ATTACHMENT 4: AIR QUALITY IMPACT ASSESSMENT
GLEN CANYON NATIONAL RECREATION AREA
AIR QUALITY ANALYSIS FOR PARK PLANNING

Prepared for:

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December 2014

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EXECUTIVE SUMMARY

This report presents air pollution emissions and air quality analyses for particulates from off-road use of motor vehicles and on-road use of off-highway vehicles (OHVs) and street-legal all-terrain vehicles (ATVs) in Glen Canyon National Recreation Area (GCNRA). The dispersion modeling analysis has been prepared on behalf of GCNRA by Air Resource Specialists, Inc. (ARS) of Fort Collins, Colorado.

GCNRA has proposed to allow off-highway vehicle use of several roads and off-road vehicle routes within Glen Canyon as well as allow off-road use of unpaved areas such as Lone Rock Beach. This report describes the air quality analyses for both a base case (current condition) and a worst-case future alternative scenario that accounts for additional access to these roads/areas.

Dispersion modeling was conducted using the most recent regulatory version of the AMS/EPA Regulatory Model (AERMOD). The modeling results are based on five years of meteorological data collected at Page, AZ for 2005-2009.

Modeling results are summarized in Table ES-1 and ES-2. The predicted modeling concentrations show that GCNRA's proposed changes will not cause or contribute to any exceedances of the National Ambient Air Quality Standards (NAAQS), as the maximum predicted concentrations, with additional OHV traffic plus current conventional vehicle traffic and background concentrations, are all below the applicable the NAAQS for PM_{10} and $PM_{2.5}$.

Table ES-1
SUMMARY OF MODELING RESULTS
Base Case Scenario

Location	Pollutant	Averaging Time	NAAQS	Maximum Air Quality Impact[3]
Lone Rock Beach	PM_{10}	24-Hour [2]	150 µg/m^3	19.25 µg/m^3
	$PM_{2.5}$	Annual [1]	12 µg/m^3	3.13 µg/m^3
		24-Hour [1]	35 µg/m^3	3.77 µg/m^3
Warm Creek Road	PM_{10}	24-Hour [2]	150 µg/m^3	41.25 µg/m^3
	$PM_{2.5}$	Annual [1]	12 µg/m^3	4.20 µg/m^3
		24-Hour [1]	35 µg/m^3	5.64 µg/m^3

[1] To attain the $PM_{2.5}$ standard, the 3-year average of the weighted annual mean must not exceed the annual standard, and the 5-year average of the 98th percentile 24-hour average must not exceed the 24-hour standard.
[2] To attain the PM_{10} standard, the average cannot exceed the standard more than once/year on average over 5 years.
[3] Hourly background concentration of 2.87µg/m^3 for $PM_{2.5}$ and 6.62 µg/m^3 for PM_{10} included.

Table ES-2
SUMMARY OF MODELING RESULTS
Future Alternative Scenario

Location	Pollutant	Averaging Time	NAAQS	Maximum Air Quality Impact[3]
Lone Rock Beach	PM_{10}	24-Hour [2]	150 µg/m^3	32.35 µg/m^3
	$PM_{2.5}$	Annual [1]	12 µg/m^3	3.49 µg/m^3
		24-Hour [1]	35 µg/m^3	4.99 µg/m^3
Warm Creek Road	PM_{10}	24-Hour [2]	150 µg/m^3	68.41 µg/m^3
	$PM_{2.5}$	Annual [1]	12 µg/m^3	5.26 µg/m^3
		24-Hour [1]	35 µg/m^3	7.86 µg/m^3

[1] To attain the $PM_{2.5}$ standard, the 3-year average of the weighted annual mean must not exceed the annual standard, and the 5-year average of the 98th percentile 24-hour average must not exceed the 24-hour standard.
[2] To attain the PM_{10} standard, the average cannot exceed the standard more than once/year on average over 5 years.
[3] Hourly background concentration of 2.87µg/m^3 for $PM_{2.5}$ and 6.62 µg/m^3 for PM_{10} included.

For the base case, the Lone Rock Beach PM_{10} and $PM_{2.5}$ 24-hour modeling results were 13 and 11 percent of the NAAQS, respectively. The annual $PM_{2.5}$ modeling result for this location was 26 percent of the NAAQS. The Warm Creek Road PM_{10} and $PM_{2.5}$ 24-hour modeling results were 27 and 16 percent of the NAAQS, respectively. The annual $PM_{2.5}$ modeling result was 35 percent of the NAAQS.

For the future alternative scenario, the Lone Rock Beach PM_{10} and $PM_{2.5}$ 24-hour modeling results were 22 and 14 percent of the NAAQS, respectively. The annual $PM_{2.5}$ modeling result for this location was 29 percent of the NAAQS. The Warm Creek Road PM_{10} and $PM_{2.5}$ 24-hour modeling results were 46 and 22 percent of the NAAQS, respectively. The annual $PM_{2.5}$ modeling result was 44 percent of the NAAQS.

1.0 INTRODUCTION AND BACKGROUND

1.1 Overview

GCNRA is proposing to allow off-road vehicles increased access to the park. This report presents air pollution emissions and air quality analyses of additional off-road vehicle use on paved and unpaved roads in the recreation area. Two scenarios were modeled: a base case (current condition) scenario and a worst-case future alternative scenario, at two park locations: Lone Rock Beach (unpaved area) and Warm Creek Road (unpaved road).

For the base scenario, only conventional highway vehicles such as cars and light duty trucks are operated on existing paved/unpaved roads. A second scenario, the future alternative scenario, estimates the air quality impact of adding off-highway vehicles (OHVs), such as ATVs, and by doubling the number of vehicle trips, which also doubles vehicle miles traveled (VMT). For this analysis, conservative or worst-case assumptions were selected for each scenario and location, based on the estimated traffic use or VMT and length of the road. Based on data from the National Park Service (NPS), Lone Rock Beach provided the worst-case scenario for a higher visitation unpaved area, and Warm Creek Road provided the worst-case scenario for a typical unpaved road. The modeling was done in this way to ensure that all roads within the recreational area are well represented by this analysis.

This dispersion modeling assessment is being provided in support of an analysis for an Environmental Impact Statement (EIS) assessing the air pollution impacts of possible changes in off-highway vehicle use. The modeling analysis is provided to assess compliance with the applicable National Ambient Air Quality Standards (NAAQS). The modeling study and report were prepared by Air Resource Specialists, Inc. (ARS) of Fort Collins, Colorado.

The dispersion modeling analysis assessed the predicted air quality impacts of particulate matter less than 10 microns (PM_{10}) as well as the predicted impacts of particulate matter less than 2.5 microns ($PM_{2.5}$). Based on the historical vehicle counts, only the PM_{10} and $PM_{2.5}$ fugitive emissions were of concern for this analysis, and emissions for other regulated pollutants were not modeled.

Dispersion modeling was conducted using the most recent regulatory version of the AMS/EPA Regulatory Model (AERMOD). ARS uses the version of AERMOD supplied by Providence-Oris dba Bee-Line Software. These modeling results are based on five years of meteorological data collected at Page, AZ for 2005-2009. Modeling followed approved U.S. Environmental Protection Agency (USEPA) procedures, as contained in the USEPA *Guideline of Air Quality Models* found in 40 CFR 51, Appendix W.

1.2 Site Description

GCNRA covers over 1.2 million acres stretching from Lees Ferry in northern Arizona northeastward to the Orange Cliffs in southeastern Utah. The primary uses for GCNRA are water–based recreation on Lake Powell and backcountry recreation in the off-shore regions. All lands within GCNRA are managed by the NPS, part of the U.S. Department of Interior.

Lone Rock Beach and the beginning of Warm Creek Road are both located off of Utah Highway 89 near the town of Big Water. Lone Rock Beach lies on the west side of Lake Powell in Kane County. Warm Creek Road also lies in Kane County on the northwest side of Lake Powell. Figure 1-1 shows the location of Lone Rock Beach and Figure 1-2 shows the location of Warm Creek Road. Both images are from Google Earth.

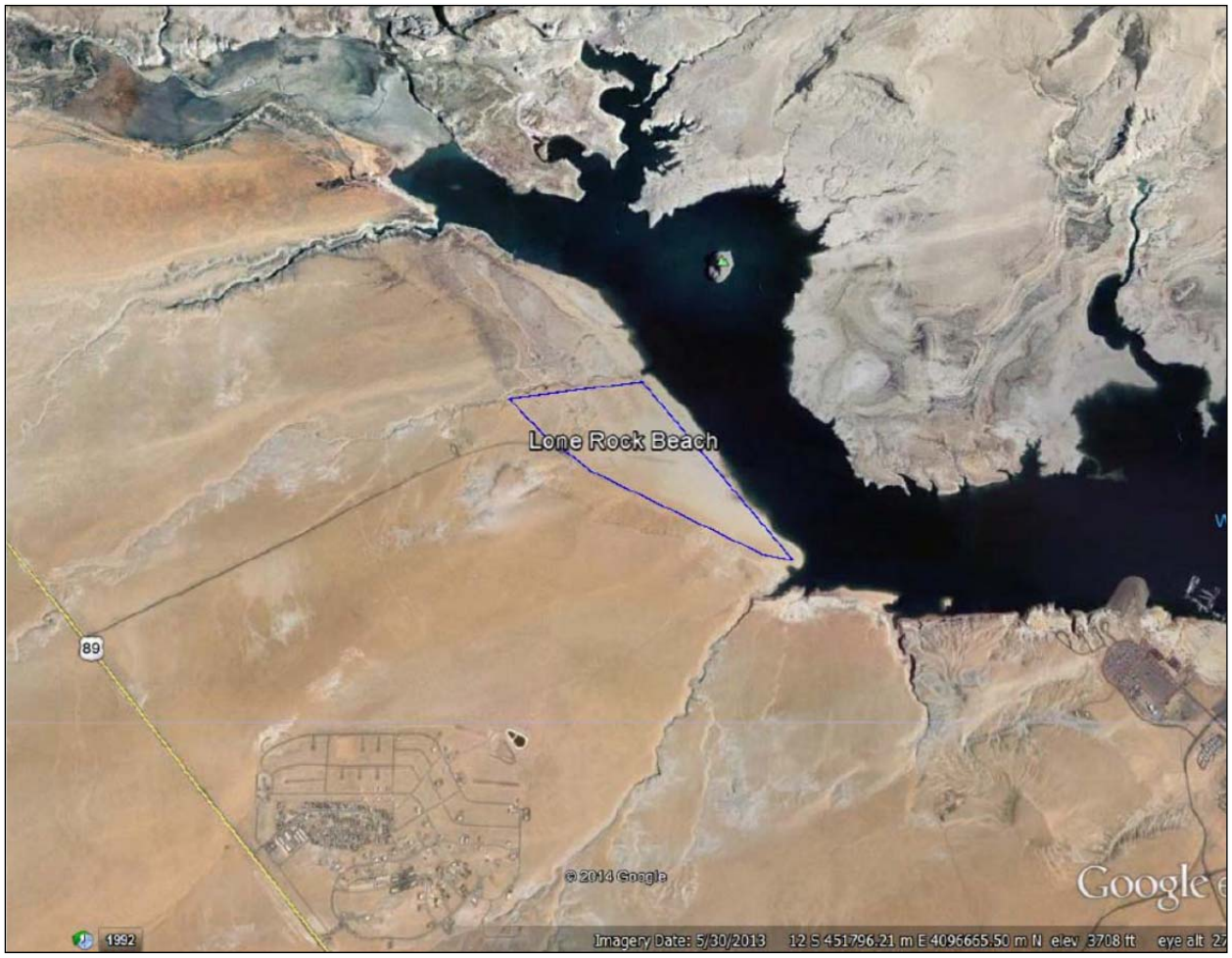

Figure 1-1: Lone Rock Beach Location Map – From Google Earth

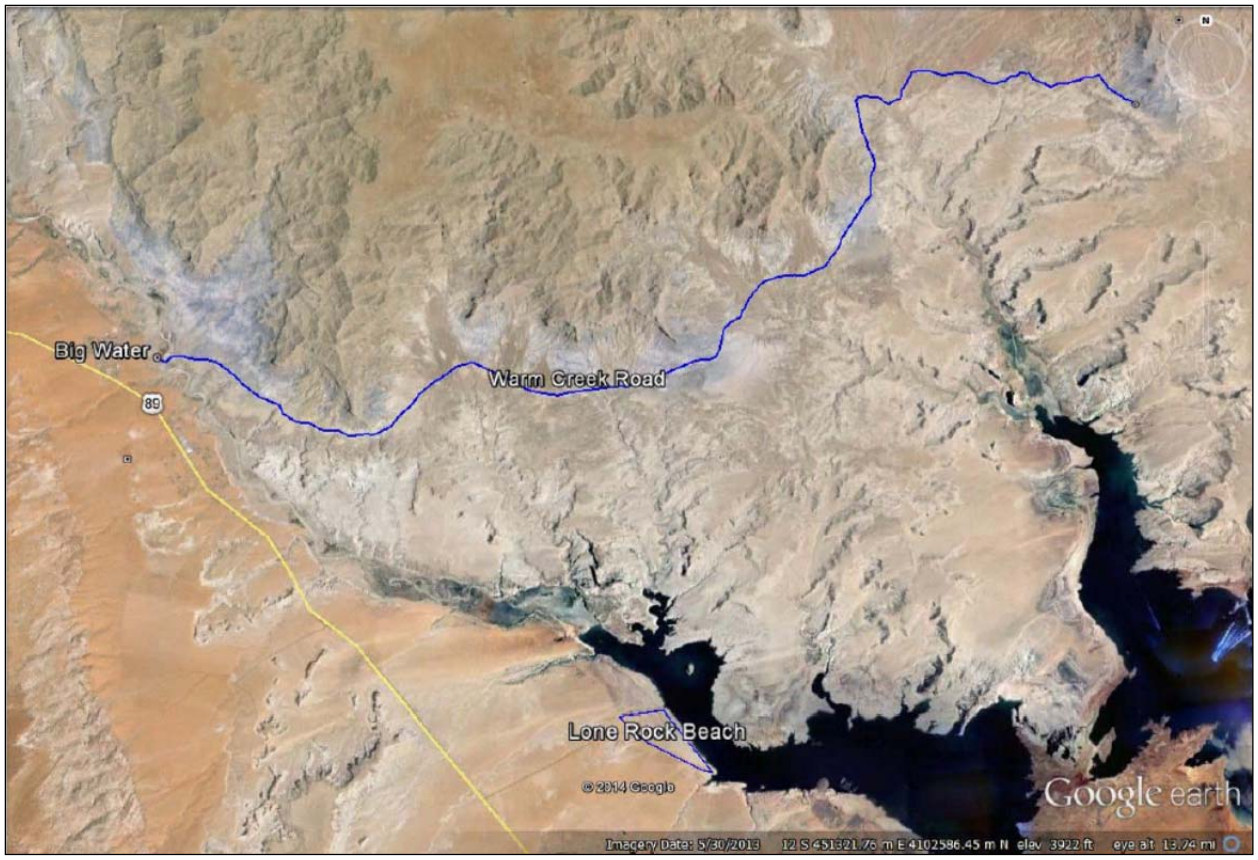

Figure 1-2: Warm Creek Road Map – From Google Earth

2.0 EMISSIONS & SOURCE INFORMATION

Emissions for the Lone Rock Beach and the Warm Creek Road locations are based on road use data provided as part of the proposed Off-road Vehicle Management Plan for GCNRA. This includes vehicle counts as well as posted (or proposed) speed limits for the areas of study. Fugitive particulate emissions were obtained using Table 13.2.2-2 in *AP-42, Section 13.2.2 Unpaved Roads*. EPA's NONROAD Emissions Model (version 2008a) and Motor Vehicle Emission Simulator (MOVES2010b) provided particulate exhaust emissions for OHVs and conventional on-highway vehicles, respectively. Further technical information for these emissions is included in Attachments 1 through 3 of the Technical Support Document.

2.1 Lone Rock Beach Area Source

There are no defined roads in the Lone Rock Beach area. Therefore, it was modeled as a series of four area sources. It was estimated that the area around the point of entry (Lone Rock Beach Road) would have a greater emission rate than that of the rest of the beach due to increased vehicle activity at the area entrance. Therefore, the representative emission rate per square foot for each area decreases as distance from the point of entry increases.

Figure 2-1 shows a map with the approximate breakdown of these four area sources. Tables 2-3 and 2-4 list the area size as well as a breakdown of emission factors associated with each area source.

Figure 2-1: Lone Rock Beach Area Source Breakdown

Road use data from the peak visitation month of June of 2011 was used, as it represented the most conservative estimate for the air quality analysis.

Table 2-1
Lone Rock Beach Base Scenario Emissions

Area ID	Area in ft^2	PM_{10} Emissions ($lb/hr*ft^2$)	$PM_{2.5}$ Emissions ($lb/hr*ft^2$)
A	702,604	4.38E-06	4.39E-07
B	1,509,955	2.04E-06	2.04E-07
C	2,466,457	1.25E-06	1.25E-07
D	3,031,229	1.02E-06	1.02E-07

Table 2-2
Lone Rock Beach Alternative Scenario Emissions

Area ID	Area in ft^2	PM_{10} Emissions ($lb/hr*ft^2$)	$PM_{2.5}$ Emissions ($lb/hr*ft^2$)
A	702,604	8.93E-06	1.04E-06
B	1,509,955	4.16E-06	4.84E-07
C	2,466,457	2.54E-06	2.96E-07
D	3,031,229	2.07E-06	2.41E-07

2.2 Warm Creek Road Volume Source

Warm Creek Road is a 24.1 mile unpaved road. The modeling analysis utilized ten (10) volume sources along a 4000 foot segment of road to represent this source. Each volume source was 24 feet wide and 6 feet tall. Initial lateral and vertical dimensions were estimated per Table 3-1 in EPA's *User Guide for the AMS/EPA Regulatory Model – AERMOD (*EPA-454/B-03-001, September 2004). Other modeling factors, such as the top of plume height, were determined following guidance from EPA's *Haul Road Workgroup Recommendations* memorandum (November 2011). Road use data from the peak visitation month of May of 2013 was used, as it represented the most conservative estimate for the air quality analysis.

Since each of the volume sources is identical, Table 2-3 shows the modeled emission factors, for one of these sources, for the base and alternative scenarios.

Table 2-3
Warm Creek Road Emissions (per modeled volume source)

Scenario	PM_{10} Emissions (lb/hr)	$PM_{2.5}$ Emissions (lb/hr)
Base	0.51	0.05
Alternative	0.91	0.09

3.0 DISPERSION MODELING INPUT DATA

3.1 Model Selection and Technical Inputs

Dispersion modeling was conducted using AERMOD. Selected technical options followed the regulatory default option. Model inputs also specified rural conditions for dispersion coefficients and other variables. AERMOD version 14134 was utilized for this analysis.

The application of AERMOD follows guidance from the *EPA Guideline for Air Quality Models* (40 CFR 51, Appendix W). All modeling used the Universal Transverse Mercator (UTM) grid coordinates. Modeling input/output files are included on the enclosed CD-ROM, as Appendix B.

For modeling at both locations, the emission rates from Section 2.0 were weighted by hour of day to account for normal fluctuations in vehicle traffic or VMT in the recreation area. For more details, please refer to data provided in the Appendices.

Since no road source is perfectly straight, a representative segment of Warm Creek Road was analyzed several times at a variety of angles to represent different orientations. Only the worst-case output results from these varying analyses is presented in this report. By modeling in this manner, the results not only represent Warm Creek Road emissions, but would be a worst-case representation of all roads within the park.

3.2 Receptor Inputs

As explained previously, GCNRA is comprised of over 1.2 million acres of public lands and covers portions of Kane, Garfield, and San Juan Counties in southeastern Utah. Generally, access to public lands is unrestricted within GCNRA.

Lone Rock Beach is a highly visited area and the only location in Glen Canyon where OHV and street-legal ATVs (in addition to conventional motor vehicles) are currently allowed to be operated off-road. The area also includes recreational activities such as swimming, fishing, boating, and camping. For Lone Rock Beach, beginning at five meters out from the source, receptors were spaced every 100 meters out to a distance of approximately 200 meters (also 100 meters spacing between receptors for each interval). Additional receptors at a higher density were not utilized based on the initial modeling results. As modeled concentrations were well below the NAAQS and dropped off sharply from the initial (five meter) receptor interval closest to the source, there is a high confidence that the maximum pollutant concentrations were identified with the current receptor density.

Warm Creek Road stretches from Big Water, Utah, below the southern edge of the Kaiparowits Plateau, and connects to roads within Grand Staircase-Escalante National Monument to the north. The area of interest in this modeling study is limited to the beginning of Warm Creek Road near Big Water until it meets up with National Park Route 264. Around the

Warm Creek Road segment, receptors were placed at 20 meter intervals out to a distance of approximately 100 meters (also 100 meters spacing between receptors for each interval).

Terrain elevations for receptors were determined from USGS National Elevation Dataset (NED) input data for the surrounding area. The USGS downloaded elevation data uses the NAD83 coordinate system. Terrain heights for receptors and point sources were calculated using the most recent version of AERMap supplied by Beeline Software.

3.3 Meteorological Data Inputs

The AERMOD inputs of meteorological data for both locations in the park are a five-year data set from the National Weather Service (NWS) observation site at Page, AZ. The five-year period covers 2005-09. Utah Division of Air Quality (UDAQ) performed the AERMET data processing using the most recent regulatory version of AERMET (Version 14134) and provided these data electronically to ARS. The meteorological data are included with the modeling files on the CD-ROM.

4.0 RESULTS AND DISCUSSION

Tables 4-1 and 4-2 summarize the dispersion modeling results and documents compliance with Federal PM_{10} and $PM_{2.5}$ air quality standards. Dispersion modeling results are presented using the highest predicted 24-hour average for both PM_{10} and $PM_{2.5}$ and highest predicted annual $PM_{2.5}$ average concentration for the meteorological data set employed. As noted above, all modeling input/output files are also included on the enclosed CD-ROM in Appendix B.

The coordinates for the maximum impact point for each scenario are also provided. The maximum impact for both the base scenario and the future alternative scenario for the Lone Rock Beach is concentrated around the point of entry to the beach near Lone Rock Beach Road. The maximum impact for both the base scenario and the future alternative scenario for the Warm Creek Road is concentrated directly along the road. This dispersion modeling analysis concludes that additional OHV use in GCNRA will not cause or contribute to any exceedances of the PM_{10} or $PM_{2.5}$ NAAQS.

Table 4-1
Predicted Concentration Lone Rock Beach (Base vs. Future Alternative)

AVERAGING PERIOD	SCENARIO	TOTAL IMPACT ($\mu g/m^3$)*	PRIMARY NAAQS ($\mu g/m^3$)	RECEPTOR UTM (METERS) E-W	RECEPTOR UTM (METERS) N-S
PM_{10} 24-Hour Ave. (6^{th} Highest)	Base	19.25	150	451,490.9	4,096,815.5
	Alternative	32.35			
$PM_{2.5}$ 24-Hour Ave. (8^{th} Highest)	Base	3.77	35		
	Alternative	4.99			
$PM_{2.5}$ Annual Ave. (1^{st} Highest)	Base	3.13	12		
	Alternative	3.49			

*This includes an hourly background concentration of 2.87$\mu g/m^3$ for $PM_{2.5}$ and 6.62 $\mu g/m^3$ for PM_{10}. Data obtained from Colorado State University's IMPROVE Database Query Wizard; Canyonlands 2005-2009.

Table 4-2
Predicted Concentration Warm Creek Road (Base vs. Future Alternative)

AVERAGING PERIOD	SCENARIO	TOTAL IMPACT ($\mu g/m^3$)*	PRIMARY NAAQS ($\mu g/m^3$)	RECEPTOR UTM (METERS) E-W	RECEPTOR UTM (METERS) N-S
PM_{10} 24-Hour Ave. (6^{th} Highest)	Base	41.25	150	545,946.6	4,550,008.7
	Alternative	68.41			
$PM_{2.5}$ 24-Hour Ave. (8^{th} Highest)	Base	5.64	35	545,272.6	4,550,008.7
	Alternative	7.86			
$PM_{2.5}$ Annual Ave. (1^{st} Highest)	Base	4.20	12		
	Alternative	5.26			

*This includes an hourly background concentration of 2.87$\mu g/m^3$ for $PM_{2.5}$ and 6.62 $\mu g/m^3$ for PM_{10}. Data obtained from Colorado State University's IMPROVE Database Query Wizard; Canyonlands 2005-2009.

For the base case, the Lone Rock Beach PM_{10} and $PM_{2.5}$ 24-hour modeling results were 13 and 11 percent of the NAAQS, respectively. The annual $PM_{2.5}$ modeling result was 26 percent of the NAAQS. At this location, the future alternative scenario PM_{10} and $PM_{2.5}$ 24-hour modeling results were 22 and 14 percent of the NAAQS, respectively. The future alternative annual $PM_{2.5}$ modeling result was 29 percent of the NAAQS.

At Warm Creek Road, the base case, the PM_{10} and $PM_{2.5}$ 24-hour modeling results were 27 and 16 percent of the NAAQS, respectively. The annual $PM_{2.5}$ modeling result was 35 percent of the NAAQS. At this location, the future alternative scenario PM_{10} and $PM_{2.5}$ 24-hour modeling results were 46 and 22 percent of the NAAQS, respectively. The future alternative annual $PM_{2.5}$ modeling result was 44 percent of the NAAQS.

APPENDIX A

Modeling Source Input Calculations

APPENDIX B

Electronic Copy of AERMOD Modeling Input/Output Files