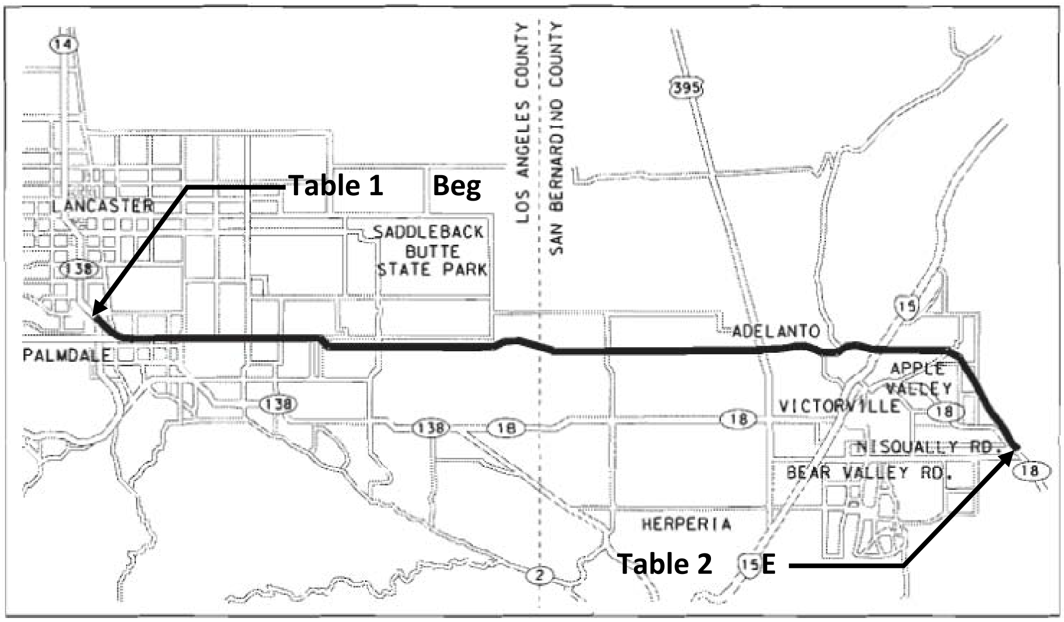
Quantitative PM_{10} Hot-Spot Analysis

HIGH DESERT CORRIDOR



<u>High Desert Corridor</u>

IN SAN BERNARDINO COUNTY, CALIFORNIA

FROM COUNTY LINE

TO STATE ROUTE 18

Caltrans EA: 07-2600U

Project ID: 1C0404, LA962212, LA0G665, and SB20061702

Prepared by

California Department of Transportation, District 7
Division of Design
Office of Environmental Design

Caltrans

May 2014

1. Introduction

In November 2013, the EPA released a final *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (Guidance) for quantifying the local air quality impacts of transportation projects and comparing them to the particulate matter (PM) national ambient air quality standards (NAAQS) (75 FR 79370). EPA originally released the quantitative guidance in December 2010, which has now been revised in November 2013 to reflect California's latest approved emissions model, EMFAC2011, and EPA's 2012 PM NAAQS final rule. The Transportation Conformity Rules and Regulations based on the Clean Air Act and its Amendments require a hot-spot analysis to be completed for a project of air quality concern (POAQC). The Guidance is provided by EPA to describe how quantitative analyses should be completed for POAQCs. The final rule in 40 CFR 93.123(b)(1) defines the POAQC as:

(i) New or expanded highway projects that have a significant number of or significant increase in diesel vehicles;

(ii) Projects affecting intersections that are at Level-of-Service (LOS) D, E, or F with a significant number of diesel vehicles, or those that will change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;

(iii) New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;

(iv) Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and

(v) Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ and PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The project under study in this Quantitative Hot-Spot analysis (Analysis) proposes to construct a new freeway and/or tollway with expressway and high-speed rail (HSR) feeder system. The new facility would be 500 feet at the maximum width and extend approximately 63 miles from State Route 14 (SR-14) in the City of Palmdale to SR-18 in the Town of Apple Valley. Because this project is to construct a new facility and there is no existing highway, Post Mile information is not available for the project at this time. Based on the forecast traffic data that indicate increase in the number of diesel vehicles, the project is considered to be of air quality concern as described in 40 CFR 93.123(b)(1)(i); and requires this Analysis. This Analysis has been prepared according to the procedures and methodology provided in the Guidance as well as based on consultations with EPA as noted throughout this Analysis.

2. Project Description and Location

The proposed corridor project is located in the High Desert area of Los Angeles and San Bernardino Counties and extends for a distance of approximately 63 miles between SR-14 in the City of Palmdale and SR-18 in the Town of Apple Valley. In Los Angeles County, the proposed High Desert Corridor (HDC) roughly follows the existing Avenue P-8. In San Bernardino County, the HDC runs slightly south of El Mirage Road and then follows Air Expressway Road near I-15. East of I-15, the proposed route curves south until it ends at SR-18 in the Town of Apple Valley at Bear Valley Road.

The High Desert region in northern Los Angeles and San Bernardino Counties has been one of the fastest growing areas in Southern California and has been the subject of several major studies to define the transportation infrastructure improvements necessary to accommodate the ever increasing travel demand. In April of 2002, the Caltrans and FHWA, SCAG, SANBAG, Metro, the Counties of Los Angeles and San Bernardino, the Cities of Palmdale, Lancaster, Adelanto, Hesperia and Victorville and the Town of Apple Valley, led an effort that culminated in the completion of the Regionally Significant Transportation Investment Study (RSTIS) for the HDC. Simultaneously, the North County Combined Highway Corridor Study was initiated to develop a multi-modal transportation plan for the northern portion of Los Angeles County, addressing both short-term and long-term requirements to accommodate a variety of trip purposes. This Corridor serves large volume of truck traffic for personal travel and goods movement. The North County Combined Highway Corridors Study, approved in June 2004, was conducted by Metro in cooperation with the Cities of Lancaster, Los Angeles, Palmdale, Santa Clarita and the County of Los Angeles. The east-west corridor study focused on SR-138 circulation as a key feature to reduce the traffic congestion.

3. Purpose and Need

The purpose of the proposed project is to improve east-west mobility within the High Desert region of southern California by addressing present and future travel demand and mobility needs within the Antelope and Victor valleys. The proposed action is intended to achieve the following objectives:

- Increase capacity of east-west transportation facilities to accommodate existing and future transportation demand;
- Improve travel safety and reliability within the High Desert region;
- Improve the regional goods movement network;
- Provide improved access and connectivity to regional transportation facilities, including airports and the existing and future passenger rail systems, including, the proposed California High Speed Rail system and the proposed XpressWest High Speed Rail system; and
- Contribute to state greenhouse gas reduction goals through the use of green energy features.

The specific needs to be addressed by the proposed action include:

- Recent and future population growth within the High Desert Region;
- Limited and unreliable east-west connectivity within the High Desert Region;

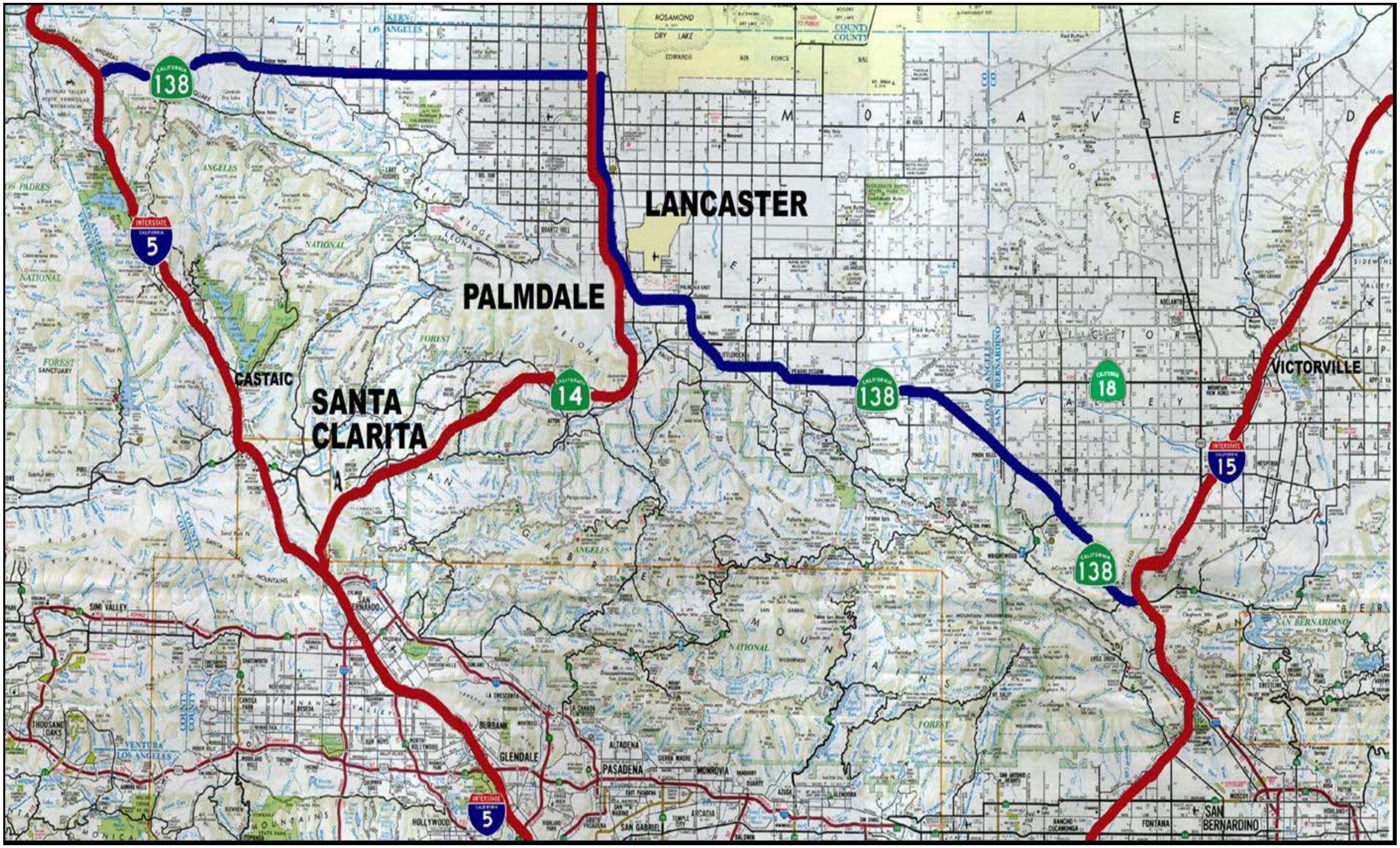


Figure 1. **Project Vicinity Map**

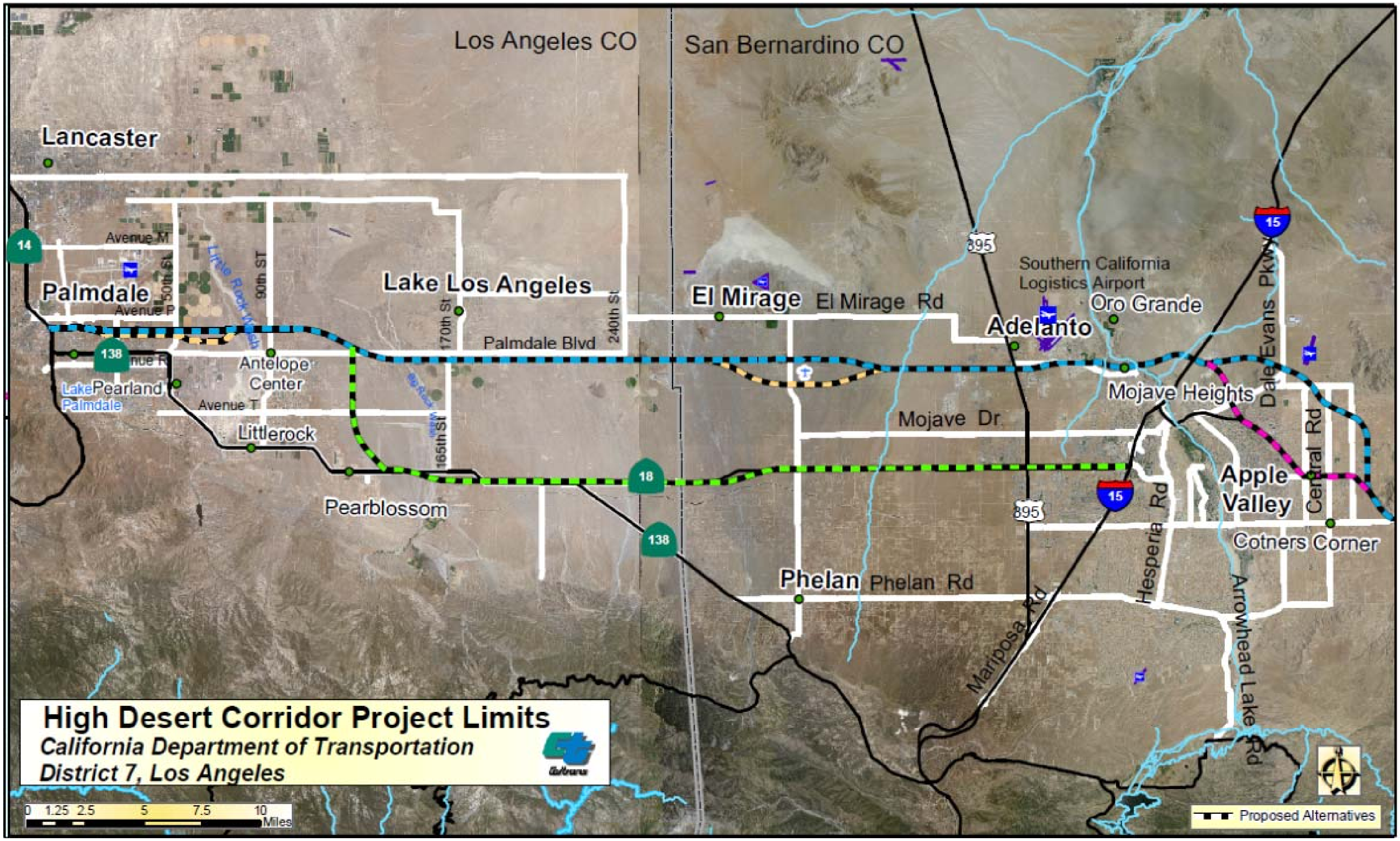


Figure 2. **Project Location Map**

Note: TSM/TDM Alternative; Alignment for Freeway/Tollway/Expressway/High Speed Rail Feeder Alternatives; Route Variation (dropped); Route Variations in Consideration

- Regional demands for goods movement to support the growth of the regional economy; and
- Future demands for the use of green energy, including sustainability and green energy provisions in state law and policy.

4. Project Alternatives

1. No-Build Alternative

The No-Build (No Action) Alternative consists of those transportation projects that are already planned and committed to be constructed by or before 2040. Consequently, the No-Build alternative represents future travel conditions in the HDC study area without the HDC project.

2. Transportation System/Demand Management (TSM/TDM) Alternative

The TSM/TDM alternative is a collection of lower cost roadway improvements through the project corridor that can be evaluated against the proposed project alternatives. The TSM/TDM alternative focuses on improvements that connect SR-14 with SR-138 and then extend east to connect with US- 395, I-15 and SR -18. The key elements that are under consideration for this alternative include:

- An eight-lane grade-separated freeway from SR-14 to 30th Street East;
- A transition to a four-lane at-grade expressway from 30th Street East to Longview Road;
- A four-lane at-grade highway connecting to SR-138 and extending east to US-395 along SR-18;
- A six-lane arterial highway along SR-18 (Palmdale Road) from US -395 to I-15; and
- Minor roadway and signal improvements along SR-18 from I-15 to Bear Valley Road.

Except for the freeway portion between SR-14 and 30th Street East, these TSM/TDM roadway improvements would maintain at-grade intersections with local roads and driveway access.

3. Freeway/Expressway Alternative (Avenue P-8, I-15 and SR-18)

This Alternative consists of a combination of a controlled-access freeway and an expressway. It generally follows Avenue P-8 in Los Angeles County and just south of El Mirage Road in San Bernardino County. This alternative then extends to Air Expressway Road near I-15 and curves south terminating at Bear Valley Road. The incorporation of green energy technologies and a bike path along the alternative will also be considered.

There are four physical alignment variations that are being considered:

- Variation A
  - Near the City of Palmdale, the freeway/expressway would dip slightly south of the main alignment, approximately between 15th St. East and Little Rock Wash.

- Variation B (south)
  - East of the county line, the freeway/expressway would flare out slightly south of the main alignment between Oasis Rd. and Coughlin Rd.

- Variation D

- Near the community of Lake Los Angeles, the freeway/expressway would dip slightly south of the main alignment, just south of Avenue R approximately between 180th St. East and 230th St. East.

▪ Variation E
- Near the cities of Adelanto and Victorville, the freeway/expressway would dip south of the federal prison.

4. **Freeway/Tollway Alternative (Avenue P-8, I-15 and SR-18)**

This Alternative follows the same physical alignment as the Freeway/Expressway Alternative (including Variations A, D, B and E) but would have sections operate as a tollway. Details of this operating feature are being evaluated as part of the ongoing Public Private Partnership analysis. The incorporation of green energy technologies and a bike path will also be considered.

5. **Freeway/Expressway Alternative with High Speed Rail Feeder Service**

This Alternative is the same as the Freeway/Expressway Alternative (including Variations A, D, B and E) and includes a High Speed Rail (HSR) Feeder Service between Palmdale and Victorville. The HSR Feeder Service would utilize proven steel wheel on steel track technology and have a maximum operating speed of 150 miles per hour. The HSR Feeder Service will utilize electric locomotives and is proposed to be located in the median of the HDC alignment. The incorporation of green energy technologies and a bike path will also be considered.

6. **Freeway/Tollway Alternative with High Speed Rail Feeder Service**

This Alternative is the same as the Freeway/Tollway Alternative (including Variations A, D, B and E) and includes a High Speed Rail (HSR) Feeder Service between Palmdale and Victorville. The HSR Feeder Service would utilize proven steel wheel on steel track technology and have a maximum operating speed of 150 miles per hour. The HSR Feeder Service will utilize electric locomotives and is proposed to be located in the median of the HDC alignment. The incorporation of green energy technologies and a bike path will also be considered.

7. **Hybrid Corridor Alternative**

This Alternative would consist of a combination of the previously identified alternatives, whose elements (TSM/TDM, Freeway, Expressway, Tollway, HSR Feeder Service, Green Energy Technologies, bike path) would be pieced together to best fit the needs of each section of the corridor. The determination of which elements to use, and at which locations, would be based on the results of the traffic study, environmental studies and public input.

Among the multiple Alternatives with route options in various locations, this Analysis focuses on demonstrating conformity with the Freeway/Tollway/HSR Alternative (No. 6 above) with no alignment variations because this Alternative comprises of the most complete set of proposed project features, including the toll program and rail system.

5. Interagency Consultation

Pursuant to 40 CFR 93.105(c)(1)(i), the conformity rule requires interagency consultation to evaluate and choose models and associated methods and assumptions. The interagency consultation for the area where this project is proposed has been established as a Transportation Conformity Working Group (TCWG) organized by the Southern California Association of Governments (SCAG). As required by the conformity rule, a summary of methods and assumptions applied in this Analysis was submitted and reviewed by TCWG in June 2011; and is included in Attachment A.

The Guidance further provides that, in Section 2, the general requirement of interagency consultation can be satisfied without consulting separately on each and every specific decision for many aspects of the hot-spot analyses. The Guidance notes that, as long as the consultation requirements are met, agencies have discretion as to how they consult on hot-spot analyses. In addition to the summary of methods and assumptions reviewed and concurred with by the TCWG in June 2011, Caltrans has also consulted with the EPA for many key decisions applied in this Analysis. Table 1 below summarizes methods and assumptions concurred with by the TCWG in June 2011 and other key decisions and considerations applied in this Analysis based on consultations with EPA which are further explained in each applicable Section of this Analysis.

Table 1 Summary of Methods/Assumption/Decisions for this Analysis

Area for Analysis	Proposed Project within San Bernardino County only
Analysis Years	Opening Year in 2020 and Horizon in 2040, based on the project schedule and consistency with the regional plan
Applicable Standard	24-Hour PM_{10} NAAQS
Type of Emissions	▪ Direct emissions of PM_{10} (exhaust and tire/brake wear) ▪ Construction emissions are not considered (< 5 years at individual locations) ▪ Re-entrained PM_{10} road dust ▪ Nearby sources within 2 miles ▪ Fugitive dust emissions from HSR feeder service (reference provided by EPA – Attachment B)
Emission Model	EMFAC2011 for San Bernardino County in MDAB
Dispersion Model	▪ First round of Modeling using AERMOD View Message Passing Interface (MPI), a modified parallel version of EPA AERMOD (version 12345) by Lakes Environmental with FASTALL option; ▪ Second round of modeling using AERMOD MPI version 12345 by Lakes Environmental without FASTALL option.
Surface Met Data	Victorville Monitoring Station at 14306 Park Ave, Victorville, CA (Latitude: 34.51096, Longitude: -117.32555, Elevation: 913 m)
Upper Air Met Data	Mercury/Desert Rock Air Base, NV
Background Monitoring	Victorville Monitoring Station at 14306 Park Ave, Victorville, CA
Receptor Locations	▪ First round of modeling: 25 meters interval up to 50 meters; and 100 meters interval from 100 to 300 meters ▪ Second round of modeling: 15 meters interval up to 50 meters; and 50 meters interval from 50 to 250 meters
Other Input Parameters	Recommendations from EPA hot-spot training and the Guidance

6. Hot-Spot Analysis Methodology

The proposed project spans over Los Angeles and San Bernardino Counties within the Mojave Desert Air Basin (MDAB). As illustrated in Figure 3, Los Angeles County within the MDAB is in nonattainment of the ozone standard only while San Bernardino County within the MDAB is in nonattainment of 24-hour PM_{10} standards. This Analysis was therefore prepared to satisfactorily demonstrate conformity with the 24-hour PM_{10} standard only, for the proposed project in San Bernardino County within the MDAB. Caltrans is currently in the process of preparing an environmental document for the proposed project in both Counties.

A hot-spot analysis is defined in the 40CFR93.101 as an estimation of likely future localized pollutant concentrations and a comparison of those concentrations to the relevant air quality standards. A project-level hot-spot analysis assesses the air quality impacts on a scale smaller than an entire nonattainment or maintenance area such as a congested freeway corridor. Such an analysis is a means of demonstrating that a transportation project meets Clean Air Act (CAA) conformity requirements to support state and local air quality goals with respect to potential localized air quality impacts.

CAA Section 176(c)(1)(B) is the statutory criterion that must be met by all projects in nonattainment and maintenance areas that are subject to transportation conformity. Section 176(c)(1)(B) states that federally supported transportation projects must not "cause or contribute to any new violation of any standard in any area; increase the frequency or severity of any existing violation of any standard in any area; or delay timely attainment of any standard or any required interim emission reductions or other milestones in any area." As aforementioned, this Analysis has been prepared according to the procedures and methodology provided in the Guidance and utilizes dispersion modeling.

According to the Guidance, a hot-spot analysis must include the entire transportation project. For large projects such as this HDC, the current modeling technology cannot capture the entire project length of 63 miles in a single run. The proposed HDC alignment was thus divided into four domains of approximately 15 miles in length along with connecting facilities; and a model was set up and run separately for each of the domains. Approximate limits along the proposed HDC and connecting facilities as established in each of the Domains are as follows:

- Domain 1 (Los Angeles County) – SR-14 from West Avenue S to West Avenue M; and the HDC from SR-14 Interchange to 100^{th} Street East;
- Domain 2 (Los Angeles County) – HDC from 100^{th} Street East to the County line;
- Domain 3 (San Bernardino County) – HDC from the County line to Bellflower Street; and
- Domain 4 (San Bernardino County) – HDC from Bellflower Street to I-15 Interchange; I-15 from Nisqualli Road to Dale Evans Parkway; and HDC (as an Expressway) from I-15 Interchange to Bear Valley Cutoff in the town of Apple Valley.

As this Analysis demonstrates conformity for a portion of the project within the area in nonattainment of the 24-hour PM_{10} NAAQS, only those modeling results from San Bernardino County (Domains 3 and 4) are included for discussion. Figure 4 illustrates the project covered by each Domain and its nonattainment status. Figures 5 and 6 illustrate the extent of a first-round modeling in Domains 3 and 4, respectively, in which blue lines represent line-volume sources.

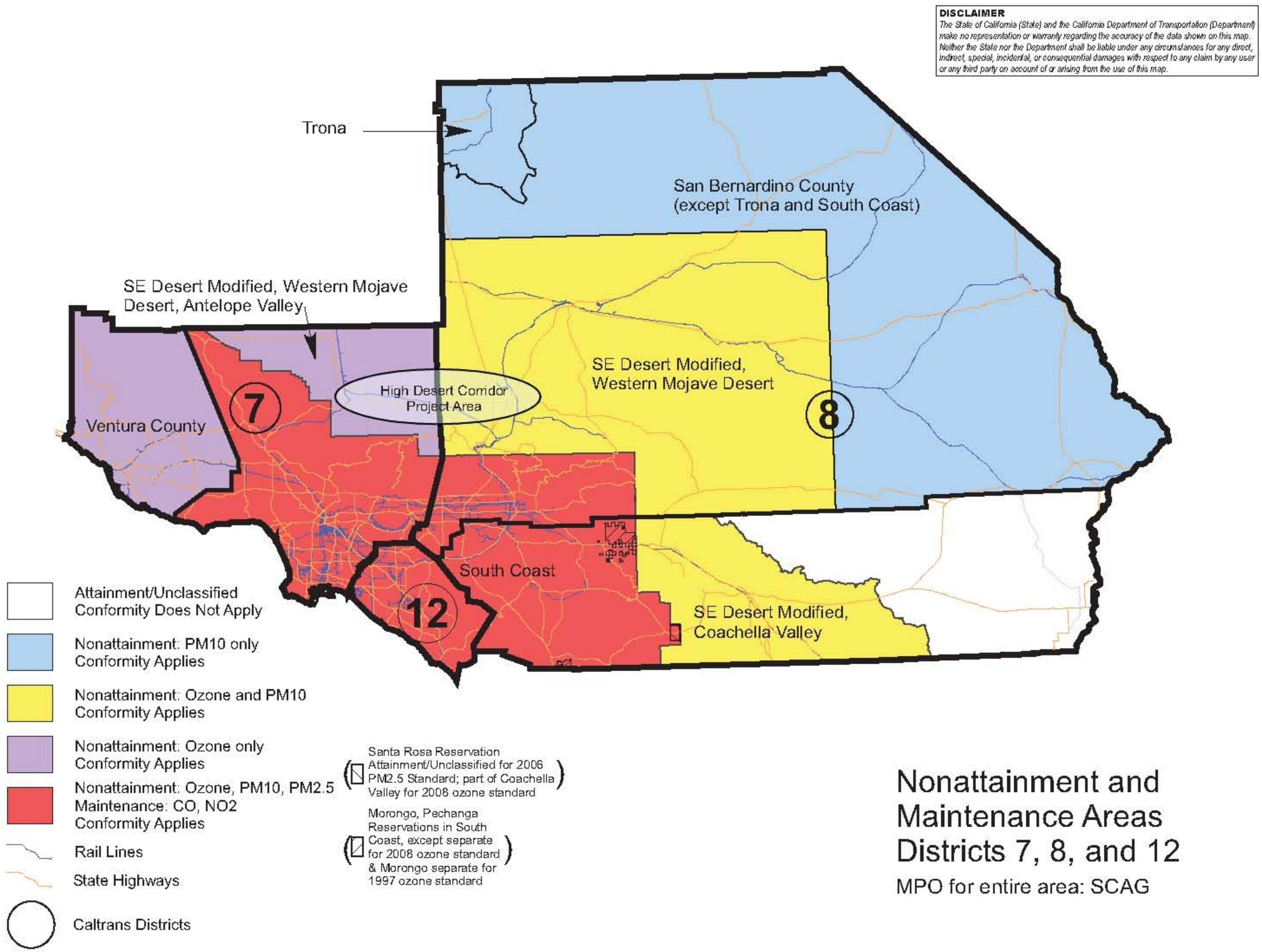


Figure 3. Attainment status of the areas surrounding the proposed project

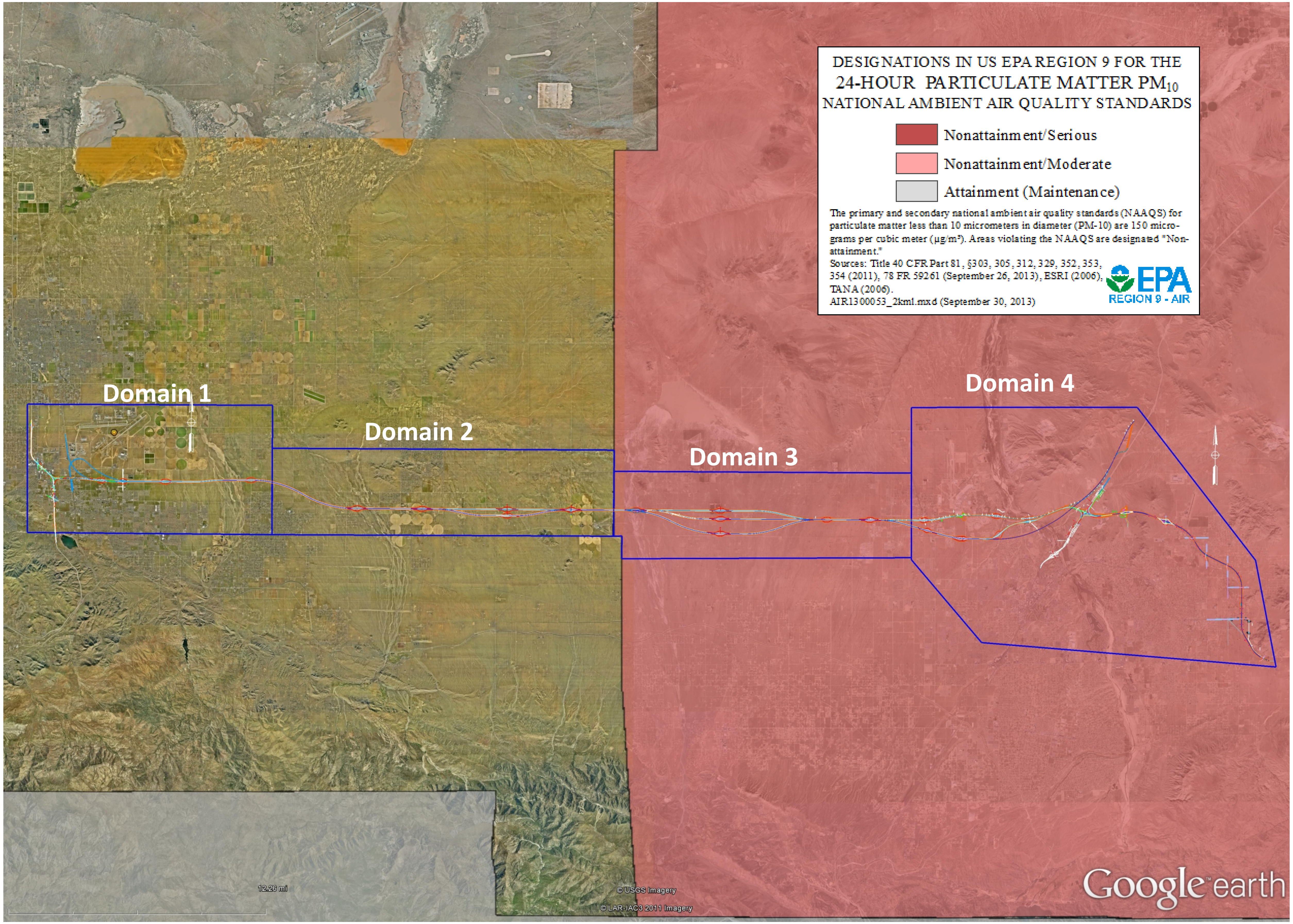


Figure 4. **Modeling domains and attainment status**

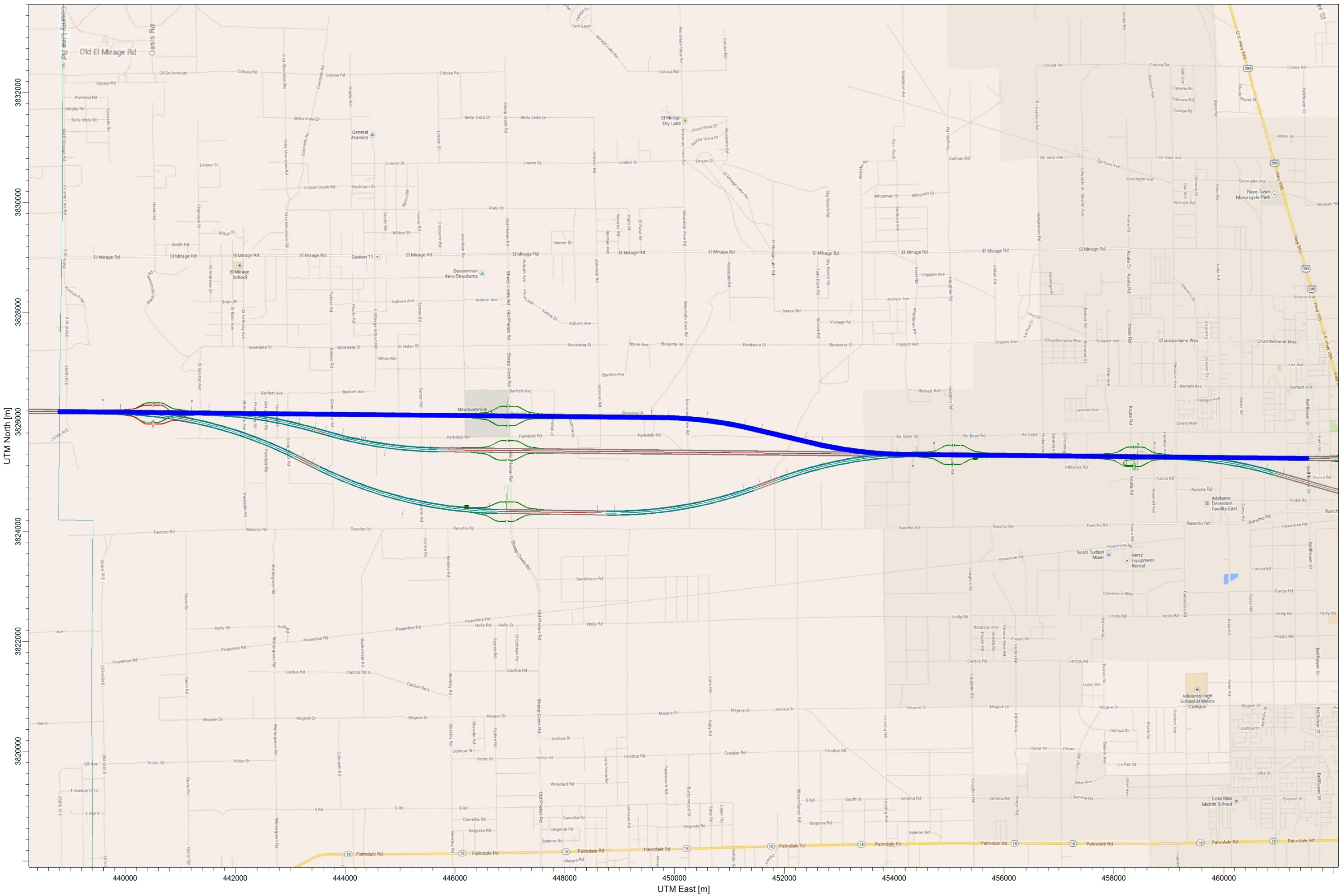


Figure 5. Extent of modeling in Domain 3 (first round model run)

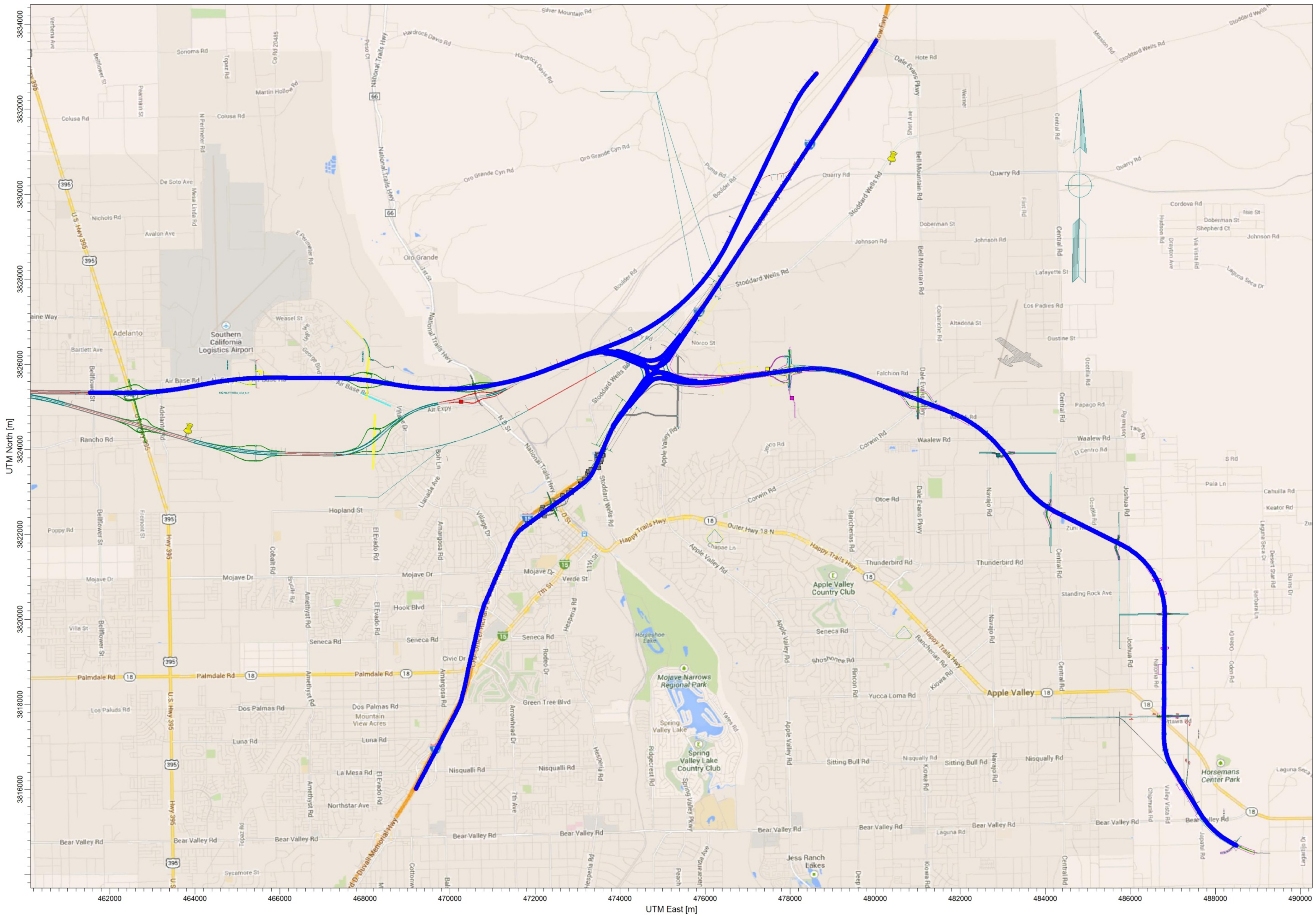


Figure 6. Extent of modeling in Domain 4 (first round model run)

Due to the extent of the project area and based on the consultation with EPA, Caltrans used an iterative modeling strategy in identifying a hot-spot location along the proposed project where the highest concentration would likely occur. Two rounds of modeling runs were completed as part of this iterative process in which the first round of modeling was run with FASTALL option and the second round of modeling was run without. The first round model was run with a coarser receptor grid to identify potential hot-spot locations while the second round model was run with a finer receptor grid to encompass the hot-spot location identified from the first round model run. Receptor grids were placed as summarized in Table 1. The non-default FASTALL option was utilized in the first round modeling to reduce run-time greatly while predicting concentrations within 2 percent of the normal model operation. The non-default FASTALL option was selected only for the first round of modeling based on consultation with EPA in November 2012.

Based on the results from the first round model runs, a hot-spot location was identified within the project area, just north of the junction between I-15 and the proposed HDC in Domain 4. Figure 7 provides a contour map of concentrations from the first round of model run of Domain 4 and illustrates the location identified as hot-spot (in red). As this hot-spot location identified from the first round model run, a second round of modeling was run surrounding this identified hot-spot locations with a finer receptor grid, but without the FASTALL option. The FASTALL option is not acceptable for estimating final design value concentrations and may not be used to demonstrate conformity.

7. National Ambient Air Quality Standard

Nonattainment and maintenance areas are required to attain and maintain the following standard for PM_{10}:

- 24-hour standard: 150 $\mu g/m^3$.

The 24-hour PM_{10} standard is attained when the average number of exceedance in the previous three calendar years is less than or equal to 1. The annual PM_{10} standard of 50 $\mu g/m^3$ is no longer used for determining the federal attainment status; and is not considered in this Analysis.

8. Types of Emissions Considered

In accordance with the Guidance, this Analysis is based on directly emitted PM emissions and also considers brake wear and tire wear emissions. Precursors of PM and secondary particles are not considered in this Analysis; but they are considered as part of the regional emission analysis prepared for the conforming RTP and TIP.

Vehicles cause dust from paved and unpaved roads to be re-entrained, or re-suspended, in the atmosphere. According to the July 1995 Attainment Plan by the Mojave Desert Air Quality Management District, paved road dust entrainment is a significant contributor to the PM emissions, accounting for approximately seven percent of the total planning area inventory. Therefore, the re-entrained road dust has been considered in this Analysis.

Implementation of a HSR feeder service between Palmdale and Victorville is proposed with a maximum operating speed of 150 mph. Turbulence caused by trains operating at such high speeds

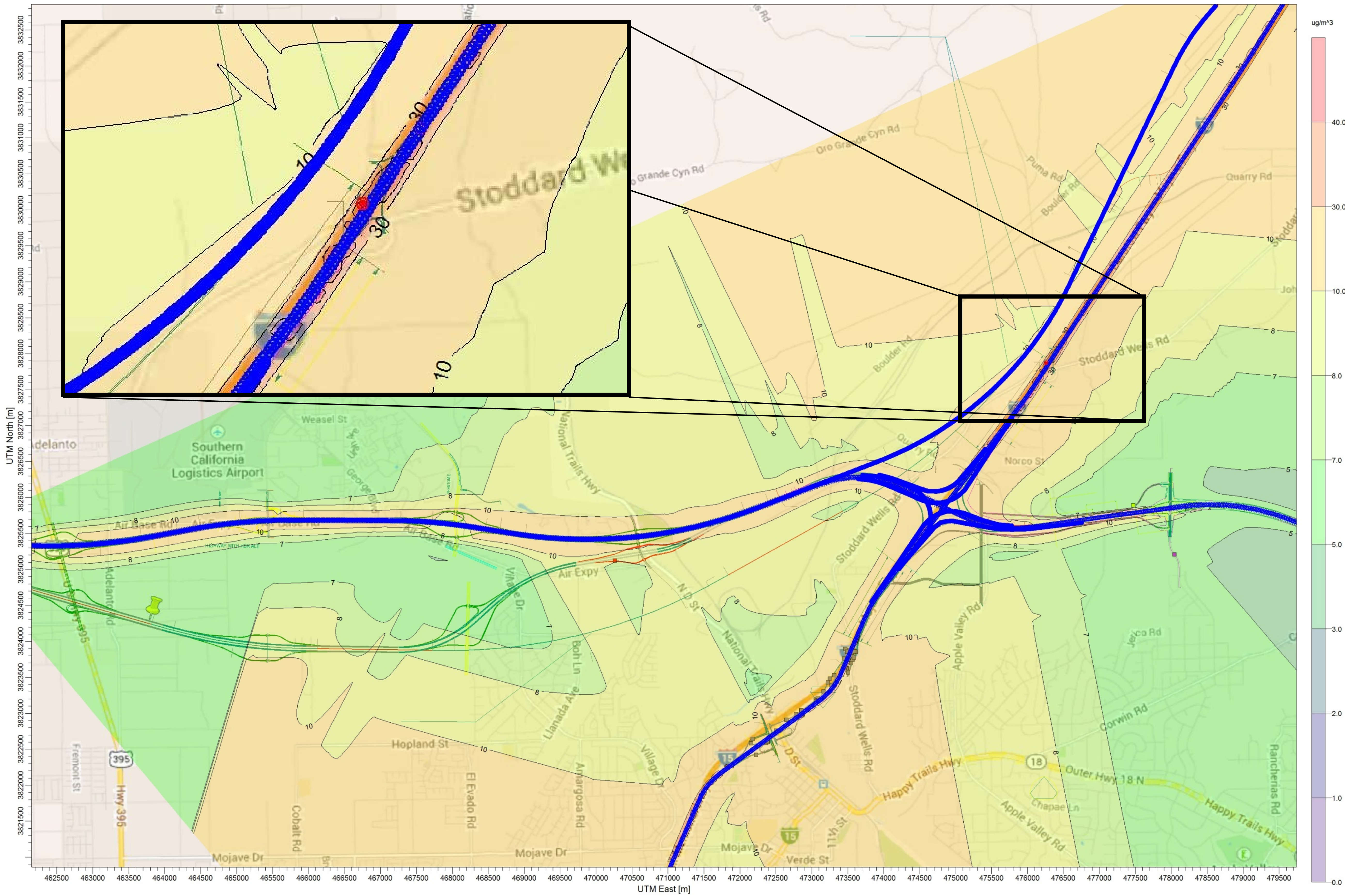


Figure 7. Contour map for Domain 4 and location of hot-spots

induces wind erosion, resulting in suspension of erodible debris and fine particulates from the surface of the surrounding impacted area. According to a study completed as part of the California High Speed Rail (CALHSR), estimates of the fugitive dust emissions from the particle suspension can be derived, using AP-42 Chapter 13.2.5. The CALHSR study assumes much higher operating speed of 220 mph and this project proposes the HSR feeder in the media with low inventory of fugitive dust. An estimate of fugitive dust based on the CALHSR study is thus considered conservative; and is included in this Analysis to evaluate the potential impacts from the proposed HSR feeder system. This CALHSR study was obtained through discussion with the EPA; and is provided in Attachment B.

According to the project schedules, the construction will not last more than 5 years at any individual sites. Construction-related emissions due to this project are thus considered temporary as defined in 40 CFR 93.123(c)(5); and are not included in this Analysis. This project will comply with the Mojave Desert Air Quality Management District (MDAQMD) Fugitive Dust Rules (Rule 403) for any fugitive dusts emitted during the construction. Excavation, transportation, placement, and handling of excavated soils shall result in no visible dust migration. A water truck or tank will be available within the project limits at all times to suppress and control the migration of fugitive dusts from earthwork operations. The project is required to comply with any state, federal, and/or local rules and regulations developed as a result of implementing control and mitigation measures proposed as part of their respective SIPs.

9. Emission and Dispersion Models

The Guidance requires use of the latest emissions model in hot-spot analyses. This Analysis has been prepared based on the latest EPA-approved emissions model for use in California, EMFAC2011. As recommended by the Guidance, this Analysis applied the simplified approach using the Project-Level Assessment tool, EMFAC2011-PL, to generate emission rates for non-trucks and trucks operating at different speeds within the MDAB portion of San Bernardino County. An EMFAC2011emissions model run was completed for each of different analysis years of 2020 and 2040.

Traffic analysts have provided forecasts for the proposed project that were divided into individual links by facilities. Average speeds and volumes for non-truck and truck traffic were obtained to represent traffic data for each link in four different time periods of a typical day: night time (7 PM – 6 AM), AM peak period (6 AM – 9 AM), mid-day period (9 AM – 3 PM), and PM peak period (3 PM – 7 PM). Emission factors for non-truck and trucks generated at different speeds were then applied to produce total exhaust emissions for each time period. Tire and brake wear emissions were estimated based on: the emission factors generated from EMFAC2011 for non-truck and truck traffic in the MDAB portion of San Bernardino County; and truck percentage for each link and for each time period. The emissions of paved road dust were estimated using the formula in the AP-42, Section 13.2.1 (January 2011); and calculated using the following values: silt loading of 0.002 g/m^2; average weights of 2 tons for non-truck and 20 tons for trucks; and particle size multipliers of 1.00 g/VMT for PM_{10}. The exhaust, tire and brake wears, and paved road dust emissions estimated for each link was prepared on a grams/second for each time period of a day. A total for all emission types for each time period was then used as input to the dispersion model.

Emissions of wind-induced fugitive dust were estimated based on the formulae and defaults utilized in estimates of such for the CALHSR with operating speed of 220 mph. The estimates of wind-reduced emissions resulted in 636.72 lb of PM_{10} per mile at grade track. These estimates are considered conservative because the HSR feeder service for this project is proposed in the median of the freeway/toll facility where the inventory of dust sources is already limited and the operating speed is anticipated at 150 mph, much lower than the operating speed of the CALHSR. The emissions for the HSR feeder service was then applied according to the specific length of input source for each HSR feeder service alignment established in the dispersion model.

The Guidance recommends that hot-spot analyses be developed consistent with the EPA's current recommended model under Appendix W to 40 CFR Part 51. While the American Meteorological Society/EPA Regulatory Model (AERMOD) is the EPA's recommended near-field dispersion model, Section 3.2 of Appendix W provides applicable guidance with which an EPA's Regional Office may determine acceptability of alternative models such as some commercial Graphical User Interface (GUI) versions of AERMOD. Due to the magnitude of the project area and complexity of the project scope, this Analysis has been prepared utilizing the Lakes Environmental AERMOD View Message Passing Interface (Lakes AERMOD View MPI).

Prior to the use of the Lakes AERMOD View MPI, however, Caltrans initiated consultation with EPA Region 9 Office and Model Clearinghouse in May 2013. As required by the Appendix W, Caltrans provided: a validation report for the Lakes AERMOD View MPI, which was based on the latest EPA AERMOD version 12345; and results of validation model runs. Based on the discussion and consultation with EPA Region 9, the validation report and validation model runs satisfactorily demonstrated that the Lakes AERMOD View MPI produced concentration estimates equivalent to the those obtained using the EPA's standard AERMOD for all types of sources typically used in dispersion modeling and those used in this Analysis. Furthermore, the consultation with EPA in regards to the Lakes AERMOD MPI was initiated with then the latest version of 12345. Portions of project model runs were already set up and initiated prior to the release of a new EPA AERMOD version 13305; so this Analysis continued utilizing the Lakes AERMOD MPI based on EPA's AERMOD version 12345 as consulted and concurred with by EPA. A request by Caltrans to EPA for acceptance of the Lakes AERMOD View MPI for conformity analysis is included in Attachment C.

Individual emission for roadway or HSR feeder service was set up in the model as a line-volume source. With the help of GUI of the Lakes AERMOD View, line-volume sources were created along the roadway and HSR feeder service alignments, with each width set to match the width of the roadway width or HSR rail width. A release height for each roadway source was estimated as a weighted average of non-truck and truck traffic based on the formula in Appendix J of the Guidance. It should be noted that each line-volume was then further divided into multiple individual and adjacent volume sources whose side equals to the width defined for each roadway or rail facility. Each line-volume source was initially assigned with an emission rate of 1 g/s; but was further directed to vary emission rates on an hourly basis for each period according to the rates summarized in Attachment D.

Receptors were placed in order to estimate the highest concentrations of PM_{10} and to determine any possible violations of the NAAQS. As concurred with by the interagency consultation in 2011 and based on subsequent consultation with EPA, a different set of receptor grids was applied for each round of model runs. A fence line receptor utility in Lakes AERMOD View was used in establishing lines of receptors at different intervals for each round as noted in Table 1. GIS software was used to delineate right-of-way (R/W) lines and define excluded areas; and the fence line receptors were developed perpendicular to the R/W at the noted intervals.

Figures 8 and 9 illustrate the extent of receptor grids for Domains 3 and 4, respectively, used in the first round of modeling. Figure 10 illustrates receptor grids used in the second round of model run while Figure 11 offers a lose-up view of receptor grids in the vicinity of hot-spot location identified from the first round of model run.

10.Meteorology and Climate

The High Desert is classified as an arid desert climate. In the Mojave Desert, this is modified by the San Bernardino and San Jacinto mountains forming barriers to precipitation. The rain shadow causes the aridity of the High Desert climate, while leaving the summers hot and the winters generally mild.

For most of the summer, the Mojave Desert region is under edge of the Pacific Subtropical Ridge that limits cloud formation and allows strong daytime heating. This is a zone with no dominant winds, which allows more local effects such as the sea breeze passing through the Banning Pass to control the local weather. The high pressure systems also contribute to the presence of persistent inversion layers that trap pollutants by preventing their dispersion through vertical mixing. In late summer, the ridge can move far enough north to allow humid air from the Gulf of California, and even as far east as the Gulf of Mexico, into the High Desert. When this happens, thunderstorms may form causing isolated flash floods and high wind gusts.

Average high temperatures in summer are in the mid 90s to 100^{o} Fahrenheit (F). Average low temperatures are in the mid 60s to 70s. During winter, the Polar Front Jet stream steers pressure systems from west to east across the region. Mild rains result from systems steered in from the southwest and northwest. Winter storm systems are often followed by periods of clear skies and strong westerly or northerly winds. Average high temperatures in winter are in the mid 50s and average low temperatures are in the mid 30s. The annual average maximum temperature recorded from January 1981 to December 2010 at the Victorville Station is 25.3°C (77.5°F), and the annual average minimum is 6.6°C (43.8°F) (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca9325).

Prevailing winds in the MDAB are out of the west and southwest. Theses prevailing winds are due to the proximity of the MDAB to coastal and central regions and the blocking nature of the Sierra Nevada Mountains to the north; air masses pushed onshore in Southern California by differential heating are channeled through the MDAB. The MDAB is separated from the Southern California coastal and central California Valley regions by mountains (highest elevation approximately 10,000 feet), whose passes from the main channels for these air masses.

The Mojave Desert receives precipitation from winter cold fronts and moist southerly air masses during the late summer. Annual average precipitation for the same period is recorded at 5.56 inches at the Victorville Station. Summer thunderstorms bring highly variable amounts of localized rain. The rain from these storms falling into the dry air often evaporates before reaching the surface. However, if the storm lasts long enough, the area beneath the storm may get several

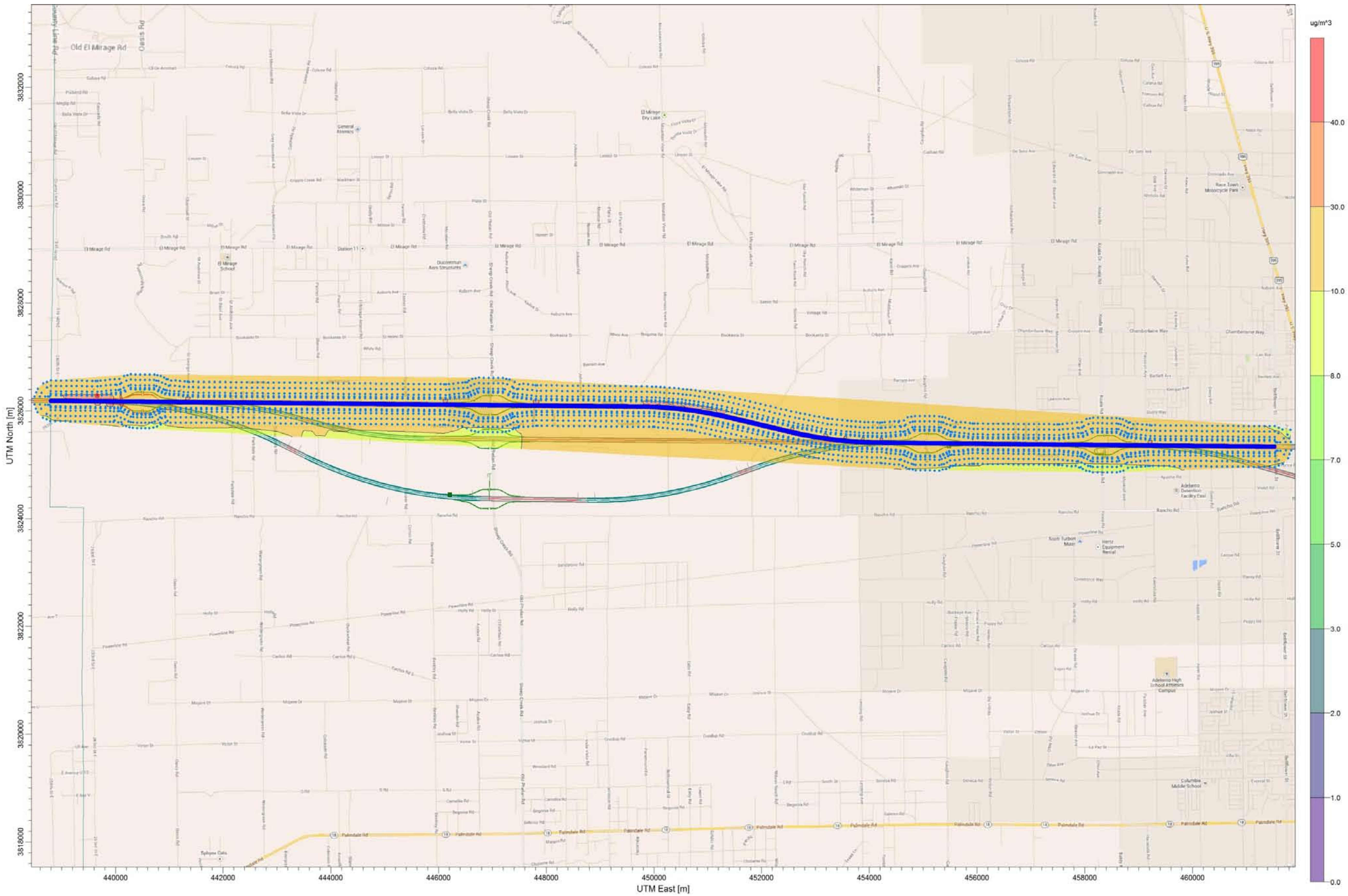


Figure 8. Extent of receptor grids in Domain 3 and contour map of concentrations (first round model run)

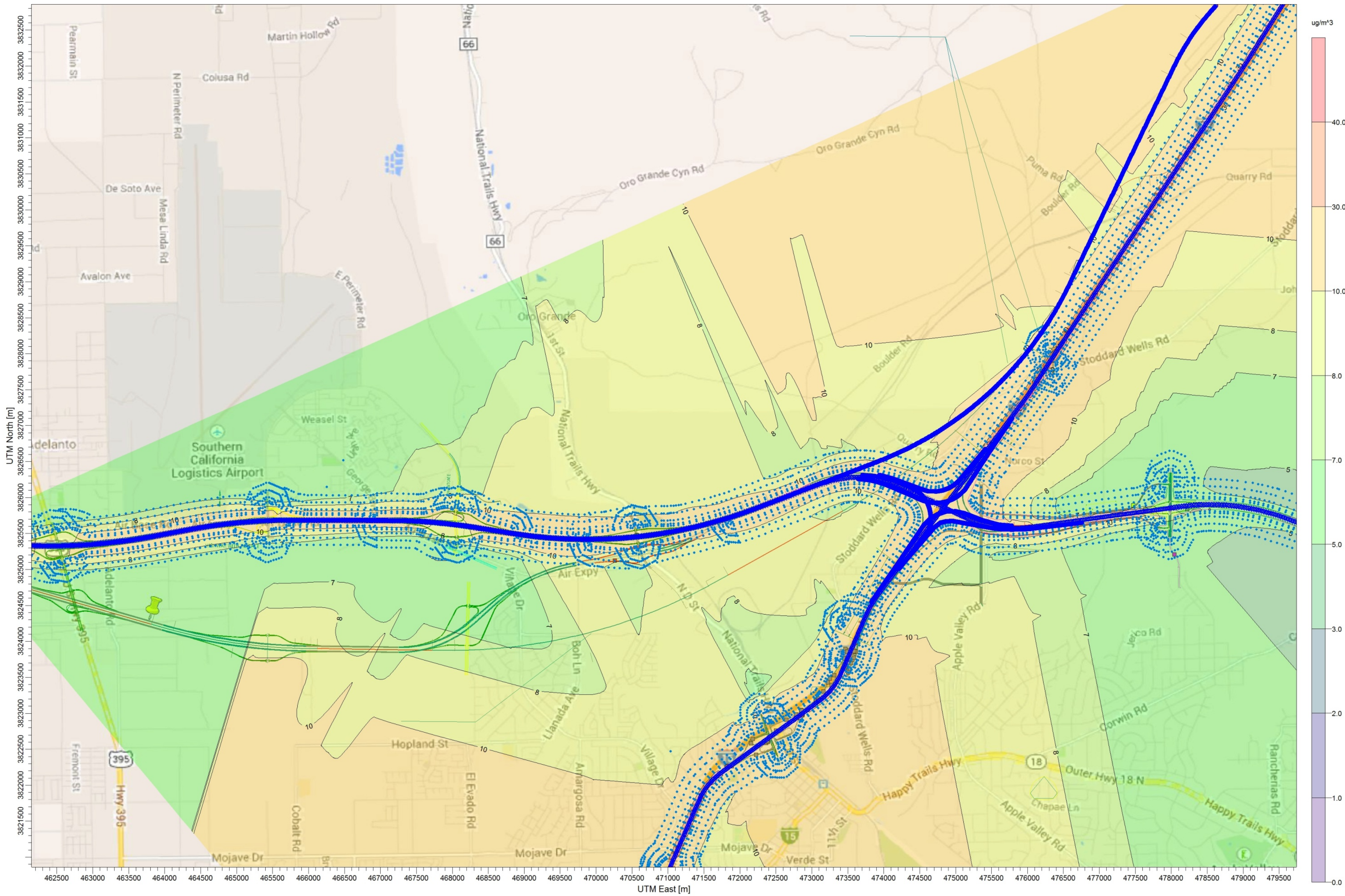


Figure 9. Extent of receptor grids in Domain 4 and contour map of concentrations (first round model run)

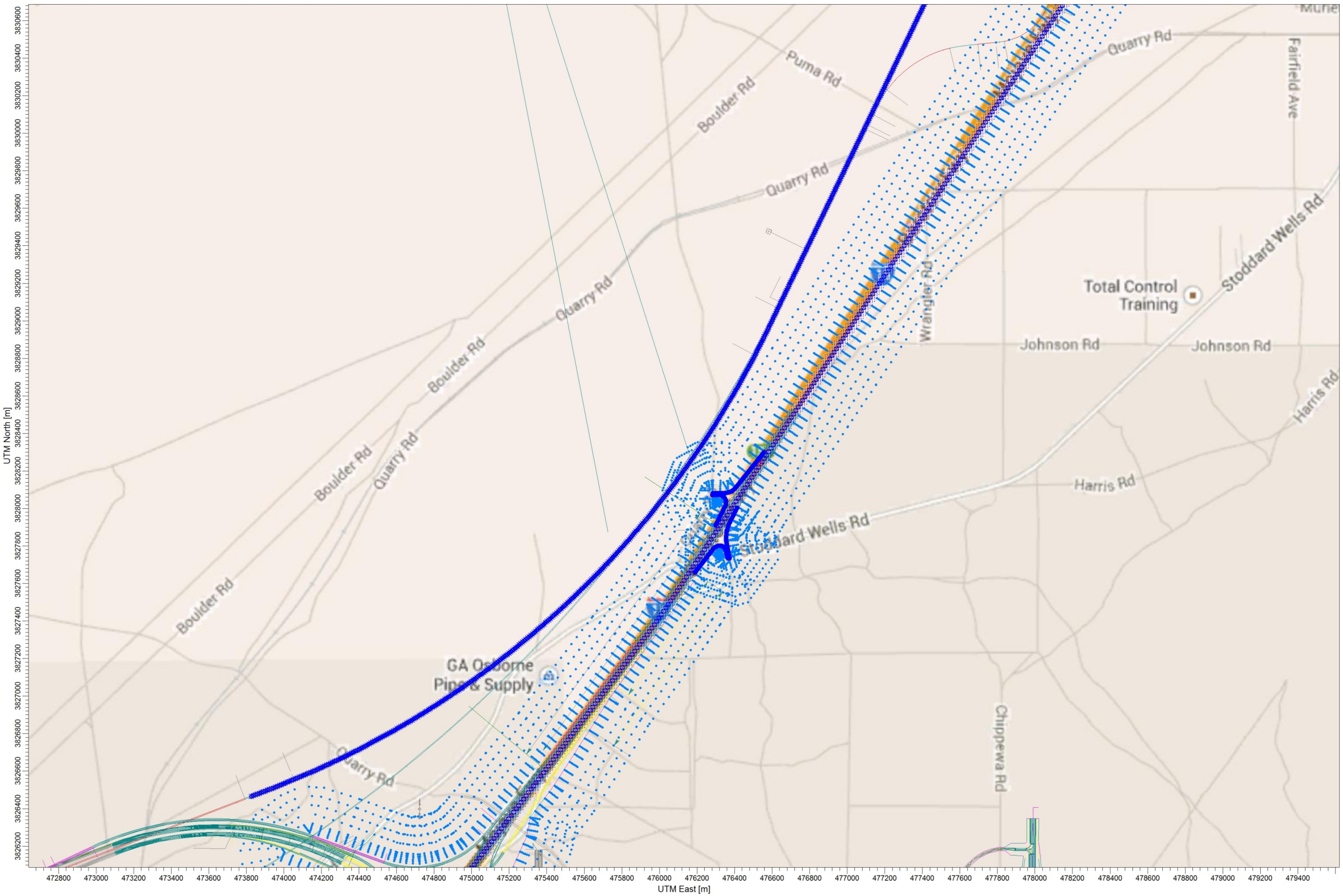


Figure 10. Receptor grids in second round of model run surrounding hot-spot locations (second round model run)

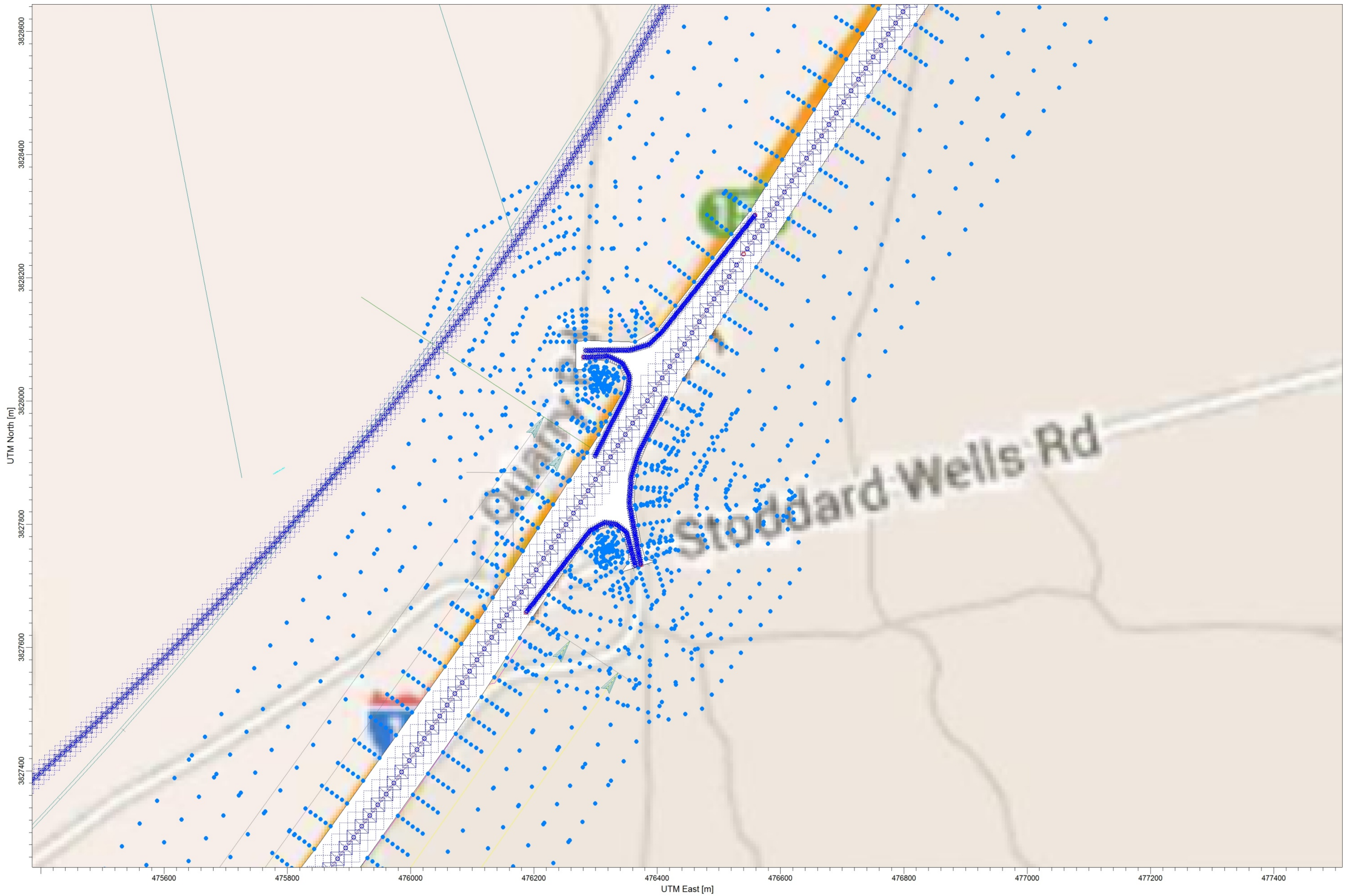


Figure 11. Close-up view of receptor grids in the vicinity of hot-spot location (second round model run)

inches of rain over a short time leading to flash floods and rapid erosion in washes and gullies. The Southern California region frequently experiences temperature inversions in which pollutants are trapped and accumulate close to the ground. Inversions are layers in the atmosphere where the temperature increases with height instead of decreasing as is normal. There are two types of inversion affecting the High Desert. The first is the regional inversions caused by subsiding air within the high-pressure systems that dominate the summer weather. These subsidence inversions can occur at varying altitudes, with corresponding variable effects on the pollution levels. The lower the inversion level is, the greater the concentration of pollutants between it and the ground becomes. The second type is the radiation inversion that forms when the ground cools rapidly after sunset, cooling the air immediately above it at the same time. Radiation inversions can cause significant concentrations of pollutants because they are generally only a few hundred feet above the ground and are strongest during early morning commuting time. Especially in the desert, rapid heating of the ground usually disperses radiation inversions within an hour of sunrise.

At a height of 1,200 feet, the inversion puts a tight lid on pollutants, concentrating them in a shallow layer. Smog in Southern California is generally the result of these temperature inversions combining with coastal day winds and local mountains to contain the pollutants for long period of time, allowing them to form secondary pollutants by reacting with sunlight. The inversion conditions in the MDAB are much less favorable for the buildup of high ozone concentrations than in the coastal areas of Southern California. When subsidence inversions occur, they are generally 6,000 to 8,000 feet above the desert surface, allowing much greater vertical mixing than along the coast where the inversion base is often much lower. As a result, meteorology in the MDAB is less conducive for the chemical mixing characteristic of typical ozone formation.

The area in which the proposed project is located offers clear skies and sunshine; however, it is still susceptible to air inversions. This traps a layer of stagnant air near the ground where it is further loaded with pollutants. These inversions cause haziness, which is caused by moisture, suspended dust, and a variety of chemical aerolsols emitted by trucks, automobiles, furnaces, and other sources.

Caltrans accessed the National Climatic Data Center under the National Oceanic and Atmospheric Administration in January 2012 to obtain the most recent 5 years worth of surface meteorological data at the Southern California Logistics Airport (SCLA, Station No. 23131, latitude: 34.598 and longitude: -117.383). A research of those data sets revealed that a number of hourly observations were missing from 2007 through 2010. Due to the lack of complete data set at the SCLA, therefore, local surface data for this Analysis were obtained from the Victorville monitoring stations (ARB Site Number 36306, AIRS Number 060710306). The Victorville station is located approximately 7 miles southwest of the identified hot-spot location; and is located less than 0.5 mile from SR-18 and I-15 with traffic volumes comparable or higher than those forecasted on the proposed HDC. The Victorville monitoring station is therefore deemed representative of the project area based on the proximity and similarity to the project area.

As the dispersion modeling also requires upper air data, Caltrans reviewed available upper data from the following sites near the project area: Edwards Air Force Base, Miramar Air Force Base, and Mercury/Desert Rock Station in Nevada. As recommended by the local air district, MDAQMD, and based on a detailed review of their representativeness, upper air data from the

Mercury/Desert Rock station were selected for use in this Analysis. A review of the historical upper air data revealed that considerable amount of observations was not available in recent years.

Based on a review of available upper air and surface data, Caltrans presented two options to EPA in April 2012 for establishing meteorological data sets that would satisfy EPA's modeling guidance. Option 1 proposed to utilize upper air and surface data from April 2000 to March 2005 while Option 2 proposed using the data from January 2001 to December 2005. Option 1 provided a complete data set for the Palmdale portion of the proposed project at the least; but it would still result in upper air data missing considerably for two quarters. Option 2 presented data sets that included more parameters at the Victorville station than Option 1. While some parameters for the upper air data presented in Option 2 were not as complete as the EPA requirement, they were able to be brought to above the EPA requirement by using EPA's missing data procedure. Upon consultation and teleconference in April 2012, EPA concurred that Option 2 was acceptable based on the information presented. The memorandum presented to EPA for consultation on the surface and upper air data is included in Attachment E.

11.Air Quality Trend Analysis

As discussed above, predominant wind direction and speed in Victorville area are due to the region's terrain and geographical features. Dry conditions and heavy winds contribute to the severity of air pollution issues in the MDAB. Figure 12 below indicates the predominant wind direction in the region based on meteorological data from the Victorville monitoring station.

PM_{10} concentrations monitored at the Victorville station are presented in Table 2 and Figure 13 for the six-year period from 2007 to 2012. As indicated in the table and figure below, maximum 24-hour PM10 concentrations at the Victorville monitoring station has generally declined from 2007 to 2012. Maximum concentrations monitored at the Victorville station exceeded the national ambient standard of 150 μg/m^3 in 2007, according to the EPA database.

Table 2 Ambient PM10 Concentrations at the Victorville Station

	2007	2008	2009	2010	2011	2012
National maximum 24-hour concentration (μg/m^3)	358	77	53	40	37	45
National second-highest 24-hour concentration (μg/m^3)	130	74	49	34	36	43
NAAQS 24-hour (>150 (μg/m3), Estimated	7	0	0	0	0	0
Exceeds the federal 24-hour standard (150 μg/m^3)?	Yes	No	No	No	No	No

Source: United States Environmental Protection Agency 2014, compiled by Caltrans
Estimated number of days of exceedance based on ARB Air Quality Data Statistics

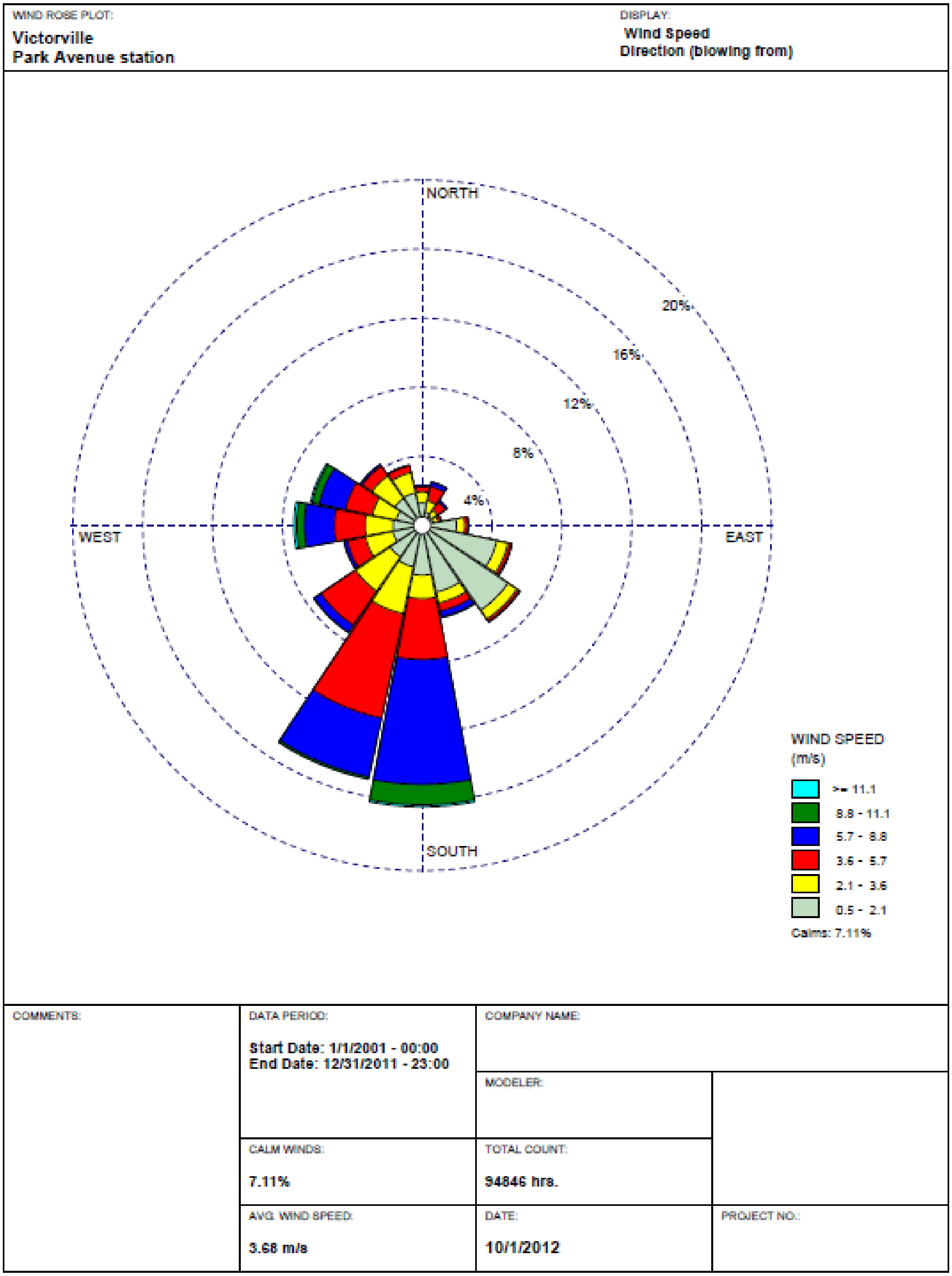


Figure 12. Predominant Wind Direction at Victorville-Park Avenue Station

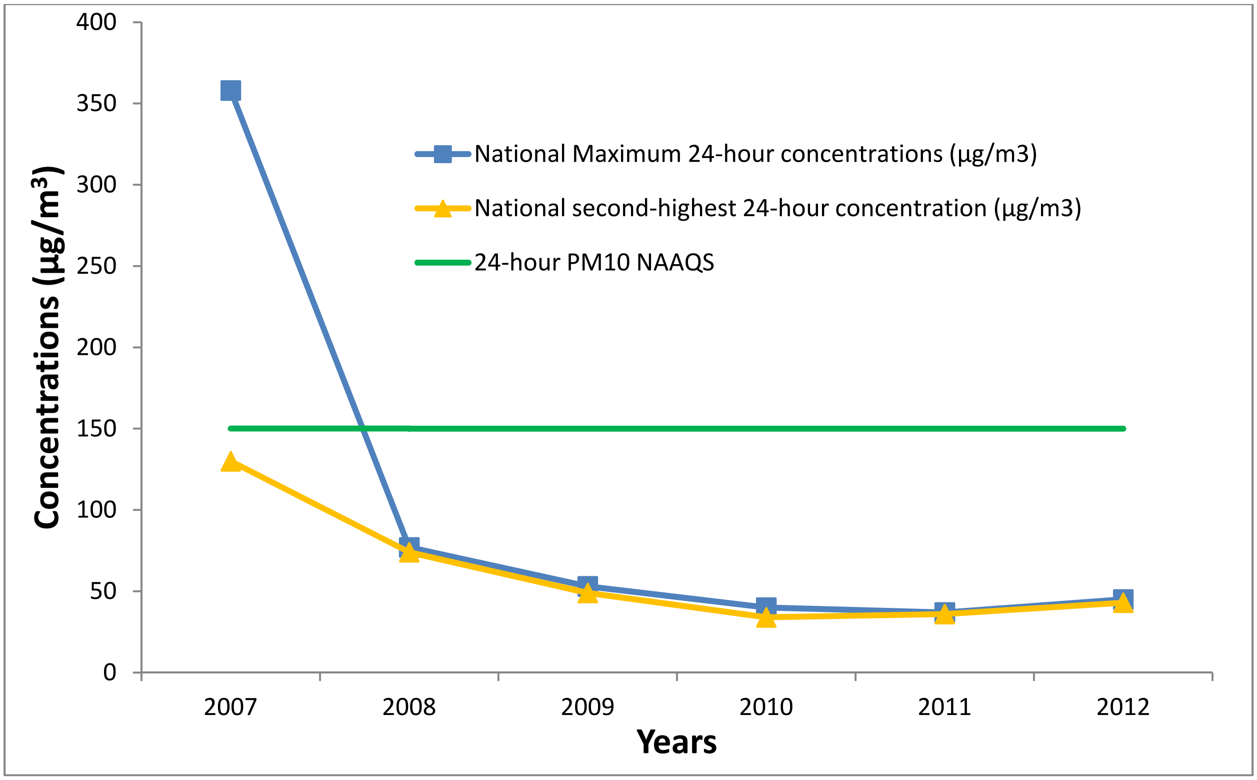


Figure 13. 24-Hour PM_{10} Concentrations at the Victorville Station

12. Background Concentration

The Guidance requires that the background concentration be determined based on available measurements for 12 consecutive quarters. Caltrans obtained the most recent measurements at 5 monitoring stations in San Bernardino County within the MDAB. The measurements were obtained through EPA's AirData website (http://www.epa.gov/airdata/). Table 3 summarizes quarterly maximum 24-hour PM_{10} measurements at all five monitoring stations reviewed as part of this Analysis. Figure 14 illustrates the locations of these monitoring stations relative to the proposed project site.

As noted in Table 3, the number of measurements at the monitoring stations ranges from 53 to 61 in a year during the three-year period. The highest measurement at each monitoring station during the 12 consecutive quarters is noted as shaded cells in the table.

Based on a review of the monitoring stations available in the vicinity of the proposed project, Caltrans selected the Victorville monitoring station for representative background concentrations for this Analysis, based on an evaluation of the criteria including:

- Proximity to the proposed project;
- Similar climate and meteorology; and
- Land use and level of traffic similar to the proposed project.

The selection of the Victorville monitoring station is also consistent with the methods and assumptions reviewed and concurred with by TCWG in June 2011.

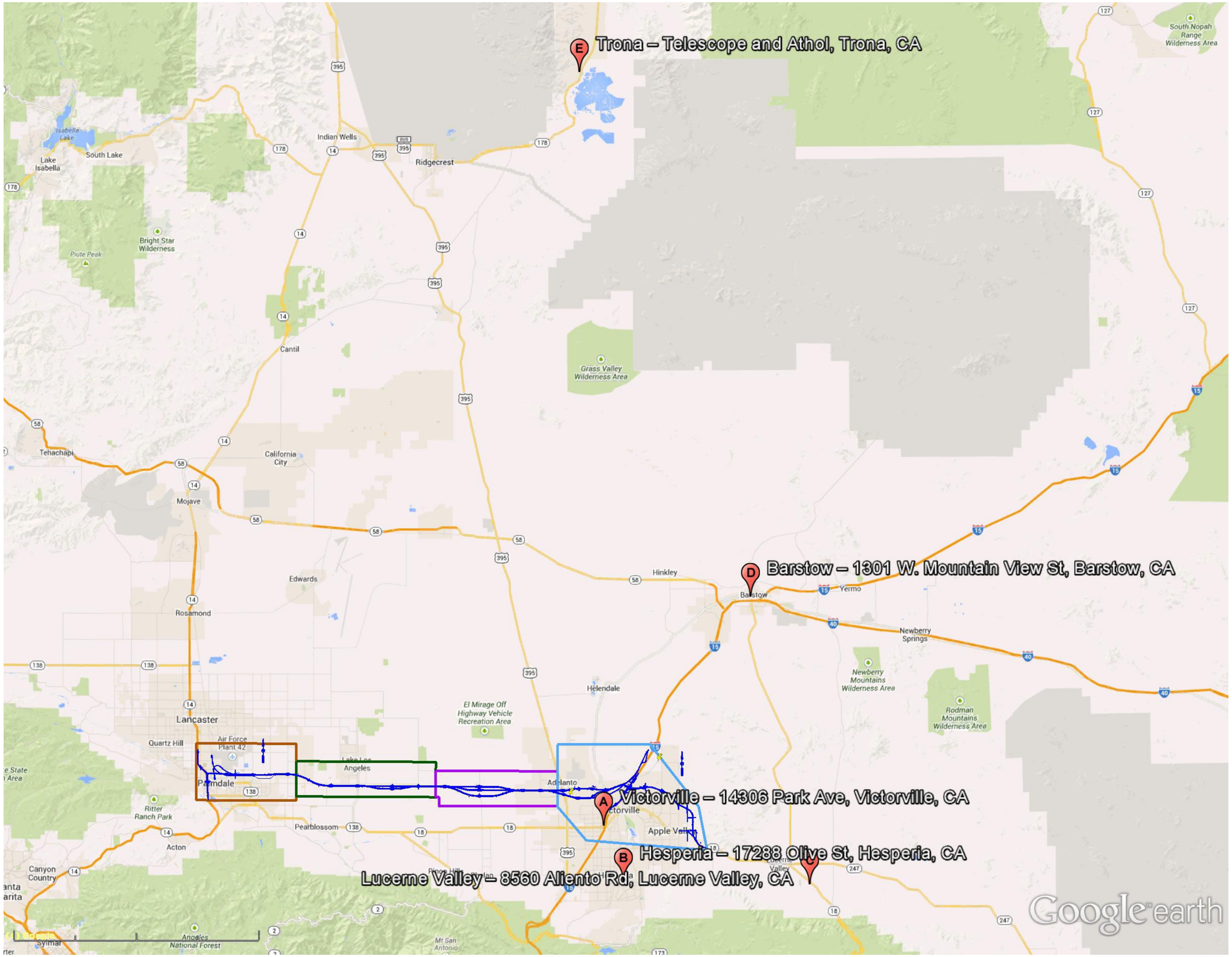


Figure 14. Monitoring stations in San Bernardino County within MDAB

According to the summary in Table 3, the highest 24-hour PM_{10} measured at Victorville station was determined as 45 μg/m³ and was used in the calculation of a design value in this Analysis. This value is considered conservative since concentrations at the Victorville station have been decreasing since 2007; and are also anticipated to decrease in the future years due to the state and federal rules and regulations to limit emissions of PMs. It should also be noted that this value of 45 μg/m³ is comparable to the ambient concentrations measured at other five stations around the proposed project.

Table 3 Quarterly First Maximum 24-hour PM_{10} Values at Monitoring Stations (in μg/m³)

Year	Q1	Q2	Q3	Q4	No. of Measurements / year
Victorville – 14306 Park Ave, Victorville, CA (Noted as "A" on Figure 14)					
2012	43	45	34	41	55
2011	34	37	36	34	60
2010	35	32	44	29	60
Hesperia – 17288 Olive St, Hesperia, CA (Noted as "B" on Figure 14)					
2012	30	36	25	45	60
2011	41	38	36	31	59
2010	31	33	48	26	60
Lucerne Valley – 8560 Aliento Rd, Lucerne Valley, CA (Noted as "C" on Figure 14)					
2012	19	28	30	20	56
2011	29	33	27	17	56
2010	22	32	43	25	60
Barstow – 1301 W. Mountain View St, Barstow, CA (Noted as "D" on Figure 14)					
2012	39	39	42	31	61
2011	29	98	41	43	59
2010	28	27	38	29	55
Trona – Telescope and Athol, Trona, CA (Noted as "E" on Figure 14)					
2011	36	45	29	32	53
2010	22	37	30	51	59
2009	32	31	32	60	61

Source: EPA AirData (http://www.epa.gov/airdata/) accessed in January 2014

Note: Measurements are not available for the 2nd quarter of 2012 at Trona, CA; and 3 years of measurements from 2009 to 2011 are included.

13. Analysis Years and Traffic Data

According to the Guidance, a hot-spot analysis compares the air quality concentrations with the proposed project to the applicable NAAQS or to the concentrations without the project. These concentrations with the project are determined using a design value that is a combination of the modeled value and background concentration. The background concentration has been evaluated and determined as discussed above. The modeled value is determined from model runs of the proposed improvements and scope with emissions calculated for years during which peak emissions from the project are expected; and a new NAAQS violation would most likely occur due to the cumulative impacts of the project and background concentrations.

The proposed project will likely affect local and regional travel patterns in the High Desert area upon its completion, resulting in changes in vehicle fleets and increase traffic volumes, speeds, and VMT along the HDC and neighboring facilities. Coupled with the declining trend for the background concentrations as discussed above, the project area is likely to be affected with increase in emissions from additional traffic immediately following the completion of the project. In addition to the opening year, this Analysis also considers traffic impact after the full 20-year life span of the project when this project area will have been developed according to the latest planning assumptions in the regional plan.

The conformity rule requires that the latest planning assumptions available at the time of analysis must be used in conformity determinations (40 CFR 93.110). Furthermore, assumptions applied in hot-spot analyses must be consistent with those used in the regional emissions analyses for any inputs that are required for both analyses (40 CFR 93.123(c)(3)). Traffic data used in this Analysis have been estimated using the latest travel demand model consistent with the SCAG's model at the time the analysis began. The future forecast have been estimated by Parsons according to 4 individual periods of a day: AM (6 AM to 9 AM), mid-day (9 AM to 3 PM), PM (3 PM to 7 PM), and night time (7 PM to 6 AM). Traffic data have been developed in links (approximately one ramp interchange to another) and VMTs have been calculated based on volumes and length of each link.

A summary of forecast traffic data used in the Analysis is provided in Attachment F.

14. Calculation of Design Values and Determine Conformity

The Guidance provides that compliance with the 24-hour PM_{10} NAAQS is based on the expected number of 24-hour exceedances of 150 μg/m^3, averaged over three consecutive years. The NAAQS is met when the expected number of exceedances is less than or equal to 1.0. According to the Guidance, the design value for 24-hour PM_{10} was calculated by combining the background concentrations with the concentration values generated for receptors in AERMOD.

DV for PM_{10} = Background Concentration + the highest 6th highest concentration from AERMOD

As discussed above, the background concentration was determined to be 45 μg/m^3. Using appropriate control and output pathways, the Lakes AERMOD View MPI was programmed to estimate and identify the highest of all 6th highest concentrations from model runs among all the receptors placed. Among the receptors in the second round of model, the highest 6th highest PM_{10} occurred in 2040 near the ramp off the I-15 north of the HDC (latitude: 34° 35' 37.92", longitude: 117° 15' 24.83"); and its concentration was determined as 42.43256 μg/m^3. The highest 6th highest PM_{10} modeled with the 2020 emission rates was determined as 37.13296 μg/m^3. Figures 15 and 16 provide contour maps for 2020 and 2040, respectively, with the location of the highest 6th highest concentration identified in red. As this hot-spot location is the one at which the most likely new PM_{10} NAAQS violations would occur, it can be assumed that conformity is satisfied in the entire area if conformity is demonstrate at this hot-spot location.

The design value for this Analysis was thus calculated based on the highest 6^{th} highest PM_{10} concentration modeled, which is 42.43256 $\mu g/m^3$. The modeled value and the background concentration from the Victorville monitoring station were combined together to result in 87.43256 $\mu g/m^3$. As required by the Guidance, the result was then rounded to the nearest 10 $\mu g/m^3$ and the final design value was calculated to be 90 $\mu g/m^3$ for the project. The design value of 90 $\mu g/m^3$ was compared to the 24-hour PM_{10} NAAQS (150 $\mu g/m^3$). As the design value was calculated to be below the 24-hour PM_{10} NAAQS, the project was determined to conform.

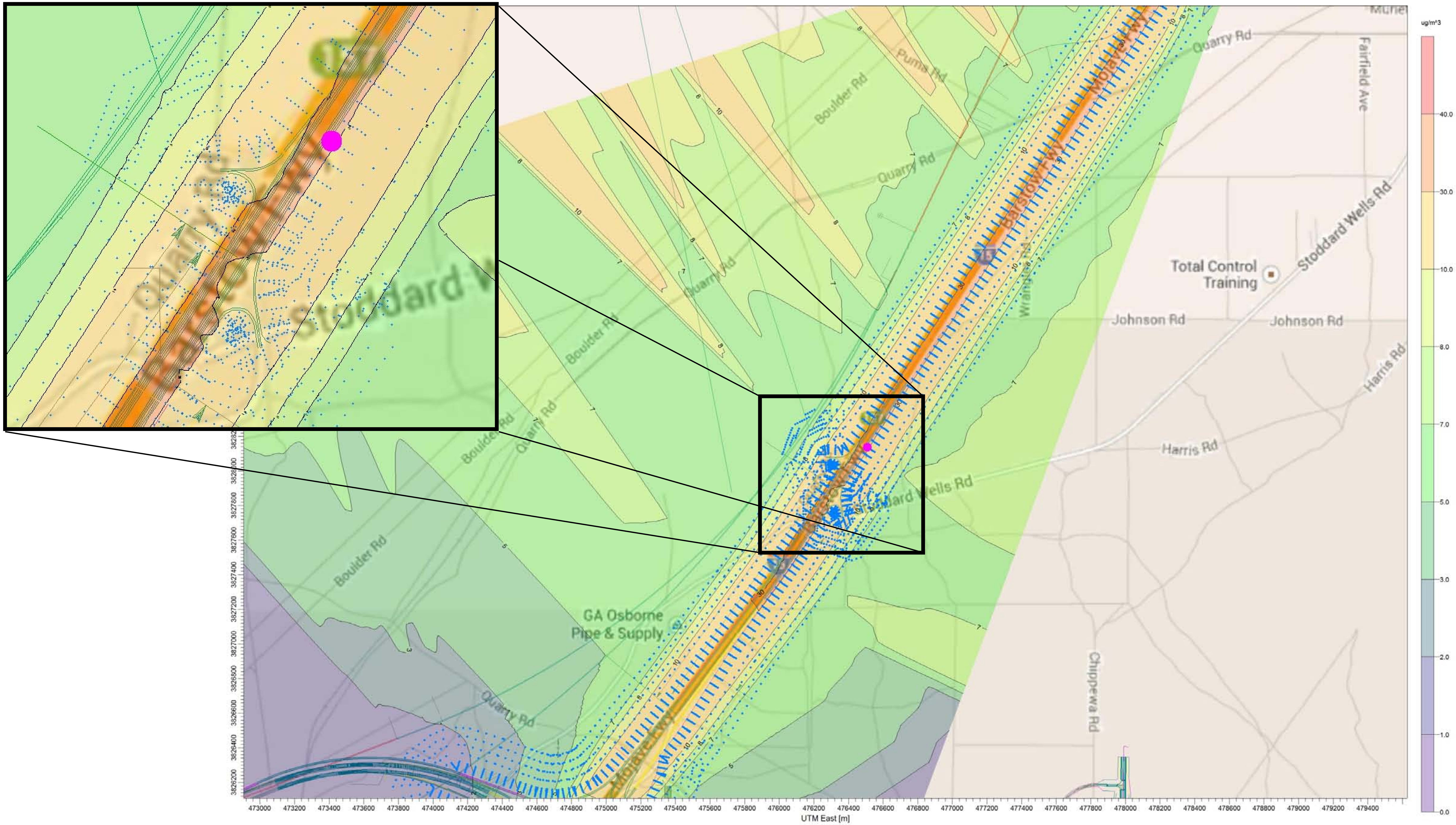


Figure 15. Contour Map of Concentrations and Location of the highest 6th highest 24-hour PM_{10} in 2020

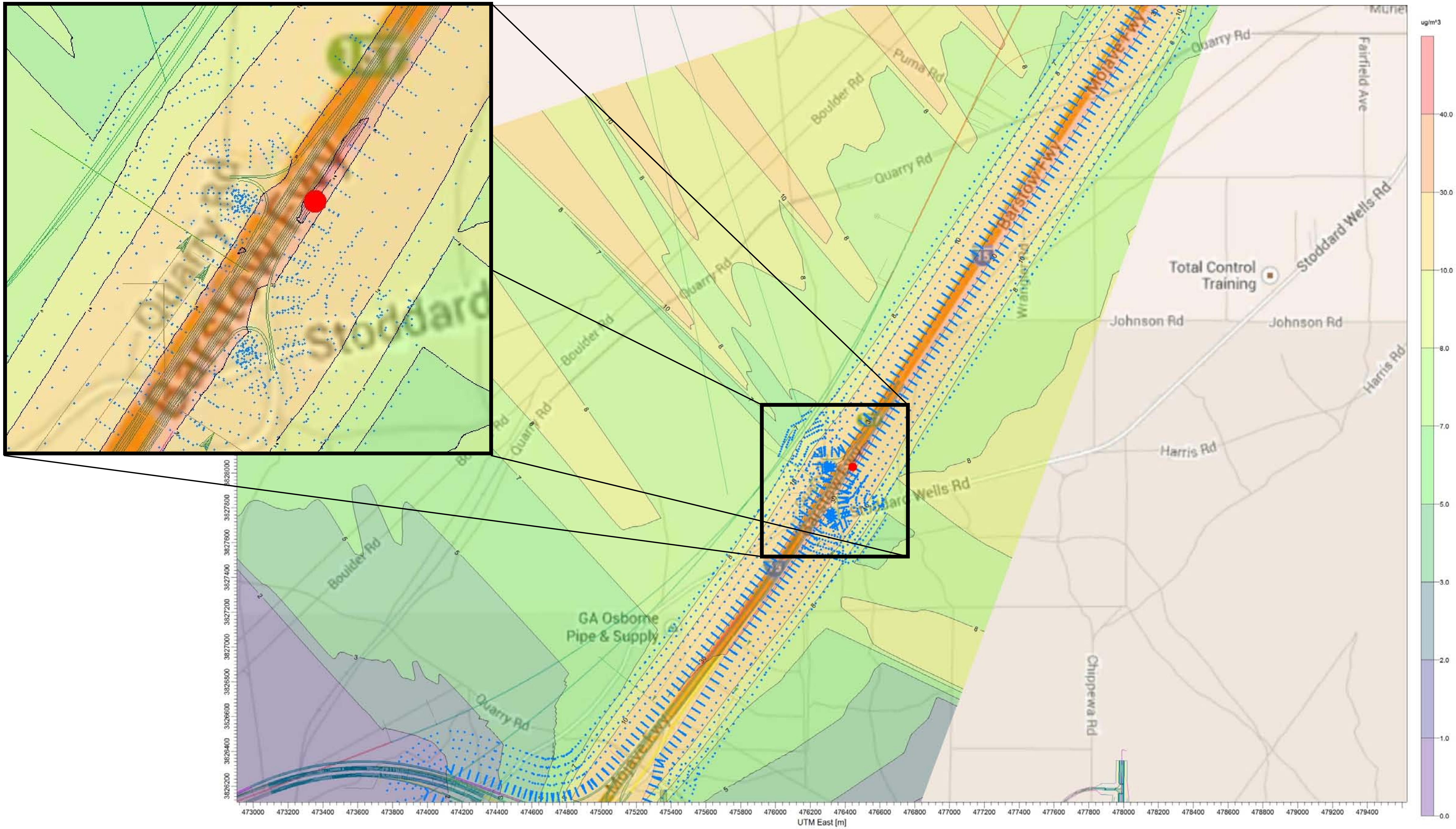


Figure 16. Contour Map of Concentrations and Location of the highest 6th highest 24-hour PM_{10} in 2040

Attachment A

Methods and Assumption Submitted to TCWG in June 2011

Method and Assumptions requiring Review and Concurrence by TCWG:

The Geographic Area covered by the analysis:

The proposed project is located in the High Desert area of Los Angeles and San Bernardino Counties and extends for a distance of approximately 63 miles between SR-14 in the City of Palmdale and SR-18 in the Town of Apple Valley. In Los Angeles County, the High Desert Corridor (HDC) roughly follows the Avenue P-8 corridor. In San Bernardino County, the HDC runs slightly south of El Mirage Road and then follows Air Expressway Road near I-15. East of I-15, the proposed route curves south until it ends at SR-18 in the Town of Apple Valley at Bear Valley Road. The hot-spot conformity analysis will be prepared for the portion of the proposed HDC in San Bernardino County, from the county line to SR-18. The portion of the proposed HDC in Los Angeles County is in an area that is in nonattainment only for ozone.

General Approach and Analysis years for emissions and air quality modeling:

The hot-spot analysis will evaluate the build scenarios first to see if a new or worsened PM_{10} NAAQS violation is predicted. There are currently 8 Alternatives as follow, including a No-Build Alternative: TSM/TDM; Freeway/Expressway; Freeway/Toll way; Avenue P-8 Corridor, SR-138 and SR-18 Improvements; Freeway/Expressway with ROW for potential High Speed Rail (HSR) facility; Freeway/Toll way with ROW for potential HSR facility; and a Hybrid of the alternatives.

The hot-spot analysis will follow the December 2010 EPA Guidance for Quantitative Analyses. The following analysis years will be evaluated for the existing, opening, and horizon years: 2010, 2020, and 2040.

Construction at each individual site is not anticipated to last more than 5 years; and therefore, the construction emissions will not be included in this hot-spot analysis because they are considered temporary as defined in 40 CFR 93.123(c)(5).

Emissions and Air Quality Models and Methods to be used:

EMFAC2007 will be used in "emfac" mode for emissions inventory; and AERMOD will be used for dispersion due to necessity for modeling of freeways and nearby sources. Future developments of EMFAC will be considered and incorporated only when required by EPA for conformity purposes for this project.

Applicable PM NAAQS to be evaluated:

The Mojave Desert Air Basin within San Bernardino County is currently in nonattainment of the 24-hour PM_{10} NAAQS; so the applicable NAAQS for the purpose of this hot-spot analysis is 150 $\mu g/m^3$ for the 24-hour PM_{10}. There are no applicable annual PM_{10} NAAQS.

Type of PM emissions to be modeled for project sources:

Direct exhaust emissions of PM_{10} (EMFAC2007); Brake and Tire wear PM_{10} (EMFAC2007); and re-entrained PM_{10} paved road dust (using the January 2011 AP-42).

Nearby Sources:

A number of nearby sources have been identified based on the State Facility Inventory Database (see attached map and spreadsheet). Among those identified are large cement and aggregate plants. Only nearby PM_{10} sources within approximately 2 miles of the proposed alignments will be considered in the modeling.

HSR alternatives only propose to preserve ROW with no engineering plans to open any stations or to implement the actual HSR; therefore, no emissions will be considered attributed by the HSR components.

Receptor Locations:

Receptors near sensitive zones will be sited just outside the proposed project ROW (< 5 meters) with finer spacing of 10 meters in a grid format out to 50 meters from the ROW; and with wider spacing of 50 meters in a grid format out to 150 meters.

Receptors in the rural or commercial/non-sensitive zones will be sited just outside the proposed project ROW with wider spacing of 50 meters in a grid format out to 150 meters from the proposed ROW.

Meteorological and Background Data:

Victorville monitoring station is maintained by the MDAQMD, located at 14306 Park Avenue in the City of Victorville, approximately 0.2 miles west of I-15 and 0.25 miles north of SR-18. The Avenue P-8 Corridor Alternative roughly follows the existing SR-18 alignment to the junction with I-15, located approximately 0.25 miles from the Victorville station. The Freeway/Expressway/Toll Alternatives of the HDC are located approximately 4 miles north of the Victorville station. As the Victorville station is located in close proximity to freeway (I-15) and highway (SR-18) facilities with a similar level of use anticipated in the HDC; it may be considered as site-specific and the hot-spot analysis will be prepared with the meteorological and monitoring data at the Victorville station upon concurrence.

No preprocessed AERMOD-ready meteorological data are readily available from the MDAQMD or ARB that utilize the most current surface or upper air data. A preprocessed AERMOD-ready data set has been identified from dispersion modeling done for a nearby power plant. However, the preprocessed data set was created to represent the Victorville station with the surface data from 2002 through 2004 and upper air data from the Mercury-Desert Rock Airport in Mercury, NV. Upon concurrence by TCWG, the hot-spot analysis will be prepared using this preprocessed AERMOD-ready data.

The Victorville station is located close to the I-15 (PM 40.509) with a daily total volume of approximately 87,000; and to SR-18 (PM 96.571) with a daily total volume of approximately 43,500 based on the Caltrans 2009 count data. The Victorville station is located in a commercial area and is similar to portions of the proposed alignments of the HDC within the urban area. It should be noted that large portions of the proposed HDC alignments are located in a rural and desert area. Upon concurrence, the hot-spot analysis will be prepared based on the background PM_{10} concentrations at the Victorville station.

Project-specific data to be used:

A traffic analysis is being prepared and operational analyses will be performed. Traffic data for the new mainlines will become available this summer. Although there are 8 Alternatives for the proposed project, the traffic analysis, for the purpose of forecast modeling, will evaluate 4 scenarios only – No-Build, and various toll and freeway/expressway options.

Schedule for conducting the analysis and points of consultation:

The analysis will be performed as the project specific traffic data become available (this summer per project schedule) and the hot-spot analysis may be submitted for review and concurrence by TCWG in the late 2011 or early 2012.

Attachment B

Wind-Generated Fugitive Dust Emissions from a Passing High-Speed Train by California High Speed Rail

URS/HMM/Arup Joint Venture

[redacted]

MEMORANDUM

To: **PMT**
From: Nathalia Prasetyo Jo (URS)
Date: July 12, 2010
Subject: **Wind-Generated Fugitive Dust Emissions from a Passing High-Speed Train**

Wind erosion occurs when drag forces or shear stresses exerted by the wind exceed the retention forces acting on particles or debris at the surface. Once the minimum wind speed required to initiate particle motion (threshold friction velocity) has been reached, wind erosion occurs as a function of wind power or wind speed.

Trains traveling at high velocity, such as the High-Speed Train, drag the surrounding air along the side of its body, which induces sideways turbulent fluctuations and rear wake. The strong turbulent airflow along the sides of a moving train and the wake at the rear of the train may resuspend erodible debris and fine particulates from the surface of the surrounding impacted area, similar to particle resuspension from wind erosion.

Methodology

To estimate the fugitive dust emission from the particle resuspension, the AP42 guidance Chapter 13.2.5 Wind Erosion was used to quantify the emission factor for wind-generated fugitive particulates emissions from a passing High-Speed Train. This memo presents the approach used to estimate the annual PM_{10} and $PM_{2.5}$ emissions from the High-Speed Train operation based on the AP42 guidance and current project description (at 15%design).

Annual wind-generated fugitive dust/particulates emissions from a passing High-Speed Train are a function of the impacted zone area and the wind erosion emission factor (per unit area). According to the AP42 guidance, the wind erosion emission factor emission factor (in terms of mass per unit area) is a function of the disturbance frequency (where disturbance is defined as an action that results in the exposure of fresh surface material) in a year and erosion potential (which depends on friction velocity and threshold friction velocity).

The influencing factors such as the impacted zone area, wind erosion emission factor, disturbance frequency, erosion potential and induced wind speed profile are discussed in detail in the following subsections.

Impacted Zone Area
The impacted zone area for the High-Speed Train scenario is defined as the surface area within both shoulders of the train track or within the right of way, at which the maximum friction

velocity on the surface material is higher than the threshold friction velocity (the minimum wind speed required to initiate particle motion).

The length of the impacted zone area is equal to the length of the at-grade track. Along the Fresno to Bakersfield alignment, the length of the at-grade track is approximately 43.56 miles (total track length subtracted by the elevated track section length)[1].

The width of the impacted zone is twice the distance from the beginning of the right of way area to the point where the corresponding maximum surface friction velocity generated by the induced turbulence is equal to the threshold friction velocity (assumed 0.19 m/s, based on the lowest value available for disturbed desert soil[2]). In this memo, the width of the impacted zone is referred to in terms of distance from the train body. The doubling of width was to account for the right of way area on the left and right side of the train track.

The boundary for the impacted zone is assumed to start at beginning of the right of way area (approximately one meter from the train body) and end at the distance where the corresponding friction velocity is equal to the threshold friction velocity. The surface area from the train body to the beginning of the right of way area was assumed to consist of non-erodible material because that area is within the embankment and rock ballast area.

To quantify the fugitive dust emissions generated by a High-Speed train passing at the speed of 220 mph, the emission factor needs to account for the induced wind speed profile and the distance within the impacted zone. Further discussion on the determination of the impacted zone boundary is presented in the induced wind speed section.

Wind Erosion Emission Factor
Based on the AP42 guidance, the emission factor for wind-generated dust emissions from the surface material of the impacted zone should be calculated as follows:

Emission factor (g/m2): $k\sum_{i=1}^{N} P_i$ (Eq.1)

Where:
k = particle size multiplier
N = number of disturbances per year
Pi = erosion potential corresponding to the observed (or probable) fastest mile of wind for the ith period between disturbances, g/m^2

As described in Eq.1, the emission factor is a function of the disturbance frequency and erosion potential. The approach and assumptions used to determine the disturbance frequency and

1 The length of at-grade track was estimated based on the Fresno to Bakersfield HST Alignments Preliminary Draft Map, URS, 2010.
2 Watson, J.G, "Effectiveness Demonstration of Fugitive Dust Control Methods for Public Unpaved Roads and Unpaved Shoulders on Paved Roads", DRI Document No. 685-5200. IF2: August 2, 1996.

erosion potential for the High-Speed Train operation scenario are presented as follows:

Disturbance Frequency
The disturbance is defined as an action that results in the exposure of fresh surface material. The number of disturbances per year during normal High-Speed Train operation is equal to the frequency of right of way access in a year (for maintenance or other purposes). The wind generated emission factor is dependent on the disturbance frequency because each time that the right of way surface area is disturbed, its erosion potential is restored.

The right of way surface area is currently expected to be disturbed twice monthly for visual inspection based on the operational and maintenance schedule of the High-Speed Train. Therefore, the erosion potential is assumed to be restored twice a month, which translates to 24 disturbances/year or N=24[3].

Erosion Potential
The erosion potential (P_i) is the finite availability of erodible material (mass/area) on a surface. For the wind erosion emission factor calculation, P_i is defined as the erosion potential corresponding to the observed fastest mile of wind[4] for the i_{th} period between disturbances, and can be calculated as follows:

$$P = 58\,(u^* - u^*_t)^2 + 25\,(u^* - u^*_t) \qquad \text{(Eq.2)}$$
$$P = 0 \text{ for } u^* < u^*_t \qquad \text{(Eq.3)}$$

Where:
u^* = friction velocity (m/s)
u^*_t = threshold friction velocity (m/s). Assumed 0.19 m/s, based on the lowest value available for disturbed desert soil.

Since there was no documentation for the friction velocity from High-Speed Train operation, induced wind velocity was used to estimate the friction velocity on the right of way surface based on the correlation given by Eq.4.

$$u_z = \frac{u^*}{0.4}\ln\left(\frac{z}{z_0}\right) \qquad (z > z_0) \qquad \text{(Eq.4)}$$

Where:
u_z = induced wind speed, m/s
u^* = friction velocity, m/s
z = height above test surface, cm
z_0 = roughness height, cm
0.4 = von Karman's constant, dimensionless

---

3 Email correspondence between Thomas Baily (URS) with Arnold Luft (ARUP) dated July 6, 2010.
4 Fastest mile is the fastest one minute observed wind speed taken from a multiple register that contains a time record of the passing of each mile of wind

By substituting the friction velocity (u*) from Eq.4 into Eq.2 and the erosion potential (Pi) from Eq. 2 into Eq. 1, the emission factor in Eq.1 can be expressed as a function of induced wind speed as shown in Eq. 5

Emission factor (g/m²): $$k\sum_{i=1}^{N}\left[58\left(\frac{0.4\,u_z}{\ln\left(\frac{z}{z_0}\right)}-u_t^*\right)^2+25\left(\frac{0.4\,u_z}{\ln\left(\frac{z}{z_0}\right)}-u_t^*\right)\right]_i \qquad \text{(Eq.5)}$$

Where:
k = particle size multiplier (0.5 for PM_{10} and 0.075 for $PM_{2.5}$).
u_z = induced wind speed at a certain height above the surface (m/s). Note that emissions are only calculated in area with $u^* > u^*_t$. Because, when $u^* < u^*_t$, the erosion potential (P) is equal to zero.
u^*_t = threshold friction velocity. Assumed 0.19 m/s, based on the lowest value available for disturbed desert soil.
z = height above the surface (288 cm), based on 1/2 of the train height (1.88 m) and the average embankment height (3ft ~1 meter) with respect to the right of way5.
z_0 = surface roughness height (cm), assume 0.01 cm for the at grade right of way
0.4 = von Karman's constant, dimensionless

By substituting the assumptions above and other known parameters into Eq. 5, the equation can be simplified to.

Emission factor (g/m²): $$k\sum_{i=1}^{N}\left[58\,(0.038955u_z-0.19)^2+25\,(0.038955u_z-0.19)\right]_i \qquad \text{(Eq.6)}$$

Where:
k = particle size multiplier (0.5 for PM_{10} and 0.075 for $PM_{2.5}$).
u_z = induced wind speed at a certain height above the surface (m/s). Note that emissions are only calculated in area with $u_z > 4.88$ m/s (a substitute for $u^* > u^*_t$). Because, when $u^* < u^*_t$, the erosion potential (P) is equal to zero.

As shown in Eq. 6, the emission factor can be expressed as a function of induced wind speed along the side of the train body. By integrating the emission factor function in Eq.6 across the induced wind speed values within the impacted zone boundary (u_z) area, and multiplying the emission factor by the number of disturbance (24 times per year) and the particle size multiplier (k), the annual fugitive dust emissions from the High-Speed Train activity can be estimated. Dust emissions generated by the wake at the rear of the train were not added to this calculation to avoid double counting. The erodible dust is already suspended in the air when the rear end of the train passes through and therefore additional turbulence or the rear wake will not contribute to more raised dust in the air.

Induced Wind Speed Profile

The width of the impacted zone is twice the distance from the beginning of the right of way to

---

5 Track related measurements are based on Technical Memorandum, Typical Cross Sections for 15% Design TM 1.1.21 Appendix A: Two Track At-Grade Drawing and Project Description Summary (June 28, 2010)

the point where the corresponding maximum surface friction velocity generated by the induced turbulence is equal to the threshold friction velocity. To determine the distance where the corresponding maximum surface friction velocity generated by the induced turbulence is equal to the threshold friction velocity, a wind speed profile analysis is required.

A study on the potential aerodynamic forces created by a passing High-Speed Train on nearby objects (such as humans standing in the proximity of the train) are influenced by train speed, distance from the train, and the geometry of the train[6]. Li, et. al. analyzed the maximum wind velocity around a human body for a specific train speed as a function of human-train distance based on different train shape models:

$$u = (1.2319)^{0.072v-4} \times (0.4575d^2 - 3.5496d + 9.1545) \qquad \text{(Eq.7)}$$

Where:

u: the maximum wind velocity around human body near the train (m/s).
d: human-train distance (m).
v: train running speed (m/s).

The range of train speeds specified for Eq. 7 are between 55.56 m/s and 97.22 m/s (between 124 mph and 217 mph) with a human-train distance between 1.0 m and 3.5 m. This raises questions about the validity of this equation to estimate aerodynamic forces from a High Speed train traveling at a speed of 220 mph.

An induced wind speed profile comparison was graphed to determine the relative accuracy of using Eq 7 to estimated aerodynamic forces for train speeds of 220 mp compared to 217 mph (the upper bound of the train speed range for Eq 7). Figure 1 shows that Eq. 7 presents a similar trend when a train speed of 220 mph is used as compared to a train speed of 217 mph. Therefore Eq. 7 can be used to determine the induced wind speed profile as a function of distance from train body for train passing at 220 mph.

6 Li, Renxian, et.al, "A Study of the Influence of Aerodynamic Forces on a Human Body near a High-Speed Train, Aerodynamics of Heavy Vehicles", Trucks, Buses, and Trains, 2008.

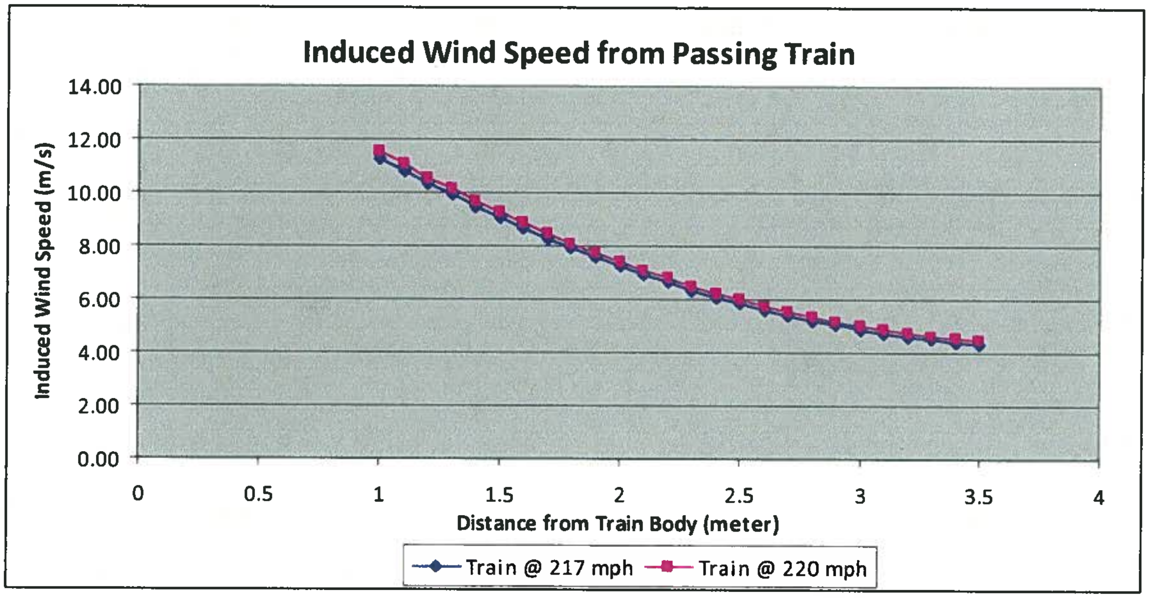


Figure 1. Wind Speed Profile Comparison from Train at 220 mph and 217 mph

Emission Calculation

The emission factor profiles over the distance from the train body are presented in Figure 2 and the emission factor over the impacted zone area is summarized in Table 1.

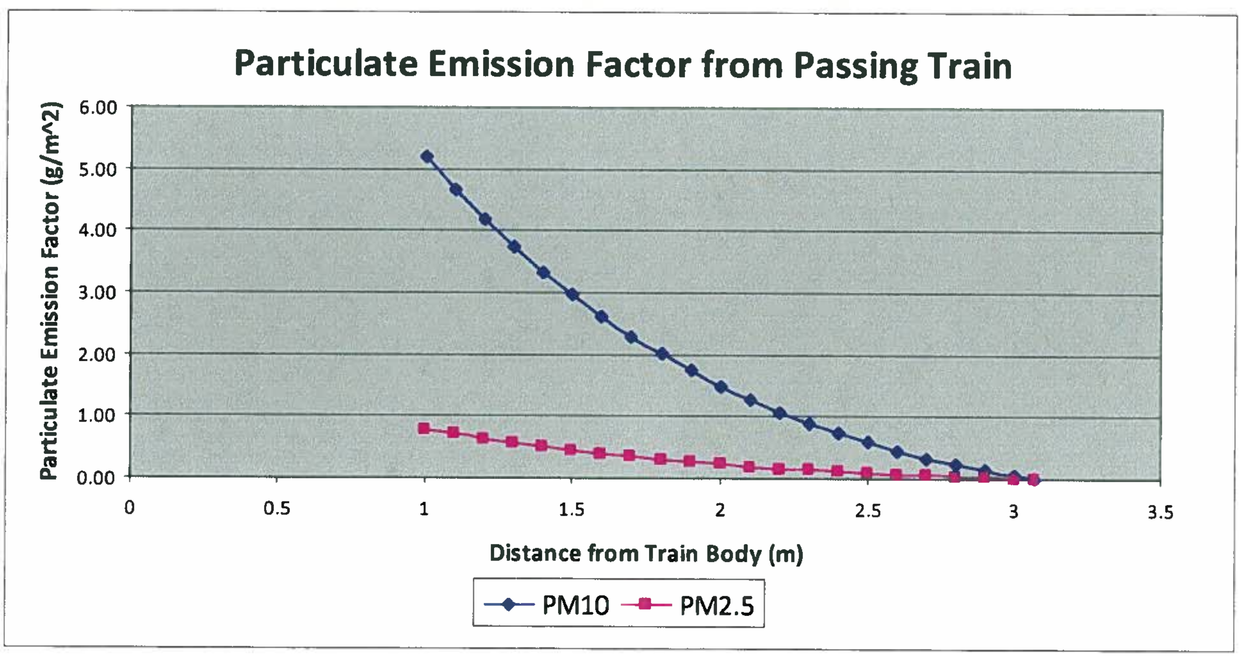


Figure 2. Particulate Emission Factor from Passing Train

Table 1. Emission Factor from Passing Train

Distance from Train-Body	Wind Speed (220 mph Train)	Friction Velocity	Erosion Potential	Emission Factor (g/m^2)	
(m)	u (m/s)	u*(m/s)	P (g/m^2)	PM_{10}	$PM_{2.5}$
1	11.53	0.45	10.37	5.18	0.78
1.1	11.03	0.43	9.33	4.67	0.70
1.2	10.56	0.41	8.38	4.19	0.63
1.3	10.10	0.39	7.49	3.75	0.56
1.4	9.66	0.38	6.68	3.34	0.50
1.5	9.24	0.36	5.92	2.96	0.44
1.6	8.83	0.34	5.23	2.62	0.39
1.7	8.45	0.33	4.60	2.30	0.34
1.8	8.08	0.31	4.02	2.01	0.30
1.9	7.72	0.30	3.48	1.74	0.26
2	7.39	0.29	3.00	1.50	0.22
2.1	7.07	0.28	2.56	1.28	0.19
2.2	6.77	0.26	2.16	1.08	0.16
2.3	6.48	0.25	1.79	0.90	0.13
2.4	6.22	0.24	1.46	0.73	0.11
2.5	5.97	0.23	1.17	0.58	0.09
2.6	5.74	0.22	0.90	0.45	0.07
2.7	5.53	0.22	0.67	0.33	0.05
2.8	5.33	0.21	0.46	0.23	0.03
2.9	5.15	0.20	0.27	0.14	0.02
3	4.99	0.19	0.11	0.05	0.01
3.07	4.88	0.19	0.01	0.00	0.00

As shown in Table 1, the corresponding friction velocity at the distance of 3.07 meters from the train body is equal to the threshold friction velocity of 0.19 m/s. Therefore, emission factor for wind-generated dust emissions should be calculated from the beginning of the right of way (1 meter from the train body) to the distance of 3.07 meters from the train body.

The emission factor for wind-generated particulate emissions from a passing High-Speed Train moving at 220 mph was calculated with the following steps:

- Using Eq. 6 and Eq. 7, integrate the emission factor over the distance of 1 meter to 3.07 meter from the train body.
- Multiply by particle size multiplier, k (0.5 for PM_{10} and 0.075 for $PM_{2.5}$)
- Multiply by 43.56 miles of at grade track length (impacted zone length).
- Multiply by two (to account for the left and right shoulders).
- Multiply by 24 disturbances per year (twice monthly).

Using the trapezoidal rule for numerical integration, the results for emission factor for wind-generated particulate emissions from a passing High-Speed train moving at 220 mph are 26.53 lb PM_{10} /miles of at grade track and 3.98 lb $PM_{2.5}$/ miles of at grade track. Multiplied by the impacted zone length and disturbance frequency, the annual PM_{10} and $PM_{2.5}$ emissions from the High-Speed Train operation for the Fresno-Bakersfield section are 13.9 ton of PM_{10} /year and 2.1 ton of $PM_{2.5}$ /year.

Reference

H. Lee, "Assessment of Potential Aerodynamic Effects on Personnel and Equipment in Proximity to High-Speed Trains Operations", DOT/FRA/ORD-99/11, December 1999.

U.S. Environmental Protection Agency (USEPA), "Compilation of Air Pollutant Emission Factors Chapter 13.2.5", AP-42, 5th ed., Washington, D. C., 2006.

Li, Renxian, et.al, "A Study of the Influence of Aerodynamic Forces on a Human Body near a High-Speed Train, Aerodynamics of Heavy Vehicles", Trucks, Buses, and Trains, 2008.

Watson, J.G, "Effectiveness Demonstration of Fugitive Dust Control Methods for Public Unpaved Roads and Unpaved Shoulders on Paved Roads", DRI Document No. 685-5200. IF2: August 2, 1996.

Attachment C

Request to EPA for Determination of Acceptability of Lakes' AERMOD View MPI

DEPARTMENT OF TRANSPORTATION
DISTRICT 7
100 SOUTH MAIN STREET, SUITE 100
LOS ANGELES, CA 90012-3606
PHONE (213) 897-0362
FAX (213) 897-0360
TTY (213) 897-4937

Flex your power!
Be energy efficient!

January 7, 2014

Dr. Deborah Jordan
Director, Air Division
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

Attention: Carol Bohnenkamp

RE: Request for Determination of Acceptability of Lakes' AERMOD parallel version with Message Passing Interface (MPI) parallel version on Project-Level Conformity Analysis

Dear Ms. Bohnenkamp:

The California Department of Transportation (Caltrans) is currently preparing an Environmental Impact Statement and project-level hot-spot analyses for the High Desert Corridor (HDC) project in the Mojave Desert Air Basin (MDAB) in Los Angeles and San Bernardino Counties. In accordance with the EPA's Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas dated November 2013 (EPA Quantitative Guidance), Caltrans has selected AERMOD to model air quality impacts within and near the limits of the HDC project that proposes several Alternatives including new 63-mile transportation corridor improvements (Caltrans EA No. 2600U).

While the EPA Quantitative Guidance recommends the use of the EPA standard AERMOD model (preferred model) available on the EPA's SCRAM website, commercial products are also available by third-party vendors as optimized versions of AERMOD that can provide the benefit of reduced model runtimes from "parallel" processing, utilizing multiple processors. Caltrans proposes to utilize one of such commercial products, AERMOD View MPI, marketed by Lakes Environmental (Lakes); and respectfully requests that EPA determine acceptability of this alternative model in accordance with the Guideline on Air Quality Models (Appendix W to 40 CFR Part 51).

The HDC project proposes Alternatives that include construction of new Freeway, Expressway, Toll lanes, and/or high-speed rail components for approximately 63 miles in total lengths in the high desert area of Los Angeles and San Bernardino Counties. Due to the complexities associated with setting up inputs and modeling various source types for these project alternatives, the use of Lakes AERMOD View MPI is proposed. As indicated in the attached validation documentation by Lakes, Lakes has adjusted the EPA AERMOD source code (version 12345) by reorganizing the computation problem into independent parts so that each processing element can execute its part of the algorithm simultaneously with all others (i.e., in parallel). This is accomplished using the Message Passing Interface (MPI) communication protocol which makes it possible for different processors to communicate with each other.

Section 3.2 of Appendix W provides applicable guidance with which an EPA's Regional Office may determine acceptability of alternative models such as Lakes AERMOD View MPI. Paragraph 3.2.2.b under Section 3.2 cites 3 separate conditions under which the use of such an alternative model may normally be determined acceptable. Condition (1) under this Paragraph recommends a demonstration that the model produces concentration estimates equivalent to the estimates obtained using a preferred model. Condition (2) under this Paragraph recommends a statistical performance evaluation using measured air quality data whose results indicate the alternative model performs better for this project than the preferred model. Condition (3) is applicable if the preferred model is less appropriate for the specific project, or if there is no preferred model.

Condition (2) is considered not applicable for this project because the Lakes AERMOD View MPI is not expected to perform better for this project than the preferred model; but the alternative model is rather expected to perform at the same level as it relies its executable on the preferred model. Condition (3) is considered not applicable for this project because the EPA Quantitative Guidance recommends the use of the preferred model and its use is appropriate. Condition (1) evaluates if the alternative model produces concentration estimates equivalent to those obtained using a preferred model; and is considered applicable for demonstration of acceptability of the Lakes AERMOD View MPI for this project.

As part of an effort by Lakes to validate the AERMOD View MPI in comparison to the preferred model, 27 test cases, as published by EPA, were processed for six different AERMOD/AERMET scenarios. In addition to the EPA test cases, Lakes processed other test cases to ensure that all of AERMOD's options were tested in the parallel environment. At the request of EPA, Caltrans also performed additional test runs using the MPI as well as the preferred model in which an elongated area and line volume source types, frequently utilized in transportation projects such as the HDC project, were evaluated. Caltrans selected and ran a model input provided as part of the EPA's training in September 2011 on completing quantitative PM hot-spot analyses, along with updated meteorological data files compatible with the latest preferred model version 12345.

Results from the Lakes' test runs are documented in the attached Lakes Environmental Software AERMOD View MPI Validation (Version 12345); and those from Caltrans runs are documented in the attached Outputs for Elongated Area and Line Volume Source Types. As demonstrated in the attachments, the concentration estimates based on the Lakes AERMOD View MPI are consistent with those based on the EPA preferred model. The concentration estimates from the Lakes AERMOD View MPI demonstrate that they are identical or nearly identical with (and thus within two percent of) the estimates obtained from the preferred model. The results satisfy the conditions established in Section 3.2, paragraphs 3.2.2.b.(1) and 3.2.2.c; and they demonstrate that the Lakes AERMOD View MPI is so nearly identical to the preferred model that it can be treated for practical purposes as the preferred model.

It is therefore requested that EPA Region IX determine acceptability of the Lakes AERMOD View MPI for the proposed use as a tool in conducting project-level hot-spot analyses for the HDC project described above.

If you have any questions regarding this request, please contact me at 213.897.6117 or andrew.yoon@dot.ca.gov.

Sincerely,

Andrew Yoon, P.E.
Senior Transportation Engineer
Air Quality Branch
Office of Environmental Engineering Design

Attachments

Cc: Matthew Lakin – Chief, Air Division, EPA Region IX
Karina O'Connor – EPA, Region IX
Jim Andrews – Caltrans HQ
Mike Brady – Caltrans HQ

Lakes Environmental Software
AERMOD MPI™ Validation (Version 12345)

E-mail: support@webLakes.com
Web: www.webLakes.com

1 Executive Summary

Lakes Environmental Software performed extensive software validation of its parallel AERMOD MPI™ executable to substantiate that model results are identical to those generated using the U.S. EPA AERMOD executable. Study findings verify that results generated by *Lakes Environmental*'s AERMOD MPI are **identical** to results generated using the U.S. EPA AERMOD Version 12345 executable.

This document details the test cases used to validate AERMOD MPI. Explanations, project setups, and results are provided as well as a methodology description.

2 Background

The U.S. EPA AERMOD modeling executable (dated 12345) was written in a traditional manner where computations are executed serially. While a perfectly acceptable method, the U.S. EPA AERMOD serial executable is not capable of running in such a way that computation performance can be improved by taking advantage of multiple central processing units (CPUs). Parallel computing has become the modern standard in computer architecture, predominantly in the form of multicore processors. Today's modern PCs come standard with multiple CPUs, with 2 – 8 core CPUs now commonplace.

Due to increasing complexities associated with today's air quality modeling and permitting requirements, AERMOD air dispersion modeling run times have increased significantly and can require days, weeks, and even months to complete. In order to overcome this obvious limitation and take advantage of improvements in modern PC computing power, *Lakes Environmental* developed a "parallelized" version of the AERMOD executable, called AERMOD MPI. The objective of parallel processing is to reduce runs times by sharing the computation workload over multiple processors. To achieve this objective *Lakes Environmental* adjusted the U.S. EPA AERMOD source code (Version 12345) by reorganizing the computation problem into independent parts so that each processing element can execute its part of the algorithm simultaneously with all others (i.e., in parallel). This was specifically accomplished using the Message Passing Interface (MPI) communication protocol which makes it possible for different processors to communicate with each other which makes parallelization possible. Specific to implementation with AERMOD MPI, parallelization was implemented at the receptor level as shown in Figure 1.

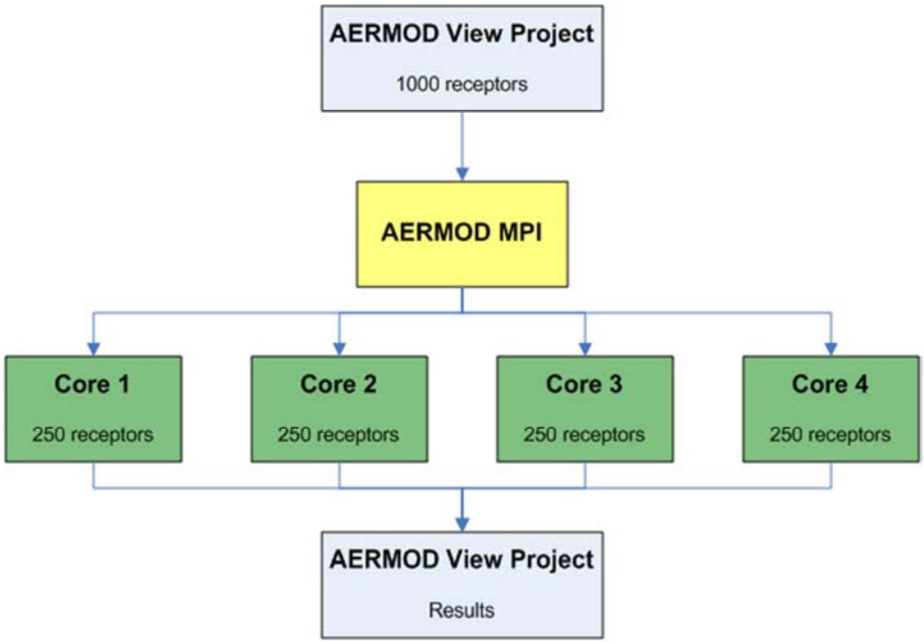


Figure 1. Example Schematic of AERMOD MPI Process on a 4 CPU System

Extensive testing of the AERMOD MPI indicates that run times decrease approximately linear with the number of processors. For example:

1. For a 4-Core processor, the gain in processing speed is approximately 3.75 times faster.
2. For an 8-Core processor, the gain is processing speed is almost a full 8 times faster.

While demonstration of improved model performance is an important accomplishment, software validation must also be performed to substantiate the numerical accuracy of model results. To accomplish this objective, *Lakes Environmental* performed extensive software validation to verify that the AERMOD MPI parallel executable produces results identical to those generated using the U.S. EPA AERMOD serial executable. Use of the term "software validation", in context of this memorandum, refers to the confirmation by examination and provision of objective evidence that software specifications conform to user needs and intended uses, and that the particular requirements implemented through software can be consistently fulfilled. This definition is further extended to apply to the numerical validation and verification of accuracy of the expected model results (for a defined set of conditions). The following Section describes validation methodologies completed in support of this study.

E-mail: support@webLakes.com
Web: www.webLakes.com

3 Validation Methodology

Lakes Environmental performed extensive numeric validation by comparing results generated using the AERMOD MPI parallel version against results generated using the U.S. EPA AERMOD serial executable. To ensure that a comprehensive set of applicable test conditions was used during model validation, the extensive U.S. EPA test project library was evaluated. U.S. EPA specifically developed this set of test cases to document test results across an extensive set of model configuration options and settings.

Each test case was executed on a dual-core machine three separate times: first using the original U.S. EPA AERMOD executable, next with the AERMOD MPI executable utilizing a single processor, and finally with the AERMOD MPI executable utilizing both processors.

All output files were compared for exact matches. Noting the exceptions described in Section 5, *Lakes Environmental* AERMOD MPI produced identical results to the original U.S. EPA AERMOD model in all test cases.

3.1 EPA Test Cases

U.S. EPA published test cases with the release of the AERMOD Version 12345 executable. Each of the 27 test cases were processed for six different AERMOD/AERMET scenarios to "*document test results for AERMOD changes only versus AERMET changes only versus AERMOD and AERMET changes combined*". The 27 test cases are summarized in Table 1 while Table 2 describes the six scenarios.

Table 1. EPA Test Case Descriptions

Test Name	Description
AERTEST	Simple test case referenced in AERMOD User's Guide
ALLSRCS	Test case including all standard source types
CAPPED	Capped and horizontal stack tests with BETA option
CAPPED_NOSTD	Capped and horizontal stack tests using MC w/NOSTD option
TESTGAS	Gas deposition test case with limited screening met data
TESTGAS2	Gas deposition test case with 1 year of Houston met data
TESTPART	Particle deposition test with limited screening met data
TESTPART2	Particle deposition test with 1 year of Houston met data
OPENPITS	OPENPIT source test case
LOVETT	Lovett model evaluation data
FLATELEV	FLAT & ELEV test case based on Lovett data
MCR	Martin's Creek model evaluation data
MULTURB	Multiple urban area test case
HRDOW	Hour-of-day by day-of-week EMISFACT test case
SURFCOAL	Surface coal mine evaluation data

E-mail: support@webLakes.com
Web: www.webLakes.com

Test Name	Description
OLM	OLM test case
OLMGRP	OLM test case with OLMGROUP option
PVMRM	PVMRM test case
PSDCRED	PVMRM test case with PSDCREDIT BETA option
SCIMTEST	SCIM (Sampled Chronological Input Model) test case
TESTPM25	PM-2.5 test case with 5-years of met data
TESTPM10_1986	PM-10 test case with MULTYEAR option - Year 1
TESTPM10_1987	PM-10 test case with MULTYEAR option - Year 2
TESTPM10_1988	PM-10 test case with MULTYEAR option - Year 3
TESTPM10_1989	PM-10 test case with MULTYEAR option - Year 4
TESTPM10_1990	PM-10 test case with MULTYEAR option - Year 5
TESTPM10	PM-10 test case with single 5-year data file (1986-1990)

Table 2. EPA Test Case Scenarios

Test No.	AERMOD/AERMET Runs	Description	VectorWS in AERMOD V12345
1	12060_Def_11059_Def	12060 AERMOD/11059 AERMET	N/A
2	12060_Def_12345_Def	12060 AERMOD/12345 AERMET	N/A
3	12345_Def_11059_Def	12345 AERMOD/11059 AERMET	No
4	12345_Def_12345_Def	12345 AERMOD/12345 AERMET	No
5	12345_Vect_11059_Def	12345 AERMOD/11059 AERMET	Yes
6	12345_Vect_12345_Def	12345 AERMOD/12345 AERMET	Yes

The only changes made to these test cases were the paths of input and output files in the AERMOD.INP file associated with each case. The test case files used for the AERMOD MPI validation come from the U.S. EPA Support Center for Regulatory Atmospheric Modeling (SCRAM) website located at: http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod.

3.2 Additional Test Cases

In addition to the EPA test cases, other test cases were used to ensure that all of AERMOD's options were tested in the parallel environment. Details for each additional test case are further described in the following sub-sections.

3.2.1 Output File Types

The various output files that AERMOD is capable of producing were evaluated with AERMOD MPI. All projects in this set contain point, volume, and area sources; elevated terrain; and gridded and discrete receptors.

1. **MAXIFILE** Threshold violation file created
2. **POSTFILE** Post-processing file created
3. **PLOTFILE** Contour plot file created
4. **TOXXFILE** TOXX model file created
5. **RANKFILE** Ranked output values file created
6. **EVALFILE** Evaluation file created

3.2.2 Source Types

These test cases used all of the different source types, including the beta source types and a pseudo line source. Flat terrain and gridded receptors were used.

1. **AREA** Area source
2. **BETA** Beta capped and horizontal point sources with downwash
3. **LINE** Pseudo-line source using separated volume sources
4. **LINE_NEW** Line source (as implemented in AERMOD 12345)
5. **OPENPIT** Open pit source (using modified AERMOD MPI routine – see Section 5 of this report)
6. **PT** Point source, no downwash
7. **PT_DWSH** Point source with downwash
8. **VOLUME** Volume source

3.2.3 Variable Emissions

These test cases utilized the different variable emission types as well as the external hourly emission file. All projects in this set contain point, volume, and area sources; elevated terrain; with gridded and discrete receptors.

1. **EMIS1** By hour of day
2. **EMIS3** By season, by month, by hour of day, by wind speed
3. **EMIS4** By season/hour, by season/hour/day, by season/hour/7 days, by month/hour/day, by month/hour/7 days
4. **EMIS5** hourly emission file

3.2.4 Chemical Transformations

The test cases in this set modeled chemical transformation options available in AERMOD. All projects in this set contain point, volume, and area sources; elevated terrain; with gridded and discrete receptors.

1. **OLM** Ozone Limiting Method
2. **PSD** PSD groups and PVMRM
3. **PVMRM** Plume Volume Molar Ratio Method
4. **SO2** SO2 with the urban option and exponential decay

3.2.5 Deposition

Our evaluation test cases tested different deposition types. All projects in this set contain point, volume, and area sources; elevated terrain; with gridded and discrete receptors.

1. **METH1** Particle deposition, method 1
2. **METH2** Particle deposition, method 2
3. **GAS** Gas deposition

3.2.6 Pollutants

Different pollutant types are tested in these cases. All projects in this set contain point, volume and area sources; elevated terrain; with gridded and discrete receptors.

1. **Pollute1** SO2 with urban option
2. **Pollute2** NOx with OLM
3. **Pollute3** CO
4. **Pollute4** TSP
5. **Pollute5** PM-10 Pre 1997 NAAQS
6. **Pollute6** PM-2.5
7. **Pollute7** Other

4 Sample Results Comparisons

The following sections contain samples of output files to illustrate that the *Lakes Environmental* AERMOD MPI executable gives identical results to the original U.S. EPA AERMOD executable. Comparisons included:

1. Output files from the AERTEST project from the EPA test cases (12345 met)
2. Summary files from the ALLSRCS project from the EPA test cases (12345 met)
3. Plot files from the LOVETT project from the EPA test cases (12345 met), and
4. Rank files from the RANKFILE project from *Lakes Environmental* additional test cases (see section 3.2.1).

E-mail: support@webLakes.com
Web: www.webLakes.com

4.1 Output File – AERTEST (Original U.S. EPA)

```
                                   *** THE MAXIMUM   50   1-HR AVERAGE CONCENTRATION   VALUES FOR SOURCE GROUP:  ALL      ***
                                       INCLUDING SOURCE(S):     STACK1      ,

                                         ** CONC OF SO2      IN MICROGRAMS/M**3                          **

 RANK        CONC    (YYMMDDHH) AT      RECEPTOR (XR,YR) OF TYPE    RANK        CONC    (YYMMDDHH) AT      RECEPTOR (XR,YR) OF TYPE
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    1.     753.65578 (88030111) AT (    303.11,    -175.00)  GP       26.     271.98810 (88030114) AT (    984.81,    -173.65)  GP
    2.     746.09698 (88030111) AT (    433.01,    -250.00)  GP       27.     268.29042 (88030114) AT (    350.00,       0.00)  GP
    3.     621.55497 (88030111) AT (    328.89,    -119.71)  GP       28.     256.27434 (88030116) AT (    866.03,    -500.00)  GP
    4.     611.84333 (88030111) AT (    469.85,    -171.01)  GP       29.     250.04231 (88030113) AT (    866.03,    -500.00)  GP
    5.     439.74373 (88030114) AT (    492.40,     -86.82)  GP       30.     248.67339 (88030113) AT (    321.39,    -383.02)  GP
    6.     423.53134 (88030113) AT (    433.01,    -250.00)  GP       31.     242.65242 (88030116) AT (    328.89,    -119.71)  GP
    7.     402.45797 (88030114) AT (    469.85,    -171.01)  GP       32.     242.52725 (88030114) AT (    939.69,    -342.02)  GP
    8.     392.23024 (88030113) AT (    383.02,    -321.39)  GP       33.     236.55604 (88030111) AT (    134.06,    -112.49)  GP
    9.     386.26151 (88030111) AT (    866.03,    -500.00)  GP       34.     230.60531 (88030113) AT (    766.04,    -642.79)  GP
   10.     386.22641 (88030111) AT (    151.55,     -87.50)  GP       35.     222.89094 (88030113) AT (    224.98,    -268.12)  GP
   11.     371.92116 (88030116) AT (    433.01,    -250.00)  GP       36.     221.15706 (88030116) AT (    268.12,    -224.98)  GP
   12.     367.13462 (88030111) AT (    268.12,    -224.98)  GP       37.     210.71844 (88030114) AT (    433.01,    -250.00)  GP
   13.     365.10735 (88030113) AT (    303.11,    -175.00)  GP       38.     203.08634 (88030116) AT (    939.69,    -342.02)  GP
   14.     355.47062 (88030114) AT (    344.68,     -60.78)  GP       39.     190.44350 (88030114) AT (    303.11,    -175.00)  GP
   15.     335.65680 (88030113) AT (    268.12,    -224.98)  GP       40.     177.92786 (88030116) AT (    766.04,    -642.79)  GP
   16.     333.27041 (88030116) AT (    469.85,    -171.01)  GP       41.     167.26912 (88030111) AT (    344.68,     -60.78)  GP
   17.     329.81496 (88030111) AT (    164.45,     -59.85)  GP       42.     152.14069 (88030116) AT (    492.40,     -86.82)  GP
   18.     326.47253 (88030111) AT (    383.02,    -321.39)  GP       43.     149.12870 (88030114) AT (   1000.00,       0.00)  GP
   19.     325.20497 (88030113) AT (    469.85,    -171.01)  GP       44.     146.07476 (88030111) AT (    766.04,    -642.79)  GP
   20.     324.71723 (88030114) AT (    500.00,       0.00)  GP       45.     144.17532 (88030111) AT (    172.34,     -30.39)  GP
   21.     322.70553 (88030114) AT (    328.89,    -119.71)  GP       46.     143.30852 (88030113) AT (    939.69,    -342.02)  GP
   22.     306.89487 (88030116) AT (    383.02,    -321.39)  GP       47.     137.61180 (88030111) AT (    492.40,     -86.82)  GP
   23.     297.95832 (88030111) AT (    939.69,    -342.02)  GP       48.     135.38082 (88030116) AT (    321.39,    -383.02)  GP
   24.     291.38226 (88030113) AT (    328.89,    -119.71)  GP       49.     133.58285 (88030116) AT (    344.68,     -60.78)  GP
   25.     273.59073 (88030116) AT (    303.11,    -175.00)  GP       50.     131.03984 (88030112) AT (    433.01,    -250.00)  GP

  *** RECEPTOR TYPES:  GC = GRIDCART
                       GP = GRIDPOLR
                       DC = DISCCART
                       DP = DISCPOLR
```


E-mail: support@webLakes.com
Web: www.webLakes.com

4.2 Output File – AERTEST (AERMOD MPI)

```
                                   *** THE MAXIMUM    50   1-HR AVERAGE CONCENTRATION   VALUES FOR SOURCE GROUP:  ALL      ***
                                       INCLUDING SOURCE(S):      STACK1       ,

                                             ** CONC OF SO2       IN MICROGRAMS/M**3                          **

 RANK        CONC     (YYMMDDHH) AT      RECEPTOR (XR,YR) OF TYPE    RANK        CONC     (YYMMDDHH) AT      RECEPTOR (XR,YR) OF TYPE
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    1.     753.65578 (88030111) AT (    303.11,    -175.00)  GP       26.     271.98810 (88030114) AT (    984.81,    -173.65)  GP
    2.     746.09698 (88030111) AT (    433.01,    -250.00)  GP       27.     268.29042 (88030114) AT (    350.00,       0.00)  GP
    3.     621.55497 (88030111) AT (    328.89,    -119.71)  GP       28.     256.27434 (88030116) AT (    866.03,    -500.00)  GP
    4.     611.84333 (88030111) AT (    469.85,    -171.01)  GP       29.     250.04231 (88030113) AT (    866.03,    -500.00)  GP
    5.     439.74373 (88030114) AT (    492.40,     -86.82)  GP       30.     248.67339 (88030113) AT (    321.39,    -383.02)  GP
    6.     423.53134 (88030113) AT (    433.01,    -250.00)  GP       31.     242.65242 (88030116) AT (    328.89,    -119.71)  GP
    7.     402.45797 (88030114) AT (    469.85,    -171.01)  GP       32.     242.52725 (88030114) AT (    939.69,    -342.02)  GP
    8.     392.23024 (88030113) AT (    383.02,    -321.39)  GP       33.     236.55604 (88030111) AT (    134.06,    -112.49)  GP
    9.     386.26151 (88030111) AT (    866.03,    -500.00)  GP       34.     230.60531 (88030113) AT (    766.04,    -642.79)  GP
   10.     386.22641 (88030111) AT (    151.55,     -87.50)  GP       35.     222.89094 (88030113) AT (    224.98,    -268.12)  GP
   11.     371.92116 (88030116) AT (    433.01,    -250.00)  GP       36.     221.15706 (88030116) AT (    268.12,    -224.98)  GP
   12.     367.13462 (88030111) AT (    268.12,    -224.98)  GP       37.     210.71844 (88030114) AT (    433.01,    -250.00)  GP
   13.     365.10735 (88030113) AT (    303.11,    -175.00)  GP       38.     203.08634 (88030116) AT (    939.69,    -342.02)  GP
   14.     355.47062 (88030114) AT (    344.68,     -60.78)  GP       39.     190.44350 (88030114) AT (    303.11,    -175.00)  GP
   15.     335.65680 (88030113) AT (    268.12,    -224.98)  GP       40.     177.92786 (88030116) AT (    766.04,    -642.79)  GP
   16.     333.27041 (88030116) AT (    469.85,    -171.01)  GP       41.     167.26912 (88030111) AT (    344.68,     -60.78)  GP
   17.     329.81496 (88030111) AT (    164.45,     -59.85)  GP       42.     152.14069 (88030116) AT (    492.40,     -86.82)  GP
   18.     326.47253 (88030111) AT (    383.02,    -321.39)  GP       43.     149.12870 (88030114) AT (   1000.00,       0.00)  GP
   19.     325.20497 (88030113) AT (    469.85,    -171.01)  GP       44.     146.07476 (88030111) AT (    766.04,    -642.79)  GP
   20.     324.71723 (88030114) AT (    500.00,       0.00)  GP       45.     144.17532 (88030111) AT (    172.34,     -30.39)  GP
   21.     322.70553 (88030114) AT (    328.89,    -119.71)  GP       46.     143.30852 (88030113) AT (    939.69,    -342.02)  GP
   22.     306.89487 (88030116) AT (    383.02,    -321.39)  GP       47.     137.61180 (88030111) AT (    492.40,     -86.82)  GP
   23.     297.95832 (88030111) AT (    939.69,    -342.02)  GP       48.     135.38082 (88030116) AT (    321.39,    -383.02)  GP
   24.     291.38226 (88030113) AT (    328.89,    -119.71)  GP       49.     133.58285 (88030116) AT (    344.68,     -60.78)  GP
   25.     273.59073 (88030116) AT (    303.11,    -175.00)  GP       50.     131.03984 (88030112) AT (    433.01,    -250.00)  GP

  *** RECEPTOR TYPES:  GC = GRIDCART
                       GP = GRIDPOLR
                       DC = DISCCART
                       DP = DISCPOLR
```

4.3 Summary File – ALLSRCS (Original U.S. EPA)

```
                                        *** THE SUMMARY OF HIGHEST  1-HR RESULTS ***

                            ** CONC OF SO2      IN MICROGRAMS/M**3                         **

                                                        DATE                                                            NETWORK
GROUP ID                                  AVERAGE CONC     (YYMMDDHH)              RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

STACKDW  HIGH   1ST HIGH VALUE IS      753.65578  ON 88030111: AT (     303.11,     -175.00,       0.00,       0.00,       0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS      423.53134  ON 88030113: AT (     433.01,     -250.00,       0.00,       0.00,       0.00)  GP  POL1

AREA     HIGH   1ST HIGH VALUE IS    11648.19306  ON 88030206: AT (       0.00,        0.00,       0.00,       0.00,       0.00)  GC  CAR1
         HIGH   2ND HIGH VALUE IS    11326.58166  ON 88030205: AT (       0.00,        0.00,       0.00,       0.00,       0.00)  GC  CAR1

CIRC     HIGH   1ST HIGH VALUE IS    99248.24861  ON 88030317: AT (     134.06,      112.49,       0.00,       0.00,       0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS    73527.22719  ON 88030207: AT (     328.89,     -119.71,       0.00,       0.00,       0.00)  GP  POL1

AREAP    HIGH   1ST HIGH VALUE IS    18728.42468  ON 88030219: AT (       0.00,        0.00,       0.00,       0.00,       0.00)  GC  CAR1
         HIGH   2ND HIGH VALUE IS    17005.76526  ON 88030218: AT (       0.00,        0.00,       0.00,       0.00,       0.00)  GC  CAR1

VOL      HIGH   1ST HIGH VALUE IS       72.74275  ON 88030320: AT (     172.34,      -30.39,       0.00,       0.00,       0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS       32.84424  ON 88030124: AT (     164.45,      -59.85,       0.00,       0.00,       0.00)  GP  POL1

STACK    HIGH   1ST HIGH VALUE IS      300.73465  ON 88030111: AT (     303.11,     -175.00,       0.00,       0.00,       0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS      184.59817  ON 88030114: AT (     328.89,     -119.71,       0.00,       0.00,       0.00)  GP  POL1

OPENPIT  HIGH   1ST HIGH VALUE IS     1478.86933  ON 88030401: AT (     171.01,      469.85,       0.00,       0.00,       0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS     1417.33879  ON 88030324: AT (     171.01,      469.85,       0.00,       0.00,       0.00)  GP  POL1

 *** RECEPTOR TYPES:  GC = GRIDCART
                      GP = GRIDPOLR
                      DC = DISCCART
                      DP = DISCPOLR
```

4.4 Summary File – ALLSRCS (AERMOD MPI)

```
                                         *** THE SUMMARY OF HIGHEST  1-HR RESULTS ***

                                ** CONC OF SO2      IN MICROGRAMS/M**3                          **

                                                         DATE                                                                 NETWORK
GROUP ID                                  AVERAGE CONC    (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

STACKDW  HIGH   1ST HIGH VALUE IS      753.65578  ON 88030111: AT (     303.11,     -175.00,       0.00,      0.00,      0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS      423.53134  ON 88030113: AT (     433.01,     -250.00,       0.00,      0.00,      0.00)  GP  POL1

AREA     HIGH   1ST HIGH VALUE IS    11648.19306  ON 88030206: AT (       0.00,        0.00,       0.00,      0.00,      0.00)  GC  CAR1
         HIGH   2ND HIGH VALUE IS    11326.58166  ON 88030205: AT (       0.00,        0.00,       0.00,      0.00,      0.00)  GC  CAR1

CIRC     HIGH   1ST HIGH VALUE IS    99248.24861  ON 88030317: AT (     134.06,      112.49,       0.00,      0.00,      0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS    73527.22719  ON 88030207: AT (     328.89,     -119.71,       0.00,      0.00,      0.00)  GP  POL1

AREAP    HIGH   1ST HIGH VALUE IS    18728.42468  ON 88030219: AT (       0.00,        0.00,       0.00,      0.00,      0.00)  GC  CAR1
         HIGH   2ND HIGH VALUE IS    17005.76526  ON 88030218: AT (       0.00,        0.00,       0.00,      0.00,      0.00)  GC  CAR1

VOL      HIGH   1ST HIGH VALUE IS       72.74275  ON 88030320: AT (     172.34,      -30.39,       0.00,      0.00,      0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS       32.84424  ON 88030124: AT (     164.45,      -59.85,       0.00,      0.00,      0.00)  GP  POL1

STACK    HIGH   1ST HIGH VALUE IS      300.73465  ON 88030111: AT (     303.11,     -175.00,       0.00,      0.00,      0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS      184.59817  ON 88030114: AT (     328.89,     -119.71,       0.00,      0.00,      0.00)  GP  POL1

OPENPIT  HIGH   1ST HIGH VALUE IS     1478.86933  ON 88030401: AT (     171.01,      469.85,       0.00,      0.00,      0.00)  GP  POL1
         HIGH   2ND HIGH VALUE IS     1417.33879  ON 88030324: AT (     171.01,      469.85,       0.00,      0.00,      0.00)  GP  POL1

 *** RECEPTOR TYPES:  GC = GRIDCART
                      GP = GRIDPOLR
                      DC = DISCCART
                      DP = DISCPOLR
```


E-mail: support@webLakes.com
Web: www.webLakes.com

4.5 Plot File – Lovett (Original U.S. EPA)

```
* AERMOD ( 12345):  AERMOD Test Case - Lovett Complex Terrain Study
* MODELING OPTIONS USED:
* RegDFAULT CONC                                                  ELEV
*         PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL
*         FOR A TOTAL OF     11 RECEPTORS.
*         FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
*        X             Y      AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP       NUM HRS   NET ID
* ____________  ____________  ____________  ______   ______   ______  ______  ________  ________  ________
   3500.00000   67750.00000       0.76647   237.48   239.26     0.00  PERIOD  ALL       00008784
   3600.00000   69700.00000       2.26554   319.31   330.67     0.00  PERIOD  ALL       00008784
   4520.00000   69780.00000       4.12913   296.71   296.71     0.00  PERIOD  ALL       00008784
   5500.00000   70450.00000       2.46510   234.88   329.78     0.00  PERIOD  ALL       00008784
   4780.00000   70700.00000       4.23125   324.80   329.02     0.00  PERIOD  ALL       00008784
   5110.00000   70850.00000       4.28669   319.80   322.66     0.00  PERIOD  ALL       00008784
   5810.00000   70900.00000       2.93327   253.17   323.10     0.00  PERIOD  ALL       00008784
   5860.00000   71340.00000       1.14222   160.97   340.96     0.00  PERIOD  ALL       00008784
   6250.00000   71070.00000       3.50208   276.63   276.63     0.00  PERIOD  ALL       00008784
   6930.00000   71300.00000       0.99788   156.75   276.71     0.00  PERIOD  ALL       00008784
   7870.00000   69130.00000       0.55916    26.09    26.09     0.00  PERIOD  ALL       00008784
```

4.6 Plot File – Lovett (Parallel)

```
* AERMOD ( 12345):  AERMOD Test Case - Lovett Complex Terrain Study
* MODELING OPTIONS USED:
* RegDFAULT CONC                                                  ELEV
*         PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL
*         FOR A TOTAL OF     11 RECEPTORS.
*         FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
*        X             Y      AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP       NUM HRS   NET ID
* ____________  ____________  ____________  ______   ______   ______  ______  ________  ________  ________
   3500.00000   67750.00000       0.76647   237.48   239.26     0.00  PERIOD  ALL       00008784
   3600.00000   69700.00000       2.26554   319.31   330.67     0.00  PERIOD  ALL       00008784
   4520.00000   69780.00000       4.12913   296.71   296.71     0.00  PERIOD  ALL       00008784
   5500.00000   70450.00000       2.46510   234.88   329.78     0.00  PERIOD  ALL       00008784
   4780.00000   70700.00000       4.23125   324.80   329.02     0.00  PERIOD  ALL       00008784
   5110.00000   70850.00000       4.28669   319.80   322.66     0.00  PERIOD  ALL       00008784
   5810.00000   70900.00000       2.93327   253.17   323.10     0.00  PERIOD  ALL       00008784
   5860.00000   71340.00000       1.14222   160.97   340.96     0.00  PERIOD  ALL       00008784
   6250.00000   71070.00000       3.50208   276.63   276.63     0.00  PERIOD  ALL       00008784
   6930.00000   71300.00000       0.99788   156.75   276.71     0.00  PERIOD  ALL       00008784
   7870.00000   69130.00000       0.55916    26.09    26.09     0.00  PERIOD  ALL       00008784
```


E-mail: support@webLakes.com
Web: www.webLakes.com

4.7 Rank File - Rankfile (Original U.S. EPA)

```
* AERMOD ( 12345): RANKFILE test
* MODELING OPTIONS USED:
* RegDFAULT CONC                                                  ELEV
*         RANK-FILE OF UP TO   100 TOP  1-HR VALUES FOR     1 SOURCE GROUPS
*         INCLUDES OVERALL MAXIMUM VALUES WITH DUPLICATE DATA PERIODS REMOVED
*         FORMAT: (1X,I6,1X,F13.5,1X,I8.8,2(1X,F13.5),3(1X,F7.2),2X,A8)
*  RANK  AVERAGE CONC   DATE          X             Y        ZELEV   ZHILL   ZFLAG     GRP
*_______ ____________ ________  ____________ ____________  ______  ______  ______  ________
      1     459.99237 86052805  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      2     455.50758 86070603  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      3     429.59792 86100507  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      4     374.98301 86122118  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      5     328.41287 86090205  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      6     326.23265 86102017  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      7     317.15603 86123119  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      8     310.69303 86101302  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      9     307.29561 86010705  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
     10     302.41133 86101805  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
```

4.8 Rank File – Rankfile (Parallel)

```
* AERMOD ( 12345): RANKFILE test
* MODELING OPTIONS USED:
* RegDFAULT CONC                                                  ELEV
*         RANK-FILE OF UP TO   100 TOP  1-HR VALUES FOR     1 SOURCE GROUPS
*         INCLUDES OVERALL MAXIMUM VALUES WITH DUPLICATE DATA PERIODS REMOVED
*         FORMAT: (1X,I6,1X,F13.5,1X,I8.8,2(1X,F13.5),3(1X,F7.2),2X,A8)
*  RANK  AVERAGE CONC   DATE          X             Y        ZELEV   ZHILL   ZFLAG     GRP
*_______ ____________ ________  ____________ ____________  ______  ______  ______  ________
      1     459.99237 86052805  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      2     455.50758 86070603  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      3     429.59792 86100507  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      4     374.98301 86122118  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      5     328.41287 86090205  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      6     326.23265 86102017  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      7     317.15603 86123119  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      8     310.69303 86101302  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
      9     307.29561 86010705  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
     10     302.41133 86101805  463906.59000 5263493.99000  694.00  694.00    0.00  ALL
```

5 Known Issues

The following exceptions were made when comparing AERMOD MPI output to that generated with the serial U.S. EPA AERMOD executable:

1. Date/time stamps in the main output file were not compared as the two models were run at different times.
2. Evaluation Files may contain uninitialized REAL values for the "Effective Height for Stable Plume Reflections"; in cases where such values exist, an exact match is not expected.

In addition, an issue with the OPENPIT source type was identified when comparing results of multi-processor runs of the 11103 version of the AERMOD executable. There is a receptor-based calculation of the effective center coordinates that changes if the first polar gridded receptor is located inside the source footprint. In order to preserve identical results with the U.S. EPA AERMOD executable, minor changes were implemented to AERMOD MPI. Documentation of the AERMOD code changes and test projects demonstrating the issues were subsequently sent to the EPA Office of Air Quality Planning and Standards Air Quality Modeling Group.

6 Conclusion

Lakes Environmental AERMOD MPI produced identical results to the original U.S. EPA AERMOD executable dated 12345 in all test cases.

Run time using AERMOD MPI is reduced by a factor almost equal to the number of cores being used, when compared to the U.S. EPA AERMOD executable.

Due to an issue in the OPENPIT source type algorithms, the *Lakes Environmental* AERMOD MPI implements small code changes designed to fully parallelize runs using these algorithms while maintaining identical results to the U.S. EPA AERMOD results.

7 Disclaimer

Findings of this validation study in no way apply, infer, or otherwise suggest the regulatory status of *Lakes Environmental's* AERMOD MPI. The U.S. EPA has issued regulatory guidelines and clarification memoranda regarding the determination of the regulatory status of commercial software packages.[1,2]

[1] U.S. EPA. Guideline on Air Quality Models (Appendix W to 40 CFR Part 51). November 9, 2005.
[2] U.S. EPA. Clarification on Regulatory Status of Priority Versions of AERMOD. Air Quality Modeling Group. December 11, 2007.

E-mail: support@webLakes.com
Web: www.webLakes.com

The general issue of whether commercial software can be considered as a preferred model is addressed in Section 3.1 of Appendix W.

In the memorandum "Clarification on Regulatory Status of Proprietary Versions of AERMOD", the EPA writes:

> "*The determination of acceptability of a model is a Regional Office responsibility, where the burden of proof is on the applicant to provide an adequate demonstration of equivalency, subject to Regional Office acceptance. The first condition for approving use of an alternate model requires that a demonstration be made that the model produces concentration estimates equivalent to the estimates obtained using a preferred model. The condition for establishing equivalency is demonstrating that the maximum or highest and second highest concentrations are within 2 percent of the estimates obtained from the preferred model."*

The memorandum goes on to say "*the standard test cases packaged with the AERMOD model on the SCRAM website provide a reasonable starting point for equivalency demonstration, with additional test to be determined as needed on a case-by-case basis."*

Lakes Environmental specifically utilized the complete set of standard test cases in our validation study as suggested by the clarification memo. As confirmed, all results generated based on standard test cases are identical. *Lakes Environmental* has made every effort to ensure the accuracy of AERMOD MPI; however, *Lakes Environmental* takes no responsibility for any modeling results using AERMOD MPI.

E-mail: support@webLakes.com
Web: www.webLakes.com

Attachment D-1

Summary of 2020 Emission Rate Inputs by Period

Attachment D-1

2020 PM10 Emission Rate Input by Period

Source ID	Link Description	AM (6AM - 9AM)				MID-DAY (9AM - 3PM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	EB HDC - COUNTY LINE TO OASIS	0.00307231	0.03780350	0.09866193	0.13953774	0.00261240	0.02188080	0.05512392	0.07961712
AUT011	EB HDC - OASIS & SHEEP CREEK	0.01643553	0.11212833	0.28664482	0.41520869	0.01634585	0.06624688	0.16015282	0.24274555
AUT012	EB HDC - SHEEP CREEK & CAUGHLIN	0.02268825	0.13598238	0.36026279	0.51893343	0.02255850	0.08619596	0.21617630	0.32493076
AUT013	EB HDC - CAUGHLIN & KOALA	0.00877671	0.04815590	0.13259141	0.18952402	0.00874487	0.03178022	0.08268152	0.12320660
AUT014	EB HDC - KOALA & US395	0.00998447	0.07358392	0.19230778	0.27587616	0.00987716	0.04427132	0.10919641	0.16334488
AUT015	EB HDC - US395 & W.PHANTOM	0.00861669	0.08289640	0.19348190	0.28499500	0.00879583	0.05027659	0.11226552	0.17133793
AUT016	EB HDC - W.PHANTOM & E.PHANTOM	0.00611318	0.04945715	0.12238301	0.17795335	0.00637045	0.03115783	0.07296133	0.11048961
AUT017	EB HDC - E.PHANTOM & NATIONAL TRAIL	0.00695566	0.04195879	0.11323599	0.16215045	0.00735060	0.03134673	0.08097983	0.11967717
AUT018	EB HDC - NATIONAL TRAIL & I-15	0.00893586	0.04444362	0.13361570	0.18699518	0.00954948	0.03165247	0.08867163	0.12987359
AUT019	EB HDC - I-15 & CHOCO	0.00198155	0.02106107	0.04464168	0.06768430	0.00205594	0.01449008	0.02981462	0.04636064
AUT020	EB HDC - CHOCO & DALE EVANS	0.00124857	0.01347293	0.02758112	0.04230261	0.00127549	0.00942168	0.01878652	0.02948369
AUT021	EB EXPWY- DALE EVANS & WAALEW	0.00061867	0.01230548	0.02018613	0.03311028	0.00065197	0.00863475	0.01380721	0.02309394
AUT022	EB EXPWY - WAALEW & CAHUILLA	0.00023615	0.00490165	0.00770606	0.01284385	0.00025370	0.00345149	0.00529699	0.00900218
AUT023	EB EXPWY - CAHUILLA & JOSHUA	0.00020236	0.00398847	0.00647282	0.01066366	0.00025394	0.00302483	0.00475783	0.00803660
AUT024	EB EXPWY - JOSHUA & STANDING ROCK	0.00013518	0.00218155	0.00363082	0.00594755	0.00022387	0.00231649	0.00372816	0.00626853
AUT025	EB EXPWY - STANDING ROCSK & SR18	0.00044779	0.00543897	0.00953834	0.01542510	0.00028141	0.00363534	0.00641616	0.01033291
AUT026	EB EXPWY - SR18 & NASQUILLY	0.00032855	0.00458086	0.00766106	0.01257046	0.00021516	0.00307581	0.00515989	0.00845086
AUT027	EB EXPWY - NASQUILLY & BEAR VALLEY	0.00067428	0.01024219	0.01834388	0.02926035	0.00053293	0.00653238	0.01150651	0.01857182
AUT045	NB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.01947784	0.06251514	0.22858064	0.31057362	0.02328361	0.07211659	0.25918896	0.35458916
AUT046	NB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01178625	0.03584036	0.13466752	0.18229413	0.01403749	0.04058280	0.14932020	0.20394049
AUT047	NB I-15 LAPAZ DR TO MOJAVE DR	0.00998632	0.03020906	0.11371800	0.15391338	0.01186965	0.03429235	0.12655473	0.17271673
AUT048	NB I-15 MOJAVE DR TO SR18	0.02016923	0.05205207	0.20597603	0.27819733	0.02359837	0.06261084	0.24580388	0.33201310
AUT049	NB I-15 SR18 TO SOTDDARD WELLS	0.01394732	0.03569737	0.14360224	0.19324693	0.01718510	0.04486865	0.17860705	0.24066081
AUT050	NB I-15 STODDARD WELLS TO HDC	0.01104602	0.02714989	0.11362736	0.15182327	0.01394414	0.03295120	0.13484078	0.18173611
AUT051	NB I-15 HDC TO VICTOVVILE QUARRY RD	0.02836515	0.06851741	0.28303938	0.37992194	0.03402622	0.08532377	0.35036014	0.46971013
AUT052	NB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.05957952	0.13296309	0.53985589	0.73239851	0.07112013	0.17863570	0.73534397	0.98509980
AUT307	NB I-15 OFF-RAMP AT STODDARD WELLS	0.00008677	0.00091596	0.00214451	0.00314724	0.00003971	0.00027268	0.00059722	0.00090961
AUT309	NB I-15 ON-RAMP AT STODDARD WELLS	0.00001593	0.00030770	0.00043689	0.00076053	0.00001122	0.00018476	0.00025958	0.00045556

Attachment D-1

2020 PM10 Emission Rate Input by Period

Source ID	Link Description	PM (3PM - 7PM)				NIGHT (7PM - 6AM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	EB HDC - COUNTY LINE TO OASIS	0.00350064	0.03553637	0.09096101	0.12999801	0.00062106	0.00402232	0.00981241	0.01445579
AUT011	EB HDC - OASIS & SHEEP CREEK	0.02048114	0.10661595	0.26427115	0.39136824	0.00420059	0.01239616	0.02850821	0.04510497
AUT012	EB HDC - SHEEP CREEK & CAUGHLIN	0.02888557	0.14109690	0.36450063	0.53448310	0.00594372	0.01741099	0.04187881	0.06523353
AUT013	EB HDC - CAUGHLIN & KOALA	0.01098396	0.05071755	0.13602945	0.19773096	0.00229727	0.00637741	0.01585860	0.02453328
AUT014	EB HDC - KOALA & US395	0.01250197	0.07137789	0.18104589	0.26492575	0.00254113	0.00792598	0.01836548	0.02883260
AUT015	EB HDC - US395 & W.PHANTOM	0.01048493	0.07480954	0.17004744	0.25534192	0.00311435	0.01168598	0.02471529	0.03951563
AUT016	EB HDC - W.PHANTOM & E.PHANTOM	0.00802024	0.05219812	0.12621524	0.18643361	0.00183093	0.00668678	0.01508362	0.02360132
AUT017	EB HDC - E.PHANTOM & NATIONAL TRAIL	0.00936236	0.05898304	0.15913265	0.22747804	0.00272371	0.00816316	0.01978429	0.03067116
AUT018	EB HDC - NATIONAL TRAIL & I-15	0.01129201	0.06569847	0.20032356	0.27731404	0.00362708	0.00850256	0.02173350	0.03386314
AUT019	EB HDC - I-15 & CHOCO	0.00301498	0.02775312	0.05825887	0.08902697	0.00145036	0.00505643	0.00940061	0.01590739
AUT020	EB HDC - CHOCO & DALE EVANS	0.00191486	0.01883832	0.03833562	0.05908880	0.00088027	0.00326539	0.00593218	0.01007783
AUT021	EB EXPWY- DALE EVANS & WAALEW	0.00140629	0.02313556	0.03770112	0.06224297	0.00021233	0.00229307	0.00361817	0.00612357
AUT022	EB EXPWY - WAALEW & CAHUILLA	0.00064394	0.01131623	0.01768384	0.02964401	0.00006168	0.00086646	0.00133429	0.00226243
AUT023	EB EXPWY - CAHUILLA & JOSHUA	0.00059954	0.01050878	0.01695051	0.02805883	0.00005949	0.00076460	0.00121207	0.00203616
AUT024	EB EXPWY - JOSHUA & STANDING ROCK	0.00059428	0.01024225	0.01709063	0.02792716	0.00005267	0.00062908	0.00102739	0.00170913
AUT025	EB EXPWY - STANDING ROCSK & SR18	0.00044045	0.00557101	0.00980198	0.01581344	0.00007212	0.00092517	0.00163514	0.00263244
AUT026	EB EXPWY - SR18 & NASQUILLY	0.00033819	0.00507510	0.00853253	0.01394582	0.00006415	0.00082130	0.00136964	0.00225510
AUT027	EB EXPWY - NASQUILLY & BEAR VALLEY	0.00069332	0.01015650	0.01814147	0.02899129	0.00018782	0.00191762	0.00333626	0.00544170
AUT045	NB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.01872189	0.11294235	0.44279558	0.57445982	0.01669095	0.03298071	0.10622873	0.15590039
AUT046	NB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01214011	0.06318360	0.25386404	0.32918776	0.01016564	0.01850585	0.05980255	0.08847404
AUT047	NB I-15 LAPAZ DR TO MOJAVE DR	0.01035148	0.05365892	0.21612957	0.28013998	0.00878940	0.01603590	0.05203982	0.07686513
AUT048	NB I-15 MOJAVE DR TO SR18	0.02058268	0.09789914	0.42343343	0.54191525	0.01765419	0.03079914	0.10678892	0.15524225
AUT049	NB I-15 SR18 TO SOTDDARD WELLS	0.01476246	0.06777658	0.29942265	0.38196169	0.01320007	0.02252068	0.07870108	0.11442183
AUT050	NB I-15 STODDARD WELLS TO HDC	0.01174067	0.05227768	0.24192867	0.30594702	0.01051232	0.01722749	0.06212356	0.08986337
AUT051	NB I-15 HDC TO VICTOVVILE QUARRY RD	0.02764682	0.13292568	0.61178720	0.77235970	0.02425775	0.03974292	0.14353451	0.20753518
AUT052	NB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.05801755	0.28096829	1.29759854	1.63658438	0.05118914	0.08456021	0.30733418	0.44308353
AUT307	NB I-15 OFF-RAMP AT STODDARD WELLS	0.00003688	0.00035836	0.00082903	0.00122427	0.00000656	0.00002323	0.00004173	0.00007152
AUT309	NB I-15 ON-RAMP AT STODDARD WELLS	0.00001862	0.00036812	0.00052342	0.00091016	0.00000328	0.00005063	0.00007080	0.00012470

Attachment D-1

2020 PM10 Emission Rate Input by Period

Source ID	Link Description	AM (6AM - 9AM)				MID-DAY (9AM - 3PM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	WB HDC - COUNTY LINE TO OASIS	0.00203106	0.01502730	0.04020602	0.05726438	0.00250365	0.01825005	0.04857771	0.06933142
AUT011	WB HDC - OASIS & SHEEP CREEK	0.01322622	0.04586515	0.11681151	0.17590287	0.01636362	0.05585959	0.14113396	0.21335717
AUT012	WB HDC - SHEEP CREEK & CAUGHLIN	0.01870162	0.06596516	0.17219166	0.25685844	0.02275646	0.07365943	0.18811237	0.28452825
AUT013	WB HDC - CAUGHLIN & KOALA	0.00719628	0.02303442	0.06197063	0.09220134	0.00904564	0.02678435	0.07086266	0.10669265
AUT014	WB HDC - KOALA & US395	0.00826945	0.03455698	0.08916027	0.13198670	0.01003122	0.03825308	0.09651989	0.14480419
AUT015	WB HDC - US395 & W.PHANTOM	0.00750122	0.04451884	0.10227288	0.15429295	0.00890232	0.04713216	0.10664022	0.16267470
AUT016	WB HDC - W. PHANTOM & E.PHANTOM	0.00589385	0.03336081	0.08189749	0.12115214	0.00664408	0.02963188	0.07049404	0.10677000
AUT017	WB HDC - E.PHANTOM & NATIONAL TRAIL	0.00731445	0.03936989	0.11104006	0.15772439	0.00765309	0.03039101	0.08190589	0.11994999
AUT018	WB HDC - NATIONAL TRAIL & I-15	0.00836412	0.04308241	0.13296261	0.18440914	0.00981355	0.03075499	0.08682057	0.12738911
AUT019	WB HDC - I-15 & CHOCO	0.00264054	0.01919309	0.04016157	0.06199520	0.00253035	0.01576536	0.03248730	0.05078302
AUT020	WB HDC - CHOCO & DALE EVANS	0.00162578	0.01340003	0.02740962	0.04243543	0.00157131	0.01035923	0.02081128	0.03274182
AUT021	WB EXPWY- DALE EVANS & WAALEW	0.00090992	0.01377719	0.02305843	0.03774554	0.00062972	0.00838841	0.01391684	0.02293498
AUT022	WB EXPWY - WAALEW & CAHUILLA	0.00038833	0.00602824	0.00971499	0.01613155	0.00023516	0.00335791	0.00538733	0.00898040
AUT023	WB EXPWY - CAHUILLA & JOSHUA	0.00035699	0.00470867	0.00790356	0.01296922	0.00022080	0.00303810	0.00512253	0.00838143
AUT024	WB EXPWY - JOSHUA & STANDING ROCK	0.00035317	0.00406029	0.00733028	0.01174374	0.00019584	0.00248617	0.00453135	0.00721336
AUT025	WB EXPWY - STANDING ROCSK & SR18	0.00021014	0.00381887	0.00633258	0.01036158	0.00031069	0.00340196	0.00544972	0.00916237
AUT026	WB EXPWY - SR18 & NASQUILLY	0.00021804	0.00474386	0.00771567	0.01267757	0.00023021	0.00273252	0.00428372	0.00724645
AUT027	WB EXPWY - NASQUILLY & BEAR VALLEY	0.00056070	0.00981160	0.01695006	0.02732236	0.00055545	0.00599675	0.00999089	0.01654309
AUT045	SB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.01768222	0.08792554	0.36332877	0.46893654	0.02329063	0.06857240	0.25663699	0.34850002
AUT046	SB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01069645	0.05160599	0.21432638	0.27662882	0.01412324	0.03908450	0.14625922	0.19946696
AUT047	SB I-15 LAPAZ DR TO MOJAVE DR	0.00911004	0.04676460	0.19085062	0.24672526	0.01225940	0.03461269	0.12722133	0.17409342
AUT048	SB I-15 MOJAVE DR TO SR18	0.01913629	0.08203071	0.36656941	0.46773640	0.02486494	0.05846021	0.23006614	0.31339129
AUT049	SB I-15 SR18 TO SOTDDARD WELLS	0.01349258	0.05360513	0.24604066	0.31313836	0.01777239	0.04185592	0.17025473	0.22988304
AUT050	SB I-15 STODDARD WELLS TO HDC	0.01071867	0.04149099	0.20099983	0.25320949	0.01440250	0.03055209	0.12800291	0.17295750
AUT051	SB I-15 HDC TO VICTOVVILE QUARRY RD	0.02569707	0.09900533	0.47547393	0.60017632	0.03503944	0.07857196	0.33045034	0.44406174
AUT052	SB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.05430440	0.21094389	1.02678120	1.29202950	0.07397796	0.16579461	0.70526334	0.94503592
AUT308	SB I-15 ON-RAMP AT STODDARD WELLS	0.00001261	0.00017796	0.00031742	0.00050799	0.00001307	0.00015530	0.00027258	0.00044095
AUT310	SB I-15 OFF-RAMP AT STODDARD WELLS	0.00001553	0.00030030	0.00042759	0.00074342	0.00001029	0.00016615	0.00023373	0.00041017
SLINE	HIGH SPEED RAIL	0.00000000	0.00000000	0.24749769	0.24749769	0.00000000	0.00000000	0.24749769	0.24749769

Attachment D-1

2020 PM10 Emission Rate Input by Period

Source ID	Link Description	PM (3PM - 7PM)				NIGHT (7PM - 6AM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	WB HDC - COUNTY LINE TO OASIS	0.00428648	0.05259089	0.14689609	0.20377346	0.00079138	0.00472871	0.01225531	0.01777541
AUT011	WB HDC - OASIS & SHEEP CREEK	0.02348458	0.15661206	0.42678064	0.60687728	0.00545989	0.01468265	0.03560565	0.05574819
AUT012	WB HDC - SHEEP CREEK & CAUGHLIN	0.03273385	0.21281450	0.59086076	0.83640911	0.00769446	0.02046692	0.05057377	0.07873516
AUT013	WB HDC - CAUGHLIN & KOALA	0.01281029	0.07727966	0.22409975	0.31418971	0.00299119	0.00756954	0.01939334	0.02995407
AUT014	WB HDC - KOALA & US395	0.01484326	0.11026564	0.30176884	0.42687774	0.00331192	0.00944350	0.02253524	0.03529066
AUT015	WB HDC - US395 & W.PHANTOM	0.01155243	0.11231336	0.26585530	0.38972109	0.00369319	0.01484079	0.03239545	0.05092942
AUT016	WB HDC - W. PHANTOM & E.PHANTOM	0.00876995	0.06846788	0.17212238	0.24936021	0.00213361	0.00791679	0.01839136	0.02844176
AUT017	WB HDC - E.PHANTOM & NATIONAL TRAIL	0.01067846	0.06414976	0.18121946	0.25604768	0.00316627	0.00925758	0.02356576	0.03598961
AUT018	WB HDC - NATIONAL TRAIL & I-15	0.01314161	0.07643538	0.23730557	0.32688257	0.00427173	0.00958192	0.02462064	0.03847430
AUT019	WB HDC - I-15 & CHOCO	0.00340627	0.03744625	0.08065489	0.12150742	0.00158362	0.00544546	0.01023615	0.01726523
AUT020	WB HDC - CHOCO & DALE EVANS	0.00204941	0.02354736	0.04920448	0.07480124	0.00095855	0.00346327	0.00637464	0.01079646
AUT021	WB EXPWY- DALE EVANS & WAALEW	0.00101196	0.01650315	0.02777103	0.04528613	0.00021683	0.00242634	0.00398258	0.00662575
AUT022	WB EXPWY - WAALEW & CAHUILLA	0.00040637	0.00675207	0.01092356	0.01808200	0.00006528	0.00090570	0.00145345	0.00242444
AUT023	WB EXPWY - CAHUILLA & JOSHUA	0.00038290	0.00576637	0.00976649	0.01591576	0.00006186	0.00079647	0.00133992	0.00219825
AUT024	WB EXPWY - JOSHUA & STANDING ROCK	0.00032784	0.00372472	0.00672394	0.01077650	0.00005256	0.00062597	0.00113690	0.00181543
AUT025	WB EXPWY - STANDING ROCSK & SR18	0.00071988	0.01234240	0.02038740	0.03344968	0.00007373	0.00097264	0.00158438	0.00263075
AUT026	WB EXPWY - SR18 & NASQUILLY	0.00053371	0.00916526	0.01473500	0.02443397	0.00006210	0.00079050	0.00124798	0.00210058
AUT027	WB EXPWY - NASQUILLY & BEAR VALLEY	0.00114851	0.01748000	0.03006011	0.04868863	0.00018591	0.00184253	0.00305870	0.00508715
AUT045	SB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.02176867	0.07789507	0.30346054	0.40312428	0.01762816	0.03489351	0.11885434	0.17137601
AUT046	SB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01339805	0.04392721	0.17094029	0.22826556	0.01048356	0.02014655	0.06870353	0.09933364
AUT047	SB I-15 LAPAZ DR TO MOJAVE DR	0.01133110	0.03952087	0.15140538	0.20225735	0.00906853	0.01749474	0.05834722	0.08491049
AUT048	SB I-15 MOJAVE DR TO SR18	0.02337762	0.06858109	0.28448659	0.37644530	0.01718379	0.03096209	0.11180193	0.15994782
AUT049	SB I-15 SR18 TO SOTDDARD WELLS	0.01611429	0.04605945	0.19773152	0.25990527	0.01285995	0.02287266	0.08558086	0.12131347
AUT050	SB I-15 STODDARD WELLS TO HDC	0.01278543	0.03458476	0.15497808	0.20234826	0.01024794	0.01750931	0.06815973	0.09591698
AUT051	SB I-15 HDC TO VICTOVVILE QUARRY RD	0.03300577	0.09742543	0.43881400	0.56924520	0.02416146	0.04094915	0.15919278	0.22430340
AUT052	SB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.06959205	0.18980122	0.84976575	1.10915902	0.05120484	0.08756532	0.34597318	0.48474334
AUT308	SB I-15 ON-RAMP AT STODDARD WELLS	0.00008212	0.00100542	0.00176999	0.00285752	0.00000000	0.00000000	0.00000000	0.00000000
AUT310	SB I-15 OFF-RAMP AT STODDARD WELLS	0.00001771	0.00034937	0.00049806	0.00086514	0.00000320	0.00004972	0.00006974	0.00012267
SLINE	HIGH SPEED RAIL	0.00000000	0.00000000	0.24749769	0.24749769	0.00000000	0.00000000	0.24749769	0.24749769

Attachment D-2

Summary of 2040 Emission Rate Inputs by Period

Attachment D-2

2040 PM10 Emission Rate Input by Period

Source ID	Link Description	AM (6AM - 9AM)				MID-DAY (9AM - 3PM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	EB HDC - COUNTY LINE TO OASIS	0.00386965	0.06555544	0.16078299	0.23020808	0.00294571	0.03482343	0.08344614	0.12121528
AUT011	EB HDC - OASIS & SHEEP CREEK	0.02230055	0.18635962	0.45578646	0.66444662	0.02020998	0.10066585	0.23620215	0.35707798
AUT012	EB HDC - SHEEP CREEK & CAUGHLIN	0.02992596	0.19866860	0.52660316	0.75519772	0.02716409	0.11199716	0.28215091	0.42131216
AUT013	EB HDC - CAUGHLIN & KOALA	0.01188950	0.06929005	0.19075585	0.27193539	0.01041737	0.04080015	0.10675375	0.15797127
AUT014	EB HDC - KOALA & US395	0.01344318	0.11714182	0.30141357	0.43199857	0.01193109	0.05903136	0.14365300	0.21461546
AUT015	EB HDC - US395 & W.PHANTOM	0.01113283	0.12550049	0.30281339	0.43944672	0.01143482	0.07345031	0.17027069	0.25515582
AUT016	EB HDC - W.PHANTOM & E.PHANTOM	0.00662090	0.07168115	0.16011398	0.23841603	0.00604900	0.03883913	0.08361149	0.12849961
AUT017	EB HDC - E.PHANTOM & NATIONAL TRAIL	0.01029153	0.07266224	0.20936129	0.29231507	0.01117754	0.05024382	0.13699407	0.19841543
AUT018	EB HDC - NATIONAL TRAIL & I-15	0.01556959	0.09362109	0.29128654	0.40047722	0.01628086	0.06267547	0.18232380	0.26128013
AUT019	EB HDC - I-15 & CHOCO	0.00314390	0.04942167	0.08448996	0.13705553	0.00187574	0.02000490	0.03360086	0.05548151
AUT020	EB HDC - CHOCO & DALE EVANS	0.00173958	0.02670767	0.04687730	0.07532454	0.00108007	0.01130434	0.01949121	0.03187563
AUT021	EB EXPWY- DALE EVANS & WAALEW	0.00172888	0.03089229	0.05348010	0.08610128	0.00089586	0.01336211	0.02265449	0.03691246
AUT022	EB EXPWY - WAALEW & CAHUILLA	0.00075174	0.01532067	0.02691473	0.04298714	0.00037199	0.00553776	0.00953851	0.01544825
AUT023	EB EXPWY - CAHUILLA & JOSHUA	0.00069411	0.01368107	0.02492251	0.03929770	0.00036982	0.00512192	0.00911947	0.01461121
AUT024	EB EXPWY - JOSHUA & STANDING ROCK	0.00070930	0.01405237	0.02738743	0.04214909	0.00036014	0.00445552	0.00842690	0.01324255
AUT025	EB EXPWY - STANDING ROCSK & SR18	0.00089228	0.01650021	0.03120393	0.04859642	0.00046772	0.00605186	0.01117882	0.01769840
AUT026	EB EXPWY - SR18 & NASQUILLY	0.00054486	0.01002562	0.01874255	0.02931303	0.00032412	0.00447487	0.00820616	0.01300516
AUT027	EB EXPWY - NASQUILLY & BEAR VALLEY	0.00091830	0.01592251	0.02967328	0.04651409	0.00054316	0.00784857	0.01432073	0.02271246
AUT045	NB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.01806175	0.07241979	0.24146185	0.33194339	0.02137230	0.08165875	0.26610366	0.36913471
AUT046	NB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01097155	0.04287396	0.14407615	0.19792166	0.01313308	0.04635551	0.15118875	0.21067734
AUT047	NB I-15 LAPAZ DR TO MOJAVE DR	0.00950363	0.03740935	0.12511115	0.17202413	0.01137143	0.04037776	0.13105469	0.18280388
AUT048	NB I-15 MOJAVE DR TO SR18	0.01757378	0.05844756	0.19522412	0.27124545	0.02092962	0.06685718	0.21972372	0.30751051
AUT049	NB I-15 SR18 TO SOTDDARD WELLS	0.01196501	0.03898670	0.13511898	0.18607069	0.01496366	0.04691902	0.15886570	0.22074839
AUT050	NB I-15 STODDARD WELLS TO HDC	0.00964122	0.03143518	0.11025636	0.15133276	0.01233869	0.03724153	0.12721888	0.17679910
AUT051	NB I-15 HDC TO VICTOVVILE QUARRY RD	0.03037013	0.09795595	0.35806447	0.48639055	0.03530471	0.11391819	0.41037000	0.55959290
AUT052	NB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.06268286	0.16632523	0.62258990	0.85159799	0.06992331	0.21152295	0.79820307	1.07964932
AUT307	NB I-15 OFF-RAMP AT STODDARD WELLS	0.00017860	0.00249282	0.00477978	0.00745120	0.00014525	0.00173797	0.00327309	0.00515632
AUT309	NB I-15 ON-RAMP AT STODDARD WELLS	0.00001881	0.00036663	0.00050630	0.00089174	0.00001086	0.00019954	0.00027448	0.00048487

Attachment D-2

2040 PM10 Emission Rate Input by Period

Source ID	Link Description	AM (6AM - 9AM)				MID-DAY (9AM - 3PM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	WB HDC - COUNTY LINE TO OASIS	0.00190950	0.01891656	0.04547081	0.06629687	0.00274775	0.02937116	0.07116085	0.10327976
AUT011	WB HDC - OASIS & SHEEP CREEK	0.01436265	0.05431339	0.12592444	0.19460048	0.01996963	0.08543759	0.20137639	0.30678361
AUT012	WB HDC - SHEEP CREEK & CAUGHLIN	0.01954149	0.07060016	0.17696625	0.26710789	0.02691351	0.09547540	0.23848010	0.36086900
AUT013	WB HDC - CAUGHLIN & KOALA	0.00765215	0.02420077	0.06357981	0.09543273	0.01022637	0.03270140	0.08562440	0.12855217
AUT014	WB HDC - KOALA & US395	0.00865736	0.03843220	0.09408094	0.14117050	0.01176531	0.04902064	0.11862313	0.17940907
AUT015	WB HDC - US395 & W.PHANTOM	0.00909833	0.05497570	0.12637816	0.19045219	0.01143573	0.06776630	0.15488751	0.23408954
AUT016	WB HDC - W. PHANTOM & E.PHANTOM	0.00554297	0.03911911	0.08429513	0.12895721	0.00621609	0.03710203	0.07863363	0.12195175
AUT017	WB HDC - E.PHANTOM & NATIONAL TRAIL	0.01016842	0.06147680	0.17681838	0.24846360	0.01142955	0.04888045	0.13362770	0.19393770
AUT018	WB HDC - NATIONAL TRAIL & I-15	0.01339982	0.07416907	0.22842009	0.31598899	0.01652066	0.06179421	0.17766954	0.25598441
AUT019	WB HDC - I-15 & CHOCO	0.00290907	0.03343928	0.05220998	0.08855833	0.00247577	0.02420574	0.03739877	0.06408028
AUT020	WB HDC - CHOCO & DALE EVANS	0.00165087	0.01827387	0.02881040	0.04873513	0.00145343	0.01391778	0.02173099	0.03710219
AUT021	WB EXPWY- DALE EVANS & WAALEW	0.00111665	0.01932348	0.02980864	0.05024877	0.00105826	0.01444607	0.02189900	0.03740333
AUT022	WB EXPWY - WAALEW & CAHUILLA	0.00047914	0.00804886	0.01217631	0.02070432	0.00048151	0.00618644	0.00919001	0.01585796
AUT023	WB EXPWY - CAHUILLA & JOSHUA	0.00043825	0.00639685	0.00978248	0.01661758	0.00047734	0.00548255	0.00823124	0.01419114
AUT024	WB EXPWY - JOSHUA & STANDING ROCK	0.00038731	0.00423287	0.00658458	0.01120477	0.00048907	0.00485081	0.00747439	0.01281427
AUT025	WB EXPWY - STANDING ROCSK & SR18	0.00048375	0.00677036	0.01060852	0.01786263	0.00060977	0.00647310	0.00990757	0.01699043
AUT026	WB EXPWY - SR18 & NASQUILLY	0.00037011	0.00636903	0.01004109	0.01678023	0.00039943	0.00454074	0.00694402	0.01188419
AUT027	WB EXPWY - NASQUILLY & BEAR VALLEY	0.00068106	0.01105749	0.01733553	0.02907408	0.00065774	0.00787168	0.01203829	0.02056772
AUT045	SB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.01666632	0.10206703	0.38404686	0.50278021	0.02299010	0.07673823	0.26382147	0.36354979
AUT046	SB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01044994	0.05965280	0.22152468	0.29162742	0.01395850	0.04483716	0.15237032	0.21116597
AUT047	SB I-15 LAPAZ DR TO MOJAVE DR	0.00895995	0.05429544	0.19833253	0.26158793	0.01176601	0.03946930	0.13162032	0.18285563
AUT048	SB I-15 MOJAVE DR TO SR18	0.01608444	0.08647098	0.32793096	0.43048639	0.02136793	0.06028593	0.20513032	0.28678417
AUT049	SB I-15 SR18 TO SOTDDARD WELLS	0.01173786	0.05796774	0.22846367	0.29816926	0.01541234	0.04214149	0.14851262	0.20606645
AUT050	SB I-15 STODDARD WELLS TO HDC	0.00941310	0.04612983	0.18746051	0.24300344	0.01228821	0.03217346	0.11546297	0.15992463
AUT051	SB I-15 HDC TO VICTOVVILE QUARRY RD	0.02726132	0.12448187	0.53176670	0.68350989	0.03688490	0.09939395	0.38004516	0.51632401
AUT052	SB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.05215704	0.25142841	1.14331297	1.44689841	0.07364103	0.19089610	0.76155671	1.02609384
AUT308	SB I-15 ON-RAMP AT STODDARD WELLS	0.00007538	0.00091715	0.00175779	0.00275032	0.00008537	0.00100015	0.00190879	0.00299431
AUT310	SB I-15 OFF-RAMP AT STODDARD WELLS	0.00002388	0.00047963	0.00065996	0.00116346	0.00000971	0.00017567	0.00024004	0.00042543
SLINE	HIGH SPEED RAIL	0.00000000	0.00000000	0.24749769	0.24749769	0.00000000	0.00000000	0.24749769	0.24749769

Attachment D-2

2040 PM10 Emission Rate Input by Period

Source ID	Link Description	PM (3PM - 7PM)				NIGHT (7PM - 6AM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	EB HDC - COUNTY LINE TO OASIS	0.00386741	0.05193208	0.12500630	0.18080579	0.00084054	0.00660383	0.01505848	0.02250284
AUT011	EB HDC - OASIS & SHEEP CREEK	0.02551752	0.15054623	0.35622993	0.53229368	0.00706733	0.01976437	0.04248606	0.06931776
AUT012	EB HDC - SHEEP CREEK & CAUGHLIN	0.03580070	0.18558123	0.47847226	0.69985419	0.00970908	0.02589215	0.06053882	0.09614004
AUT013	EB HDC - CAUGHLIN & KOALA	0.01415569	0.06842991	0.18371243	0.26629803	0.00377906	0.00946288	0.02279646	0.03603840
AUT014	EB HDC - KOALA & US395	0.01587420	0.09679963	0.24025818	0.35293201	0.00428703	0.01244808	0.02753277	0.04426789
AUT015	EB HDC - US395 & W.PHANTOM	0.01395081	0.10566735	0.24654775	0.36616591	0.00585966	0.01987069	0.04212244	0.06785279
AUT016	EB HDC - W.PHANTOM & E.PHANTOM	0.00925720	0.07193856	0.15563414	0.23682990	0.00236450	0.00973682	0.01987288	0.03197420
AUT017	EB HDC - E.PHANTOM & NATIONAL TRAIL	0.01243045	0.09439064	0.27089716	0.37771826	0.00649633	0.01618299	0.03892135	0.06160067
AUT018	EB HDC - NATIONAL TRAIL & I-15	0.01832342	0.12241985	0.38165215	0.52239542	0.00938295	0.02070054	0.05211119	0.08219469
AUT019	EB HDC - I-15 & CHOCO	0.00662937	0.06169093	0.10204651	0.17036681	0.00047758	0.00470102	0.00785475	0.01303335
AUT020	EB HDC - CHOCO & DALE EVANS	0.00369607	0.03006273	0.05065375	0.08441256	0.00028256	0.00273740	0.00469569	0.00771566
AUT021	EB EXPWY- DALE EVANS & WAALEW	0.00289374	0.03251156	0.05402172	0.08942703	0.00025099	0.00334631	0.00564599	0.00924329
AUT022	EB EXPWY - WAALEW & CAHUILLA	0.00142521	0.01570291	0.02623193	0.04336005	0.00007894	0.00123341	0.00213530	0.00344765
AUT023	EB EXPWY - CAHUILLA & JOSHUA	0.00135598	0.01378700	0.02370456	0.03884754	0.00007663	0.00115770	0.00207812	0.00331245
AUT024	EB EXPWY - JOSHUA & STANDING ROCK	0.00152779	0.01295882	0.02338803	0.03787464	0.00006653	0.00090466	0.00172676	0.00269794
AUT025	EB EXPWY - STANDING ROCSK & SR18	0.00179853	0.01669217	0.02963753	0.04812823	0.00010318	0.00143056	0.00266302	0.00419677
AUT026	EB EXPWY - SR18 & NASQUILLY	0.00106656	0.00980075	0.01718007	0.02804738	0.00007473	0.00101509	0.00186536	0.00295519
AUT027	EB EXPWY - NASQUILLY & BEAR VALLEY	0.00169106	0.01572955	0.02739988	0.04482049	0.00013066	0.00181482	0.00330883	0.00525431
AUT045	NB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.01584803	0.12030864	0.42603401	0.56219068	0.01678239	0.03761199	0.11106321	0.16545758
AUT046	NB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01002670	0.06987531	0.24846296	0.32836496	0.00981909	0.02059314	0.06005157	0.09046380
AUT047	NB I-15 LAPAZ DR TO MOJAVE DR	0.00869371	0.06109152	0.21612750	0.28591272	0.00849104	0.01786504	0.05183298	0.07818907
AUT048	NB I-15 MOJAVE DR TO SR18	0.01704431	0.10640022	0.38248153	0.50592606	0.01485614	0.03038531	0.08973619	0.13497764
AUT049	NB I-15 SR18 TO SOTDDARD WELLS	0.01207165	0.07504923	0.27936126	0.36648214	0.01070478	0.02157543	0.06529993	0.09758014
AUT050	NB I-15 STODDARD WELLS TO HDC	0.01043263	0.05991753	0.22525445	0.29560461	0.00884827	0.01697337	0.05150648	0.07732812
AUT051	NB I-15 HDC TO VICTOVVILE QUARRY RD	0.02686933	0.17288795	0.68106279	0.88082007	0.02554379	0.04965646	0.15769470	0.23289495
AUT052	NB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.05224108	0.33774052	1.42147265	1.81145424	0.05200098	0.09777278	0.32905167	0.47882543
AUT307	NB I-15 OFF-RAMP AT STODDARD WELLS	0.00015253	0.00193258	0.00366221	0.00574732	0.00006750	0.00045685	0.00078432	0.00130868
AUT309	NB I-15 ON-RAMP AT STODDARD WELLS	0.00002499	0.00049067	0.00067794	0.00119360	0.00000452	0.00007809	0.00010694	0.00018955

Attachment D-2

2040 PM10 Emission Rate Input by Period

Source ID	Link Description	PM (3PM - 7PM)				NIGHT (7PM - 6AM)			
		Exhaust	Tire and Brake Wear	Re-entrained Dust	Total	Exhaust	Tire and Brake Wear	Re-entrained Dust	Total
AUT010	WB HDC - COUNTY LINE TO OASIS	0.00472728	0.08256048	0.20608556	0.29337332	0.00089978	0.00753476	0.01775049	0.02618503
AUT011	WB HDC - OASIS & SHEEP CREEK	0.02650270	0.23612479	0.58712013	0.84974762	0.00734264	0.02234045	0.05011953	0.07980261
AUT012	WB HDC - SHEEP CREEK & CAUGHLIN	0.03741994	0.27264001	0.73194247	1.04200242	0.01001498	0.02818115	0.06770609	0.10590222
AUT013	WB HDC - CAUGHLIN & KOALA	0.01453178	0.09449551	0.26957571	0.37860300	0.00389847	0.01031793	0.02614556	0.04036197
AUT014	WB HDC - KOALA & US395	0.01646862	0.14742909	0.38463767	0.54853538	0.00442733	0.01368401	0.03137522	0.04948655
AUT015	WB HDC - US395 & W.PHANTOM	0.01366464	0.15104970	0.35914867	0.52386301	0.00618404	0.02424123	0.05266993	0.08309519
AUT016	WB HDC - W. PHANTOM & E.PHANTOM	0.00818083	0.08617484	0.18960932	0.28396500	0.00234937	0.01109588	0.02292193	0.03636718
AUT017	WB HDC - E.PHANTOM & NATIONAL TRAIL	0.01225323	0.09983332	0.29167821	0.40376476	0.00658651	0.01708669	0.04218532	0.06585852
AUT018	WB HDC - NATIONAL TRAIL & I-15	0.01853153	0.13682584	0.42782770	0.58318507	0.00937514	0.02077954	0.05213977	0.08229446
AUT019	WB HDC - I-15 & CHOCO	0.00554210	0.08953467	0.14156103	0.23663780	0.00044996	0.00455545	0.00706776	0.01207317
AUT020	WB HDC - CHOCO & DALE EVANS	0.00292236	0.04584910	0.07333182	0.12210328	0.00027316	0.00275826	0.00433037	0.00736178
AUT021	WB EXPWY- DALE EVANS & WAALEW	0.00269663	0.03937352	0.06137198	0.10344212	0.00024165	0.00336601	0.00512863	0.00873629
AUT022	WB EXPWY - WAALEW & CAHUILLA	0.00121162	0.02090040	0.03208198	0.05419400	0.00007910	0.00130838	0.00198146	0.00336893
AUT023	WB EXPWY - CAHUILLA & JOSHUA	0.00114804	0.02106606	0.03296578	0.05517989	0.00007488	0.00114376	0.00175907	0.00297770
AUT024	WB EXPWY - JOSHUA & STANDING ROCK	0.00095590	0.01918612	0.03121822	0.05136023	0.00006655	0.00094982	0.00151225	0.00252862
AUT025	WB EXPWY - STANDING ROCSK & SR18	0.00114099	0.02328527	0.03742016	0.06184641	0.00009670	0.00149459	0.00236252	0.00395381
AUT026	WB EXPWY - SR18 & NASQUILLY	0.00067654	0.01320114	0.02107441	0.03495209	0.00007021	0.00106396	0.00166770	0.00280186
AUT027	WB EXPWY - NASQUILLY & BEAR VALLEY	0.00118732	0.02096654	0.03339865	0.05555251	0.00012328	0.00190578	0.00298159	0.00501064
AUT045	SB I-15 NASQUALLI RD TO PEAR BLOSSOM	0.02015149	0.08756979	0.31523698	0.42295826	0.01733083	0.03809427	0.12043349	0.17585860
AUT046	SB I-15 PEAR BLOSSOM TO LAPAZ DR	0.01249966	0.05124910	0.18232525	0.24607402	0.01001325	0.02237662	0.07008830	0.10247817
AUT047	SB I-15 LAPAZ DR TO MOJAVE DR	0.01063201	0.04633948	0.16237892	0.21935041	0.00866033	0.01944390	0.05963588	0.08774011
AUT048	SB I-15 MOJAVE DR TO SR18	0.01912281	0.07023813	0.25195939	0.34132033	0.01441272	0.03108577	0.09854226	0.14404076
AUT049	SB I-15 SR18 TO SOTDDARD WELLS	0.01344190	0.04916014	0.18447262	0.24707466	0.01074319	0.02254056	0.07448810	0.10777185
AUT050	SB I-15 STODDARD WELLS TO HDC	0.01106326	0.03752247	0.14375453	0.19234026	0.00863640	0.01775238	0.06007319	0.08646197
AUT051	SB I-15 HDC TO VICTOVVILE QUARRY RD	0.03456034	0.11716435	0.46931130	0.62103599	0.02563226	0.05147750	0.18318231	0.26029206
AUT052	SB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	0.07062440	0.21371698	0.88416762	1.16850900	0.05216141	0.10084828	0.37698949	0.52999919
AUT308	SB I-15 ON-RAMP AT STODDARD WELLS	0.00012694	0.00182938	0.00358101	0.00553734	0.00005720	0.00040393	0.00071213	0.00117326
AUT310	SB I-15 OFF-RAMP AT STODDARD WELLS	0.00002057	0.00039543	0.00054258	0.00095858	0.00000359	0.00005828	0.00007899	0.00014086
SLINE	HIGH SPEED RAIL	0.00000000	0.00000000	0.24749769	0.24749769	0.00000000	0.00000000	0.24749769	0.24749769

Attachment E

Memorandum to EPA for Consultation on Surface and Upper Air Data

ZM ASSOCIATES INC.
Environmental Consultants
www.zmassociates.com

April 16, 2012

Memorandum

To: Andrew Yoon, PE
Caltrans

From: Thomas Miller

Subject: Caltrans HDC $PM_{2.5}$ & PM_{10} Conformity Analysis AERMOD Modeling Project Summary of Meteorological Data Options

Upon a detailed review of available meteorological data for the project site area, between 2000 through 2005, two data packages offer a reasonable fit for this project. Of the two, only one offers complete calendar fit for five consecutive years. The data package for either option includes surface data from Palmdale and Victorville, sky cover from Palmdale and upper air data from Mercury. In order to meet U.S. EPA modeling guidance, the ideal data set would be 90%+ complete per parameter per quarter. The two options are described below, and of the two, ZMassociates recommends Option 2, as it utilizes complete four quarters for each year, and the missing data is limited to only upper air data, which can be completed to meet the 90% completeness criteria using U.S. EPA missing data procedures.
(Attached is a spreadsheet describing the data completeness for each parameter, for each station, and for each year by quarter.)

Option 1: Q2 2000 – Q1 2005

This option includes combining met data from April 2000 to March 2005 (note: this option does not use full four quarter data from each of the five years).

- All parameters from Palmdale are above 90% for this period.
- Several parameters are below 90% for Victorville.
    - Pressure is entirely missing for quarters 3 and 4 in year 2000.
    - Pressure is 42.40% complete in Q2 in year 2000.
    - Temperature, Solar Radiation, Wind Direction, and Wind Speed are all 67.39% complete for Q3 in year 2000.
    - Q1 in 2001 has 89.68%, 88.89%, and 88.89% data completeness for Temperature, Wind Direction, and Wind Speed, respectively.
- Upper Air in Q1 in 2005 is 80.22% complete for Mercury.
- Sky cover from Palmdale is 82.84% complete in Q4 in 2001.

Option 2: 2001 – 2005

This option included using full years, all four quarters, from 2001 to 2005.

- Wind Direction for Q4 in 2005 is 86.59% complete for Palmdale.
- Some parameters are below 90% for Victorville.
  - Q1 in 2001 has 89.68%, 88.89%, and 88.89% data completeness for Temperature, Wind Direction, and Wind Speed, respectively.
  - Wind Speed for Q2 in 2005 is 67.03% complete for Victorville.
- Upper Air data from Mercury for all quarters in 2005 is below 90% completeness.
  - Q1: 80.22%
  - Q2: 65.93%
  - Q3: 69.57%
  - Q4: 64.13%
- Sky cover from Palmdale is 82.84% complete in Q4 of 2001.

Although it is not possible to have 90%+ completeness for all parameters, the combined data for each option is acceptable, however, there are advantages, as well as disadvantages, to using one over the other.

Advantages and Disadvantages for Option 1:

1. The only advantage to using this option is that all parameters for Palmdale are complete.
2. The main disadvantage to using this option is that there is a lot of missing data for quarters 3 and 4. Using option 2, this disadvantage would be eliminated.
3. EPA's missing data procedures, where missing data is replaced with previous day's data, is not able to be used for these surface parameters because there is not enough good data to bring it to 90%+ completeness.

Advantages and Disadvantages for Option 2:

1. The advantage to using this option is that full years would be used not partial years. Also, there are less parameters missing for Victorville for this option.
2. Although the quarters in 2005 are below 90% completeness, by using EPA's missing data procedure, these parameters can be brought up to the following percentage:
   a. Q1: 98.90%
   b. Q2: 94.51%
   c. Q3: 97.83%
   d. Q4: 94.57%

Year		Data completeness			Missing days	
		Mercury,NV	Mercury,NV	Total days	Mercury,N'	Mercury,NV
		Raw	Filled		Raw	Filled
2000	Q1	100.00%	100.00%	91	0	0
2000	Q2	100.00%	100.00%	91	0	0
2000	Q3	100.00%	100.00%	92	0	0
2000	Q4	98.91%	100.00%	92	1	0
2001	Q1	100.00%	100.00%	90	0	0
2001	Q2	100.00%	100.00%	91	0	0
2001	Q3	98.91%	100.00%	92	1	0
2001	Q4	97.83%	100.00%	92	2	0
2002	Q1	98.89%	100.00%	90	1	0
2002	Q2	100.00%	100.00%	91	0	0
2002	Q3	95.65%	100.00%	92	4	0
2002	Q4	100.00%	100.00%	92	0	0
2003	Q1	100.00%	100.00%	90	0	0
2003	Q2	98.90%	100.00%	91	1	0
2003	Q3	98.91%	100.00%	92	1	0
2003	Q4	100.00%	100.00%	92	0	0
2004	Q1	100.00%	100.00%	91	0	0
2004	Q2	98.90%	100.00%	91	1	0
2004	Q3	100.00%	100.00%	92	0	0
2004	Q4	98.91%	100.00%	92	1	0
2005	Q1	80.22%	98.90%	91	18	1
2005	Q2	65.93%	94.51%	91	31	5
2005	Q3	69.57%	97.83%	92	28	2
2005	Q4	64.13%	94.57%	92	33	5

		Data completeness						MissingNums				
Year	Quarter	Pressure	Temperature	Solar radiation	Wind directior	Wind Speed	total number	Pressure	Temperatu	Solar radia	Wind direc	Wind Speed
2000	Q1	0.00%	21.06%	21.06%	21.06%	21.06%	2184	2184	1724	1724	1724	1724
2000	Q2	42.40%	100.00%	100.00%	100.00%	100.00%	2184	1258	0	0	0	0
2000	Q3	0.00%	67.39%	67.39%	67.39%	67.39%	2208	2208	720	720	720	720
2000	Q4	0.00%	100.00%	100.00%	100.00%	100.00%	2208	2208	0	0	0	0
2001	Q1	90.09%	89.68%	90.09%	88.89%	88.89%	2160	214	223	214	240	240
2001	Q2	99.82%	99.86%	100.00%	99.86%	99.86%	2184	4	3	0	3	3
2001	Q3	98.05%	98.14%	98.14%	98.14%	98.14%	2208	43	41	41	41	41
2001	Q4	99.91%	98.01%	99.95%	98.01%	98.01%	2208	2	44	1	44	44
2002	Q1	99.95%	99.49%	100.00%	97.87%	97.87%	2160	1	11	0	46	46
2002	Q2	99.91%	99.91%	100.00%	99.91%	99.91%	2184	2	2	0	2	2
2002	Q3	99.95%	99.95%	100.00%	99.95%	99.95%	2208	1	1	0	1	1
2002	Q4	99.91%	99.91%	100.00%	99.91%	99.91%	2208	2	2	0	2	2
2003	Q1	100.00%	100.00%	100.00%	100.00%	100.00%	2160	0	0	0	0	0
2003	Q2	99.95%	99.68%	99.95%	99.68%	99.68%	2184	1	7	1	7	7
2003	Q3	100.00%	100.00%	100.00%	100.00%	100.00%	2208	0	0	0	0	0
2003	Q4	100.00%	100.00%	100.00%	100.00%	100.00%	2208	0	0	0	0	0
2004	Q1	99.73%	99.63%	99.73%	99.31%	99.31%	2184	6	8	6	15	15
2004	Q2	99.77%	99.77%	99.77%	99.77%	99.77%	2184	5	5	5	5	5
2004	Q3	99.86%	100.00%	100.00%	99.86%	99.86%	2208	3	0	0	3	3
2004	Q4	100.00%	100.00%	100.00%	100.00%	100.00%	2208	0	0	0	0	0
2005	Q1	100.00%	99.68%	100.00%	99.68%	99.68%	2184	0	7	0	7	7
2005	Q2	100.00%	100.00%	100.00%	94.51%	67.03%	2184	0	0	0	120	720
2005	Q3	98.10%	98.10%	98.73%	98.10%	98.10%	2208	42	42	28	42	42
2005	Q4	99.73%	99.77%	100.00%	99.73%	99.77%	2208	6	5	0	6	5

Year	Quarter	Data completeness Pressure
2000	Q1	97.71%
2000	Q2	98.81%
2000	Q3	97.87%
2000	Q4	98.05%
2001	Q1	95.69%
2001	Q2	94.28%
2001	Q3	97.28%
2001	Q4	82.84%
2002	Q1	99.17%
2002	Q2	96.98%
2002	Q3	97.42%
2002	Q4	97.42%
2003	Q1	97.41%
2003	Q2	95.97%
2003	Q3	96.01%
2003	Q4	97.10%
2004	Q1	97.76%
2004	Q2	98.49%
2004	Q3	98.14%
2004	Q4	94.61%
2005	Q1	99.35%
2005	Q2	97.48%
2005	Q3	95.06%
2005	Q4	97.78%

Attachment F-1

Summary of 2020 Forecast Travel Activity Data by Period

Attachment F-1

Summary of 2020 Forecast Travel Activity Data By Period

Source ID	Link Description	Length (mile)	AM Period			Mid-day Period			PM Period			Night Period		
			Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed
AUT010	EB HDC - COUNTY LINE TO OASIS	1.25	6787	540	65	7584	1132	67	8343	981	65	2475	532	69
AUT011	EB HDC - OASIS & SHEEP CREEK	3.64	6787	540	65	7584	1132	67	8343	981	65	2475	532	69
AUT012	EB HDC - SHEEP CREEK & CAUGHLIN	5.11	5802	538	66	6963	1127	67	7827	971	65	2473	537	69
AUT013	EB HDC - CAUGHLIN & KOALA	2.04	5110	518	66	6373	1105	68	6990	938	66	2241	524	70
AUT014	EB HDC - KOALA & US395	2.59	6237	520	60	7083	1104	63	7829	942	61	2184	522	65
AUT015	EB HDC - US395 & W.PHANTOM	1.95	9503	583	57	11028	1273	61	11136	1040	58	4451	824	64
AUT016	EB HDC - W.PHANTOM & E.PHANTOM	1.48	7393	554	59	8815	1265	62	10166	1049	59	3341	642	64
AUT017	EB HDC - E.PHANTOM & NATIONAL TRAIL	1.54	5838	650	61	8350	1394	62	10939	1222	58	3740	945	64
AUT018	EB HDC - NATIONAL TRAIL & I-15	2.34	4009	541	62	5321	1212	63	8014	939	61	2391	857	64
AUT019	EB HDC - I-15 & CHOCO	2.65	1808	73	64	2415	183	64	3146	163	64	1396	286	65
AUT020	EB HDC - CHOCO & DALE EVANS	1.59	1935	76	64	2636	186	64	3586	166	63	1526	287	65
AUT021	EB EXPWY- DALE EVANS & WAALEW	1.80	1587	28	44	2171	103	47	3952	100	37	1043	66	50
AUT022	EB EXPWY - WAALEW & CAHUILLA	1.10	1038	16	47	1427	62	48	3176	71	39	659	26	51
AUT023	EB EXPWY - CAHUILLA & JOSHUA	1.11	836	15	48	1229	67	49	2919	73	41	574	26	51
AUT024	EB EXPWY - JOSHUA & STANDING ROCK	1.35	373	11	50	766	53	50	2341	62	43	387	20	51
AUT025	EB EXPWY - STANDING ROCSK & SR18	1.52	805	44	48	1083	51	49	1103	56	48	506	23	51
AUT026	EB EXPWY - SR18 & NASQUILLY	0.89	1167	51	46	1572	63	48	1733	65	45	765	36	51
AUT027	EB EXPWY - NASQUILLY & BEAR VALLEY	1.42	1654	60	41	2075	116	45	2181	86	41	1103	78	50
AUT045	NB I-15 NASQUALLI RD TO PEAR BLOSSOM	1.52	7916	2034	62	17952	5046	60	20446	3338	47	13489	6002	66
AUT046	NB I-15 PEAR BLOSSOM TO LAPAZ DR	0.88	7858	2018	64	17426	4989	62	19751	3292	54	12795	6181	67
AUT047	NB I-15 LAPAZ DR TO MOJAVE DR	0.76	7654	1980	64	17036	4882	63	19396	3251	55	12843	6183	67
AUT048	NB I-15 MOJAVE DR TO SR18	1.57	6131	1913	64	14633	4734	62	16805	3176	54	11655	6017	66
AUT049	NB I-15 SR18 TO SOTDDARD WELLS	1.18	5571	1759	65	13858	4588	63	15488	2883	56	11195	5987	67
AUT050	NB I-15 STODDARD WELLS TO HDC	0.93	5343	1788	65	12681	4667	63	15168	2946	57	10711	6110	67
AUT051	NB I-15 HDC TO VICTOVVILE QUARRY RD	1.95	6296	2244	64	15587	5695	61	18145	3697	51	11707	6681	66
AUT052	NB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	4.14	5664	2182	64	15430	5624	61	18152	3661	51	11823	6658	66
AUT307	NB I-15 OFF-RAMP AT STODDARD WELLS	0.22	939	64	34	523	79	35	484	40	34	67	29	35
AUT309	NB I-15 ON-RAMP AT STODDARD WELLS	0.23	308	3	35	366	8	35	492	4	35	183	5	35

Attachment F-1

Summary of 2020 Forecast Travel Activity Data By Period

Source ID	Link Description	Length (mile)	AM Period			Mid-day Period			PM Period			Night Period		
			Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed
AUT010	WB HDC - COUNTY LINE TO OASIS	1.25	2567	458	68	6203	1172	68	12505	1158	61	2869	701	69
AUT011	WB HDC - OASIS & SHEEP CREEK	3.64	2567	458	68	6203	1172	68	12505	1158	61	2869	701	69
AUT012	WB HDC - SHEEP CREEK & CAUGHLIN	5.11	2639	460	68	5766	1172	68	12074	1160	62	2842	705	69
AUT013	WB HDC - CAUGHLIN & KOALA	2.04	2265	451	68	5180	1148	68	10921	1123	63	2599	691	69
AUT014	WB HDC - KOALA & US395	2.59	2744	454	63	5941	1157	63	12383	1128	57	2543	689	64
AUT015	WB HDC - US395 & W.PHANTOM	1.95	4906	537	62	10231	1315	61	17004	1238	52	5698	995	64
AUT016	WB HDC - W. PHANTOM & E.PHANTOM	1.48	4819	564	62	8296	1302	62	13504	1184	56	3968	746	64
AUT017	WB HDC - E.PHANTOM & NATIONAL TRAIL	1.55	5414	680	61	7987	1471	62	11781	1456	57	4213	1102	64
AUT018	WB HDC - NATIONAL TRAIL & I-15	2.34	3906	502	62	5101	1256	63	9295	1125	60	2652	1014	64
AUT019	WB HDC - I-15 & CHOCO	2.65	1604	116	64	2595	236	64	4295	163	63	1499	313	65
AUT020	WB HDC - CHOCO & DALE EVANS	1.59	1888	117	64	2867	240	64	4519	166	63	1610	314	65
AUT021	WB EXPWY- DALE EVANS & WAALEW	1.80	1748	64	43	2110	99	46	2807	85	40	1107	66	50
AUT022	WB EXPWY - WAALEW & CAHUILLA	1.10	1256	43	46	1393	55	49	1883	56	45	689	27	51
AUT023	WB EXPWY - CAHUILLA & JOSHUA	1.11	962	46	47	1247	53	49	1585	59	46	598	27	51
AUT024	WB EXPWY - JOSHUA & STANDING ROCK	1.35	677	40	49	837	40	50	828	49	49	385	20	51
AUT025	WB EXPWY - STANDING ROCSK & SR18	1.52	581	13	49	1000	63	50	2494	67	43	533	23	51
AUT026	WB EXPWY - SR18 & NASQUILLY	0.89	1241	16	46	1378	77	49	3160	83	40	736	35	51
AUT027	WB EXPWY - NASQUILLY & BEAR VALLEY	1.42	1599	41	43	1885	129	47	3781	117	36	1058	77	50
AUT045	SB I-15 NASQUALLI RD TO PEAR BLOSSOM	1.52	11907	1984	56	16821	5080	61	13260	3256	59	14282	6338	66
AUT046	SB I-15 PEAR BLOSSOM TO LAPAZ DR	0.88	12140	1970	59	16569	5047	63	12910	3220	61	14269	6344	66
AUT047	SB I-15 LAPAZ DR TO MOJAVE DR	0.76	12812	1973	58	17081	5057	62	13552	3226	61	14362	6348	66
AUT048	SB I-15 MOJAVE DR TO SR18	1.57	10641	1905	61	13357	4767	64	11011	3088	63	11900	5841	67
AUT049	SB I-15 SR18 TO SOTDDARD WELLS	1.18	9100	1809	61	12594	4658	63	9751	2837	63	11606	5813	66
AUT050	SB I-15 STODDARD WELLS TO HDC	0.93	8949	1844	61	11398	4735	64	9200	2895	63	11127	5937	67
AUT051	SB I-15 HDC TO VICTOVVILE QUARRY RD	1.95	10003	2216	59	13904	5754	62	12309	3832	59	12280	6637	66
AUT052	SB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	4.14	10090	2210	59	13861	5741	62	11134	3752	60	12466	6642	66
AUT308	SB I-15 ON-RAMP AT STODDARD WELLS	0.18	223	8	35	383	21	35	1658	85	34	0	0	35
AUT310	SB I-15 OFF-RAMP AT STODDARD WELLS	0.23	311	3	35	340	8	35	483	4	34	186	5	35
SLINE	HIGH SPEED RAIL	27.02	No vehicular traffic on the HSR											

Attachment F-2

Summary of 2040 Forecast Travel Activity Data by Period

Attachment F-2

Summary of 2040 Forecast Travel Activity Data By Period

Source ID	Link Description	Length (mile)	AM Period			Mid-day Period			PM Period			Night Period		
			Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed
AUT010	EB HDC - COUNTY LINE TO OASIS	1.25	11843	817	58	12293	1441	65	12277	1323	62	4067	911	69
AUT011	EB HDC - OASIS & SHEEP CREEK	3.64	11355	813	59	11769	1429	65	11833	1315	62	3881	907	69
AUT012	EB HDC - SHEEP CREEK & CAUGHLIN	5.11	8493	764	63	9101	1386	67	10289	1271	63	3580	894	69
AUT013	EB HDC - CAUGHLIN & KOALA	2.04	7353	740	64	8230	1346	67	9442	1240	64	3222	879	69
AUT014	EB HDC - KOALA & US395	2.59	9999	748	57	9531	1358	62	10627	1255	59	3349	896	64
AUT015	EB HDC - US395 & W.PHANTOM	1.95	14383	891	49	16175	1773	58	15614	1589	53	7336	1638	64
AUT016	EB HDC - W.PHANTOM & E.PHANTOM	1.48	10901	597	55	11385	1120	61	14128	1306	55	4961	815	64
AUT017	EB HDC - E.PHANTOM & NATIONAL TRAIL	1.54	10143	1080	56	13274	2326	60	17499	1947	50	6914	2395	63
AUT018	EB HDC - NATIONAL TRAIL & I-15	2.34	8505	1061	58	10647	2239	61	14858	1817	54	5579	2315	64
AUT019	EB HDC - I-15 & CHOCO	2.65	4330	78	62	3444	131	64	6973	388	61	1476	65	65
AUT020	EB HDC - CHOCO & DALE EVANS	1.59	3907	75	63	3249	128	64	5629	372	62	1435	65	65
AUT021	EB EXPWY- DALE EVANS & WAALEW	1.80	3999	59	35	3388	130	46	5386	332	34	1548	68	50
AUT022	EB EXPWY - WAALEW & CAHUILLA	1.10	3252	46	40	2305	84	48	4226	304	40	946	29	51
AUT023	EB EXPWY - CAHUILLA & JOSHUA	1.11	2875	47	41	2104	89	48	3646	303	41	879	29	51
AUT024	EB EXPWY - JOSHUA & STANDING ROCK	1.35	2431	42	44	1496	77	50	2768	296	45	562	23	51
AUT025	EB EXPWY - STANDING ROCSK & SR18	1.52	2515	54	42	1802	87	49	3185	302	42	787	31	51
AUT026	EB EXPWY - SR18 & NASQUILLY	0.89	2606	56	42	2282	99	48	3185	307	42	951	39	51
AUT027	EB EXPWY - NASQUILLY & BEAR VALLEY	1.42	2617	45	35	2526	104	43	3222	308	35	1070	45	48
AUT045	NB I-15 NASQUALLI RD TO PEAR BLOSSOM	1.52	9500	1952	60	20939	4938	58	22349	2880	44	16022	6004	65
AUT046	NB I-15 PEAR BLOSSOM TO LAPAZ DR	0.88	9794	1938	62	20555	4880	61	22520	2844	51	14968	5934	66
AUT047	NB I-15 LAPAZ DR TO MOJAVE DR	0.76	9904	1940	62	20749	4885	61	22812	2846	50	15045	5936	66
AUT048	NB I-15 MOJAVE DR TO SR18	1.57	7327	1620	64	16493	4004	63	19140	2434	56	12349	4876	67
AUT049	NB I-15 SR18 TO SOTDDARD WELLS	1.18	6461	1470	64	15193	3934	62	17811	2416	54	11449	4819	67
AUT050	NB I-15 STODDARD WELLS TO HDC	0.93	6656	1513	65	15360	4039	64	18131	2502	57	11401	4959	67
AUT051	NB I-15 HDC TO VICTOVVILE QUARRY RD	1.95	9601	2485	61	22007	6138	59	24349	3908	46	15504	7207	66
AUT052	NB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	4.14	7328	2409	62	18790	5960	59	22308	3795	42	14201	6954	66
AUT307	NB I-15 OFF-RAMP AT STODDARD WELLS	0.22	2641	80	32	3617	184	33	2698	118	33	1589	259	34
AUT309	NB I-15 ON-RAMP AT STODDARD WELLS	0.23	368	3	35	399	5	35	657	5	34	285	5	35

Attachment F-2

Summary of 2040 Forecast Travel Activity Data By Period

Source ID	Link Description	Length (mile)	AM Period			Mid-day Period			PM Period			Night Period		
			Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed	Total Vol.	Truck Vol.	Speed
AUT010	WB HDC - COUNTY LINE TO OASIS	1.25	3278	512	68	10260	1430	66	19809	1526	52	4692	937	69
AUT011	WB HDC - OASIS & SHEEP CREEK	3.64	3065	507	68	9803	1418	66	19054	1516	53	4473	930	69
AUT012	WB HDC - SHEEP CREEK & CAUGHLIN	5.11	2815	496	68	7587	1371	67	15524	1416	58	3949	915	69
AUT013	WB HDC - CAUGHLIN & KOALA	2.04	2365	483	68	6370	1329	68	13370	1346	61	3566	900	69
AUT014	WB HDC - KOALA & US395	2.59	3061	488	63	7719	1344	62	16686	1358	52	3743	917	64
AUT015	WB HDC - US395 & W.PHANTOM	1.95	6042	676	61	14810	1761	59	22894	1637	41	9233	1685	63
AUT016	WB HDC - W. PHANTOM & E.PHANTOM	1.48	5777	516	61	10778	1178	61	17326	1120	52	5760	811	64
AUT017	WB HDC - E.PHANTOM & NATIONAL TRAIL	1.55	8458	1047	58	12784	2401	60	18603	1947	49	7399	2416	63
AUT018	WB HDC - NATIONAL TRAIL & I-15	2.34	6704	878	60	10429	2283	61	16742	1881	51	5611	2312	64
AUT019	WB HDC - I-15 & CHOCO	2.65	2887	100	63	4136	193	64	10437	213	59	1433	60	65
AUT020	WB HDC - CHOCO & DALE EVANS	1.59	2631	98	63	3969	192	64	8929	187	60	1450	61	65
AUT021	WB EXPWY- DALE EVANS & WAALEW	1.80	2476	65	42	3638	168	45	6797	99	28	1562	63	50
AUT022	WB EXPWY - WAALEW & CAHUILLA	1.10	1686	49	46	2545	127	47	5923	75	32	1006	28	51
AUT023	WB EXPWY - CAHUILLA & JOSHUA	1.11	1318	51	48	2218	133	48	5922	75	35	869	28	51
AUT024	WB EXPWY - JOSHUA & STANDING ROCK	1.35	703	45	50	1596	120	49	4444	56	38	592	22	51
AUT025	WB EXPWY - STANDING ROCSK & SR18	1.52	1014	42	49	1894	130	49	4769	61	39	828	26	51
AUT026	WB EXPWY - SR18 & NASQUILLY	0.89	1647	45	46	2278	142	48	4609	61	38	1003	34	51
AUT027	WB EXPWY - NASQUILLY & BEAR VALLEY	1.42	1795	56	42	2493	149	45	4611	61	34	1132	38	49
AUT045	SB I-15 NASQUALLI RD TO PEAR BLOSSOM	1.52	14009	2066	52	19247	5116	59	15332	3130	56	16108	6213	65
AUT046	SB I-15 PEAR BLOSSOM TO LAPAZ DR	0.88	14210	2052	56	19548	5089	61	15594	3106	59	16485	6204	66
AUT047	SB I-15 LAPAZ DR TO MOJAVE DR	0.76	15061	2057	54	19990	5098	61	16441	3112	58	16605	6206	66
AUT048	SB I-15 MOJAVE DR TO SR18	1.57	11579	1580	60	14486	4037	64	11862	2461	63	12758	4851	67
AUT049	SB I-15 SR18 TO SOTDDARD WELLS	1.18	10170	1563	59	13222	4002	63	10949	2376	62	12158	4817	67
AUT050	SB I-15 STODDARD WELLS TO HDC	0.93	10325	1604	59	12719	4098	64	10557	2448	62	12132	4957	67
AUT051	SB I-15 HDC TO VICTOVVILE QUARRY RD	1.95	12912	2372	57	18456	6179	61	15194	4093	59	16309	7210	66
AUT052	SB I-15 VICTORVILLE QUARRY RD TO DALE EVANS	4.14	12276	2317	55	16354	6046	61	12658	4013	59	14842	6958	65
AUT308	SB I-15 ON-RAMP AT STODDARD WELLS	0.18	1135	58	33	2465	138	33	3083	83	32	1686	256	35
AUT310	SB I-15 OFF-RAMP AT STODDARD WELLS	0.23	499	3	34	363	5	35	547	5	35	219	5	35
SLINE	HIGH SPEED RAIL	27.02	No vehicular traffic on the HSR											