 kW Refrig #2 DeC2 Reboiler Exhaust Stack	664,387	5,916,910	4.4	0.25	4.7	482	2.51E-03	<u>7.25E-04</u>	<u>1.68E-05</u>
10133RP6	New Star Energy Ltd.	Highvale Sour Gas Plant	29 kW Heat Medium Heater Exhaust Stack	664,407	5,916,844	4.1	0.25	0.6	593	3.46E-04	<u>2.74E-04</u>	<u>2.40E-06</u>
10133RP7	New Star Energy Ltd.	Highvale Sour Gas Plant	626 kW Compressor Engine Exhaust Stack	664,396	5,916,874	14.0	0.26	29.6	605	4.03E-02	<u>3.35E-02</u>	<u>1.01E-04</u>
10133RP9	New Star Energy Ltd.	Highvale Sour Gas Plant	293 kW Treater Exhaust Stack	664,515	5,916,925	6.9	0.44	2.0	482	3.37E-03	<u>5.11E-04</u>	<u>7.20E-06</u>
11327RP1	Ricochet Oil Corp.	Berrymoor Sour Gas Processing Plant	955 kW Compressor Engine 1 Exhaust Stack	651,760	5,905,209	9.6	0.36	36.2	761.15	1.06E-01	<u>6.91E-02</u>	<u>9.51E-06</u>
11327RP2	Ricochet Oil Corp.	Berrymoor Sour Gas Processing Plant	955 kW Compressor Engine 2 Exhaust Stack	651,759	5,905,221	9.6	0.36	36.2	761.15	1.11E-01	<u>6.91E-02</u>	<u>9.60E-06</u>
11327RP4	Ricochet Oil Corp.	Berrymoor Sour Gas Processing Plant	205 kW Glycol Reboiler Exhaust Stack	651,760	5,905,267	7.4	0.41	2.8	664.15	9.98E-04	<u>1.21E-03</u>	<u>2.83E-05</u>
11327RP5	Ricochet Oil Corp.	Berrymoor Sour Gas Processing Plant	LP (Acid Gas) Flare Stack	651,672	5,905,241	19.8	0.10	0.6	1,155.15	1.34E-03	<u>4.53E-03</u>	<u>1.56E-03</u>
1759RP1	Journey Energy Inc.	Genesee Sour Gas Processing Plant	Acid Gas Flare Stack	671,067	5,903,907	18.5	0.40	0.1	1,170.24	1.19E-02	<u>5.98E-02</u>	<u>2.27E-02</u>
1759RP10	Journey Energy Inc.	Genesee Sour Gas Processing Plant	220 kW Test Heater Exhaust Stack	670,935	5,903,758	5.3	0.31	3.6	626.15	1.08E-03	<u>3.60E-04</u>	<u>2.40E-06</u>
1759RP2	Journey Energy Inc.	Genesee Sour Gas Processing Plant	1464 kW Utility Heater Exhaust Stack	670,823	5,903,785	4.0	0.61	1.5	701.15	7.16E-03	<u>2.39E-03</u>	<u>2.16E-05</u>
1759RP3	Journey Energy Inc.	Genesee Sour Gas Processing Plant	293 kW Inlet Line Heater Exhaust Stack	670,930	5,903,876	4.2	0.31	0.5	668.15	3.97E-02	<u>5.57E-04</u>	<u>4.80E-06</u>
1759RP4	Journey Energy Inc.	Genesee Sour Gas Processing Plant	440 kW Glycol Heater Exhaust Stack	670,961	5,903,944	5.9	0.31	2.1	660.15	2.51E-03	<u>8.38E-04</u>	<u>7.20E-06</u>
1759RP5	Journey Energy Inc.	Genesee Sour Gas Processing Plant	1832 kW Treater Exhaust Stack (Burner 1 - North)	670,940	5,903,804	7.7	0.79	5.0	635.15	8.96E-03	<u>2.99E-03</u>	<u>2.88E-05</u>
1759RP6	Journey Energy Inc.	Genesee Sour Gas Processing Plant	1832 kW Treater Exhaust Stack (Burner 2 - South)	670,940	5,903,803	7.7	0.79	5.0	635.15	8.96E-03	<u>2.99E-03</u>	<u>2.88E-05</u>
1759RP8	Journey Energy Inc.	Genesee Sour Gas Processing Plant	453 kW Process Compressor Engine Exhaust Stack	670,903	5,903,882	9.2	0.20	35.0	857.15	3.20E-01	<u>2.17E-01</u>	<u>5.54E-04</u>
1759RP9	Journey Energy Inc.	Genesee Sour Gas Processing Plant	164 kW HP Compressor Engine Exhaust Stack	670,937	5,903,939	6.7	0.15	18.2	880.15	1.16E-01	<u>8.48E-02</u>	<u>2.30E-04</u>
773RP1	Capital Power Generation Services Inc.	Genesee 1360 MW Generating Station Thermal Electric Power Plant	Stack No. 1	679,401	5,913,830	121.0	7.31	31.6	403	5.04E+01	<u>2.24E+01</u>	<u>2.53E+00</u>
773RP12	Capital Power Generation Services Inc.	Genesee 1360 MW Generating Station Thermal Electric Power Plant	Unit 1 HRSG Stack	679,307	5,913,998	61.0	7.20	20.3	347	1.55E+00	<u>2.71E+00</u>	<u>1.91E-01</u>
773RP13	Capital Power Generation Services Inc.	Genesee 1360 MW Generating Station Thermal Electric Power Plant	Unit 2 HRSG Stack	679,309	5,913,948	61.0	7.20	20.3	347	1.55E+00	<u>2.71E+00</u>	<u>1.91E-01</u>
773RP2	Capital Power Generation Services Inc.	Genesee 1360 MW Generating Station Thermal Electric Power Plant	Stack No. 2	679,567	5,913740	138.0	5.74	25.3	367.5	7.44E+00	<u>3.86E+01</u>	<u>4.22E-01</u>

Table B-6: Regional Area Source Emissions

Source ID	Owner	Project Name	Source Description	SW UTM Coordinates (m)		NW UTM Coordinates (m)		NE UTM Coordinates (m)		SE UTM Coordinates (m)		Area (m²)	Effective Height (m)	Initial Sigma Z (m)	NO _x Emission Rate (t/d)		
				Easting	Northing	Easting	Northing	Easting	Northing	Easting	Northing				NO _x (t/d)	CO	PM _{2.5}
~~10404NP110~~ ~~404NP3~~	~~Capital Power Generation Services Inc.~~ ~~Capital Power Generation Services Inc.~~	~~Genesee Coal Mine~~ ~~Genesee Coal Mine~~	~~Excavation~~ ~~Diesel Combustion~~	~~674,694~~ ~~671,257~~	~~5,908,953~~ ~~5,906,807~~	~~674,694~~ ~~671,257~~	~~5,913,012~~ ~~5,917,233~~	~~685,938~~ ~~688,420~~	~~5,913,012~~ ~~5,917,233~~	~~685,938~~ ~~688,420~~	~~5,908,953~~ ~~5,906,807~~	~~45,642,426~~ ~~78,936,304~~	~~0.00~~ ~~-0~~	~~3.31~~ ~~6.0~~	~~-8.19E-01~~	-	~~2.19E-02~~
~~10404NP211~~ ~~327NP3~~	~~Capital Power Generation Services Inc.~~ ~~Ricochet Oil Corp.~~	~~Genesee Coal Mine~~ ~~Berrymoor Sour Gas Processing Plant~~	~~Unpaved Road Dust~~ ~~Space Heater Exhaust Vents~~	~~671,257~~ ~~661,657~~	~~5,906,807~~ ~~5,905,157~~	~~671,257~~ ~~661,657~~	~~5,917,233~~ ~~5,905,381~~	~~688,420~~ ~~661,834~~	~~5,917,233~~ ~~5,905,381~~	~~688,420~~ ~~661,834~~	~~5,906,807~~ ~~5,905,157~~	~~178,936,304~~ ~~39,708~~	~~0.03~~ ~~-2~~	~~16.03~~ ~~-9~~	~~-4.05E-03~~	-	~~3.10E-02~~
~~10404NP311~~ ~~187NP11~~	~~Capital Power Generation Services Inc.~~ ~~TransAlta Corporation~~	~~Genesee Coal Mine~~ ~~Highvale Coal Mine~~	~~Diesel Combustion~~ ~~Pit 06 Mobile Combustion~~	~~671,257~~ ~~661,855~~	~~5,906,807~~ ~~5,930,707~~	~~671,257~~ ~~661,164~~	~~5,917,233~~ ~~5,930,871~~	~~688,420~~ ~~661,388~~	~~5,917,233~~ ~~5,929,144~~	~~688,420~~ ~~661,916~~	~~5,906,807~~ ~~5,928,915~~	~~178,936,304~~ ~~4,044,312~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~8.19E-01~~ ~~0.11~~ ~~0.92E-03~~	~~3.66E-01~~	~~2.41E-02~~
~~10404NP411~~ ~~187NP14~~	~~Capital Power Generation Services Inc.~~ ~~TransAlta Corporation~~	~~Genesee Coal Mine~~ ~~Highvale Coal Mine~~	~~Unloading~~ ~~Pit 07 Mobile Combustion~~	~~675,275~~ ~~666,889~~	~~5,910,073~~ ~~5,925,226~~	~~675,275~~ ~~666,837~~	~~5,913,852~~ ~~5,924,789~~	~~685,190~~ ~~666,839~~	~~5,913,852~~ ~~5,924,417~~	~~685,190~~ ~~666,934~~	~~5,910,073~~ ~~5,924,427~~	~~37,463,148~~ ~~856,397~~	~~3.60~~ ~~-0~~	~~1.91~~ ~~6.0~~	~~-2.40E-02~~	-	~~4.86E-03~~
~~10404NP511~~ ~~187NP17~~	~~Capital Power Generation Services Inc.~~ ~~TransAlta Corporation~~	~~Genesee Coal Mine~~ ~~Highvale Coal Mine~~	~~Wind Erosion from Storage Piles~~ ~~Pit 08 Mobile Combustion~~	~~675,275~~ ~~667,081~~	~~5,910,073~~ ~~5,922,592~~	~~675,275~~ ~~661,107~~	~~5,913,852~~ ~~5,922,629~~	~~685,190~~ ~~661,552~~	~~5,913,852~~ ~~5,919,240~~	~~685,190~~ ~~661,037~~	~~5,910,073~~ ~~5,919,181~~	~~37,463,148~~ ~~3,766,136~~	~~5.40~~ ~~-0~~	~~12.51~~ ~~6.0~~	~~-2.05E-02~~	-	~~1.22E-02~~
~~11327NP311~~ ~~187NP2~~	~~Ricochet Oil Corp.~~ ~~TransAlta Corporation~~	~~Berrymoor Sour Gas Processing Plant~~ ~~Highvale Coal Mine~~	~~Space Heater Exhaust Vents~~ ~~Pit 03 Mobile Combustion~~	~~651,657~~ ~~665,319~~	~~5,905,157~~ ~~5,930,520~~	~~651,657~~ ~~665,319~~	~~5,905,381~~ ~~5,931,773~~	~~651,834~~ ~~665,591~~	~~5,905,381~~ ~~5,931,773~~	~~651,834~~ ~~665,591~~	~~5,905,157~~ ~~5,930,520~~	~~39,708~~ ~~3,405,494~~ ~~405,494~~	~~3.20~~ ~~-0~~	~~3.91~~ ~~6.0~~	~~4.05E-03~~ ~~0.36~~ ~~0.78E-04~~	~~3.37E-03~~	~~1.08E-04~~
~~773NP25111~~ ~~87NP20~~	~~Capital Power Generation Services Inc.~~ ~~TransAlta Corporation~~	~~Genesee 1360 MW Generating Station Thermal Electric Power Plant~~ ~~Highvale Coal Mine~~	~~Road Dust~~ ~~Pit 09 Mobile Combustion~~	~~679,342~~ ~~666,759~~	~~5,914,034~~ ~~5,916,283~~	~~679,585~~ ~~666,759~~	~~5,914,039~~ ~~5,919,332~~	~~679,589~~ ~~667,047~~	~~5,913,930~~ ~~5,919,332~~	~~679,589~~ ~~667,047~~	~~5,913,930~~ ~~5,916,283~~	~~13,257~~ ~~7,469~~ ~~469,749~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~-1.30E-01~~	-	~~1.51E-03~~
~~11187NP111~~ ~~187NP5~~	~~TransAlta Corporation~~ ~~TransAlta Corporation~~	~~Highvale Coal Mine~~ ~~Highvale Coal Mine~~	~~Pit 03 Road Dust~~ ~~Pit 04 Mobile Combustion~~	~~653,195~~ ~~665,036~~	~~5,930,520~~ ~~5,933,762~~	~~653,195~~ ~~665,270~~	~~5,931,773~~ ~~5,933,844~~	~~655,913~~ ~~665,288~~	~~5,931,773~~ ~~5,932,204~~	~~655,913~~ ~~665,040~~	~~5,930,520~~ ~~5,932,066~~	~~3,405,494~~ ~~405,494~~ ~~018,905~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~-4.52E-04~~	-	~~3.68E-04~~
~~11187NP101~~ ~~1187NP8~~	~~TransAlta Corporation~~ ~~TransAlta Corporation~~	~~Highvale Coal Mine~~ ~~Highvale Coal Mine~~	~~Pit 06 Road Dust~~ ~~Pit 05 Mobile Combustion~~	~~658,855~~ ~~665,925~~	~~5,930,707~~ ~~5,928,438~~	~~661,164~~ ~~666,124~~	~~5,930,871~~ ~~5,928,589~~	~~661,388~~ ~~666,359~~	~~5,929,144~~ ~~5,926,904~~	~~659,160~~ ~~666,292~~	~~5,928,915~~ ~~5,926,255~~	~~4,044,312~~ ~~3,779,008~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~-3.42E-03~~	-	~~4.48E-04~~
~~11187NP111~~ ~~0404NP3~~	~~TransAlta Corporation~~ ~~Capital Power Generation Services Inc.~~	~~Highvale Coal Mine~~ ~~Genesee Coal Mine~~	~~Pit 06 Mobile Combustion~~ ~~Diesel Combustion~~	~~658,855~~ ~~667,125~~	~~5,930,707~~ ~~5,906,807~~	~~661,164~~ ~~667,125~~	~~5,930,871~~ ~~5,917,233~~	~~661,388~~ ~~668,420~~	~~5,929,144~~ ~~5,917,233~~	~~659,160~~ ~~668,420~~	~~5,928,915~~ ~~5,906,807~~	~~4,044,312~~ ~~178,936,304~~ ~~8,936,304~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~1.92E-03~~ ~~0.38~~ ~~0.19E-01~~	~~5.82E-04~~	~~1.03E-04~~
~~11187NP131~~ ~~1327NP3~~	~~TransAlta Corporation~~ ~~Ricochet Oil Corp.~~	~~Highvale Coal Mine~~ ~~Berrymoor Sour Gas Processing Plant~~	~~Pit 07 Road Dust~~ ~~Space Heater Exhaust Vents~~	~~666,889~~ ~~665,165~~	~~5,925,226~~ ~~5,905,157~~	~~668,377~~ ~~665,165~~	~~5,924,789~~ ~~5,905,381~~	~~668,393~~ ~~665,183~~	~~5,924,417~~ ~~5,905,381~~	~~666,934~~ ~~665,183~~	~~5,924,427~~ ~~5,905,157~~	~~856,397~~ ~~39,708~~ ~~708~~	~~0.03~~ ~~-2~~	~~16.03~~ ~~-9~~	~~-4.05E-03~~	-	~~1.94E-03~~
~~11187NP141~~ ~~1187NP11~~	~~TransAlta Corporation~~ ~~TransAlta Corporation~~	~~Highvale Coal Mine~~ ~~Highvale Coal Mine~~	~~Pit 07 Mobile Combustion~~ ~~Pit 06 Mobile Combustion~~	~~666,889~~ ~~665,855~~	~~5,925,226~~ ~~5,930,707~~	~~668,377~~ ~~666,116~~	~~5,924,789~~ ~~5,930,871~~	~~668,393~~ ~~666,138~~	~~5,924,417~~ ~~5,929,144~~	~~666,934~~ ~~666,916~~	~~5,924,427~~ ~~5,928,915~~	~~856,397~~ ~~4,044,312~~ ~~4,312~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~2.40E-02~~ ~~0.21~~ ~~0.92E-03~~	~~7.88E-03~~	~~1.44E-03~~
~~11187NP161~~ ~~1187NP14~~	~~TransAlta Corporation~~ ~~TransAlta Corporation~~	~~Highvale Coal Mine~~ ~~Highvale Coal Mine~~	~~Pit 08 Road Dust~~ ~~Pit 07 Mobile Combustion~~	~~670,081~~ ~~666,688~~	~~5,922,592~~ ~~5,925,226~~	~~671,107~~ ~~666,837~~	~~5,922,629~~ ~~5,924,789~~	~~671,552~~ ~~666,839~~	~~5,919,240~~ ~~5,924,417~~	~~670,373~~ ~~666,934~~	~~5,919,181~~ ~~5,924,427~~	~~3,766,136~~ ~~856,397~~ ~~6,397~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~-2.40E-02~~	-	~~1.90E-03~~
~~11187NP171~~ ~~1187NP17~~	~~TransAlta Corporation~~ ~~TransAlta Corporation~~	~~Highvale Coal Mine~~ ~~Highvale Coal Mine~~	~~Pit 08 Mobile Combustion~~ ~~Pit 08 Mobile Combustion~~	~~670,081~~ ~~667,081~~	~~5,922,592~~ ~~5,922,592~~	~~671,107~~ ~~661,107~~	~~5,922,629~~ ~~5,922,629~~	~~671,552~~ ~~661,552~~	~~5,919,240~~ ~~5,919,240~~	~~670,373~~ ~~661,037~~	~~5,919,181~~ ~~5,919,181~~	~~3,766,136~~ ~~3,766,136~~ ~~766,136~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~2.05E-02~~ ~~0.22~~ ~~0.05E-02~~	~~7.71E-03~~	~~1.40E-03~~
~~11187NP191~~ ~~1187NP2~~	~~TransAlta Corporation~~ ~~TransAlta Corporation~~	~~Highvale Coal Mine~~ ~~Highvale Coal Mine~~	~~Pit 09 Road Dust~~ ~~Pit 03 Mobile Combustion~~	~~667,597~~ ~~665,319~~	~~5,916,283~~ ~~5,930,520~~	~~667,597~~ ~~665,319~~	~~5,919,332~~ ~~5,931,773~~	~~670,047~~ ~~665,591~~	~~5,919,332~~ ~~5,931,773~~	~~670,047~~ ~~665,591~~	~~5,916,283~~ ~~5,930,520~~	~~7,469,749~~ ~~3,405,494~~ ~~405,494~~	~~0.00~~ ~~-0~~	~~16.01~~ ~~6.0~~	~~-6.78E-04~~	-	~~9.61E-03~~

<u>11187NP211</u> <u>187NP20</u>	<u>TransAlta</u> <u>Corporation</u> ~~TransAlta~~ <u>Corporation</u>	<u>Highvale Coal Mine</u> ~~Highvale~~ <u>Coal Mine</u>	<u>Pit 03 Mobile Combustion</u> ~~Pit 09~~ <u>Mobile Combustion</u>	<u>653,19566</u> <u>7,597</u>	<u>5,930,5205</u> <u>,916,283</u>	<u>653,19566</u> <u>7,597</u>	<u>5,931,7735</u> <u>,919,332</u>	<u>655,91367</u> <u>0,047</u>	<u>5,931,7735</u> <u>,919,332</u>	<u>655,91367</u> <u>0,047</u>	<u>5,930,5205</u> <u>,916,283</u>	<u>3,405,4947,</u> <u>469,749</u>	<u>0.00-0</u>	<u>16.016-0</u>	<u>6.78E-</u> <u>041-30E-</u> <u>01</u>	<u>2.05E-04</u>	<u>3.42E-05</u>
<u>11187NP201</u> <u>1187NP5</u>	<u>TransAlta</u> <u>Corporation</u> ~~TransAlta~~ <u>Corporation</u>	<u>Highvale Coal Mine</u> ~~Highvale~~ <u>Coal Mine</u>	<u>Pit 09 Mobile Combustion</u> ~~Pit 04~~ <u>Mobile Combustion</u>	<u>667,59765</u> <u>0,366</u>	<u>5,916,2835</u> <u>,933,762</u>	<u>667,59765</u> <u>2,700</u>	<u>5,919,3325</u> <u>,933,844</u>	<u>670,04765</u> <u>2,880</u>	<u>5,919,3325</u> <u>,932,204</u>	<u>670,04765</u> <u>0,408</u>	<u>5,916,2835</u> <u>,932,066</u>	<u>7,469,7494,</u> <u>018,905</u>	<u>0.00-0</u>	<u>16.016-0</u>	<u>1.30E-</u> <u>014-52E-</u> <u>04</u>	<u>4.53E-02</u>	<u>8.32E-03</u>
<u>11187NP411</u> <u>187NP8</u>	<u>TransAlta</u> <u>Corporation</u> ~~TransAlta~~ <u>Corporation</u>	<u>Highvale Coal Mine</u> ~~Highvale~~ <u>Coal Mine</u>	<u>Pit 04 Road Dust</u> ~~Pit 05 Mobile~~ <u>Combustion</u>	<u>650,36665</u> <u>9,252</u>	<u>5,933,7625</u> <u>,928,438</u>	<u>652,70066</u> <u>1,242</u>	<u>5,933,8445</u> <u>,928,589</u>	<u>652,88066</u> <u>3,598</u>	<u>5,932,2045</u> <u>,926,904</u>	<u>650,40866</u> <u>2,928</u>	<u>5,932,0665</u> <u>,926,255</u>	<u>4,018,9053,</u> <u>779,008</u>	<u>0.00-0</u>	<u>16.016-0</u>	<u>-3.42E-</u> <u>03</u>	<u>-</u>	<u>3.52E-04</u>
<u>11187NP5</u>	<u>TransAlta Corporation</u>	<u>Highvale Coal Mine</u>	<u>Pit 04 Mobile Combustion</u>	<u>650,366</u>	<u>5,933,762</u>	<u>652,700</u>	<u>5,933,844</u>	<u>652,880</u>	<u>5,932,204</u>	<u>650,408</u>	<u>5,932,066</u>	<u>4,018,905</u>	<u>0.0</u>	<u>16.0</u>	<u>4.52E-04</u>	<u>1.37E-04</u>	<u>3.42E-05</u>
<u>11187NP7</u>	<u>TransAlta Corporation</u>	<u>Highvale Coal Mine</u>	<u>Pit 05 Road Dust</u>	<u>659,252</u>	<u>5,928,438</u>	<u>661,242</u>	<u>5,928,589</u>	<u>663,598</u>	<u>5,926,904</u>	<u>662,928</u>	<u>5,926,255</u>	<u>3,779,008</u>	<u>0.0</u>	<u>16.0</u>	<u>-</u>	<u>-</u>	<u>4.92E-04</u>
<u>11187NP8</u>	<u>TransAlta Corporation</u>	<u>Highvale Coal Mine</u>	<u>Pit 05 Mobile Combustion</u>	<u>659,252</u>	<u>5,928,438</u>	<u>661,242</u>	<u>5,928,589</u>	<u>663,598</u>	<u>5,926,904</u>	<u>662,928</u>	<u>5,926,255</u>	<u>3,779,008</u>	<u>0.0</u>	<u>16.0</u>	<u>3.42E-03</u>	<u>7.88E-04</u>	<u>1.37E-04</u>

Table B-7: Regional Volume Source Emissions

Source ID	Owner	Project Name	Source Description	UTM Coordinates (m)		Effective Height	Initial Sigma Z	Initial Sigma Y	NO _x Emission Rate <u>(t/d)</u>		
				Easting	Northing				~~(t/d)~~ NO _x	CO	PM _{2.5}
10133NP3	New Star Energy Ltd.	Highvale Sour Gas Plant	Space Heater Exhaust Vents	664,466	5,916,925	4.3	4.8	5.0	5.52E-03	<u>4.59E-03</u>	<u>1.48E-04</u>

B5 REFERENCES

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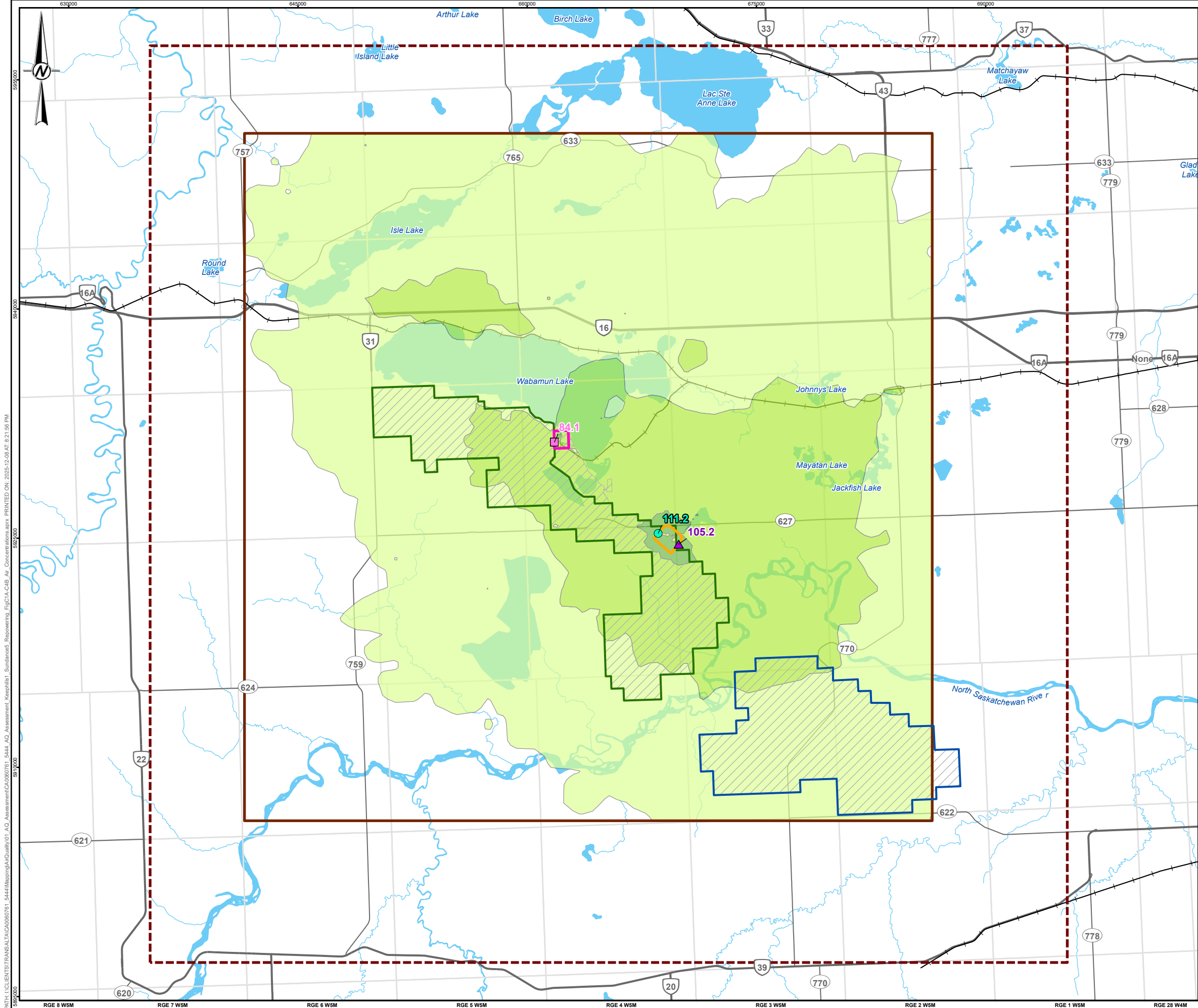
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US EPA. 2000. AP-42 Chapter 3.1 Stationary Gas Turbines. Available at https://www.epa.gov/sites/default/files/2020-09/documents/1.4_natural_gas_combustion.pdf.

ATTACHMENT C

Model Prediction Contour Figures



LEGEND

- KEEPHILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 300
- ≥ 225 to < 300
- ≥ 112.5 to < 225
- ≥ 75 to < 112.5
- ≥ 30 to < 75
- ≥ 15 to < 30
- < 15

NOTE(S)

- MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
- ALBERTA AMBIENT AIR QUALITY OBJECTIVE [$\mu\text{g}/\text{m}^3$] = 300
- BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = N/A

REFERENCE(S)

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PROJECT

KEEPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

PROJECT ONLY CASE MAXIMUM 1-HOUR NO₂ CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2025-12-08
DESIGNED	DC	
PREPARED	PRR LB	
REVIEWED	TJ	
APPROVED	DC	

PROJECT NO. CONTROL

CA0060761.5444

REV.

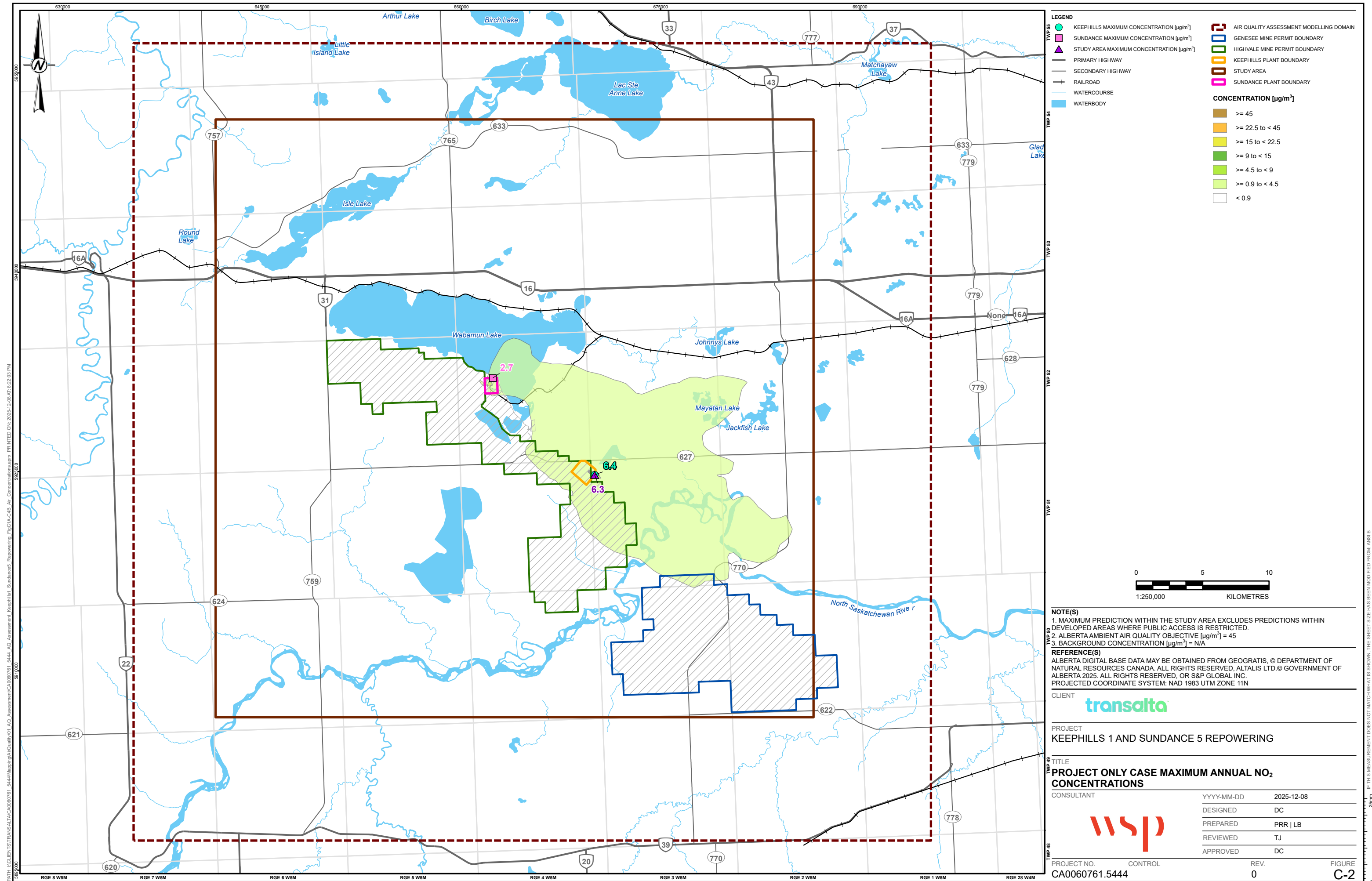
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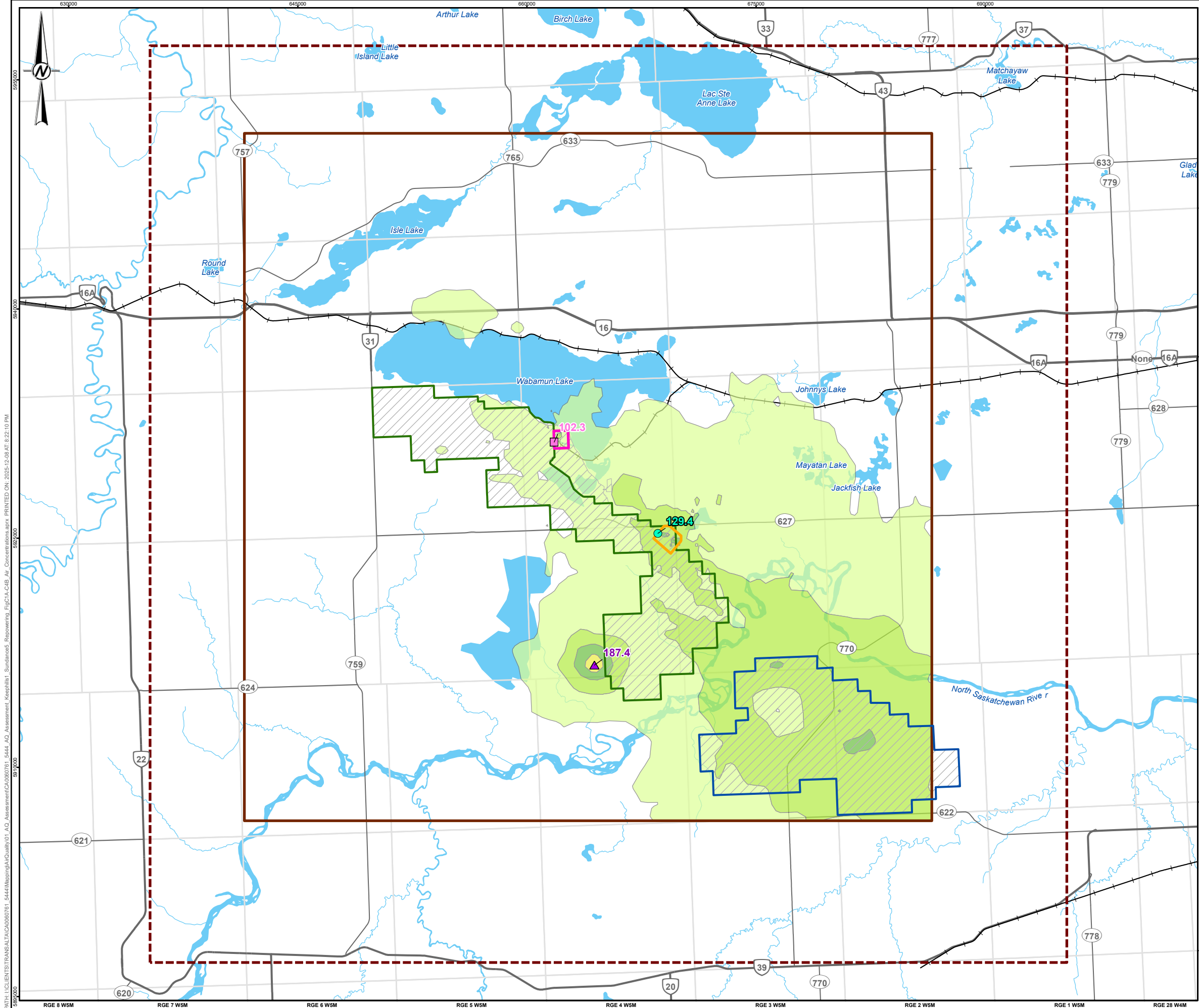
FIGURE

C-1

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LEGEND

- KEEPHILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY

AIR QUALITY ASSESSMENT MODELLING DOMAIN

- GENESEEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 300
- ≥ 225 to < 300
- ≥ 150 to < 225
- ≥ 120 to < 150
- ≥ 90 to < 120
- ≥ 60 to < 90
- < 60

NOTE(S)

- MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
- ALBERTA AMBIENT AIR QUALITY OBJECTIVE [$\mu\text{g}/\text{m}^3$] = 300
- BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = 18.2

REFERENCE(S)

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PROJECT

KEEPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

APPLICATION CASE MAXIMUM 1-HOUR NO₂ CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2025-12-08
DESIGNED	DC	
PREPARED	PRR LB	
REVIEWED	TJ	
APPROVED	DC	

PROJECT NO. CONTROL

CA0060761.5444

REV.

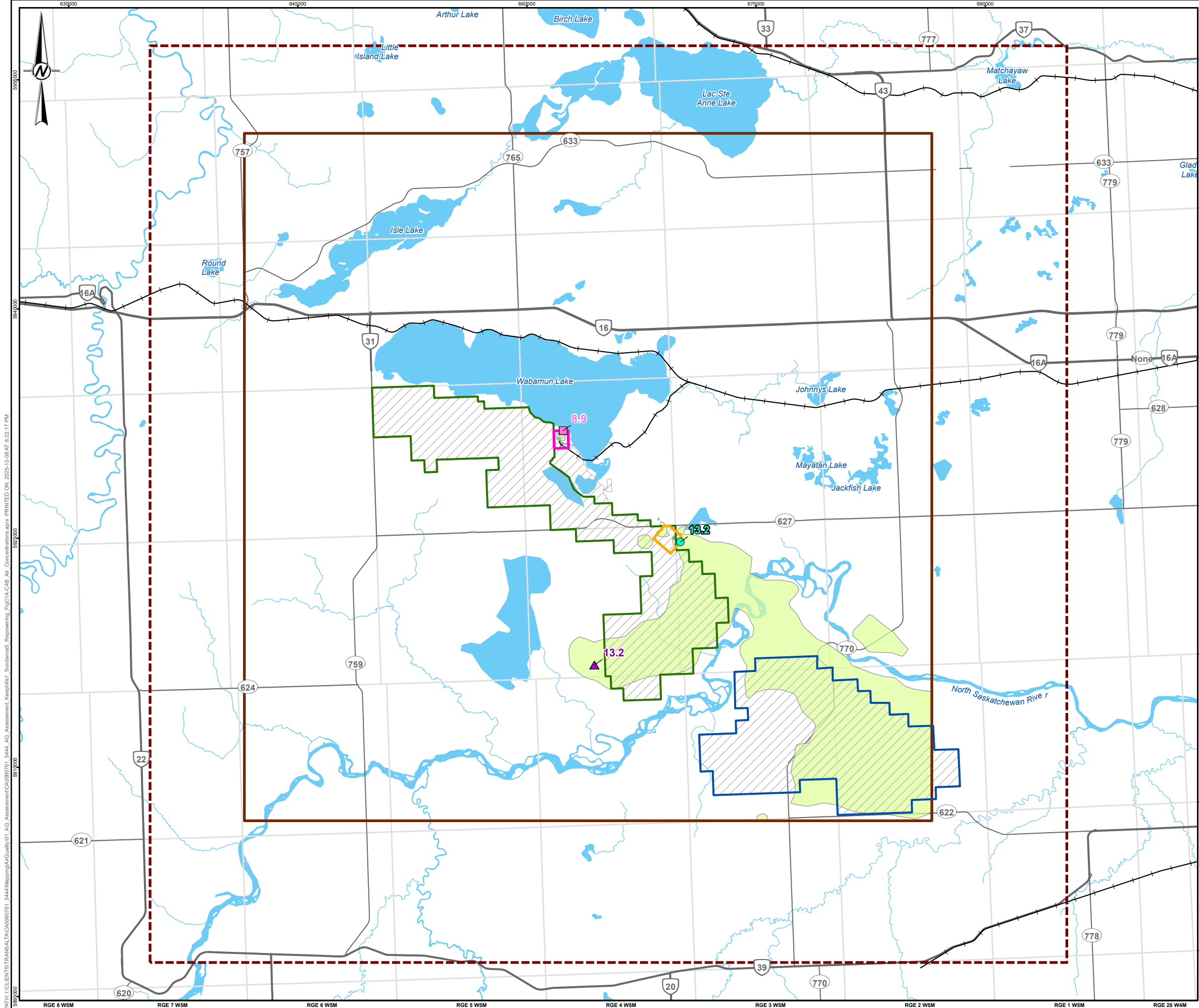
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FIGURE

C-3

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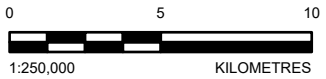


LEGEND

- KEEPPHILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 45
- ≥ 33.75 to < 45
- ≥ 22.5 to < 33.75
- ≥ 17 to < 22.5
- ≥ 13.5 to < 17
- ≥ 9 to < 13.5
- < 9



NOTE(S)

- MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
- ALBERTA AMBIENT AIR QUALITY OBJECTIVE [$\mu\text{g}/\text{m}^3$] = 45
- BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = 5.7

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PROJECT

KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

APPLICATION CASE MAXIMUM ANNUAL NO₂ CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2025-12-08
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PREPARED	PRR LB	
REVIEWED	TJ	
APPROVED	DC	

PROJECT NO. CONTROL

CA0060761.5444

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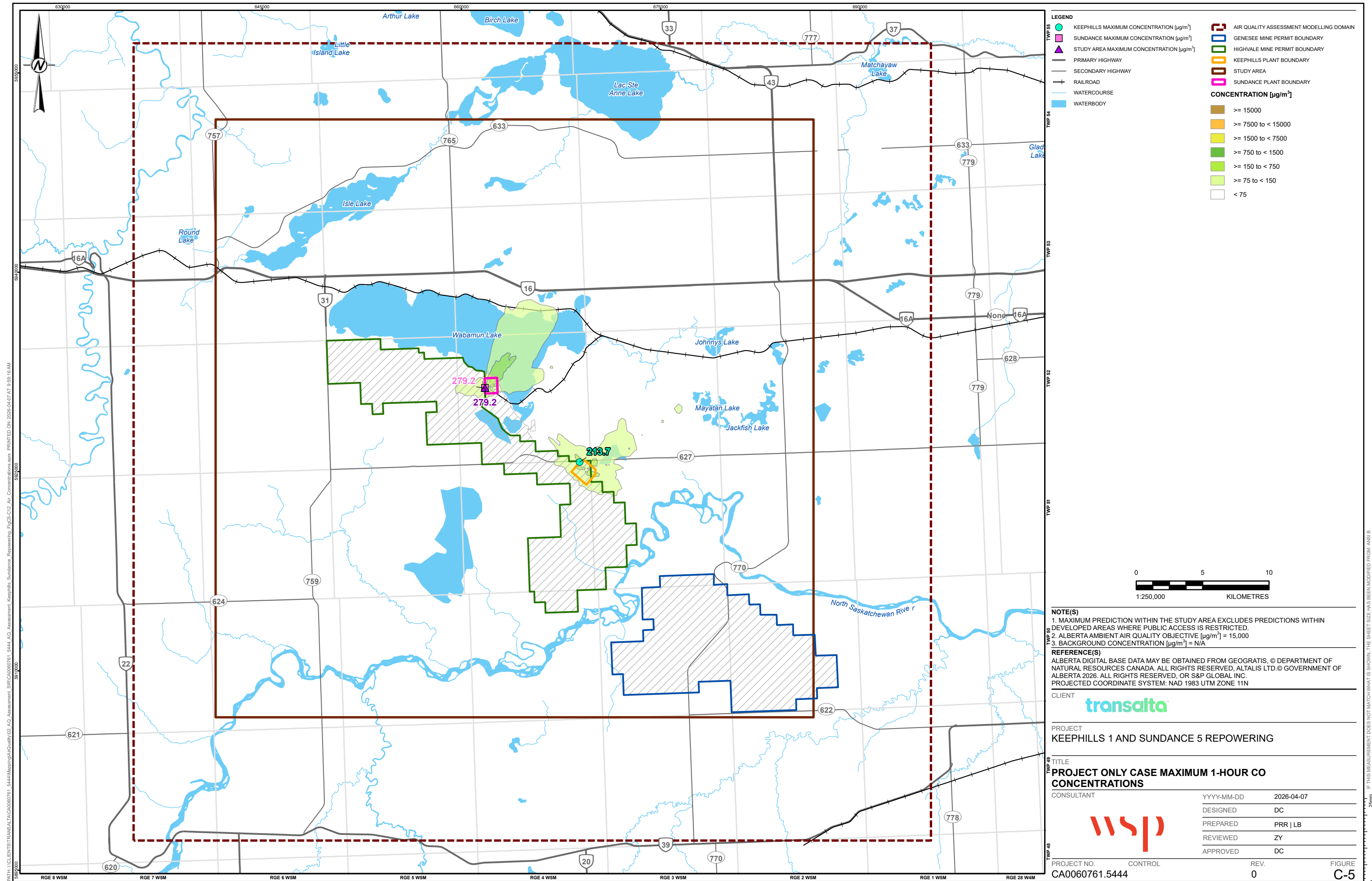
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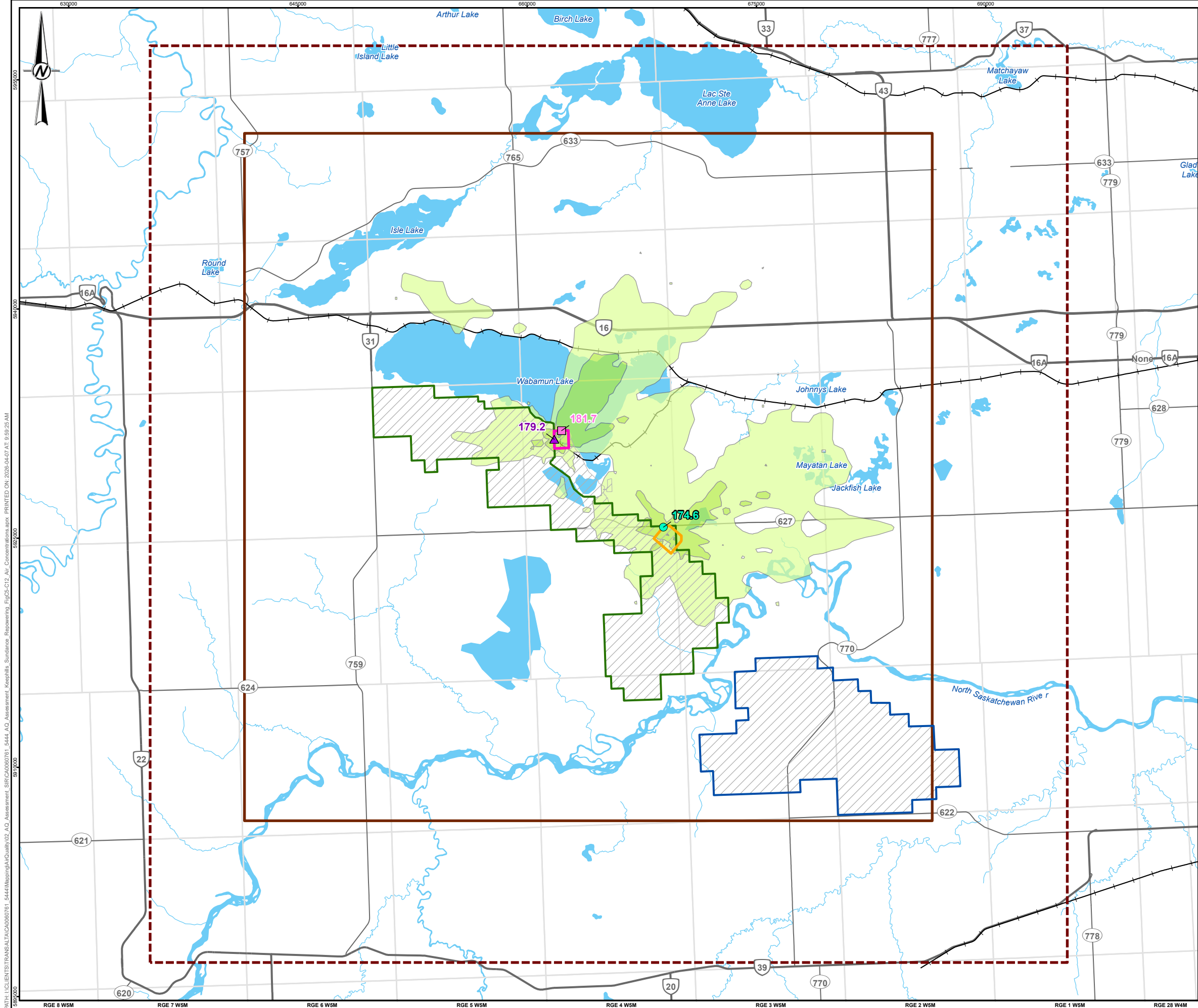
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C-4

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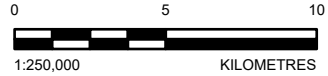


LEGEND

- KEEPILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- ▲ SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESSEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 6000
- ≥ 3000 to < 6000
- ≥ 600 to < 3000
- ≥ 300 to < 600
- ≥ 60 to < 300
- ≥ 30 to < 60
- < 30



NOTE(S)

1. MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
2. ALBERTA AMBIENT AIR QUALITY OBJECTIVE [$\mu\text{g}/\text{m}^3$] = 6,000
3. BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = N/A

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PROJECT

KEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

PROJECT ONLY CASE MAXIMUM 8-HOUR CO CONCENTRATIONS

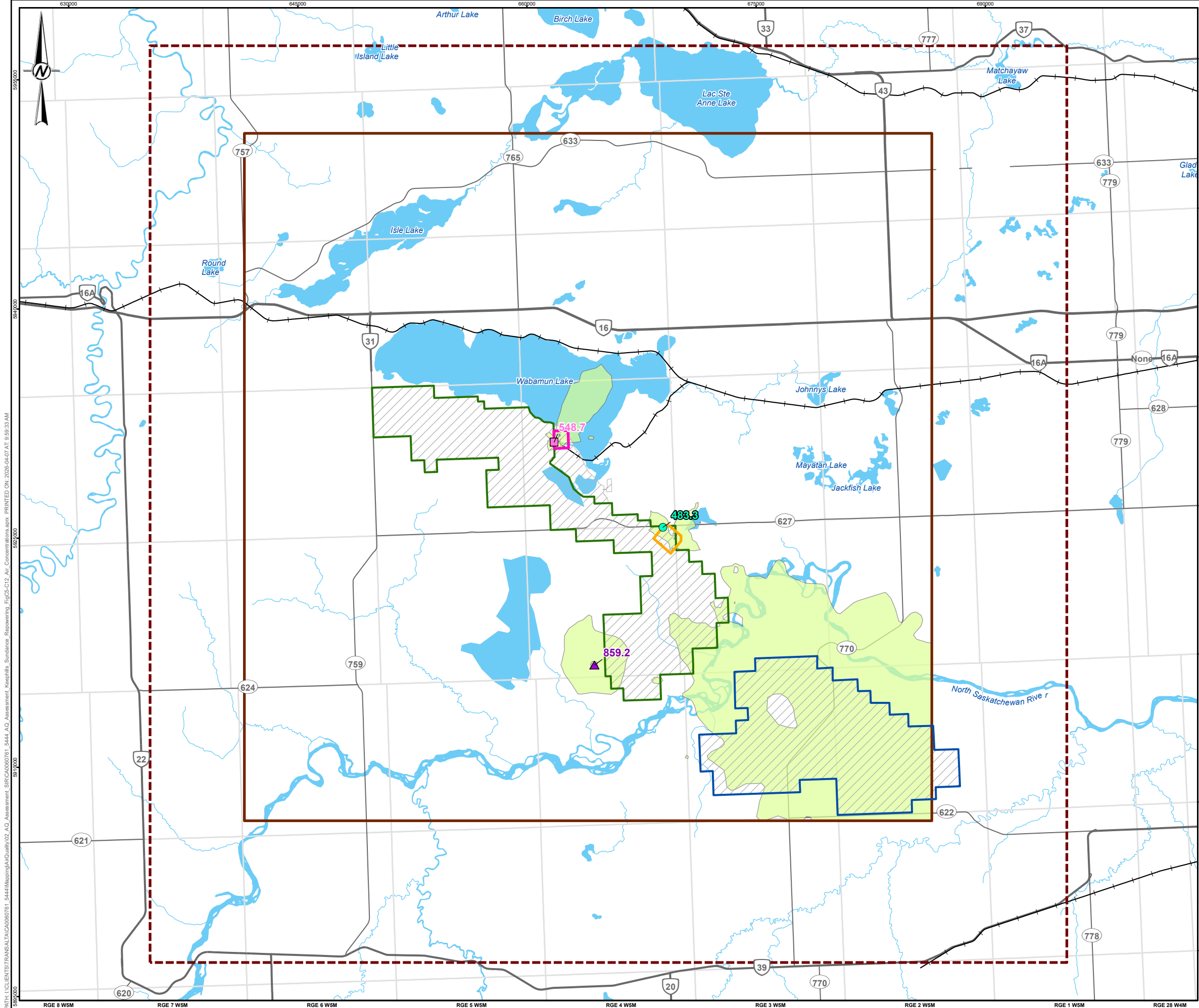
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PREPARED	PRR LB	
REVIEWED	ZY	
APPROVED	DC	

PROJECT NO. CA0060761.5444

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FIGURE C-6



LEGEND

- KEEPHILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 15000
- ≥ 7500 to < 15000
- ≥ 3000 to < 7500
- ≥ 1500 to < 3000
- ≥ 750 to < 1500
- ≥ 375 to < 750
- < 375

NOTE(S)

- MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
- ALBERTA AMBIENT AIR QUALITY OBJECTIVE [$\mu\text{g}/\text{m}^3$] = 15,000
- BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = 269.4

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PROJECT

KEEPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

APPLICATION CASE MAXIMUM 1-HOUR CO CONCENTRATIONS

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PREPARED	PRR LB	
REVIEWED	ZY	
APPROVED	DC	

PROJECT NO. CONTROL

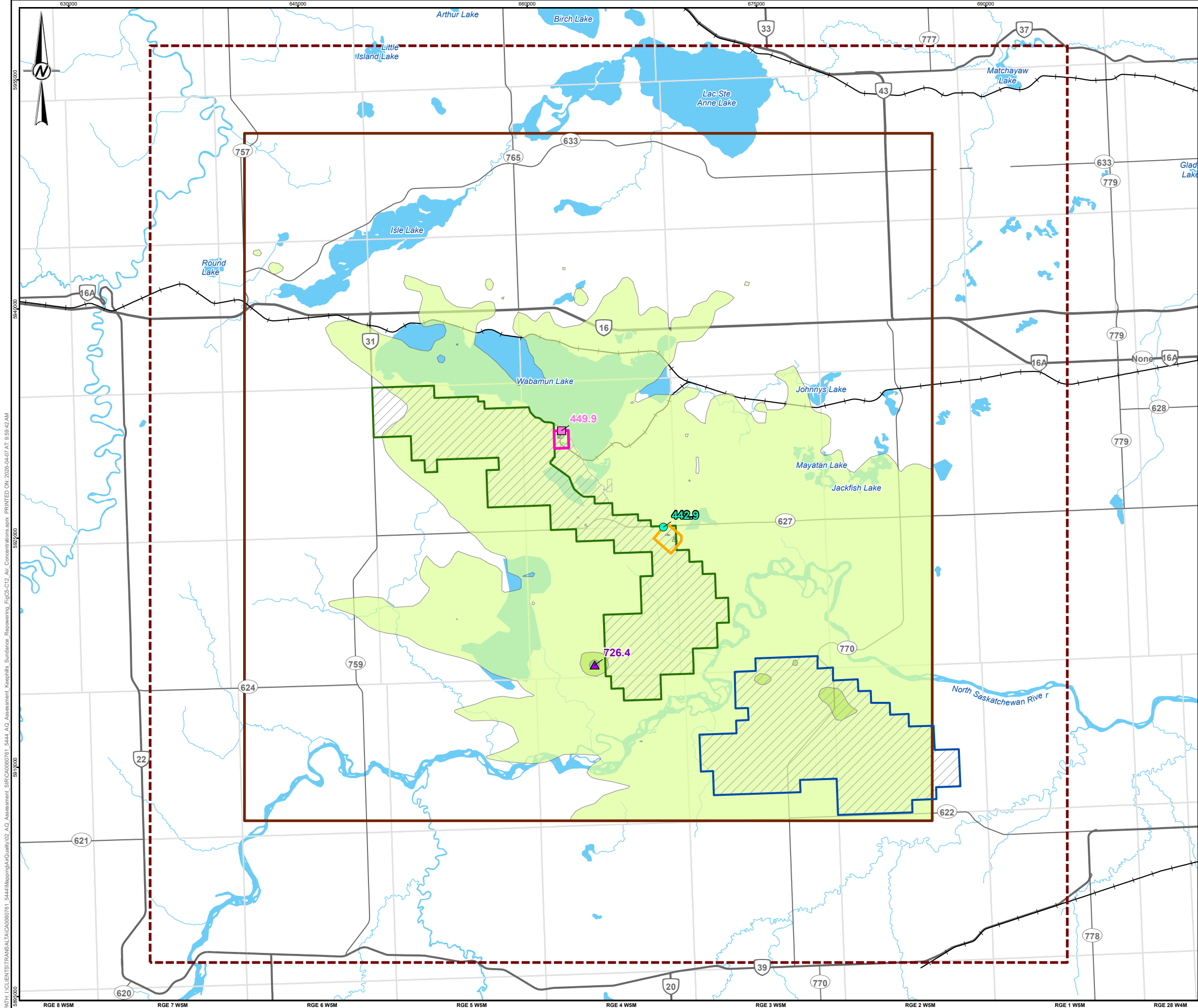
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FIGURE C-7

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LEGEND

- KEEPHILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 6000
- ≥ 3000 to < 6000
- ≥ 1500 to < 3000
- ≥ 600 to < 1500
- ≥ 450 to < 600
- ≥ 300 to < 450
- < 300

NOTE(S)

- MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
- ALBERTA AMBIENT AIR QUALITY OBJECTIVE [$\mu\text{g}/\text{m}^3$] = 6,000
- BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = 268.2

REFERENCE(S)

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CLIENT

PROJECT

KEEPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

APPLICATION CASE MAXIMUM 8-HOUR CO CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2026-04-07
DESIGNED	DC	
PREPARED	PRR LB	
REVIEWED	ZY	
APPROVED	DC	

PROJECT NO. CONTROL

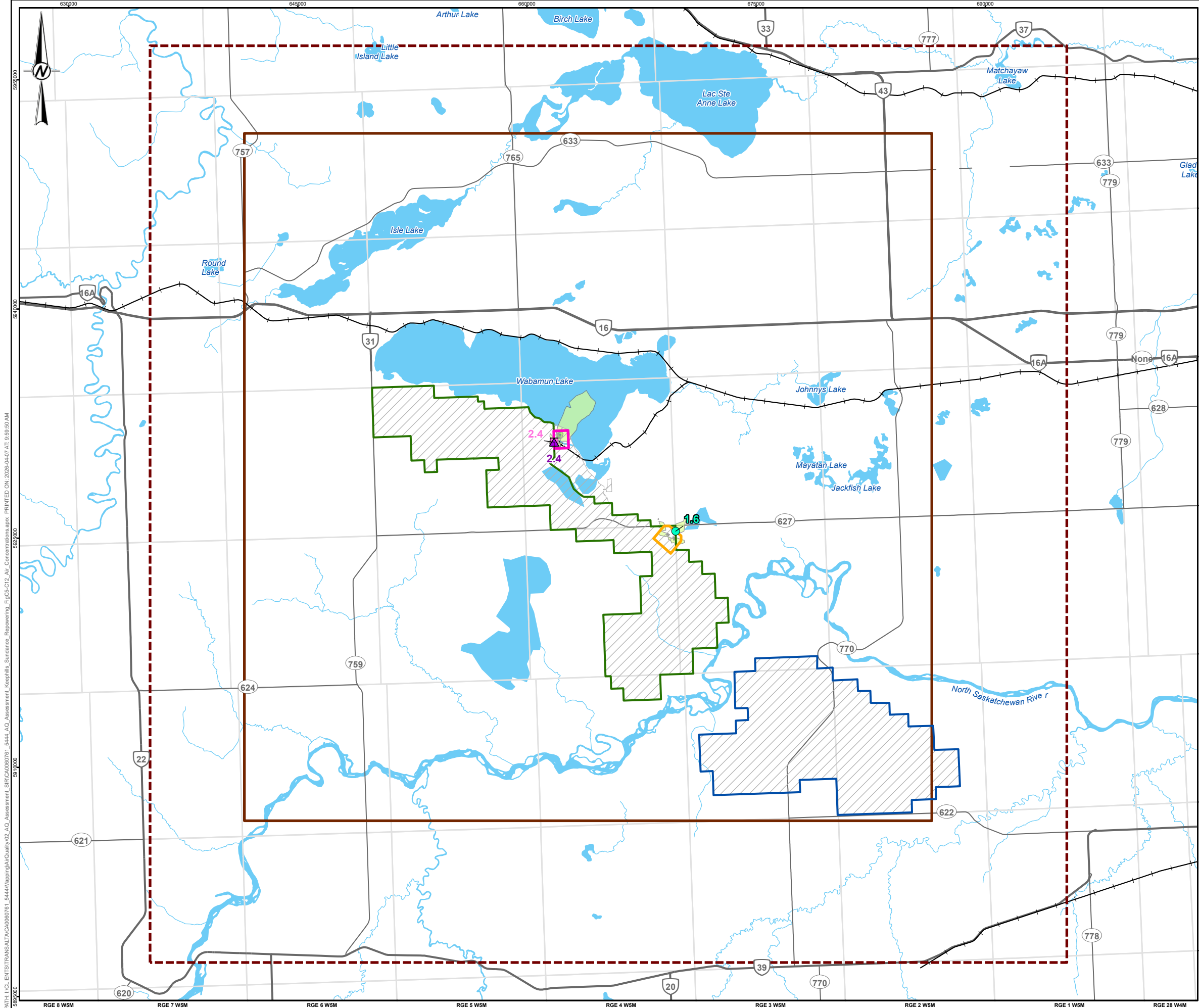
CA0060761.5444

REV. 0

FIGURE C-8

PATH: I:\CLIENT\TRANSALTA\CA0060761_5444\Mapping\AQ\Quality\02_AD_Assessment_SIR\CA0060761_5444_AQ_Assessment_Keephills_Sundance_Repowering_FigC5-C12_Air_Concentrations.aprx PRINTED ON: 2026-04-07 AT: 9:59:42 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

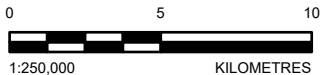


LEGEND

- KEEPPHILLS MAXIMUM CONCENTRATION [µg/m³]
- SUNDANCE MAXIMUM CONCENTRATION [µg/m³]
- STUDY AREA MAXIMUM CONCENTRATION [µg/m³]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [µg/m³]

- >= 80
- >= 8 to < 80
- >= 4 to < 8
- >= 3 to < 4
- >= 2 to < 3
- >= 1 to < 2
- < 1



NOTE(S)

1. MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
2. ALBERTA AMBIENT AIR QUALITY GUIDELINE [µg/m³] = 80
3. BACKGROUND CONCENTRATION [µg/m³] = N/A

REFERENCE(S)

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PROJECT

KEEPPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

PROJECT ONLY CASE MAXIMUM 1-HOUR PM_{2.5} CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2026-04-07
DESIGNED	DC	
PREPARED	PRR LB	
REVIEWED	ZY	
APPROVED	DC	

PROJECT NO. CA0060761.5444

CONTROL

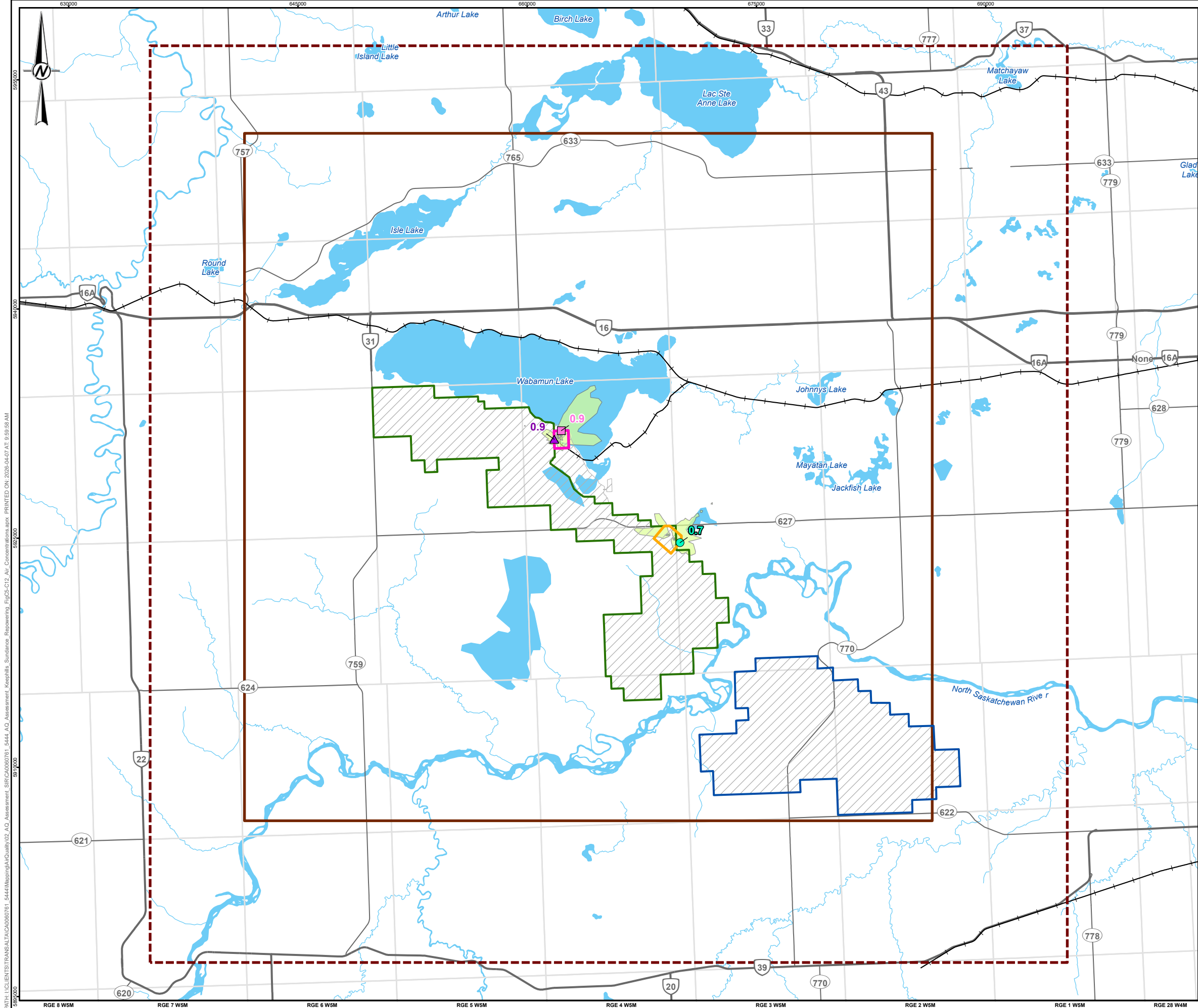
REV. 0

FIGURE

C-9

PATH: I:\CLIENT\TRANSALTA\CA0060761_5444\Maping\AQ\Quality\02_AQ_Assessment_SIR\CA0060761_5444_AQ_Assessment_Keephills_Sundance_Repowering_FigC5-C12_Air_Concentrations.aprx PRINTED ON: 2026-04-07 AT: 9:59:50 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

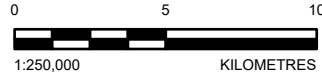


LEGEND

- KEEPHILLS MAXIMUM CONCENTRATION [µg/m³]
- SUNDANCE MAXIMUM CONCENTRATION [µg/m³]
- STUDY AREA MAXIMUM CONCENTRATION [µg/m³]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [µg/m³]

- >= 29
- >= 2.9 to < 29
- >= 2 to < 2.9
- >= 1.5 to < 2
- >= 1 to < 1.5
- >= 0.29 to < 1
- < 0.29



NOTE(S)

- MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
- ALBERTA AMBIENT AIR QUALITY OBJECTIVE [µg/m³] = 29
- BACKGROUND CONCENTRATION [µg/m³] = N/A

REFERENCE(S)

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PROJECT

KEEPHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

PROJECT ONLY CASE MAXIMUM 24-HOUR PM_{2.5} CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2026-04-07
DESIGNED	DC	
PREPARED	PRR LB	
REVIEWED	ZY	
APPROVED	DC	

PROJECT NO. CA0060761.5444

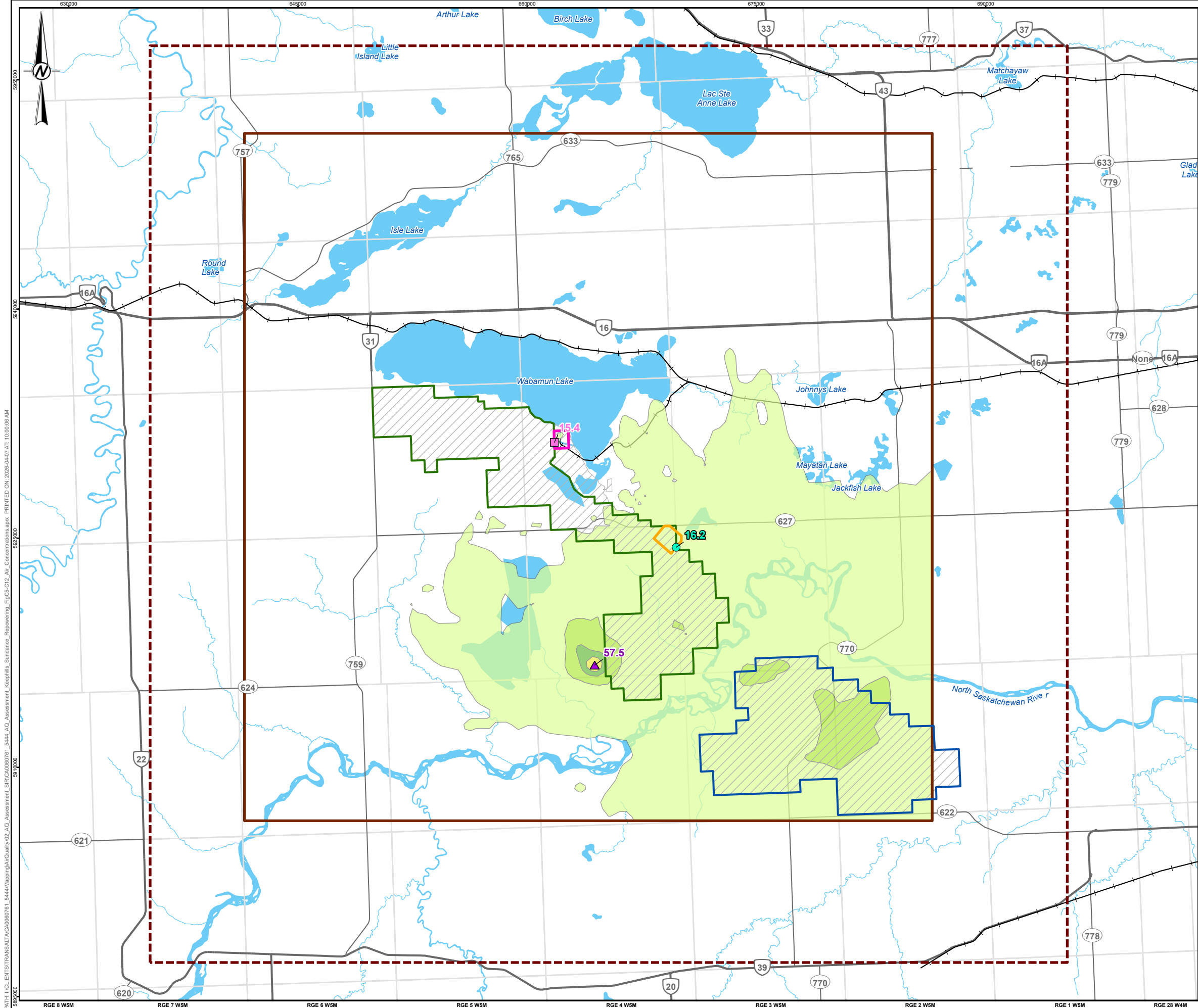
CONTROL

REV. 0

FIGURE C-10

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- KEEPHILLS MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- ▲ SUNDANCE MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- STUDY AREA MAXIMUM CONCENTRATION [$\mu\text{g}/\text{m}^3$]
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- WATERBODY
- AIR QUALITY ASSESSMENT MODELLING DOMAIN
- GENESEE MINE PERMIT BOUNDARY
- HIGHVALE MINE PERMIT BOUNDARY
- KEEPHILLS PLANT BOUNDARY
- STUDY AREA
- SUNDANCE PLANT BOUNDARY

CONCENTRATION [$\mu\text{g}/\text{m}^3$]

- ≥ 80
- ≥ 60 to < 80
- ≥ 40 to < 60
- ≥ 30 to < 40
- ≥ 20 to < 30
- ≥ 15 to < 20
- < 15

NOTE(S)

1. MAXIMUM PREDICTION WITHIN THE STUDY AREA EXCLUDES PREDICTIONS WITHIN DEVELOPED AREAS WHERE PUBLIC ACCESS IS RESTRICTED.
2. ALBERTA AMBIENT AIR QUALITY GUIDELINE [$\mu\text{g}/\text{m}^3$] = 80
3. BACKGROUND CONCENTRATION [$\mu\text{g}/\text{m}^3$] = 12.8

REFERENCE(S)

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PROJECT

KEEPIHILLS 1 AND SUNDANCE 5 REPOWERING

TITLE

APPLICATION CASE MAXIMUM 1-HOUR PM_{2.5} CONCENTRATIONS

CONSULTANT	YYYY-MM-DD	2026-04-07
DESIGNED	DC	
PREPARED	PRR LB	
REVIEWED	ZY	
APPROVED	DC	

PROJECT NO. CONTROL

CA0060761.5444

REV.

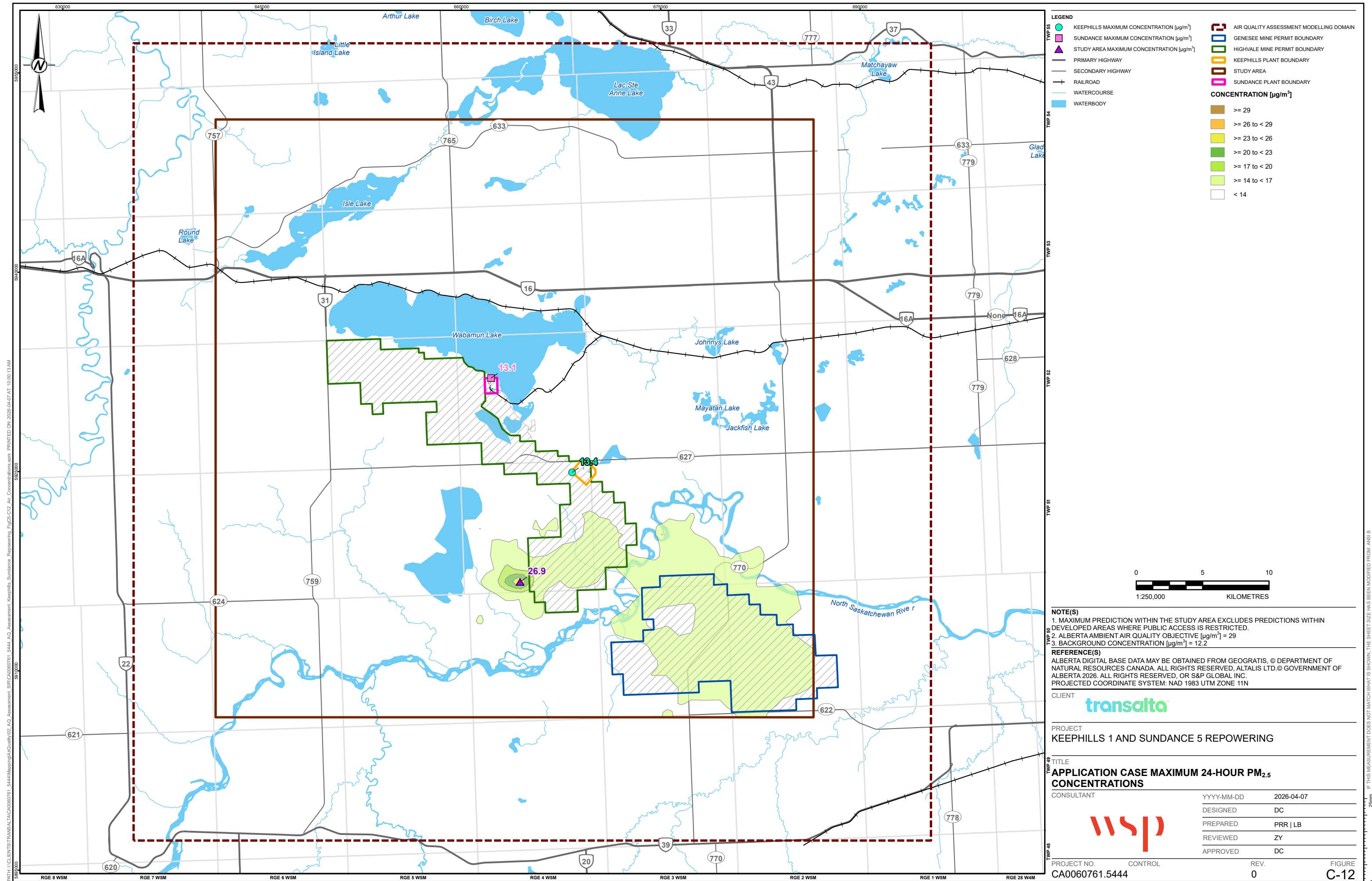
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FIGURE

C-11

PATH: I:\CLIENTS\TRANSALTA\CA0060761_5444\Mapping\AQ\Quality\02_AQ_Assessment_SIR\CA0060761_5444_AQ_Assessment_Keeyik Hills_Sundance Repowering_FigC5-C12_Air_Concentrations.aprx PRINTED ON: 2026-04-07 AT: 10:00:08 AM

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