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February 11, 2005

Mr. Bruce Bayle
Southern Region Air Resource Program Manager
USDA Forest Service
1720 Peachtree Road NW
Atlanta, GA 30309

Ms. Meredith Bond
PSD Coordinator
U.S. Fish & Wildlife Service
7333 W. Jefferson Avenue
Lakewood, CO 80235

RE: Norbord Georgia Inc. – Cordele (Crisp County), Georgia
Class I PSD Increment and Air Quality Related Values Analysis

Dear Mr. Bayle & Ms. Bond:

Norbord Georgia Inc. (Norbord) has proposed to construct an expansion to its existing oriented strandboard (OSB) mill located in Cordele, Crisp County, Georgia. The expansion project will be a major modification to an existing major stationary source of air emissions and is accordingly being permitted under the New Source Review (NSR) program. Crisp County is designated as "attainment" or "unclassifiable" for all criteria air pollutants. Accordingly, the Prevention of Significant Deterioration (PSD) programs as administered by the Georgia Environmental Protection Division (EPD) apply. Norbord submitted a PSD permit application to Georgia EPD on November 9, 2004, and a written response to a request for additional information was provided on February 2, 2005 for the permit application and on February 11, 2005 for the Class II air quality analysis. A completed Class I Area Project Information Form for the Cordele OSB Mill was provided in the initial permit application to assist Georgia EPD in notifying the Federal Land Manager (FLM) of the proposed expansion project.

On behalf of Norbord, Trinity Consultants (Trinity) has prepared a refined Class I PSD Increment analysis as well as an analysis of the project's potential impacts to Air Quality Related Values (AQRV) at three Class I areas that may potentially be affected by air emissions from Norbord's operations. The three Class I areas within approximately 200 km of the Cordele OSB Mill are the Okefenokee National Wildlife Refuge, located approximately 170 km southeast of the mill along the Georgia-Florida border, and the Bradwell Bay Wilderness and Saint Marks National Wildlife Refuge areas approximately 205 km to the south of the mill along the Florida Gulf Coast. The U.S. Fish & Wildlife Service (USFW) is the FLM responsible for oversight of Okefenokee and Saint Marks; the USDA Forest Service oversees Bradwell Bay.

Trinity's analysis finds that the proposed expansion project and continued operation of Norbord's Cordele OSB Mill near Cordele, Georgia, will neither cause nor contribute to an exceedance of a Class I PSD Increment standard, nor cause adverse impacts on air quality related values at the Okefenokee, Saint Marks, or Bradwell Bay Class I areas. This report is submitted to provide the FLM the opportunity to review the potential air quality impacts associated with this project and the air quality modeling analysis. Trinity's analysis methods are consistent with those recommended by the Interagency Workgroup on Air Quality Modeling (IWAQM) *Phase 2*

Summary Report, the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) *Phase I Report*, and the U.S. EPA's *Guideline on Air Quality Mo*dels (*Guideline*).[1,2,3] A CD-ROM is enclosed with this letter to provide modeling input and output files necessary to review the results summarized herein.

FACILITY AND PROJECT DESCRIPTION

Norbord operates an OSB manufacturing plant located near Cordele, Georgia along Highway 280 West in Crisp County. A facility area map is provided in Figure A-1 of this letter. Mixed southern hardwoods and pine are received by truck, debarked, cut to length, flaked, and conveyed to dryer metering bins. Upon dryer passage, the dry flakes are collected, screened for fines removal, and conveyed to blender metering bins. The flakes are then mixed with wax and resin and formed into a continuous mat. The mat is cut into sections and pressed at high temperature and pressure. Finally, the boards are sanded, trimmed to size, edge coated, and packaged for shipment. As part of the sawing and sanding finishing operations, a portion of the boards are passed through the Tongue & Groove process line.

The major emission units at the facility currently comprise four triple pass rotary dryers, a 210 MMBtu/hr Wellons energy system, and a board press. The energy system combusts woodwaste to generate the required process air to simultaneously dry and transport the wood flakes. The energy system also heats the press plate thermal oils. A wet electrostatic precipitator (WESP) is currently utilized to control PM emissions from the dryers, and a thermal oxidizer (TO) is used to control PM and VOC emissions from the board press.

The proposed expansion project comprises essentially a second manufacturing line that will increase annual OSB production capacity by 650 million square feet upon project completion. There are no changes proposed to the existing equipment or operations. New process equipment will include two dryers, a 285 MMBtu/hr wood fired energy system, blending and forming machines, a press, and additional finishing capacity. Norbord determined that best available control technology comprises a WESP followed by a thermal oxidizer (TO) to control emissions from the new energy system and dryers, a separate TO installed to control emissions from the new press, and baghouses to control emissions from forming, handling, and finishing operations. Table 1 summarizes the equipment and emissions inventory associated with the expansion project.

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[1] U.S. EPA, *IWAQM Phase 2 Summary Report and Recommendations for Modeling Long-Range Transport Impacts*, Research Triangle Park, North Carolina, EPA-454/R-95-006, 1995.

[2] U.S. Forest Service – Air Quality Program, National Park Service – Air Resources Division, U.S. Fish and Wildlife Service – Air Quality Branch, *Phase I Report of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG)*, December 2000.

[3] 40 CFR Part 51, Appendix W (Revised, April 15, 2003).

TABLE 1. EXPANSION PROJECT EQUIPMENT AND EMISSIONS INVENTORY

	Stack ID	Source ID	APC ID	Future Potential Emissions PM (tpy)	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)
Proposed Sources	S201	Dryer Exhaust (WESP/RTOs)	C201	153	343	343	262	2.63
	S202	Press Exhaust (TO)	C202	17.4	89.4	107	50.1	12.0
	S203	Resinated Fines Baghouse	C203	4.38	--	--	52.0	--
	S204	Unresinated Fines Baghouse	C204	4.38	--	--	39.0	--
	S205	Finishing Line Baghouse	C205	4.38	--	--	4.88	--
	S206	Wet Strand Fines Baghouse	C206	4.38	--	--	39.0	--
	S207	Dry Fuel Bin Baghouse	C207	7.01	--	--	19.5	--
	S208	Blowline Baghouse	C208	2.19	--	--	--	--
Total (Proposed Sources)				197	433	451	466	14.7

REGULATORY APPLICABILITY

Crisp County, in which Norbord's operations are located, is designated as "attainment" or "unclassifiable" for all criteria pollutants with respect to the National Ambient Air Quality Standards (NAAQS).[4] The Cordele OSB Mill is an existing major source under the PSD program as administered by Georgia EPD. Accordingly, the proposed project is potentially subject to PSD for each criteria pollutant for which the potential emissions increase is greater than the applicable NSR Significant Emission Rate (SER). As summarized in Table 2, the potential emissions increase of oxides of nitrogen (NO_X), particulate matter with an aerodynamic diameter less than ten microns (PM_{10}), volatile organic compounds (VOC), and carbon monoxide (CO) exceed the applicable SER.

TABLE 2. NET EMISSIONS AND PSD SIGNIFICANT EMISSION RATES

	PM (tpy)	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)
Total Potential Emissions Increases	169	433	451	466	15
PSD Significant Emission Rate	15	40	100	40	40
PSD Triggered?	**Yes**	**Yes**	**Yes**	**Yes**	No

The project is subject to PSD review for these pollutants including best available control technology (BACT) and air quality analyses. A complete description of the BACT and Class II air quality analyses were provided in the PSD permit application. Because the proposed project is minor with respect to SO_2 emissions, this pollutant was not evaluated for BACT or Class II air quality impacts. Nonetheless, emissions of SO_2 are considered in this analysis to ensure that

[4] 40 CFR § 81.311.

there is no degradation of air quality with respect to the PSD Class I Increment, and since sulfur emissions are of interest in assessing visibility degradation and deposition. Further, because the entire Cordele OSB Mill was constructed in 1988 after the baseline date, all facility-wide emissions are increment-affecting. The Class I PSD Increment and AQRV analyses presented in this report therefore consider total facility-wide emissions and air quality impacts are assessed against the single-facility decision making thresholds.

EMISSIONS INVENTORY

The PSD permit application provided a complete description of the emissions inventory for the purposes of assessing regulatory requirements and PSD permitting applicability of all criteria pollutants and several hazardous air pollutants. For the Class I area analysis, emissions of NO_X, SO_2, and particulate matter (including PM_{10} and speciated components) are of interest. For this analysis, Trinity has assessed the air quality impacts of Norbord's facility-wide potential emissions against the applicable Class I PSD Increment significance levels and decision-making thresholds for visibility degradation and sulfur and nitrate deposition. Accordingly, this report focuses on the facility-wide emissions inventory for only NO_X, SO_2, and particulate matter. Please refer to the complete PSD permit application for more detailed information about the PSD applicability analysis and emissions of other pollutants. Table 3 summarizes facility-wide potential emissions upon completion of the proposed expansion project.

TABLE 3. FACILITY-WIDE EQUIPMENT AND EMISSIONS INVENTORY

	Source ID	Source Description	NO_X Emissions (lb/hr)	NO_X Emissions (tpy)	PM_{10} Emissions (lb/hr)	PM_{10} Emissions (tpy)	SO_2 Emissions (lb/hr)	SO_2 Emissions (tpy)
Existing Sources	S01	WESP/Wellons	30.00	131	70.70	310	0.46	2.0
	S03	System 1 Baghouse	0.00	0	0.04	0	0.00	0
	S04	System 2 Baghouse	0.00	0	0.10	0	0.00	0
	S10	HP Waste Baghouse	0.00	0	1.14	5.0	0.00	0
	S11	T&G Sander	0.00	0	0.43	1.9	0.00	0
	S12	T&G Saw Line	0.00	0	0.18	0.8	0.00	0
	S13	Globe Line	0.00	0	0.53	2.3	0.00	0
	S63	Press RTO	12.56	55	6.63	29	1.69	7.4
New Sources	S201	Dryer Exhaust (RTO)	78.41	343	35.00	153	0.60	2.6
	S202	Press Exhaust (RTO)	20.40	89	4.00	18	2.75	12.0
	S203	Resinated Fines	0.00	0	1.00	4.4	0.00	0
	S204	Non-resinated Fines	0.00	0	1.00	4.4	0.00	0
	S205	Finishing Line	0.00	0	1.00	4.4	0.00	0
	S206	Wet Strand Line	0.00	0	1.00	4.4	0.00	0
	S207	Dry Fuel Bin	0.00	0	1.60	7.0	0.00	0
	S208	Blowline	0.00	0	0.50	2.2	0.00	0

To properly model the impacts of the emissions on visibility and sulfur and nitrogen deposition, it is necessary to further speciate the emitted pollutants. The FLM has increasingly required speciation of particulate and sulfur species to account for the variable efficiency of light scattering components in the model. Although the FLM has published speciation guidance for certain source types (e.g., gas-, oil-, and coal-fired power plants), Trinity is not aware specific

guidance for facilities engaged in wood products manufacturing. Therefore, Norbord and Trinity developed the following emissions profiles based on engineering knowledge of wood products operations, limited reference data (e.g., AP-42 and industry analyses), and selected stack test results.

NO_X emissions from the Cordele OSB Mill were modeled in a straightforward fashion since these emissions result from combustion operations, which are well controlled and captured prior to exhaust to the atmosphere. Similarly, SO_2 emissions emanate only from combustion sources, and result from the incomplete oxidation of fuel-bound sulfur in the wood fuel. Primary emissions of sulfuric acid mists or vapors, if any, are assumed to occur as only a small percentage (1% by mass) of the primary SO_2 emissions. Because of the condensable nature of such emissions, primary sulfate is evaluated as a speciated particulate fraction.

Emissions of particulate occur throughout the plant from the primary process units (combustion, dryers, and press) and from secondary material handling operations. Particulate emissions from the primary units include both filterable and condensable (volatile) components, whereas emissions from secondary operations are essentially entirely filterable. Norbord has conducted a limited amount of stack testing for speciated particulate components at its OSB operations across the U.S. While few data are available to estimate speciated emissions, Norbord has reviewed what data that are available to arrive at a conservative, yet reasonable estimate of speciated PM emissions. However, it should be noted that the data quality on PM speciation is inadequate for setting regulatory emission limits and are provided here solely as the best estimated data for a scientific analysis of potential impacts on Class I area AQRV.

The following equations demonstrate the calculation process for speciating short-term PM emissions from the sources of filterable and condensable PM: the dryers and presses. Note that the calculations were performed in a spreadsheet and the values shown here may differ slightly from those modeled due to the limited significant figures shown in the sample calculation. The following methodology illustrates the computation sequence for speciated particulate emissions from the existing combustion sources and dryers that are abated by the WESP and exhaust through stack code PS01.

Norbord's analysis of stack test data suggests that the particulate matter emitted from an OSB dryer controlled by a WESP is on average 33% filterable and 67% percent condensable. Since the potential-to-emit of PM_{10} would be determined by U.S. EPA reference method 5 for the filterable component, the condensable emissions from the existing WESP are estimated as:

$$\mathrm{PM}_{\mathrm{filterable}} = 70.7\frac{\mathrm{lb}}{\mathrm{hr}}; \quad \mathrm{PM}_{\mathrm{condensable}} = 67\% \times \left(\frac{\mathrm{PM}_{\mathrm{filterable}}}{33\%}\right) = 143\frac{\mathrm{lb}}{\mathrm{hr}}.$$

Equation 1

Because of the WESP control, all emissions are assumed to be in the fine mode and there are no coarse PM emissions. The filterable PM is split into elemental carbon (EC) and non-EC $PM_{2.5}$

based on an assumed value of 5% EC for unburned fuel, or 3.5 lb/hr. The remaining fine, filterable mass totals 67.2 lb/hr.

$$\mathrm{EC} = \mathrm{PM}_{\mathrm{filterable}} \times 5\% = 3.5 \frac{\mathrm{lb}}{\mathrm{hr}};$$
$$\mathrm{PM}_{\mathrm{filterable,non-EC}} = \mathrm{PM}_{\mathrm{filterable}} - \mathrm{EC} = 67.2 \frac{\mathrm{lb}}{\mathrm{hr}}$$

Equation 2

The condensable portion is split between organic condensable (OC) and inorganic condensable (IOC) based on an estimated 50%/50% split.

$$\mathrm{OC} = \mathrm{PM}_{\mathrm{condensable}} \times 50\% = 71.4 \frac{\mathrm{lb}}{\mathrm{hr}} \text{ as SOA};$$
$$\mathrm{IOC} = \mathrm{PM}_{\mathrm{condensable}} \times 50\% = 71.4 \frac{\mathrm{lb}}{\mathrm{hr}}$$

Equation 3

The inorganic condensable term includes both sulfate (SO_4) and non-sulfate IOC that must be further speciated due to their differing scattering properties. Then, the non-sulfate IOC and non-EC filterable are summed to determine the overall PM fine (PMF) emissions. Primary sulfate is estimated at 1% of the primary SO_2 mass emission rate.

$$\mathrm{SO}_4 = 0.46 \frac{\mathrm{lb}}{\mathrm{hr}} \times 1\% = 0.0046 \frac{\mathrm{lb}}{\mathrm{hr}}; \quad \mathrm{IOC}_{\text{non-SO}_4} = \mathrm{IOC} - \mathrm{SO}_4 = 71.3 \frac{\mathrm{lb}}{\mathrm{hr}}$$
$$\mathrm{PMF} = \mathrm{PM}_{\mathrm{filterable,\ non\text{-}EC}} + \mathrm{IOC}_{\text{non-SO}_4} = 138.6 \frac{\mathrm{lb}}{\mathrm{hr}}$$

Equation 4

The result of the calculation is five species for inclusion in the modeling. After each term the related abbreviation used by CALPUFF is included in parenthesis:

- PM Coarse (PMC) 0 lb/hr
- PM Fine (PMF) 138.6 lb/hr
- Elemental Carbon (EC) 3.5 lb/hr
- Organic Carbon (SOA) 71.4 lb/hr
- Sulfate (SO_4) 0.0046 lb/hr

The same calculation approach was used to estimate speciated emissions from the new combustion source, dryers, and WESP (stack code S201). An analogous approach was used to estimate emissions from the existing and proposed press, except that Norbord estimates a slightly different ratio of filterable (37%) to condensable (63%) fractions based on limited stack testing analysis.

Particulate emissions from the secondary product handling operations (both existing and proposed) are well controlled by baghouses, and all particulate emissions are in the fine, filterable mode and quantified based on process throughputs and grain loadings. Table 4 summarizes the modeled emission rates for the Class I area analysis calculated from the preceding approach.

TABLE 4. SPECIATED MODELED EMISSION RATES

Source Code	SO_2 (lb/hr)	SO_4 (lb/hr)	NOx (lb/hr)	Organic Carbon (SOA) (lb/hr)	Coarse PM (PMC) (lb/hr)	Fine PM (PMF) (lb/hr)	Elemental Carbon (EC) (lb/hr)
PS01	0.46	0.00	30.00	71.44	0.00	138.60	3.54
PS03	0.00	0.00	0.00	0.00	0.00	0.04	0.00
PS04	0.00	0.00	0.00	0.00	0.00	0.10	0.00
PS10	0.00	0.00	0.00	0.00	0.00	1.14	0.00
PS11	0.00	0.00	0.00	0.00	0.00	0.43	0.00
PS12	0.00	0.00	0.00	0.00	0.00	0.18	0.00
PS13	0.00	0.00	0.00	0.00	0.00	0.53	0.00
PS63	1.69	0.02	12.56	5.53	0.00	11.81	0.33
S201	0.73	0.01	78.41	35.36	0.00	68.61	1.75
S202	2.75	0.03	20.40	3.33	0.00	7.11	0.20
S203	0.00	0.00	0.00	0.00	0.00	1.00	0.00
S204	0.00	0.00	0.00	0.00	0.00	1.00	0.00
S205	0.00	0.00	0.00	0.00	0.00	1.00	0.00
S206	0.00	0.00	0.00	0.00	0.00	1.00	0.00
S207	0.00	0.00	0.00	0.00	0.00	1.60	0.00
S208	0.00	0.00	0.00	0.00	0.00	0.50	0.00

CLASS I AREA MODELING ANALYSES

There are two principal air quality impacts considered for Class I areas: PSD Increments for NO_X, SO_2, and PM_{10}, and air quality related values (AQRV). This section of the report describes the procedural requirements for assessing the impacts of Norbord's proposed project.

CLASS I PSD INCREMENT

In general, all PSD permit applications are required to demonstrate through air quality modeling that the emissions increases from the proposed project will not cause or contribute to any violations of allowable increments within affected Class I areas, which are protected to a greater degree (i.e., the allowable increments are lower) than Class II areas. A significant contribution to Class I Increment consumption is defined as a modeled concentration in excess of the significant impact levels summarized in Table 5, which were originally developed as part of NSR reform rulemaking and have subsequently been adopted as informal modeling significance levels for Class I analyses that are used to aid in decision making as to whether a project is likely to cause or contribute to an adverse impact.

TABLE 5. CLASS I INCREMENT LEVELS

Pollutant	Averaging Period	Class I Increment ($\mu g/m^3$)	Significance Level ($\mu g/m^3$)
PM_{10}	24-hour	8.0	0.32
	Annual	4.0	0.16
SO_2	3-hour	25.0	1.0
	24-hour	5.0	0.2
	Annual	2.0	0.1
NO_2	Annual	2.5	0.1

Modeling assessment of NO_2 and SO_2 impacts is computed in a straightforward fashion by comparing the concentrations calculated to result due to primary NO_X and SO_2 emissions from the source. Modeling assessment of PM_{10} impacts is conservatively computed by summing the calculated concentrations of particulate species emitted by the facility: coarse particulate matter (PMC), fine particulate matter (PMF), organic carbon (SOA), and elemental carbon (EC).

As described in a subsequent section of this report, because Norbord's impacts were found to be below the significant impact levels for all pollutants and all averaging periods summarized in Table 5, an analysis of the cumulative impacts from the proposed facility and regional sources together was not necessary since the operations are presumed to neither cause nor contribute to excessive consumption of allowable PSD Class I Increment. Note that for the purposes of this analysis, the entire facility-wide potential emissions were considered in this analysis, since the entire facility was constructed after the baseline date and consumed available increment in both Class I and II areas.

CLASS I AQRV ANALYSES

With the exception of visibility, the Clean Air Act and the PSD regulations do not define AQRV, do not provide procedures for defining AQRV, and do not provide criteria to determine critical pollutant loadings at which an adverse impact on AQRV would occur. The FLM AQRV Workgroup (FLAG) December 2000 Phase I report defines the following:[5]

> *Air Quality Related Value* - A resource, as identified by the FLM for one or more Federal areas, that may be adversely impacted by a change in air quality. The resource may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the FLM for a particular area.

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[5] U.S. Forest Service – Air Quality Program, National Park Service – Air Resources Division, U.S. Fish and Wildlife Service – Air Quality Branch, *Phase I Report of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG)*, December 2000.

Adverse Impact on Air Quality Related Values - A deleterious effect on any AQRV defined by the FLM, resulting from the emissions of a proposed sources or modification, that interferes with the management, protection, preservation, or enjoyment of the AQRV.

AQRV indicators typically identified by FLM include visibility degradation, nitrogen deposition, and sulfur deposition. The following sections discuss the AQRV addressed for this project.

Visibility

Visibility can be affected by plume impairment (heterogeneous) or regional haze (homogeneous). Plume impairment results when there is a contrast or color difference between the plume and a viewed background (the sky or a terrain feature). Plume impairment is generally only of concern when the Class I area is near the proposed source (i.e., less than 50 km). Since the distance between the Cordele OSB Mill and the three Class I areas evaluated ranges between approximately 170 km and 205 km, only regional haze was considered in this analysis. Note that since visibility is not an AQRV for Bradwell Bay, visibility impacts at this area were not considered in this analysis.

Regional haze occurs at distances where the plume has become evenly dispersed into the atmosphere such that there is no definable plume. The primary causes of regional haze are sulfates (SO_4) and nitrates (NO_3) (primarily as ammonium salts), which are formed from sulfur dioxide (SO_2) and oxides of nitrogen (NO_X) through chemical reactions in the atmosphere. These reactions take time. Near a source little NO_X or SO_2 will have formed nitrate or sulfate, whereas far from a source nearly all SO_2 will have formed sulfate and most NO_X will have formed nitrate. Particulate emissions also contribute to regional haze but to a lesser extent.

Regional haze is measured using the light extinction coefficient (b_{ext}). To determine a change in regional haze, the percentage change of the light extinction coefficient (Δb_{ext}) was evaluated as shown in the following Equation 5:

$$\Delta b_{ext} = \frac{b_{ext,project}}{b_{ext,background}} \qquad \textit{Equation 5}$$

The background extinction coefficient $b_{\text{ext, background}}$ is affected by various chemical species and the Rayleigh scattering phenomenon and can be calculated as shown in Equation 6:[6]

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[6] U.S. Forest Service – Air Quality Program, National Park Service – Air Resources Division, U.S. Fish and Wildlife Service – Air Quality Branch, *Phase I Report of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG)*, December 2000.

$$b_{ext,background}\,(km^{-1}) = b_{SO_4} + b_{NO_3} + b_{OC} + b_{soil} + b_{coarse} + b_{ap} + b_{ray} \qquad \textit{Equation 6}$$

where,

$b_{SO_4} = 0.003\left[(NH_4)_2SO_4\right]f(RH)$
$b_{NO_3} = 0.003\left[NH_4NO_3\right]f(RH)$
$b_{OC} = 0.004\left[OC\right]$
$b_{Soil} = 0.001\left[Soil\right]$
$b_{Coarse} = 0.0006\left[\text{Coarse Mass}\right]$
$b_{ap} = 0.01[\text{Elemental Carbon}]$
b_{Ray} = Rayleigh Scattering
f(RH) = relative humidity adjustment factor
[ ] = Concentration in $\mu g/m^3$

Values for the parameters listed above specific to the natural background conditions at the Class I areas considered in this analysis are provided on an annual average basis in the U.S. EPA's *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule*.[7] Table 6 summarizes these values, which represent the default natural background condition using average natural concentrations of sulfate, nitrate, and particulate species (reference Table 2-1 of the U.S. EPA report) for areas in the Eastern U.S.

TABLE 6. COPY OF TABLE 2-1 FROM EPA-454/B-03-005.

Component	West (µg/m3)	East (µg/m3)	Error Factor	Dry Extinction Efficiency (m2/g)
Ammonium sulfate	0.12	0.23	2	3
Ammonium nitrate	0.1	0.1	2	3
Organic carbon mass	0.47	1.4	2	4
Elemental carbon	0.02	0.02	2-3	10
Soil	0.5	0.5	1½ - 2	1
Coarse Mass	3	3	1½ - 2	0.6

The preceding values represent an updated, though essentially equivalent, representation of the natural background values as would be computed using the

[7] U.S. EPA, *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule* , Table 2-1, Attachment A, September 2003, EPA-454/B-03-005.

FLAG guidance. Tables 7 and 8 summarize the FLAG reference values for Okefenokee and Saint Marks, respectively.

TABLE 7. COPY OF OKEFENOKEE PORTION OF TABLE 2.B-1 FROM FLAG

Season	Hygro $(Mm)^{-1}$	Non-Hygro $(Mm)^{-1}$	Components of Dry Extinction Rayleigh $(Mm)^{-1}$	f(RH) (d'less)	Particle b_{ext} with f(RH) $(Mm)^{-1}$	Reference Level $(Mm)^{-1}$
Annual	0.9	8.5	10	3.5	11.7	21.7
Winter	0.9	8.5	10	3.2	11.3	21.3
Spring	0.9	8.5	10	3.4	11.5	21.5
Summer	0.9	8.5	10	3.9	12.0	21.0
Fall	0.9	8.5	10	3.6	11.7	21.7

TABLE 8. COPY OF SAINT MARKS PORTION OF TABLE 2.B-1 FROM FLAG

Season	Hygro $(Mm)^{-1}$	Non-Hygro $(Mm)^{-1}$	Components of Dry Extinction Rayleigh $(Mm)^{-1}$	f(RH) (d'less)	Particle b_{ext} with f(RH) $(Mm)^{-1}$	Reference Level $(Mm)^{-1}$
Annual	0.9	8.5	10	3.6	11.8	21.8
Winter	0.9	8.5	10	3.2	11.4	21.4
Spring	0.9	8.5	10	3.5	11.7	21.7
Summer	0.9	8.5	10	3.0	12.1	21.1
Fall	0.9	8.5	10	3.6	11.8	21.8

Although the data in the three tables are not presented in the same units, they can be compared by multiplying the *East* column by the *Dry Extinction Efficiency* column in Table 6, then summing the hygroscopic (ammonium sulfate and ammonium nitrate) and non-hygroscopic (remaining rows). The data in Table 6 convert to scattering values of 0.99 $(Mm)^{-1}$ for hygroscopic and 8.1 $(Mm)^{-1}$ for non-hygroscopic, which are essentially the same as the values listed in Table 7 and 8 from FLAG.

Because the 2003 reference values provide an equivalent estimate of natural background conditions and was computed from the most recent U.S. EPA guidance, Trinity believes it is the most appropriate basis for visibility computations. The 2003 U.S. EPA document was developed by many of the same group that developed the

recommendations for visibility modeling in the 2000 FLAG report. Staff from the Federal Land Manager agencies involved included the following individuals.

- Rodger Ames, National Park Service (NPS), Cooperative Institute for Research in the Atmosphere (CIRA)
- Dennis Haddow, U.S. Fish and Wildlife Service (FWS)
- Bill Leenhouts, FWS
- William Malm, NPS CIRA
- Debbie Miller, NPS
- Janice Peterson, U.S. Department of Agriculture, Forest Service (USFS)
- Bruce Polkowsky, NPS
- David Sandberg, USFS
- Jim Sisler, NPS CIRA

In summary, the 2003 U.S. EPA report used by Trinity provides the most recent published data on background visibility and its calculated values are nearly identical to those from the 2000 FLAG report.

The extinction coefficient due to emissions increases from the proposed project $b_{\text{ext,project}}$ must also be calculated. Pollutants that have the potential to affect visibility (SO_2, NO_X, and particulate species) will be emitted from the proposed project. The extinction due to the project will be calculated as shown in Equation 7.

$$b_{ext,project}(km^{-1}) = b_{SO_4} + b_{NO_3} + b_{PMF} + b_{PMC} + b_{SOA} + b_{EC} \qquad \textit{Equation 7}$$

where,

$b_{SO_4} = 0.003\left[(\mathrm{NH_4})_2\mathrm{SO_4}\right]f(RH)$
$b_{NO_3} = 0.003\left[\mathrm{NH_4NO_3}\right]f(RH)$
$b_{PMC} = 0.0006[PMC]$
$b_{PMF} = 0.001[PMF]$
$b_{soa} = 0.004[SOA]$
$b_{EC} = 0.01[EC]$
$f(RH)$ = relative humidity adjustment factor
[ ] = Concentration in $\mu g/m^3$

In this analysis, Trinity placed an upper bound on the relative humidity function such that no *f*(RH) factors are applied greater than *f*(95%) to the extinction caused by hygroscopic sulfate and nitrate species. Although variable *f*(RH) limits are recommended in the prevailing guidance, the cap at *f*(95%) has been recently approved by FLM for other Class I area impact analyses in the Southeastern U.S.[8]

[8] See, for example, AQRV analysis of Chemical Lime Company's O'Neal Plant expansion impacts on the Sipsey Wilderness Area in Alabama (December 2004).

The Δb_{ext} value attributable to a single facility that is acceptable to the FLM is 5% on a 24-hour average basis.[9] As will be discussed in a subsequent section of this report, potential visibility impacts from facility-wide emissions from Norbord's Cordele OSB Mill do not exceed the 5% threshold.

This analysis utilizes the beta version of the latest CALPOST processor (Version 5.51, 030709) to assess impacts from the proposed project on regional haze. Trinity used the IWAQM recommended "Method 2" - speciated PM measurements with hourly relative humidity adjustment applied to observed and modeled sulfate and nitrate with the relative humidity factor capped. This postprocessing option uses observed relative humidity values and pollutant concentrations at each receptor to compute the percent change in visibility due to the facility's emissions compared against the natural background visibility under the prevailing atmospheric conditions.

Deposition

In the deposition analysis, the project's contribution to the deposition of chemical species in the Class I area were evaluated against values set by the FLM. The objective of the deposition analysis is to demonstrate that emissions from the facility would not increase total deposition beyond a deposition assessment threshold (DAT) for either sulfate or nitrate. The DAT represents "the additional amount of N or S deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered insignificant."[10] Therefore, predicted impacts below the DAT suggest that no further analysis of deposition impacts is warranted for this project. FLM guidance for assessment of deposition impacts suggests that an appropriate sulfur and nitrogen DAT is 0.01 kg/ha/yr (each) for Class I areas in the Eastern United States.[11]

Gas-phase dry deposition was modeled for SO_2, NO_X, and HNO_3. Particulate-phase dry deposition was modeled for SO_4, NO_3, and PM_{10}. Wet deposition was modeled for SO_2, SO_4, HNO_3, and NO_3. The sum of wet and dry deposition fluxes for SO_2 and SO_4 represents the total sulfur deposition as shown in Equation 8.

$$\text{Sulfur Deposition (kg/ha/yr)} = \left(\text{flux}\left[SO_2\right] + \text{flux}\left[(NH_4)_2SO_4\right]\right)_{\text{wet}} + \left(\text{flux}[SO_2] + \text{flux}[(NH_4)_2SO_4]\right)_{\text{dry}}$$

Equation 8

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[9] Note that f(RH) values are calculated on an hourly basis and then used to either (1) calculate hourly Δb_{ext} values that are then averaged or (2) calculate a daily average f(RH) value.

[10] U.S. National Park Service - Air Resources Division and U.S. Fish and Wildlife Service - Air Quality Branch, *Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds*, May 2002.

[11] *Ibid*.

The sum of wet and dry deposition fluxes for NO_X, NO_3, HNO_3, and ammonium ion (NH_4) from ammonium nitrate and sulfate represent the total nitrogen deposition, as shown in Equation 9.

$$\text{Nitrogen Deposition (kg/ha/yr)} = \left(\text{flux}[NH_4NO_3] + \text{flux}[HNO_3] + \text{flux}[(NH_4)_2SO_4]\right)_{wet} + \left(\text{flux}[NOx] + \text{flux}[NH_4NO_3] + \text{flux}[HNO_3] + \text{flux}[(NH_4)_2SO_4]\right)_{dry}$$

Equation 9

The contribution of the proposed project to the deposition of nitrogen and sulfur species in each Class I area was estimated and assessed against the DAT. As will be discussed in a subsequent section of this report, facility-wide potential emissions from Norbord's Cordele OSB Mill do not cause sulfur or nitrogen deposition above the applicable DAT.

MODEL AND PARAMETER SELECTION

The preferred model for analyzing long-range pollutant transport (i.e., distances greater than 50 km) is the CALPUFF modeling system. The latest EPA-approved version (Version 040716) of the CALPUFF model was used to determine the possible impacts of the proposed project on Class I Increment and AQRV at Okefenokee, Saint Marks, and Bradwell Bay. Note that the beta version of CALPUFF was used to avoid many known bugs in the preceding regulatory Version 030402. Most notably, this analysis was conducted using a Lambert Conformal Coordinate (LCC) system representation, which is most appropriate for a modeling domain of the size considered in this analysis. LCC are not supported in the previous version 030402.

CALPUFF is a multi-layer, multi-species, non-steady-state Lagrangian puff model, which can simulate the effects of time- and space-varying meteorological conditions on pollutant transport, transformation, and removal. For this refined analysis, meteorological fields generated by CALMET were used as inputs to the CALPUFF model to ensure that the effects of terrain and spatially varying surface characteristics on meteorology was considered.

In addition to meteorological data, the CALPUFF model uses several other input files to specify source and receptor parameters. The selection and control of CALPUFF options are determined by user-specific inputs contained in the control file. This file contains all of the necessary information to define a model run (e.g., starting date, run length, grid specifications, technical options, output options). The air quality modeling was performed using CALPUFF default options unless otherwise noted, as specified in the federal *Guideline* and IWAQM documents. The following sections describe the modeling domain, meteorological data, background concentrations, and model implementation.

MODELING DOMAINS

The meteorological CALMET domain and computational CALPUFF domain is illustrated in Figure A-2 in the attachment to this document. For the purposes of this analysis, these domains are identical and are singularly referred to herein as the "domain." The size of the domain is 342 km by 321 km, and is selected to encompass both the Cordele OSB Mill and the Okefenokee, Saint Marks, and Bradwell Bay areas, and to extend at least 50 km beyond in all directions. The size of the domain allows for the possible recirculation of puffs beyond the facility and areas being evaluated.

The horizontal domain is comprised of grid cells, each containing a central grid point at which meteorological and computational parameters are calculated at each time step. For this analysis, a grid spacing interval of 3 km was selected to resolve terrain features within the domain, which is generally flat. Given this interval, the domain consists of 114 by 107 grid cells. Table 9 summarizes the vertical grid structure selected for this analysis. The cell face height of each cell indicates its vertical extent. The vertical domain is also composed of terrain-following grid cells, the number and size of which are chosen so as to constrain the boundary layer in which dispersion and chemical transformations take place. The highest cell face was selected to be 3,500 meters to constrain the default maximum mixing height of 3,000 meters. Ambient impacts were predicted at receptors specified by the FLM to represent the Okefenokee, Saint Marks, and Bradwell Bay areas as depicted in Figure A-3 in the attachment to this report.[12]

TABLE 9. VERTICAL GRID STRUCTURE

Vertical Grid Cell	Cell Face Height (meters)
1	20
2	50
3	100
4	150
5	250
6	500
7	1,000
8	2,000
9	3,500

CALMET METEOROLOGICAL PROCESSING

CALMET is the meteorological preprocessor that compiles meteorological data from raw observations of surface and upper air conditions, precipitation measurements, mesoscale model output, and geophysical parameters into a single hourly, gridded data set for input to CALPUFF.

[12] http://www2.nature.nps.gov/air/maps/Receptors/index.htm

The federal Guideline for CALPUFF processing provides the following recommendations for the meteorological data period analyzed at Section 9.3.1.2:

> *For LRT situations (subsection 7.2.3) … if only NWS or comparable standard meteorological observations are employed, five years of meteorological data (within and near the modeling domain) should be used. Consecutive years from the most recent, readily available 5-year period are preferred. Less than five, but at least three, years of meteorological data (need not be consecutive) may be used if mesoscale meteorological fields are available, as discussed in paragraph 9.3(c). These mesoscale meteorological fields should be used in conjunction with available standard NWS or comparable meteorological observations within and near the modeling domain.*

The FLM frequently prefer the application of mesoscale meteorological (MM) data due to its high resolution, three-dimensional representation of meteorological conditions. Presently, three years of MM data have been widely distributed by the FLM, are quality assured, and generally accepted for use in regulatory modeling applications: 1990 MM4 data (80 km resolution), 1992 MM4 data (80 km resolution), and 1996 MM5 data (36 km resolution). These mesoscale datasets were used in this analysis.

Geophysical Data

CALMET requires geophysical data about the domain to characterize the terrain and land use parameters that potentially affect dispersion. Terrain features affect flows and create turbulence in the atmosphere and are potentially subjected to higher concentrations of elevated puffs, and different land uses exhibit variable characteristics such as surface roughness, albedo, Bowen ratio, and leaf-area index that also effect turbulence and dispersion. Terrain and land use data for this analysis were obtained from the USGS in 1-degree (1:250,000 scale or approximately 90-meter resolution) digital formats. Data preprocessors were used to format and assimilate these data into a single geophysical data file for processing by CALMET. Figures A-4 and A-5 in the attachment to this report depict the terrain and land use in the modeling domain as represented in CALMET.

Surface Meteorological Data

The use of multiple stations for meteorological observations in CALMET/CALPUFF provides a substantial enhancement over the steady-state treatment of observations from a single meteorological station in the ISC model. Parameters affecting turbulent dispersion that are observed hourly at surface stations include wind speed and direction, temperature, cloud cover and ceiling, relative humidity, and precipitation type. Surface data were extracted from among the surface stations listed in Table 10 and illustrated in Figure A-6 of the attachment to this protocol. These sources were selected from the available data inventory to optimize spatial coverage and representation of the domain. Raw observations from these stations were obtained

from the National Climatic Data Center (NCDC), quality assured and were merged using the SMERGE pre-processor to create a single assimilated data file of surface observations for each year analyzed.

TABLE 10. SURFACE METEOROLOGICAL STATIONS

Station Name	Station Identifier	WBAN Identifier	LCC East (km)	LCC North (km)	Elevation (meters)
Gainesville, Florida	GNV	12816	274.196	26.003	37.5
Jacksonville, Florida	JAX	13889	327.731	116.384	7.9
Tallahassee, Florida	TLH	93805	74.245	100.558	16.8
Albany, Georgia	ABY	13869	89.193	226.526	57.9
Columbus, Georgia	CSG	93842	16.400	335.501	119.5
Macon, Georgia	MCN	03813	137.988	354.840	104.5
Moody AFB, Georgia	VAD	13857	183.334	164.845	73.2
Savannah, Georgia	SAV	03822	369.311	297.460	14.0

Upper Air Data

Observations of meteorological conditions in the upper atmosphere provide a profile of turbulence from the surface through the depth of the boundary layer in which dispersion occurs. Upper air data are collected by balloons launched simultaneously across the observation network at 0000 Greenwich Mean Time (GMT) (7 o'clock PM in Georgia) and 1200 GMT (7 o'clock AM in Georgia). Sensors observe pressure, wind speed and direction, and temperature (among other parameters) as the balloon rises through the atmosphere. The upper air observation network is less dense than surface observation points since upper air conditions vary less and are generally not as affected by local effects (e.g., terrain or water bodies). Upper air data were extracted from among the observation stations listed in Table 11 and illustrated in Figure A-6 of the attachment to this report. These sources were selected from the available data inventory to optimize spatial coverage and representation of the domain, and utilization from year to year may vary due to availability and data quality. Raw observations from these stations were obtained from the NCDC and quality assured.

TABLE 11. UPPER AIR METEOROLOGICAL STATIONS

Station Name	Station Identifier	WBAN Identifier	LCC East (km)	LCC North (km)	Elevation (meters)
Apalachicola, Florida	AQQ	12832	8.874	26.220	6.1
Waycross, Georgia	AYS	13861	258.753	197.841	42.7
Athens, Georgia	AHN	13873	165.404	496.153	239.3
Tallahassee, Florida	TLH	93805	74.245	100.558	16.8
Jacksonville, Florida	JAX	13889	327.731	116.384	7.9
Peachtree City, Georgia†	FFC	53819	52.477	430.117	243.2

† FFC replaced the upper air observation point at AHN on November 1, 1995

Precipitation Data

Trinity considered the effects of chemical transformations and deposition processes on ambient pollutant concentrations in this analysis. Therefore, it was necessary to include observations of precipitation in the CALMET analysis. Precipitation data were collected from selected surface meteorological data stations included in the analysis, plus Cooperative Observation Network (COOP) stations nearer to or within the domain. Precipitation data were extracted from among the surface stations listed in Table 12 and illustrated in Figure A-6 of the attachment to this report. These sources were selected from the available data inventory to optimize spatial coverage and representation of the domain. Raw observations from these stations were obtained from the NCDC, quality assured, and merged using the PMERGE pre-processor to create a single assimilated data file of precipitation observations.

TABLE 12. PRECIPITATION MEASUREMENT STATIONS

Station Name	Station Identifier	COOP Identifier	LCC East (km)	LCC North (km)	Elevation (meters)
Apalachicola Municipal Airport, Florida	APA	080211	8.842	26.257	6.1
Branford, Florida	BRA	080975	212.489	54.251	9.1
Cross City (2 WNW), Florida	CRO	082008	189.046	18.637	12.8
Dowling Park (1 W), Florida	DOW	082391	179.895	85.137	16.5
Gainesville (11 WNW), Florida	GAI	083322	253.306	23.645	29.1
Inglis (3 E), Florida	ING	084273	243.655	-48.805	9.1
Jacksonville International Airport, Florida	JAC	084358	327.731	116.384	7.9
Lynne, Florida	LYN	085237	309.493	-28.618	25.9
Monticello (3 SW), Florida	MON	034900	115.599	115.732	88.4
Panacea (1 S)	PAN	086828	71.356	54.257	1.8
Raiford State Prison, Florida	RAI	087440	281.146	66.923	36.6
Tallahassee Regional Airport, Florida	TAL	088758	74.245	100.558	16.8
Woodruff Dam, Florida	WOO	089795	24.668	135.505	32.6
Abbeville (4 S), Georgia	ABB	090010	172.075	272.021	73.2
Americus Experimental Station, Georgia	AME	090258	80.792	289.455	137.2
Bainbridge/International Paper, Georgia	BAI	090586	45.318	144.828	57.9
Brunswick, Georgia	BRU	091340	344.484	190.993	4.0
Claxton, Georgia	CLA	091973	303.309	300.89	57.3
Doles, Georgia	DOL	092728	117.362	245.352	78.0
Dublin (2), Georgia	DUB	092844	208.398	343.063	61.0
Edison, Georgia	EDI	093028	37.072	229.958	89.6
Fargo, Georgia	FAR	093312	244.357	134.544	35.1
Folkston (3 SW), Georgia	FOL	093460	296.52	148.816	9.1
Hazlehurst, Georgia	HAZ	094204	239.763	267.775	76.2
Jesup, Georgia	JES	094671	306.684	238.002	30.5
Macon Regional Airport, Georgia	MAC	095443	137.987	354.877	104.5
Pearson, Georgia	PEA	096879	215.917	202.447	62.5
Richmond Hill, Georgia	RIC	097468	357.331	280.337	6.1
Sylvania (2 SSE), Georgia	SYL	098517	327.99	364.632	76.2
The Rock, Georgia	ROC	098657	81.614	385.788	240.5
Valdosta (2 S), Georgia	VAL	098974	170.813	153.493	80.8

Overwater Data

Because parts of the modeling domain encompass the open waters of the Atlantic Ocean and Gulf of Mexico, and the Saint Marks and Bradwell Bay areas are located along the Gulf Coast, Trinity included meteorological data from buoys to utilize overwater meteorological processing algorithms in CALMET.

The critical differences in behavior of the inland and marine boundary layers, and atmospheric dispersion phenomena occurring within these distinct regimes, is well documented and recognized to play a vital role in the dispersion of pollutants originating in, or destined to affect, coastal areas. Key phenomena occurring in coastal environments that affect pollutant dispersion include land/sea-breezes that cause recirculation of pollutant mass, temperature moderation that results in sharp gradients and mixing height discontinuities at the land-sea interface, and thermal internal boundary layers that could cause severe fumigation under certain conditions. The CALMET processor is equipped to assimilate overwater data obtained from coastal, near-shore, and offshore observation platforms. CALMET uses a profile method to simulate boundary layer effects by computing the friction velocity, Monin-Obukhov length, surface roughness, and mixing height over the water surface. The details of the formulation of marine dispersion algorithms are provided in the documentation accompanying the CALPUFF modeling system.

To perform its simulation of the coastal environment, CALMET requires hourly observations of air temperature, air-sea temperature difference, wind speed and direction, relative humidity, overwater mixing height, and the overwater temperature gradients above and below the overwater mixing height. For practical applications of overwater boundary layer computations, these data can be obtained in part from the National Data Buoy Center (NBDC). The NBDC maintains an inventory of standard meteorological data observed by ships, buoys, and C-MAN stations in coastal, near-shore, and offshore locations.

NDBC's data sets provide direct wind and temperature measurements, and relative humidity can be inferred from pressure and dewpoint observations. The mixing height and temperature gradients and default values must be applied by CALMET when simulating the coastal atmosphere. Raw observations from these stations were obtained from the NDBC and quality assured. Table 13 summarizes the stations used in this analysis.

TABLE 13. OVERWATER DATA STATIONS

Buoy Name and Approximate Location	Station Identifier	LCC East (km)	LCC North (km)
Gray's Reef (40 NM SE of Savannah, Georgia)	41008	403.350	218.984
Folly Island, South Carolina	FBIS1	489.593	364.962
West Tampa, Florida (1996 only)	42036	60.062	-109.503

Mesoscale Model Output

Output from mesoscale meteorological (MM) forecast models is an ideal input for air quality models because parameters that characterize the state of turbulence in the atmosphere are diagnosed on a high resolution, three-dimensional grid. For this analysis, output from mesoscale models were used to provide the "initial guess" wind field for CALMET processing, using 1990 MM4 data (80 km resolution), 1992 MM4 data (80 km resolution), and 1996 MM4 data (36 km resolution). Figure A-7 in the attachment to this report shows the extraction domains of meteorological data used in this analysis.

Using this approach, the wind field at grid points within the horizontal and vertical CALMET domain was initially interpolated from the MM grid. Observations of winds from surface and upper air stations (which may in fact be quite distant from a particular CALMET grid point) were subsequently interpolated using an inverse-distance scheme to define the meteorological fields within the domain.

CALMET Processing Control

CALMET assimilates all of the surface, upper air, precipitation, geophysical, and mesoscale data described in the previous sections into a single hourly, gridded data file for use by CALPUFF. This file contains winds, temperature, micrometeorological variables, and turbulence parameters necessary for CALPUFF to make dispersion, chemical transformation, and deposition computations at each grid cell and time step. A control file contains all the inputs to run the CALMET processor. For this analysis, default values were used with the following exceptions, for which there is no default parameter or case-by-case analysis is warranted.

As previously discussed MM data were used as the initial guess wind field. Similarity theory was selected to derive the vertical turbulence profile from an extrapolation of surface winds. Kinematic effects, divergence minimization, Froude number adjustment, and computation of slope flows were enabled to allow for local adjustment of wind fields introduced by MM data.

The choice of the radius of influence of the surface observations (RMAX1) and upper air observations (RMAX2) is left to the discretion of the user since there are no accepted default values provided, for example, by the Interagency Workgroup on Air Quality Modeling (IWAQM) *Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*.[13] Appendix A of the IWAQM report provides recommended default CALMET settings, for which there is no default for RMAX1 and RMAX2. Trinity is not aware of other guidance that would define what is normally used for these parameters for analyses conducted in the Southeastern United States and in particular the region of southern Georgia and northern Florida that was simulated in this analysis.

The settings of RMAX1 and RMAX2 cause the CALMET model to use observed wind measurements in the Step 2 wind field computation wherein the observations are blended with the first-guess windfield generated from MM4/MM5 wind data to represent local effects (e.g., terrain) that may not be resolved in the lower resolution (e.g., 80 km [1990 and 1992] or 36 km [1996]) MM data. Note that in conjunction with the RMAX settings, Trinity also set LVARY to false so that the weight of observations would be limited within these radii and CALMET would not artificially use observed values for portions of the grid outside of the observation radius.

Trinity's selection of RMAX1 as 50 km and RMAX2 as 200 km is justified by the relative scarcity of observations within the large (342 km by 321 km) modeling domain. Figure A-6 in the report illustrates the location of surface and upper air observation stations used in the CALMET analysis, which demonstrates that seven surface observation stations and four upper stations are located within the model domain. Therefore, the use of supplementary observation stations beyond the modeling domain and an adequately large radius of influence were necessary to cover the majority of the domain. Figure A-6 includes the radii-of-influence to illustrate this coverage.

Trinity also notes that additional parameters, R1 and R2, control the relative weighting of observed and first-guess MM4/MM5 data. R1 (surface) and R2 (upper air) represent the distance at which the observation and MM data are equally weighted, and are the more relevant parameters for assessing the relative weight of surface and upper air observations compared to the MM4/MM5 wind field. Trinity set each of R1 and R2 to the relatively small value of 10 km, to balance the relatively low resolution of MM4/MM5 data (36 km or 80 km) and the lower density of NWS observations.

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[13] U.S. EPA Report EPA-454/R-98-019, December 1998.

CALPUFF MODEL PROCESSING

Using the data provided by CALMET, CALPUFF simulates the dispersion, deposition, and chemical transformation of discrete puffs of mass from emission sources. Each puff contains emissions of NO_X, SO_2, and PM_{10} and is advected throughout the domain while deposition and chemical transformation processes take place. CALPUFF is a Lagrangian puff model, the principle advantages of which are that pollutant plumes can evolve dynamically and chemically over time and can respond to complex winds caused by terrain effects, stagnation, or recirculation.

Emissions data for each emission source were entered into CALPUFF for sources at the Cordele OSB Mill as previously described in Table 4 of this report. Building downwash was enabled and output from the Building Input Profile Program (BPIP) was used to evaluate downwash effects. Note that although BPIP-PRIME was used to represent building downwash in the Class II air quality analysis, a known bug in the beta version CALPUFF prevents the PRIME downwash parameters from being used successfully, even though it is an available model option. Therefore, only the standard BPIP parameters (building height and alongwind width) were used in this analysis.

This analysis was performed with the deposition and chemical transformation algorithms enabled. A full resistance model is provided in CALPUFF for the computation of dry deposition rates of gases and particulate matter as a function of geophysical parameters, meteorological conditions, and pollutant species. An empirical scavenging coefficient approach using default options was enabled in CALPUFF to compute the depletion and wet deposition fluxes due to precipitation scavenging.

The CALPUFF model is capable of simulating linear chemical transformation effects by using pseudo-first-order chemical reaction mechanisms for the conversions of SO_2 to SO_4 and NO_X, which consists of nitrogen oxide (NO) and nitrogen dioxide (NO_2), to nitrate (NO_3) and nitric acid (HNO_3). In this study, chemical transformations involving five species (SO_2, SO_4, NO_X, HNO_3, and NO_3) were modeled using the MESOPUFF II chemical transformation scheme, per IWAQM guidance. There are two user-selected input parameters that affect the MESOPUFF II chemical transformation, ammonia concentrations and ozone concentrations. The selection of each parameter is discussed separately.

Ozone

Ambient ozone concentrations can be input to the model as a background level or using hourly, spatially varying observations. For this analysis, monitored hourly ozone data from each data year from ozone monitors within and near the domain were included. Operational monitors on the CASTNET and AIRS reporting networks considered in this analysis are listed in Table 14 and illustrated in Figure A-8 in the attachment to this report. Ozone stations for each year of the analysis were selected from among the stations listed in Table 14 since some monitors were operated intermittently and/or installed between the start and end years of this analysis.

TABLE 14. LOCATION OF AMBIENT OZONE MONITORS

Location (City, County)	Station/AIRS Identifier	LCC East (km)	LCC North (km)
Cocoa Beach, Florida	12-009-4001	441.176	-123.01
Palm Bay, Florida	12-009-5001	438.226	-154.952
Jacksonville/Duval County, Florida	12-031-0070	331.465	87.39
Jacksonville/Duval County, Florida	12-031-0077	338.577	114.218
Pensacola, Florida	12-033-0004	-198.93	116.024
Pensacola, Florida	12-033-0018	-205.644	98.704
Holmes County, Florida	12-059-0004	-45.718	150.104
Tallahassee, Florida	12-073-0003	82.047	96.513
Orlando, Florida	12-095-0008	365.747	-109.805
Winter Park, Florida	12-095-2002	367.011	-93.607
Holiday, Florida	12-101-2001	231.886	-142.247
Lakeland, Florida	12-105-6005	306.878	-168.811
Lakeland, Florida	12-105-6006	309.363	-158.783
St. Johns County, Florida	12-109-1003	363.102	74.08
Seminole County, Florida	12-117-1002	371.622	-77.228
Port Orange, Florida	12-127-2001	400.922	-35.781
Daytona Beach, Florida	12-127-5002	394.782	-25.128
Augusta, Georgia	BUNG	287.972	441.327
Columbus, Georgia	AIRPT	16.999	335.99
Columbus, Georgia	CRIME	26.391	338.016
Leslie, Sumter County, Georgia	LESLIE	98.554	273.284
Savannah, Georgia	PRES	383.707	292.586
Pike County, Georgia	Pike	66.978	409.316
Augusta, Georgia	Richmond	287.976	441.318
Conyers, Georgia	Rockdale	98.069	454.754
Aiken County, South Carolina	Aiken	309.919	431.812
Barnwell County, South Carolina	Barnwell	340.02	430.306
Beaufort County, South Carolina	Beaufort	400.954	311.394
Berkeley County, South Carolina	Berkeley	483.659	398.874
Charleston County, South Carolina	Charleston	481.387	390.179
Colleton County, South Carolina	Colleton	387.762	397.225

Ammonia

IWAQM Phase 2 recommends the use of spatially constant background ammonia concentrations to participate in the MESOPUFF-II chemical transformation mechanism.[14] In the absence of an extensive monitoring network for ammonia and due to the limitation of CALPUFF to simulate only a single, domain-average background ammonia level for each month of analysis. The land use analysis presented in Figure A-5 illustrates that the majority of the modeling domain is forested or agricultural area. The IWAQM guidance recommends the ammonia value be set between 0.5 ppb for forested areas and 10 ppb for grasslands. Although the modeling

[14] U.S. EPA, *IWAQM Phase 2 Summary Report and Recommendations for Modeling Long-Range Transport Impacts*, Research Triangle Park, North Carolina, EPA-454/R-95-006, 1995 at 14.

domain is predominantly forested, the ammonia background level was conservatively set at 10 ppb for this analysis.

RESULTS – CLASS I INCREMENT ANALYSIS

The results of the Class I Increment Analysis are presented in Table 15. A significant contribution to Class I Increment consumption is defined as a modeled concentration in excess of the Class I Increment significant impact levels. As Table 15 indicates, the maximum impacts predicted by CALPUFF are below the significant impact levels for all pollutants and all averaging periods. Accordingly, compliance with the applicable Class I Increment is determined and an analysis of the cumulative impacts from the proposed facility and regional sources together was not necessary. A plot of impacts for each pollutant and each applicable averaging period is provided in Figures A-9 through A-14 in the attachment to this report.

TABLE 15. CLASS I INCREMENT ANALYSIS SUMMARY

Pollutant	Averaging Period	Okefenokee Maximum Predicted Impact ($\mu g/m^3$)	Saint Marks Maximum Predicted Impact ($\mu g/m^3$)	Bradwell Bay Maximum Predicted Impact ($\mu g/m^3$)	Significance Level ($\mu g/m^3$)
NO_2	Annual	1.80×10^{-3}	5.67×10^{-4}	4.32×10^{-4}	0.1
SO_2	Annual	1.26×10^{-4}	4.36×10^{-5}	3.98×10^{-5}	0.08
	24-hour	0.0035	0.0016	0.0017	0.2
	3-hour	0.0075	0.0058	0.0045	1
PM_{10}	Annual	0.012	0.0050	0.0048	0.16
	24-hour	0.30	0.17	0.15	0.32

RESULTS – DEPOSITION ANALYSIS

The maximum predicted sulfur and nitrogen depositions at the Okefenokee, Saint Marks, and Bradwell Bay areas are presented in Table 16. A plot of deposition impacts for each pollutant is provided in Figures A-15 and A-16 in the attachment to this report. The results of the deposition analysis show that the predicted sulfur deposition and nitrogen deposition impacts are well below the threshold screening values.

TABLE 16. SULFUR AND NITROGEN DEPOSITION IMPACTS

Species	Deposition Assessment Threshold (kg/ha/yr)	1990 Modeled Deposition (kg/ha/yr)	1992 Modeled Deposition (kg/ha/yr)	1996 Modeled Deposition (kg/ha/yr)
Total Sulfate - Okefenokee	0.01	6.34×10^{-5}	7.98×10^{-5}	9.84×10^{-5}
Total Nitrate – Okefenokee	0.01	5.06×10^{-4}	7.20×10^{-4}	8.54×10^{-4}
Total Sulfate – Saint Marks	0.01	3.72×10^{-5}	3.17×10^{-5}	4.53×10^{-5}
Total Nitrate – Saint Marks	0.01	2.79×10^{-4}	2.65×10^{-4}	3.36×10^{-4}
Total Sulfate – Bradwell Bay	0.01	3.91×10^{-5}	3.34×10^{-5}	3.85×10^{-5}
Total Nitrate - Bradwell Bay	0.01	3.20×10^{-4}	2.81×10^{-4}	2.73×10^{-4}

RESULTS – REGIONAL HAZE ANALYSIS

The 24-hour average visibility impacts predicted by CALPUFF for the Okefenokee and Saint Marks areas are presented in Table 17. A time series of daily visibility extinction is provided in Figure A-17 in the attachment to this report. The results of the visibility analysis show that at no time do the facility-wide emissions from Norbord's Cordele OSB Mill cause visibility extinction in excess of the 5% threshold.

TABLE 17. VISIBILITY DEGRADATION

Metric	Critical Single Source Extinction Change	1990 Modeled Extinction Change	1992 Modeled Extinction Change	1996 Modeled Extinction Change
Visibility Extinction - Okefenokee	5%	2.93%	4.35%	3.06%
Visibility Extinction – Saint Marks	5%	1.46%	2.10%	2.52%

Summarizing the preceding results, Norbord's proposed expansion project and continued operation of the Cordele OSB Mill in Crisp County, Georgia will neither cause nor contribute to an exceedance of a Class I PSD Increment standard, nor cause adverse impacts on air quality related values at the Okefenokee NWR in southeastern Georgia or the Saint Marks NWR or Bradwell Bay Wilderness on the Florida Gulf Coast.

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Norbord and Trinity appreciate your prompt review of this analysis. If you have any questions, please do not hesitate to contact me at (404) 256-1919 at any time during your review to discuss any questions or comments.

Sincerely,

TRINITY CONSULTANTS

Ryan A. Gesser
Managing Consultant

Attachment/Enclosure

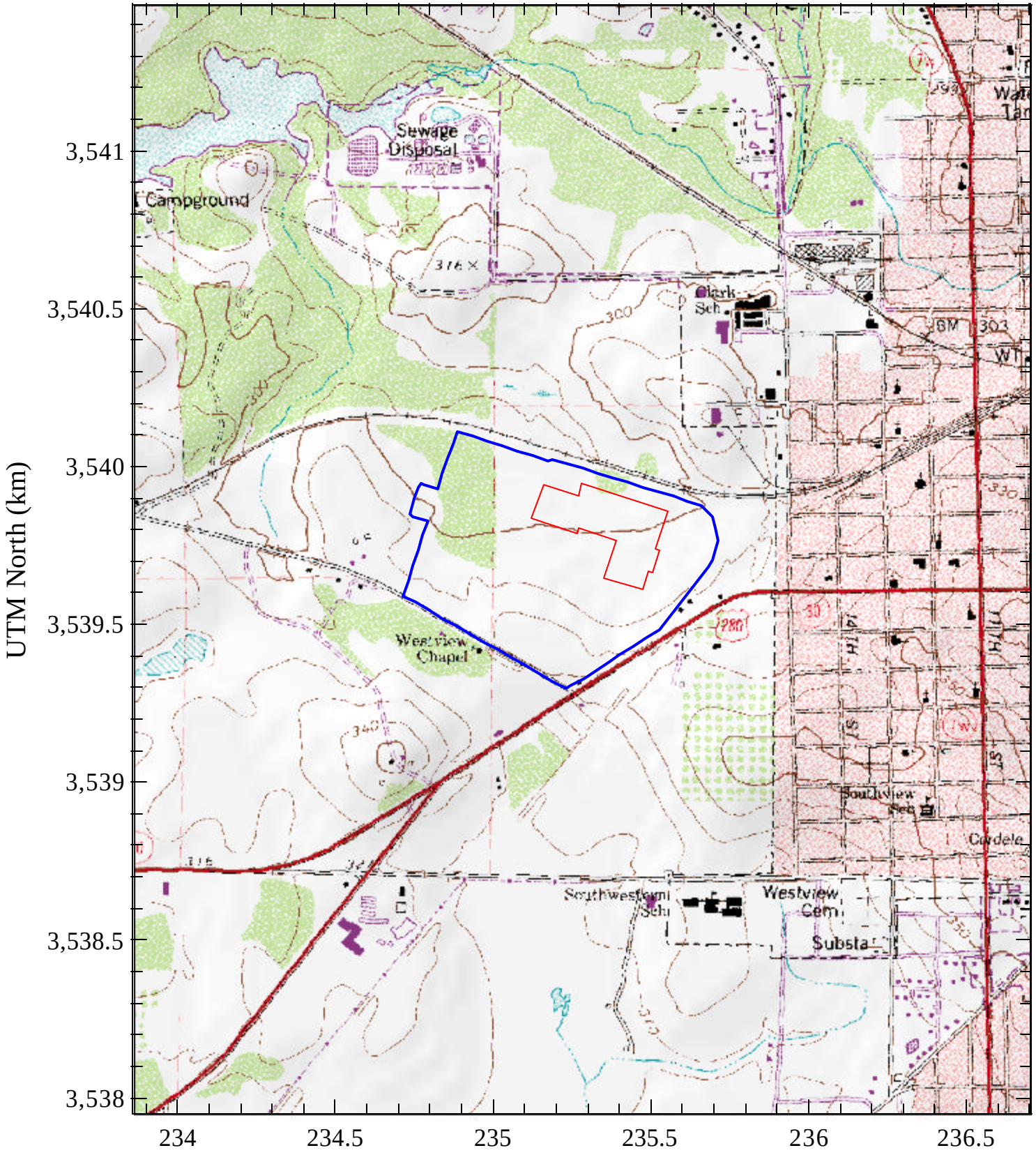
cc: Mr. John Yntema, Georgia EPD (Atlanta)
Mr. Richard Monteith, Georgia EPD (Atlanta)
Mr. Phil Towles, Norbord (Kinards, South Carolina)
Mr. Denis Lalonde, Norbord (Montreal)

ATTACHMENT

Reference Figures

List of Figures

Figure A-1. Regional Area Map
Norbord - Cordele, Georgia



Edge markings shown in Universal Transverse Mercator Coordinates, Zone 17, NAD27

Norbord
041101.0101
Figure B-1 Regional Area Map.srf

Figure A-2. CALMET/CALPUFF Computational Domain

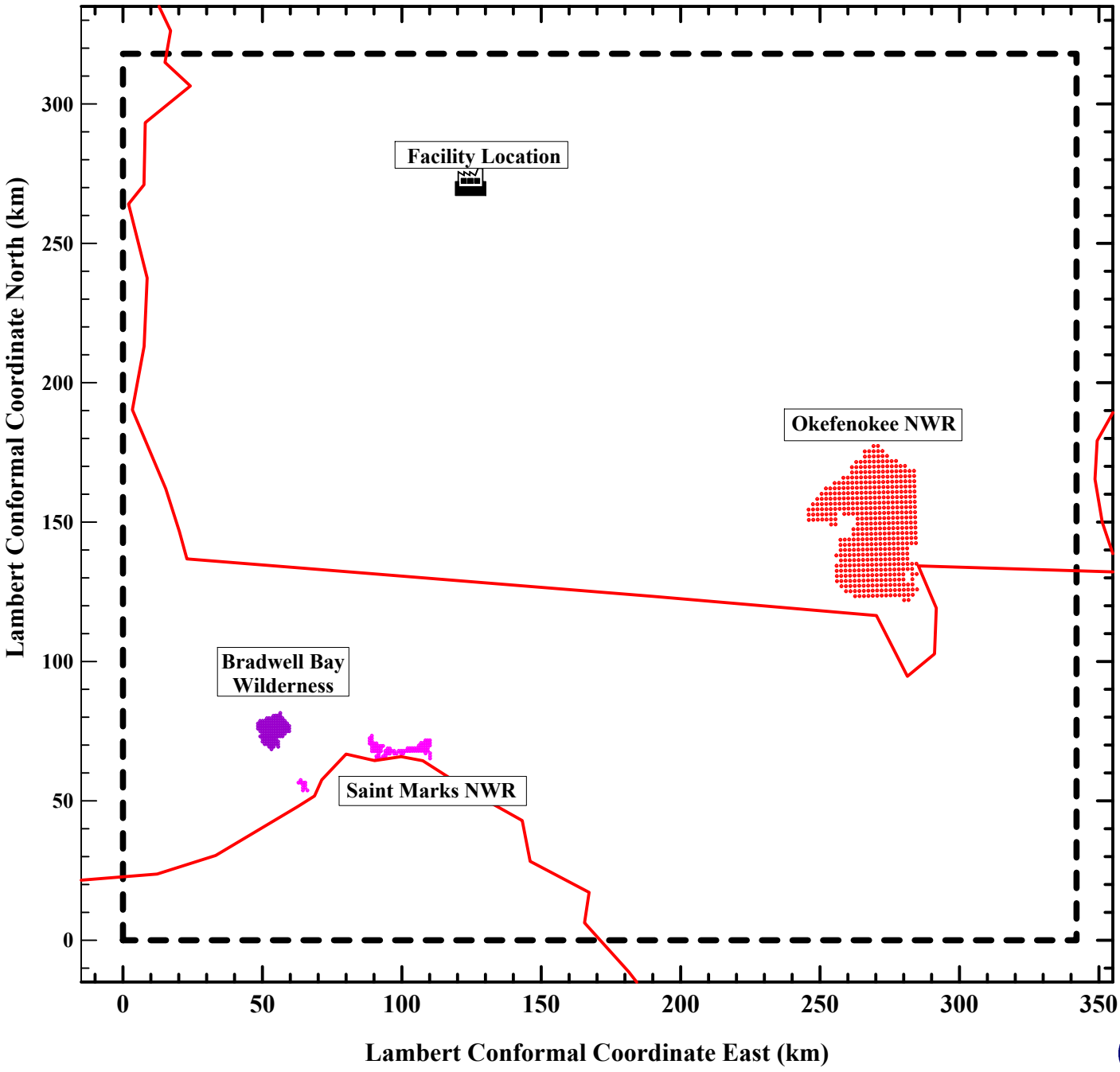


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Figure A-3. Class I Area Receptor Locations

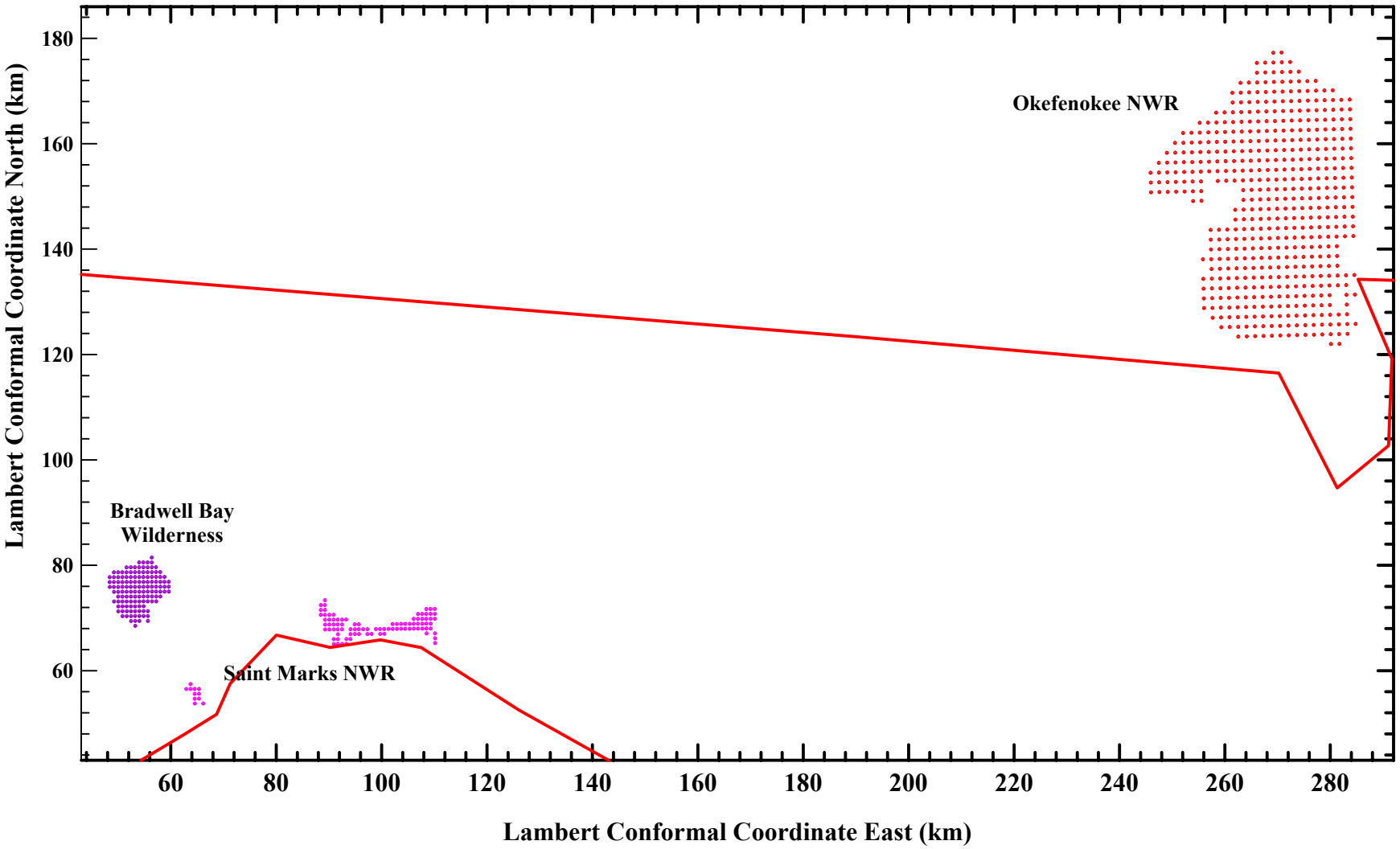

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Figure A-4. Terrain Variability within the Computational Domain

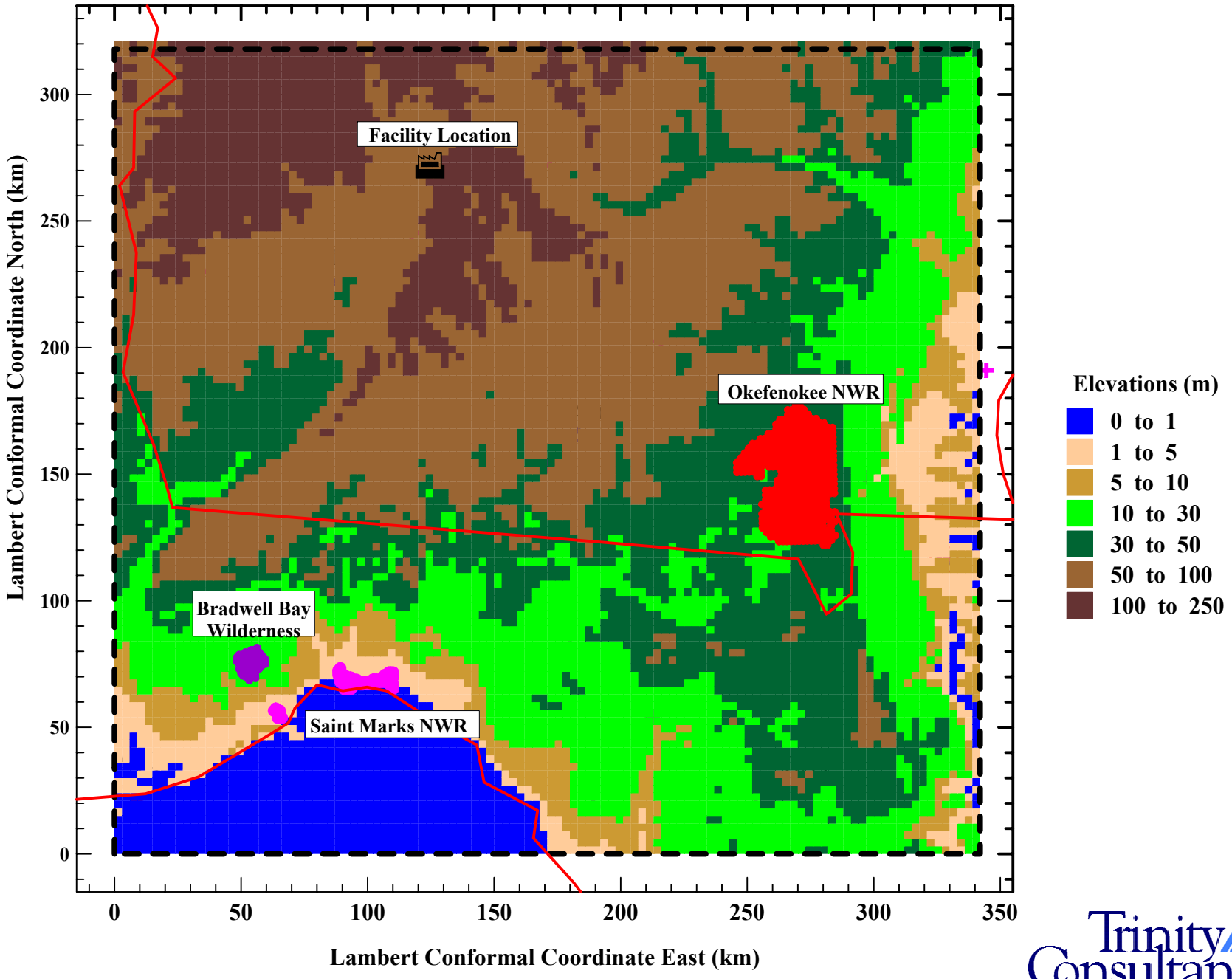

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Figure A-5. Land Use and Cover within the Computational Domain

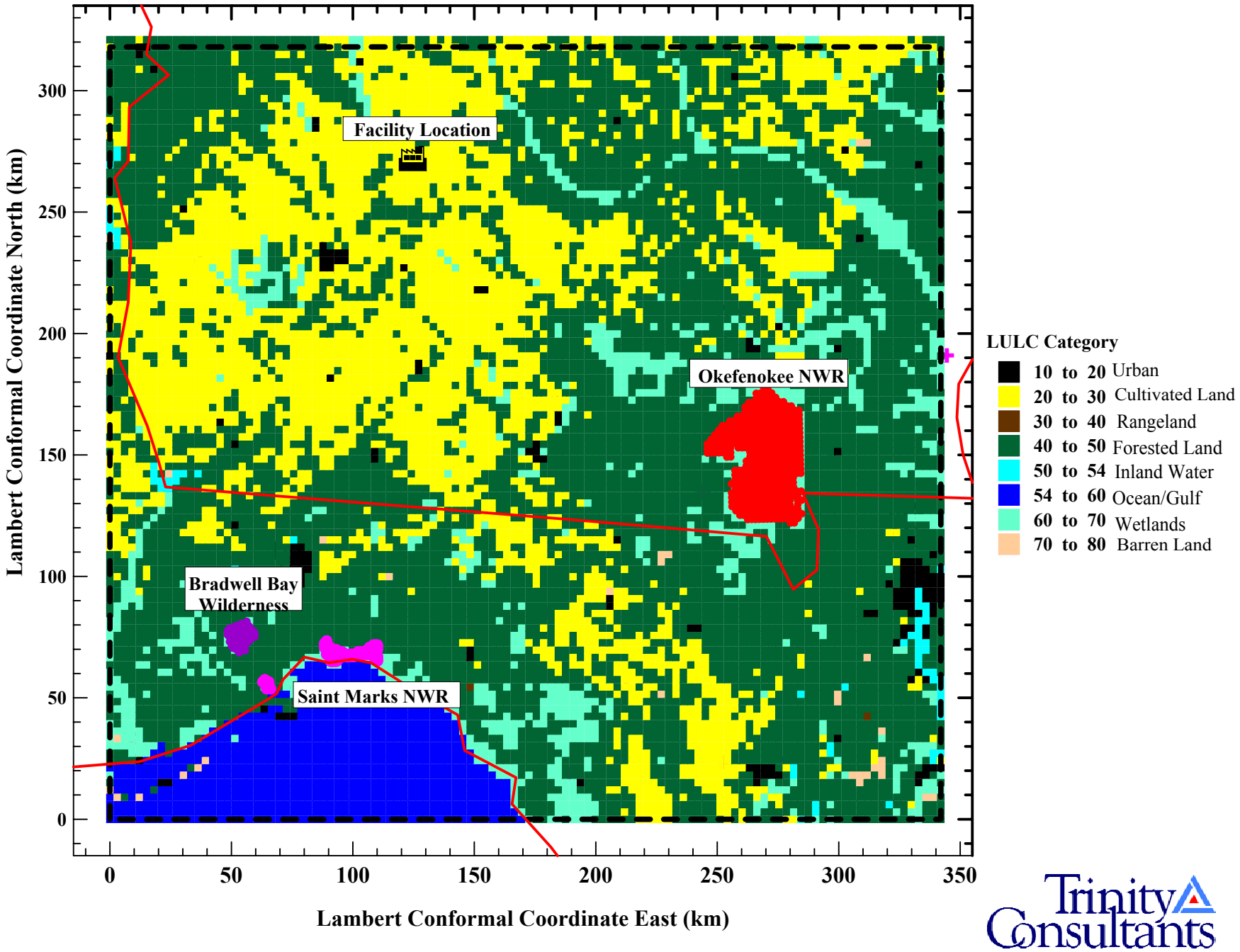

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Figure A-6. CALMET Meteorological Data Stations

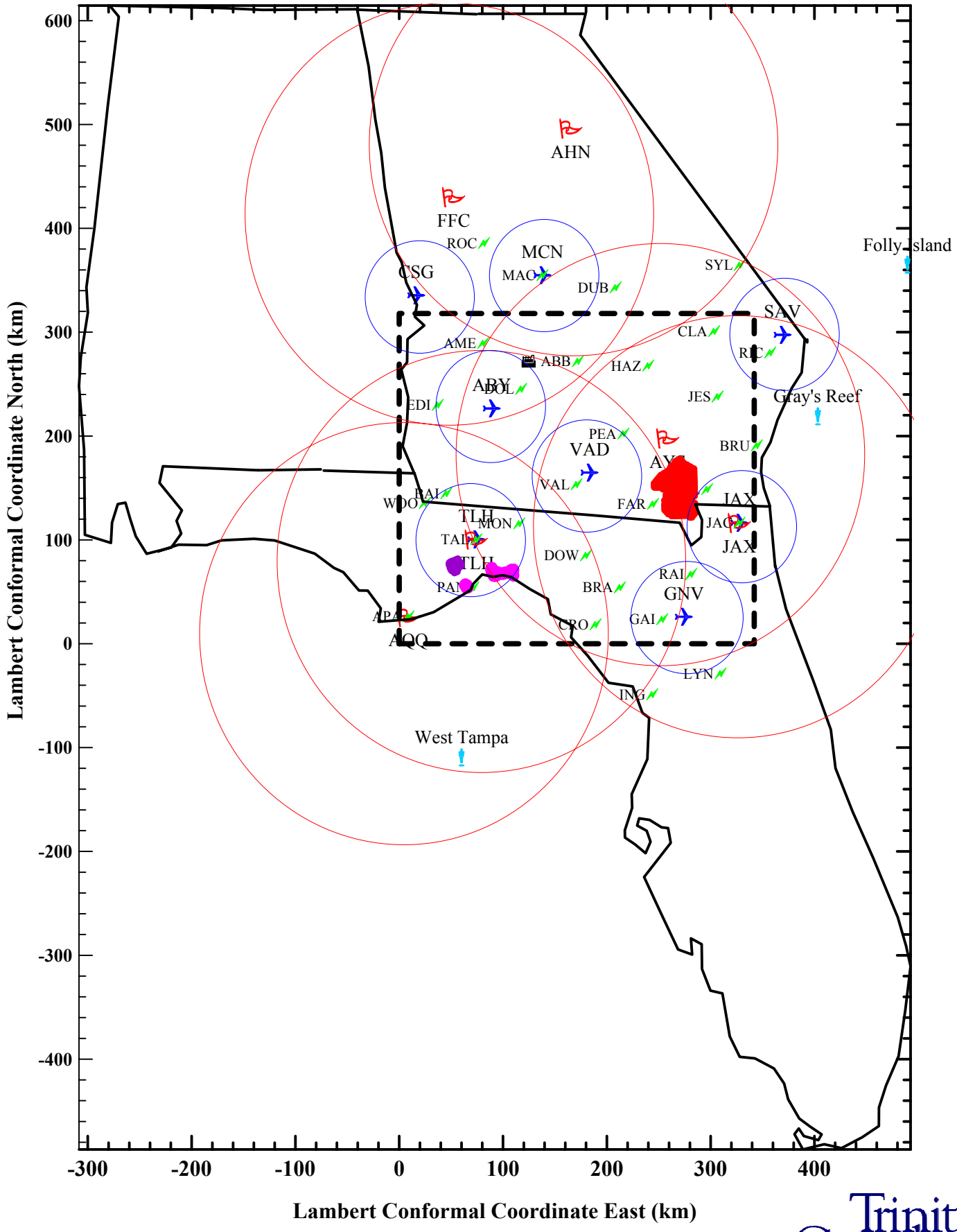

Figure A-7. Mesoscale Meteorological Model Extraction Domain

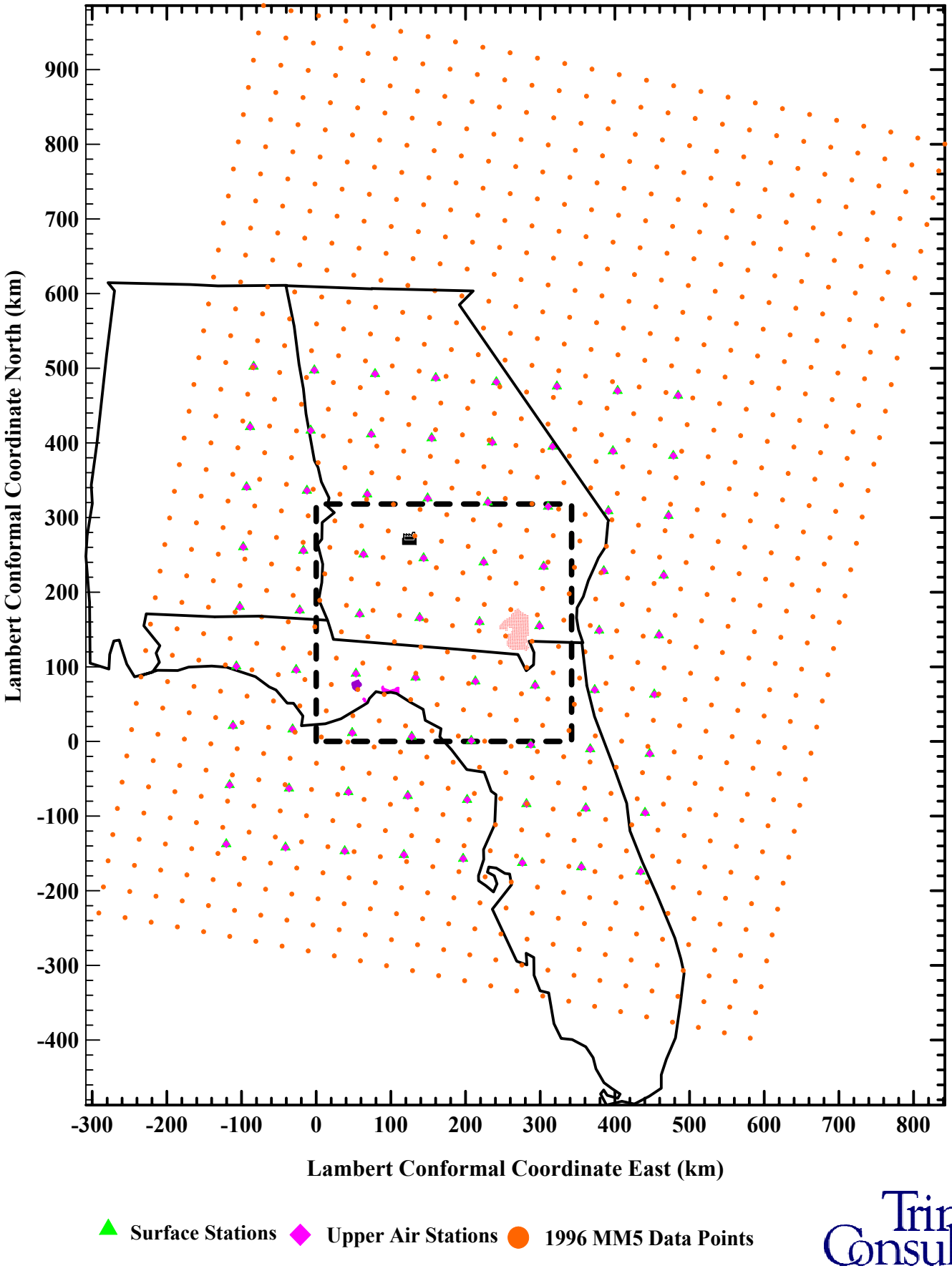

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Figure A-8. Ozone Monitoring Locations

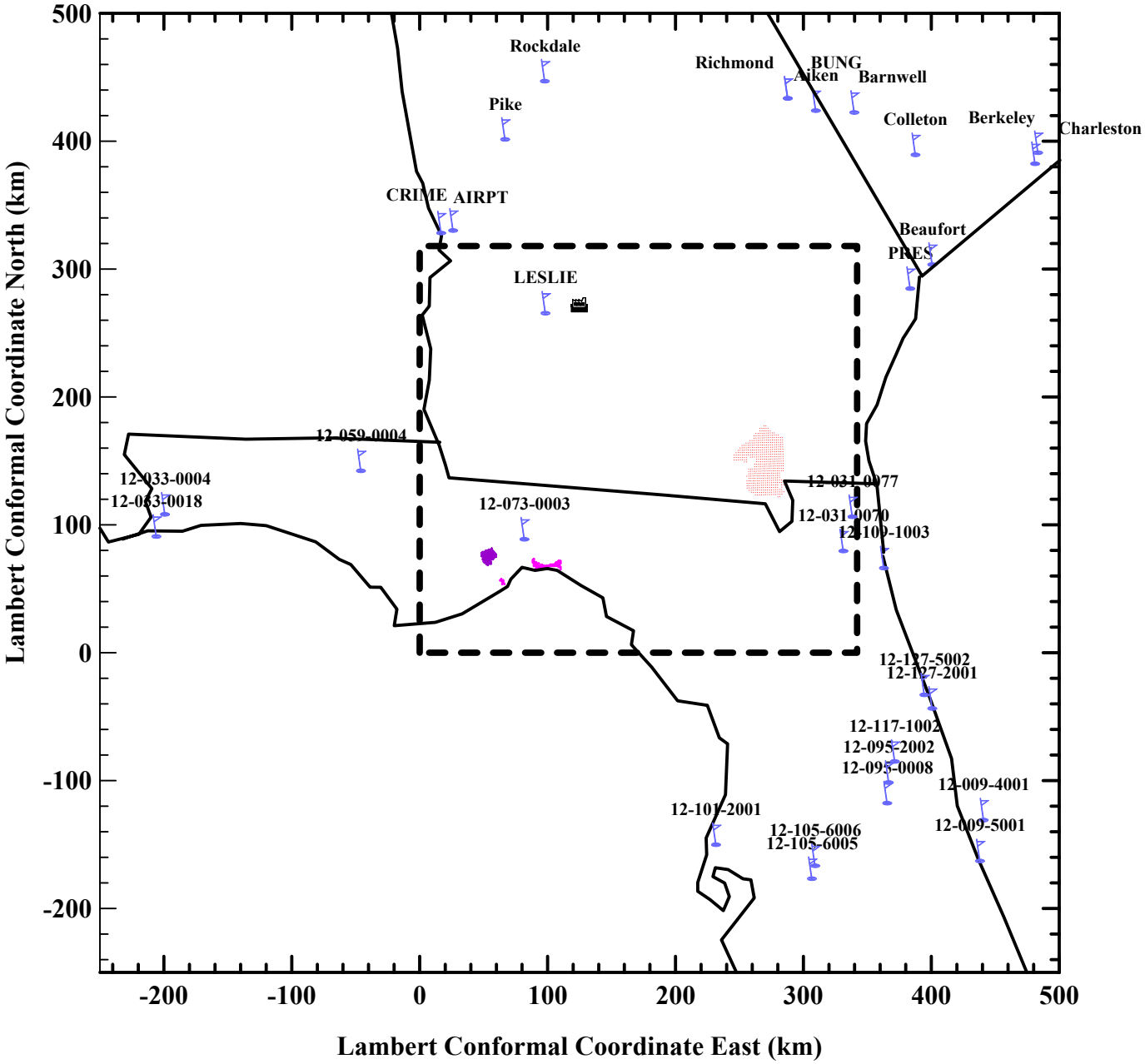

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Figure A-9. Maximum Impacts of SO2, 3-hour Averaging Period

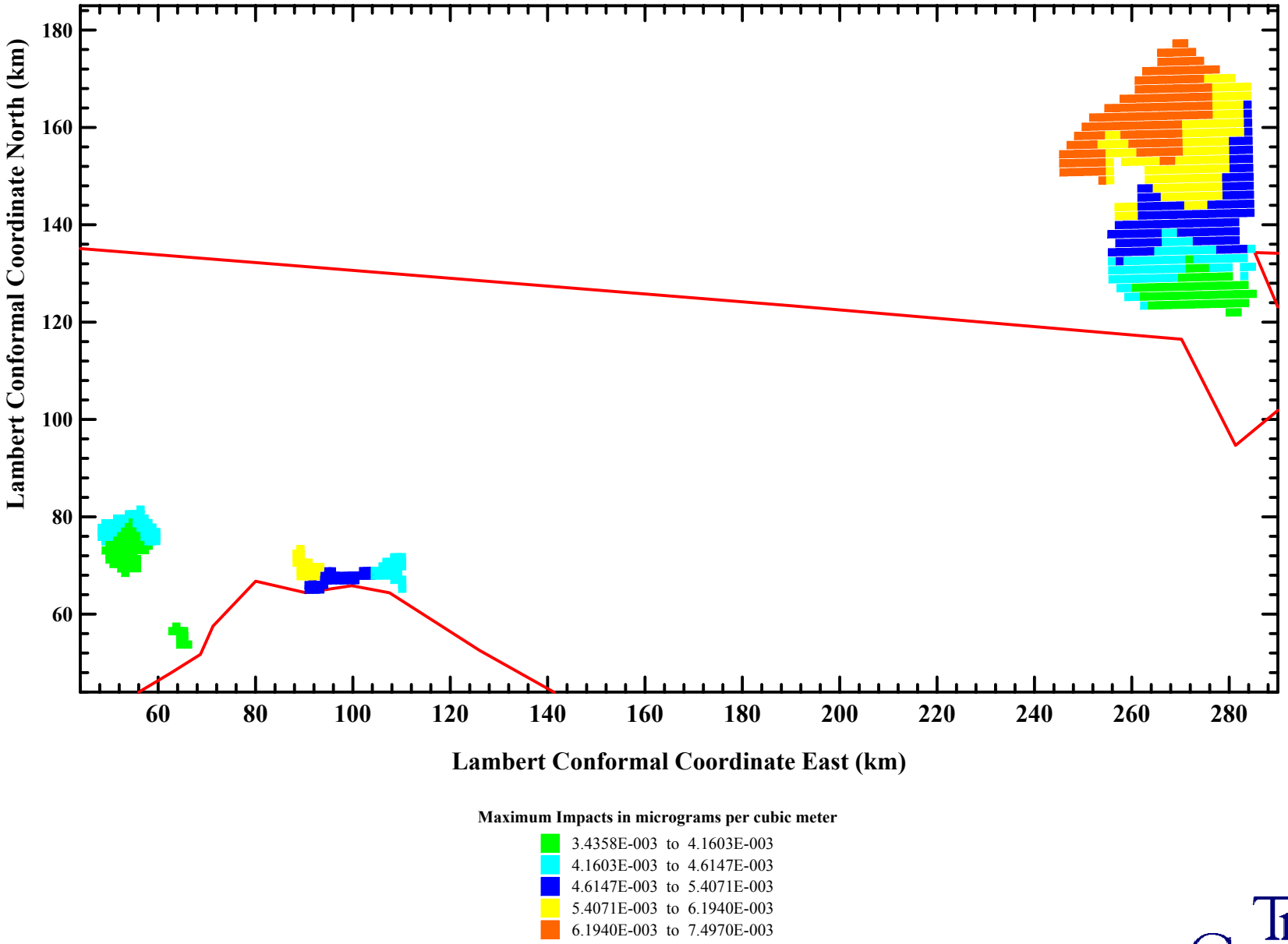

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Figure A-10. Maximum Impacts of SO2, 24-hour Averaging Period

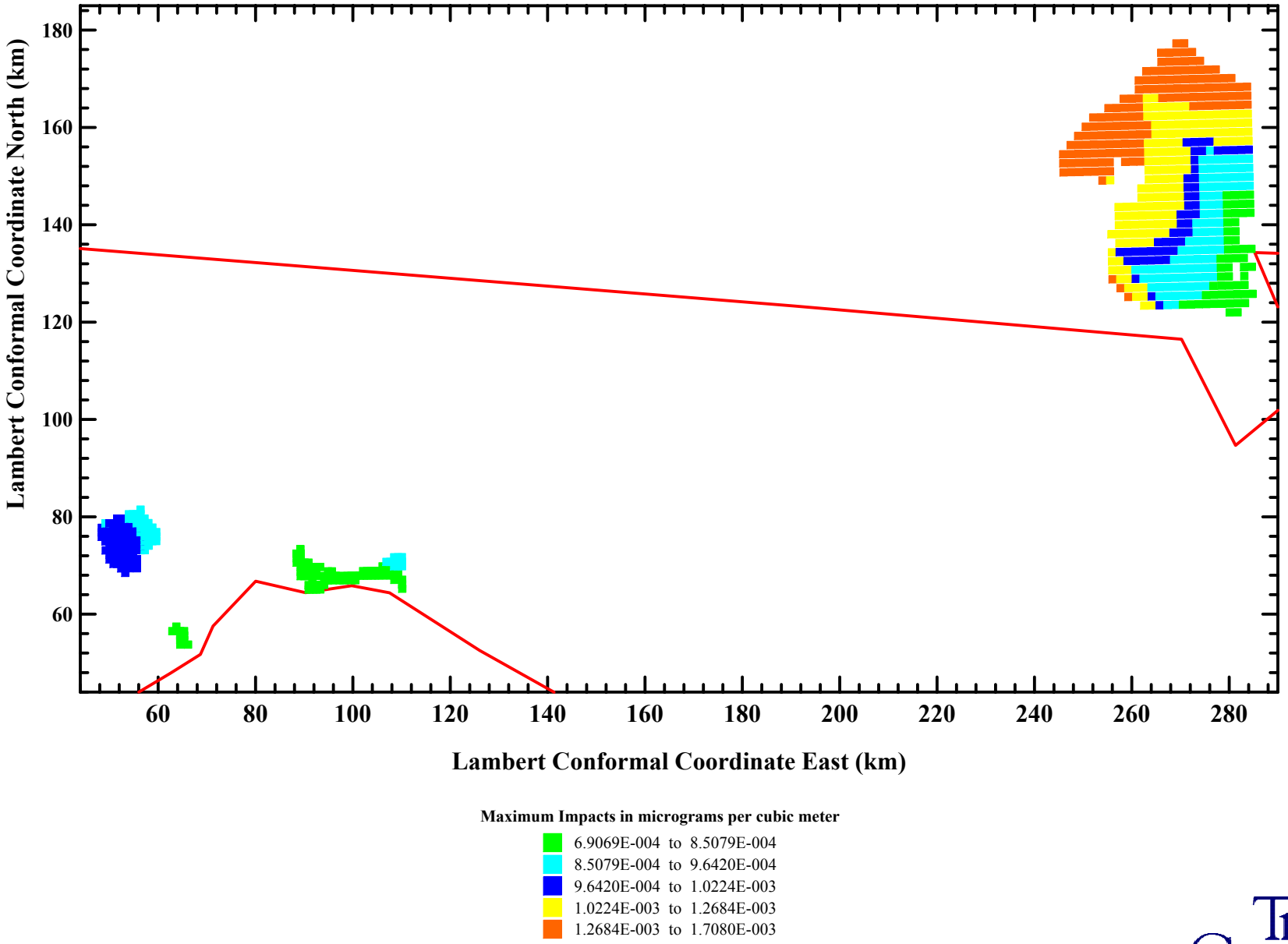

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Figure A-11. Maximum Impacts of SO2, Annual Averaging Period

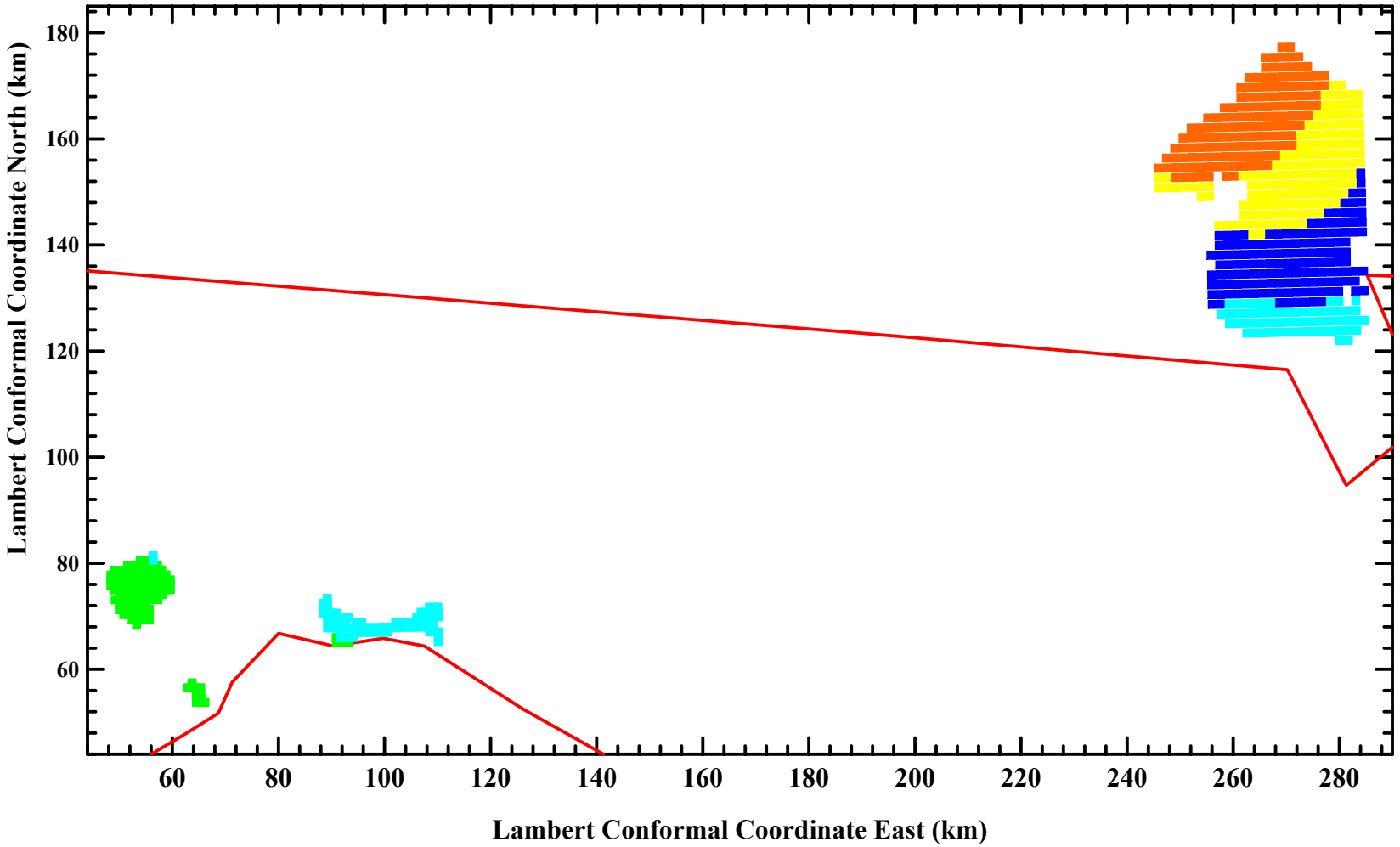

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Figure A-12. Maximum Impacts of PM10, 24-hour Averaging Period

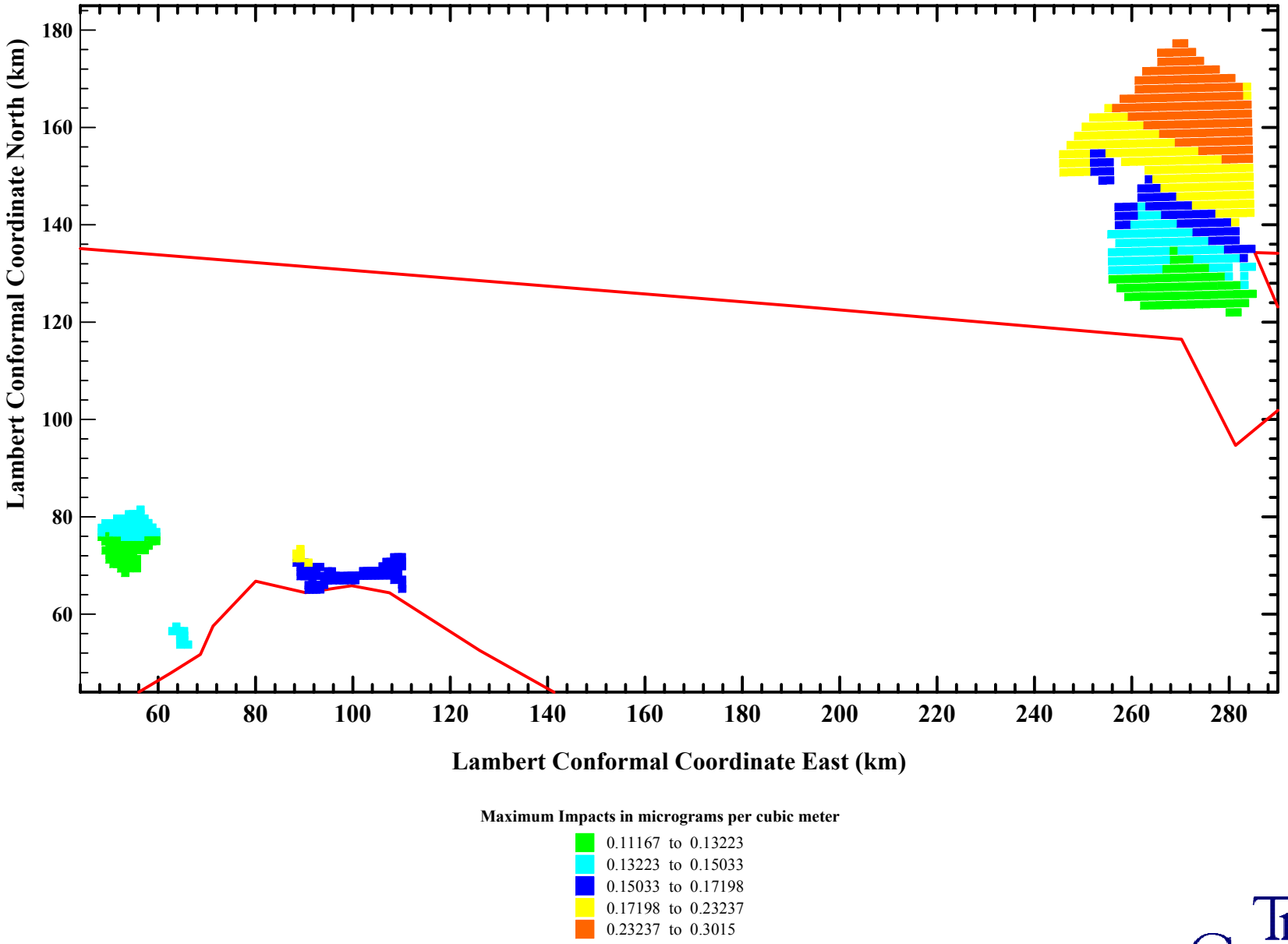

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Figure A-13. Maximum Impacts of PM10, Annual Averaging Period

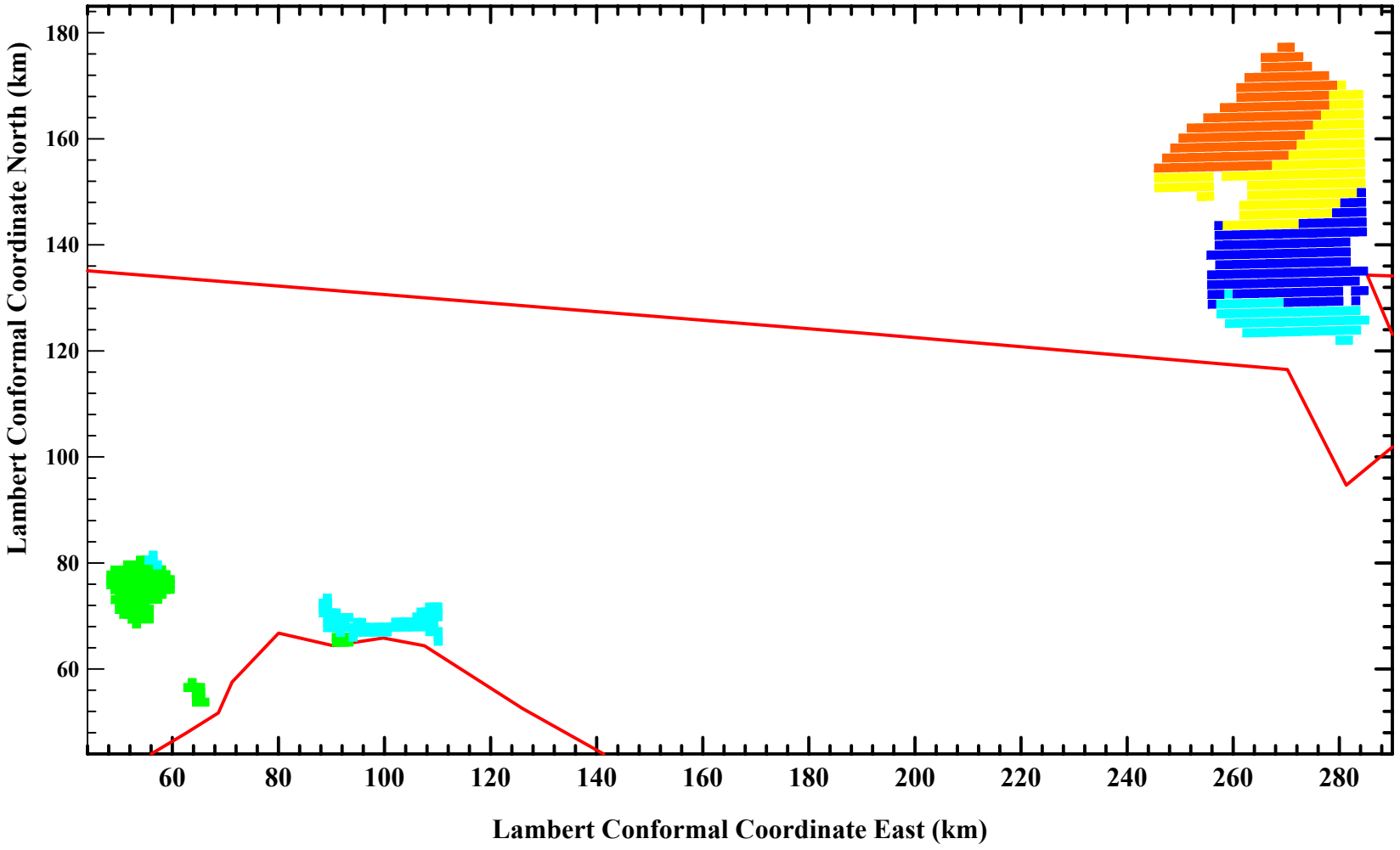

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Figure A-14. Maximum Impacts of NOx, Annual Averaging Period

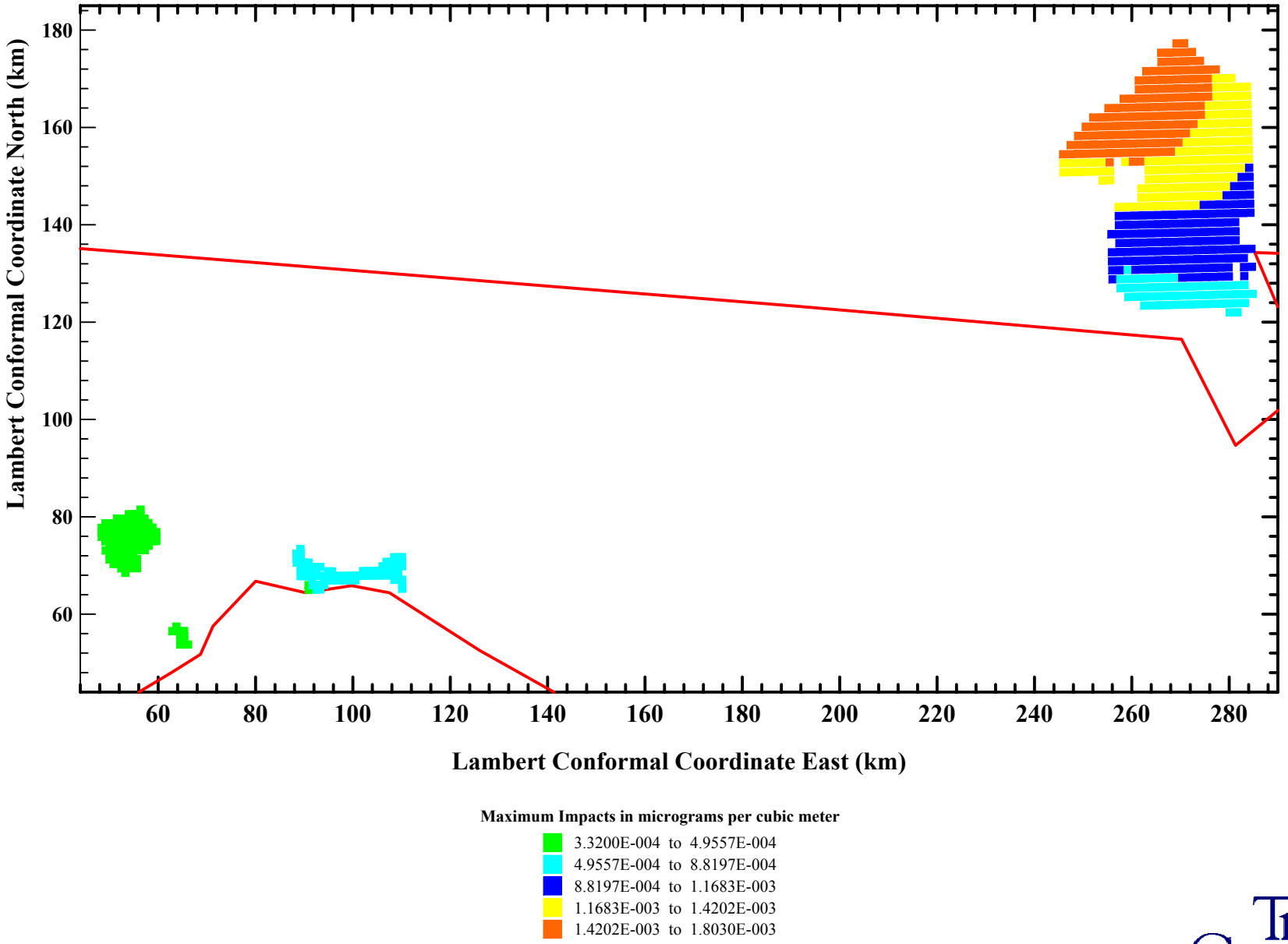

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Figure A-15. Maximum Total Sulfur Deposition

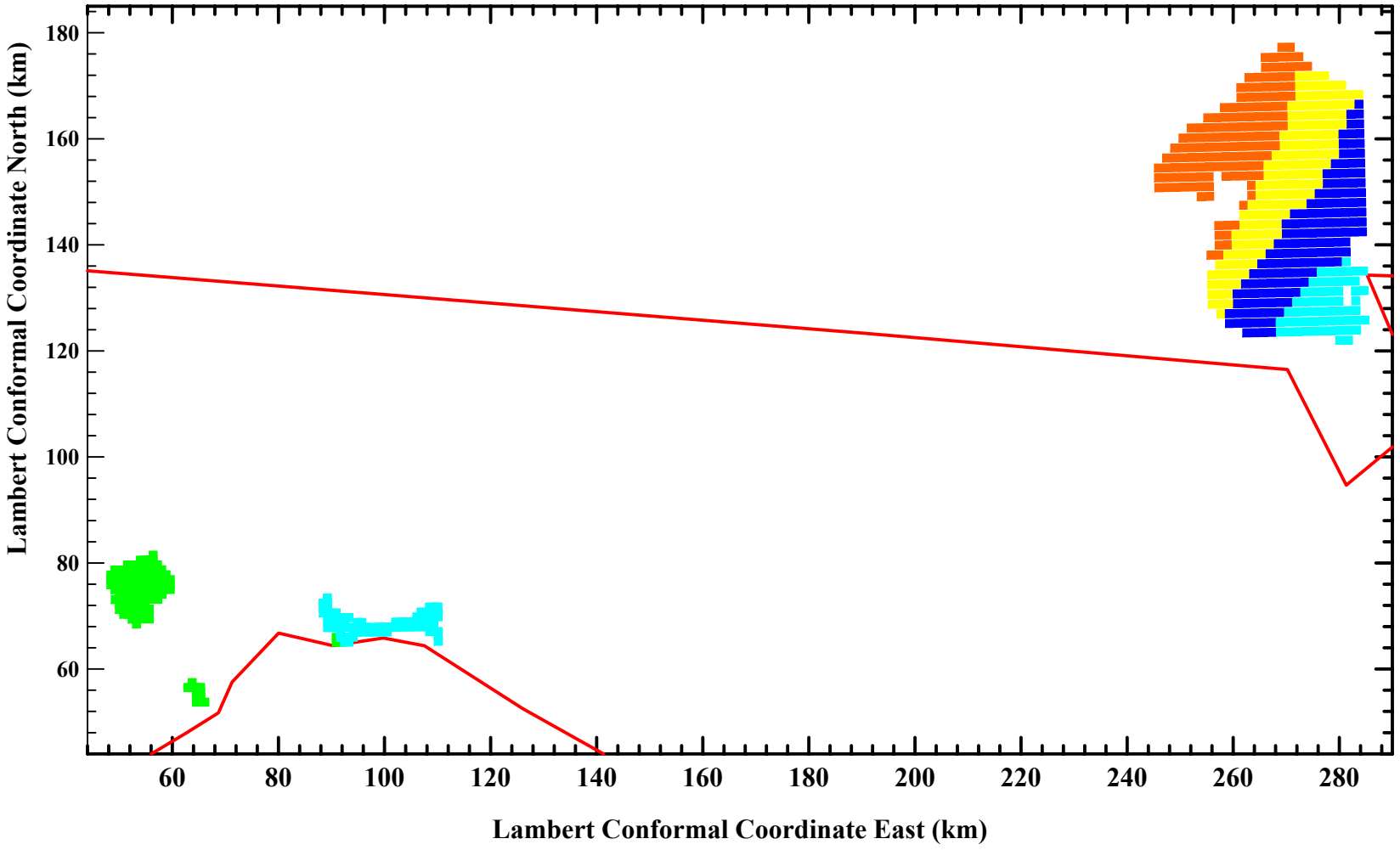

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Figure A-16. Maximum Total Nitrogen Deposition

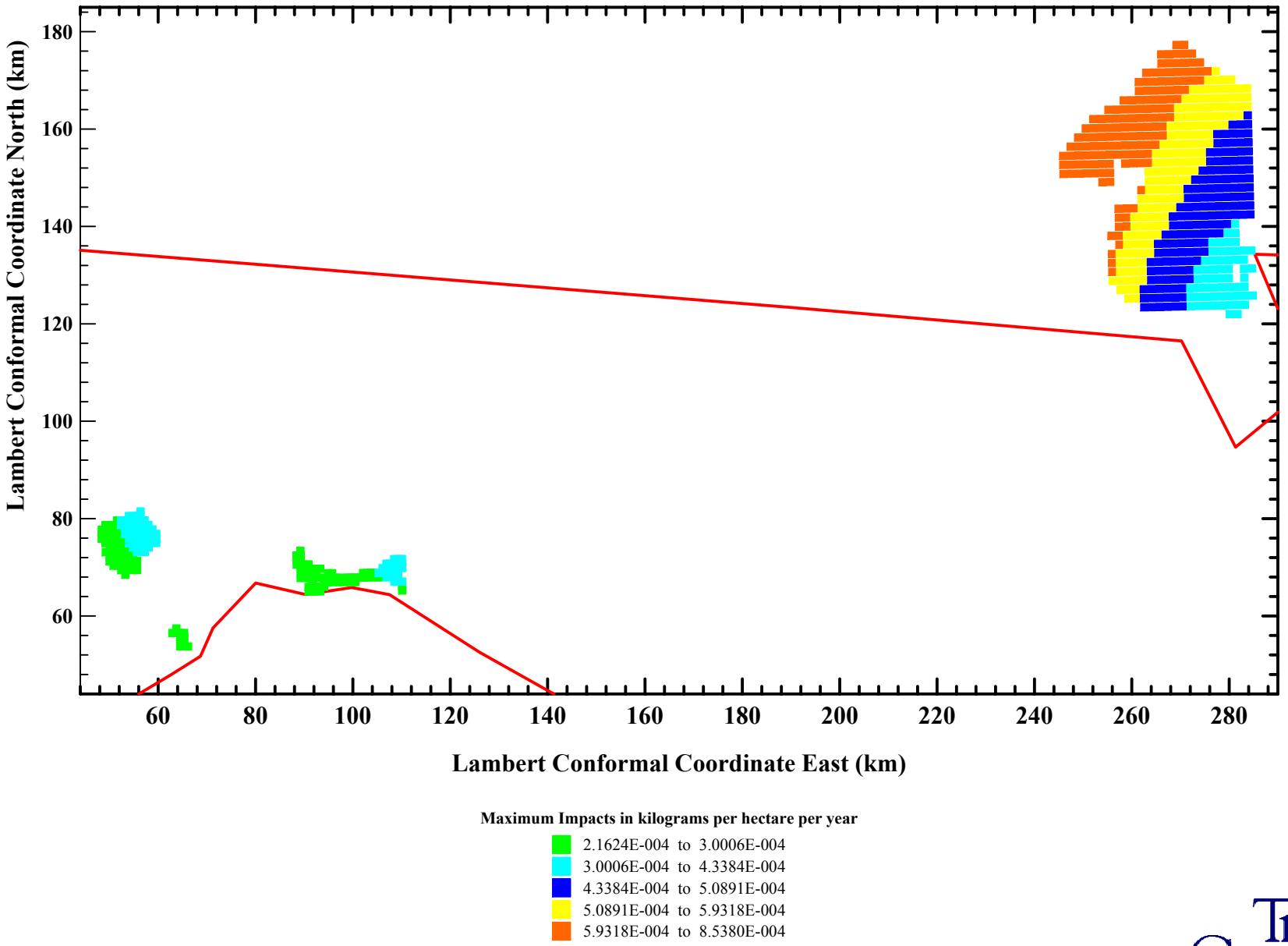

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Figure A-17. Maximum Daily Visibility Impacts