Modeling Compliance with the 1-Hour SO_2 NAAQS

Modeling Report
for the
Continental Carbon Company
Ponca City Plant

Prepared by the Engineering Section of the Permitting Unit
Air Quality Division
Oklahoma Department of Environmental Quality

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Table of Contents

1. INTRODUCTION

On June 22, 2010, the Environmental Protection Agency (EPA) revised the primary sulfur dioxide (SO_2) National Ambient Air Quality Standards (NAAQS). The EPA promulgated a new 1-hour annual primary SO_2 standard at a level of 75 parts per billion (ppb), based on the 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentrations. The area designation process typically relies on the air quality concentrations characterized by ambient monitoring data to identify areas that are either meeting or violating the relevant standard. However, a hybrid approach using modeling and monitoring for the designation process was proposed because of the following:

- SO_2 impacts are considered to be "source-oriented" rather than "regional" (peak concentrations of SO_2 are commonly caused by one or a few major point sources in an area and peak concentrations are typically observed relatively close to the source);
- Ambient SO_2 concentrations can be modeled accurately using well understood air quality modeling tools; and
- Only approximately 35% of the monitoring network was addressing locations of maximum (highest) concentrations of specific sources or groups of sources.

On August 21, 2015, EPA promulgated Title 40 of the Code of Federal Regulations (40 CFR) Part 51, Subpart BB, Data Requirements for Characterizing Air Quality for the Primary SO_2 NAAQS (Data Requirements Regulation or DRR). The DRR requires the State of Oklahoma to develop and submit air quality data to characterize the maximum 1-hour ambient air concentrations of SO_2 for any area in which an applicable source is located through either ambient monitoring or air quality modeling analyses. Applicable sources were defined as any source with emissions of greater than 2,000 tons per year (TPY) as determined using the most recent (2014) emission inventory data.

In accordance with § 51.1203(a), in a letter dated January 11, 2016, the State of Oklahoma submitted to EPA a list of applicable sources, identified pursuant to § 51.1202, which are located in the State of Oklahoma and had actual annual SO_2 emissions of 2,000 tons or more. In a letter dated March 21, 2016, EPA concurred with the list of applicable sources submitted by the State of Oklahoma.

In accordance with § 51.1203(b), in a letter dated June 29, 2016, the State of Oklahoma provided EPA notification whether the State of Oklahoma would characterize the peak 1-hour SO_2 concentrations for each applicable source through ambient air quality monitoring or air quality modeling techniques, or would establish federally enforceable emissions limits that would limit the applicable source's SO_2 emissions to less than 2,000 TPY. In addition to the notice of which methodology would be used for characterization of the peak 1-hour SO_2 concentration, in accordance with § 51.1203(d), the State of Oklahoma provided a technical protocol for conducting the modeling for review. The State of Oklahoma consulted with the EPA Region 6 Office when developing the modeling protocol.

In accordance with § 51.1203(d)(3), the State of Oklahoma has conducted the modeling analyses for the applicable sources and the surrounding areas for which the air quality would be characterized through modeling and has generated separate modeling reports for each applicable source.

1.1 Which applicable source is addressed in this modeling report?

This report will exclusively focus on the modeling analysis conducted for the Continental Carbon Company (CCC) Ponca City Plant located in Kay County.

CCC Ponca City Plant 2014 SO_2 Emissions

Emission Unit	Emissions (TPY)
Production Unit 1	1,009
Production Unit 2	1,245
Production Unit 3	1,538
Production Unit 4	2,094

Unit 1 & 2 are routed to the same thermal oxidizer.

A revised emission inventory was submitted on January 28, 2016, reducing the reported emissions from this facility from 6,088 TPY to 5,886 TPY of SO_2.

1.1.1 What changes have occurred at the CCC Ponca City Plant?

Since the "Modeling Protocol for Modeling Compliance with the 1-Hour SO_2 NAAQS" dated December 30, 2015, was drafted, a construction permit was issued on April 25, 2016, for the CCC Ponca City Plant to complete the activities required by Consent Decree Case No. 5:15-cv-00290F. The construction permit authorizes the facility to remove the three thermal oxidizers, which control the four carbon black production units, and replace them with two clean gas and energy cogeneration units (CGEU) which include dry scrubbers for control of SO_2. The CCC Ponca City Plant will reduce its potential to emit (PTE) to 708 TPY of SO_2 by April 2019. Since the facility will still have potential and actual emissions of more than 2,000 TPY of SO_2 after January 13, 2017, an air quality characterization using modeling was conducted for the area surrounding the facility.

2. WHAT MODELING PROGRAMS WERE USED FOR THE AIR QUALITY CHARACTERIZATION MODELING?

Given the source-oriented nature of SO_2, dispersion models are appropriate to characterize the air quality in the area of the applicable source. For air quality characterization modeling for the 2010 1-hour SO_2 primary NAAQS, the AMS/EPA Regulatory Model (AERMOD) was used as outlined in the August 2016, "SO_2 NAAQS Designations Modeling Technical Assistance Document." AERMOD is the preferred air dispersion model because it is capable of handling rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources) to address ambient impacts for the designations process.

The AERMOD modeling system includes the following components:

- AERMOD (Version 15181): the dispersion model;
- AEMAP (Version 11103): the terrain processor for AERMOD;
- AERMET (Version 15181): the meteorological data processor for AERMOD;
- AERMINUTE (Version 15272): the 1-minute ASOS winds per-processor for AERMET;
- BPIPPRIME (Version 01274): the building input processor; and
- AERSUFACE (Version 13016): the surface characteristics processor for AERMET.

3. HOW WAS THE MODELING DOMAIN CREATED FOR THE AIR QUALITY CHARACTERIZATION MODELING?

3.1 How was the modeling domain set up?

The CCC Ponca City Plant is the largest source of SO_2 emissions located in the area. Therefore, the modeling domain was centered over the facility. The following table shows the assigned domain identification (ID) number and name of the corresponding Oklahoma Mesonet meteorological data site.

Facility, Domain ID, and Mesonet Site

Company/Facility	Domain ID	Mesonet Site
CCC Ponca City Plant	5	Blackwell

Based on EPA guidance, the general guideline for determining the distance between an affected source and where the maximum ground level concentration will occur is generally ten (10) times the stack height in flat terrain. The terrain surrounding the CCC Ponca City Plant was reviewed and was determined to have no hills with an elevation at or above the stack height. The facility is located in an area of relatively flat terrain. The following table shows the stack heights of emission units at the plant and the distance within which the expected maximum ground level concentration will occur in flat terrain. Aerial photos of the domain at the state and county levels are included in Appendix A.

Stack Heights and Distance for Maximum Impact

Company/Facility	Stack	Stack Ht. (ft / m)	Distance (km)
CCC Ponca City Plant	Unit 1/2	150 / 45.7	0.46
	Unit 3	150 / 45.7	0.46
	Unit 4	213 / 64.9	0.65

Since the maximum impact is expected to occur less than 1 km from the stack, a domain extending out 10 km from the facility fence line is expected to be of sufficient size to determine the ambient air impacts.

3.2 Is the domain classified as rural or urban?

The determination of whether or not the domain of an affected source should be classified as urban or rural was based primarily on land use (the preferred method). Based on the surrounding land use of the domain, the domain was classified as rural. An aerial photo indicating the area surrounding the facility is included in Appendix C.

3.3 How was the receptor grid generated?

Receptor placement was established to be of sufficient density to provide the resolution needed to detect significant concentration gradients, with receptors placed closer together near the source to detect local gradients and placed farther apart away from the source. In addition, receptors were placed along the fence line (the ambient air boundary of the affected source).

A Cartesian receptor grid was generated by spacing the receptors as follows:

- Receptors spaced at 100 m along the fence line of the affected source;
- Receptors spaced at 100 m from the fence line out to 1 km;
- Receptors spaced at 250 m from 1 km out to 2.5 km;
- Receptors spaced at 500 m from 2.5 km to 5 km; and
- Receptors spaced at 1 km from 5 km out to 10 km (the edge of the domain).

An aerial photo of the domain with the receptors is included in Appendix B. Fence line data are contained in the Microsoft Excel workbook *SO2 DRR - Modeling Data - CCC Ponca City Plant.xlsx*.

3.4 What terrain data was used and how was it utilized?

Terrain data obtained from the United States Geological Survey (USGS) Seamless Data Server at http://viewer.nationalmap.gov/viewer/ was used to determine the receptor base elevation and hill height elevation. The 1/3 arc-second National Elevation Data (NED) was obtained in the GeoTIFF format for use with AERMAP. Interpolation of receptor and source heights from the 1/3 arc-second NED elevation data is based on the current AERMAP guidance in Section 4.4 of the *User's Guide for the AERMOD Terrain Processor (AERMAP)* (EPA-454/B-03-0003, 10/2004). AERMAP uses a distance weighted bilinear interpolation method. This domain falls entirely in UTM Zone 14. All coordinates were based on the North American Datum (NAD) of 1927 (NAD27).

4. WHAT SOURCE DATA WILL BE USED IN THE AIR QUALITY CHARACTERIZATION MODELING?

4.1 What were the modeled source types and configuration?

All of the modeled sources were point sources. Stack parameters and facility data (building and fence line data) were submitted by the affected facility. The facility data was then reviewed and checked for consistency with emission inventory data and aerial images including location (i.e., latitude and longitude or Universal Transverse Mercator (UTM) coordinates and datum) of the emission unit's stack relative to the nearby buildings or structures. An aerial photo indicating the facility data superimposed onto the aerial photos are included in Appendix D. Stack parameters for each of the modeled sources is included in Appendix E and the Microsoft Excel workbook *SO2 DRR - Modeling Data - CCC Ponca City Plant.xlsx*.

4.2 What nearby sources were included in the modeling domain?

In determining which nearby sources should be included in the modeling domain, all sources within 20 km of the applicable source were evaluated. All natural gas fired sources that were not part of the CCC Ponca City Plant were excluded from the 2010 1-hour SO_2 NAAQS air quality characterization because of the following:

- They do not cause a significant concentration gradient;
- They are not expected to cause or contribute to a NAAQS violation; and
- They are represented via the background concentrations.

There are four facilities that were included in the modeling analysis:

- Magellan Pipeline Company, LP, Ponca City Station;
- Phillips 66 Company – Ponca City Refinery, Ponca City Refinery;
- Jupiter Sulfur, LLC, Nitrogen Sulfur Fertilizer Facility;
- Oklahoma Gas & Electric, Sooner Generating Station.

4.3 How were intermittent sources addressed?

For the 2010 1-hour SO_2 NAAQS air quality characterizations, modeling of sources with intermittent emissions, such as emergency generators and limited intermittent startup/shutdown emissions were not included based on the recommendations in the March 1, 2011 memorandum "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standards." As a general guidance, sources that operated less than 100 hours per year were excluded. Diesel-fired generator engines located at the CCC Ponca City Plant and at the Phillip 66 Company –Ponca City Refinery were excluded from the air quality characterization.

4.4 What were the modeled sources' emission inputs based on?

Since the modeling is being used as a surrogate to ambient monitoring (i.e., modeling simulates a monitor), the emissions included in the modeling were based on the most recent three years of actual emissions data that were concurrent with the meteorological dataset.

4.4.1 How were hourly emissions from the modeled sources determined?

Actual emission data for input into AERMOD was generated for modeled source. Most electric generating units (EGU) have continuous emissions monitoring systems (CEMS). CEMS data was used to generate hourly emissions files for the OG&E Sooner Generating Station using the following methodology:

Step 1: CEMS data was downloaded from the Clean Air Markets Database (CAMD): https://ampd.epa.gov/ampd/QueryToolie.html.

Step 2: The monthly data was combined into annual emission data files.

Step 3: The emissions for the hourly emission file were generated from the CAMD dataset. CEM data provided by OG&E was used to establish the stack temperature and velocity for the hourly emission file.

Step 4: The data was reviewed for continuity and for missing data. Missing data was replaced based on review of operational data.

Emissions and flow rates for the other sources included in the model were based on actual operational data that were concurrent with the meteorological dataset.

4.5 How was GEP stack height addressed?

Good Engineering Practice (GEP) stack height is the minimum stack height needed to prevent the stack exhaust plume from being entrained in the wake of nearby obstructions. For the 2010 1-hour SO_2 NAAQS air quality characterization, actual stack heights were used rather than following the GEP stack height policy. The stack heights at the CCC facility were all less than 65 meters. Therefore, all stacks were below the GEP stack height.

4.6 Was building downwash included in the modeling analysis?

When one or more structures interrupt the wind flow, an area of turbulence called building downwash is created. Pollutants emitted at a fairly low level (e.g., a roof, vent, or short stack) can be caught in this turbulence, affecting their dispersion. Modeling including calculations for building downwash gives a more accurate representation of pollutant impacts than does modeling that omits consideration of downwash effects. Therefore, the air quality characterization modeling includes building downwash and was implemented using BPIP-PRIME.

CCC submitted information regarding buildings located on their property. These parameters were used as inputs into BPIP-PRIME to calculate building downwash parameters for input into AERMOD. The building data used in the modeling is included in the Microsoft Excel workbook *SO2 DRR - Modeling Data - CCC Ponca City Plant.xlsx*.

5. WHAT METEOROLOGICAL DATA WAS USED IN THE AIR QUALITY CHARACTERIZATION MODELING?

5.1 What meteorological data was used?

When conducting air dispersion modeling, the State of Oklahoma utilizes meteorological data from the following:

- Oklahoma Mesonet 5-Minute Average Surface Data;
- National Centers for Environmental Information (NCEI), formerly National Climatic Data Center (NCDC), Integrated Surface Hourly Database (ISHD) Surface Data; and
- Earth System Research Laboratory (ESRL) Global Systems Division (GSD), formerly Forecast Systems Laboratory (FSL), Upper Air (UA) data.

Oklahoma Mesonet data is incorporated to help make more accurate forecasts of ambient impacts from modeled sources. Incorporation of Oklahoma Mesonet data makes the AERMET-processed meteorological data more accurate because the datasets contain sub-hourly values and the sites are usually closer to and more representative of the areas being modeled. Standard ISHD surface data usually only contains a single two minute average recorded during an hour whereas Oklahoma Mesonet datasets contain twelve five minute averages for each hour.

The 2012-2014 meteorological data from the Blackwell (BLAC) Oklahoma Mesonet surface station was used in conjunction with ISHD surface data from the Ponca City Municipal Airport (KPNC) in Kay County, Oklahoma and ESRL UA data from the Max Westheimer Airport (OUN) in Cleveland County, Oklahoma for the modeling analysis. Information for the selected sites is included in Appendix F. A wind rose for the meteorological data utilized is contained in Appendix G.

5.1.1 What is Oklahoma Mesonet data and how was it processed?

The Oklahoma Mesonet is a world-class network of meteorological monitoring stations. The Oklahoma Mesonet is unique in its capability to measure a large variety of meteorological conditions at so many sites across an area as large as Oklahoma. Oklahoma Mesonet data is provided courtesy of the Oklahoma Mesonet, a cooperative venture between Oklahoma State University (OSU) and the University of Oklahoma (OU) and supported by the taxpayers of Oklahoma. Additional information regarding the Oklahoma Mesonet can be viewed at the following web site: http://www.mesonet.org. At each site, the meteorological conditions are continuously measured and packaged into 5-minute observations. These 5-minute observations from the Oklahoma Mesonet were processed into an AERMET acceptable format.

Meteorological data from Oklahoma Mesonet sites surrounding CCC Ponca City Plant were utilized to evaluate the wind flow patterns in the area. The BLAC Oklahoma Mesonet station (located approximately 19.4 km W 31.6°N from the center of the domain) was determined to be the most representative Oklahoma Mesonet station for the domain.

5.1.2 How was data from the ISHD processed?

The ISH data files were downloaded from the NCDC ISHD web site: ftp://ftp.ncdc.noaa.gov/pub/data/noaa. The ISH data was reviewed for completeness by evaluating the number of hours that were recorded and the number of cloud cover values that were recorded. The primary ISH station (KPNC), located approximately 8.7 km N 19.7°W from the center of the domain, was determined to be the most representative site for the domain. Records with missing cloud cover data were substituted with cloud cover data from other records during the same hour. The Blackwell Tonkawa Municipal Airport (KBKN) southeast of Blackwell, Oklahoma, was designated as the secondary ISH station and is located approximately 26.4 km W 19.7°N from the center of the domain. The secondary ISH station was used for additional data substitution. Records from KBKN were used to replace hours of KPNC data that were completely missing and to replace missing cloud cover data.

5.1.2.1 Was AERMINUTE utilized in the modeling analysis?

There are two types of ISHD surface stations; Automated Surface Observing Systems (ASOS) and Automated Weather Observing Systems (AWOS). All ASOS stations record continuous sub-hourly (2-minute averages) wind data. KPNC is an ASOS site. Therefore, AERMINUTE was utilized for this air quality characterization.

5.1.3 How was the upper air data processed?

The ESRL data files were downloaded from the ESRL ROAB web site: http://esrl.noaa.gov/raobs/. Selection of appropriate ESRL UA data to use in the meteorological data set was primarily based on proximity to the domain and included a review for missing soundings. Upper air data from the Max Westheimer Airport (OUN) in Norman, Oklahoma (located at approximately 162 km S 12.9°W from the center of the domain) was determined to be the most representative upper air site for the domain. The ESRL UA stations usually take soundings twice a day. A single missing sounding can cause a whole day (24 hours) of missing meteorological data values. To reduce the number of missing meteorological data, replacement soundings were substituted for missing soundings. The replacement soundings were selected from a site with similar thermodynamic profiles. The upper air data from the Dallas-Fort Worth Airport (DFW) in Fort-Worth, Texas was used to substitute missing soundings.

5.1.4 How were surface characteristics determined?

When using AERMET, three surface characteristics (Albedo, Bowen Ratio, and Surface Roughness Length) must be determined for the meteorological stations. Albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux.

Surface roughness length is related to the height of obstacles to the wind flow and is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer. Albedo and Bowen Ratio are used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux.

AERSURFACE uses land cover data from the U.S. Geological Survey (USGS) National Land Cover Data 1992 archives (NLCD92) to determine the land cover types for a specified location. AERSURFACE matches the NLCD92 land cover categories to seasonal values of Albedo, Bowen Ratio, and Surface Roughness and then calculates the surface characteristics for input into AERMET. NLCD92 data in GeoTIFF format was downloaded from the Multi-Resolution Land Characteristics (MRLC) Consortium at the following link: http://www.mrlc.gov/viewerjs/. Seasonal surface characteristics for the CCC Ponca City Plant, BLAC, and KPNC, are included in Appendix H.

5.1.5 What was used to determine the surface moisture conditions?

The monthly rainfall for the Oklahoma Mesonet site was analyzed from the beginning of the establishment of the Oklahoma Mesonet program (approximately 20 years). The surface moisture conditions (Average, Wet, Dry) for each month were then determined using the monthly rainfall amounts compared to the average rainfall. These determinations were based on the guidance contained in the AERSURFACE User's Guide. The Bowen Ratio was then assigned as either average, dry, or wet based on the monthly surface moisture conditions for the BLAC Oklahoma Mesonet station. Moisture conditions for each month are included in Appendix H.

6. WHAT BACKGROUND MONITORING DATA WAS USED IN THE AIR QUALITY CHARACTERIZATION MODELING?

6.1 What background monitoring data will be utilized?

Background concentrations were added to the impacts from the 2010 1-hour SO_2 NAAQS air quality characterization modeling analyses. Monitoring data was obtained from the EPA air data web site: http://www.epa.gov/air/data/index.html. Background concentrations were based on the most recent complete year(s) of available monitoring data in the form of the standard indicated below. Only data meeting the minimum data collection requirements or the minimum percent observations were used when determining the design values.

Pollutant	Averaging Period	Basis of Design Value
SO_2	1-hour	3 year average of 99^{th} Percentile 1-hour daily maximum

The inclusion of ambient monitored background concentrations in the model results is important in determining the projected cumulative impact of the affected sources and other contributing nearby source impacts. A uniform monitored background concentration based on the monitored design values for the latest 3-year period was based on a "regional site" (i.e., a site that is located away from the areas of interest but is impacted by similar natural and distant man-made sources).

All of the monitoring sites in the state of Oklahoma and their related design concentrations are shown in the following table.

2012-2014 Monitoring Design Values

Monitor ID	County	Latitude	Longitude	Conc. μg/m^3
40-001-9009	Adair	35.75074	-94.66970	39.5
40-071-0604	Kay	36.69727	-97.08130	99.5
40-101-0167	Muskogee	35.79313	-95.30220	129.2
40-109-1037	Oklahoma	35.61413	-97.47510	9.6
40-143-0175	Tulsa	36.14988	-96.01170	100.4
40-143-0179	Tulsa	36.15483	-96.01580	72.0
40-143-0235	Tulsa	36.12695	-95.99890	46.3
40-143-1127	Tulsa	36.20490	-95.97650	36.0

All of the monitoring sites are impacted by large SO_2 sources except for the monitor located in Oklahoma County. The monitors in Tulsa County are impacted by the Holly Tulsa Refinery and the PSO Northeastern Power Station. The monitor located in Muskogee County is impacted by the OG&E Muskogee Generating Station and the Georgia Pacific Muskogee Mill. The monitor in Kay County is impacted by the Continental Carbon Ponca City facility and the Phillips 66 Ponca City Refinery. The monitor in Adair County is impacted by the Flint Creek Power Plant. Therefore, the impacts from the Oklahoma County monitor were used to represent background impacts from area sources for all modeling domains.

The modeled sources include all of the large sources of SO_2 emissions near the domain (i.e. OG&E Sooner Generating Station). Therefore, only area sources of SO_2 emissions need to be accounted for making the Oklahoma City monitor the most representative. The Kay county monitor is located just north of the Phillips 66 Company –Ponca City Refinery and is impacted by both the refinery and the CCC Ponca City Plant. Use of the Kay County monitor to represent the background concentration would double count the impacts from the facilities included in the model. The model predicted impacts at the location of the monitor (81.5 μg/m^3) was within 18 % of the monitor design value.

7. WHAT WERE THE MODELING RESULTS?

The table below shows the results of the air quality characterization analysis for the CCC Ponca City Plant. The results of the modeling analysis are the three year average of the highest fourth highest (H4H) daily maximum impact or the three year average of the 99th percentile daily maximum impact.

Modeling Impacts for the CCC Ponca City Plant Domain

Domain	Source Group	Modeled Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)
D5	ALL	161.0	9.6	170.6

[1] - The ALL source group represents the impacts from all modeled sources.

Based on the modeling review, the domain is in compliance with the 2010 1-hour SO_2 NAAQS of 75 ppb (196.4 µg/m^3 based on EPA Reference Conditions, 40 CFR §50.3).

8. WHAT REFERENCES WERE USED?

- *Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS* (March 1, 2011);
  - http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

- *Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program* (August 23, 2010);
  - https://www.epa.gov/sites/production/files/2015-07/documents/appwso2.pdf

- *Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 NAAQS* (August 23, 2010);
  - http://www.epa.gov/ttn/scram/guidance/clarification/ClarificationMemo_AppendixW_Hourly-SO2-NAAQS_FINAL_08-23-2010.pdf

- *SO_2 NAAQS Designations Modeling Technical Assistance Document* (August 2016);
  - https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf

- Guidance for 1-Hour SO2 NAAQS SIP Submissions (April 23, 2014);
  - https://www.epa.gov/sites/production/files/2016-06/documents/20140423guidance_nonattainment_sip.pdf

- User's Guide for the AMS/EPA Regulatory Model - AERMOD
  - http://www.epa.gov/ttn/scram/models/aermod/aermod_userguide.zip.

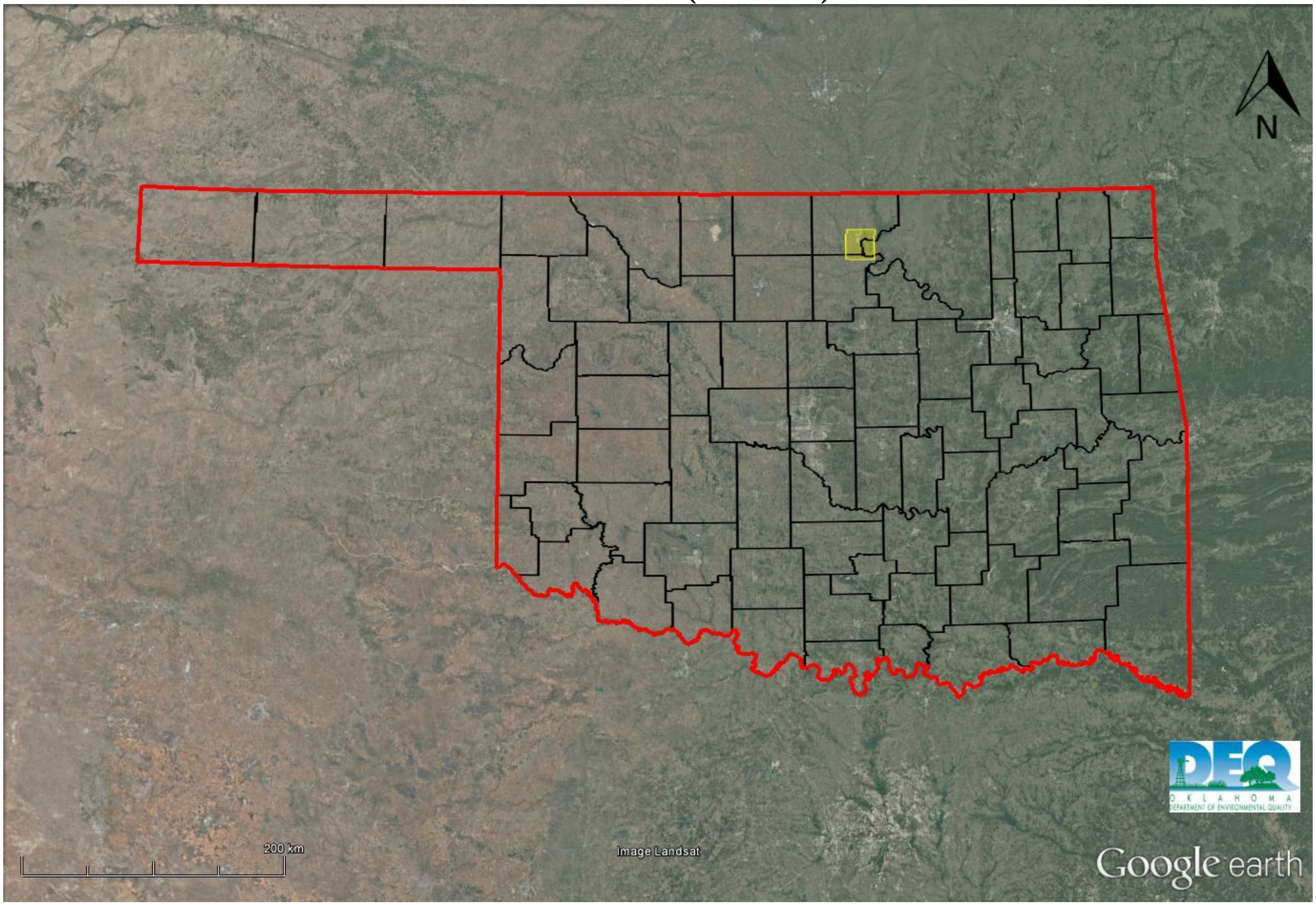
- User's Guide for the AERMOD Meteorological Data Preprocessor (AERMET)
  - http://www.epa.gov/ttn/scram/7thconf/aermod/aermet_userguide.zip.

- AERMINUTE User's Instruction
  - http://www.epa.gov/ttn/scram/7thconf/aermod/aerminute_14337.zip.

- AERSURFACE User's Guide
  - http://www.epa.gov/ttn/scram/7thconf/aermod/aersurface_userguide.pdf

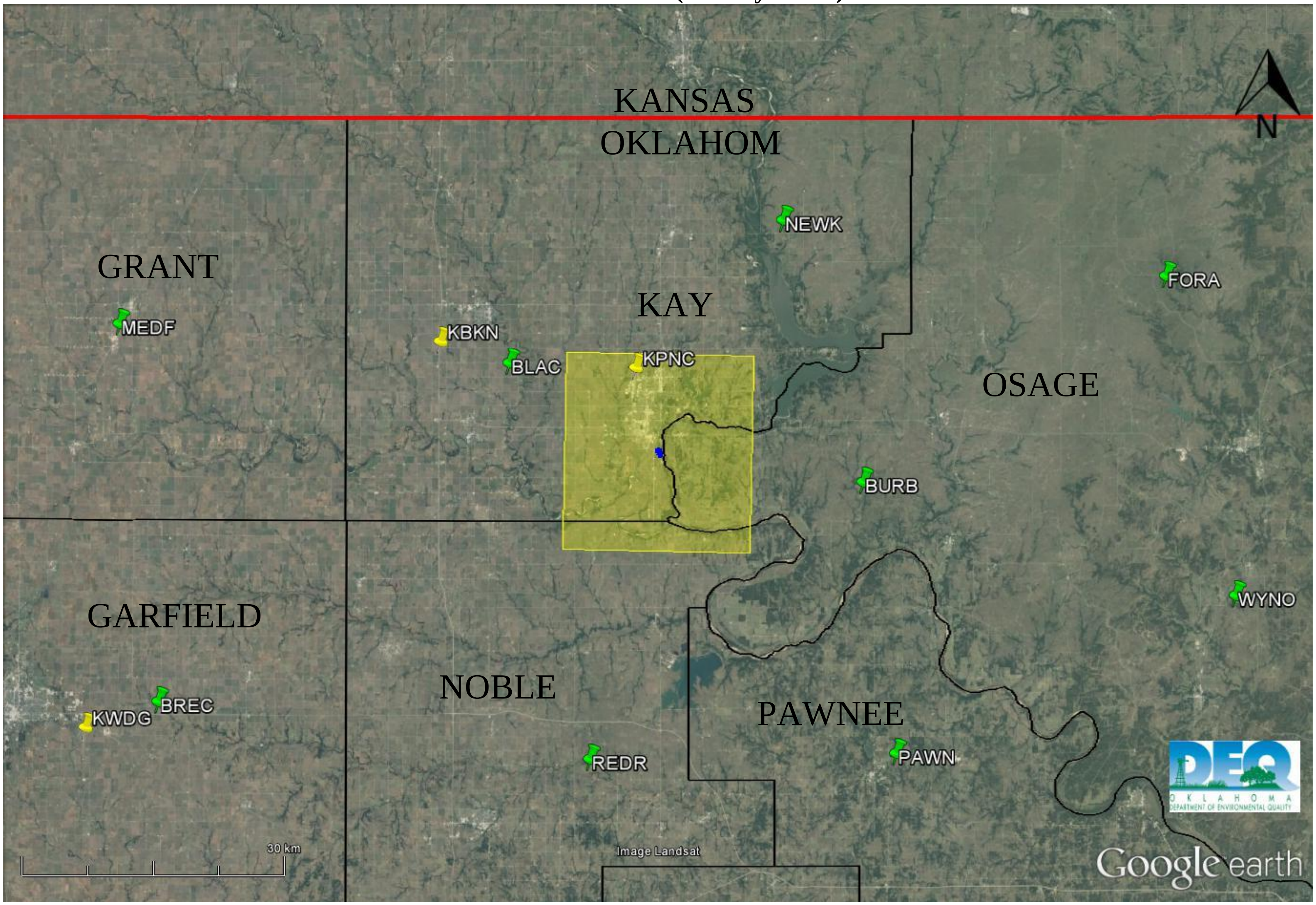
APPENDIX A DOMAIN LOCATION

Domain Location (State Level)



* Boundaries: Red – State of Oklahoma; Black - Oklahoma Counties; Yellow – Modeling Domain.

Domain Location (County Level)

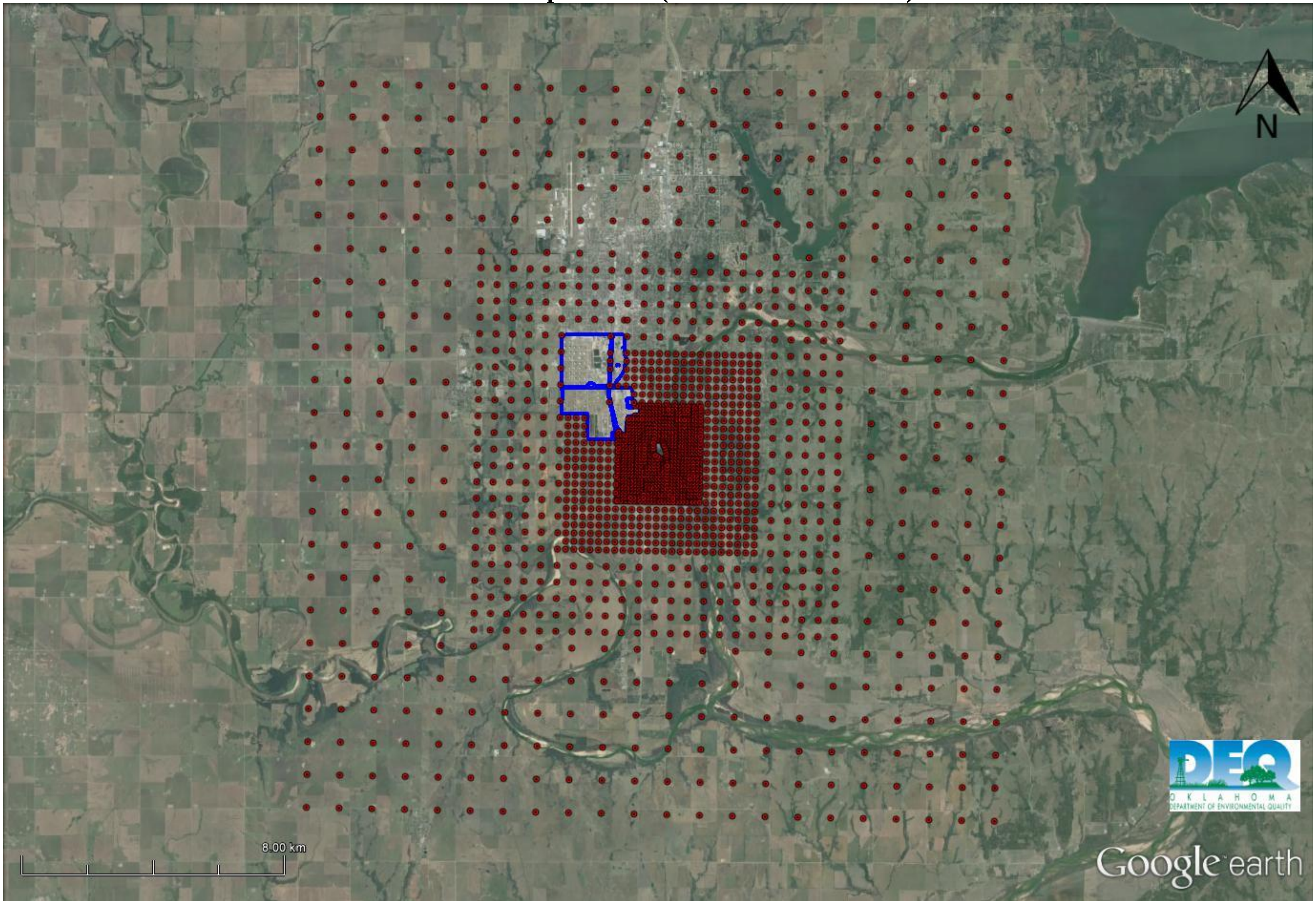


* Red – Oklahoma/Kansas Boarder; Black - Oklahoma County Lines; Yellow Area – Modeling Domain; Green Push-Pin – Mesonet Stations; Yellow Push Pins – ISH Stations.

** Blue property boundary identifies the CCC Ponca City Plant.

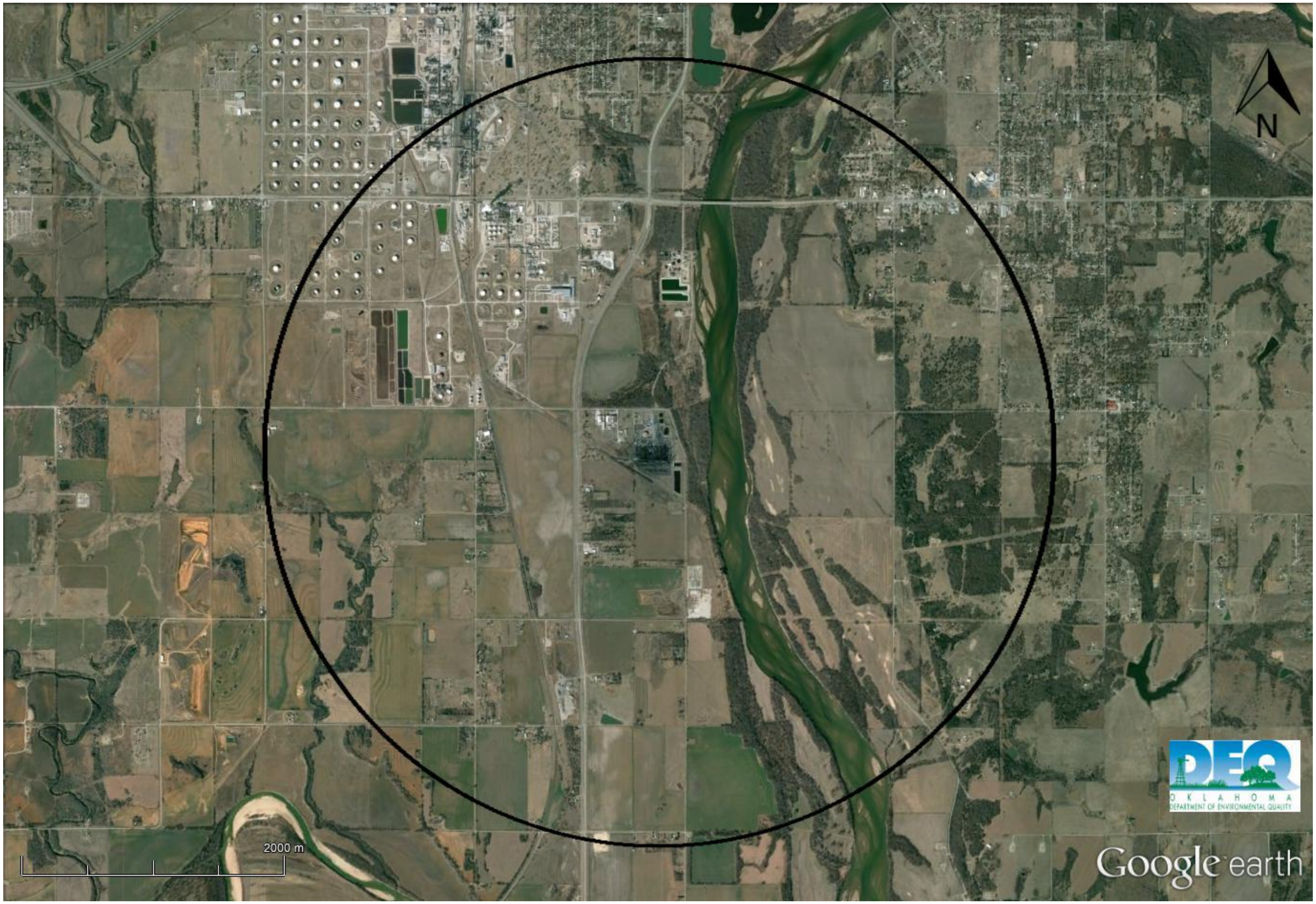
APPENDIX B DOMAIN RECEPTOR GRID

Domain Receptor Grid (10 km from fence line)



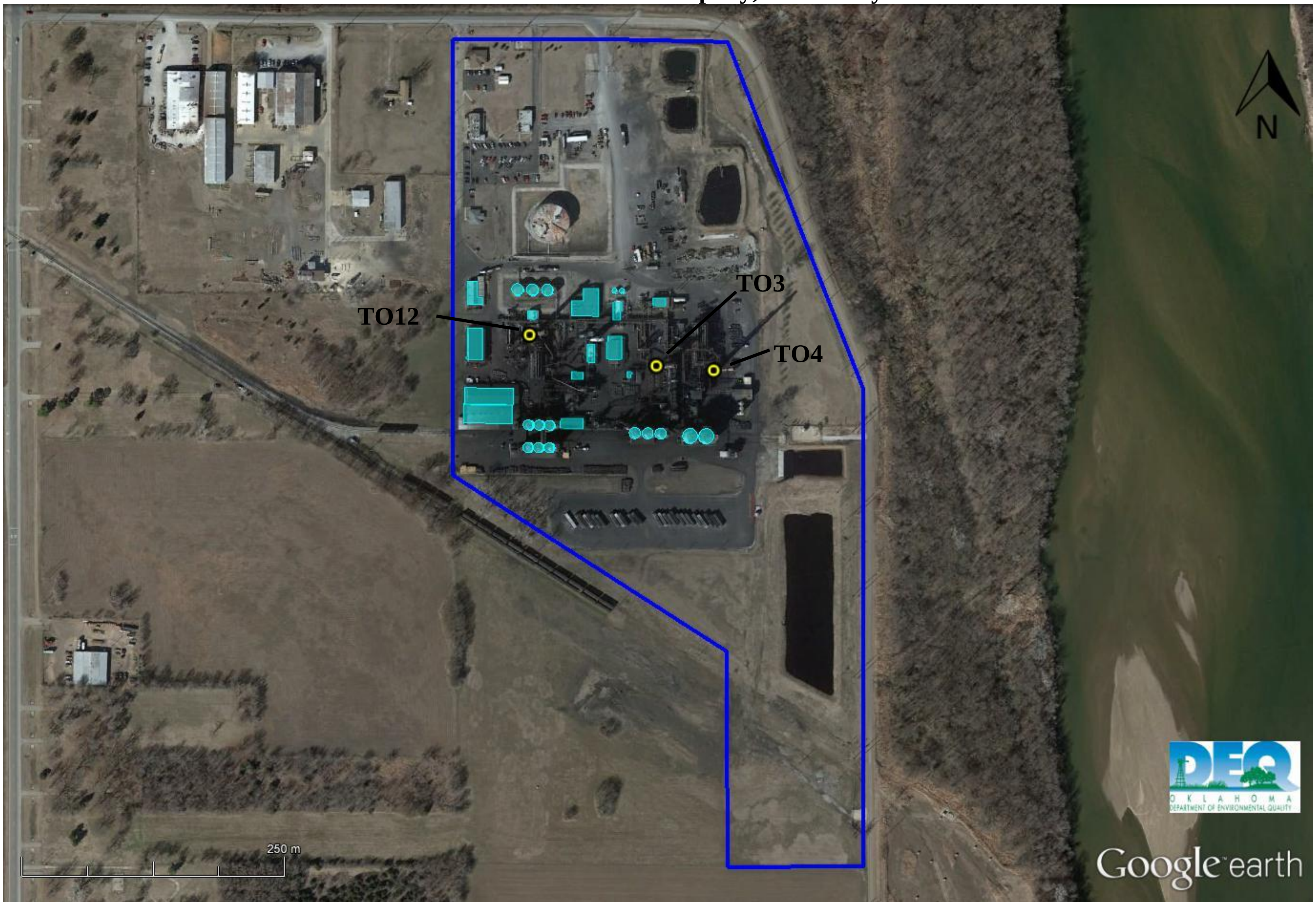
APPENDIX C LAND USE/LAND COVER AREAL PHOTO

Aerial Photo with 3 km Radius Circle



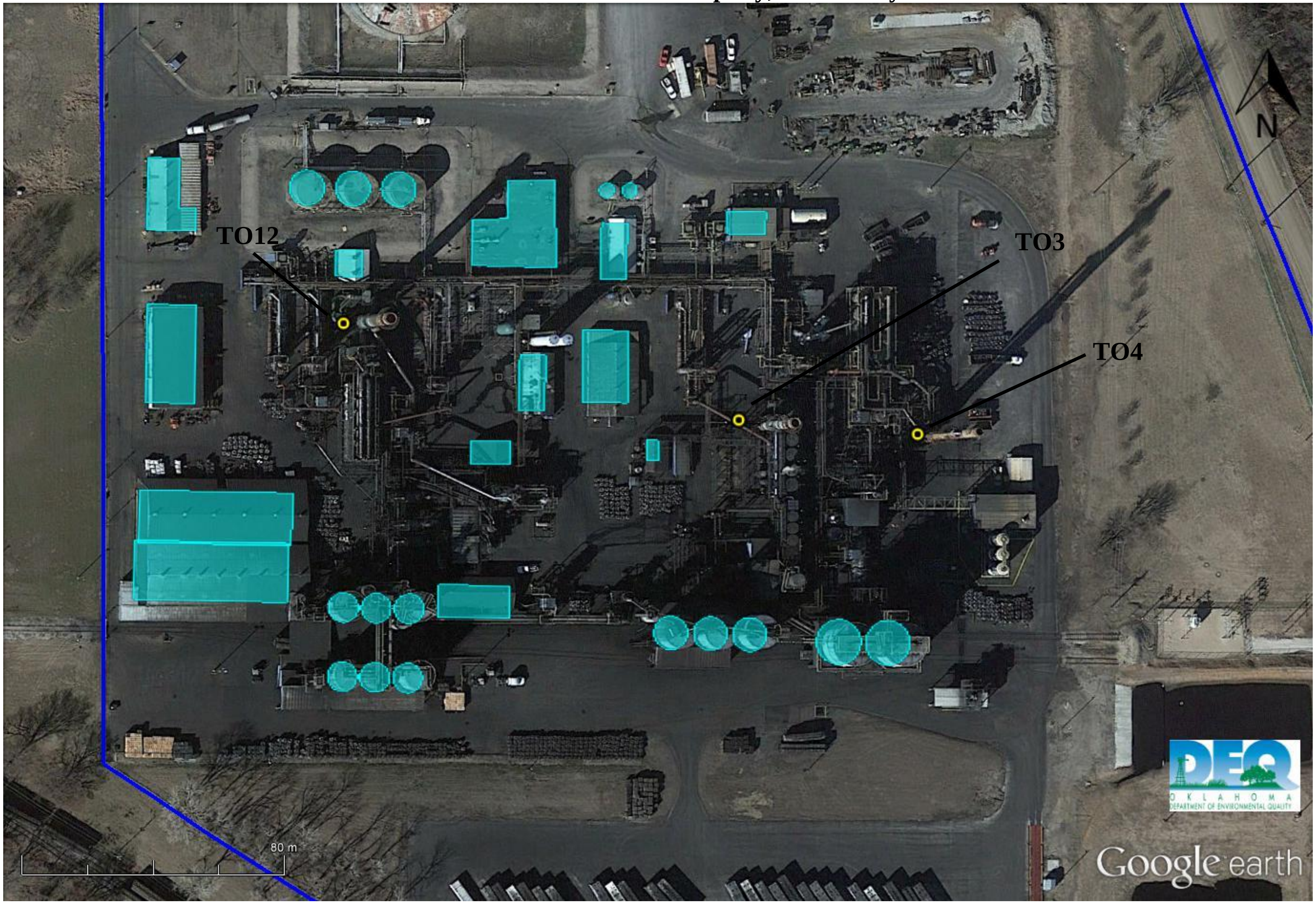
APPENDIX D AERIAL PHOTO OVERLAID WITH FACILITY DATA

Continental Carbon Company, Ponca City Plant



* Cyan – Buildings; Blue – Property boundary; Yellow – Point Sources.

Continental Carbon Company, Ponca City Plant



* Cyan – Buildings; Blue – Property boundary; Yellow – Point Sources.

APPENDIX E SOURCE DATA

CCC Ponca City Plant Source Data

Source ID	Description	Easting	Northing	Elevation	Stk Ht.	Temp.	Velocity	Stk. Dia.	SO_2
		(m)	(m)	(m)	(ft)	(°F)	(fps)	(ft)	(lb/hr)
TO4	Thermal Oxidizer 4	672619.2	4059054.1	293.1	213.3	1599.0	119.8	7.0	447.11
TO12	Thermal Oxidizer 1/2	672443.6	4059084.2	293.6	150.0	1648.0	60.8	11.5	610.46
TO3	Thermal Oxidizer 3	672564.6	4059057.3	293.5	150.0	1574.0	52.8	9.5	339.96

OG&E Sooner Generating Station Source Data

Source ID	Description	Easting	Northing	Elevation	Stk Ht.	Temp.	Velocity	Stk. Dia.	SO_2
		(m)	(m)	(m)	(ft)	(°F)	(fps)	(ft)	(lb/hr)
1	Unit 1	674572.1	4036106.8	286.1	500.0	264.0	60.0	20.0	2012.1
2	Unit 2	674497.9	4036137.0	286.2	500.0	264.0	59.0	20.0	1841.9

Phillips 66 Ponca City Refinery Source Data

Source ID	Description	Easting	Northing	Elevation	Stk Ht.	Temp.	Velocity	Stk. Dia.	SO_2
		(m)	(m)	(m)	(ft)	(°F)	(fps)	(ft)	(lb/hr)
H0001	No. 1 CTU Atm Tower Feed Heater	670836.9	4061657.3	303.6	120.0	557.0	37.6	8.4	0.750
H0003	No. 4 CVU Feed Heater	670905.7	4061669.4	304.6	100.0	769.0	27.5	5.0	0.140
H0004	No. 4 CTU Feed Heater	670886.8	4061677.9	304.4	80.0	714.0	34.6	6.3	0.450
H0005	No. 1 CTU Tar Stripper Feed Heater	670864.6	4061667.5	304.0	82.0	632.0	19.7	6.0	0.260
H0010	Saturate Gas Plant Naphtha Reboiler	670819.0	4061580.0	302.4	92.0	632.0	24.2	4.8	0.200
H0023	No. 5 HDT Heater	671122.7	4061407.7	300.5	105.0	632.0	17.6	3.0	0.040
H0028	No. 7 Coker Heater	671057.5	4061500.4	300.8	165.0	428.0	28.8	7.5	0.260
H0029	No. 7 Coker Heater	671057.5	4061500.4	300.8	165.0	428.0	28.8	7.5	0.130
H0046	No. 2 HDS Feed Heater	671009.4	4061216.1	301.5	60.0	632.0	34.9	3.5	0.120
H0048	No. 2 CRU Heater	671004.5	4061199.7	301.5	171.0	574.0	17.9	11.0	0.510

Phillips 66 Ponca City Refinery Source Data

Source ID	Description	Easting	Northing	Elevation	Stk Ht.	Temp.	Velocity	Stk. Dia.	SO_2
		(m)	(m)	(m)	(ft)	(°F)	(fps)	(ft)	(lb/hr)
H6007	No. 3 CRU Heater	671143.5	4062249.1	302.2	124.0	940.0	30.0	7.5	0.180
H6008	Butane Dryers Regenerator Heater	671255.0	4060896.5	307.2	40.0	632.0	8.3	2.3	0.010
H6012	No. 3 HDS Heater	671154.5	4062242.7	301.6	90.0	632.0	33.6	4.2	0.040
H6013	No. 3 CRU Heater	671165.2	4062244.1	301.4	92.0	632.0	10.7	6.0	0.110
H6014	No. 2 CVU Feed Heater	671157.8	4062249.4	301.8	140.0	635.0	9.1	7.3	0.130
H6015	No. 2 CTU Feed Heater	671239.6	4062201.9	299.2	160.0	658.0	22.7	6.3	0.110
H6151	No. 4 FCCU Feed Preheater	671247.9	4062253.8	300.4	131.0	632.0	27.2	6.0	0.110
H0011	No. 7 HDT Heater	670837.9	4061574.9	302.5	95.0	632.0	13.1	2.8	0.010
NO.4FCC	No. 4 Fluidized Bed Catalytic Cracking Unit Catalyst Regenerator	671277.2	4062246.2	300.7	175.0	423.0	81.3	4.5	1.120
NO.5FCC	No. 5 Fluidized Bed Catalytic Cracking Unit Catalyst Regenerator	671179.4	4060857.6	307.0	175.0	147.0	46.3	8.5	8.240
FLARESP	South Plant Flare	671403.5	4060469.6	301.1	199.0	1832.0	65.3	3.0	1.020
FLARECC	Coker/Combo Alky Flare	670846.4	4061102.2	301.3	150.0	1832.0	65.6	2.5	10.630
FLAREEP	East Plant Flare	671223.6	4062045.4	295.9	245.0	1832.0	65.6	2.5	3.130
H7501	No. 6 HDT Heater	671131.2	4061390.9	300.9	106.0	632.0	33.7	3.4	0.050
H6005	No. 2 CTU Preflash Reboiler Heater	671170.1	4062225.4	301.0	149.0	657.0	18.0	8.3	0.260
H8601	No. 8 HDT Splitter Reboiler Heater	670725.9	4061857.9	302.4	130.0	582.0	16.2	8.5	0.350
H8602	No. 8 HDT Heater	670731.5	4061843.6	302.4	130.0	536.0	14.0	4.0	0.130
H8801/02	No. 1 Hydrogen Plant Reformer Heater	670790.7	4061925.8	304.1	129.0	411.0	64.0	3.8	0.020
FLARECF	Clean Fuels and West Plant Flare	670532.6	4061690.9	301.3	198.0	1832.0	65.3	3.5	0.845
B0008	Main Power Plant Steam Boiler	670867.1	4061766.3	304.6	162.0	336.0	12.6	8.0	1.430
H0016	No. 1 CVU Feed Heater	670832.4	4061582.5	302.5	157.0	818.0	37.1	5.8	0.430
H1001	No. 4 HDT Heater	671060.1	4061237.4	301.7	130.0	933.0	100.1	2.8	0.060
TEMPEQP	Temporary Equipment Operating Emissions (Misc.)	670516.7	4061137.8	305.3	3.0	368.0	342.2	0.2	0.850
B9/B10	Main Power Plant Steam Boiler	670863.5	4061859.5	304.9	89.0	305.0	31.8	11.8	1.850

Phillips 66 Ponca City Refinery Source Data

Source ID	Description	Easting	Northing	Elevation	Stk Ht.	Temp.	Velocity	Stk. Dia.	SO_2
		(m)	(m)	(m)	(ft)	(°F)	(fps)	(ft)	(lb/hr)
H9851	No. 2 Hydrogen Plant Reformer Heater	670740.7	4061922.5	303.3	129.0	431.0	58.4	6.5	0.530
H9901	No. 9 HDT Heater	670730.2	4062002.2	303.7	130.0	635.0	17.6	4.1	0.160
H9902	No. 9 HDT Stripper Reboiler Heater	670729.5	4061991.1	303.6	130.0	671.0	24.0	4.4	0.110
H5002	No. 5 FCC Feed Preheater	671251.9	4060907.0	307.3	167.0	543.0	9.6	6.5	0.205
B0021	Leased Boiler No. 1	670943.2	4061717.9	305.2	33.3	309.0	31.3	3.0	0.030
B0022	Leased Boiler No. 2	670943.6	4061696.8	305.1	33.3	309.0	31.3	3.0	0.030
H0060	Alky Depropanizer Heater	670819.0	4061310.3	301.9	146.0	507.0	20.0	7.5	0.150
H9301	BFU Heater	670867.9	4061907.3	305.0	199.0	691.0	36.6	8.6	0.480

APPENDIX F 2012-2014 OKLAHOMA MESONET SITE & ASSOCIATED ISH & ESRL STATION

Mesonet Station

ID	Station #	Name/City	County	State	Latitude	Longitude	Elev. (m)	Commissioned	Retired
BLAC	11	Blackwell	Kay	OK	36.7544	-97.2545	304	01/01/1994	NA

ISHD Stations

Call Sign	USAF #	WBAN #	Name	County	State	Latitude	Longitude	Elev. (m)
KPNC	724530	13969	Ponca City Municipal Airport	Kay	OK	36.7369	-97.1024	303.9
KBKN	720625	00212	Blackwell Tonkawa Municipal Airport[1]	Kay	OK	36.7507	-97.3503	313.0

[1] - The WBAN changed in 2014 to 00212.

ESRL Station

Call Sign	WMO #	WBAN #	Name	County	State	Latitude	Longitude	Elev. (m)
OUN	723570	03948	Norman/Max Westheimer Airport	Cleveland	OK	35.23	-97.47	362

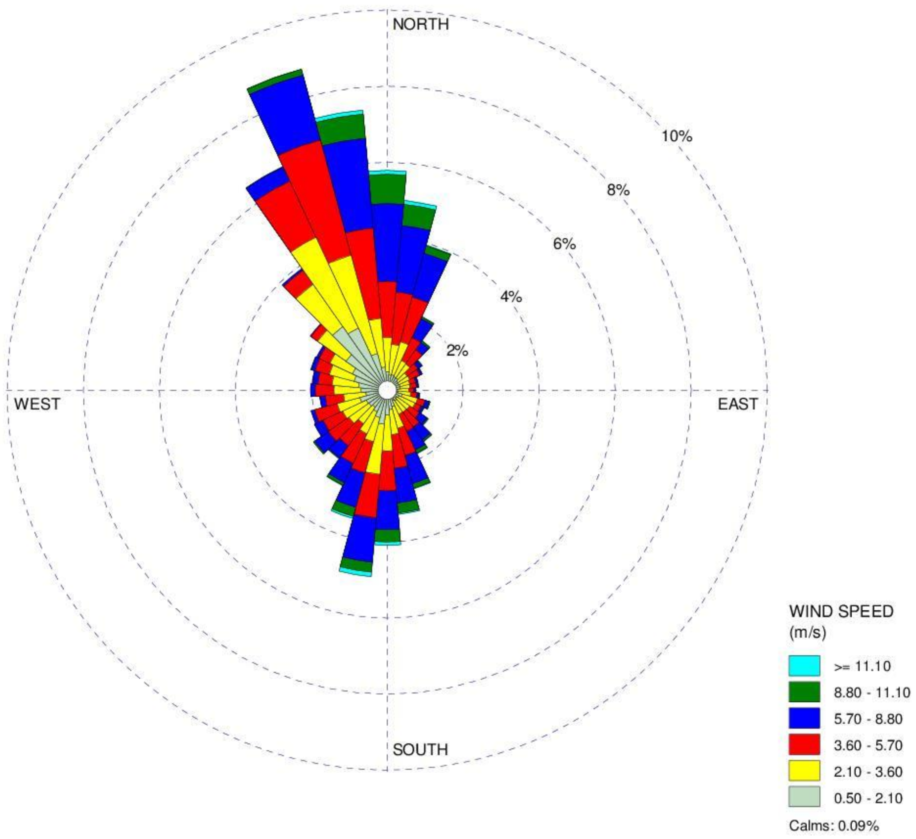
APPENDIX G WIND ROSES

WIND ROSE PLOT:

BLAC

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2012 - 00:00 **End Date: 12/31/2014 - 23:59**		
		MODELER:	
	CALM WINDS: **0.09%**	TOTAL COUNT: **26290 hrs.**	
	AVG. WIND SPEED: **4.10 m/s**	DATE: **10/17/2016**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

APPENDIX H SURFACE CHARACTERISTICS

Facility Domain Surface Characteristics

CCC	Albedo	Bowen Ratio (Average)	Bowen Ratio (Wet)	Bowen Ratio (Dry)	Surface Roughness
Winter	0.18	0.78	0.44	1.79	0.020
Spring	0.16	0.40	0.27	1.05	0.034
Summer	0.18	0.56	0.34	1.41	0.066
Fall	0.18	0.78	0.44	1.79	0.066

Modeling Domain Surface Characteristics

BLAC	Albedo	Bowen Ratio (Average)	Bowen Ratio (Wet)	Bowen Ratio (Dry)	Surface Roughness
Winter	0.18	0.74	0.42	1.94	0.017
Spring	0.15	0.32	0.22	1.00	0.035
Summer	0.19	0.54	0.32	1.54	0.145
Fall	0.19	0.74	0.42	1.94	0.145

Modeling Domain Surface Characteristics

KPNC	Albedo	Bowen Ratio (Average)	Bowen Ratio (Wet)	Bowen Ratio (Dry)	Surface Roughness
Winter	0.18	0.84	0.48	2.10	0.017
Spring	0.16	0.42	0.29	1.19	0.033
Summer	0.19	0.64	0.38	1.72	0.074
Fall	0.19	0.84	0.48	2.10	0.069

Modeling Domain Moisture Conditions[1]

Year	2012	2013	2014
January	A	W	D
February	W	W	D
March	W	D	A
April	W	A	D
May	D	W	W
June	D	A	W
July	D	W	W
August	D	A	A
September	D	A	A
October	D	A	A
November	A	A	A
December	D	A	A

[1] - Moisture conditions based on rainfall data from the BLAC Oklahoma Mesonet station unless otherwise noted.
A - Average (precipitation in the middle 40^{th} percentile);
D - Dry (precipitation in the lower 30^{th} percentile);
W - Wet (precipitation in the upper 30^{th} percentile).