Exemption Modeling Analysis in Support of the Best Available Retrofit Technology (BART) Regulations - 40 CFR 51.300 and Appendix Y

Prepared for:

INTERNATIONAL PAPER

International Paper Augusta Mill
4278 Mike Padgett Highway
Augusta, GA 30906

Prepared by:

URS

URS Corporation – North Carolina
1600 Perimeter Park Drive, Suite 400
Morrisville, North Carolina 27560

July 28, 2006

Exemption Modeling Analysis in Support of the Best Available Retrofit Technology (BART) Regulations - 40 CFR 51.300 and Appendix Y

International Paper
Augusta, Georgia

Prepared for:

International Paper – Augusta Mill
4278 Mike Padgett Highway
Augusta, Georgia 30906

Prepared by:

URS Corporation – North Carolina
1600 Perimeter Park Drive, Suite 400
Morrisville, North Carolina 27560

July 28, 2006

Table of Contents

Page

Appendices

List of Tables

Page

List of Figures

Executive Summary

The International Paper (IP) Augusta Mill has performed a long-range transport modeling analysis using the CALPUFF modeling system to demonstrate that air emissions from BART-eligible units at the IP Augusta Mill do not cause or contribute to visibility impairment in any Federal Class I area within 300 kilometers of the mill. The modeling analysis was performed according to the conservative guidance provided by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) in the *Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), December 22, 2005, Revision 3, 7/18/06.*

This report documents the BART exemption modeling procedures and results and demonstrates that the IP Augusta Mill should be exempted from any further requirements under the BART rule. A summary of the results is presented below.

Class I Area	Distance (km) From Mill to Class I Area Boundary	No. of days with impact >0.5 dv in Class I Area: 2001	No. of days with impact >0.5 dv in Class I Area: 2002	No. of days with impact >0.5 dv in Class I Area: 2003	No. of days with impact >1.0 dv in Class I Area for 3-yr Period	Max 24-hr impact for Highest 8th High Value for Any Year	Max. 24-hr impact over 3-yr period, 22nd Highest Value
Cohutta	294	0	0	0	0	0.114	0.110
Cape Romain	219	0	0	0	0	0.211	0.198
Great Smoky Mt	268	0	0	0	0	0.093	0.085
Joyce Kilmer	289	0	0	0	0	0.086	0.075
Linville Gorge	275	0	0	0	0	0.103	0.100
Okefenokee	254	0	0	0	0	0.157	0.129
Shining Rock	236	0	0	0	0	0.127	0.118
Wolf Island	226	0	0	0	0	0.148	0.128

1.0 Introduction and Background

International Paper (IP) has retained URS Corporation (URS) to assist in the development of a long-range transport modeling analysis using the CALPUFF modeling system to demonstrate that air emissions from BART eligible units at the IP Augusta Mill do not cause or contribute to visibility impairment in any Federal Class I area within 300 kilometers of the mill. These regulatory modeling requirements are briefly defined in 40 CFR 51, Appendix Y. The modeling was conducted using the detailed procedures outlined in a common protocol developed by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) and a "site-specific" protocol developed by URS and submitted to the Georgia Department of Natural Resources, Environmental Protection Division (Georgia DNR) on April 28, 2006.

Comments and recommendations from Georgia DNR on the "site-specific" protocol have been incorporated into this modeling analysis. The following provides a regulatory background of the BART regulation and summarizes the modeling procedures used to conduct the BART exemption modeling.

The Clean Air Act established goals for visibility in many national parks and wilderness areas. Through the 1977 amendments to the Clean Air Act, Congress set a national goal for visibility as "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution." The Amendments required EPA to issue regulations to assure "reasonable progress" toward meeting the national goal.

In 1980, EPA promulgated regulations to address the visibility impairment that is "reasonably attributable" to a single source or small group of sources. In 1988, the States, Federal Land Managers (e.g., National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management), and EPA began monitoring of fine particle concentrations and visibility in 30 national parks and wilderness areas across the country.

The Clean Air Act Amendments of 1990 required EPA to take regulatory action on regional haze and they proposed the Regional Haze Regulations in July 1997 in conjunction with issuing new national ambient air quality standards for fine particulate matter.

On July 1, 1999, EPA promulgated the final Regional Haze Regulation. The final Regional Haze Regulation calls for state and federal agencies to work together to improve visibility in 156 national parks and wilderness areas in the United States by developing and implementing long-term air quality protection plans to reduce the pollution that causes visibility impairment in these protected areas.

The Regional Haze regulation provides States flexibility in determining reasonable progress goals for protected areas by conducting certain analyses to ensure that they consider the possibility of setting an ambitious reasonable progress goal, one that is aimed at reaching natural background conditions by the year 2064. The regulation requires States to establish goals for each affected area to (1) improve visibility on the haziest days, and (2) ensure no degradation occurs on the clearest days over the period of each implementation plan.

The Regional Haze regulation also requires States to develop long-term strategies including enforceable measures designed to meet reasonable progress goals. The first long-term strategy will cover 10 to 15 years, with reassessment and revision of those goals and strategies in 2018 and every 10 years thereafter. State's strategies will address their contribution to visibility problems in Class I areas both within and outside the State.

One of the principal elements of the visibility protection provisions of the Clean Air Act addresses installation of best available retrofit technology (BART) for certain existing sources. "BART-eligible" sources are those sources built between 1962 and 1977 that have the potential to emit more than 250 tons per year of one or more visibility-impairing compounds including sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM), and volatile organic compounds (VOCs), and that fall within 26 industrial source categories (including Kraft pulp and paper manufacturing).

Soon after the Regional Haze Regulation was finalized, several parties filed petitions to challenge the rule with the U.S. Court of Appeals for the D.C. Circuit. In April 2004, EPA Administrator Mike Leavitt signed a proposed amendment to the 1999 Regional Haze Regulation. The proposed rule satisfied the terms of a May 2002 ruling by the U.S. Court of Appeals for the D.C. Circuit, which vacated parts of the BART provisions of the 1999 Regional Haze Regulation (*American Corn Growers et. al. v. EPA*, 291 F. 3d 1 (D.C. cir. 2002)).

The rule requires states to consider the visibility impacts of an individual facility when determining whether they have to install controls. The final BART implementation and guidance rule (40 CFR Part 51, Appendix Y) was published on July 6, 2005 and it allows for a BART evaluation for any BART-eligible source that "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility" in any mandatory Class I federal area.

Pursuant to the rule, States have the option of exempting a BART-eligible source from the BART requirements based on dispersion modeling demonstrating that the source cannot reasonably be anticipated to cause or contribute to visibility impairment in a Class I area. Regional Planning Organizations (RPOs), such as the VISTAS have prepared guidance for performing the dispersion modeling analyses. According to 40 CFR Part 51, Appendix Y, a BART-eligible source is considered to "contribute" to visibility impairment in a Class I area if the modeled 98^{th} percentile change in dv is equal to or greater than the "contribution threshold." Any BART-eligible source determined to cause or contribute to visibility impairment in any Class I area is subject to a BART evaluation.

The *Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), December 22, 2005, Revision 3, 7/18/06*, was prepared by the VISTAS RPO to provide some common guidance for performing conservative BART exemption and determination modeling evaluations as allowed by the regulation.

The final BART rule defines a "contribution threshold" of 0.5 dv as the value where a modeled BART eligible source may "contribute" to visibility impairment and the threshold to determine whether a single source "causes" visibility impairment is set at a 1.0-dv change from natural conditions (background visual range) over a 24-hour averaging period in the final BART rule (70

FR 39118). An approximate 1.0 deciview change was defined by Pitchford and Malm (1992) as a "just noticeable change" to the observer when the background visual range equals the line-of-sight (LOS) of the observer. According to L. Willard Richards in "Use of the Deciview Haze Index as an Indicator for Regional Haze" if a shorter LOS distance than the background visual range (natural conditions) is used in performing the calculations then a higher extinction value, or deciview, is needed to cause a "just noticeable change." In other words, when the LOS is less than the background visual range, then it would require a higher deciview value in order to be a "just noticeable change." Since large concentration gradients are expected when modeling single sources, it is generally understood that "single-source" visibility impairment modeling include some estimate of the change in concentration with distance. However, this is not done using current VISTAS modeling guidance.

The exemption modeling results presented in this report only use the conservative modeling approach as defined by the VISTAS protocol by determining the change in extinction at single maximum receptors in a Class I area and did not use the a refined modeling line-of-sight or sight path approach that is consistent with the definition of the deciview metric. This was done since the more conservative VISTAS modeling results produced values below levels of concern at each Class I area and the extra time and effort to do LOS modeling would provide little added value to the BART exemption analysis.

1.1 Objective of BART Exemption Modeling

The objective of this BART exemption modeling analysis is to demonstrate that all BART eligible emission units located at the IP Augusta Mill do not cause or contribute to visibility impairment in any of the Class I areas located within 300 kilometers of the plant site. The VISTAS organization has developed a set of modeling procedures that were used to conduct the exemption modeling. These modeling procedures are discussed in the VISTAS document titled; *Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), December 22, 2005- Revision 3 – 7/18/06*. The VISTAS modeling procedures and additional refinements are also discussed in a "site-specific" protocol developed by URS titled; *Protocol for the Application of the CALPUFF Model in Support of the Best Available Retrofit Technology (BART) Regulations – 40 CFR 51.300 and Appendix Y, April 28, 2006*. The VISTAS States, including Georgia, have accepted EPA's guidance to use the CALPUFF modeling system to comply with the BART modeling requirements of the regional haze rule.

International Paper has conducted refined CALPUFF modeling to quantify the estimated visibility impairment of the mill's BART-eligible emission units as compared to natural visibility conditions. The refined modeling procedures are discussed in this summary report. International Paper requests that the GA DNR review this report and provide IP with a notification letter stating that the BART exemption request has been approved based on the technical accuracy of the modeling approaches used therein. International Paper and URS Corporation are willing to discuss these model results in greater detail at any time with the Georgia DNR and supply any additional material needed in order to facilitate the review.

1.2 Response to Protocol Comments

The Georgia DNR provided comments to IP Augusta regarding the site-specific BART exemption modeling protocol on June 23, 2006. The following items respond to the June 1, 2006 General Comments for all Georgia BART exemption Modeling Protocols from the US EPA.

Item 1. Rayleigh Scattering and Sea Salt: An adjusted Rayleigh Scattering and the use of a sea salt adjustment factor is a reasonable assumption that is based on good science. However, to expedite the review process, URS did not include any adjustments for Rayleigh Scattering and sea salts in this analysis.

Item 2. GEP Stack Height: No IP Augusta BART eligible unit has a height greater than 65 meters; therefore, this issue does not impact the IP Augusta Mill.

Item 3. a: Input modeling tables are being provided in this report which include all the recommended EPA model settings. b: We have included the basis for the determination of all BART eligible units. c: Comment not applicable to IP Augusta.

Specific EPA Comments on the IP Augusta Mill are addressed below.

1. Use of 98^{th} percentile for visibility threshold comparison. URS did not conduct any screening level CALPUFF modeling. Only refined 4-km modeling was performed, which allows the use of 98^{th} percentile values. Final modeling results are based on the 98^{th} percentile value for three individual years and three years combined.

2. AERMOD Turbulence-based dispersion. Standard Pasquill-Gifford (P-G) curves were used for this BART exemption modeling.

3. Ammonia-Limiting Method: As recommended by the Georgia DNR in the June 23, 2006 protocol comment letter under item 2, a value of 0.5 ppb for background ammonia was used for all modeling.

4. Alternative methodologies when VISTAS BART Protocol method fails.
a. *Sea Salt and Rayleigh Scattering Adjustments*. URS did not make adjustments to the standard IMPROVE equation in this modeling submittal.

b. *Line-of-sight (LOS)*. The LOS approach was not used in this modeling analysis.

c. URS believes that applying Method 7 or 7 prime would remove yet another conservative component from the BART modeling process. However, URS did not conduct any Method 7 or 7 prime modeling for this analysis.

d. URS conducted all BART modeling for this analysis using the recommended VISTAS model procedures. These standard procedures are discussed in the reminder of this report.

The following items address the comments in the May 18, 2006 letter from the United States Department of Agriculture, Forest Service (FS) to Georgia Department of Natural Resources, Environmental Protection Division.

With respect to the FS comment on 12 kilometer screening procedures please refer to the URS response to the US EPA under specific item 1.

With respect to the FS comment on the use of ammonia data please refer to the URS response to the US EPA under specific item 3.

LOS modeling technique: LOS was not used in this modeling analysis.

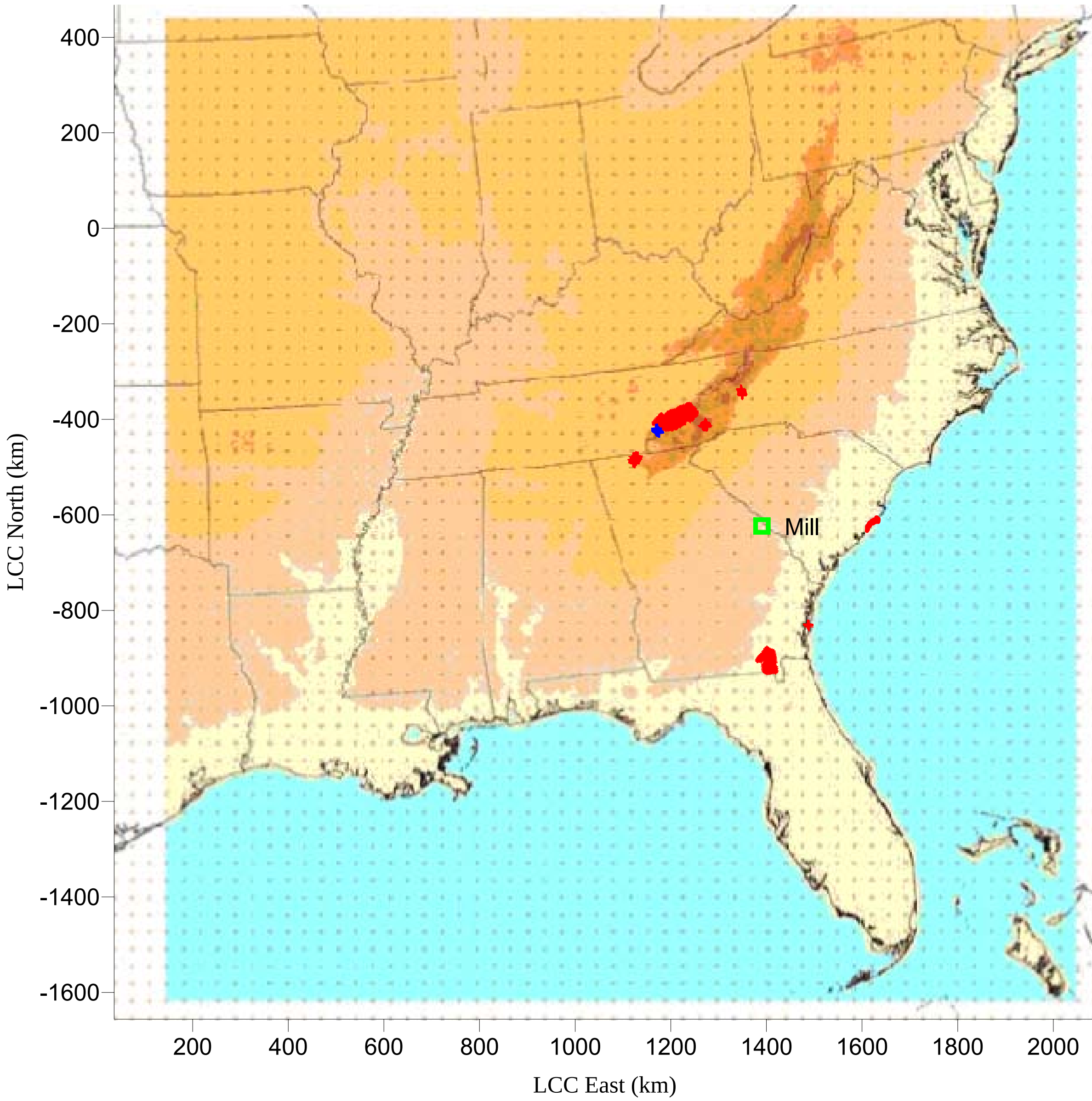
Method 7: URS did not use Method 7 modeling assumptions in this analysis.

Relative Humidity, f(RH) and EPRI Coefficients: URS did not use any of these adjustments in this analysis.

This BART exemption modeling analysis was conducted using standard (VISTAS) recommended modeling procedures. These procedures are discussed in the remainder of this report.

1.3 Facility Location and Relevant Class I Areas

The International Paper Augusta, Georgia pulp and paper mill is located at 4278 Mike Padgett Highway near Augusta, Georgia. The Universal Transverse Mercator (UTM) coordinates, in kilometers (km), for the mill are Zone 17, 411.300 East and 3688.200 North. The approximate Lambert Conformal Conic (LCC) coordinates are 1390.566 km East and -623.286 km North. There are eight (8) Class I areas within 300 kilometers of the Augusta Mill: Cape Romain, Okefenokee and Wolf Island National Wildlife Refuge Areas, Shining Rock, Linville Gorge, Joyce Kilmer/Slickrock and Cohutta Wilderness Areas and the Great Smoky Mountains National Park. Figure 1-1 displays the location of the mill and the eight Class I areas. Cape Romain is located approximately 219 kilometers east of the mill, Wolf Island is located approximately 226 kilometers southeast of the mill, Okefenokee is located 254 kilometers south of the mill, Shining Rock is located 236 km northwest of the mill, Great Smoky Mountains is located 268 kilometers northwest of the mill, Linville Gorge is located 275 kilometers north of the mill, Joyce Kilmer/Slickrock is located 289 kilometers northwest of the mill and Cohutta is located 294 kilometers northwest of the mill.



URS	**URS Corporation – North Carolina** ***1600 Perimeter Park Drive Suite 400*** ***Morrisville, North Carolina 27560*** ***Telephone (919) 461-1100 Fax (919) 461-1415*** SCALE: AS SHOWN · DRAWN BY: **SCL** · DATE: SCL CHECKED BY: · DATE:	**International Paper, Augusta** **Facility Location Relative to Class I Areas**	FILE NO. 31825278 FIG. NO. 1-1

1.4 Source Impact Evaluation Criteria

To assess whether a BART eligible source is exempt from performing a BART control technology evaluation, a two-tiered modeling approach is suggested by VISTAS: a screening level analysis which uses 12-km grid data from CALMET with no supporting observational data included or a more refined CALMET data with a grid spacing of 4-km with observational data to better define a facilities impact. In order to perform the exemption modeling in the most efficient manner, URS has skipped the screening level modeling analysis using the 12-km grid data and has only used the 4-km refined meteorological data. Using the 4-km data provides a more accurate prediction of the mill's impact on visibility as compared to natural conditions.

As suggested in VISTAS BART modeling guidance, the CALPUFF/CALPOST models were used to estimate a maximum 98^{th} percentile value for visibility impairment during a 24-hour averaging period. The higher of the 8^{th} highest individual year or the 22^{nd} highest for the three-year modeling period are reported. This value was compared to the EPA/VISTAS recommended visibility threshold of 0.5 dv.

1.5 General Overview of the CALPUFF Modeling System

The CALPUFF modeling system consists of three main processors: CALMET, CALPUFF and CALPOST. CALMET is the meteorological model that generates hourly three-dimensional meteorological fields of variables such as wind and temperature. CALPUFF simulates the transport, dispersion, and transformation of compounds emitted from a source and calculates hourly concentration values for visibility impairing compounds at each receptor located in the modeling domain. CALPOST calculates time-averaged concentration values from the CALPUFF predictions and performs regional haze calculations like those described in the Section 6.1 of this report.

2.0 BART Source Descriptions

The IP Augusta Mill is located near Augusta, Georgia, along the Savannah River. The primary activities at Augusta Mill are pulp production (Standard Industrial Classification [SIC] code 2611) and paperboard production (SIC code 2631). The Mill began operations in 1960. Primary operations at the mill include multiple fuel-fired boilers, chemical recovery operations, wood pulping and bleaching operations, papermaking, and additional operations and equipment necessary to support these operations. The facility currently employs about 750 people, and produces a nominal 750,000 tons per year of coated bleached board used for greeting cards, pharmaceutical and foodservice packaging, and cigarette packaging.

2.1 Unit Specific Source Data

The emission estimates used in the CALPUFF model are intended to reflect steady-state operating conditions during periods of high capacity utilization. Consistent with the VISTAS common protocol, modeled emissions do not include periods of start-up, shutdown, and malfunction. The modeling is based on the 24-hour average actual emission rate from the highest emitting day during the most recent 3-year period. The following hierarchy for developing the emission estimates was used for the IP Augusta mill:

- Continuous Emissions Monitoring (CEM) data;
- Facility emissions tests;
- Emission factors;
- Permit limits; or
- Potential to emit.

The Augusta Mill developed emission estimates based on source testing and accepted emission factors used for routine annual emissions reporting. In general, the following emission rates were used:

- Short-term (24-hours) allowable emission rates (e.g., emission rates calculated using the maximum rated capacity of the source);
- Federally enforceable short-term limits (24-hours); or
- Peak 24-hour actual emission rates (or calculated emission rates) from the most recent 3-years of operation that account for "high capacity utilization" during normal operating conditions and fuel/material flexibility allowed under the existing air permit. In situations where a unit is allowed to use more than one fuel, the fuel resulting in the highest emission rates was used for the modeling, as long as that fuel represented a realistic 24-hour operating scenario. Scenarios representing periods of startup, shutdown, or malfunction were not modeled.

Short-term emission rates (24-hours) for SO_2, NO_x, H_2SO_4 mist, and PM_{10} (including condensable and filterable direct PM_{10}) were modeled since visibility changes are calculated for a 24-hour averaging period. All BART-eligible emission units at the mill that emit these compounds were modeled together in the CALPUFF model.

Listed below is a brief description of all the BART-eligible emission units at the mill:

- No. 2 Power Boiler (PB2A): This boiler fires pulverized coal, No. 6 fuel oil, natural gas, and used oil. The No. 2 Power Boiler also serves as a backup control device for the non-condensable gas (NCG) system. The No. 2 Power Boiler nominal throughput is 532 MMBtu/hr when firing pulverized coal, 600 MMBtu/hr when firing No. 6 fuel oil, and 677 MMBtu/hr when firing natural gas. The unit is controlled by an electrostatic precipitator.
- No. 2 Recovery Boiler (RB2A): This direct contact evaporator (DCE) recovery boiler fires black liquor solids, with No. 6 fuel oil or natural gas as auxiliary fuels. The No. 2 Recovery Boiler nominal throughput is 2.0 million pounds of black liquor solids per day, 460 MMBtu/hr when firing No. 6 fuel oil during periods of SSM or low BLS throughput, and 100 MMBtu/hr of natural gas. The unit is controlled by an electrostatic precipitator.
- No. 2 Smelt Dissolving Tank (ST2A): This smelt dissolving tank receives smelt from the No. 2 Recovery Boiler. This unit is controlled by a wet scrubber.
- No. 2 Paper Machine (PM2A): This paper machine is equipped with 28 infrared (IR) heaters (1.1 MMBtu/hr each) and 2 aircap heaters (rated at 3.4 and 8.0 MMBtu/hr) that are natural gas fired.

- No. 1 Slaker/Causticizer (CAU1): The No. 1 Slaker/Causticizer has a maximum throughput of 13 tons CaO per hour. The slaker vent duct is equipped with a liquid spray nozzle, but this is not considered a formal air pollution control device.

The following BART-eligible units do not emit SO_2, NO_x, H_2SO_4 mist, or PM_{10} and were not modeled.

- No. 2 A/B Filtrate Tank (2ABF)
- No. 2 Brownstock Washer and Screens (BSW2)
- No. 2 Evaporators (EV2A)
- No. 2 Green Liquor Clarifier (GLC2)
- No. 1 Black Liquor Pond (BLP1) – Closed in 2006

The Riley Auxiliary Boiler (RLYA) was recently excluded from the list of BART-eligible emission units because it is a backup boiler with heat input less than 250 MMBtu. It is not integral to the process. The Riley Auxiliary Boiler fires No. 2 fuel oil or natural gas and is permitted to operate only when one of the primary boilers or recovery boilers is offline. The Riley Boiler's nominal throughput is 220 MMBtu/hr.

Appendix A provides information on how the list of BART-eligible units was developed and presents the emission rate calculations for the BART-eligible units that emit SO_2, NO_x, H_2SO_4 mist, or PM_{10}. Tables 2-1 and 2-2 provide detailed stack parameter information for the modeled BART-eligible emission units at the mill.

2.2 Tabulated Source Data

TABLE 2-1
BART ELIGIBLE EMISSION UNITS - POINT SOURCE PARAMETERS
INTERNATIONAL PAPER, AUGUSTA, GEORGIA
URS PROJECT NO. 31825278

Model ID	Source Description	UTM Easting (m)	UTM Northing (m)	LCC Easting (km)	LCC Northing (km)	Base Elevation (m)	Stack Height (m)	Temperature (°K)	Exit Velocity (m/s)	Stack Diameter (m)
PB2A	No. 2 Power Boiler	411316.00	3688176.25	1390.566	-623.286	48.0	60.96	518.7	20.6	2.74
RB2A	No. 2 Recovery Boiler	411375.41	3688129.25	1390.566	-623.286	48.0	60.96	430.93	21.8	2.44
ST2A	No. 2 Smelt Dissolving Tank	411313.84	3688110.25	1390.566	-623.286	48.0	39.40	336.7	17.8	1.05
CAU1	No. 1 Slaker/Causticizer	411373.9	3688026.5	1390.566	-623.286	48.0	11.58	293.0	0.01	1.0

TABLE 2-2
BART ELIGIBLE EMISSION UNITS - VOLUME SOURCE PARAMETERS
INTERNATIONAL PAPER, AUGUSTA, GEORGIA
URS PROJECT NO. 31825278

Model ID	Source Description	UTM Easting (m)	UTM Northing (m)	LCC Easting (km)	LCC Northing (km)	Base Elevation (m)	Release Height (m)	Horizontal Dimension (m)	Vertical Dimension (m)
PM2A	No. 2 Paper Machine	411142.09	3688250.00	1390.566	-623.286	48.0	19.5	14.84	9.08

3.0 Geophysical and Meteorological Data

URS used the geophysical and meteorological data developed by VISTAS for the 4-km BART exemption modeling. The development of this information was discussed in detail in the VISTAS common protocol.

4.0 CALPUFF Modeling Methodology

CALPUFF modeling was conducted using the 4-km data in order to efficiently and more accurately demonstrate that the IP Augusta Mill does not cause or contribute to visibility impairment in any Class I area and thus is exempt from the BART rule. The modeling methods described in this section were used to identify specific Class I areas that might be most affected by emissions from the BART eligible emission units located at the IP Augusta Mill. It needs to be noted that the CALPUFF modeling used all recommended data that was publicly available on April 1, 2006. Background concentrations for SO_4 and TNO_3 from CMAQ (2001-2003) annual runs were not publicly available on that date; therefore, URS could not include this information in the CALPUFF runs and still meet Georgia DNR submittal deadlines.

CALPUFF modeling was performed using the standard set of default meteorological, air quality and dispersion conditions that have been developed by VISTAS for the 4-km gridded CALMET domain number five. It is our understanding that these data were developed to be consistent with recommendations developed by the Interagency Workgroup on Air Quality Modeling (IWAQM, 1998) and FLAG (2000).

4.1 Methodology

This analysis was performed using the CALPUFF model with three years of meteorological data developed by VISTAS along with the standard compliment of model algorithms invoked. URS evaluated the 98th percentile impacts since 4-km data is being used for the analysis and this percentile is recommended under 40 CFR 51, Appendix Y.

The regional haze impacts at each applicable Class I area were calculated from the daily visibility values for each receptor by determining the change in deciviews compared against natural visibility conditions. EPA's "Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule," EPA-454/B03-005 (September 2003) lists recommended natural visibility conditions. To determine whether IP Augusta may reasonably be anticipated to cause or contribute to visibility impairment at a nearby Class I area, the impacts predicted by CALPUFF were compared against the pertinent natural visibility background and the threshold that has been selected.

4.2 CALMET Model Configuration and Application

Sections 4.3.2 and 4.4.2 within the VISTAS common protocol discuss in detail the model configurations used to generate the common CALMET meteorological files for modeling BART eligible sources. The configuration is reported to follow the IWAQM recommendations (EPA, 1998, Appendix A), except as noted in the protocol. For CALPUFF modeling there is no need to compile CALMET inputs, run the CALMET model or evaluate the outputs.

The model-ready meteorological data sets have been developed by VISTAS for one large regional domain and five smaller sub-regional domains. The IP Augusta Mill is located in sub-regional domain number 4 depicted in the VISTAS common protocol. Figure 4-1 displays the configuration of the regional domain and the size and location of the smaller CALPUFF modeling domain used in the analysis.

4.3 CALPUFF Model Configuration and Application

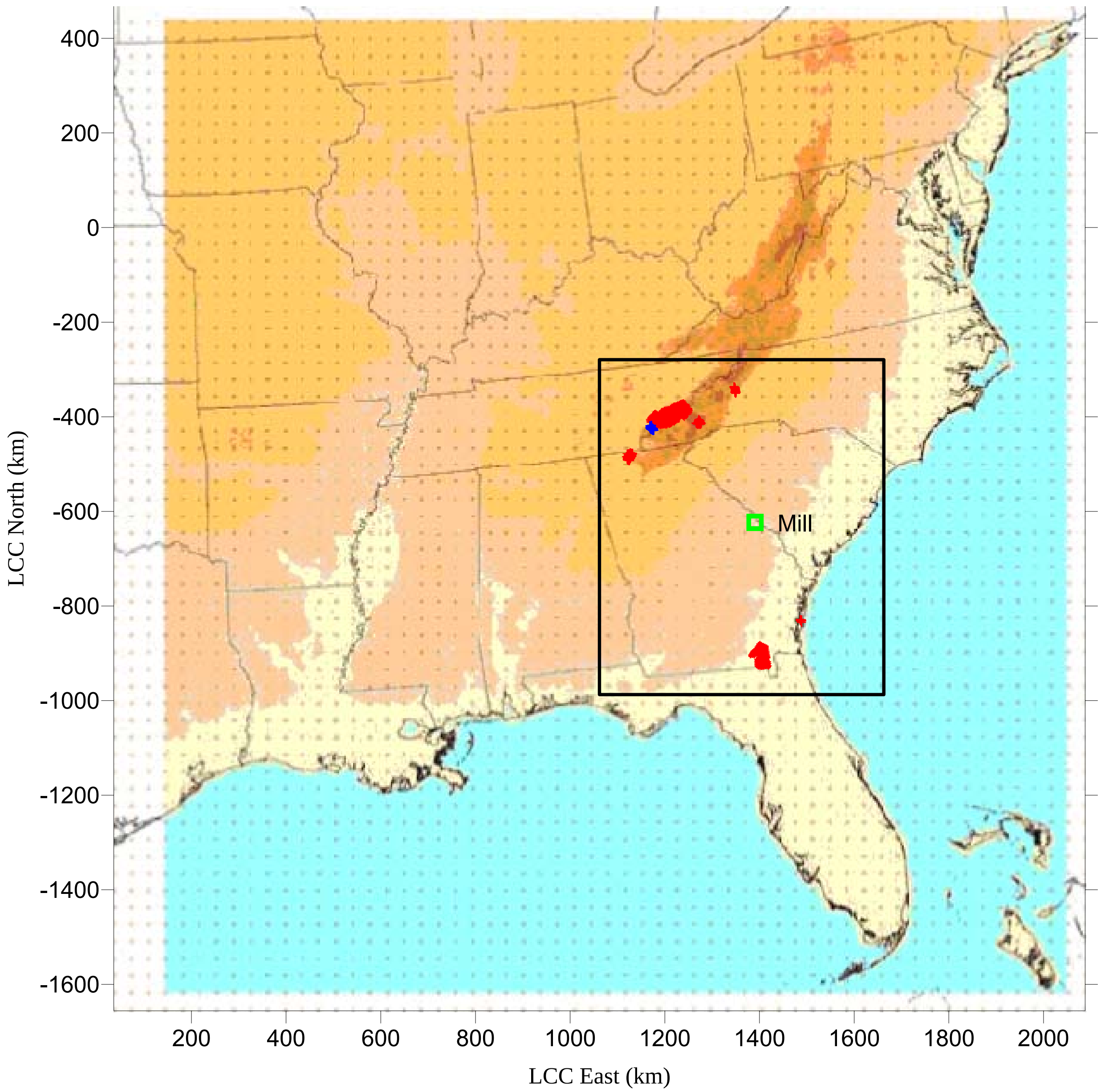
URS used the newly released VISTAS version of the CALPUFF modeling system version 5.754. This version contains enhancements funded by the Minerals Management Service (MMS) and VISTAS. This version includes CALMET, CALPUFF, CALPOST, CALSUM, POSTUTIL, and CALVIEW, and it was obtained from the CALPUFF website.

All CALPUFF modeling used the standard P-G curves. The sequence of model processors for all modeling was CALPUFF then CALPOST. POSTUTIL was not used to conduct ALM modeling since very little benefits (lower predicted concentrations) were seen from using the ALM procedures for this facility. POSTUTIL also was not used for particle size modeling since all particulate matter (PM) was assumed to be in the 0.48 micron category and this greatly speeded up the modeling process by being able to go directly from CALPUFF to CALPOST by simply defining the PM components in terms of coarse, soil, elemental carbon and secondary organic aerosol. Not using POSTUTIL for ALM or PM particle size modeling is a conservative process (may produce slightly higher impacts). Initial tests using POSTUTIL showed this to be the case. The total contribution to visibility impairment from PM emissions is relatively minor when compared to the contributions from nitrates and sulfates. This can be seen by examining the CALPOST output files. CALMET and associated preprocessors are not discussed since VISTAS performed these model runs.

4.3.1 Domain Definition

The meteorological modeling data sets cover three contiguous years (2001, 2002, and 2003) and have been resolved to a 4-km horizontal resolution grid using MM5 data. Details of the modeling domains and the meteorological databases for 2001, 2002, and 2003 are discussed in detail in the VISTAS common protocol.

Receptor Network and Class I Receptors. Discrete receptor coordinate data for the eight Federal Class I areas within 300 km of the source were developed using the National Park Service (NPS) Convert Class I Areas (NCC) computer program. The receptor elevations provided by the NPS were used for modeling. All receptors for each Class I area were included in single CALPUFF simulations. There are 110 receptors listed for Shining Rock, 745 receptors for the Great Smoky Mountains, 66 receptors for Linville Gorge, 101 receptors for Joyce Kilmer/Slickrock 220 receptors for the Cohutta Class I area, 164 receptors for Cape Romain, 30 receptors for Wolf Island and 490 receptors for the Okefenokee Class I area. Appendix D contains a listing of the Lambert Conformal coordinates for each Class I area with the associated receptor heights.



URS	URS Corporation – North Carolina *1600 Perimeter Park Drive Suite 400* *Morrisville, North Carolina 27560* *Telephone (919) 461-1100 Fax (919) 461-1415*			**International Paper - Augusta** **VISTAS CALMET DOMAIN with CALPUFF Sub-domain**
	SCALE: AS SHOWN	DRAWN BY: **SCL** CHECKED BY:	DATE: SCL DATE:	FILE NO. 31825278 FIG. NO. 4-1

4.3.2 Model Set-Up

The modeling used a CALPUFF computational domain that includes all applicable Class I areas within 300 km of the source and a 50-kilometer buffer around applicable Class I areas and the mill. The size and location of the 4-km CALPUFF computational domains is shown in Figure 4-1.

As depicted in Figure 4-1, the CALPUFF modeling domain is a subset of the larger regional and sub-regional CALMET meteorological domains. A smaller CALPUFF domain is being used to reduce the CALPUFF run times. The CALPUFF 4-km sub domain is approximately 612 km in the east/west direction and 684 km in the north/south direction. Using a 4-km grid spacing from the CALMET files, this would relate to 153 x 171 grid squares. Appendix B contains a summary of the input options selected when performing CALPUFF modeling.

4.3.3 Emissions Input Development

Emissions from the facility include SO_2, NO_x, H_2SO_4 mist, and PM_{10} (including condensable and filterable in the form of coarse, soil, elemental carbon, and secondary organic aerosol PM).

Emissions Speciation. URS used the example spreadsheets supplied by VISTAS and the CMAQ speciation profiles available on EPA's website for PM speciation. Appendix A provides detailed information on PM speciation for the BART-eligible units.

Condensable Emissions. Condensable emissions were considered primary fine particulate matter. Appendix A provides detailed information on condensable and filterable PM emissions from the BART-eligible units.

Size Classification of Primary PM Emissions. As a conservative modeling assumption all PM was modeled in the 0.48 micron category. This is due to the fact that the non-hygroscopic PM has a relatively minor impact on visibility impairment based information from CALPOST.

4.3.4 Additional CALPUFF Input Information and Settings

CALPUFF Model Options. The model options, parameter settings, and 'switches' for exercising CALPUFF for BART modeling are discussed below. Appendix B contains tables that list the default and the actual modeled configurations used for the BART modeling. The default configurations are from the IWAQM Phase 2 Report (EPA, 1998).

Visibility Modeling Domain. The CALPUFF domain was configured to include the source and all Class I areas within 300 km. An additional 50-km buffer zone was established in each cardinal direction from the source and Class I area.

Building Downwash. Building and structure information was not included.

Puff Dispersion. Based on recent guidance from EPA and VISTAS the current default P-G dispersion curves were used for CALPUFF modeling.

Puff Representation. The default integrated puff sampling methodology was used in CALPUFF.

Puff Splitting. There is no quantitative evidence that the horizontal and vertical puff-splitting algorithms in CALPUFF yield improved accuracy and precision in model estimates of inert or linearly reactive compounds although conceptually the methods are appealing because they mimic lateral and vertical wind speed and direction shears. Therefore puff splitting was not invoked.

Chemical Mechanism. The MESOPUFF II module was used for BART modeling. For the aqueous phase conversion of SO_2 to sulfate (important when the plume interacts with clouds and fog), the IWAQM defaults were used, i.e., nighttime SO_2 loss rate (RNITE1) is assumed to be 0.2 percent per hour. The nighttime NO_x loss rate (RNITE2) and HNO_3 formation rate (RNITE3) are both set to 2.0 percent per hour.

Particulate matter emissions by size category were combined into the appropriate species for the visibility analysis. These species include (a) elemental carbon (EC), (b) fine PM or "soil" (<2.5 µm in diameter), (c) coarse PM (between 2.5-10 µm in diameter), and (d) organics, referred to as secondary organic aerosols in the CALPOST postprocessor.

Background Ozone Concentrations. Ozone concentration data for 2001-2003 from ambient AIRS/CASNET monitors located within the particular domain being modeled were used to develop background estimates. Only non-urban ozone stations were used in the OZONE.DAT file. Monthly average ozone background values was computed for the Class I area that had the highest ozone measurements in the domain which was Shinning Rock. The values represent the daytime average ozone concentrations (6 am to 6 pm average).

Background Ammonia Concentrations. A constant (0.5 ppb) value was used for ammonia.

Other Background Concentrations. Concentrations of SO_4 and TNO_3 (HNO_3 + NO_3) from CMAQ 2001-2003 were not made available in time to be included in the modeling submittal. In a borderline modeling situation this could be an important component. However, the current modeling results indicate that this data would need to have a major impact to change the conclusions given in this report. Georgia DNR or VISTAS may wish to include this data for completeness after the submittal date should data became available.

5.0 POSTUTIL PROCESSING

No POSTUTIL processing was conducted due to the limited benefits on modeling results. Not using the POSTUTIL program adds a slightly higher degree of conservatism to the modeling results but greatly speeds up the time needed to evaluate the modeling results. Initial testing using POSTUTIL for ALM and particle size modeling indicated only slightly lower values in visibility impacts.

6.0 CALPOST PROCESSING

CALPOST Parameters. Appendix B summarizes the CALPOST post-processor options, parameters, and switches. Tables are presented containing the actual and default configurations for the BART modeling. All Class I receptors were included in a single CALPUFF simulation, URS has calculated the visibility impacts in CALPOST for each Class I area separately using the NDRECP parameter. It specifies the receptor range to be processed in CALPOST. Given the importance of the CALPOST processor to the entire BART visibility estimation a brief overview of how CALPOST calculates visibility impacts is presented in the following section.

6.1 Visibility Assessment

The recommended procedure for quantifying visibility impacts is described in detail in the VISTAS common protocol. The key point is that the light extinction coefficient (bext) can be calculated from the IMPROVE Equation as:

$$b_{ext} = 3\ f(RH)\ [(NH_4)_2SO_4] + 3\ f(RH)\ [NH_4NO_3] + 4[OC] + 1[Soil] + 0.6[Coarse\ Mass] + 10[EC] + b_{ray}$$

The monthly site-specific f(RH) values were obtained for each mandatory Federal Class I Area from Table A-3 in the EPA (2003) guidance document. Then, the haze index (HI), in deciviews, was calculated in terms of the extinction coefficient via:

$$HI = 10 \ln (b_{ext}/10)$$

The change in visibility (measured in terms of 'delta-deciviews') were compared against background conditions. The delta-deciview, .dv, value was calculated from the IP Augusta Mill's contribution to extinction, b_{source}, and background extinction, $b_{background}$, as follows:

$$dv = 10 \ln (\{b_{background} + b_{source}\}/ b_{background})$$

If the dv value is greater than the 0.5 dv threshold, then IP Augusta could contribute to visibility impairment and may be subject to BART controls. If not, IP Augusta will be BART-exempt.

<u>Visibility Impacts from BART-Eligible Sources</u>

Visibility Impact Method. CALPOST was run using Method 6 (MVISBK=6) for calculating extinction. That is, monthly f(RH) adjustment factors were applied directly to the background and modeled sulfate and nitrate concentrations, as recommended in the BART guidelines. Note that the RHMAX parameter (the maximum relative humidity factor used in the particle growth equation) is not used when Method 6 is selected. Similarly, the relative humidity adjustment factor (f(RH)) curves in CALPOST (e.g., IWAQM/FLAG/EPA growth curves) are not used when MVISBK is equal to 6. f(RH) is taken directly from EPA documentation.

Monthly average Class I area-specific relative humidity values were employed in the extinction analysis (EPA, 2003, Table A-3). Species considered include SO_4, NO_3, EC, SOA (i.e., condensable organic emissions), soil, and coarse PM. With Method 6, background extinction coefficients are computed from EPA (2003) monthly estimates of concentrations of ammonium sulfate ($BKSO_4$), ammonium nitrate ($BKNO_3$), coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and elemental carbon (BKEC). Values for these coefficients are listed in CALPOST input group 2 contained in Appendix C. The extinction due to Rayleigh scattering (i.e., the scattering of light by natural particles much smaller than the wavelength of the light) was set to 10 Mm-1 (BEXTRAY = 10.0) for all modeled Class I areas.

Natural Background Light Extinction. The Appendix Y BART guidance recommends that visibility impacts should be evaluated against 'natural' background conditions. EPA (2003) describes the calculation of the annual average background extinction (in 1/Mm) for a Class I area using the area's annual f(RH) and average natural concentrations based on the area's geographic location. Annual average background extinction values (in 1/Mm) are converted to annual average Haze Index (HI) values (in deciview or dv). The average HI value is for the 20% best visibility days (Best Days (dv)) is estimated from 10th percentile of the annual average HI value for a Class I area assuming a normal distribution. Thus, no average natural concentrations are provided for determining extinction for the 20% best visibility days. EPA maintains that the above definition of natural visibility baseline as the 20% best visibility days is likely to be reasonably conservative and consistent with the Regional Haze Rule goal of natural conditions.

There are major technical issues with this approach: (a) the same concentrations assumed at all Class I areas in the East or West, (b) the same concentrations assumed to occur every month of the year, and (c) fine sea salt and associated water is not included. Also, in the calculation of 20% best visibility days, the same frequency distribution is assumed for every Class I area in the East or in the West. In other words, 'one size fits all' (Tombach, 2004). But this really is not the case.

The background extinction computation with Method 6 in CALPOST involves user-supplied monthly concentrations of SO_4, NO_3, PM coarse, organic carbon, soil, and elemental carbon species. In practice, concentrations for only 2 species, SO_4 ([BKSO_4]) and soil ([BKSOIL]), are frequently supplied in the CALPOST input file to represent hygroscopic and non-hygroscopic portions of background extinction, respectively. Furthermore, the species concentrations are held constant over the annual cycle (i.e., no daily, monthly, or seasonal variation). Finally, the EPA natural background default values are defined separately for the eastern and western U.S. result in natural background extinction values that vary spatially and temporally only in response to the spatial distribution and monthly variation of climatologically-representative relative humidity values (EPA, 2003, Table A-3). Thus, the default definition of natural conditions does not take into account meteorologically caused visibility impairment.

Based on recent regulatory rulings, URS has opted to use the annual average method for calculating natural background conditions. The components for the Eastern U.S. are provided in Table 6-1 and were input to the CALPOST model.

Impact Threshold. The EPA BART guidance recommends that the threshold value for defining whether a source "contributes" to visibility impairment is 0.5-dv change from natural conditions.

When 98th percentile modeling is conducted the highest modeled delta deciview value for each modeling day is determined by using CALPOST. The higher, of the 8th highest value for each year or the 22nd highest over the three year period value is compared to the 0.5-dv contribution threshold value. If the value exceeds the "contribution" threshold of 0.5-dv, the source will be subject to a BART evaluation. If the value is less than the "contribution" threshold 0.5-dv, the source is exempted from the BART requirements.

Since the current regulatory version of CALPOST does not generate 98th percentile results for a three-year period, URS used a simple spreadsheet to determine the 22nd highest values for the three year period by importing the needed information from the CALPOST output file.

Table 6-1
Default Natural Background Concentrations (μg/m³) for Eastern U.S. Class I Areas (Source: EPA, 2003, Table 2-1)

	Average Natural[a] Concentration East (μg/m³)	Error Factor	Dry Extinction Efficiency (m^2/g)
Ammonium sulfate[b]	0.23	2	3
Ammonium nitrate	0.10	2	3
Organic carbon mass[c]	1.40	2	4
Elemental carbon	0.02	2-3	10
Soil	0.50	1 ½ -2	1
Coarse Mass	3.0	1 ½ -2	0.6

[a] After Trijonis (1990)
[b] Values adjusted to represent chemical S3 species in current IMPROVE light extinction algorithm; Trijonis estimates were 0.1 μg /m³ and 0.2 μg/m³ of ammonium bisulfate.
[c] Values adjusted to represent chemical species in current IMPROVE light extinction algorithm; Trijonis estimates were 0.5 μg/m³ and 1.5 μg/m³ of organic compounds.

7.0 REPORTING

7.1 CALPUFF Modeling Results

The CALPUFF modeling results are summarized in Tables 7-1 and 7-2. The format of the tables was taken directly from the VISTAS common protocol. The modeling results clearly indicate that the IP Augusta Mill BART eligible units do not cause or contribute to any visibility impairment in any Class I area within 300 kilometers of the facility. Based on the modeling information and results presented in this report, IP Augusta requests that the Georgia DNR review this modeling submittal for completeness and respond with a letter stating that the Augusta facility is exempt from any additional BART regulatory requirements.

Included with this report is a CD that includes the full set of CALPUFF inputs and output files as well as other post-processor files used to generate the results. As indicated in the VISTAS common protocol, regional CALPUFF-ready meteorological files are not being supplied. The modeling information being supplied should be sufficient to allow an independent modeler to fully corroborate the CALPUFF modeling results.

Table 7-1
BART Exemption Modeling Results
for Eight Class I Areas
IP Augusta Mill

Class I Area	2001	2002	2003
	Delta-Deciview Rank 1-8	**Delta-Deciview Rank 1-8**	**Delta-Deciview Rank 1-8**
Cohutta	0.145	0.203	0.323
	0.136	0.199	0.191
	0.125	0.198	0.168
	0.116	0.169	0.161
	0.111	0.129	0.157
	0.110	0.127	0.153
	0.089	0.118	0.114
	0.088	0.111	**0.114**
Cape Romain	0.435	0.333	0.369
	0.337	0.306	0.311
	0.276	0.278	0.268
	0.241	0.263	0.246
	0.229	0.250	0.242
	0.222	0.242	0.227
	0.178	0.224	0.220
	0.177	0.198	**0.211**
Great Smoky	0.178	0.364	0.214
	0.158	0.160	0.176
	0.113	0.151	0.176
	0.092	0.131	0.137
	0.084	0.092	0.114
	0.079	0.090	0.108
	0.074	0.087	0.094
	0.072	0.085	**0.093**
Joyce Kilmer	0.128	0.321	0.242
	0.095	0.134	0.124
	0.090	0.094	0.118
	0.088	0.090	0.111
	0.082	0.088	0.107
	0.079	0.086	0.093
	0.073	0.084	0.086
	0.069	0.075	**0.086**

Table 7-1, continued
BART Exemption Modeling Results
for Eight Class I Areas
IP Augusta Mill

Class I Area	2001 Delta-Deciview Rank 1-8	2002 Delta-Deciview Rank 1-8	2003 Delta-Deciview Rank 1-8
Linville Gorge	0.237	0.338	0.216
	0.232	0.134	0.157
	0.223	0.123	0.136
	0.220	0.119	0.125
	0.171	0.118	0.122
	0.157	0.101	0.110
	0.145	0.100	0.101
	0.103	0.094	0.098
Okefenokee	0.264	0.335	0.257
	0.204	0.319	0.221
	0.165	0.268	0.198
	0.155	0.254	0.161
	0.125	0.197	0.158
	0.125	0.164	0.151
	0.113	0.160	0.140
	0.107	**0.157**	0.129
Shining Rock	0.257	0.384	0.270
	0.165	0.190	0.192
	0.154	0.185	0.172
	0.130	0.168	0.157
	0.118	0.152	0.137
	0.110	0.128	0.136
	0.107	0.124	0.128
	0.091	0.107	**0.127**
Wolf Island	0.325	0.241	0.324
	0.269	0.177	0.314
	0.197	0.175	0.299
	0.135	0.172	0.141
	0.128	0.168	0.139
	0.120	0.168	0.138
	0.104	0.157	0.124
	0.095	**0.148**	0.121

Table 7-2
Summary of BART Exemption Modeling Results
Three-Year Approach
IP Augusta Mill

Class I Area	Distance (km) From Source to Class I Area Boundary	No. of days with impact >0.5 dv in Class I Area: 2001	No. of days with impact >0.5 dv in Class I Area: 2002	No. of days with impact >0.5 dv in Class I Area: 2003	No. of days with impact > 1.0 dv in Class I Area for 3-yr Period	Max. 24-hr impact over 3-yr period 22nd Highest
Cohutta	294	0	0	0	0	0.110
Cape Romain	219	0	0	0	0	0.198
Great Smoky Mt	268	0	0	0	0	0.085
Joyce Kilmer	289	0	0	0	0	0.075
Linville Gorge	275	0	0	0	0	0.100
Okefenokee	254	0	0	0	0	0.129
Shining Rock	236	0	0	0	0	0.118
Wolf Island	226	0	0	0	0	0.128

8.0 REFERENCES

VISTAS, 2006. Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), December 22, 2005, Revision 3 – 7/17/06

CDPHE, 2005. CALMET/CALPUFF BART Protocol for Class I Federal Area Individual Source Attribution Visibility Impairment Modeling Analysis, prepared by the Air Pollution Control Division, Colorado Department of Public Health and Environment, Denver, CO.

Earth Tech, Inc., 2002. "Application of CALMET/CALPUFF and MESOPUFF II to Compare Regulatory Design Concentrations for a Typical Long-Range Transport Analysis", prepared for U.S. EPA, prepared by Earth Tech, Inc, Concord, MA.

EPA, 1995. "Interagency Workgroup on Air Quality Modeling (IWAQM): Assessment of Phase 1 Recommendations Regarding the Use of MESOPUFF II", EPA- 54/R-95-006. Office of Air Quality Planning and Standards, U.S Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA, 1998b. "An Analysis of the CALMET/CALPUFF Modeling System in a Screening Mode." EPA-454/R-98-010. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA, 1998c. "A Comparison of CALPUFF with ISC3." EPA-454/R-98-020. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA, 1998d. Phase 2 Summary Report and Recommendations for Modeling Long Range Transport and Impacts. Interagency Workgroup on Air Quality Modeling (IWAQM). EPA454/R-98-019, U.S. Environmental Protection Agency, RTP, NC.

EPA. 1998e. "Response to Peer Review Comments of CALMET/CALPUFF Modeling System." Research Triangle Park, NC. November.

EPA. 1999. "Response to Peer Review Comments of the Interagency Workgroup on Air Quality Modeling Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts." Research Triangle Park, NC. February.

EPA. 1999. Regional Haze Regulations; Final Rule. *Federal Register,* 64, 357 13-35774.

EPA, 2003. Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule. EPA-454/B-03-005. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 2005. *Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations.* Federal Register, 70 (128), Wednesday, July 6, 2005.

Escoffier-Czaja, C., and J. Scire. 2002: The Effects of Ammonia Limitation on Nitrate Aerosol Formation and Visibility Impacts in Class I Areas. Paper J5.13, 12th AMS/A&WMA Conference on the Applications of Air Pollution Meteorology, Norfolk, VA. May 2002.

Escoffier-Czaja, C., and J. Scire. 2005: Comments on the Computation of Nitrate Using the Ammonia Limiting Method in CALPUFF", Earth Tech, Inc., Concord, MA.

Federal Register. 2003. 40 CFR Part 51. "Revisions to the Guidelines on Air Quality Models: Adoption of a Preferred Long Range Transport Model and Other Revisions; Final Rule. Federal Register/Vol. 68, No 72/Tuesday April 15, 2003.

FLAG 2000. "Federal Land Managers' Air Quality Related Values Workgroup (FLAG)": Phase I Report. USDI – National Park Service, Air Resources Division, Denver, CO.

Garrison, M., A. Gray, S.T. Rao, M. Scruggs, 1999. "Peer Review of the Interagency Workgroup On Air Quality Modeling Phase 2 Summary Report and Recommendations For Modeling Long Range Transport Impacts", report compiled by: John S. Irwin Air Policy Support Branch, Atmospheric Sciences Modeling Division U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

Irwin, J.S., 1998b. "Interagency Workgroup on Air Quality Modeling (IWAQM): Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts." EPA-454/R-98-019, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 151 pp. (NTIS Accession Number PB 99-121089).

Irwin, J.S. and J.P. Notar. 2001. Long-range-transport screening technique using CALPUFF. Proceedings of Guideline on Air Quality Modeling: A New Beginning AW&MA Specialty Conference. April 4-6, 2001, Newport, RI.

Grell, G.A., J. Dudhia, and D.R. Stauffer, 1995: A Description of the Fifth Generation Penn State/NCAR MM5, NCAR TN-398-STR, NCAR Technical Note.

IWAQM. 1998. Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long-Range Transport and Impacts on Regional Visibility. EPA-454/R-98-019. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Part, NC.

Tonnesen G.S., R.E. Morris, M. Uhl, K. Briggs, J. Vimont and T. Moore. 2003. "The WRAP Regional Modeling Center – Application and Evaluation of Regional Visibility Models" presented at 96th Annual Conference and Exhibition of the Air and Waste Management Association, San Diego, California.

Tombach, I., 2004. "Options for Estimating Natural Background Visibility in the VISTAS Region", prepared for the VISTAS Technical Analysis Work Group (TAWG), 15 January.

Tombach, I., and P. Brewer, 2005. Natural background visibility and regional haze goals in the Southeastern United States. *Journal of the Air & Waste Management Association.* (in press).

Tombach, I., P. Brewer, T. Rogers, and C. Arrington, 2005a. "BART modeling protocol for VISTAS: First Draft", 22 March.

Tombach, I., P. Brewer, T. Rogers, C. Arrington, J. Scire 2005b. "Protocol for the application of the CALPUFF model for analyses of Best Available Retrofit Technology (BART): VISTAS second draft", 22 August.

Scire, J., I. Tombach, et al. 2005. Protocol for the application of the CALPUFF model for analyses of Best Available Retrofit Technology (BART): (VISTAS third draft), Prepared for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS), Prepared by Earth Tech, Inc., VISTAS Technical Analysis Work Group (TAWG), the Florida Department of Environmental Protection, and the West Virginia Department of Environmental Protection.

Scire, J.S., D.G. Strimaitis, and R.J. Yamartino, 2000a: A User's Guide for the CALPUFF Dispersion Model (Version 5). Earth Tech, Inc., Concord, MA.

Scire, J.S., F.R. Robe, M.E. Fernau, and R.J. Yamartino, 2000b: A User's Guide for the CALMET Meteorological Model (Version 5). Earth Tech, Inc., Concord, MA.

Scire, J.S., Z-X Wu, D.G. Strimaitis and G.E. Moore, 2001: The Southwest Wyoming Regional CALPUFF Air Quality Modeling Study – Volume I. Prepared for the Wyoming Dept of Environmental Quality. Available from Earth Tech, Inc., 196 Baker Avenue, Concord, MA.

McNally, D. E., 2003. "Annual Application of MM5 for Calendar Year 2001." Prepared for the U.S. EPA, Office of Air Quality Planning and Standards, Prepared by Alpine Geophysics, LLC, Arvada, CO. 178 pp.

McNally, D. E., and T. W. Tesche, 2002. "Annual Meteorological Modeling Protocol: Annual Application of the MM5 to the Continental United States", prepared for the EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC.

Ryan, P., D. Lowenthal and N. Kumar, 2004: Light Extinction Reconstruction in IMPROVE. Presented at the A&WMA Specialty Conference on Regional and Global Perspectives in Haze: Causes, Consequences and Controversies, Asheville, NC, 26-29 October 2004.

Johnson, M. T., 2003b. *Iowa DNR 2002 Annual MM5 Modeling Project.* Presented at the August 11th, 2003 CENRAP Workgroup Meeting in Bloomington, Minnesota.

Johnson, M. T., 2005. CALPUFF Modeling Protocol in Support of Best Available Retrofit Technology Determinations", Prepared by the Iowa Department of Natural Resources, Air Quality Bureau, Des Moines, IA.

LADCo, 2005. "Single Source Modeling to Support Regional Haze BART: Version 3", Prepared by the Lake Michigan Air Directors Consortium (LADCO), Des Plaines, IL.

Levy, J., J. Spengler, D, Hlinka, D. Sullivan, and D. Moon, 2002. Using CALPUFF to evaluate the impacts of power plant emissions in Illinois: model sensitivity and implications. *Atmospheric Environment.* 36 (6). 1063-1075.

Morris, R., C. Tana, and G. Yarwood, 2003. "Evaluation of the Sulfate and Nitrate Formation Mechanism in the CALPUFF Modeling System", *Proceedings of the A&WMA Specialty Conference --Guideline on Air Quality Models: The Path Forward.* Mystic, CT. 22-24 October.

Morris, R.E., B. Koo, T.W. Tesche, C. Loomis, G. Stella, G. Tonnesen, and Z. Wang. 2004a. Modeling protocol for the VISTAS Phase II regional haze modeling. (http://pah.cert.ucr.edu/vistas/vistas2/)

MPCA, 2005. "Best Available Retrofit Technology (BART) Modeling Protocol to Determine Sources Subject to BART in the State of Minnesota", prepared by the Minnesota Pollution Control Agency, St. Paul, MN.

NDDH, 2005, "Protocol for BART-Related Visibility Impairment Modeling Analyses in North Dakota", prepared by the North Dakota Department of Health, Division of Air Quality, Bismarck, ND.

NPS, 1993. "Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 1 Report: Interim Recommendation for Modeling Long Range Transport And Impacts On Regional Visibility", EPA-454/R-93-015, U.S. Environmental Protection Agency, Technical Support Division, Research Triangle Park, NC.

Scire, J.S. and F.R. Robe, 1997: Fine-Scale Application of the CALMET Meteorological Model to a Complex Terrain Site. Paper 97-A1313. Air & Waste Management Association 90th Annual Meeting & Exhibition, Toronto, Ontario, Canada. 8-13 June 1997.

Scire, J.S., F.W. Lurmann, A. Bass and S.R. Hanna, 1983: Development of the MESOPUFF II Dispersion Model. EPA-600/3-84-057, U.S. Environmental Protection Agency, Research Triangle Park, NC.

APPENDIX A – Emission Rates and Supporting Information

International Paper-Augusta Mill Emission Unit BART Eligibility Determination

EMISSION UNIT ID	EMISSION UNIT DESCRIPTION	BART ELIGIBLE & Modeled	Started Operation Between 8/7/1962 and 8/7/1977	Comments
~~DIG1~~	~~No. 1 Digester~~			Removed from Service under permit 2361-245-0006-V-02-0
DIG2	No. 2 Digester			NSPS/PSD Rebuild 1989
DIG3	No. 3 Digester			
~~BSW1~~	~~No. 1 Pulp washer & screens~~			Removed from Service under permit 2361-245-0006-V-02-0
BSW2	No. 2 Pulp washer & screens		X	Does Not emit SO2, NOx, H2SO4 mist, or PM-10
BSW3	No. 3 Pulp washer & screens			
BP1A	No. 1 Bleach Plant			
BP2A	No. 2 Bleach Plant			Reconstructed 1998 for ECF
BP3A	No. 3 Bleach Plant			
PM1A	No. 1 Paper Machine			
PM2A	No. 2 Paper Machine	X	X	Modeled
PM3A	No. 3 Paper Machine			PSD Rebuild 1990
EV1A	No. 1 Evaporator Set			
EV2A	No. 2 Evaporator Set		X	Does Not emit SO2, NOx, H2SO4 mist, or PM-10
EV3A	No. 3 Evaporator Set			
RB2A	No. 2 Recovery Boiler	X	X	Modeled
RB3A	No. 3 Recovery Boiler			
ST2A	No. 2 Smelt Dissolving Tnk	X	X	Modeled
ST3A	No. 3 Smelt Dissolving Tnk			
LK1A	No. 1 Lime Kiln			
LK2A	No. 2 Lime Kiln			
LS1A	No. 1 Lime Silo			
LS3A	No. 3 Lime Silo			
CAU1	No. 1 Slaker/Causticizers	X	X	Modeled
CAU2	No. 2 Slaker/Causticizers			
GLC2	No. 2 GL Clarifier		X	Does Not emit SO2, NOx, H2SO4 mist, or PM-10
GLC3	No. 3 GL Clarifier			
PCF1	No. 1 Precoat Mud Filters			
PCF2	No. 2 Precoat Mud Filters			
WLF1	No. 1 WL & Mud Filters			
WLF2	No. 2 WL & Mud Filters			
PB1A	No. 1 Power Boiler			
PB2A	No. 2 Power Boiler	X	X	Modeled
PB3A	No. 3 Power Boiler			
RLYA	Package Boiler		X	Exemption <250 mmBTU/hr;Limited Intermittent Use Boiler
SB2A	No. 1 Starch Bin Vent			
SB3A	No. 3 Starch Bin Vent			
~~SS1A~~	~~No. 1 Starch Silo~~			Removed from Service under permit 2361-245-0006-V-02-0
SS2A	No. 2 Starch Silo			
SS3A	No. 3 Starch Silo			
BMPS	BMP Spill Collection Sys.			BMP system was installed with Cluster rule
R8AA	ClO2 Generator			
PPCC	Condensate Collection Sys			Condensate Collection was installed for cluster rule
NCGS	NCG System			NCG System was installed with GA Odor rules
~~BLP1~~	~~No. 1 Black Liquor Pond~~		X	Removed from Service under permit 2361-245-0006-V-01-5
~~BLP2~~	~~No. 2 Black Liquor Pond~~			To be removed from Service under permit 2361-245-0006-V-01-5
2ABF	No.2 A/B Filtrate Tank		X	Does Not emit SO2, NOx, H2SO4 mist, or PM-10; vent to be collected under permit 2631-245-0006-V-01-5
HLRD	Haul Roads			
WWTP	Wastetreatment Facilities			
WOOD	Wood, Bark, Log Handling			

(1) Emission Units included in 2006 Air Quality Permit Renewal Application, Except Liquid Storage
Strike-thru units are shutdown or soon-to-be shutdown, previously considered on BART eligibility analyses.

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
POINT SOURCE STACK PARAMETERS
URS PROJECT NO. 31825278

Emission Source ID[1]	Source Description	Type	UTM System Coordinates X meters	UTM System Coordinates Y meters	Base Elevation meters	Stack Height meters	Horiz Dimension meters	Vert Dimension meters	Temp K	Velocity m/sec	Stack Diameter meters	Stack Flow ACFM
PM2A	No. 2 Paper Machine	V	411142.09	3688250.00	50.5	19.5	14.8	9.1	--	--	--	--
PB2A	No. 2 Power Boiler	P	411316.00	3688176.25	50.5	60.96	--	--	518.7	20.6	2.74	257,340
RB2A	No. 2 Recovery Boiler	P	411375.41	3688129.25	50.5	60.96	--	--	430.93	21.8	2.44	215,698
ST2A	No. 2 Smelt Dissolving Tnk	P	411313.84	3688110.25	50.5	39.40	--	--	336.7	17.8	1.05	32,854

Note - although the Riley package boiler falls within the operational time frame for BART eligible units, it was not modeled as it is a backup boiler <250 MMBtu/hr (not integral to the process).

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
MODELED SO2 EMISSION RATES

Emission Source ID	Source Description	Type	Emission Factor	Units	Throughput	Units	SO_2 Emission Rate (lb/hr)	SO_2 Emission Rate (lb/day)	SO_2 Emission Rate (g/sec)
PM2A	No. 2 Paper Machine [1]	V	5.88E-04	lb/MMBtu	28	MMBtu/hr	0.02	0.4	0.00
PB2A	No. 2 Power Boiler Coal Firing [2]	P	1.32	lb/MMBtu	520	MMBtu/hr	687.52	16,500.58	86.63
RB2A	No. 2 Recovery Boiler [3]	P	2.29	lb/TBLS	36.5	TBLS/hr	83.5	2005.1	10.527
ST2A	No. 2 Smelt Tank [4]	P	0.005	lb/TBLS	36.5	TBLS/hr	0.2	4	0.02

1. No. 2 Paper Machine emission rate based on maximum natural gas usage from the No. 2 PM Nos. 1 and 2 IR and Aircap coaters and the SO2 emission factor from AP-42, Section 1.4-2 dated 7/98, and assumes a heating value of 1020 Btu/SCF.
2. No. 2 Power Boiler worst case actual emissions are based on the historical max coal rate with a balance of natural gas to total the unit's maximum firing rate.
Coal emission factor is based on a sulfur content of 0.86%. No SO2 from natural gas. SO2 from NCG burning is not included as this is a back-up unit for NCG control.
3. No. 2 Recovery Boiler emissions are based on black liquor solids firing (i.e., does not include auxilary fuel firing). Emission factor is from TB 884, dated 8/04, Table 4-11.
4. No. 2 Smelt Tank emission factor is from TB 884, dated 8/04, Table 4-15.

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
MODELED H2SO4 EMISSION RATES

Emission Source ID	Source Description	Type	Emission Factor	Units	Throughput	Units	H_2SO_4 Emission Rate (lb/hr)	H_2SO_4 Emission Rate (lb/day)	H_2SO_4 Emission Rate (g/sec)
PB2A	No. 2 Power Boiler Coal Firing [1]	P	1.98E-02	lb/MMBtu	520	MMBtu/hr	10.32	247.68	1.30
RB2A	No. 2 Recovery Boiler [2]	P	0.008	lb/TBLS	36.5	TBLS/hr	0.3	7	0.04

1. No. 2 Power Boiler based on maximum historical coal firing rate. Emission factor from NCASI SARA Section Form R Reporting and EPA SARA Guidance document EPA-745-R-97-007, dated 4/05.
2. No. 2 Recovery Boiler emissions are based on max black liquor solids firing (i.e., does not include auxilary fuel firing). Emission factor is from TB 858, dated 2/03, Table 13a.

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
MODELED NOx EMISSION RATES

Emission Source ID	Source Description	Type	Emission Factor	Units	Throughput	Units	NOx Emission Rate (lb/hr)	NOx Emission Rate (lb/day)	NOx Emission Rate (g/sec)
PM2A	No. 2 Paper Machine [1]	V	0.033	lb/MMBtu	28	MMBtu/hr	1	22	0.12
PB2A	No. 2 Power Boiler Coal Firing - coal[2]	P	0.45	lb/MMBtu	520	MMBtu/hr	234.52	5,628.48	29.55
PB2A	No. 2 Power Boiler Coal Firing - NG[2]	P	0.19	lb/MMBtu	157	MMBtu/hr	29.20	700.85	3.68
PB2A	No. 2 Power Boiler Coal Firing - total	P					263.72	6,329.33	33.23
RB2A	No. 2 Recovery Boiler [3]	P	1.09	lb/TBLS	36.5	TBLS/hr	39.77	954	5.01
ST2A	No. 2 Smelt Dissolving Tank[4]	P	0.02	lb/TBLS	36.5	TBLS/hr	0.7	18	0.09

1. No. 2 Paper Machine emission rate based on natural gas usage from the Nos. 1 and 2 IR and Aircap coaters. The emission factor is from AP-42, dated 7/98, Section 1.4-2 and assumes a heating value of 1020 Btu/SCF.
2. No. 2 Power Boiler worst case emissions are based on max historical coal firing rate with a balance of natural gas to total the unit's maximum firing rate (677 MMBtu/hr). Coal emission factor average NOx factor from EPA Database of Wall-fired, Dry Bottom Coal Boilers. The natural gas emission factor is from AP-42, dated 7/98, Section 1.4-2 assuming a heating value of 1020 Btu/SCF.
3. No. 2 Recovery Boiler emissions are based on max black liquor solids firing only (i.e., does not include auxilary fuel firing). Emission factor is from TB 884, Table 4.11.
4. The emission factor for the No. 2 Smelt Tank is taken from NCASI TB 884, Table 4.15, median emission factor.

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
MODELED PM EMISSION RATES

													Filterable PM			
									PM10		PM2.5		Coarse			
Source ID	**Source Description**	**Ref**	**Filterable Emission Factor (lb/unit)**	**Filterable Emission Factor Units**	**Condensible Emission Factor (lb/unit)**	**Condensible Emission Factor Units**	**Short Term Activity Factor**	**Short Term Activity Factor Units**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**
													6.0-10.0 µm		2.5-6.0 µm	
CAU1	No. 1 Slaker/Causticizer	1	0.022	lb/TCaO	--	--	11	TCaO/hr	0.25	3.11E-02	0.23	2.89E-02	0.04	5.18E-03	0.04	5.18E-03
PB2A	No. 2 Power Boiler Coal Firing	2	0.715	lb/MMBtu	0.056	lb/MMBtu	520	MMBtu/hr	284.67	3.59E+01	204.48	2.58E+01	33.46	4.22E+00	40.90	5.15E+00
PM2A	No. 2 Paper Machine	3	0.002	lb/MMBtu	0.006	lb/MMBtu	28	MMBtu/hr	0.21	2.66E-02	0.21	2.66E-02	--	--	--	--
RB2A	No. 2 Recovery Furnace	4	3.78	lb/hr	2.376	lb/hr	1	unitless	4.73	5.96E-01	3.31	4.17E-01	0.33	4.10E-02	0.54	6.86E-02
ST2A	No. 2 Smelt Tank	5	3.13	lb/hr	0.595	lb/hr	1	unitless	3.33	4.20E-01	3.03	3.82E-01	0.03	4.34E-03	0.22	2.80E-02

Example Calculations

PM10 Emission Rate (lb/hr) = (Filterable Emission Factor (lb/unit) + Condensible Emission Factor (lb/unit)) * Short Term Activity Factor (units/hr) * PM Size Fraction
PM2.5 Emission Rate (lb/hr) = (Filterable Emission Factor (lb/unit) + Condensible Emission Factor (lb/unit)) * Short Term Activity Factor (units/hr) * PM Size Fraction
Filterable Coarse PM Emission Rate (lb/hr) = Filterable Emission Factor (lb/unit) * Short Term Activity Factor (units/hr) * PM Size Fraction
Filterable Soil PM Emission Rate (lb/hr) = Filterable Emission Factor (lb/unit) * Short Term Activity Factor (units/hr) * (1 - PEC (%)) * PM Size Fraction
Filterable Elemental Carbon PM Emission Rate (lb/hr) = Filterable Emission Factor (lb/unit) * Short Term Activity Factor (units/hr) * PEC (%) * PM Size Fraction
Organic Condensible PM Emission Rate (lb/hr) = Condensible Emission Factor (lb/unit) * Short Term Activity Factor (units/hr) * Organic PM (%)
Inorganic Condensible PM Emission Rate (lb/hr) = Condensible Emission Factor (lb/unit) * Short Term Activity Factor (units/hr) * Inorganic PM (%)

References

1. Filterable PM rate from No. 1 Slaker/Causticizer is based on No. 1 Lime Kiln production and slaker vent emission factor from TB 884, Table 4.14; no condensible PM. PM10 assumed to equal PM.
   Filterable PM10 and 2.5 size fraction data based on Lime Kiln fraction from TB 884, Table 4.13. No other filterable PM size fraction data available. Filterable PM divided equally among size categories.
2. Filterable PM rate from No. 2 Power Boiler based on maximum historical coal firing rate, balance natural gas. Emission factor from GA 391-3-1.02(2)(d)2(ii). (PM=0.7*(10/R)^0.202 lb/MMBtu)
   Condensible PM based on AP-42 Section 1.1, Table 1.1-5, CPM = 0.1S-0.03 lb/MMBtu, assume 0.86% sulfur in coal. Contribution of PM from natural gas assumed negligible.
   Filterable PM size fraction data from AP-42 Section 1.1, Table 1.1-6, scrubber controlled.
3. Filterable and condensible PM rates from No. 2 Paper Machine are based on AP-42 Table 1.4-2 and natural gas usage by the aircap and IR dryers.
   Per AP-42 Section 1.4, all PM is assumed to be less than 1.0 micrometer in diameter. PM divided evenly between sizes 1 micrometer and below.
4. Filterable PM rate from actual MACT II stack testing results (lb/hr). Condensible PM portion extrapolated from data in TB 884, Table 4.11.
   PM10 size fraction data only from TB 884, Table 4.11. All other fraction data from AP-42 Section 10.2, Table 10.2-2 (ND for PM10).
5. Filterable PM rate from No. 2 Smelt Dissolving Tank is Permit Condition 3.3.37. Condensible PM is assumed to be 19% of filterable per TB 884, Table 4.15.
   Filterable PM size fraction data from AP-42 Section 10.2, Table 10.2-7.
6. Filterable and condensible PM rates from AP-42 Section 1.3, Tables 1.3-1 and 1.3-2, respectively.
   Filterable PM size fraction data from AP-42 Section 1.3, Table 1.3-6.
7. No data for Condensible PM0.625 and PM1.0 fractions. Condensible PM is divided between the two fractions.

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
MODELED PM EMISSION RATES

	Filterable PM																Condensible PM[7]							
	Soil								Elemental Carbon								Organic				Inorganic			
Source ID	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**
	1.25-2.5 µm		1.0-1.25 µm		0.625-1.0 µm		0.5-0.625 µm		1.25-2.5 µm		1.0-1.25 µm		0.625-1.0 µm		0.5-0.625 µm		0.625-1.0 µm		0.5-0.625 µm		0.625-1.0 µm		0.5-0.625 µm	
CAU1	0.04	5.04E-03	0.04	5.04E-03	0.04	5.04E-03	0.04	5.04E-03	0.001	1.36E-04	0.001	1.36E-04	0.001	1.36E-04	0.001	1.36E-04	--	--	--	--	--	--	--	--
PB2A	58.90	7.42E+00	14.72	1.86E+00	40.49	5.10E+00	73.62	9.28E+00	0.59	7.50E-02	0.15	1.87E-02	0.41	5.15E-02	0.74	9.37E-02	7.98	1.01E+00	7.98	1.01E+00	6.58	8.29E-01	6.58	8.29E-01
PM2A	--	--	--	--	0.03	3.32E-03	0.03	3.32E-03	--	--	--	--	--	--	--	--	0.06	7.43E-03	0.06	7.43E-03	0.02	2.54E-03	0.02	2.54E-03
RB2A	0.50	6.24E-02	0.23	2.95E-02	0.45	5.63E-02	0.83	1.04E-01	0.008	9.69E-04	0.004	4.59E-04	0.007	8.74E-04	0.013	1.62E-03	0.12	1.53E-02	0.12	1.53E-02	1.07	1.34E-01	1.07	1.34E-01
ST2A	0.55	6.91E-02	0.27	3.42E-02	0.49	6.21E-02	1.19	1.50E-01	0.01	1.07E-03	0.004	5.31E-04	0.008	9.65E-04	0.019	2.34E-03	0.030	3.83E-03	0.030	3.83E-03	0.27	3.36E-02	0.27	3.36E-02

		TOTAL COARSE		TOTAL SOIL		TOTAL EC		TOTAL CONDENSIBLE	
Source ID	Source Description	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**	**Emission Rate (lb/hr)**	**Emission Rate (g/s)**
CAU1	No. 1 Slaker/Causticizer	8.22E-02	1.04E-02	1.60E-01	2.02E-02	4.32E-03	5.45E-04	--	--
PB2A	No. 2 Power Boiler Coal Firing	7.44E+01	9.37E+00	1.88E+02	2.37E+01	1.90E+00	2.39E-01	2.91E+01	3.67E+00
PM2A	No. 2 Paper Machine	--	--	5.27E-02	6.65E-03	--	--	1.58E-01	1.99E-02
RB2A	No. 2 Recovery Furnace	8.69E-01	1.10E-01	2.00E+00	2.52E-01	3.11E-02	3.92E-03	2.38E+00	2.99E-01
ST2A	No. 2 Smelt Tank	2.57E-01	3.23E-02	2.51E+00	3.16E-01	3.89E-02	4.91E-03	5.95E-01	7.49E-02

INTERNATIONAL PAPER - AUGUSTA MILL
BART ELIGIBLE EMISSION UNITS
MODELED PM EMISSION RATES

PM size fraction data from CMAQ

Source/SCC	Profile Name/Number	Category	%	% Organic	% Inorganic
Power Boiler - Coal	NCOAL PM2_5	PEC	1.00%	54.79%	45.21%
	NCOAL PM2_5	PMFINE	62.50%		
10200202	NCOAL PM2_5	PNO3	0.50%		
	NCOAL PM2_5	POA	20.00%		
	NCOAL PM2_5	PSO4	16.00%		
Recovery Furnace	22044 PM2_5	PEC	1.53%	10.21%	89.79%
& Smelt Tank	22044 PM2_5	PMFINE	36.99%		
30700110	22044 PM2_5	PNO3	0.35%		
30700105	22044 PM2_5	POA	6.28%		
	22044 PM2_5	PSO4	54.85%		
Package Boiler	22003 PM2_5	PEC	7.70%	10.59%	89.41%
Distillate oil	22003 PM2_5	PMFINE	56.05%		
10200501	22003 PM2_5	PNO3	0.24%		
	22003 PM2_5	POA	3.84%		
	22003 PM2_5	PSO4	32.17%		
Causticizing	22045 PM2_5	PEC	2.63%	63.21%	36.79%
30700122	22045 PM2_5	PMFINE	40.91%		
	22045 PM2_5	PNO3	0.37%		
	22045 PM2_5	POA	35.69%		
	22045 PM2_5	PSO4	20.40%		
Natural Gas Process Hea	22004 PM2_5	PEC	0.00%	74.49%	25.51%
30790003	22004 PM2_5	PMFINE	19.45%		
	22004 PM2_5	PNO3	0.55%		
	22004 PM2_5	POA	60.00%		
	22004 PM2_5	PSO4	20.00%		

APPENDIX B - CALPUFF Configuration

The tables below identify the recommended CALPUFF configurations for VISTAS BART modeling. Also identified are the default recommendations from the IWAQM Phase 2 Report (EPA, 1998).

Input Groups in the CALPUFF Control File.

Input Group	Description	Applicable to BART Modeling
0	Input and output file names	Yes
1	General run control parameters	Yes
2	Technical options	Yes
3	Species list	Yes
4	Grid control parameters	Yes
5	Output options	Yes
6	Sub grid scale complex terrain inputs	No
7	Dry deposition parameters for gases	Yes
8	Dry deposition parameters for particles	Yes
9	Miscellaneous dry deposition for parameters	Yes
10	Wet deposition parameters	Yes
11	Chemistry parameters	Yes
12	Diffusion and computational parameters	Yes
13	Point source parameters	Yes
14	Area source parameters	No
15	Line source parameters	No
16	Volume source parameters	Yes
17	Discrete receptor information	Yes

CALPUFF Model Input Group 1: General Run Control Parameters

Parameter	Default	IP	Comments
METRUN	0	0	All model periods in met file(s) will be run
IBYR	-	2001	Starting year
IBMO	-	1	Starting month
IBDY	-	1	Starting day
IBHR	-	1	Starting hour
XBTZ	-	5	Base time zone (6 = CST)
IRLG	-	8760	Length of run
NSPEC	5	6	Number of MESOPUFF I I chemical species
NSE	3	4	Number of chemical species to be emitted
ITEST	2	2	Program is executed after SETUP phase
MRESTART	0	0	Do not read or write a restart file during run
NRESPD	0	0	File written only at last period
METFM	1	1	CALMET binary file (CALMET.MET)
AVET	60	60	Averaging time in minutes
PGTIME	60	60	PG Averaging time in minutes

CALPUFF Model Input Group 2: Technical Options

Parameter	Default	IP	Comments
MGAUSS	1	1	Gaussian distribution used in near field
MCTADJ	3	3	Partial plume path terrain adjustment
MCTSG	0	0	Sub-grid-scale complex terrain not modeled
MSLUG	0	0	Near-field puffs not modeled as elongated
MTRANS	1	1	Transitional plume rise modeled
MTIP	1	1	Stack tip downwash used
MSHEAR	0	0	(0, 1) Vertical wind shear (not modeled, modeled)
MSPLIT	0	0	Puffs are not split
MCHEM	1	1	MESOPUFF I I chemical parameterization Scheme
MAQCHEM	0	0	Aqueous phase transformation not modeled
MWET	1	1	Wet removal modeled
MDRY	1	1	Dry deposition modeled
MDISP	3	2	Dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological calculated variables

CALPUFF Model Input Group 2: Technical Options

MTURBVW	3	3	Use both σv and σw from PROFILE.DAT to compute σy and σz (n/a)
MDISP2	3	2	Dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological calculated variables
MROUGH	0	0	PG σy and σz not adjusted for roughness
MPARTL	1	1	No partial plume penetration of elevated inversion
MTINV	0	0	Strength of temperature inversion computed from default gradients
MPDF	0	1	PDF not used for dispersion under convective conditions
MSGTIBL	0	0	Sub-grid TIBL module not used for shoreline
MBCON	0	0	Boundary concentration conditions not modeled
MFOG	0	0	Do not configure for FOG model output
MREG	1	0	NO checks are made

CALPUFF Model Input Group 3: Species List-Chemistry Options.

CSPEC	Modeled[1]	Emitted[2]	Dry Deposition[3]	Output Group Number
SO_2	1	1	1	0
SO_4^{-2}	1	1	2	0
NOx	1	1	1	0
HNO_3	1	0	1	0
NO_3 -	1	0	2	0
NH_3	1	0	1	0
PMC	1	1	2	0
PMF	1	1	2	0
EC	1	1	2	0
SOA	1	1	2	0

Notes: 1 0=no, 1=yes
2 0=no, 1=yes
3 0=none; 1=computed-gas; 2=computed-particle; 3=user-specified

CALPUFF Model Input Group 4: Map Projection and Grid Control Parameters.

Parameter	Default	IP	Comments
PMAP	UTM	LCC	Map Projection
NX	-	160	Number of X grid cells in meteorological grid
NY	-	172	Number of Y grid cells in meteorological grid
NZ	-	10	Number of vertical layers in meteorological Grid
DGRIDKM	-	12	Grid spacing (km)
ZFACE	-	0, 20 40, 80, 160, 320, 640, 1200, 2000, 3000, 4000	Cell face heights in meteorological grid (m)
XORIGKM	-	137.973	Reference X coordinate for SW corner of grid cell (1,1) of meteorological grid (km)
YORIGKM	-	-1625.974	Reference Y coordinate for SW corner of grid cell (1,1) of meteorological grid (km)
IUTMZN	-	17	UTM zone of coordinates
IBCOMP	-		X index of lower left corner of the computational grid
JBCOMP	-		Y index of lower left corner of the computational grids
IECOMP	-		X index of the upper right corner of the computational grid
JECOMP	-		Y index of the upper right corner of the computational grid
LSAMP	T	F	Sampling grid is not used
IBSAMP	-	0	X index of lower left corner of the sampling Grid
JBSAMP	-	0	Y index of lower left corner of the sampling Grid
IESAMP	-	0	X index of upper right corner of the sampling grid
JESAMP	-	0	Y index of upper right corner of the sampling grid
MESHDN	1	1	Nesting factor of the sampling grid

CALPUFF Model Input Group 5: Output Options.

Parameter	Default	IP	Comments
ICON	1	1	Output file CONC.DAT containing concentrations is created
IDRY	1	1	Output file DFLX.DAT containing dry fluxes is Created
IWET	1	1	Output file WFLX.DAT containing wet fluxes is created
IVIS	1	1	Output file containing relative humidity data is created
LCOMPRS	T	T	Perform data compression in output file
IMFLX	0	0	Do not calculate mass fluxes across specific boundaries
IMBAL	0	0	Mass balances for each species not reported hourly
ICPRT	0	1	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 hr
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 g/m3 for concentration and g/m2/s for deposition
IMESG	2	2	Messages tracking the progress of run written to screen
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

CALPUFF Model Input Group 6: Sub-Grid Scale Complex Terrain Inputs.

Parameter	Default	IP	Comments
NHILL	0	0	Number of terrain features
NCTREC	0	0	Number of special complex terrain receptors
MHILL	-	2	Input terrain and receptor data for CTSG hills input in CTDM format
XHILL2M	1	1	Conversion factor for changing horizontal dimensions to meters
ZHILL2M	1	1	Conversion factor for changing vertical dimensions to meters
XCTDMKM	-	0.0 E+00	X origin of CTDM system relative to CALPUFF coordinate system (km)
YCTDMKM	-	0.0 E+00	Y origin of CTDM system relative to CALPUFF coordinate system (km)

CALPUFF Model Input Group 7: Dry Deposition Parameters for Gases.

Species	Default	IP	Comments
SO_2	0.1509	0.1509	Diffusivity
	1000.	1000.	Alpha star
	8.0	8.0	Reactivity
	0.0	0.0	Mesophyll resistance
	0.04	0.04	Henry's Law coefficient
NO_x	0.1656	0.1656	Diffusivity
	1.0	1.0	Alpha star
	8.0	8.0	Reactivity
	5.0	5.0	Mesophyll resistance
	3.5	3.5	Henry's Law coefficient
HNO_3	0.1628	0.1628	Diffusivity
	1.0	1.0	Alpha star
	18.0	18.0	Reactivity
	0.0	0.0	Mesophyll resistance
	8.0E-8	8.0E-8	Henry's Law coefficient
	0.000359	0.000359	Henry's Law coefficient

CALPUFF Model Input Group 8: Dry Deposition Parameters for Particles.

Species	Default	IP	Comments
SO_4	0.48	0.48	Geometric mass mean diameter of $SO4^{-2}$ [µm]
NO_3	2.0	0.48	Geometric mass mean diameter of $NO3^{-}$ [µm]
PMC	2.0	0.48	Geometric mass mean diameter of PMC [µm]
PMF	2.0	0.48	Geometric mass mean diameter of PMF [µm]
EC	2.0	0.48	Geometric mass mean diameter of EC [µm]
SOA	0.48	0.48	Geometric mass mean diameter of SOA [µm]

(Geometric Standard Deviation for all species assumed to be 2.0 µm).

CALPUFF Model Input Group 9: Miscellaneous Dry Deposition Parameters.

Parameter	Default	IP	Comments
RCUTR	30	30	Reference cuticle resistance (s/cm)
RGR	10	10	Reference ground resistance (s/cm)
REACTR	8	8	Reference pollutant reactivity
NINT	9	9	Number of particle size intervals for effective particle deposition velocity
IVEG	1	1	Vegetation in non-irrigated areas is active and unstressed

CALPUFF Model Input Group 10: Wet Deposition Parameters.

	Default	IP	Comments
SO_2	3.21E-05	3.21E-05	Scavenging coefficient for liquid precipitation [s^{-1}]
	0.0	0.0	Scavenging coefficient for frozen precipitation [s^{-1}]
SO_4	1.0E-04	1.0E-04	Scavenging coefficient for liquid precipitation [s^{-1}]
	3.0E-05	3.0E-05	Scavenging coefficient for frozen precipitation [s^{-1}]
HNO_3	6.0E-05	6.0E-05	Scavenging coefficient for liquid precipitation [s^{-1}]
	0.0	0.0	Scavenging coefficient for frozen precipitation [s^{-1}]
NO_3	1.0E-04	1.0E-04	Scavenging coefficient for liquid precipitation [s^{-1}]
	3.0E-05	3.0E-05	Scavenging coefficient for frozen precipitation [s^{-1}]
NH_3	8.0E-05	8.0E-05	Scavenging coefficient for liquid precipitation [s^{-1}]
	0.0	0.0	Scavenging coefficient for frozen precipitation [s^{-1}]
PMC	1.0E-04	1.0E-04	Scavenging coefficient for liquid precipitation [$^{s-1}$]
	3.0E-05	3.0E-05	Scavenging coefficient for frozen precipitation [s^{-1}]
PMF	1.0E-04	1.0E-04	Scavenging coefficient for liquid precipitation [$^{s-1}$]
	3.0E-05	3.0E-05	Scavenging coefficient for frozen precipitation [s^{-1}]
EC	1.0E-04	1.0E-04	Scavenging coefficient for liquid precipitation [$^{s-1}$]
	3.0E-05	3.0E-05	Scavenging coefficient for frozen precipitation [s^{-1}]
OC	1.0E-04	1.0E-04	Scavenging coefficient for liquid precipitation [$^{s-1}$]
	3.0E-05	3.0E-05	Scavenging coefficient for frozen precipitation [s^{-1}]

CALPUFF Model Input Group 11: Chemistry Parameters.

Parameter	Default	IP	Comments
MOZ	1	1	Read ozone background concentrations from ozone.dat file (measured values).
BCKO3	12*80	12*40	Background ozone concentration (ppb)
BCKNH3	12*10	12*0.5	Background ammonia concentration (ppb)
RNITE1	0.2	0.2	Nighttime NO_2 loss rate in percent/hour
RNITE2	2	2	Nighttime NOX loss rate in percent/hour
RNITE3	2	2	Nighttime HNO_3 loss rate in percent/hour
MH202	1	1	Background H2O2 concentrations (Aqueous phase transformations not modeled)
BCKH202	1	1	Background monthly H2O2 concentrations (Aqueous phase transformations not modeled)
BCKPMF	1.	1.	Fine particulate concentration for SOA Option (micrograms per cubic meter)
OFRAC	.2	.2	Organic fraction of fine particulate for SOA Option
VCNX	50.	50.	VOC/NOx ratio for SOA Option

CALPUFF Model Input Group 12: Dispersion/Computational Parameters.

Parameter	Default	IP	Comments
SYDEP	550	550	Horizontal size of a puff in meters beyond which the time dependant dispersion equation of Heffter (1965) 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/stable conditions

Parameter	Default	IP	Comments
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	*	Land use category for modeling domain
XLAIIN	3.0	*	Leaf area index for modeling domain
ZOIN	-0.25	*	Roughness length in meters for modeling domain
ELEVIN	0.0	*	Elevation above sea level
XLATIN	-999	-	North latitude of station in degrees
XLONIN	-999	-	South latitude of station in degrees
ANEMHT	10	10	Anemometer height in meters
ISIGMAV	1	1	Sigma-v is read for lateral turbulence data
IMIXCTDM	0	0	Predicted mixing heights are used
XMXLEN	1	1	Maximum length of emitted slug in meteorological grid units
XSAMLEN	1	10	Maximum travel distance of slug or puff in meteorological grid units during one sampling unit
MXNEW	99	60	Maximum number of puffs or slugs released from one source during one time step
MXSAM	99	60	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 transitional plume rise

Parameter	Default	IP	Comments
SYMIN	1	1	Minimum sigma y in meters for a new puff or slug
SZMIN	1	1	Minimum sigma z in meters for a new puff or slug
SVMIN	.50	.50	Minimum lateral turbulence velocities (m/s)
SWMIN	0.20, 0.12, 0.08, 0.06, 0.03, 0.016	0.20, 0.12, 0.08, 0.06, 0.03, 0.016	Minimum vertical turbulence velocities (m/s)
WSCALM	0.5	0.5	Minimum non-calm wind speeds (m/s)
XMAXZI	3000.	3000.	Maximum mixing height (m)
XMINZI	50.	20.	Minimum mixing height (m)
SL2PF	10.	10.	Maximum Sy/puff length
PLXO	0.07, 0.07, 0.10, 0.15, 0.35, 0.55	0.07, 0.07, 0.10, 0.15, 0.35, 0.55	Wind speed power-law exponents
WSCAT	1.54, 3.09, 5.14, 8.23, 10.80	1.54, 3.09, 5.14, 8.23, 10.80	Upper bounds 1st 5 wind speed classes
PGGO	0.020, 0.035	0.020, 0.035	Potential temp gradients PG E & F (deg/km)
CDIV	0.01	0.01	Divergence criterion for dw/dz (1/s)
PPC	0.5, 0.5, 0.5, 0.5, 0.35, 0.35	0.5, 0.5, 0.5, 0.5, 0.35, 0.35	Plume path coefficients (only if MCTADJ=3)
NSPLIT	3	3	Number of puffs when puffs split
IRESPLIT	-	1900	Hour(s) when puff is eligible to split
ZISPLIT	100	100	Previous hour's minimum mixing height, m
ROLDMAX	0.25	0.25	Previous Max mixing height/current mixing height ratio, must be less than this value to allow puff to split
NSPLITH	5	5	Number of puffs resulting from a split
SYSPLITH	1.0	1.0	Minimum sigma-y of puff before it may split

Parameter	Default	IP	Comments
SHSPLITH	2.0	2.0	Minimum puff elongation rate from wind shear before puff may split
CNSPLITH	1.0E-07	1.0E-07	Minimum species concentration before a puff may split
EPSSLUG	1.0E-04	1.0E-04	Criterion for SLUG sampling
EPSAREA	1.0E-06	1.0E-06	Criterion for area source integration
DSRISE	1.0	1.0	Trajectory step length for numerical rise algorithm
Note: Values indicated by an asterisk (*) were allowed to vary spatially across the domain and were obtained from CALMET			

CALPUFF Model Input Group 13: Point Source Parameters.

Parameter	Default	IP	Comments
NPT1	-	4	Number of point sources with constant stack parameters or variable emission rate scale factors
IPTU	1	3	Units for point source emission rates are g/s
NSPT1	0	0	Number of source-species combinations with variable emissions scaling factors
NPT2	-	0	Number of point sources with variable emission parameters provided in external file

CALPUFF Model Input Group 14: Area Source Parameters.

Parameter	Default	IP	Comments
NAR1		0	Number of polygon area sources
IARU	1	1	Units for area source emission rates are g/m2/s
NSAR1	0	-	Number of source species combinations with variable emissions scaling factors
NAR2	-	-	Number of buoyant polygon area sources with variable location and emission parameters

CALPUFF Model Input Group 15: Line Source Parameters.

Parameter	Default	IP	Comments
NLN2	-	-	Number of buoyant line sources with variable location and emission parameters
NLINES	-	-	Number of buoyant line sources
ILNU	1	-	Units for line source emission rates is g/s
NSLN1	0	-	Number of source-species combinations with variable emissions scaling factors
MXNSEG	7	-	Maximum number of segments used to model each line
NLRISE	6	-	Number of distance at which transitional rise is computed
XL	-	-	Average line source length (m)
HBL	-	-	Average height of line source height (m)
WBL	-	-	Average building width (m)
WML	-	-	Average line source width (m)
DXL	-	-	Average separation between buildings (m)
FPRIMEL	-	-	Average buoyancy parameter (m4/s3)

CALPUFF Model Input Group 16: Volume Source Parameters.

Parameter	Default	IP	Comments
NVL1	-	1	Number of volume sources
IVLU	1	-	Units for volume source emission rates is grams per second
NSVL1	0	-	Number of source-species combinations with variable emissions scaling factors
IGRDVL	-	-	Gridded volume source data is not used
VEFFHT	-	-	Effective height of emissions (m)
VSIGYI	-	-	Initial sigma y value (m)
VSIGZI	-	-	Initial sigma z value (m)

Table B-18. CALPUFF Model Input Group 17: Discrete Receptor Information.

Parameter	Default	IP	Comments
NREC	-	1927	Number of non-gridded receptors

APPENDIX C – CALPOST Configuration

The tables below identify the recommended CALPOST processor screening configurations for VISTAS BART modeling.

Input Groups in the CALPOST Processor Control File.

Group	Description	Applicable to BART Modeling
0	Input and output file names	Yes
1	General Run Control Parameters	Yes
2	Visibility Parameters	Yes
3	Output Options	Yes

CALPOST Processor Input Group 1: General Run Control Parameters

Parameter	DEFAULT	IP	Comments
ISYR	--	2001	Starting year
ISMO	--	1	Starting month
ISDY	--	1	Starting day
ISHR	--	0	Starting hour
NPER	--	8760	Number of periods to process
NREP	1	1	Process every hour of data? Yes = 1
ASPEC	--	VISIB	Process species for visibility
ILAYER	1	1	Layer/deposition code; 1 for CALPUFF concentrations
A	0.0	0.0	Scaling factor, slope
B	0.0	0.0	Scaling factor, intercept
LBACK	F	F	Add hourly background concentrations or fluxes?
LG	F	F	Process gridded receptors?
LD	F	T	Process discrete receptors?
LCT	F	F	Process complex terrain receptors?
LDRING	F	F	Report receptor ring results?
NDRECP	-1	-1	Select all discrete receptors
IBGRID	-1	-1	X index of LL corner of receptor grid
JBGRID	-1	-1	Y index of LL corner of receptor grid
IEGRID	-1	-1	X index of UR corner of receptor grid
JEGRID	-1	-1	X index of UR corner of receptor grid
NGONOFF	0	0	Number of gridded receptor rows
NGXRECP	1	0	Exclude specific gridded receptors, Yes = 0

CALPOST Processor Input Group 2: Species Processing Information

Parameter	Default	IP	Comments
RHMAX	98	95	Maximum RH (%) used in particle growth curve
LVSO4	T	T	Compute light extinction for sulfate?
LVNO3	T	T	Compute light extinction for nitrate?
LVOC	T	T	Compute light extinction for organic carbon?
LVMPC	T	T	Compute light extinction for coarse particles?
LVMPF	T	T	Compute light extinction for fine particles?
LVEC	T	T	Compute light extinction for elemental carbon?
LVBK	T	F	Include background in extinction calculation?
SPECPMC	PMC	PMC	Coarse particulate species
SPECPMF	PMF	PM10	Fine particulate species
EEPMC	0.6	0.6	Extinction efficiency for coarse particulates
EEPMF	1.0	1.0	Extinction efficiency for fine particulates
EEPMCBK	0.6	0.6	Extinction efficiency for coarse part. background
EESO4	3.0	3.0	Extinction efficiency for ammonium sulfate
EENO3	3.0	3.0	Extinction efficiency for ammonium nitrate
EEOC	4.0	4.0	Extinction efficiency for organic carbon
EESOIL	1.0	1.0	Extinction efficiency for soil
EEEC	10.0	10.0	Extinction efficiency for elemental carbon
MVISBK	2	6	Method 6 for background light extinction: Compute extinction from speciated PM measurements. FLAG RH adjustment factor applied to observed & modeled sulfate and nitrate
BEXTBTBK	--	10	Background extinction for MVISBK=1 (1/Mm)
RHFRAC	--	10	Percentage of particles affected by RH
RHFAC	12*value	Depends on Class I Area	Extinction coefficients for modeled and background hygroscopic species computed using EPA (2003) monthly RH adjustment factors
BKSEC	0.02	0.02	Background elem. carbon extinct. coeff – east
BKSO4	0.23	0.23	Background sulfate extinction coeff – east
BKNO3	0.10	0.10	Background nitrate extinction coeff – east
BKPMC	3.00	3.00	Background coarse part. extinction coeff – east
BKSOC	1.40	1.40	Background organic carbon extinct. coeff – east
BKSSOIL	0.50	0.50	Background soil extinction coeff – east
BKSEC	0.02	0.02	Background elem. carbon extinct. coeff – east
BEXTRAY	10.0	10.0	Extinction due to Rayleigh scattering (1/Mm)

CALPOST Processor Input Group 3: Output Options

Parameter	DEFAULT	IP	Comments
LDOC	F	F	Print documentation image?
IPRTU	1	3	Print output units (μg/m^3) for concentrations and (μg/m^2/sec) for deposition
L1HR	T	F	Report 1 hr averaging times
L3HR	T	F	Report 3 hr averaging times
L24HR	T	T	Report 24 hr averaging times
LRUNL	T	F	Report run-length (annual) averaging times
LT50	T	F	Top 50 table
LTOPN	F	F	Top 'N' table
NTOP	4	4	Number of 'Top-N' values at each receptor
ITOP	1,2,3,4	1,2,3,4	Ranks of 'Top-N' values at each receptor
LEXCD	F	F	Threshold exceedances counts
THRESH1	-1.0	-1.0	Averaging time threshold for 1 hr averages
THRESH3	-1.0	-1.0	Averaging time threshold for 3 hr averages
THRESH24	-1.0	-1.0	Averaging time threshold for 24 hr averages
THRESHN	-1.0	-1.0	Averaging time threshold for NAVG-hr averages
NDAY	0	0	Accumulation period, days
NCOUNT	1	1	Number of exceedances allowed
LECHO	F	F	Echo option
LTIME	F	F	Time series option
LPLT	F	F	Plot file option
LGRD	F	F	Use grid format instead of DATA format
LDEBUG	F	F	Output information for debugging?

APPENDIX D – Class I Receptors in Lambert Conformal Coordinates

Great Smoky Mountains								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1201.214	-417.246	521.0	1201.891	-411.546	1221.0	1192.429	-409.210	852.0
1204.191	-416.805	521.0	1203.378	-411.325	1030.0	1193.915	-408.991	978.0
1189.038	-417.173	521.0	1204.865	-411.105	983.0	1195.402	-408.772	809.0
1190.527	-416.954	522.0	1206.352	-410.883	894.0	1196.889	-408.553	761.0
1192.015	-416.736	523.0	1207.840	-410.662	675.0	1198.376	-408.333	987.0
1193.503	-416.517	521.0	1209.327	-410.440	950.0	1199.863	-408.113	874.0
1194.992	-416.298	538.0	1210.814	-410.219	915.0	1201.349	-407.893	1147.0
1196.480	-416.079	550.0	1212.301	-409.996	732.0	1202.836	-407.673	1323.0
1197.968	-415.859	640.0	1213.788	-409.774	980.0	1204.322	-407.452	1221.0
1199.456	-415.639	607.0	1216.762	-409.328	1020.0	1205.809	-407.231	1097.0
1200.944	-415.419	523.0	1218.249	-409.105	886.0	1207.296	-407.010	800.0
1202.432	-415.199	548.0	1219.736	-408.881	615.0	1208.782	-406.788	942.0
1203.920	-414.978	524.0	1221.222	-408.657	680.0	1210.268	-406.566	1167.0
1205.408	-414.757	608.0	1176.335	-413.427	767.0	1211.755	-406.344	1052.0
1208.384	-414.315	546.0	1177.823	-413.211	919.0	1213.241	-406.122	1012.0
1209.871	-414.093	566.0	1179.311	-412.995	905.0	1214.728	-405.899	1002.0
1211.359	-413.871	541.0	1180.798	-412.778	911.0	1216.214	-405.676	1143.0
1212.847	-413.649	530.0	1182.286	-412.561	965.0	1217.700	-405.453	998.0
1181.330	-416.432	683.0	1183.773	-412.344	837.0	1219.186	-405.230	710.0
1182.818	-416.216	711.0	1185.261	-412.127	1055.0	1220.672	-405.006	998.0
1184.307	-415.999	583.0	1186.748	-411.910	716.0	1222.158	-404.782	907.0
1185.795	-415.781	599.0	1188.235	-411.692	825.0	1223.644	-404.558	1200.0
1187.283	-415.564	561.0	1189.723	-411.474	609.0	1225.131	-404.333	1173.0
1188.771	-415.346	582.0	1191.210	-411.256	814.0	1226.616	-404.108	1067.0
1190.259	-415.128	703.0	1192.697	-411.037	1006.0	1228.102	-403.883	896.0
1191.747	-414.909	707.0	1194.184	-410.818	1036.0	1229.588	-403.658	799.0
1193.235	-414.690	522.0	1195.672	-410.599	732.0	1231.074	-403.432	683.0
1194.723	-414.471	760.0	1197.159	-410.379	746.0	1169.857	-410.632	330.0
1196.210	-414.252	846.0	1198.646	-410.160	929.0	1171.344	-410.418	523.0
1197.698	-414.033	952.0	1200.133	-409.940	1008.0	1172.831	-410.203	599.0
1199.186	-413.813	765.0	1201.620	-409.720	1288.0	1174.318	-409.988	769.0
1200.674	-413.593	1067.0	1203.107	-409.499	1266.0	1175.805	-409.772	831.0
1202.161	-413.372	915.0	1204.594	-409.278	1218.0	1177.292	-409.556	941.0
1203.649	-413.152	730.0	1206.081	-409.057	959.0	1178.779	-409.340	1150.0
1205.137	-412.931	822.0	1207.568	-408.836	681.0	1180.266	-409.124	1194.0
1206.624	-412.710	748.0	1209.054	-408.614	920.0	1181.753	-408.907	1084.0
1208.112	-412.488	544.0	1210.541	-408.392	1170.0	1183.240	-408.690	1206.0
1209.599	-412.267	706.0	1212.028	-408.170	956.0	1184.727	-408.473	1225.0
1211.087	-412.045	627.0	1213.515	-407.948	818.0	1186.213	-408.256	987.0
1212.574	-411.822	845.0	1215.001	-407.725	1223.0	1187.700	-408.038	1063.0
1214.061	-411.600	772.0	1216.488	-407.502	1270.0	1189.187	-407.820	873.0
1215.549	-411.377	836.0	1217.974	-407.279	872.0	1190.673	-407.602	921.0
1220.010	-410.707	665.0	1219.461	-407.055	694.0	1192.160	-407.384	1233.0
1175.112	-415.469	554.0	1220.947	-406.832	963.0	1193.646	-407.165	1006.0
1176.600	-415.254	760.0	1222.434	-406.608	859.0	1195.133	-406.946	1024.0
1178.088	-415.038	805.0	1223.920	-406.383	1000.0	1196.619	-406.726	792.0
1179.576	-414.822	703.0	1170.121	-412.460	365.0	1198.106	-406.507	1015.0
1181.064	-414.605	729.0	1171.608	-412.245	406.0	1199.592	-406.287	1094.0
1182.552	-414.388	699.0	1173.096	-412.030	600.0	1201.079	-406.067	996.0
1184.040	-414.171	1109.0	1174.583	-411.815	591.0	1202.565	-405.846	1148.0
1185.528	-413.954	1001.0	1176.070	-411.599	644.0	1204.051	-405.626	1368.0
1187.015	-413.737	811.0	1177.558	-411.383	1036.0	1205.537	-405.405	1052.0
1188.503	-413.519	522.0	1179.045	-411.167	1309.0	1207.024	-405.184	958.0
1189.991	-413.301	581.0	1180.532	-410.951	1262.0	1208.510	-404.962	988.0
1191.478	-413.082	629.0	1182.019	-410.734	1261.0	1209.996	-404.740	1019.0
1192.966	-412.864	634.0	1183.507	-410.517	1072.0	1211.482	-404.518	1344.0
1194.453	-412.645	582.0	1184.994	-410.300	1199.0	1212.968	-404.296	1246.0
1195.941	-412.426	612.0	1186.481	-410.083	1097.0	1214.454	-404.073	1377.0
1197.428	-412.206	944.0	1187.968	-409.865	720.0	1215.940	-403.850	1135.0
1198.916	-411.986	1281.0	1189.455	-409.647	640.0	1217.426	-403.627	1196.0
1200.403	-411.766	1427.0	1190.942	-409.429	873.0	1218.911	-403.404	851.0

Great Smoky Mountains								
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**
1220.397	-403.180	883.0	1181.220	-405.253	607.0	1200.267	-400.588	1222.0
1221.883	-402.956	1060.0	1182.707	-405.037	824.0	1201.752	-400.368	1524.0
1223.369	-402.732	1207.0	1184.193	-404.820	802.0	1203.237	-400.147	1386.0
1224.854	-402.508	1245.0	1185.679	-404.602	1033.0	1204.722	-399.926	1198.0
1226.340	-402.283	1045.0	1187.165	-404.385	1241.0	1206.208	-399.705	1242.0
1227.826	-402.058	1068.0	1188.651	-404.167	1297.0	1207.693	-399.484	1415.0
1229.311	-401.832	870.0	1190.137	-403.949	1503.0	1209.178	-399.262	1358.0
1230.797	-401.607	782.0	1191.623	-403.730	1477.0	1210.663	-399.040	1355.0
1241.194	-400.020	1326.0	1193.109	-403.512	1533.0	1212.148	-398.818	1403.0
1169.593	-408.805	453.0	1194.594	-403.293	1242.0	1213.633	-398.596	1712.0
1171.080	-408.590	439.0	1196.080	-403.073	1270.0	1215.118	-398.373	1431.0
1172.567	-408.376	582.0	1197.566	-402.854	1198.0	1216.603	-398.150	1422.0
1174.054	-408.160	664.0	1199.052	-402.634	1372.0	1218.087	-397.927	1236.0
1175.540	-407.945	770.0	1200.537	-402.414	1394.0	1219.572	-397.703	1228.0
1177.027	-407.729	853.0	1202.023	-402.194	1187.0	1221.057	-397.479	1492.0
1178.514	-407.513	810.0	1203.508	-401.973	1517.0	1222.542	-397.255	1372.0
1180.000	-407.297	979.0	1204.994	-401.752	1490.0	1224.026	-397.031	1181.0
1181.487	-407.080	809.0	1206.480	-401.531	1518.0	1225.511	-396.806	792.0
1182.973	-406.864	818.0	1207.965	-401.310	1632.0	1226.996	-396.581	939.0
1184.460	-406.646	1027.0	1209.450	-401.088	1692.0	1228.480	-396.356	737.0
1185.946	-406.429	1372.0	1210.936	-400.866	1888.0	1229.965	-396.131	1213.0
1187.432	-406.211	1203.0	1212.421	-400.644	1951.0	1231.449	-395.905	1173.0
1188.919	-405.994	975.0	1213.906	-400.422	1603.0	1235.902	-395.226	1111.0
1190.405	-405.775	1077.0	1215.392	-400.199	1543.0	1237.387	-395.000	1138.0
1191.891	-405.557	1343.0	1216.877	-399.976	1292.0	1238.871	-394.773	1362.0
1193.378	-405.338	1463.0	1218.362	-399.752	1067.0	1240.355	-394.545	1709.0
1194.864	-405.119	1193.0	1219.847	-399.529	928.0	1241.839	-394.318	1585.0
1196.350	-404.900	932.0	1221.332	-399.305	1190.0	1243.324	-394.090	1298.0
1197.836	-404.680	1059.0	1222.817	-399.081	1415.0	1244.808	-393.862	1224.0
1199.322	-404.461	1144.0	1224.302	-398.856	1066.0	1246.292	-393.633	1150.0
1200.808	-404.240	1231.0	1225.787	-398.632	899.0	1247.776	-393.404	1348.0
1202.294	-404.020	1197.0	1227.272	-398.407	714.0	1171.774	-402.894	383.0
1203.780	-403.799	1220.0	1228.757	-398.182	703.0	1173.260	-402.679	482.0
1205.266	-403.579	1342.0	1237.666	-396.825	1097.0	1174.746	-402.464	533.0
1206.752	-403.357	1350.0	1239.150	-396.598	1224.0	1176.231	-402.248	559.0
1208.237	-403.136	1251.0	1240.635	-396.370	1526.0	1177.717	-402.032	598.0
1209.723	-402.914	1467.0	1242.119	-396.142	1566.0	1179.202	-401.816	532.0
1211.209	-402.692	1407.0	1243.604	-395.915	1311.0	1180.688	-401.600	525.0
1212.694	-402.470	1671.0	1245.088	-395.686	1283.0	1182.173	-401.383	533.0
1214.180	-402.247	1369.0	1246.573	-395.458	1482.0	1183.659	-401.166	543.0
1215.666	-402.025	1412.0	1169.066	-405.151	290.0	1185.144	-400.949	562.0
1217.151	-401.802	1279.0	1170.552	-404.936	389.0	1186.630	-400.731	602.0
1218.637	-401.578	863.0	1172.038	-404.721	506.0	1188.115	-400.514	736.0
1220.122	-401.355	823.0	1173.524	-404.506	644.0	1189.600	-400.296	817.0
1221.608	-401.131	1103.0	1175.010	-404.291	578.0	1191.085	-400.077	809.0
1223.093	-400.906	1432.0	1176.496	-404.075	539.0	1192.571	-399.859	920.0
1224.578	-400.682	1448.0	1177.982	-403.859	634.0	1194.056	-399.640	1017.0
1226.064	-400.457	1352.0	1179.468	-403.643	662.0	1195.541	-399.421	1006.0
1227.549	-400.232	1094.0	1180.954	-403.427	567.0	1197.026	-399.201	956.0
1229.034	-400.007	802.0	1182.440	-403.210	579.0	1198.511	-398.982	1137.0
1230.519	-399.781	756.0	1183.926	-402.993	660.0	1199.996	-398.762	982.0
1239.430	-398.422	1213.0	1185.411	-402.776	878.0	1201.481	-398.541	1187.0
1240.915	-398.195	1312.0	1186.897	-402.558	907.0	1202.966	-398.321	1365.0
1169.330	-406.978	365.0	1188.383	-402.340	955.0	1204.451	-398.100	1245.0
1170.816	-406.763	393.0	1189.868	-402.122	1048.0	1205.936	-397.879	1074.0
1172.303	-406.548	455.0	1191.354	-401.904	1056.0	1207.420	-397.658	1365.0
1173.789	-406.333	590.0	1192.840	-401.685	1333.0	1208.905	-397.436	1401.0
1175.275	-406.118	775.0	1194.325	-401.466	1223.0	1210.390	-397.214	1080.0
1176.762	-405.902	690.0	1195.810	-401.247	1411.0	1211.874	-396.992	1260.0
1178.248	-405.686	697.0	1197.296	-401.028	1106.0	1213.359	-396.770	1660.0
1179.734	-405.470	678.0	1198.781	-400.808	1347.0	1214.844	-396.547	1703.0
1220.397	-403.180	883.0	1181.220	-405.253	607.0	1200.267	-400.588	1222.0
1216.328	-396.324	1525.0	1229.410	-392.480	1434.0	1245.449	-388.159	856.0
1217.813	-396.101	1299.0	1230.894	-392.255	1373.0	1246.932	-387.931	825.0

Great Smoky Mountains								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1219.297	-395.878	1389.0	1232.378	-392.029	1170.0	1248.415	-387.702	1060.0
1220.782	-395.654	1084.0	1233.861	-391.803	1293.0	1249.898	-387.473	1125.0
1222.266	-395.430	1048.0	1235.345	-391.576	1077.0	1175.435	-396.767	429.0
1223.750	-395.206	1002.0	1236.829	-391.350	953.0	1176.920	-396.551	537.0
1225.235	-394.981	1374.0	1238.312	-391.123	1202.0	1178.404	-396.335	459.0
1226.719	-394.756	910.0	1239.796	-390.895	1602.0	1179.889	-396.119	575.0
1228.203	-394.531	1109.0	1241.279	-390.668	1433.0	1181.373	-395.903	564.0
1229.687	-394.306	1002.0	1242.763	-390.440	1106.0	1182.858	-395.686	646.0
1231.172	-394.080	1469.0	1244.246	-390.212	966.0	1188.795	-394.816	609.0
1232.656	-393.854	1136.0	1245.730	-389.984	1077.0	1190.279	-394.598	535.0
1234.140	-393.628	1324.0	1247.213	-389.755	884.0	1191.764	-394.379	489.0
1235.624	-393.401	912.0	1248.696	-389.526	1096.0	1193.248	-394.161	408.0
1237.108	-393.175	1427.0	1174.216	-398.810	459.0	1194.732	-393.942	669.0
1238.592	-392.948	1487.0	1175.701	-398.594	516.0	1196.216	-393.722	675.0
1240.076	-392.720	1681.0	1177.186	-398.378	579.0	1197.700	-393.503	789.0
1241.559	-392.493	1310.0	1178.670	-398.162	576.0	1199.184	-393.283	834.0
1243.043	-392.265	1080.0	1180.155	-397.946	656.0	1200.668	-393.063	852.0
1244.527	-392.037	1029.0	1181.640	-397.729	718.0	1202.152	-392.843	817.0
1246.011	-391.808	989.0	1183.125	-397.513	760.0	1203.636	-392.622	823.0
1247.494	-391.580	1038.0	1184.610	-397.295	994.0	1205.120	-392.401	750.0
1248.978	-391.351	1337.0	1187.579	-396.860	782.0	1206.603	-392.180	930.0
1172.995	-400.852	368.0	1189.064	-396.642	618.0	1208.087	-391.959	1127.0
1174.481	-400.637	411.0	1190.548	-396.424	489.0	1209.571	-391.737	726.0
1175.966	-400.421	485.0	1192.033	-396.206	549.0	1211.055	-391.515	1065.0
1177.451	-400.205	480.0	1193.517	-395.987	598.0	1212.538	-391.293	1323.0
1178.936	-399.989	569.0	1195.002	-395.768	577.0	1214.022	-391.070	1448.0
1180.422	-399.773	610.0	1196.486	-395.549	809.0	1215.505	-390.847	1548.0
1181.907	-399.556	585.0	1197.970	-395.329	899.0	1216.989	-390.624	1772.0
1183.392	-399.339	596.0	1199.455	-395.109	1006.0	1218.472	-390.401	1416.0
1184.877	-399.122	591.0	1200.939	-394.889	1262.0	1219.956	-390.177	1198.0
1186.362	-398.905	681.0	1202.423	-394.669	988.0	1221.439	-389.954	1225.0
1187.847	-398.687	787.0	1203.907	-394.448	1120.0	1222.922	-389.729	1580.0
1189.332	-398.469	528.0	1205.392	-394.227	1054.0	1224.406	-389.505	1529.0
1190.817	-398.251	700.0	1206.876	-394.006	860.0	1225.889	-389.280	1165.0
1192.302	-398.032	615.0	1208.360	-393.785	1013.0	1227.372	-389.055	1418.0
1193.786	-397.813	905.0	1209.844	-393.563	1203.0	1228.855	-388.830	1635.0
1195.271	-397.594	836.0	1211.328	-393.341	1212.0	1230.339	-388.605	1459.0
1196.756	-397.375	827.0	1212.812	-393.118	1380.0	1231.822	-388.379	1310.0
1198.241	-397.155	768.0	1214.296	-392.896	1300.0	1233.305	-388.153	1441.0
1199.725	-396.935	983.0	1215.780	-392.673	1206.0	1234.788	-387.926	1391.0
1201.210	-396.715	1281.0	1217.263	-392.450	1581.0	1236.271	-387.700	1337.0
1202.695	-396.495	1378.0	1218.747	-392.227	1457.0	1237.754	-387.473	1455.0
1204.179	-396.274	1371.0	1220.231	-392.003	1699.0	1239.236	-387.246	1336.0
1205.664	-396.053	1135.0	1221.715	-391.779	1543.0	1240.719	-387.018	1223.0
1207.148	-395.832	884.0	1223.198	-391.555	1640.0	1242.202	-386.791	1226.0
1208.632	-395.610	907.0	1224.682	-391.330	1476.0	1243.685	-386.563	979.0
1210.117	-395.389	1249.0	1226.166	-391.106	1036.0	1245.168	-386.335	1079.0
1211.601	-395.167	1528.0	1227.649	-390.881	1315.0	1246.650	-386.106	1104.0
1213.085	-394.944	1552.0	1229.133	-390.655	1504.0	1248.133	-385.877	858.0
1214.570	-394.722	1473.0	1230.616	-390.430	1469.0	1249.616	-385.648	1030.0
1216.054	-394.499	1677.0	1232.100	-390.204	1242.0	1178.139	-394.509	475.0
1217.538	-394.276	1553.0	1233.583	-389.978	1453.0	1179.623	-394.292	440.0
1219.022	-394.052	1572.0	1235.066	-389.751	1414.0	1181.107	-394.076	640.0
1220.506	-393.828	1526.0	1236.550	-389.525	1012.0	1191.495	-392.553	369.0
1221.990	-393.604	1261.0	1238.033	-389.298	1127.0	1192.979	-392.334	478.0
1223.474	-393.380	1217.0	1239.516	-389.071	1352.0	1194.462	-392.115	570.0
1224.958	-393.156	1247.0	1240.999	-388.843	1189.0	1195.946	-391.896	552.0
1226.442	-392.931	947.0	1242.482	-388.615	1257.0	1197.430	-391.677	843.0
1227.926	-392.706	1163.0	1243.966	-388.387	1048.0	1198.913	-391.457	604.0
1216.328	-396.324	1525.0	1229.410	-392.480	1434.0	1245.449	-388.159	856.0
1200.397	-391.237	605.0	1232.748	-384.503	1802.0	1235.155	-380.401	1247.0
1201.881	-391.017	652.0	1234.230	-384.277	1371.0	1236.636	-380.174	1168.0
1203.364	-390.796	770.0	1235.713	-384.050	1674.0	1238.118	-379.947	1012.0
1204.848	-390.575	834.0	1237.195	-383.823	1676.0	1239.599	-379.720	959.0

Great Smoky Mountains								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1206.331	-390.354	725.0	1238.677	-383.596	1586.0	1241.081	-379.492	1366.0
1207.814	-390.133	608.0	1240.159	-383.369	1727.0	1242.562	-379.265	1348.0
1209.298	-389.911	656.0	1241.641	-383.142	1516.0	1244.044	-379.037	1526.0
1210.781	-389.689	1126.0	1243.124	-382.914	1359.0	1245.525	-378.808	1042.0
1212.265	-389.467	1115.0	1244.606	-382.686	1097.0	1214.134	-381.720	488.0
1213.748	-389.245	1387.0	1246.088	-382.457	1022.0	1215.616	-381.497	515.0
1215.231	-389.022	1569.0	1247.570	-382.229	1016.0	1217.097	-381.274	491.0
1216.714	-388.799	1595.0	1249.051	-382.000	732.0	1218.579	-381.051	550.0
1218.197	-388.576	1195.0	1198.372	-387.805	652.0	1220.061	-380.827	579.0
1219.680	-388.352	961.0	1199.855	-387.585	1164.0	1221.543	-380.603	781.0
1221.163	-388.128	1084.0	1201.338	-387.365	1129.0	1223.024	-380.379	900.0
1222.646	-387.904	1324.0	1202.821	-387.144	1070.0	1224.506	-380.155	1059.0
1224.129	-387.680	1732.0	1204.304	-386.924	942.0	1225.987	-379.930	1123.0
1225.612	-387.455	1720.0	1205.786	-386.703	668.0	1227.469	-379.705	1307.0
1227.095	-387.230	1512.0	1207.269	-386.481	425.0	1228.950	-379.480	1166.0
1228.578	-387.005	1680.0	1208.752	-386.260	532.0	1230.432	-379.254	1302.0
1230.061	-386.780	1528.0	1210.235	-386.038	696.0	1231.913	-379.028	1672.0
1231.544	-386.554	1452.0	1211.717	-385.816	673.0	1233.394	-378.802	1533.0
1233.026	-386.328	1535.0	1213.200	-385.594	775.0	1234.876	-378.576	1429.0
1234.509	-386.102	1401.0	1214.682	-385.371	1061.0	1236.357	-378.349	1457.0
1235.992	-385.875	1483.0	1216.165	-385.148	939.0	1237.838	-378.122	1391.0
1237.474	-385.648	1605.0	1217.647	-384.925	817.0	1239.319	-377.895	937.0
1238.957	-385.421	1574.0	1219.130	-384.701	763.0	1240.800	-377.668	1015.0
1240.439	-385.194	1577.0	1220.612	-384.478	616.0	1242.282	-377.440	1056.0
1241.922	-384.966	1326.0	1222.094	-384.254	877.0	1243.763	-377.212	1071.0
1243.404	-384.738	1393.0	1223.577	-384.029	892.0	1245.244	-376.984	1060.0
1244.887	-384.510	1134.0	1225.059	-383.805	910.0	1218.304	-379.225	427.0
1246.369	-384.282	971.0	1226.541	-383.580	1134.0	1219.785	-379.002	480.0
1247.851	-384.053	945.0	1228.023	-383.355	1358.0	1221.267	-378.778	488.0
1249.333	-383.824	1058.0	1229.506	-383.130	1512.0	1222.748	-378.554	624.0
1192.709	-390.508	492.0	1230.988	-382.904	1674.0	1224.229	-378.330	761.0
1194.193	-390.289	640.0	1232.470	-382.678	1806.0	1225.710	-378.105	732.0
1195.676	-390.070	587.0	1233.952	-382.452	1678.0	1227.191	-377.880	881.0
1197.159	-389.851	517.0	1235.434	-382.225	1725.0	1228.673	-377.655	821.0
1198.643	-389.631	876.0	1236.916	-381.999	1256.0	1230.154	-377.429	1000.0
1200.126	-389.411	983.0	1238.397	-381.772	1160.0	1231.635	-377.204	1094.0
1201.609	-389.191	850.0	1239.879	-381.544	1382.0	1233.116	-376.978	1208.0
1203.092	-388.970	776.0	1241.361	-381.317	1289.0	1234.597	-376.751	860.0
1204.576	-388.749	518.0	1242.843	-381.089	1584.0	1236.078	-376.525	857.0
1206.059	-388.528	555.0	1244.325	-380.861	1317.0	1237.558	-376.298	1391.0
1207.542	-388.307	487.0	1245.806	-380.633	1170.0	1239.039	-376.071	1265.0
1209.025	-388.085	626.0	1211.444	-383.990	548.0	1240.520	-375.843	1067.0
1210.508	-387.864	794.0	1212.926	-383.768	730.0	1235.155	-380.401	1247.0
1211.991	-387.641	824.0	1214.408	-383.545	699.0	1242.001	-375.616	921.0
1213.474	-387.419	1004.0	1215.890	-383.323	749.0	1243.482	-375.388	611.0
1214.957	-387.196	1101.0	1217.372	-383.099	624.0	1226.914	-376.055	608.0
1216.439	-386.973	1435.0	1218.854	-382.876	608.0	1229.876	-375.604	699.0
1217.922	-386.750	1039.0	1220.336	-382.652	530.0	1231.356	-375.379	785.0
1219.405	-386.527	765.0	1221.818	-382.428	797.0	1232.837	-375.153	892.0
1220.888	-386.303	961.0	1223.300	-382.204	1103.0	1234.318	-374.927	622.0
1222.370	-386.079	963.0	1224.782	-381.980	1110.0	1235.798	-374.700	762.0
1223.853	-385.855	1391.0	1226.264	-381.755	1130.0	1237.279	-374.473	1130.0
1225.336	-385.630	1485.0	1227.746	-381.530	1499.0	1238.759	-374.246	1458.0
1226.818	-385.405	1332.0	1229.228	-381.305	1742.0	1240.240	-374.019	1097.0
1228.301	-385.180	1520.0	1230.710	-381.079	1769.0	1241.720	-373.791	823.0
1229.783	-384.955	1705.0	1232.191	-380.853	1639.0	1243.201	-373.563	603.0
1231.266	-384.729	1572.0	1233.673	-380.627	1342.0	1232.558	-373.328	534.0
1200.397	-391.237	605.0	1232.748	-384.503	1802.0	1234.039	-373.102	545.0
1235.519	-372.875	582.0						
1236.999	-372.649	735.0						
1238.479	-372.422	885.0						
1239.960	-372.195	873.0						

Great Smoky Mountains								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)

Cohutta								
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**
1124.359	-493.51	903	1121.228	-487.412	557	1119.976	-483.854	426
1125.11	-493.407	958	1121.978	-487.309	598	1120.726	-483.751	458
1125.861	-493.304	1057	1122.729	-487.206	646	1121.477	-483.648	475
1123.482	-492.698	969	1123.48	-487.103	777	1122.227	-483.545	514
1124.233	-492.595	846	1124.23	-487	939	1122.977	-483.442	546
1124.984	-492.492	853	1124.981	-486.897	1000	1123.727	-483.339	623
1125.735	-492.389	873	1125.731	-486.794	1134	1124.478	-483.236	833
1121.104	-492.091	1070	1126.482	-486.691	1042	1125.228	-483.133	909
1121.855	-491.989	1189	1127.232	-486.587	1096	1125.978	-483.03	655
1122.606	-491.886	1015	1127.983	-486.484	905	1126.728	-482.927	841
1123.357	-491.783	893	1128.733	-486.38	796	1127.478	-482.823	717
1124.108	-491.68	763	1120.352	-486.6	498	1128.229	-482.72	579
1124.859	-491.576	732	1121.102	-486.497	532	1128.979	-482.616	680
1125.61	-491.473	805	1121.853	-486.394	579	1129.729	-482.513	838
1126.361	-491.37	962	1122.603	-486.291	620	1130.479	-482.409	810
1120.227	-491.279	934	1123.354	-486.188	753	1122.851	-482.527	578
1120.978	-491.176	926	1124.104	-486.085	971	1123.602	-482.424	640
1121.729	-491.073	1023	1124.855	-485.982	995	1124.352	-482.321	605
1122.48	-490.97	950	1125.605	-485.879	1063	1125.102	-482.218	722
1123.231	-490.867	823	1126.356	-485.775	912	1125.852	-482.115	654
1123.982	-490.764	762	1127.106	-485.672	1072	1126.602	-482.012	858
1124.733	-490.661	775	1127.857	-485.569	970	1127.352	-481.908	695
1125.484	-490.558	764	1128.607	-485.465	828	1128.102	-481.805	552
1126.235	-490.455	908	1120.227	-485.684	460	1128.852	-481.701	646
1120.102	-490.363	918	1120.977	-485.582	567	1129.603	-481.598	848
1120.853	-490.261	822	1121.727	-485.479	524	1130.353	-481.494	870
1121.604	-490.158	876	1122.478	-485.376	596	1131.103	-481.39	732
1122.355	-490.055	918	1123.228	-485.273	661	1122.726	-481.612	549
1123.106	-489.952	673	1123.979	-485.17	732	1123.476	-481.509	522
1123.856	-489.849	671	1124.729	-485.067	963	1124.226	-481.406	518
1124.607	-489.746	785	1125.48	-484.964	957	1124.976	-481.303	566
1125.358	-489.643	937	1126.23	-484.86	924	1125.726	-481.2	582
1126.109	-489.54	883	1126.98	-484.757	1039	1126.476	-481.096	709
1126.86	-489.436	967	1127.731	-484.654	867	1127.226	-480.993	619
1119.977	-489.448	785	1128.481	-484.55	846	1127.976	-480.89	598
1120.728	-489.345	821	1129.231	-484.447	715	1128.726	-480.786	732
1121.478	-489.243	846	1129.982	-484.343	734	1129.476	-480.683	896
1122.229	-489.14	766	1130.732	-484.239	761	1130.226	-480.579	949
1122.98	-489.037	610	1131.482	-484.136	798	1130.976	-480.475	760
1123.731	-488.934	793	1118.6	-484.974	476	1131.726	-480.372	644
1124.482	-488.831	959	1119.351	-484.872	488	1122.6	-480.697	579
1125.232	-488.728	928	1120.101	-484.769	446	1123.35	-480.594	511
1125.983	-488.624	1090	1120.852	-484.666	443	1124.1	-480.491	513
1126.734	-488.521	1154	1121.602	-484.563	549	1124.85	-480.388	549
1127.484	-488.418	1002	1122.352	-484.461	526	1125.6	-480.285	579
1128.235	-488.314	893	1123.103	-484.358	596	1126.35	-480.181	594
1120.602	-488.43	610	1123.853	-484.255	733	1127.1	-480.078	536
1121.353	-488.327	706	1124.603	-484.152	905	1127.85	-479.975	598
1122.104	-488.224	581	1125.354	-484.048	867	1128.6	-479.871	670
1122.854	-488.122	628	1126.104	-483.945	781	1129.35	-479.768	815
1123.605	-488.019	673	1126.854	-483.842	900	1130.1	-479.664	975
1124.356	-487.915	878	1127.605	-483.738	808	1130.85	-479.56	839
1125.106	-487.812	1099	1128.355	-483.635	638	1131.6	-479.457	696
1125.857	-487.709	1175	1129.105	-483.532	774	1123.225	-479.679	457
1126.608	-487.606	1139	1129.855	-483.428	881	1123.974	-479.576	457
1127.358	-487.503	1097	1130.606	-483.324	769	1124.724	-479.473	429
1128.109	-487.399	862	1118.475	-484.059	487	1125.474	-479.369	487
1120.477	-487.515	606	1119.226	-483.956	396	1126.224	-479.266	502
1126.974	-479.163	582						
1127.724	-479.06	587						
1128.474	-478.956	760						
1129.223	-478.853	914						
1129.973	-478.749	1039						

Cohutta								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1130.723	-478.645	917						
1131.473	-478.542	903						
1132.223	-478.438	654						
1122.349	-478.867	456						
1123.099	-478.764	495						
1123.849	-478.661	400						
1124.598	-478.558	519						
1125.348	-478.454	630						
1126.098	-478.351	582						
1126.848	-478.248	611						
1127.598	-478.144	769						
1128.347	-478.041	610						
1129.097	-477.938	701						
1129.847	-477.834	915						
1130.597	-477.73	890						
1131.346	-477.627	762						
1132.096	-477.523	616						
1119.974	-478.26	310						
1120.724	-478.157	408						
1121.474	-478.054	449						
1122.223	-477.951	476						
1122.973	-477.849	449						
1123.723	-477.746	468						
1124.473	-477.642	482						
1125.222	-477.539	615						
1125.972	-477.436	647						
1126.722	-477.333	614						
1127.471	-477.229	747						
1128.221	-477.126	942						
1128.971	-477.023	893						
1129.72	-476.919	955						
1130.47	-476.815	874						
1131.22	-476.712	662						
1131.969	-476.608	636						
1132.719	-476.504	544						
1126.596	-476.418	717						
1127.345	-476.314	750						
1128.095	-476.211	982						
1128.844	-476.107	1141						
1126.469	-475.503	847						
1127.219	-475.399	1013						

Shining Rock								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1273.44	-416.507	1629	1266.774	-412.878	1362			
1274.184	-416.39	1586	1267.518	-412.762	1470			
1274.928	-416.274	1370	1268.262	-412.646	1248			
1275.672	-416.157	1274	1269.006	-412.529	1058			
1276.416	-416.04	1181	1269.749	-412.413	1170			
1268.832	-416.294	1183	1270.493	-412.296	1415			
1269.576	-416.178	1416	1271.237	-412.18	1689			
1270.321	-416.062	1541	1271.981	-412.063	1547			
1271.065	-415.945	1677	1272.724	-411.946	1550			
1271.809	-415.828	1640	1273.468	-411.83	1437			
1272.553	-415.712	1770	1274.212	-411.713	1508			
1273.297	-415.595	1679	1274.955	-411.596	1300			
1274.041	-415.478	1585	1275.699	-411.479	1176			
1274.785	-415.361	1529	1268.863	-411.617	1012			
1275.529	-415.245	1309	1269.607	-411.501	1285			
1276.273	-415.128	1128	1270.35	-411.384	1366			
1267.946	-415.498	1097	1271.094	-411.268	1566			
1268.69	-415.382	1217	1271.837	-411.151	1451			
1269.434	-415.266	1536	1272.581	-411.034	1359			
1270.178	-415.149	1463	1273.325	-410.918	1273			
1270.922	-415.033	1436	1274.068	-410.801	1274			
1271.666	-414.916	1629	1274.812	-410.684	1280			
1272.41	-414.8	1771	1275.555	-410.567	1155			
1273.154	-414.683	1622	1270.207	-410.472	1179			
1273.898	-414.566	1425	1270.951	-410.355	1348			
1274.642	-414.449	1312	1271.694	-410.239	1488			
1275.385	-414.332	1362	1270.808	-409.443	1442			
1276.129	-414.215	1067	1271.551	-409.327	1565			
1276.873	-414.098	1162	1272.295	-409.21	1505			
1277.617	-413.981	1399	1273.038	-409.093	1409			
1267.059	-414.702	1029	1273.782	-408.977	1380			
1267.803	-414.586	1227	1274.525	-408.86	1303			
1268.547	-414.47	1505	1275.269	-408.743	1104			
1269.291	-414.354	1347	1269.922	-408.648	1500			
1270.035	-414.237	1317	1271.408	-408.415	1678			
1270.779	-414.121	1536	1272.152	-408.298	1707			
1271.523	-414.004	1675	1272.895	-408.181	1515			
1272.267	-413.887	1729	1273.638	-408.065	1321			
1273.011	-413.771	1523	1274.382	-407.948	1219			
1273.754	-413.654	1544	1271.265	-407.503	1394			
1274.498	-413.537	1429	1272.009	-407.386	1522			
1275.242	-413.42	1315	1272.752	-407.269	1411			
1275.986	-413.303	1068	1273.495	-407.152	1234			
1276.73	-413.186	1066	1271.122	-406.59	1189			
1277.474	-413.069	1352	1271.865	-406.474	1343			
1266.173	-413.906	1024	1272.609	-406.357	1265			
1266.917	-413.79	1296	1270.979	-405.678	1045			
1267.661	-413.674	1404	1271.722	-405.562	1235			
1268.404	-413.558	1373	1272.465	-405.445	1066			
1269.148	-413.441	1198						
1269.892	-413.325	1198						
1270.636	-413.208	1419						
1271.38	-413.092	1571						
1272.124	-412.975	1741						
1272.867	-412.859	1717						
1273.611	-412.742	1616						
1274.355	-412.625	1569						
1275.099	-412.508	1422						
1275.842	-412.391	1161						
1265.287	-413.11	968						
1266.03	-412.994	1198						

Okefenokee								
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**
1401.401	-877.287	36.0	1404.777	-888.047	36.0	1388.045	-894.538	36.0
1399.829	-877.544	36.0	1403.202	-888.305	36.0	1399.375	-894.585	36.0
1403.275	-878.866	27.0	1401.627	-888.562	36.0	1386.469	-894.792	36.0
1401.701	-879.123	27.0	1400.052	-888.819	36.0	1417.01	-893.581	36.0
1400.128	-879.38	30.0	1398.477	-889.075	36.0	1397.799	-894.842	36.0
1398.555	-879.637	36.0	1416.101	-888.073	36.0	1415.434	-893.841	36.0
1396.982	-879.893	36.0	1396.902	-889.332	36.0	1413.858	-894.1	37.0
1405.148	-880.444	36.0	1414.527	-888.332	36.0	1384.894	-895.046	36.0
1403.575	-880.702	37.0	1412.952	-888.591	36.0	1396.223	-895.098	36.0
1402.002	-880.959	36.0	1395.327	-889.588	33.0	1412.282	-894.359	36.0
1400.428	-881.216	36.0	1411.377	-888.85	38.0	1410.706	-894.618	36.0
1398.855	-881.473	36.0	1409.802	-889.109	29.0	1394.647	-895.354	36.0
1397.281	-881.729	36.0	1393.752	-889.843	32.0	1409.131	-894.877	36.0
1408.596	-881.764	36.0	1408.227	-889.368	36.0	1393.071	-895.61	36.0
1407.023	-882.023	36.0	1392.177	-890.099	36.0	1407.555	-895.135	36.0
1405.449	-882.281	36.0	1406.652	-889.626	36.0	1405.978	-895.393	36.0
1403.875	-882.538	27.0	1405.077	-889.883	37.0	1391.495	-895.865	36.0
1402.302	-882.796	27.0	1390.602	-890.354	38.0	1404.402	-895.651	36.0
1400.728	-883.053	30.0	1403.502	-890.141	37.0	1389.918	-896.12	36.0
1399.154	-883.309	27.0	1401.927	-890.398	37.0	1402.826	-895.908	36.0
1397.58	-883.566	31.0	1400.352	-890.655	36.0	1401.25	-896.165	36.0
1396.006	-883.822	36.0	1398.776	-890.912	36.0	1388.342	-896.375	36.0
1412.045	-883.083	36.0	1416.404	-889.909	36.0	1399.674	-896.422	37.0
1410.472	-883.342	36.0	1397.201	-891.168	36.0	1386.766	-896.629	36.0
1394.432	-884.078	36.0	1414.829	-890.168	36.0	1417.313	-895.417	36.0
1408.898	-883.601	36.0	1413.254	-890.428	36.0	1398.098	-896.679	36.0
1407.324	-883.859	36.0	1395.626	-891.424	36.0	1415.737	-895.677	36.0
1405.75	-884.117	36.0	1411.679	-890.687	38.0	1385.19	-896.884	36.0
1404.176	-884.374	36.0	1410.103	-890.945	37.0	1414.16	-895.937	36.0
1402.602	-884.632	36.0	1394.051	-891.68	38.0	1396.521	-896.935	36.0
1401.028	-884.889	36.0	1408.528	-891.204	36.0	1412.584	-896.196	36.0
1399.453	-885.146	36.0	1392.475	-891.936	36.0	1411.008	-896.455	36.0
1397.879	-885.402	36.0	1406.953	-891.462	36.0	1383.613	-897.137	36.0
1415.496	-884.401	27.0	1405.378	-891.72	38.0	1394.945	-897.191	36.0
1413.922	-884.66	30.0	1390.9	-892.191	38.0	1409.432	-896.713	36.0
1396.305	-885.658	31.0	1403.802	-891.978	37.0	1393.368	-897.447	36.0
1412.347	-884.919	32.0	1389.324	-892.446	37.0	1407.855	-896.972	36.0
1394.731	-885.914	27.0	1402.227	-892.235	36.0	1406.279	-897.23	36.0
1410.773	-885.178	27.0	1400.651	-892.492	36.0	1391.792	-897.702	36.0
1409.199	-885.437	36.0	1387.749	-892.701	36.0	1404.703	-897.488	36.0
1393.156	-886.17	36.0	1399.076	-892.749	36.0	1390.216	-897.957	36.0
1407.625	-885.695	36.0	1416.707	-891.745	36.0	1403.126	-897.745	36.0
1406.051	-885.953	36.0	1397.5	-893.005	36.0	1388.639	-898.212	36.0
1404.476	-886.211	36.0	1415.131	-892.005	36.0	1401.55	-898.002	36.0
1402.902	-886.468	36.0	1413.556	-892.264	36.0	1399.973	-898.259	36.0
1401.327	-886.725	36.0	1395.924	-893.261	37.0	1387.062	-898.467	36.0
1399.753	-886.982	36.0	1411.981	-892.523	38.0	1417.615	-897.254	36.0
1398.178	-887.239	36.0	1410.405	-892.782	38.0	1398.396	-898.516	36.0
1415.798	-886.237	37.0	1394.349	-893.517	38.0	1416.039	-897.514	36.0
1414.224	-886.496	36.0	1408.829	-893.04	36.0	1385.486	-898.721	36.0
1396.604	-887.495	27.0	1392.773	-893.773	36.0	1414.463	-897.773	36.0
1412.65	-886.755	27.0	1407.254	-893.299	36.0	1396.82	-898.772	36.0
1395.029	-887.751	27.0	1405.678	-893.557	36.0	1412.886	-898.033	36.0
1411.075	-887.014	27.0	1391.197	-894.028	36.0	1383.909	-898.975	36.0
1409.501	-887.273	30.0	1404.102	-893.814	36.0	1395.243	-899.028	36.0
1393.454	-888.007	34.0	1389.621	-894.283	36.0	1411.309	-898.291	36.0
1407.926	-887.531	36.0	1402.526	-894.072	36.0	1409.733	-898.55	36.0
1406.351	-887.789	36.0	1400.951	-894.329	36.0	1393.666	-899.284	36.0

Okefenokee								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1382.332	-899.228	36.0	1387.952	-903.979	36.0	1400.19	-909.539	36.0
1408.156	-898.809	36.0	1418.524	-902.764	36.0	1419.433	-908.274	36.0
1406.579	-899.067	36.0	1399.293	-904.027	36.0	1417.854	-908.534	36.0
1392.09	-899.539	36.0	1386.374	-904.233	36.0	1398.611	-909.796	36.0
1405.003	-899.325	36.0	1416.947	-903.024	37.0	1416.276	-908.794	36.0
1390.513	-899.795	36.0	1397.715	-904.284	32.0	1414.697	-909.053	36.0
1403.426	-899.582	36.0	1415.369	-903.283	27.0	1397.032	-910.052	36.0
1388.936	-900.049	36.0	1413.792	-903.543	36.0	1413.119	-909.313	36.0
1401.849	-899.839	36.0	1384.796	-904.487	37.0	1411.54	-909.572	36.0
1400.272	-900.096	36.0	1412.214	-903.802	37.0	1409.962	-909.831	36.0
1387.359	-900.304	36.0	1410.636	-904.061	36.0	1408.383	-910.089	34.0
1417.918	-899.09	36.0	1383.219	-904.741	36.0	1406.804	-910.347	30.0
1398.695	-900.353	36.0	1409.059	-904.319	36.0	1405.225	-910.605	33.0
1416.342	-899.35	36.0	1407.481	-904.577	36.0	1403.646	-910.863	33.0
1385.782	-900.558	36.0	1381.641	-904.995	36.0	1402.067	-911.12	33.0
1414.765	-899.61	36.0	1405.903	-904.835	36.0	1400.488	-911.377	31.0
1397.118	-900.609	36.0	1404.326	-905.093	36.0	1419.736	-910.111	31.0
1413.188	-899.869	36.0	1380.063	-905.248	36.0	1418.157	-910.371	36.0
1384.205	-900.812	36.0	1389.826	-905.562	36.0	1398.909	-911.634	36.0
1395.541	-900.865	36.0	1402.748	-905.351	36.0	1416.578	-910.631	36.0
1411.611	-900.128	37.0	1401.17	-905.608	36.0	1414.999	-910.891	36.0
1410.034	-900.387	37.0	1388.248	-905.817	36.0	1397.33	-911.89	36.0
1393.964	-901.121	36.0	1399.592	-905.865	36.0	1413.42	-911.15	36.0
1382.628	-901.066	36.0	1418.827	-904.6	36.0	1395.751	-912.146	36.0
1408.457	-900.645	36.0	1386.67	-906.071	36.0	1411.842	-911.409	36.0
1406.88	-900.904	36.0	1417.249	-904.86	34.0	1410.262	-911.668	36.0
1392.387	-901.377	36.0	1398.014	-906.121	29.0	1394.172	-912.402	36.0
1381.051	-901.319	36.0	1415.671	-905.12	30.0	1408.683	-911.926	36.0
1405.303	-901.161	36.0	1414.094	-905.38	36.0	1407.104	-912.184	36.0
1390.81	-901.632	36.0	1385.092	-906.325	36.0	1392.593	-912.657	36.0
1403.726	-901.419	36.0	1412.516	-905.639	36.0	1405.525	-912.442	36.0
1389.233	-901.887	36.0	1410.938	-905.898	36.0	1403.946	-912.7	36.0
1402.149	-901.676	36.0	1383.514	-906.579	36.0	1402.367	-912.957	36.0
1400.571	-901.933	36.0	1409.36	-906.156	36.0	1400.787	-913.214	36.0
1387.655	-902.141	37.0	1407.782	-906.415	36.0	1399.208	-913.471	32.0
1418.221	-900.927	36.0	1381.936	-906.833	36.0	1416.881	-912.468	33.0
1398.994	-902.19	37.0	1406.204	-906.673	36.0	1415.301	-912.728	35.0
1416.644	-901.187	36.0	1380.358	-907.086	36.0	1397.629	-913.728	35.0
1386.078	-902.396	36.0	1404.625	-906.93	36.0	1413.722	-912.987	33.0
1415.067	-901.446	36.0	1390.123	-907.399	36.0	1396.049	-913.984	31.0
1397.417	-902.446	36.0	1403.047	-907.188	36.0	1412.143	-913.246	30.0
1413.49	-901.706	36.0	1401.469	-907.445	36.0	1410.563	-913.505	31.0
1384.501	-902.65	36.0	1388.545	-907.654	36.0	1394.47	-914.24	36.0
1395.839	-902.703	36.0	1399.891	-907.702	36.0	1408.984	-913.764	36.0
1411.913	-901.965	36.0	1419.13	-906.437	36.0	1392.89	-914.495	37.0
1410.335	-902.224	36.0	1417.552	-906.697	32.0	1407.405	-914.022	36.0
1394.262	-902.958	36.0	1398.312	-907.958	30.0	1405.825	-914.28	36.0
1382.923	-902.904	36.0	1415.974	-906.957	33.0	1404.246	-914.538	36.0
1408.758	-902.482	37.0	1414.396	-907.216	33.0	1402.666	-914.795	36.0
1392.684	-903.214	36.0	1396.734	-908.215	30.0	1401.086	-915.052	36.0
1407.181	-902.74	37.0	1412.817	-907.476	36.0	1399.507	-915.309	36.0
1381.346	-903.157	36.0	1411.239	-907.735	36.0	1417.183	-914.305	36.0
1405.603	-902.998	36.0	1409.661	-907.993	36.0	1415.603	-914.565	36.0
1404.026	-903.256	36.0	1408.082	-908.252	36.0	1397.927	-915.565	36.0
1379.768	-903.41	36.0	1406.504	-908.51	36.0	1414.024	-914.824	36.0
1389.529	-903.724	36.0	1404.925	-908.768	36.0	1396.347	-915.822	36.0
1402.448	-903.513	36.0	1403.347	-909.025	36.0	1412.444	-915.084	36.0
1400.871	-903.77	36.0	1401.768	-909.282	36.0	1410.864	-915.343	32.0

Okefenokee								
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**
1394.767	-916.078	36.0	1405.444	-921.888	36.0	1420.881	-926.907	37.0
1409.285	-915.601	36.0	1403.863	-922.146	36.0	1419.299	-927.168	36.0
1393.187	-916.333	36.0	1402.282	-922.403	36.0	1400.015	-928.432	36.0
1407.705	-915.859	33.0	1421.554	-921.134	36.0	1417.717	-927.428	36.0
1406.125	-916.117	31.0	1400.701	-922.66	36.0	1416.135	-927.688	36.0
1404.545	-916.375	32.0	1419.973	-921.394	36.0	1398.433	-928.688	36.0
1402.965	-916.633	36.0	1399.12	-922.917	36.0	1414.553	-927.947	36.0
1401.385	-916.89	36.0	1416.811	-921.915	36.0	1396.851	-928.945	36.0
1399.805	-917.147	36.0	1415.23	-922.174	36.0	1412.971	-928.206	36.0
1417.485	-916.142	36.0	1397.539	-923.174	36.0	1411.389	-928.465	36.0
1415.905	-916.402	36.0	1413.649	-922.434	36.0	1395.268	-929.201	36.0
1398.225	-917.403	36.0	1412.068	-922.693	36.0	1409.807	-928.724	36.0
1414.325	-916.662	36.0	1395.958	-923.43	36.0	1408.225	-928.983	36.0
1396.645	-917.66	36.0	1410.487	-922.952	36.0	1406.643	-929.241	37.0
1412.745	-916.921	36.0	1394.376	-923.686	36.0	1405.06	-929.498	37.0
1411.165	-917.18	36.0	1408.906	-923.21	36.0	1403.478	-929.756	37.0
1395.065	-917.916	36.0	1407.325	-923.468	36.0	1401.896	-930.013	37.0
1409.585	-917.439	36.0	1392.795	-923.941	36.0	1421.184	-928.745	37.0
1393.485	-918.171	36.0	1405.744	-923.726	36.0	1419.602	-929.005	37.0
1408.005	-917.697	36.0	1404.162	-923.984	36.0	1400.313	-930.27	37.0
1406.425	-917.955	36.0	1402.581	-924.241	36.0	1418.02	-929.266	37.0
1391.904	-918.427	36.0	1401	-924.499	36.0	1416.437	-929.525	37.0
1404.845	-918.213	36.0	1420.276	-923.232	36.0	1398.731	-930.527	37.0
1403.264	-918.47	36.0	1399.418	-924.755	36.0	1414.855	-929.785	37.0
1401.684	-918.728	36.0	1417.113	-923.752	36.0	1397.148	-930.783	37.0
1420.948	-917.459	33.0	1415.532	-924.012	36.0	1413.272	-930.044	37.0
1419.368	-917.72	29.0	1397.837	-925.012	41.0			
1400.104	-918.985	36.0	1413.951	-924.271	37.0			
1417.788	-917.98	36.0	1412.369	-924.531	36.0			
1398.523	-919.241	36.0	1396.255	-925.268	36.0			
1416.207	-918.24	36.0	1410.788	-924.79	36.0			
1414.627	-918.499	36.0	1394.674	-925.524	36.0			
1396.943	-919.497	36.0	1409.206	-925.048	36.0			
1413.047	-918.759	36.0	1407.625	-925.306	36.0			
1411.466	-919.018	36.0	1393.092	-925.78	36.0			
1395.362	-919.754	36.0	1406.043	-925.564	36.0			
1409.886	-919.276	36.0	1404.462	-925.822	36.0			
1393.782	-920.009	36.0	1402.88	-926.08	36.0			
1408.305	-919.535	36.0	1401.298	-926.337	36.0			
1406.725	-919.793	36.0	1420.578	-925.069	36.0			
1405.144	-920.051	36.0	1418.997	-925.33	36.0			
1403.564	-920.308	36.0	1399.717	-926.594	36.0			
1401.983	-920.565	36.0	1417.415	-925.59	36.0			
1419.67	-919.557	36.0	1415.834	-925.85	36.0			
1400.402	-920.822	37.0	1398.135	-926.85	36.0			
1418.09	-919.817	35.0	1414.252	-926.109	36.0			
1398.822	-921.079	30.0	1396.553	-927.106	36.0			
1416.509	-920.077	36.0	1412.67	-926.368	36.0			
1414.929	-920.337	36.0	1411.089	-926.627	36.0			
1397.241	-921.336	36.0	1394.971	-927.362	36.0			
1413.348	-920.596	36.0	1409.507	-926.886	36.0			
1411.767	-920.855	36.0	1393.389	-927.618	36.0			
1395.66	-921.592	36.0	1407.925	-927.144	36.0			
1410.187	-921.114	36.0	1406.343	-927.402	36.0			
1394.079	-921.847	36.0	1404.761	-927.66	36.0			
1408.606	-921.372	36.0	1403.179	-927.918	36.0			
1407.025	-921.631	36.0	1422.463	-926.646	36.0			
1392.498	-922.103	36.0	1401.597	-928.175	37.0			

Wolf Island								
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**
1485.848	-828.138	1.0						
1485.225	-829.19	1.0						
1486.007	-829.054	1.0						
1486.789	-828.918	3.0						
1487.571	-828.781	2.0						
1488.353	-828.645	1.0						
1485.385	-830.106	1.0						
1489.135	-828.509	1.0						
1486.167	-829.97	1.0						
1486.949	-829.834	1.0						
1487.731	-829.697	1.0						
1488.513	-829.561	1.0						
1489.295	-829.424	1.0						
1486.327	-830.886	1.0						
1487.109	-830.749	1.0						
1487.891	-830.613	1.0						
1488.673	-830.476	1.0						
1489.455	-830.34	1.0						
1486.486	-831.801	1.0						
1487.268	-831.665	1.0						
1488.051	-831.529	1.0						
1488.833	-831.392	1.0						
1489.615	-831.256	1.0						
1487.428	-832.581	1.0						
1488.21	-832.444	1.0						
1488.993	-832.308	1.0						
1489.775	-832.171	1.0						
1488.53	-834.276	1.0						
1488.69	-835.192	1.0						
1489.472	-835.055	1.0						

Cape Romain Class I Area		
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**
1609.918	-633.619	0
1610.682	-633.471	1
1610.506	-632.561	1
1611.27	-632.414	1
1611.094	-631.504	1
1611.858	-631.356	1
1610.154	-630.742	1
1610.918	-630.594	1
1611.682	-630.446	1
1612.446	-630.298	1
1610.742	-629.684	1
1611.506	-629.537	1
1612.27	-629.389	1
1610.566	-628.775	0
1611.33	-628.627	1
1612.093	-628.479	1
1612.857	-628.331	1
1610.39	-627.865	1
1611.154	-627.717	1
1610.214	-626.955	1
1610.978	-626.807	1
1611.741	-626.66	1
1610.802	-625.898	1
1611.565	-625.75	1
1610.626	-624.988	1
1611.389	-624.84	2
1612.152	-624.693	1
1615.968	-623.952	0
1611.213	-623.931	1
1611.976	-623.783	1
1616.554	-622.895	0
1611.037	-623.021	1
1611.8	-622.873	1
1612.387	-621.816	1
1613.149	-621.668	1
1617.727	-620.779	0
1612.973	-620.758	1
1613.736	-620.61	1
1621.949	-618.069	0
1622.712	-617.92	1
1623.474	-617.772	1

Cape Romain Class I Area		
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**
1614.146	-618.643	1
1623.297	-616.862	1
1624.059	-616.713	1
1624.822	-616.564	1
1625.584	-616.415	1
1633.208	-614.921	1
1633.97	-614.771	0
1614.732	-617.586	1
1621.594	-616.25	0
1622.357	-616.102	1
1623.119	-615.953	1
1623.882	-615.804	1
1624.644	-615.655	1
1625.406	-615.506	1
1626.169	-615.357	1
1626.931	-615.208	1
1627.693	-615.059	1
1628.456	-614.909	2
1629.218	-614.76	2
1629.98	-614.611	1
1630.742	-614.461	2
1631.505	-614.311	1
1633.791	-613.862	0
1615.318	-616.528	1
1616.08	-616.38	1
1616.843	-616.232	1
1620.655	-615.49	0
1621.417	-615.341	1
1622.179	-615.192	1
1622.942	-615.044	1
1623.704	-614.895	1
1624.466	-614.746	1
1625.229	-614.597	1
1628.278	-614	1
1629.04	-613.851	1
1632.088	-613.253	1
1634.375	-612.803	0
1619.715	-614.729	0
1620.477	-614.581	1
1621.24	-614.432	1
1622.002	-614.283	1

Cape Romain Class I Area		
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**
1622.764	-614.134	1
1623.526	-613.986	1
1624.289	-613.837	1
1625.051	-613.688	1
1625.813	-613.539	1
1626.575	-613.389	1
1627.337	-613.24	1
1629.624	-612.792	1
1630.386	-612.643	1
1631.148	-612.493	1
1631.91	-612.344	1
1634.196	-611.894	0
1618.776	-613.968	1
1619.538	-613.82	1
1620.3	-613.671	1
1621.062	-613.523	1
1621.824	-613.374	1
1622.587	-613.225	1
1623.349	-613.076	1
1624.111	-612.927	1
1624.873	-612.778	1
1625.635	-612.629	1
1626.397	-612.48	1
1627.159	-612.331	1
1627.921	-612.182	1
1628.683	-612.033	1
1629.445	-611.883	1
1630.207	-611.734	1
1630.969	-611.584	1
1634.017	-610.985	0
1620.123	-612.762	1
1620.885	-612.613	1
1621.647	-612.465	1
1622.409	-612.316	1
1623.171	-612.167	1
1623.933	-612.018	1
1624.695	-611.869	1
1625.457	-611.72	1
1626.219	-611.571	1
1626.981	-611.422	1
1627.743	-611.273	1

Cape Romain Class I Area		
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**
1628.505	-611.123	1
1633.077	-610.226	0
1633.839	-610.076	1
1634.6	-609.927	1
1621.47	-611.555	1
1622.232	-611.407	1
1622.994	-611.258	1
1623.756	-611.109	1
1624.517	-610.96	1
1625.279	-610.811	1
1626.041	-610.662	1
1626.803	-610.513	1
1627.565	-610.364	1
1628.327	-610.214	1
1629.089	-610.065	1
1629.851	-609.916	1
1630.613	-609.766	1
1634.422	-609.018	0
1624.34	-610.051	1
1625.102	-609.902	1
1625.863	-609.753	1
1626.625	-609.604	1
1627.387	-609.455	1
1628.149	-609.305	1
1628.911	-609.156	1
1629.672	-609.007	1
1630.434	-608.857	1
1634.243	-608.109	0
1628.732	-608.247	1
1629.494	-608.098	1
1630.256	-607.948	1
1631.017	-607.799	1
1629.316	-607.189	1
1630.077	-607.039	1
1630.839	-606.89	1
1631.601	-606.74	1
1629.899	-606.13	1
1630.66	-605.981	1
1631.422	-605.831	1
1629.721	-605.221	1
1630.482	-605.072	1

Joyce Kilmer Slickrock								
Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)	Lambert Conformal X (km)	Lambert Conformal Y (km)	Height (m)
1174.116	-429.607	1154	1168.724	-423.854	1065			
1174.861	-429.499	1056	1169.468	-423.747	836			
1175.607	-429.391	903	1170.213	-423.64	700			
1176.352	-429.283	820	1170.958	-423.532	782			
1177.097	-429.175	818	1171.703	-423.425	961			
1173.239	-428.8	1278	1173.937	-423.102	809			
1173.984	-428.693	1069	1174.682	-422.995	941			
1174.729	-428.585	913	1167.847	-423.047	991			
1175.475	-428.477	776	1168.592	-422.94	817			
1176.22	-428.369	788	1169.337	-422.833	751			
1176.965	-428.262	750	1170.081	-422.726	635			
1172.362	-427.994	1327	1170.826	-422.619	772			
1173.107	-427.887	1085	1171.571	-422.511	882			
1173.852	-427.779	985	1168.461	-422.026	954			
1174.597	-427.671	934	1169.205	-421.919	739			
1175.342	-427.563	978	1169.95	-421.812	620			
1176.088	-427.456	982	1170.694	-421.705	635			
1176.833	-427.348	824	1171.439	-421.597	700			
1169.995	-427.402	1317	1172.184	-421.49	865			
1170.74	-427.295	1394	1168.329	-421.113	943			
1171.485	-427.188	1487	1169.074	-421.005	742			
1172.23	-427.08	1308	1169.818	-420.898	505			
1172.975	-426.973	1237	1170.563	-420.791	558			
1173.72	-426.865	1336	1171.307	-420.684	538			
1174.465	-426.757	1290	1172.052	-420.576	686			
1175.21	-426.65	1304	1168.198	-420.199	946			
1175.955	-426.542	1111	1168.942	-420.092	760			
1176.7	-426.434	1066	1169.686	-419.984	644			
1169.863	-426.489	1189	1170.431	-419.877	491			
1170.608	-426.381	1127	1171.175	-419.77	442			
1171.353	-426.274	1299	1171.92	-419.662	491			
1172.098	-426.166	1380	1168.066	-419.285	959			
1172.843	-426.059	1553	1168.81	-419.178	752			
1173.588	-425.951	1336	1169.555	-419.071	528			
1174.333	-425.844	1219	1170.299	-418.963	598			
1175.078	-425.736	1109	1171.043	-418.856	515			
1175.823	-425.628	1133	1171.788	-418.749	400			
1176.568	-425.52	1226	1172.532	-418.641	523			
1168.987	-425.682	1280	1167.935	-418.371	712			
1169.731	-425.575	1136	1170.167	-418.05	743			
1170.476	-425.467	906	1170.912	-417.942	684			
1171.221	-425.36	999	1171.656	-417.835	538			
1171.966	-425.253	1170	1172.4	-417.727	361			
1172.711	-425.145	1376						
1173.456	-425.037	1318						
1174.201	-424.93	1369						
1174.946	-424.822	1152						
1175.691	-424.714	924						
1176.436	-424.607	882						
1168.11	-424.875	1151						
1168.855	-424.768	1116						
1169.6	-424.661	1044						
1170.345	-424.554	772						
1171.09	-424.446	866						
1171.834	-424.339	1090						
1173.324	-424.124	1020						
1174.069	-424.016	1067						
1167.979	-423.961	1224						

Linville Gorge								
Lambert Conformal X (km)	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**	**Lambert Conformal X (km)**	**Lambert Conformal Y (km)**	**Height (m)**
1349.498	-350.859	468	1346.472	-337.331	924			
1350.236	-350.735	457	1347.209	-337.207	901			
1349.345	-349.949	478	1347.946	-337.084	1114			
1350.083	-349.825	576	1348.683	-336.96	1219			
1347.717	-349.286	550	1345.583	-336.544	946			
1348.455	-349.162	472	1346.32	-336.421	983			
1349.193	-349.039	721	1347.056	-336.297	1142			
1349.931	-348.915	759	1346.167	-335.511	1063			
1350.669	-348.791	600						
1351.406	-348.667	517						
1347.564	-348.376	641						
1348.302	-348.252	439						
1349.04	-348.129	607						
1349.778	-348.005	881						
1350.516	-347.881	758						
1347.412	-347.466	920						
1348.15	-347.342	665						
1348.887	-347.219	458						
1349.625	-347.095	585						
1350.363	-346.971	870						
1347.997	-346.432	826						
1348.735	-346.308	518						
1349.473	-346.185	525						
1350.21	-346.061	695						
1350.948	-345.937	892						
1347.845	-345.522	874						
1348.582	-345.398	581						
1349.32	-345.275	573						
1350.057	-345.151	664						
1348.43	-344.488	728						
1349.167	-344.364	694						
1349.905	-344.241	914						
1348.277	-343.578	756						
1349.015	-343.454	631						
1349.752	-343.331	944						
1348.125	-342.668	826						
1348.862	-342.544	624						
1349.599	-342.42	965						
1347.972	-341.758	732						
1348.709	-341.634	685						
1349.446	-341.51	889						
1347.819	-340.848	890						
1348.557	-340.724	697						
1349.294	-340.6	827						
1346.93	-340.061	1096						
1347.667	-339.938	749						
1348.404	-339.814	816						
1349.141	-339.69	1106						
1346.777	-339.151	1055						
1347.514	-339.027	762						
1348.251	-338.904	909						
1348.988	-338.78	1092						
1345.888	-338.364	941						
1346.625	-338.241	813						
1347.362	-338.117	953						
1348.099	-337.994	1097						
1348.835	-337.87	1083						
1345.735	-337.454	923						