I-15 ENVIRONMENTAL IMPACT STATEMENT
Farmington to Salt Lake City

Air Quality Technical Report: Hot-spot Analysis

I-15 Environmental Impact Statement Farmington to Salt Lake City

Lead agency:
Utah Department of Transportation

August 15, 2024

Contents

1.0 Introduction 1
2.0 Regulatory Environment and Compliance 3
2.1 National Ambient Air Quality Standards 3
2.2 Transportation Conformity Requirements 5
2.2.1 Transportation Conformity Compliance 6
2.2.2 Exempt Projects 6
2.2.3 Projects of Air Quality Concern 7
2.3 Hot-spot Analysis 8
3.0 Methodology 9
3.1 Interagency Consultation 9
3.2 Hot-spot Analysis Evaluation Areas 11
3.2.1 I-215 North Salt Lake Interchange Evaluation Area 14
3.2.2 600 South to 600 North Evaluation Area 14
3.3 MOVES4 Methodology 15
3.3.1 Methodology to Determine Analysis Month 15
3.3.2 Links and Traffic Data 16
3.3.3 MOVES4 Run Specification Setup 16
3.3.4 MOVES4 Input Database 17
3.3.5 MOVES4 Output 18
3.4 AERMOD Dispersion Modeling 18
3.4.1 Source Characterization 19
3.4.2 Meteorology Data 19
3.4.3 Receptors 19
3.5 Background Concentrations 23
3.6 Design Concentrations 24
4.0 Results 24
4.1 24-hour PM_{10} Analysis for the 600 South to 600 North Evaluation Area 24
4.2 24-hour $PM_{2.5}$ Analysis for the I-215 North Salt Lake Interchange Evaluation Area and for the 600 South to 600 North Evaluation Area 25
4.3 Annual $PM_{2.5}$ Analysis for the I-215 North Salt Lake Interchange Evaluation Area and for the 600 South to 600 North Evaluation Area 26
4.4 Conclusion 27
5.0 References 28

Tables

Table 1. National Ambient Air Quality Standards for Criteria Pollutants and Attainment Status for Davis and Salt Lake Counties 4
Table 2. Air Quality ICT Meetings Discussing Hot-spot Analysis Methodology 10
Table 3. Days Affected by Heavy Wildfire Smoke That Were Removed from the Background Data for $PM_{2.5}$ 23
Table 4. Background Concentrations Used in PM Hot-spot Analyses 24
Table 5. Design Concentrations for the 24-hour PM_{10} Standard in 2035 and 2050 25
Table 6. Design Concentrations for the 24-hour $PM_{2.5}$ Standard in 2035 and 2050 26
Table 7. Design Concentrations for the Annual $PM_{2.5}$ Standard in 2035 and 2050 27

Figures

Figure 1. Study Area for the I-15 EIS 2
Figure 2. I-215 North Salt Lake Interchange Evaluation Area 12
Figure 3. 600 South to 600 North Evaluation Area 13
Figure 4. Receptor Locations for the I-215 North Salt Lake Interchange Evaluation Area 21
Figure 5. Receptor Locations for the 600 South to 600 North Evaluation Area 22

Attachments

Attachment A. I-215 North Salt Lake Interchange Evaluation Area Links
Attachment B. 600 South to 600 North Evaluation Area Links
Attachment C. I-215 North Salt Lake Interchange Evaluation Area Link Characteristics
Attachment D. 600 South to 600 North Evaluation Area Link Characteristics
Attachment E. Variable Emission Generator Methodology
Attachment F. Atypical Events Selection and Justification
Attachment G. ICT Meeting Minutes and Pertinent Correspondence

Abbreviations

$\mu g/m^3$	micrograms per cubic meter
AADT	annual average daily traffic
CFR	Code of Federal Regulations
CO	carbon monoxide
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
GP	general purpose (lane)
HOT	high occupancy/toll (lane)
I-15	Interstate 15
I-15 project	Interstate 15: Farmington to Salt Lake City Project
I-215	Interstate 215
I-80	Interstate 80
ICT	interagency consultation team
LOS	level of service
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_2	nitrogen dioxide
O_3	ozone
OTAQ	Office of Transportation and Air Quality
Pb	lead
PM_{10}	particulate matter 10 microns in diameter or less
$PM_{2.5}$	particulate matter 2.5 microns in diameter or less
POAQC	project of air quality concern
RTP	regional transportation plan
SIP	state implementation plan
SO_2	sulfur dioxide
TIP	transportation improvement program
U.S.	United States
U.S. 89	U.S. Highway 89
UDAQ	Utah Division of Air Quality
UDOT	Utah Department of Transportation
USC	United States Code
UTA	Utah Transit Authority
WFRC	Wasatch Front Regional Council

This page is intentionally left blank.

1.0 Introduction

The Utah Department of Transportation (UDOT) is preparing an Environmental Impact Statement (EIS) for the Interstate 15 (I-15): Farmington to Salt Lake City Project according to the provisions of the National Environmental Policy Act (NEPA) and other laws, regulations, and guidelines of the Federal Highway Administration (FHWA). UDOT is the project sponsor and lead agency for the project and is responsible for preparing the I-15 EIS. The environmental review, consultation, and other actions required by applicable federal environmental laws for this action are being, or have been, carried out by UDOT pursuant to 23 United States Code (USC) Section 327 and a Memorandum of Understanding dated May 26, 2022, and executed by FHWA and UDOT.

What is the purpose of this technical report?

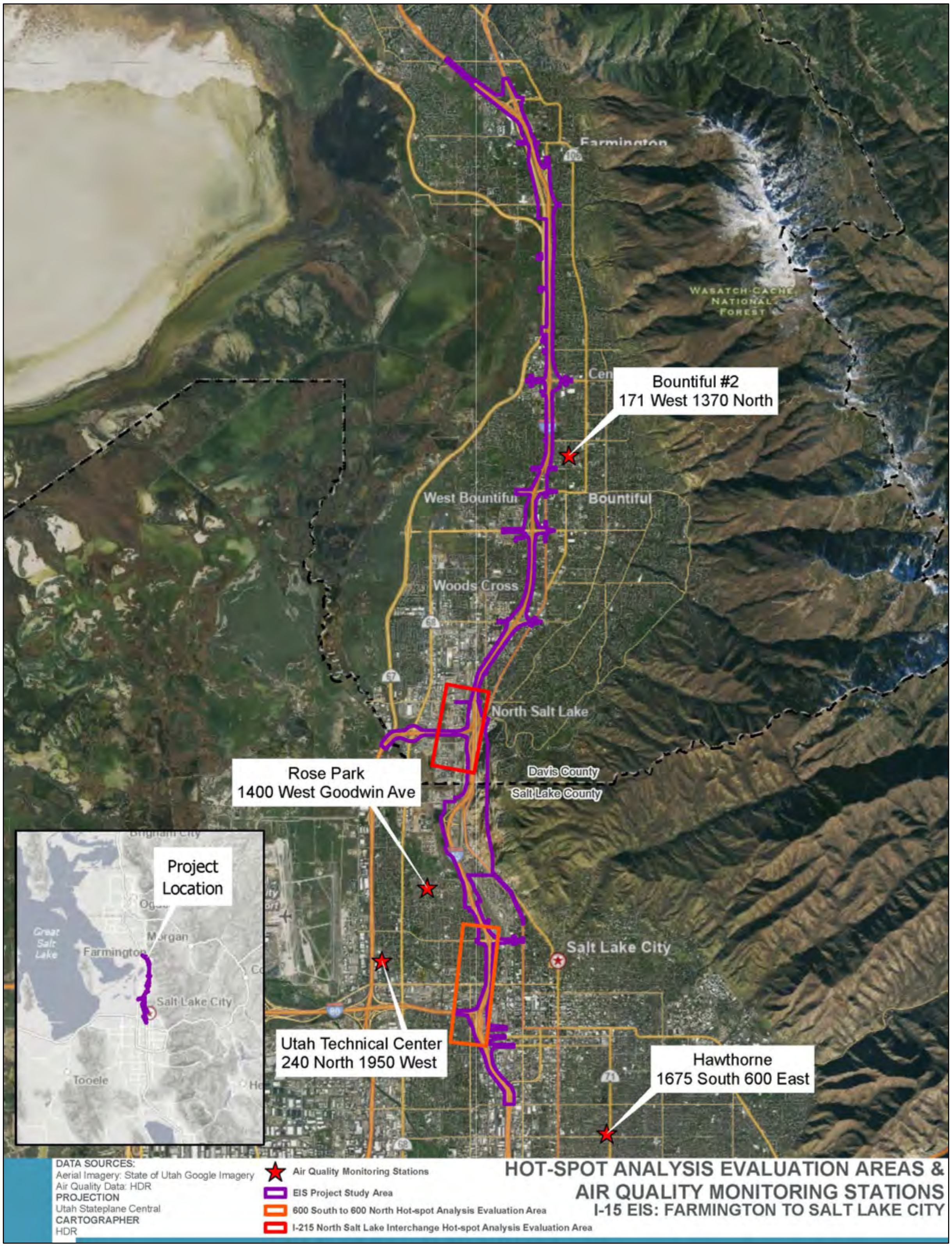
This technical report discusses the quantitative air quality analyses for particulate matter ($PM_{2.5}$ and PM_{10}) that were conducted in support of the EIS for the I-15 project.

The project study area for the I-15 EIS extends on I-15 from the U.S. Highway 89 (U.S. 89)/Legacy Parkway/ Park Lane interchange (I-15 milepost 325) in Farmington to the Interstate 80 (I-80) West/400 South interchange (I-15 milepost 308) in Salt Lake City (Figure 1).

This technical report discusses the quantitative air quality analyses for particulate matter ($PM_{2.5}$ and PM_{10}) (also called "hot-spot" or project-level analyses) that were conducted in support of the project to satisfy transportation conformity requirements (Clean Air Act Section 176(c)). The air quality analyses for the project were performed based on U.S. Environmental Protection Agency (EPA) and FHWA guidance, using required EPA models, and were developed in consultation with the State's air quality interagency consultation team (ICT), which consists of EPA, FHWA, the Federal Transit Administration, the Utah Division of Air Quality (UDAQ), the Utah Transit Authority (UTA), the Wasatch Front Regional Council (WFRC), and Mountainland Association of Governments.

Air quality modeling files associated with this report are available on request.

Figure 1. Study Area for the I-15 EIS



2.0 Regulatory Environment and Compliance

2.1 National Ambient Air Quality Standards

EPA, under the authority of the Clean Air Act (42 USC Section 7401 and subsequent sections), established National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment (40 Code of Federal Regulations [CFR] Part 50). These standards are divided into primary standards, which protect public health, and secondary standards, which protect public welfare (such as protecting property and vegetation from the effects of air pollution). These standards have been adopted by UDAQ as the official ambient air quality standards for Utah.

EPA has set NAAQS for six principal pollutants known as *criteria pollutants*. The current NAAQS are listed in Table 1. According to EPA, transportation sources currently contribute to four of the six criteria pollutants: carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), and nitrogen dioxide (NO_2).

If an area meets the NAAQS for a given air pollutant, the area is called an *attainment area* for that pollutant (because the NAAQS have been attained). If an area does not meet the NAAQS for a given air pollutant, the area is called a *nonattainment area*. A *maintenance area* is an area previously designated as a nonattainment area that has been redesignated as an attainment area and is required by Section 175A of the Clean Air Act, as amended, to have a maintenance plan for the 20 years following its redesignation to attainment or maintenance status.

The project study area is located in Davis and Salt Lake Counties. Davis and Salt Lake Counties are attainment areas for CO, NO_2, and lead (Pb), and Davis County is an attainment area for PM_{10} and sulfur dioxide (SO_2). Salt Lake County is a nonattainment area for $PM_{2.5}$, O_3, and secondary SO_2 and a maintenance area for PM_{10}, having transitioned from a nonattainment area effective March 27, 2020. Davis County is a nonattainment area for $PM_{2.5}$ and O_3. Table 1 shows the attainment status for Davis and Salt Lake Counties for each criteria pollutant.

SO_2 and Pb are not considered transportation-related criteria pollutants and are not discussed further.

Table 1. National Ambient Air Quality Standards for Criteria Pollutants and Attainment Status for Davis and Salt Lake Counties

Pollutant	Primary/ Secondary	Averaging Time	Level	Form	Attainment Status for Davis and Salt Lake Counties
Carbon monoxide (CO)	Primary	8 hours	9 ppm	Not to be exceeded more than once per year	Davis and Salt Lake Counties are attainment areas
		1 hour	35 ppm	Not to be exceeded more than once per year	
Ozone (O_3)	Primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	Davis and Salt Lake Counties are moderate nonattainment areas[c]
Particulate matter ($PM_{2.5}$)	Primary	1 year	12.0 μg/m³ [b]	Annual mean, averaged over 3 years	Davis and Salt Lake Counties are attainment areas
	Secondary	1 year	15.0 μg/m³	Annual mean, averaged over 3 years	Davis and Salt Lake Counties are attainment areas
	Primary and secondary	24 hours	35 μg/m³	98th percentile, averaged over 3 years	Davis and Salt Lake Counties are serious nonattainment areas[c]
Particulate matter (PM_{10})	Primary and secondary	24 hours	150 μg/m³	Not to be exceeded more than once per year on average over 3 years	Davis County is an attainment area, and Salt Lake County is a maintenance area
Nitrogen dioxide (NO_2)	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years	Davis and Salt Lake Counties are attainment areas
	Primary and secondary	1 year	53 ppb	Annual mean	Davis and Salt Lake Counties are attainment areas
Sulfur dioxide (SO_2)	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	Davis and Salt Lake Counties are attainment areas
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year	Davis County is an attainment area, and Salt Lake County is a nonattainment area
Lead (Pb)	Primary and secondary	Rolling 3-month average	0.15 μg/m³	Not to be exceeded	Davis and Salt Lake Counties are attainment areas

Sources: 49 CFR Part 50 (NAAQS) and EPA 2022 (attainment status)

Definitions: μg/m³ = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion; $PM_{2.5}$ = particulate matter 2.5 microns in diameter or less; PM_{10} = particulate matter 10 microns in diameter or less

[a] A "moderate" nonattainment area is one where the O_3 level has a value of 0.081 ppm up to but not including 0.093 ppm.

[b] EPA proposed revising the annual $PM_{2.5}$ NAAQS from 12 μg/m³ to 9 μg/m³ on February 7, 2024. However, the air quality analysis supporting the NEPA review for the I-15 project was initiated prior to this proposed revision. Moreover, that regulatory action is currently being challenged in court. Therefore, UDOT continues to base this air quality analyses on the 12 μg/m³ standard that was in place when this study was initiated.

[c] A "serious" nonattainment area is one that failed to meet the 2006 24-hour $PM_{2.5}$ NAAQS within a timeframe required by EPA.

2.2 Transportation Conformity Requirements

Transportation conformity is a process required by Clean Air Act Section 176(c), which establishes the framework for improving air quality to protect public health and the environment. All state governments are required to develop a state implementation plan (SIP) for each pollutant for which an area is in nonattainment or maintenance status. The SIP explains how the State will comply with the requirements of the Clean Air Act.

Section 176(c) of the Clean Air Act, and its related amendments, require that transportation plans, programs, and projects developed, funded, or approved by FHWA and/or the Federal Transit Administration and metropolitan planning organizations must demonstrate that such activities conform to the SIP. Transportation conformity requirements apply to any transportation-related criteria pollutants for which the project area is designated a nonattainment or maintenance area.

Unless the project is exempt from conformity requirements, federal agencies are required to make a conformity determination before adopting, accepting, approving, or funding an activity or project located in a nonattainment or maintenance area. A conformity determination is a finding that the activity or project conforms to the SIP's purpose of "eliminating or reducing the severity and number of violations" of the NAAQS and "achieving expeditious attainment of the NAAQS" [42 USC Section 7506(c)] and that the project or activity will not:

- Cause or contribute to new air quality violations of the NAAQS,
- Worsen existing violations of the NAAQS, or
- Delay timely attainment of the NAAQS or required interim milestones.

What is a hot-spot analysis?

A hot-spot analysis is an estimation of likely future local pollutant concentrations and a comparison of those concentrations to the relevant NAAQS.

To demonstrate project-level conformity, a project must come from a conforming RTP and transportation improvement program (TIP)[1]. The project design concept and scope must not have changed significantly from those in the RTP and TIP, and the analysis must have used the latest planning assumptions and latest estimates of emissions. Additional analysis might be necessary in CO, PM_{10}, and $PM_{2.5}$ nonattainment or maintenance areas to determine whether a project would have local air quality impacts. This analysis is referred to as a "hot-spot" analysis. A hot-spot analysis is defined in 40 CFR Section 93.101 as an estimation of likely future local pollutant concentrations and a comparison of those concentrations to the relevant NAAQS. A hot-spot analysis assesses air quality impacts on a smaller scale than an entire nonattainment or maintenance area.

A PM hot-spot analysis is required only for specific types of projects, which are listed in the transportation conformity regulations at 40 CFR Section 93.123(b)(1). EPA uses the term *project of air quality concern* (POAQC) to refer to any of the project types for which a PM hot-spot analysis is required.

Because the improvements associated with the I-15 project would be in a CO attainment area, a CO hot-spot analysis is not required.

[1] A conforming RTP or TIP is one that has been analyzed for emissions of controlled air pollutants and found to be within emission limits established in the State Implementation Plan (SIP) or within guidelines established by the EPA until a SIP is approved.

2.2.1 Transportation Conformity Compliance

WFRC, the metropolitan planning organization for the project region, develops the Wasatch Front RTP. The I-15 project used WFRC's 2019–2050 RTP (WFRC 2019), which was the current RTP at the time the EIS was initiated. The 2019–2050 RTP was adopted in 2019 and had a total of four amendments in 2020 and 2021. The amended 2019–2050 RTP includes two projects that identify improvements to I-15 in Davis and Salt Lake Counties:

- I-15 widening (from five lanes to six lanes in each direction) from Farmington to Salt Lake County line (2019 RTP project: R-D-53)
- I-15 widening (from four and five lanes to six lanes in each direction) in Davis County to 600 North (2019 RTP project: R-S-137)

According to Air Quality Memorandum 40 (WFRC 2021), which was prepared for an amendment to the RTP in 2021, the RTP is consistent with and conforms to the SIP or the EPA interim conformity guidelines.

Under federal law, WFRC must update its RTP every 4 years. WFRC's 2023–2050 RTP (WFRC 2023a) was adopted in May 2023, which was 4 months before the release of the I-15: Farmington to Salt Lake City Draft EIS in September 2023. Assumptions regarding the I-15 project presented in the 2023–2050 RTP are consistent with those presented in the 2019–2050 RTP. According to Air Quality Memorandum 41 (WFRC 2023b), the RTP is consistent with and conforms to the SIP or the EPA interim conformity guidelines. Accordingly, regional transportation conformity is demonstrated with respect to this project.

EPA approved the maintenance plan for the Salt Lake County 8-hour O_3 standard on September 26, 2013 (78 Federal Register 59242). Project-level conformity for O_3 is met by demonstrating that the area has a conforming RTP and TIP, and that the project is consistent with the description provided in the RTP.

EPA approved the maintenance plan for the Salt Lake County SIP for PM_{10} on July 8, 1994 (59 Federal Register 35036). Davis and Salt Lake Counties do not yet have an approved SIP. Until the SIP for $PM_{2.5}$ is approved, interim emissions tests are required for RTP conformity determinations.

The I-15 EIS is also listed in the 2023–2028 TIP (WFRC 2022).

2.2.2 Exempt Projects

EPA regulations set forth certain projects that are exempt from transportation conformity requirements. See 40 CFR Sections 93.126 and 93.128. Projects consistent with 40 CFR Section 93.126 or 40 CFR Section 93.128 are exempt from transportation conformity requirements. Exempt projects include safety projects such as railroad crossings, guard rails, and bridge reconstruction (with no additional travel lanes); mass transit projects such as rehabilitation of transit vehicles; air quality projects such as pedestrian and bicycle facilities; and other projects such as noise attenuation. The I-15 project does not qualify for any of these exemptions.

2.2.3 Projects of Air Quality Concern

Because the I-15 project would be located in a $PM_{2.5}$ nonattainment and a PM_{10} maintenance area, it is subject to procedures to determine whether it should be classified as a POAQC such that quantitative hot-spot analysis is warranted [see 40 CFR Section 93.123(b)(1)]. Projects that require quantitative hot-spot analyses for $PM_{2.5}$ and PM_{10} include:

i. New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles

ii. Projects affecting intersections that are at a level of service (LOS) of 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

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

EPA's *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA 2021a) provides guidance for reviewing transportation projects in the context of CFR Title 40 and clarification regarding the criteria for determining whether a project is a project of air quality concern. Appendix B of EPA's hot-spot guidance provides the following examples of projects of local air quality concern that would be covered by 40 CFR Section 93.123(b)(1)(i) and (ii):

- A project on a new highway or expressway that serves a significant volume of diesel vehicle traffic, such as facilities with greater than 125,000 AADT, and 8% or more of such AADT is diesel truck traffic (or the equivalent of 10,000 diesel new AADT)
- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal
- Expansion of an existing highway or other facility that affects a congested intersection (operated at LOS D, E, or F) that has a significant increase in the number of diesel trucks
- Similar highway projects that involve a significant increase in the number of diesel transit buses and/or diesel trucks

EPA's hot-spot guidance also provides the following examples of projects that are *not* projects of local air quality concern under 40 CFR Section 93.123(b)(1)(i) and (ii):

- Any new or expanded highway project that services primarily gasoline vehicle traffic (that is, does not involve a significant number or increase in the number of diesel vehicles), including such projects involving congested intersections operating at LOS D, E, or F.
- An intersection channelization project or interchange-configuration project that involves either turn lanes or slots, or lanes or movements that are physically separated. These kinds of projects improve

freeway operations by smoothing traffic flow and vehicle speeds by improving weave and merge operations, which would not be expected to create or worsen PM NAAQS violations.

- Intersection channelization projects, traffic circles or roundabouts, intersection signalization projects at individual intersections, and interchange-reconfiguration projects that are designed to improve traffic flow and vehicle speeds, and do not involve any increases in idling. Thus, they would be expected to have a neutral or positive influence on PM emissions.

POAQC Determination. When the Draft EIS was published, UDOT's opinion was that the I-15 project would not be considered a POAQC according to the regulations at 40 CFR Section 93.123(b)(1). UDOT's evaluation and rationale is discussed in detail in Appendix 3E, *Project of Air Quality Concern Evaluation*, in the I-15 EIS.

EPA provided a comment on the Draft EIS stating that EPA did not agree with UDOT's POAQC determination. EPA's Draft EIS comment also stated that EPA had concluded that the project should be considered a POAQC and that the Final EIS should include a particulate matter hot-spot analysis to satisfy transportation conformity requirements. In subsequent Interagency Coordination Team (ICT) meetings (see Attachment G, *ICT Meeting Minutes and Pertinent Correspondence*) the ICT determined that the project was a POAQC, and UDOT conducted hot-spot analyses for $PM_{2.5}$ and PM_{10} for this project following the transportation conformity procedures. The hot-spot analyses methodology and assumptions are described in the remainder of this report.

2.3 Hot-spot Analysis

In general, a hot-spot analysis compares air quality concentrations for a proposed project (the build scenario) to the air quality concentrations without the project (the no-build scenario). The air quality concentrations are determined by calculating a "design concentration," a statistic that describes future air quality concentration in the project area that can be compared to a particular NAAQS. EPA's hot-spot guidance (EPA 2021a) suggests modeling the build scenario first. If the design concentrations for the build scenario are less than or equal to the relevant NAAQS, the project meets the conformity rule's hot-spot requirements, and no further modeling is needed.

What is a hot-spot analysis?

A hot-spot analysis assesses air quality impacts on a smaller scale than an entire nonattainment or maintenance area.

Section 93.116(a) of the conformity rule requires that PM hot-spot analyses consider either the full timeframe of an area's transportation plan or, in an isolated rural nonattainment or maintenance area, the 20-year regional emissions analysis. Conformity requirements are met if the analysis demonstrates that no new or worsened violations occur in the year(s) of highest expected emissions, which includes the project's emissions in addition to background concentrations. Analysis years must be within the timeframe of the transportation plan. For the I-15 project, analyses were conducted for the years 2035 and 2050. The year 2035 was modeled since this is likely the opening year for the complete project, and the year 2050 was modeled because traffic and demand for transit are projected to reach their peak in 2050.

Additionally, hot-spot analyses should include the entire project area [40 CFR Section 93.123(c)(2)]. However, for larger projects, it might be appropriate to focus the analysis only on the locations of the highest air quality concentrations (EPA 2021a). If conformity is demonstrated at such locations, then it can be assumed that conformity is met in the entire project area (EPA 2021a).

3.0 Methodology

UDOT used the MOVES4 emissions model to estimate on-road motor vehicle emission rates from vehicle exhaust, brake wear, and tire wear caused by the Action Alternative. These estimates were then used in AERMOD, an air quality dispersion model, which estimates PM concentrations. UDOT followed EPA hot-spot guidance (EPA 2021a) to conduct the hot-spot analyses, as well as materials used in EPA/DOT-sponsored training classes (for example, “Completing Quantitative PM Hot-spot Analyses: 3-Day Course”), to complete hot-spot analyses for 24-hour PM_{10}, 24-hour $PM_{2.5}$, and annual $PM_{2.5}$. The hot-spot analyses were conducted for the years 2035 and 2050. The year 2035 was modeled since this is likely the opening year for the complete project, and the year 2050 was modeled because traffic and demand for transit are not projected to reach their peak until 2050. Detailed methodology is described below in Sections 3.1 through 3.6.

3.1 Interagency Consultation

The air quality analyses for the I-15 project were developed in consultation with the State’s air quality ICT. Specific items established through the interagency consultation process include:

- Hot-spot analysis evaluation areas
- Input parameters used in the emissions model and dispersion model
- Years of analysis
- Nearby emissions sources to be considered
- Representative background monitors used for the hot-spot analyses
- Project-specific data assumptions
- Appropriate placement of receptors for the hot-spot analyses
- Removal of days affected by heavy wildfire smoke from the background data

Table 2 summarizes the air quality ICT meetings that were held for the project.

Table 2. Air Quality ICT Meetings Discussing Hot-spot Analysis Methodology

Date	Attendees	Discussion Topics
4/12/2023	Full ICT	• Initial presentation of I-15 Project to ICT.
6/23/2023	UDOT, FHWA, and EPA	• Discussed EPA Region 8 comments on POAQC evaluation.
8/15/2023	Full ICT	• Discussed EPA Office of Transportation and Air Quality (OTAQ) recommendation for a hot-spot analysis.
9/13/2023	Full ICT	• Updated on UDOT's ongoing efforts to meet with EPA OTAQ.
10/16/2023	UDOT, FHWA, and EPA	• Met with EPA OTAQ to discuss modeling approach.
10/27/2023	UDOT, FHWA, and UDOT's consultant team	• Discussed the limits of the 600 South to 600 North evaluation area and appropriate receptor placement.
11/30/2023	UDOT and FHWA	• Discussed the hot-spot analysis evaluation area and modeling inputs.
1/3/2024	UDOT, FHWA, and UDOT's consultant team	• Discussed adding second evaluation area covering the I-215 North Salt Lake interchange and nearby refineries.
1/25/2024	UDOT, FHWA, EPA, and UDOT's consultant team	• Discussed EPA's comments from 11/28/2023.
1/30/2024	UDOT and FHWA	• Discussed the status and approach to hot-spot modeling effort.
2/7/2024	UDOT and FHWA	• Checked-in on hot-spot modeling effort.
2/14/2024	Full ICT	• Discussed the selection of background monitors and receptor placement for hot-spot analysis.
2/21/2024	UDOT and FHWA	• Checked in on hot-spot modeling effort.
2/23/2024	UDOT and FHWA	• Checked in on hot-spot modeling effort.
2/28/2024	UDOT and FHWA	• Discussed responses to EPA comments.
3/12/2024	UDOT and FHWA	• Checked in on hot-spot modeling effort.
3/14/2024	UDOT, FHWA, EPA, and UDOT's consultant team	• Discussed the geographic scope of hot-spot analyses, both the 600 South to 600 North evaluation area and the I-215 North Salt Lake interchange evaluation area. FHWA and EPA agreed that the proposed geographic scope of the analyses is appropriate. • Reviewed receptor locations. Initial models will be run with flat terrain.
3/15/2024	UDOT and FHWA	• Discussed MOVES modeling assumptions.
3/26/2024	UDOT, FHWA, EPA, and UDOT's consultant team	• Reviewed and approved MOVES4 inputs and modeling years. • Reviewed receptors. • Approved receptors ending at 400 South for the 600 South to 600 North evaluation area given physical improvements associated with the project terminus at 200 South. • Discussed January as the modeling month.

(*Continued on next page*)

Table 2. Air Quality ICT Meetings Discussing Hot-spot Analysis Methodology

Date	Attendees	Discussion Topics
4/9/2024	UDOT, FHWA, EPA, and UDOT's consultant team	• Reviewed receptor placement in both evaluation areas (web map of links and receptors was shared prior to meeting). • Discussed removing background days with atypical events (days affected by wildfire smoke) and how to document removal.
4/10/2024	Full ICT	• Shared the location of links and receptors along with minor changes made to the model area since last presented. There were no questions or concerns.
4/25/2024	UDOT, FHWA, EPA, and UDOT's consultant team	• EPA approved receptor placement. • Reviewed preliminary results for the 600 South to 600 North evaluation area, after which it was decided that elevation should be added into the model. • Discussed removing background days with atypical events (days affected by wildfire smoke) and how to properly document removal.
5/9/2024	UDOT, FHWA, EPA, and UDOT's consultant team	• Reviewed preliminary results for the 600 South to 600 North evaluation area. • Discussed removing background days with atypical events (days affected by wildfire smoke). • Discussed whether the Hawthorne or Utah Technical Center monitoring is more appropriate to use for PM_{10} background data. Need UDAQ input.
5/30/2024	UDOT, FHWA, EPA, UDAQ, and UDOT's consultant team	• Discussed removing background days with atypical events (days affected by wildfire smoke) and how to document. UDAQ will prepare short memo with methodology, references, and script regarding classifying atypical wildfire days. • Confirmed that Hawthorne monitor is appropriate to use as monitor for PM_{10} background data.
6/12/2024	Full ICT	• Continued discussion on atypical events approach and documentation.
6/27/2024	UDOT, FHWA, and EPA	• Continued discussion on atypical events approach and documentation.

3.2 Hot-spot Analysis Evaluation Areas

UDOT conducted a quantitative hot-spot analysis for the following two locations in the project study area:

1. **I-215 North Salt Lake Interchange Evaluation Area.** The I-215 North Salt Lake interchange evaluation area includes the section of I-15 near the I-215 North Salt Lake interchange, roughly between mileposts 314.2 and 312.8, including all associated ramps, and the section of U.S. 89 between these mileposts. This evaluation area also includes the section of I-215 between I-215 milepost 27.9 and I-15. Figure 2 shows the boundaries of the I-215 North Salt Lake interchange evaluation area.
2. **600 South to 600 North Evaluation Area.** The 600 South to 600 North evaluation area includes the section of I-15 between 600 South and just north of 600 North in Salt Lake City (between mileposts 307.8 and 309.9) as well as the section of I-80 between I-80 milepost 119.0 and the I-15 interchange. Figure 3 shows the boundaries of the 600 South to 600 North evaluation area.

Figure 1, *Study Area for the I-15 EIS*, above provides an overview map showing the location of each evaluation area within the larger EIS study area.

Figure 2. I-215 North Salt Lake Interchange Evaluation Area

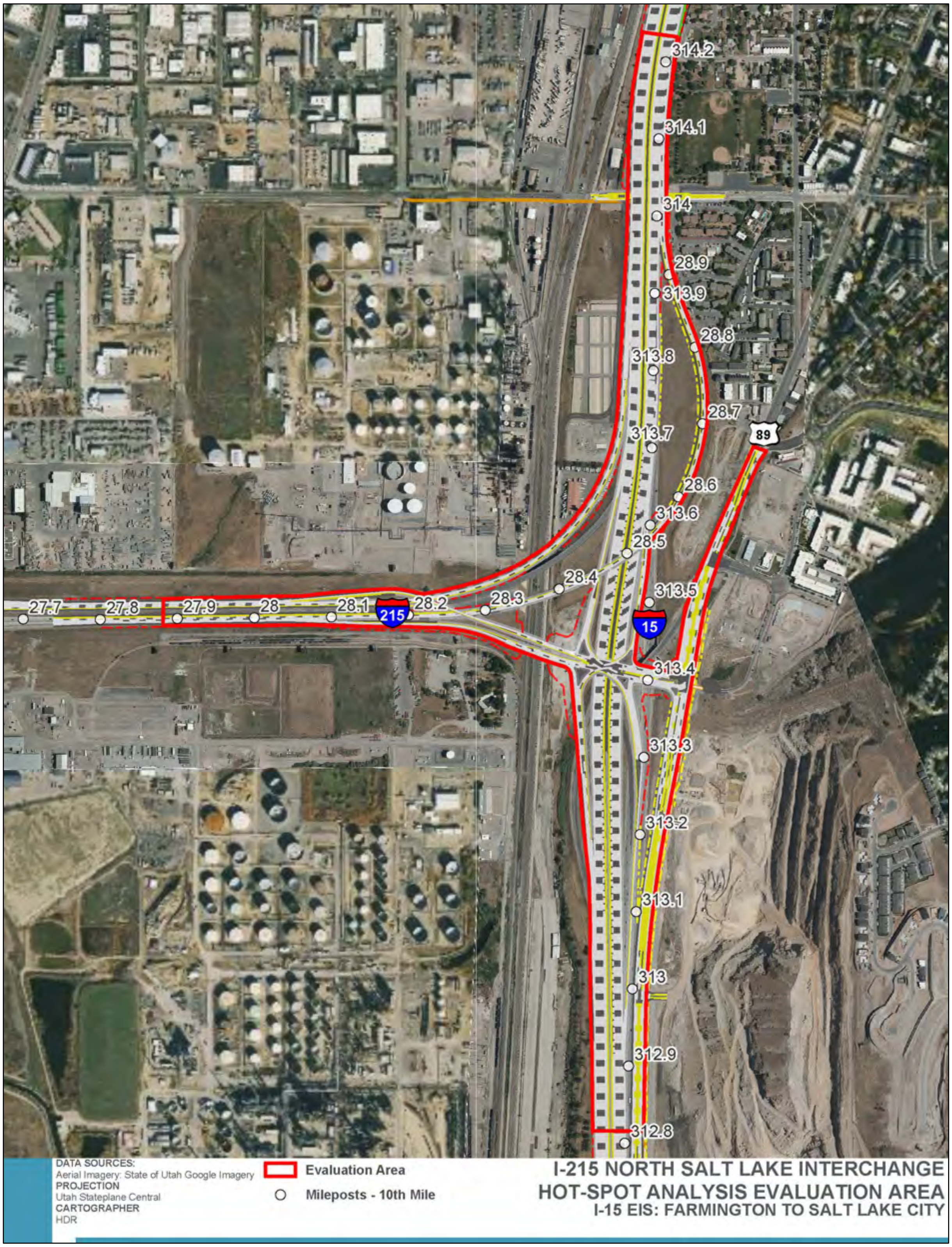
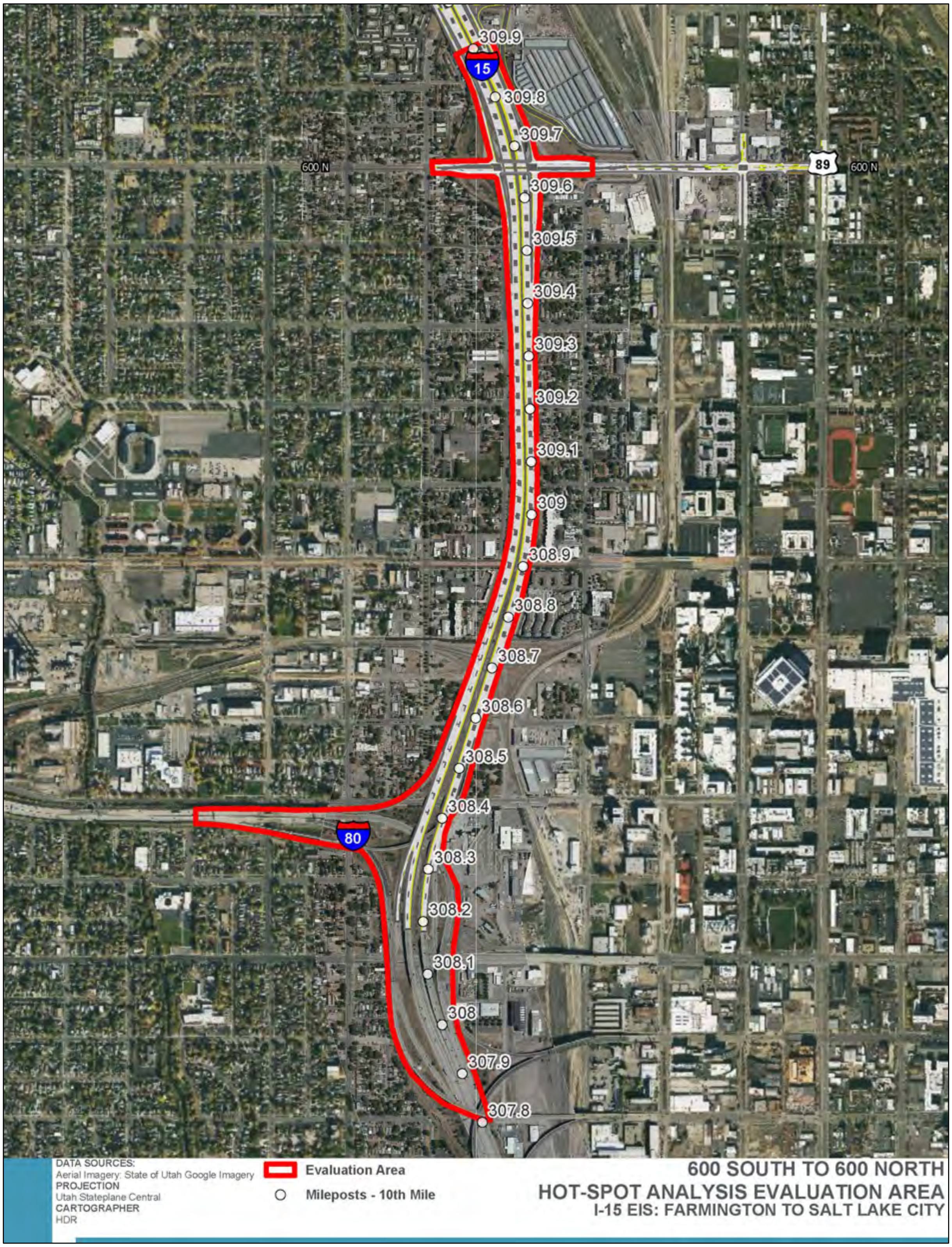


Figure 3. 600 South to 600 North Evaluation Area



3.2.1 I-215 North Salt Lake Interchange Evaluation Area

This section of I-15 was selected for a hot-spot analysis because the Chevron and Big West oil refineries are located on the west side of I-15 at this location and a residential area is located to the northeast. Section 8.2 of EPA's hot-spot guidance (EPA 2021a) states that nearby emissions sources (such as the Chevron and Big West oil refineries) are individual sources that contribute PM concentrations to a project area.

In the case of the I-215 North Salt Lake interchange evaluation area, the refineries would be considered "nearby" sources. Given that there are residential receptors near this location, a hot-spot analysis was conducted for the I-215 North Salt Lake interchange evaluation area. This section of I-15 is located in Davis County, which is a nonattainment area for $PM_{2.5}$ and an attainment area for PM_{10}, so the hot-spot analysis for this evaluation area was conducted for $PM_{2.5}$ only. Although the Bountiful #2 monitoring station is the closest monitoring station to the I-215 North Salt Lake interchange evaluation area in terms of distance, the Rose Park monitor regularly reports higher values for $PM_{2.5}$ because of its proximity to the airport and nearby highways and refineries. In terms of background data, the Rose Park monitor would represent a worst-case scenario for this evaluation area and would better represent background concentrations from nearby emission sources (such as the Chevron and Big West oil refineries). Therefore, background data from the Rose Park monitor was used for the hot-spot analysis for the I-215 North Salt Lake interchange evaluation area. 600 South to 600 North Evaluation Area

3.2.2 600 South to 600 North Evaluation Area

This section of I-15 was selected for a hot-spot analysis for the following reasons:

1. This section of I-15 is projected to have the highest AADT, and about 8% of traffic is expected to be diesel buses and trucks with the Action Alternative in 2050. For more information, see Table 2, *Estimated AADT and Percentage of Diesel Buses and Trucks on Segments of I-15 in the Project Study Area in 2019 and 2050*, in Appendix 3E, *Project of Air Quality Concern Evaluation*, of the Final EIS.
2. This section of I-15 is closer to the Rose Park and Hawthorne air quality monitoring stations, which record higher PM_{10} and $PM_{2.5}$ concentrations near the air quality evaluation area than does the Bountiful #2 monitoring station.
3. This section of I-15 is located in Salt Lake County, which is a nonattainment area for $PM_{2.5}$ and a maintenance area for PM_{10}, so the hot-spot analysis was conducted for both PM_{10} and $PM_{2.5}$.
4. This section of I-15 has residential areas on both the east and west sides. Most other sections of I-15 in the air quality evaluation area have industrial areas on at least one side of I-15.

For all of the reasons listed above, UDOT expected that this section of I-15 would have the highest future air pollutant emissions from I-15. This section has the highest projected AADT with the Action Alternative in 2050, and it is near the air quality monitoring stations along the project extent that record the highest PM_{10} and $PM_{2.5}$ concentrations.

If the predicted air quality concentrations at the I-215 North Salt Lake interchange and the 600 South to 600 North evaluation areas are below the NAAQS, then it can be concluded that conformity is met in the entire project area (EPA 2021a).

3.3 MOVES4 Methodology

3.3.1 Methodology to Determine Analysis Month

For PM hot-spot analyses, EPA recommends using the minimum number of MOVES runs necessary to capture changes in emission rates due to changes in ambient conditions (EPA 2021a). For projects that do not include gasoline start activity, hot-spot analyses for any of the PM NAAQS can be done using four unique MOVES runs that represent four different periods of the day: morning peak, midday, evening peak, and overnight. In this case, the month with the seasonal fuel that results in the highest PM emission rates should be used (EPA 2021a).

The hot-spot analyses for the I-15 project were performed for January of calendar years 2035 and 2050. To confirm that January would have the highest emissions rates, MOVES4 was used with the following run specifications:

- **Scale.** MOVES was run at the default scale using "inventory" for output.
- **Time Spans.** MOVES was executed for all months, all days, and all hours for the years 2035 and 2050.
- **Geographic Bounds.** Geographic bounds were set for Davis County, Utah, and Salt Lake County, Utah.
- **Vehicles/Equipment.** All fuel and source types were selected.
- **Road Type.** All road types were selected.
- **Pollutants and Processes.** The pollutants and processes selected in the pollutants and processes panel were "Primary Exhaust $PM_{2.5}$ – Total," "Primary $PM_{2.5}$ – Brake Wear Particulate," "Primary $PM_{2.5}$ – Tire Wear Particulate," "Primary Exhaust PM_{10} – Total," "Primary PM_{10} – Brake Wear Particulate," and "Primary PM_{10} – Tire Wear Particulate."
- **General Output.** Mass units were set to grams, distance units were set to miles, and activity was set to "distance traveled."
- **Output Emissions Detail.** Output aggregation was set to "month" by "county."

Emissions rates were calculated for PM_{10} and $PM_{2.5}$ for each month in each year (2035 and 2050) in both Davis and Salt Lake Counties. The emission rates for each pollutant-month-year-county combination were then divided by the vehicle-miles traveled for each month-year-county combination to determine the grams per vehicle mile for each month-year-county combination. The results show that January has the highest emissions rates for both PM_{10} and $PM_{2.5}$ for both counties and both years.

3.3.2 Links and Traffic Data

Before beginning the analyses, UDOT defined the project links. The map series in Attachment A, *I-215 North Salt Lake Interchange Evaluation Area Links*, shows the link setup for the I-215 North Salt Lake interchange evaluation area, and the map series in Attachment B, *600 South to 600 North Evaluation Area Links*, shows the link setup for the 600 South to 600 North evaluation area. Attachment C, *I-215 North Salt Lake Interchange Evaluation Area Link Characteristics*, and Attachment D, *600 South to 600 North Evaluation Area Link Characteristics*, provide tables of links, with associated traffic volumes and speeds for each link. Each table is keyed to the links in the associated map series.

There were 194 on-road links for the I-215 North Salt Lake interchange evaluation area and 297 on-road links for the 600 South to 600 North evaluation area. Each link represents a road segment with similar traffic, activity conditions, and characteristics; for example, decelerating vehicles approaching an intersection were treated as one link. Links are characterized by facility type, length (miles), hourly traffic volume (units of vehicles per hour), average speed (miles per hour), and road grade (percent).

UDOT determined hourly traffic volumes and speeds from data provided by the project traffic consultant (2035 and 2050 traffic conditions for the Action Alternative were obtained from WFRC's regional travel demand model, version 8.3.2). Link-specific traffic volumes and speeds were prepared for four periods: the morning peak (6:00 AM–9:00 AM), midday (9:00 AM–3:00 PM), the evening peak (3:00 PM–6:00 PM), and overnight (6:00 PM–6:00 AM).

3.3.3 MOVES4 Run Specification Setup

MOVES4 run specifications were set up as follows:

- **Description.** A short description of the run specification was provided.
- **Scale.** MOVES was run at the project scale using "inventory" for output.
- **Time Spans.** MOVES was executed for January of the years 2035 and 2050 and run for four periods (morning peak, midday, evening peak, and overnight) for a total of four runs each year.
    - The four periods are represented by the following hours:
        - Morning peak: 6 AM–9 AM (MOVES was executed for the hour from 7:00 AM to 7:59 AM to represent the morning peak period)
        - Midday: 9 AM–3 PM (MOVES was executed for the hour from 12.00 PM to 12:59 PM to represent the midday period)
        - Evening peak: 3 PM–6 PM (MOVES was executed for the hour from 5:00 PM to 5:59 PM to represent the evening peak period)
        - Overnight: 6 PM–6 AM (MOVES was executed for the hour from 12:00 AM to 12:59 AM to represent the overnight period)
- **Geographic Bounds:**
    - **I-215 North Salt Lake Interchange Evaluation Area.** Geographic bounds were set for Davis County, Utah.

   - **600 South to 600 North Evaluation Area.** Geographic bounds were set for Salt Lake County, Utah.
- **Vehicles/Equipment.** All fuel and source types were selected in the vehicle/equipment panel.
- **Road Type.** The “urban restricted” and “urban unrestricted” road types were selected.
- **Pollutants and Processes:**
   - **I-215 North Salt Lake Interchange Evaluation Area.** The pollutants and processes selected in the pollutants and processes panel were “Primary Exhaust $PM_{2.5}$ – Total,” “Primary $PM_{2.5}$ – Brake Wear Particulate,” and “Primary $PM_{2.5}$ – Tire Wear Particulate.”
   - **600 South to 600 North Evaluation Area.** The pollutants and processes selected in the pollutants and processes panel were “Primary Exhaust $PM_{2.5}$ – Total,” “Primary $PM_{2.5}$ – Brake Wear Particulate,” “Primary $PM_{2.5}$ – Tire Wear Particulate,” “Primary Exhaust PM_{10} – Total,” “Primary PM_{10} – Brake Wear Particulate,” and “Primary PM_{10} – Tire Wear Particulate.”
- **General Output.** Mass units were set to grams, distance units were set to miles, and activity was set to “distance traveled” and “population.”

3.3.4 MOVES4 Input Database

MOVES input files are described below according to the MOVES Project Data Manager tabs:

- **Age Distribution.** The age distribution files were specific for Davis and Salt Lake Counties for the years 2035 and 2050. These files were provided by UDAQ in March 2024 (McKeague 2024). The age distribution data for source types 21, 31, 32, 41, 42, 43, 51, 52, 54, and 61 were based on Utah Division of Motor Vehicles (DMV) data and were processed by EPA's age distribution tool. Age distribution data for source types 53 and 62 are based on MOVES4 default data.
- **Fuel.** Fuel files were specific for Davis and Salt Lake Counties for the years 2035 and 2050. MOVES default fuel data were used for Fuel Supply, Fuel Formulation, and Fuel Usage Fraction. The Fuel AVFT (Alternate Vehicle Fuel and Technology) files were provided by UDAQ in March 2024 (McKeague 2024). The AVFT data for source types 21, 31, and 32 were based on Utah DMV data using the zero-gap filling and proportional growth rate settings in the MOVES4 AVFT tool settings. The AVFT tool allows users to modify the fraction of vehicles capable of using different fuels and technologies. Using the AVFT tool is particularly important for projecting location-specific electric vehicle usage. AVFT data for source types 41, 42, 43, 51, 52, 53, 54, 61, 62 are based on MOVES4 default data. The model years covered were 1992–2060.
- **Meteorological Data.** EPA recommends that modelers use the meteorology file for the county in which the project is located according to the latest SIP or transportation conformity regional emissions analysis. However, since there is no running temperature sensitivity with PM in MOVES4, MOVES default files were used and were specific for Davis and Salt Lake Counties for the hours specified in the MOVES runs for the years 2035 and 2050.
- **Links.** Link data inputs were set up as described in Section 3.3.2, *Links and Traffic Data*.

- **Link Source Types.** Link source type represents the fleet mix. Link source type distribution files were specific for Davis and Salt Lake Counties for the years 2035 and 2050. The link source type distribution files were based on traffic data received from the traffic consultant and the source type files used by WFRC in the regional conformity analysis for the years 2032[2] and 2050 (Billings 2023a, 2023b). The fleet mix used in the MOVES input is identical for all road types and is based on the highway fleet mix. This is a conservative approach and overestimates the number of heavy-duty diesel vehicles for the arterial/collector/local roads.
- **IM Programs.** The IM program input represents vehicle inspection and maintenance (IM) programs that help improve air quality by identifying cars and trucks with high emissions and that might need repairs. The IM program files were those used by WFRC in the regional conformity analysis for the years 2032[1] and 2050 (Billings 2023a, 2023b) and were specific for Davis and Salt Lake Counties. However, IM credit is not allowed in MOVES, so this input is inconsequential.
- **Off-network, Operating Mode Distribution, Hoteling, Link Drive Schedules, Retrofit Data, Link Drive Schedules, and Generic.** Not used.

3.3.5 MOVES4 Output

A MOVES4 post-processing script was used to generate link-specific emission rates for total PM_{10} and $PM_{2.5}$.

What is re-entrained road dust?

Re-entrained road dust is particulates that are resuspended in the air when vehicles travel over roadway surfaces.

Re-entrained Road Dust. Emissions of re-entrained road dust were added to the link emissions rates to generate a total emission rate for PM_{10}. Values for re-entrained road dust were obtained from Table 10b of WFRC's *Air Quality Memorandum 41* (WFRC 2023b) and are those used for Salt Lake County for the 2032[2] and 2050 regional conformity analysis. These rates are based on Chapter 13.2.1, *Paved Roads*, of the latest version of EPA's *AP-42: Compilation of Air Emissions Factors* (EPA 2024). Road dust is not included in the $PM_{2.5}$ regional conformity analysis and is therefore not included in the $PM_{2.5}$ emissions for this hot-spot analysis. Emission rates were then used for AERMOD dispersion modeling, which is further described in Section 3.4 below.

3.4 AERMOD Dispersion Modeling

The latest approved version of EPA's AERMOD dispersion model (version 23132) was used in the dispersion analysis in conjunction with the Lakes Environmental AERMOD View interface software as well as Trinity Consultant's BREEZE AERMOD interface software. The Universal Transverse Mercator (UTM) 12N coordinate system was used in the dispersion model for the roadway links and receptor coordinates. The AERMOD dispersion modeling methodology is described below.

---

2 WFRC modeled the year 2032 for conformity analysis. The files for 2032 were used to model the year 2035 in this hot-spot analysis since 2032 was the closest relevant year.

3.4.1 Source Characterization

All roadway emissions sources (links) represented moving vehicles and were modeled as urban area sources. The estimated population of 200,000 for Salt Lake City, Utah was obtained from the U.S. Census Bureau (as of April 1, 2020, the population estimate for Salt Lake City was 199,708) (U.S. Census Bureau 2023). The area of each source was calculated based on the length of the link and width of each link (both in meters) from the Action Alternative. The width represented the combined roadway width of all travel lanes for each direction on a particular road, excluding road shoulders. For example, the I-15 mainlines were modeled together as one area source rather than five separate lanes. The HOT lanes were modeled separately. Source elevations were incorporated into the model consistent with project design files (terrain was not assumed to be flat).

The emissions sources were input to AERMOD with 1 gram/second emission rates that were multiplied by the emission rate calculated for each link to produce 24-hour emission profiles by hour of day based on MOVES4 output and road dust values. The 24-hour emission profiles, based on the four daily periods assessed in the MOVES runs (morning peak, midday, evening peak, and overnight), were simulated in AERMOD using 24 hourly emission scalars for each source. Attachment E, *Variable Emission Generator Methodology*, explains the methodology for using temporally varying emission rates for each source of emissions.

The initial vertical dimension was calculated to be 2.75 using a weighted approach as described in EPA's hot-spot guidance (EPA 2021a). Release height was calculated to be 1.37 meters (2.75 × 0.5).

3.4.2 Meteorology Data

UDAQ provided 5 years (2016–2020) of preprocessed surface and upper air meteorological data for the Salt Lake City International Airport (Krebs 2024). This is the same meteorological data that UDAQ uses for its AERMOD modeling in the same geographic area. The 5-year meteorological data were concatenated into one file for the AERMOD run. The anemometer height was set at 10 meters in AERMOD.

3.4.3 Receptors

In general, receptors were placed with finer spacing (25 meters apart) closer to the roadway edge of pavement to cover a distance of at least 100 meters from the roadway edge of pavement, then they were placed with wider spacing (100 meters apart) after the first 100 meters and up to 500 meters from the roadway edge of pavement (EPA 2021a). The first row of receptors was placed 5 meters from the roadway edge of pavement unless a noise wall (an existing noise wall or noise wall planned as part of the I-15 project) or a right-of-way fence was located farther than 5 meters from the roadway edge of pavement. In cases where a noise wall or right-of-way fence was located farther than 5 meters from the roadway edge of pavement, the first row of receptors was placed on the noise wall or right-of-way fence.

Five rows of receptors spaced 25 meters apart were placed around the evaluation areas, the first row of which was placed as described in the paragraph above (EPA 2021a). Receptors were placed in areas that are considered ambient air, where the public generally has access (EPA 2021a). Receptors were generally omitted from roadway right-of-way areas, railroad property, and large industrial areas. Additional receptors were placed at schools and parks located within 0.25 mile of the last row of receptors. AERMAP ver. 18081 was used to generate terrain elevations for receptor locations. A flagpole height of 1.8 meters was set for all receptors.

Figure 4 and Figure 5 show the receptor locations for the I-215 North Salt Lake interchange evaluation area and the 600 South to 600 North evaluation area, respectively. There are 629 receptors for the I-215 North Salt Lake interchange evaluation area. Receptors were placed in areas that are considered ambient air, where the public generally has access, and they were omitted from the Big West Oil and Chevron refineries on the west side of the evaluation area and the Lakeshore Rock gravel quarry on the east side of the evaluation area. There are 1,579 receptors for the 600 South to 600 North evaluation area. The receptor grid ends at 400 South because physical improvements associated with the project end at 200 South/I-80.

Figure 4. Receptor Locations for the I-215 North Salt Lake Interchange Evaluation Area

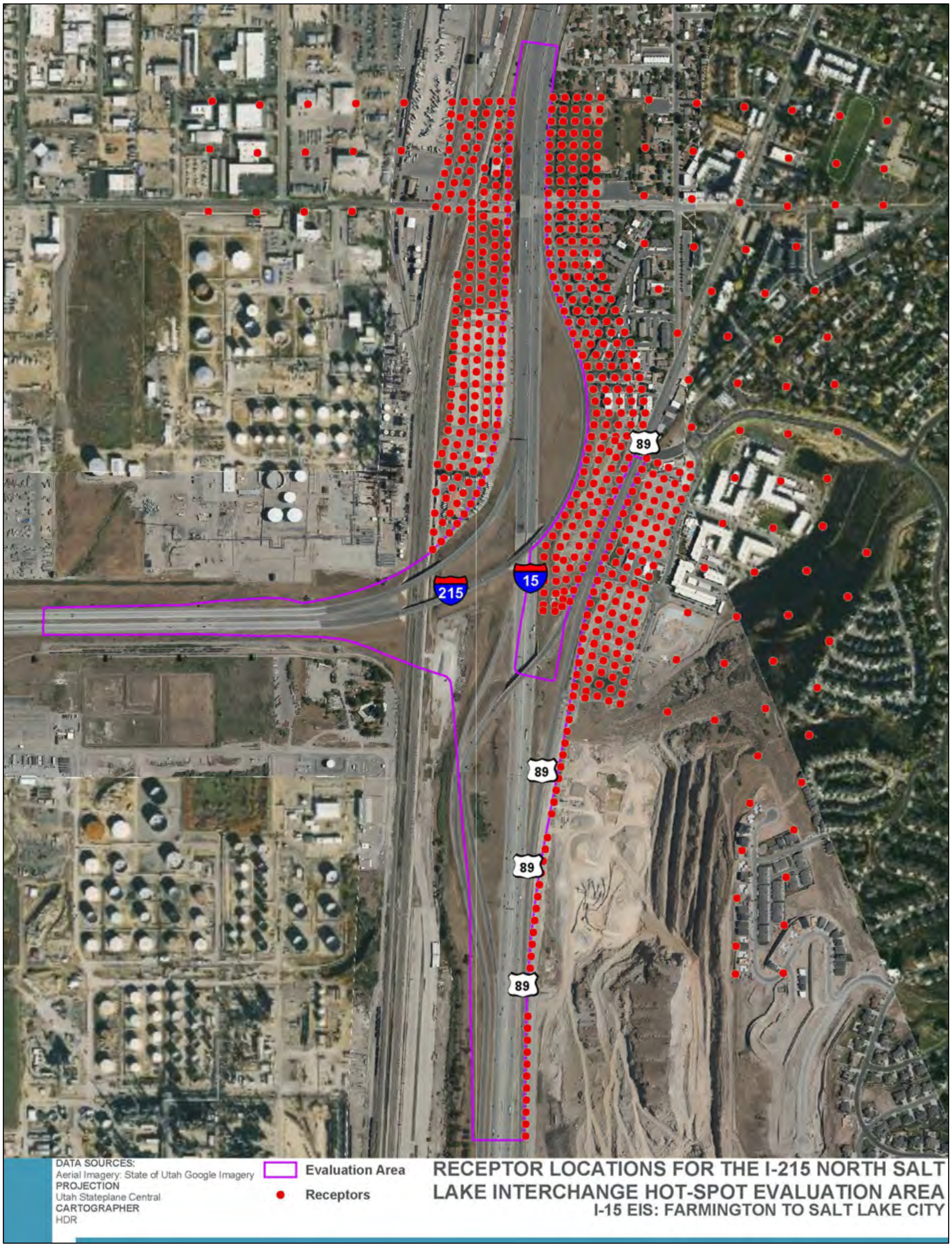
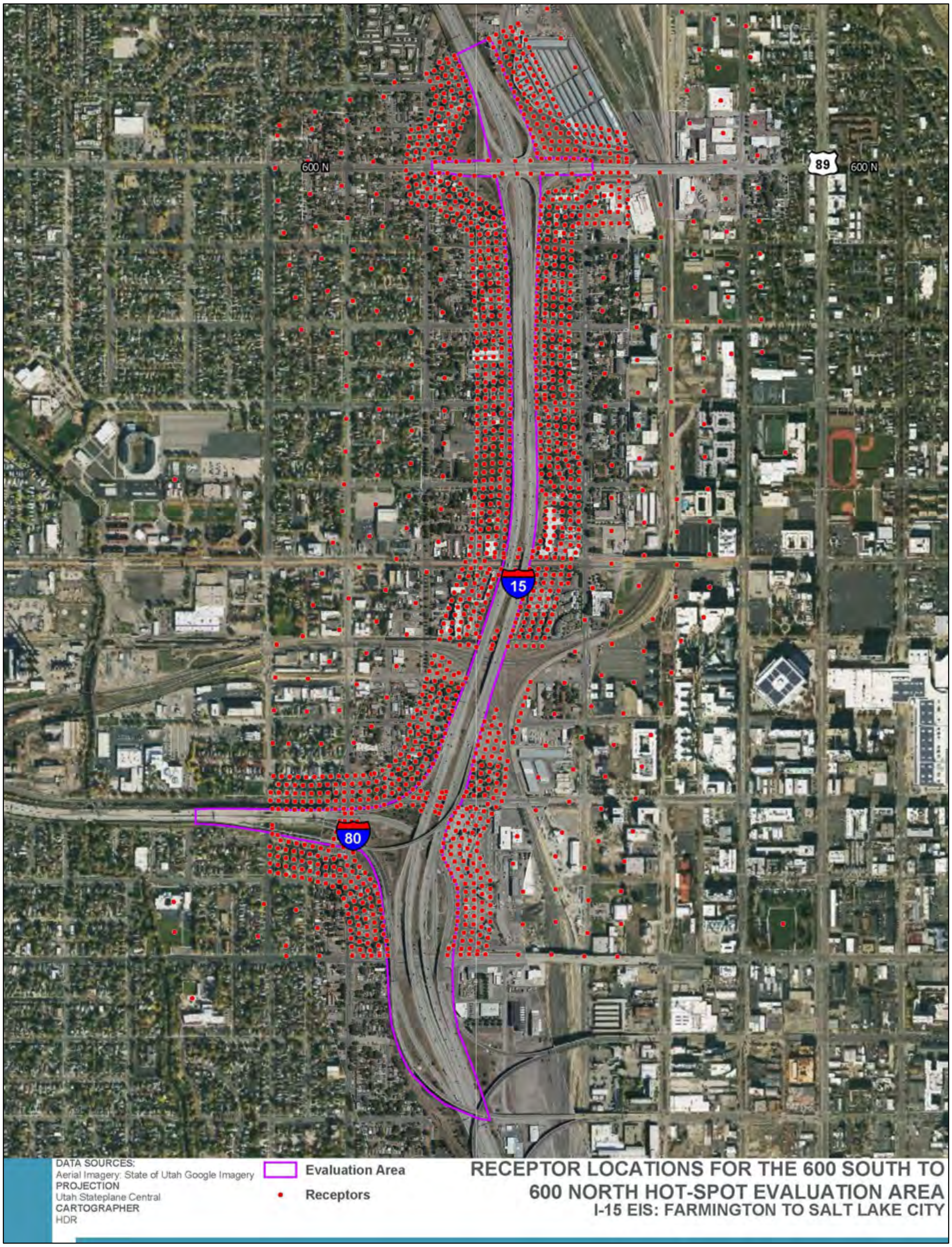


Figure 5. Receptor Locations for the 600 South to 600 North Evaluation Area



3.5 Background Concentrations

Background data from the Rose Park (EPA AIRS Code 490353010) and Hawthorne (EPA AIRS Code 490353006) monitoring stations were used for the 600 South to 600 North evaluation area. Although the Rose Park monitoring station is closest to the 600 South to 600 North evaluation area, this station does not collect data for PM_{10}. Therefore, background data for PM_{10} were obtained from the Hawthorne monitoring station, the nearest station that collects PM_{10} data that is representative of the evaluation area,[3] and background data for $PM_{2.5}$ were obtained from the Rose Park monitoring station. Background data for $PM_{2.5}$ from the Rose Park monitoring station were also used for the I-215 North Salt Lake interchange evaluation area.[4]

Background data from each monitoring station were collected from EPA's Air Data website (https://www.epa.gov/outdoor-air-quality-data) for the years 2020–2022 and processed as described in EPA's hot-spot guidance (EPA 2021a). Because wildfires can increase $PM_{2.5}$ concentrations, thereby causing atypical events in the background data, the air quality ICT determined that UDOT would remove days affected by heavy wildfire smoke (atypical events) from the background data. Removing atypical events from the background data is consistent with guidance from EPA's Office of Air Quality Planning and Standards (EPA 2019) and EPA Region 10 (EPA 2021b). The days classified as being affected by heavy wildfire smoke were determined by UDAQ. Attachment F, Atypical Events Selection and Justification, describes the methodology that UDAQ used to rate wildfire smoke days and includes a technical report that summarizes the evidence that shows that the days with heavy $PM_{2.5}$ concentrations were influenced by atypical wildfires events. Table 3 lists the 17 days influenced by heavy wildfire smoke that were removed from the background data for $PM_{2.5}$ (no days were removed from the background data for 2022).

Table 3. Days Affected by Heavy Wildfire Smoke That Were Removed from the Background Data for $PM_{2.5}$

2020		2021			
August	September	July	August		September
8/21/2020	9/6/2020	7/11/2021	8/6/2021	8/15/2021	9/7/2021
8/22/2020		7/12/2021	8/7/2021	8/16/2021	
		7/25/2021	8/8/2021	8/18/2021	
			8/9/2021	8/27/2021	
			8/10/2021	8/28/2021	

[3] Although the Utah Technical Center monitoring station (EPA AIRS Code 490353015) is the closest in terms of distance, this monitoring station is not representative of the land use types in the 600 South to 600 North evaluation area. The interagency air quality consultation group determined that the Hawthorne monitoring station, which is located in an urban corridor, is more similar to the land use patterns in the 600 South to 600 North evaluation area and should be used as the background monitor for the PM_{10} hot-spot analysis.

[4] Although the Bountiful #2 monitoring station (EPA AIRS Code 490110004) is closest to the I-215 North Salt Lake interchange evaluation area in terms of distance, using background data from the Rose Park monitor would represent a worst-case scenario for this evaluation area and would better represent background concentrations from nearby emission sources (such as the Chevron and Big West oil refineries).

The 24-hour PM_{10} background concentration is based on identifying the appropriate 24-hour monitor value from the 3 most recent years of monitoring data (2020–2022) based on Exhibit 9-6 in EPA's hot-spot guidance (EPA 2021a). The 24-hour $PM_{2.5}$ background concentration is based on the 3-year average of the 98th percentile of 24-hour recorded concentrations. The annual $PM_{2.5}$ background concentration is based on the average of 3 consecutive years' annual averages, each estimated using equally weighted quarterly averages recorded at the monitoring station. Table 4 lists the background concentration for each of these pollutants.

Table 4. Background Concentrations Used in PM Hot-spot Analyses

Pollutant	Background Concentration ($\mu g/m^3$)[a]
24-hour PM_{10}	104[b]
24-hour $PM_{2.5}$	27.867[c]
Annual $PM_{2.5}$	8.062[d]

[a] Background concentrations are reported to one decimal place beyond the NAAQS value.
[b] Based on the fourth-highest 24-hour monitoring values for 2020–2022.
[c] Based on 98th-percentile values for 2020–2022.
[d] Based on annual averages for 2020–2022.

3.6 Design Concentrations

Design concentrations were calculated by adding modeled receptor values to background monitor values as described in EPA's hot-spot guidance (EPA 2021a). The resulting design concentration was then compared to the NAAQS.

1. **24-hour PM_{10} Design Concentrations.** The 24-hour PM_{10} design concentration was calculated by first identifying the sixth-highest 24-hour concentration at each receptor across 5 years of meteorological data (as done by AERMOD). The receptor with the highest modeled concentration for a 24-hour period was then added to the background monitor value and compared to the NAAQS (EPA 2021a).
2. **24-hour $PM_{2.5}$ Design Concentrations.** The 24-hour $PM_{2.5}$ design concentration was calculated by identifying the receptor with the highest 5-year average 98th-percentile concentration (eighth highest concentration in AERMOD). The receptor with the highest modeled concentration for a 24-hour period was then added to the background monitor value and compared to the NAAQS (EPA 2021a).
3. **Annual $PM_{2.5}$ Design Concentrations.** The annual $PM_{2.5}$ design concentration was calculated directly by AERMOD by the model averaging the 5 years of annual averages for each receptor and reporting the highest receptor. The receptor with the highest modeled 5-year average concentration was identified, and this value was then added to the background monitor value and compared to the NAAQS (EPA 2021a).

4.0 Results

4.1 24-hour PM_{10} Analysis for the 600 South to 600 North Evaluation Area

The 24-hour PM_{10} design concentration was calculated by adding the modeled receptor value to the background monitor value. The resulting 24-hour PM_{10} design concentration was then rounded to the nearest 10 micrograms per cubic meter ($\mu g/m^3$) (EPA 2021a).

Table 5 shows the results of the analysis for the 24-hour PM_{10} standard for the 600 South to 600 North evaluation area for the years 2035 and 2050. The 24-hour PM_{10} design concentrations of 150 μg/m^3, for both 2035 and 2050, are equal to the 24-hour PM_{10} NAAQS (150 μg/m^3). If design concentrations are equal to or less than the NAAQS, the project meets conformity requirements (EPA 2021a).

Table 5. Design Concentrations for the 24-hour PM_{10} Standard in 2035 and 2050

In μg/m^3

Location	Modeled Value[a]	Background Concentration[b]	Design Concentration[c]	24-hour PM_{10} NAAQS
2035				
600 South to 600 North evaluation area	48.8	104.0	150	150
2050				
600 South to 600 North evaluation area	49.4	104.0	150	150

[a] Modeled values were derived from AERMOD and are reported to one decimal place beyond the NAAQS value.

[b] Background concentrations are reported to one decimal place beyond the NAAQS value.

[c] 24-hour PM_{10} design concentration is rounded to the nearest 10 μg/m^3 (EPA 2021a). The modeled value plus the background concentration would sum to 152.8 for 2035 and 153.4 for 2050, both of which would round to 150 (the nearest 10 μg/m^3).

4.2 24-hour $PM_{2.5}$ Analysis for the I-215 North Salt Lake Interchange Evaluation Area and for the 600 South to 600 North Evaluation Area

The 24-hour $PM_{2.5}$ design concentration was calculated by adding the modeled receptor value to the background monitor value. The resulting 24-hour $PM_{2.5}$ design concentration was then rounded to the nearest 1 μg/m^3 (EPA 2021a).

Table 6 shows the results of the analysis for the 24-hour $PM_{2.5}$ standard for the I-215 North Salt Lake interchange evaluation area and the 600 South to 600 North evaluation area and for the years 2035 and 2050. The 24-hour $PM_{2.5}$ design concentrations for the I-215 North Salt Lake interchange evaluation area are 30 μg/m^3 and 29 μg/m^{3}for the years 2035 and 2050, respectively, and are less than the 24-hour $PM_{2.5}$ NAAQS (35 μg/m^3). The 24-hour $PM_{2.5}$ design concentrations for the 600 South to 600 North evaluation area are 29 μg/m^3 and 29 μg/m^3 for the years 2035 and 2050, respectively, and are less than the 24-hour $PM_{2.5}$ NAAQS (35 μg/m^3). If design concentrations are equal to or less than the NAAQS, the project meets conformity requirements (EPA 2021a).

Table 6. Design Concentrations for the 24-hour $PM_{2.5}$ Standard in 2035 and 2050

In μg/m^3

Location	Modeled Value[a]	Background Concentration[b]	Design Concentration[c]	24-hour $PM_{2.5}$ NAAQS
2035				
I-215 North Salt Lake interchange evaluation area	1.6	27.9	30	35
600 South to 600 North evaluation area	1.5		29	
2050				
I-215 North Salt Lake interchange evaluation area	1.0	27.9	29	35
600 South to 600 North evaluation area	1.0		29	

[a] Modeled values were derived from AERMOD and are reported to one decimal place beyond the NAAQS value.

[b] Background concentrations are reported to one decimal place beyond the NAAQS value.

[c] 24-hour $PM_{2.5}$ design concentration is rounded to the nearest 1 μg/m^3 (EPA 2021a).

4.3 Annual $PM_{2.5}$ Analysis for the I-215 North Salt Lake Interchange Evaluation Area and for the 600 South to 600 North Evaluation Area

The annual $PM_{2.5}$ design concentration was calculated by adding the modeled receptor value to the background monitor value. The resulting annual $PM_{2.5}$ design concentration was then rounded to the nearest 0.1 μg/m^3 (EPA 2021a).

Table 7 shows the results of the analysis for the annual $PM_{2.5}$ standard for the I-215 North Salt Lake interchange evaluation area and the 600 South to 600 North evaluation area for the years 2035 and 2050. The annual $PM_{2.5}$ design concentrations for the I-215 North Salt Lake interchange evaluation area are 8.7 μg/m^3 and 8.5 μg/m^3 for the years 2035 and 2050, respectively, and are less than the annual $PM_{2.5}$ NAAQS (12 μg/m^3). The annual $PM_{2.5}$ design concentrations for the 600 South to 600 North evaluation area are 8.9 μg/m^3 and 8.7 μg/m^3 for the years 2035 and 2050, respectively, and are less than the annual $PM_{2.5}$ NAAQS (12 μg/m^3). If design concentrations are equal to or less than the NAAQS, the project meets conformity requirements (EPA 2021a).

Table 7. Design Concentrations for the Annual $PM_{2.5}$ Standard in 2035 and 2050

In μg/m^3

Location	Modeled Value[a]	Background Concentration[b]	Design Concentration[c]	Annual $PM_{2.5}$ NAAQS
2035				
I-215 North Salt Lake interchange evaluation area	0.6	8.1	8.7	12
600 South to 600 North evaluation area	0.8		8.9	
2050				
I-215 North Salt Lake interchange evaluation area	0.4	8.1	8.5	12
600 South to 600 North evaluation area	0.6		8.7	

[a] Modeled values were derived from AERMOD and are reported to one decimal place beyond the NAAQS value.

[b] Background concentrations are reported to one decimal place beyond the NAAQS value.

[c] Annual $PM_{2.5}$ design concentration is rounded to the nearest 0.1 μg/m^3 (EPA 2021a).

4.4 Conclusion

As demonstrated above in Sections 4.1, 4.2, and 4.3, the modeling showed that predicted pollutant concentrations at all receptors in the hot-spot evaluation areas do not exceed the 24-hour PM_{10}, 24-hour $PM_{2.5}$, or annual $PM_{2.5}$ NAAQS for the Action Alternative. Therefore, the I-15 project meets all conformity requirements.

5.0 References

Billings, Kip

2023a Email from Kip Billings of WFRC to Amy Croft of HDR regarding data sets for MOVES inputs. March 23.

2023b Email from Kip Billings of WFRC to Amy Croft of HDR regarding data sets for MOVES inputs. July 6.

[EPA] U.S. Environmental Protection Agency

2019 Additional Methods, Determinations, and Analyses to Modify Air Quality Data beyond Exceptional Events. April 4.

2021a Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas. October.

2021b Wildfire smoke atypical event ambient record modification guidance.

2022 EPA Greenbook. https://www3.epa.gov/airquality/greenbook/anayo_ut.html. Accessed November 7, 2023.

2024 AP-42: Compilation of Air Emissions Factors. Chapter 13.2.1, Paved Roads. https://www.epa.gov/sites/default/files/2020-10/documents/13.2.1_paved_roads.pdf. January.

Krebs, Jason

2024 Email from Jason Krebs of UDAQ to Amy Croft of HDR regarding meteorological data for the Salt Lake City International Airport. March 7.

McKeague, Rick

2024 Email from Rick McKeague of UDAQ to Amy Croft of HDR regarding data sets for MOVES inputs. March 19.

U.S. Census Bureau

2023 QuickFacts Salt Lake City, Utah. https://www.census.gov/quickfacts/fact/table/saltlakecitycityutah/PST040223#PST040223

[WFRC] Wasatch Front Regional Council

2019 Wasatch Front 2019–2050 Regional Transportation Plan. https://wfrc.org/vision-plans/regional-transportation-plan/2019-2050-regional-transportation-plan/.

2021 Air Quality Memorandum: Conformity Analysis for Amendment #3 of the WFRC 2019–2050 Regional Transportation Plan. Report No. 40. https://wfrc.org/Programs/AirQuality/AirQualityMemoArchive/AQ%20memo40_RTP_2019-2050_A3_FINAL.pdf. August 26.

2022 Transportation Improvement Program. https://wfrc.org/programs/transportation-improvement-program/.

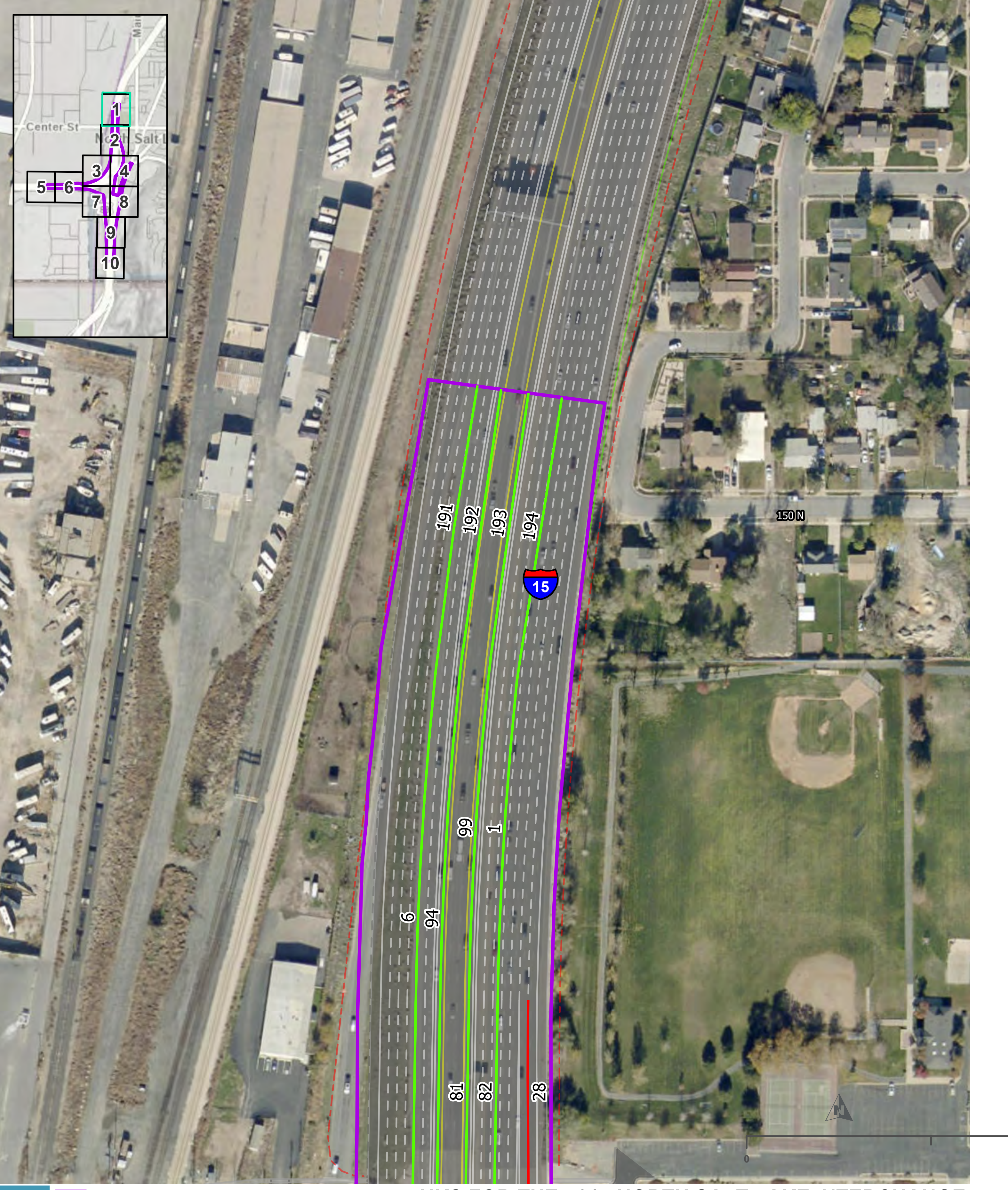
2023a Wasatch Front 2023–2050 Regional Transportation Plan. https://wfrc.org/VisionPlans/RegionalTransportationPlan/2023_2050Plan/2023RTP.pdf.

2023b Air Quality Memorandum: Conformity Analysis for the WFRC 2023–2050 Regional Transportation Plan. Report No. 41. https://wfrc.org/Programs/AirQuality/AirQualityMemoArchive/AQMemo41_RTP2023-2050_FINAL.pdf. May 26.

ATTACHMENT A

I-215 North Salt Lake Interchange Evaluation Area Links

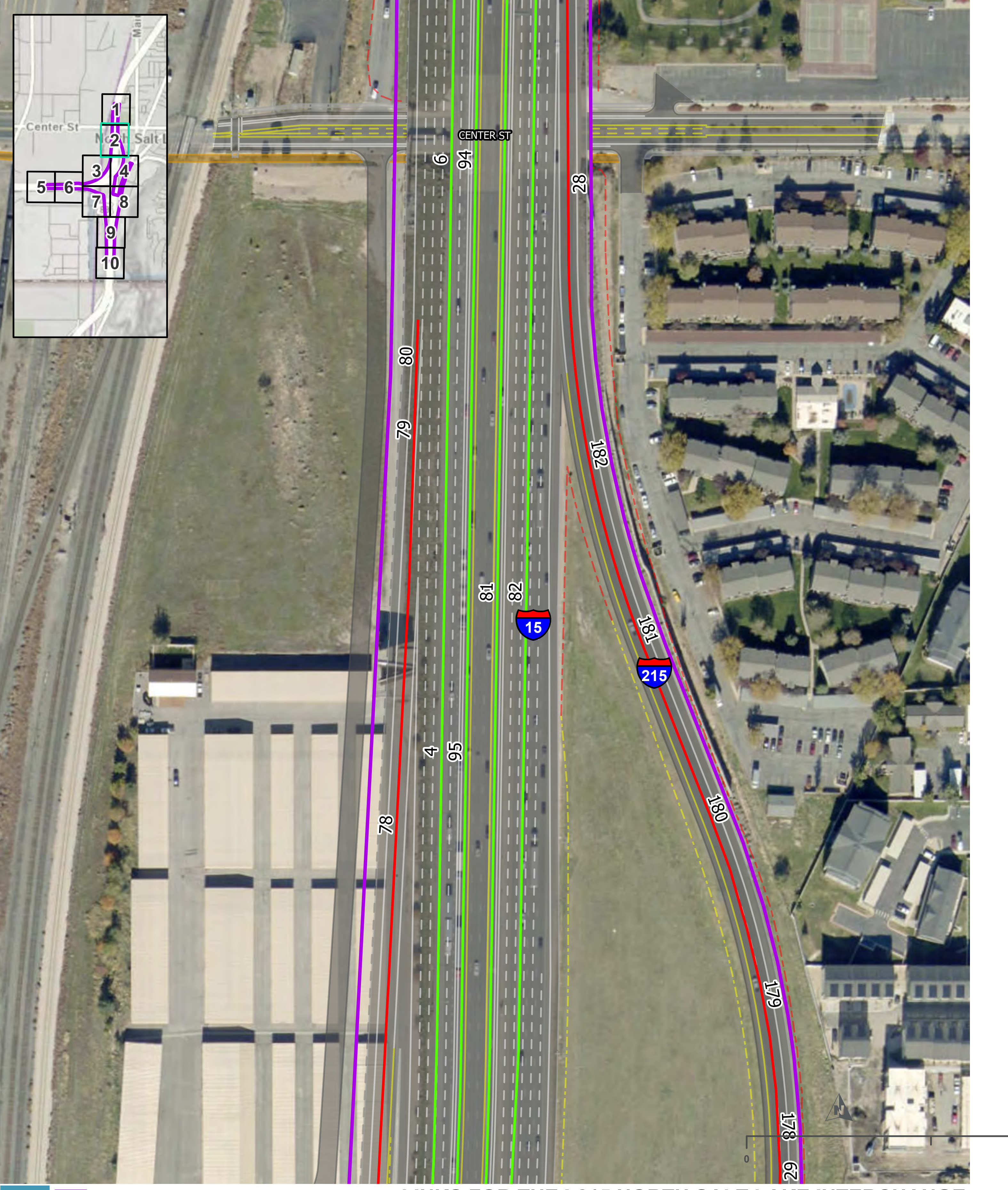
This page is intentionally left blank



Evaluation Area
Acceleration/Deceleration Links
Free-Flow Links

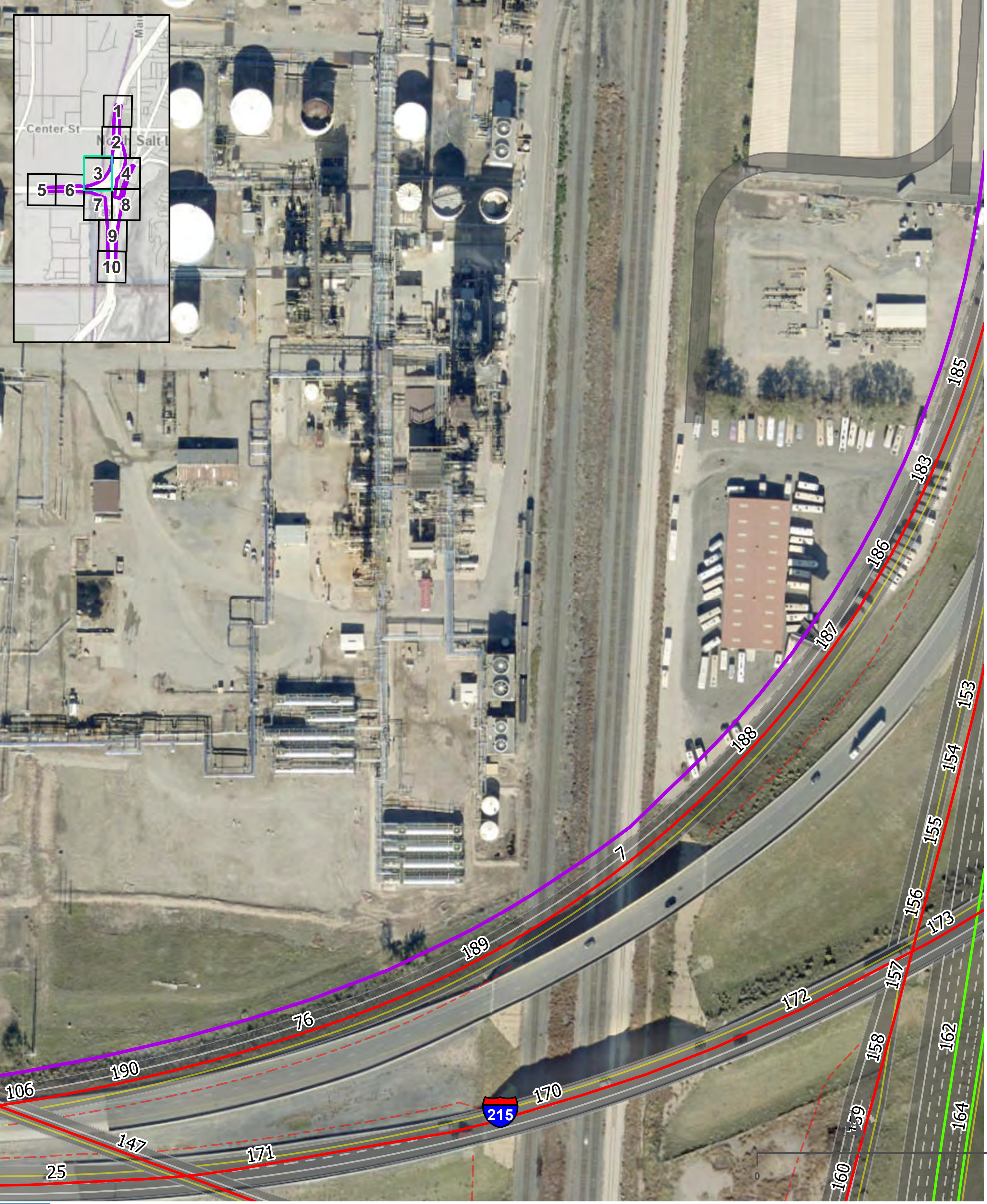
LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

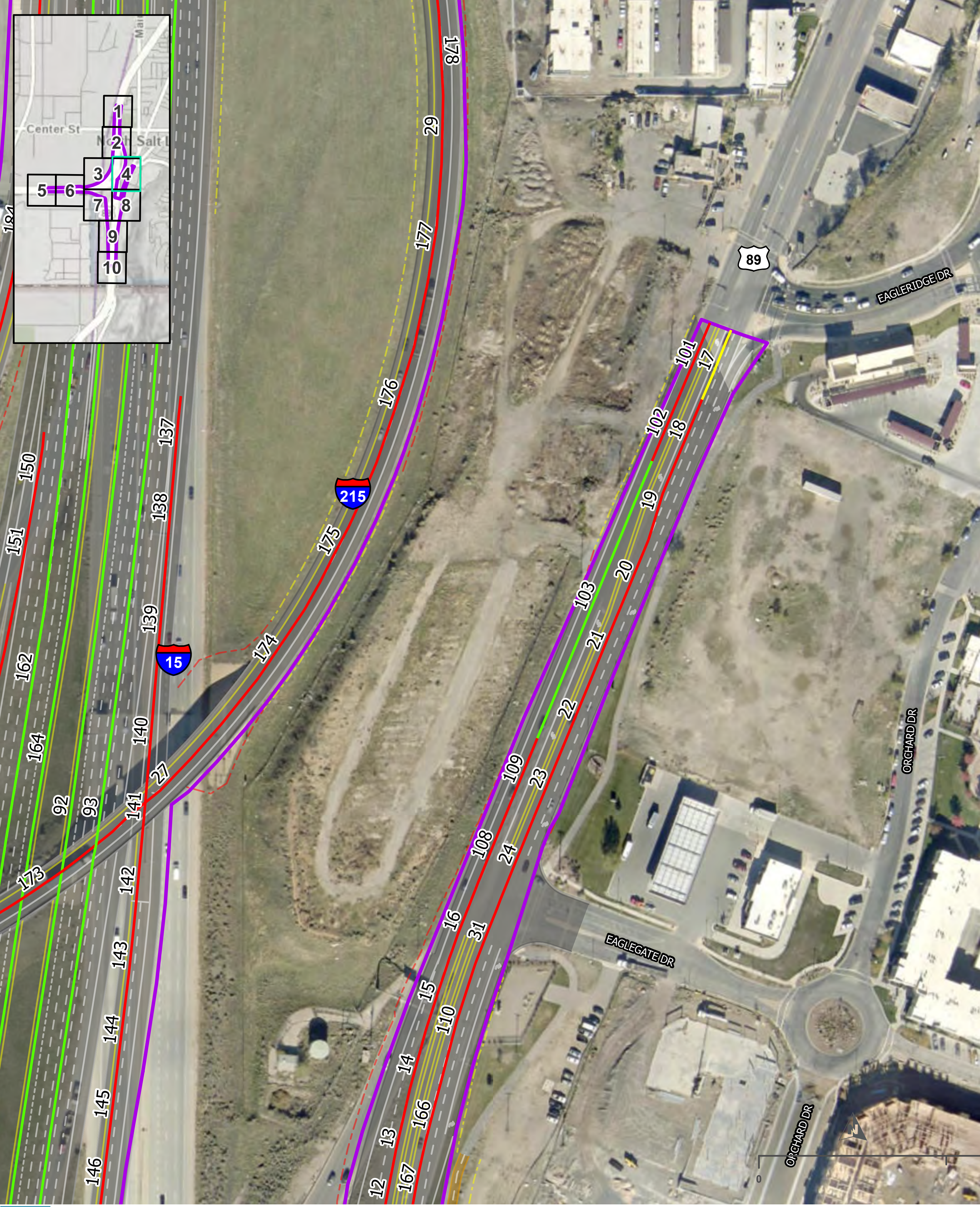
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Links
Free-Flow Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

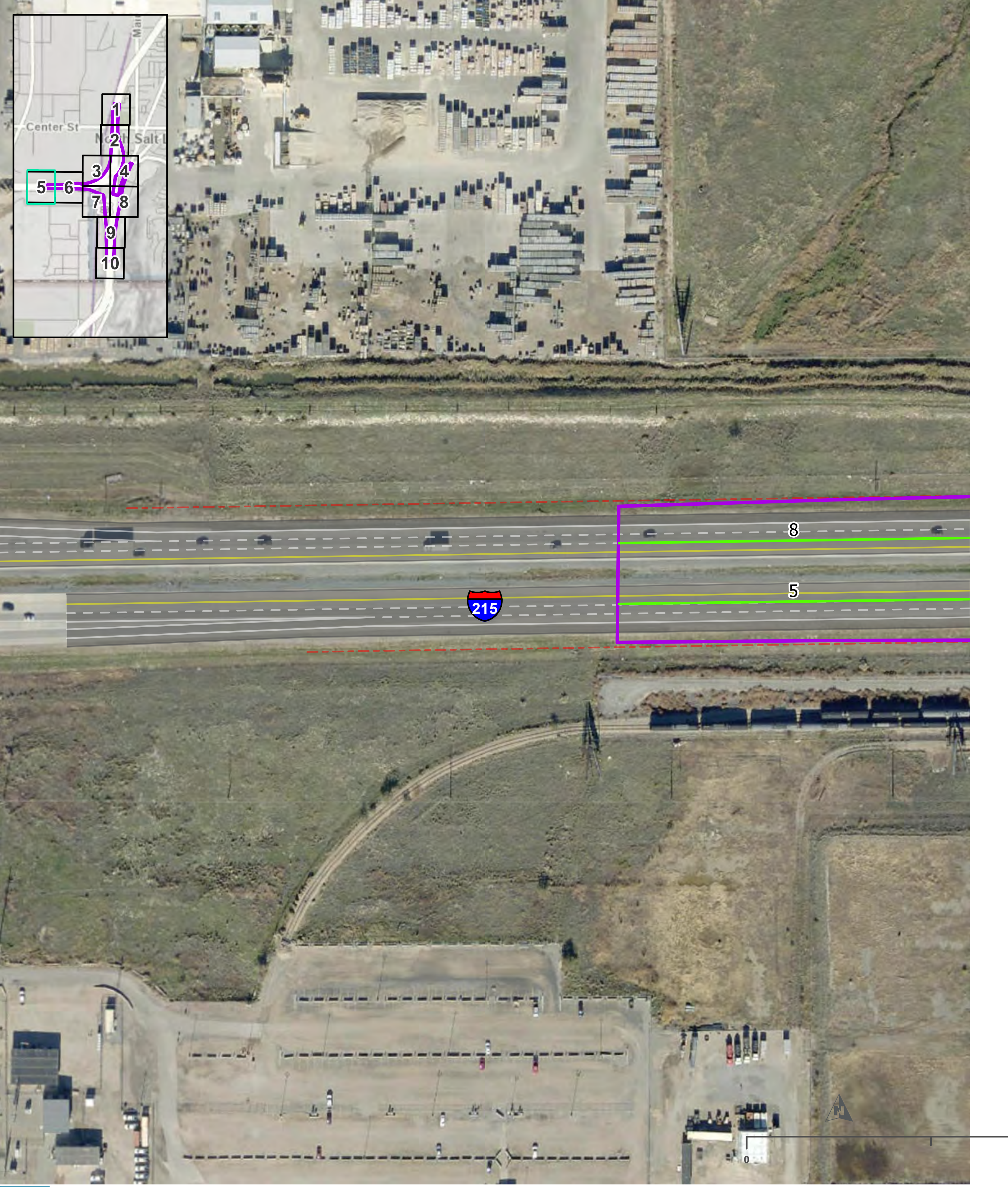
I-15 EIS: FARMINGTON TO SALT LAKE CITY



- Evaluation Area
- Acceleration/Deceleration Links
- Free-Flow Links
- Queue Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY

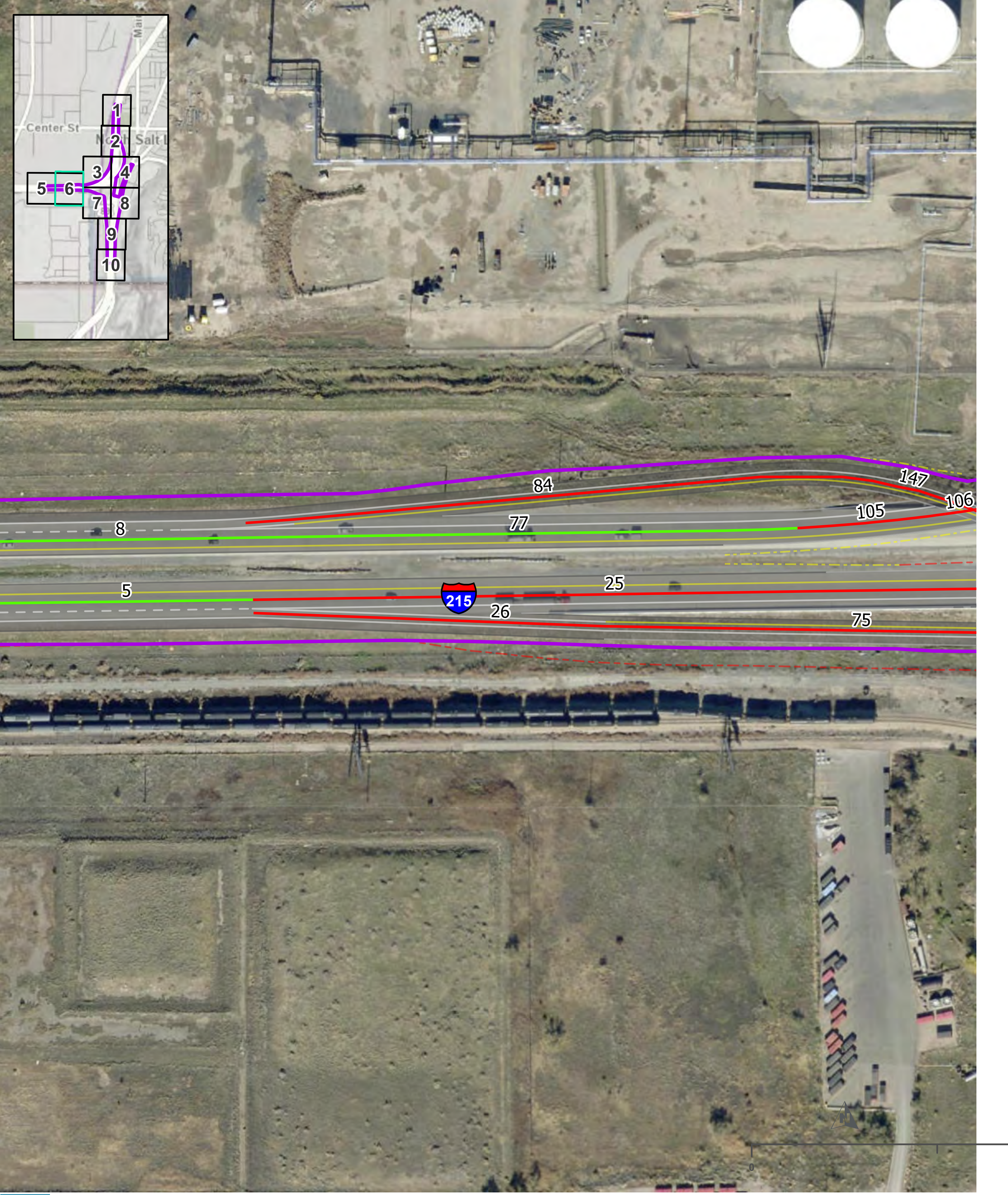


Evaluation Area

Free-Flow Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

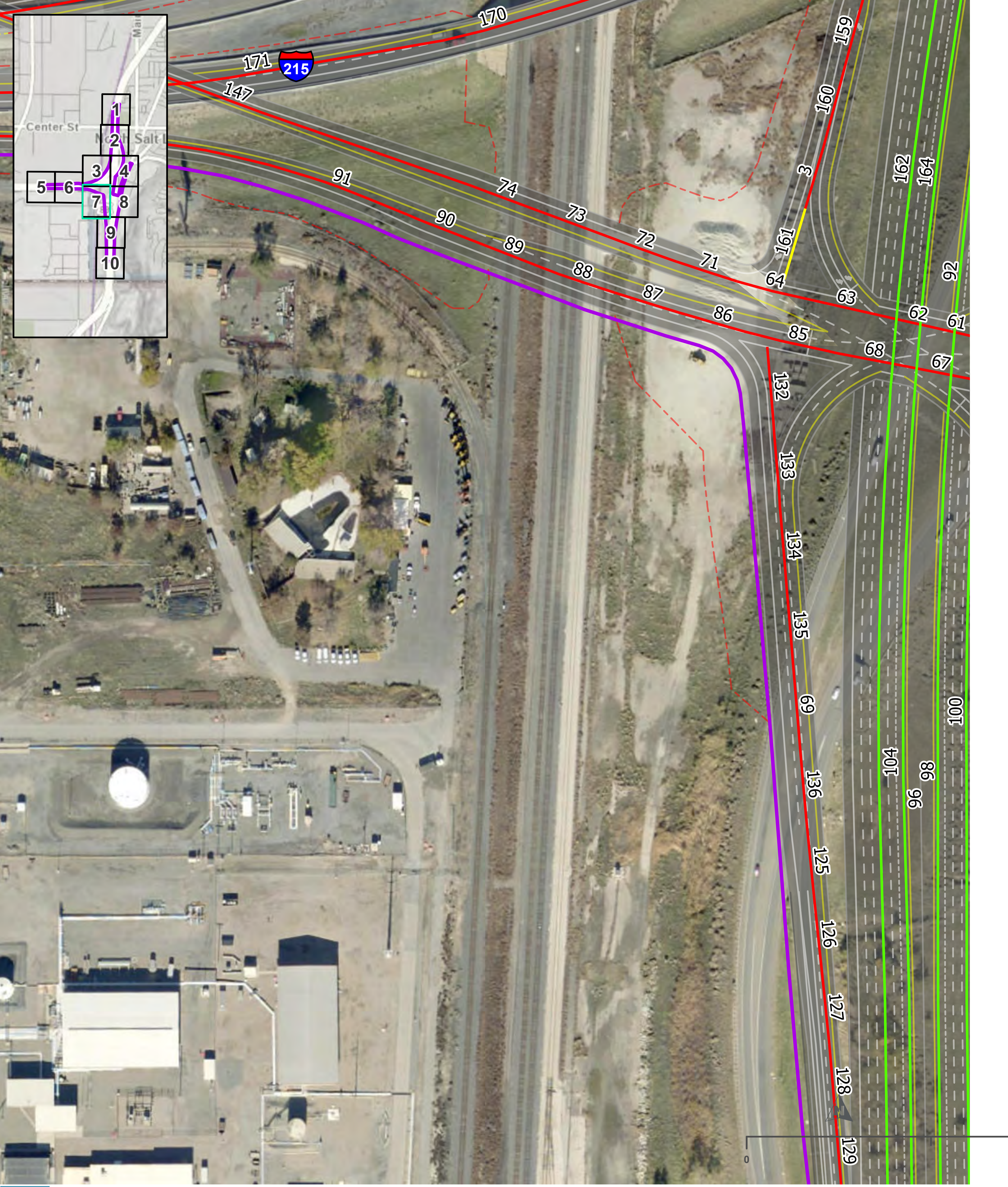
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Links
Free-Flow Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area

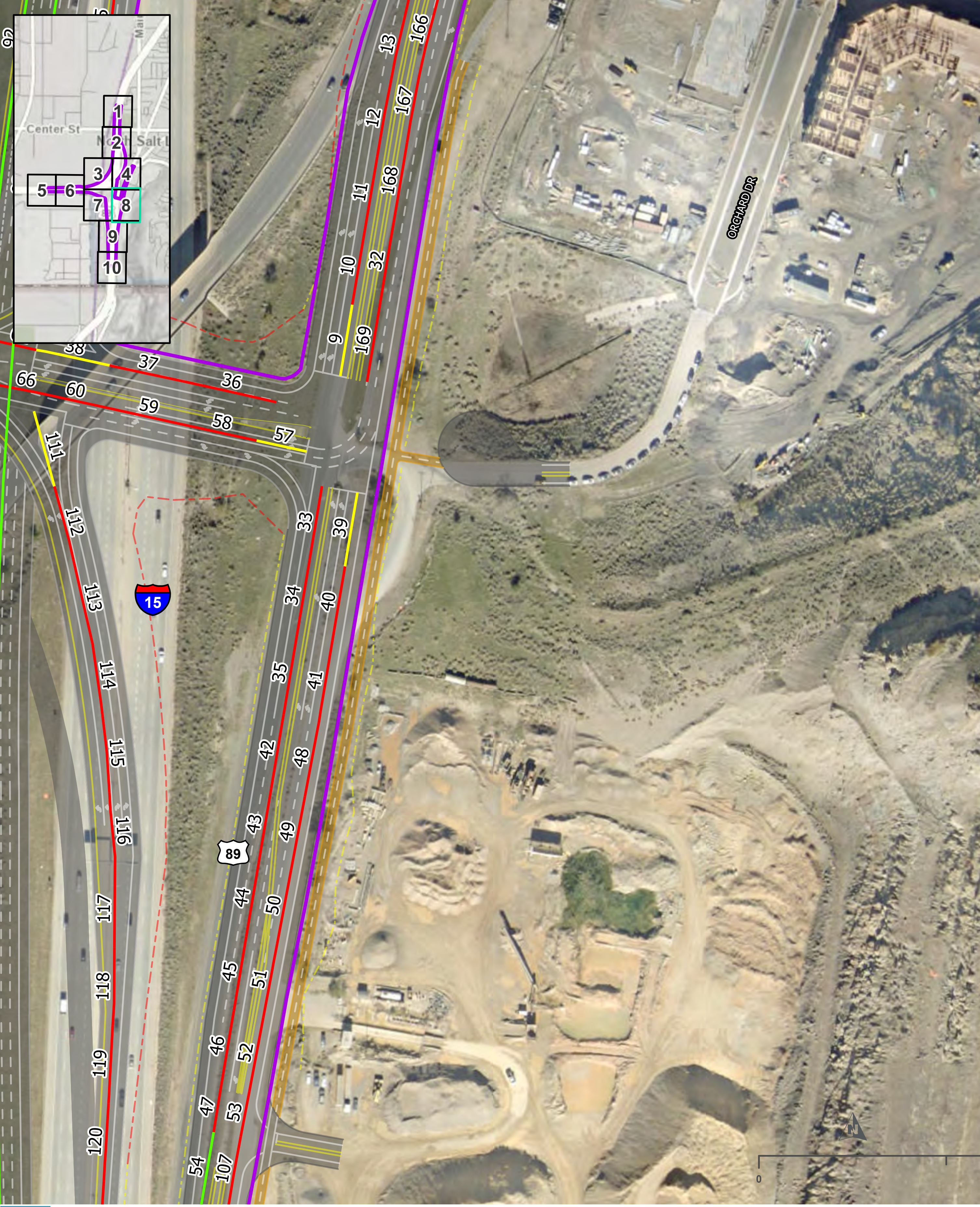
Acceleration/Deceleration Links

Free-Flow Links

Queue Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

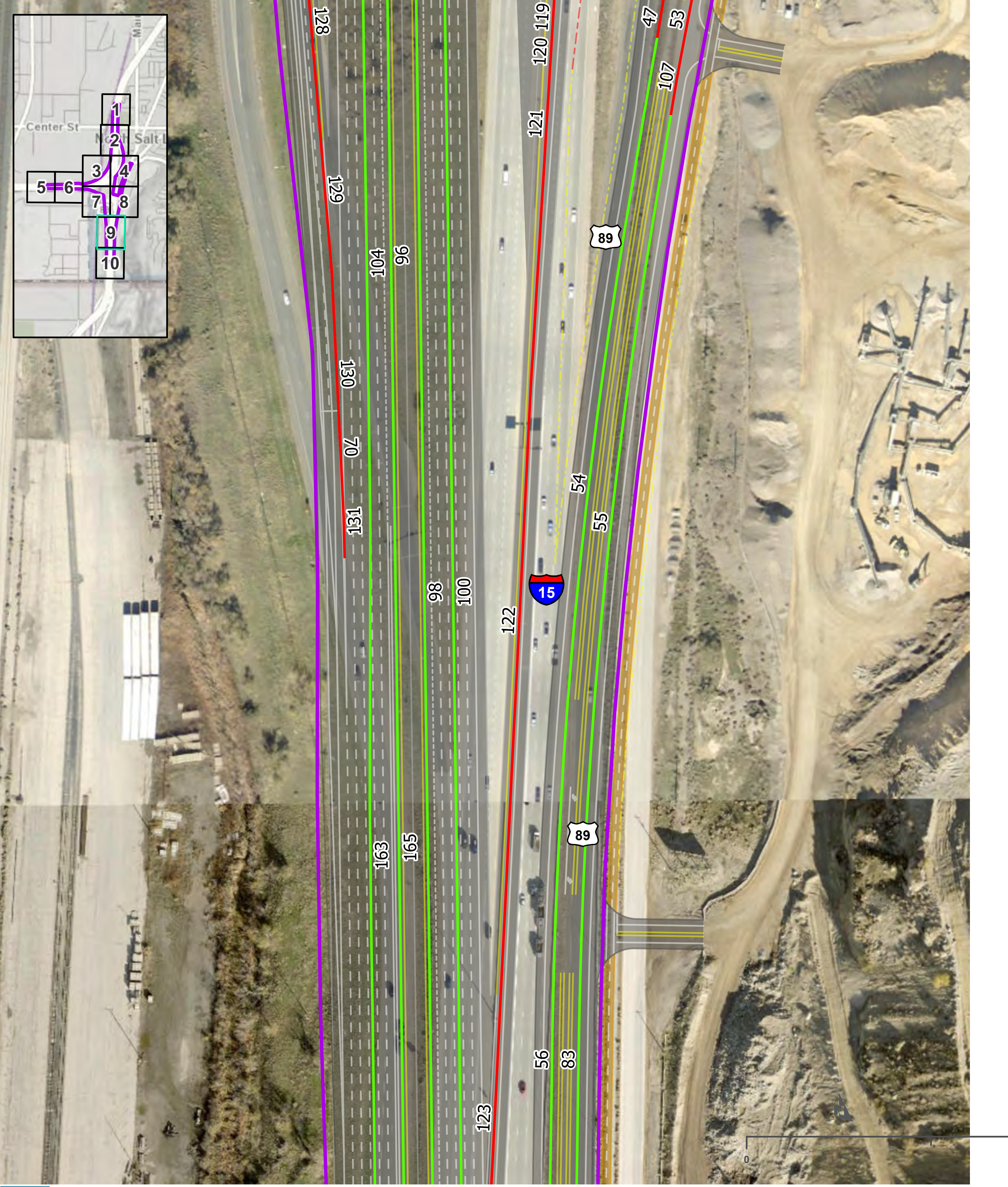
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Links
Free-Flow Links
Queue Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

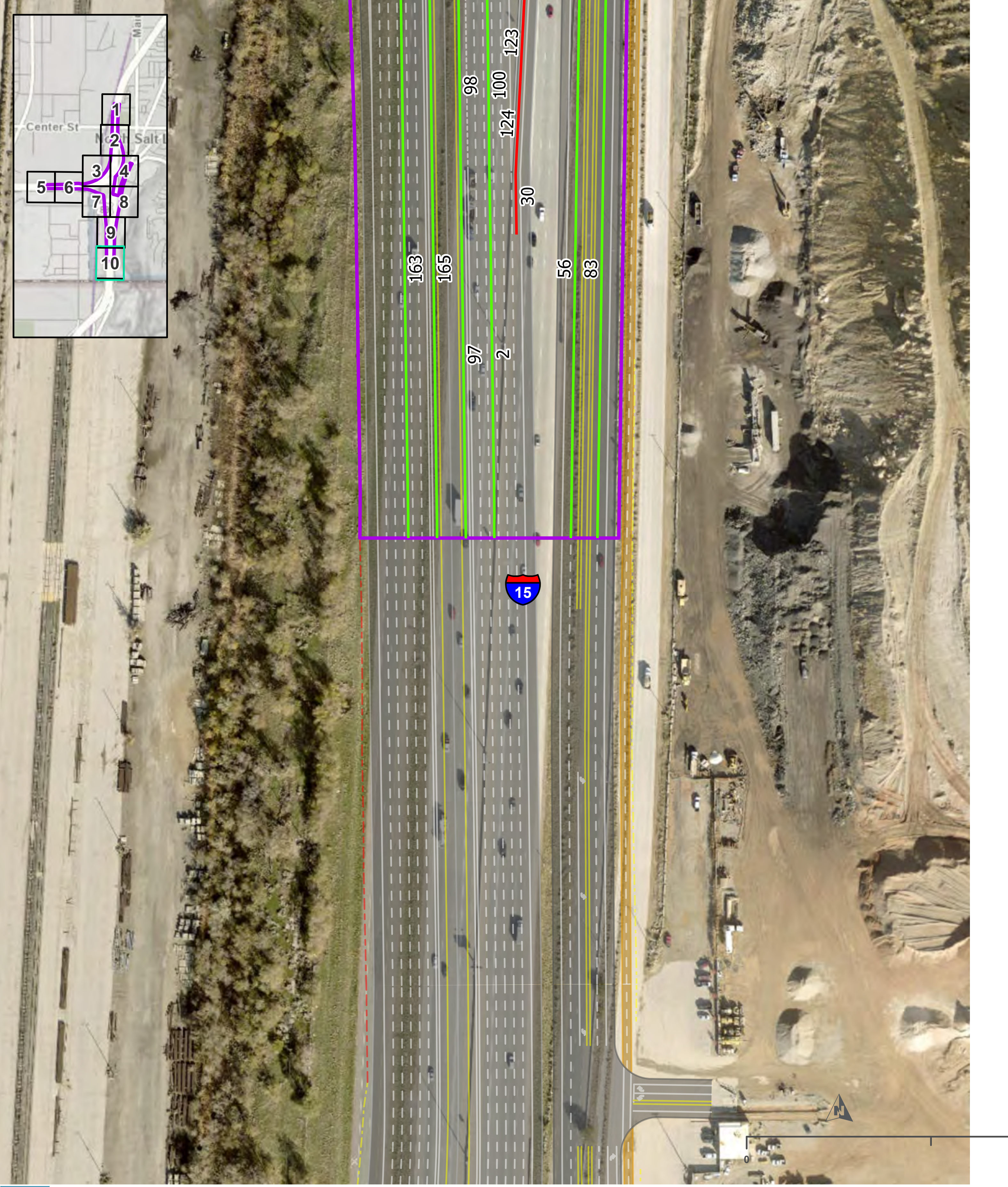
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Links
Free-Flow Links

LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Links
Free-Flow Links

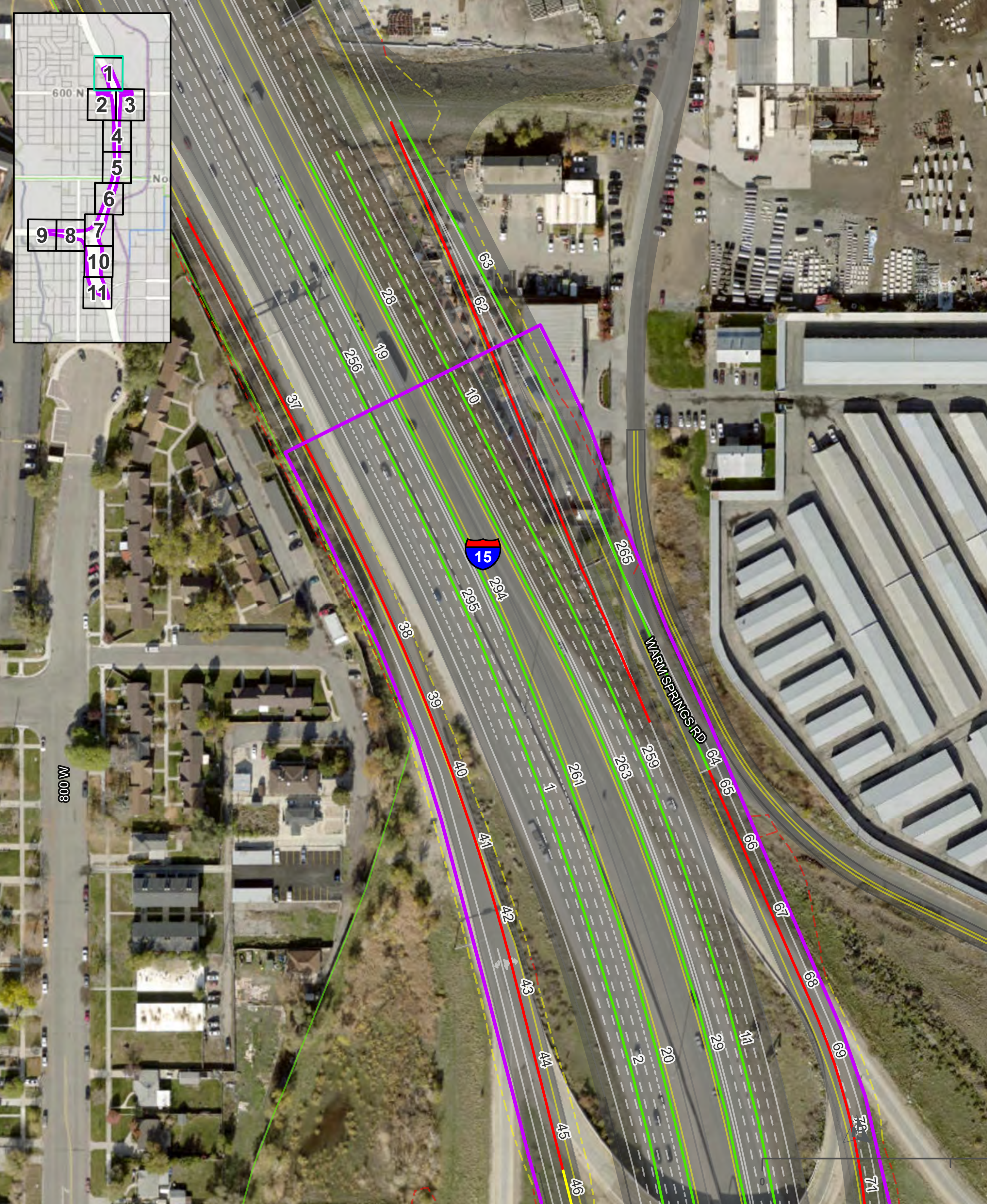
LINKS FOR THE I-215 NORTH SALT LAKE INTERCHANGE HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY

ATTACHMENT B

600 South to 600 North Evaluation Area Links

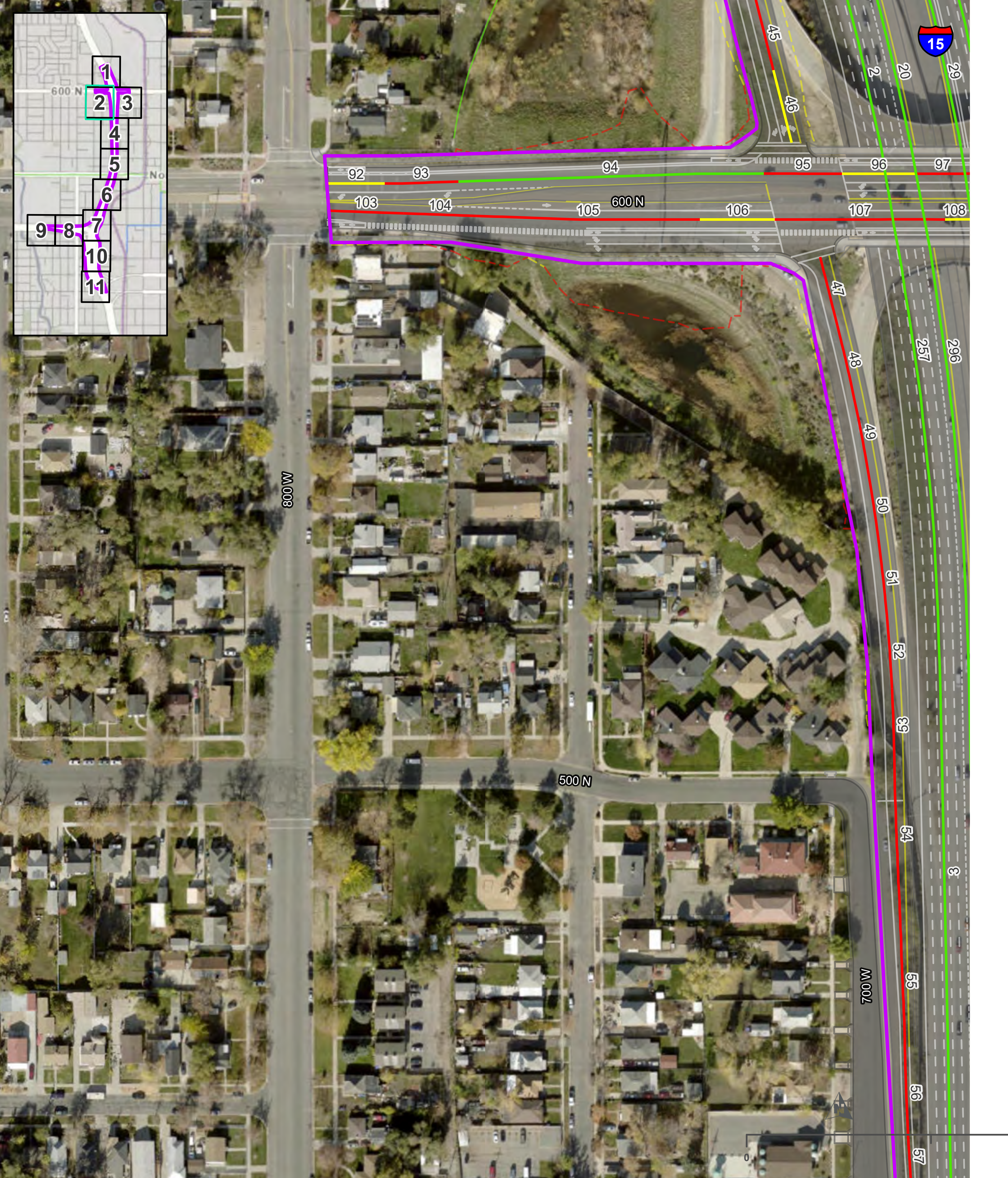
This page is intentionally left blank



Evaluation Area
Acceleration/Deceleration Link
Free-Flow Links
Queue Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

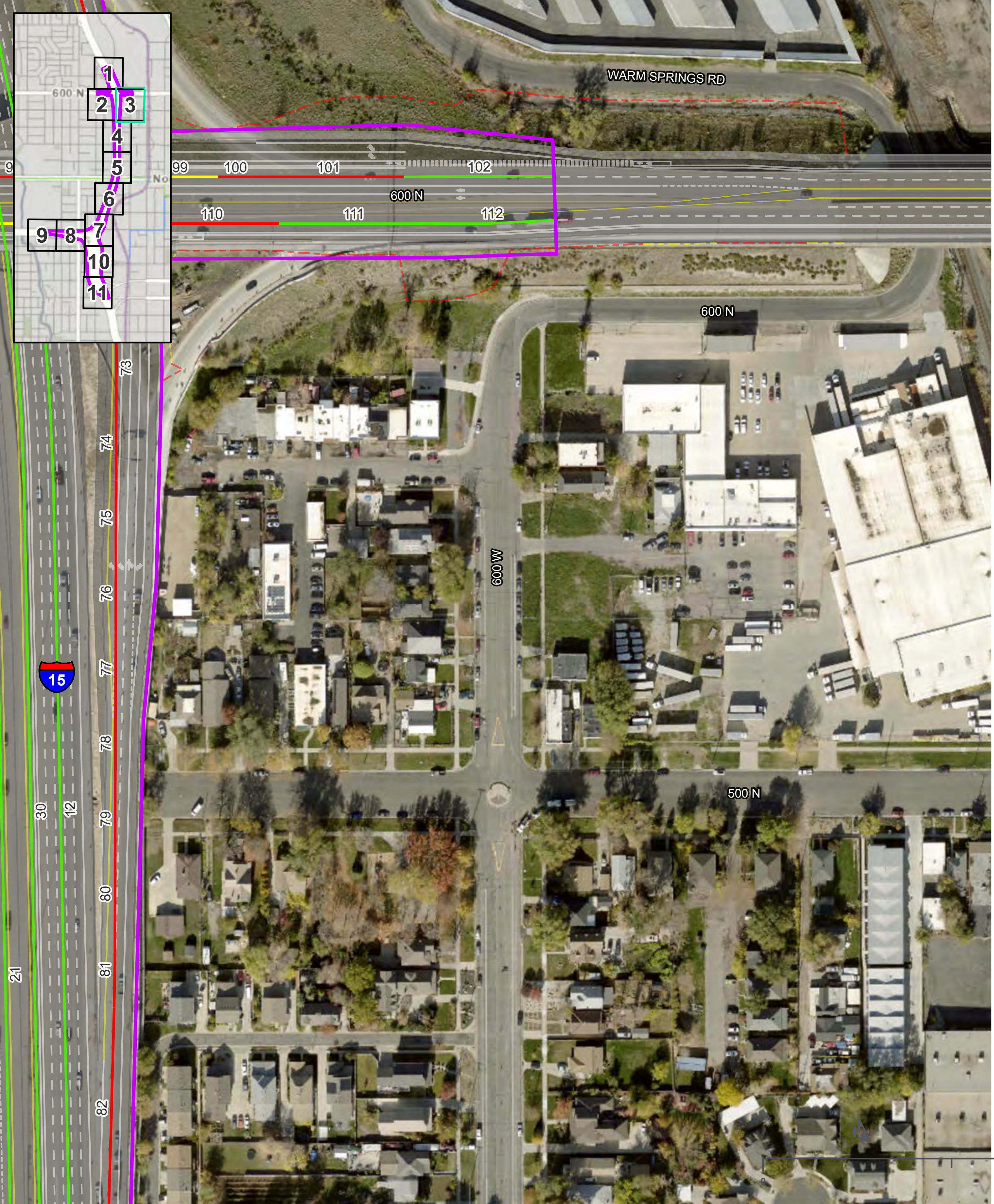
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Link
Free-Flow Links
Queue Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area

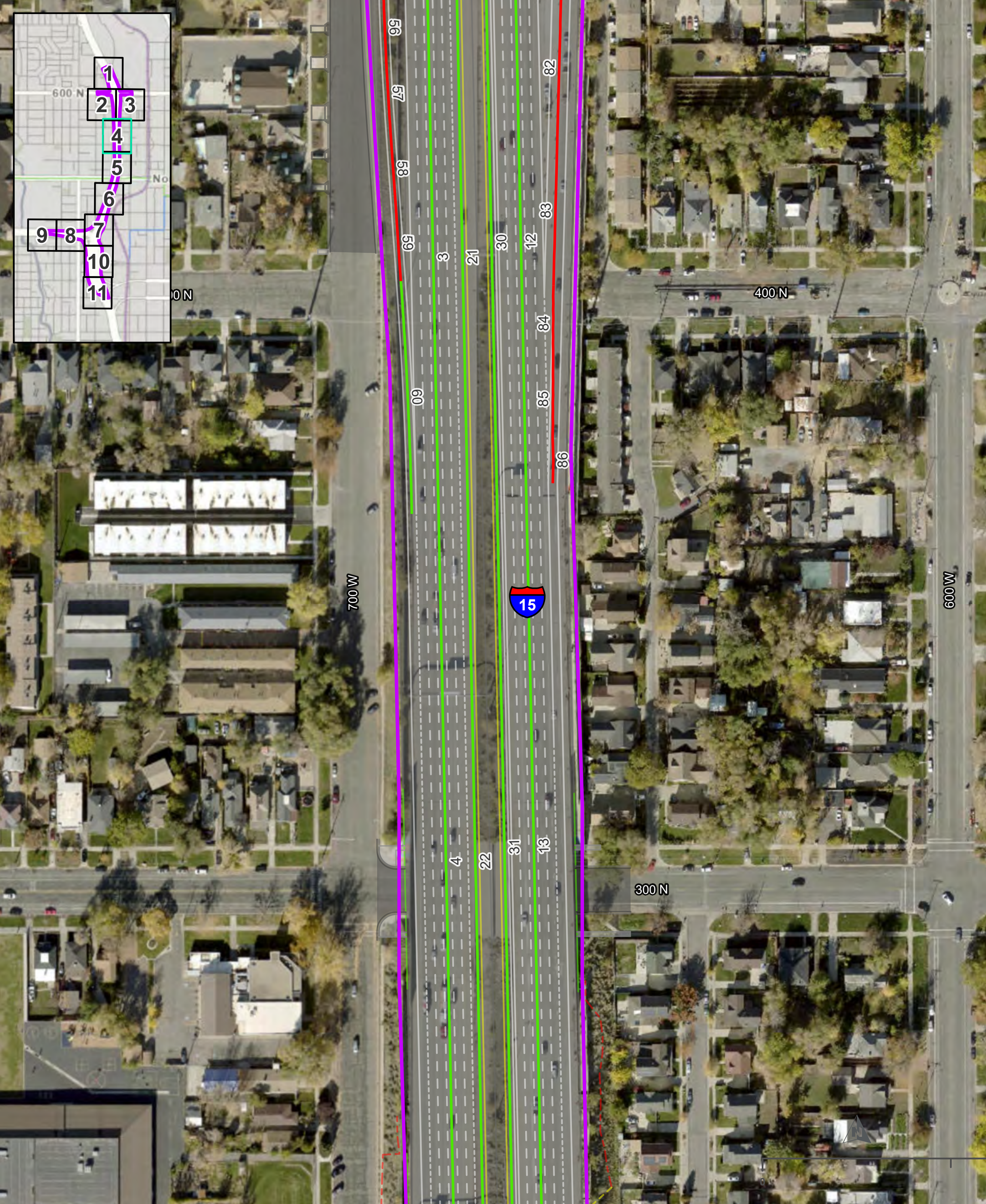
Acceleration/Deceleration Link

Free-Flow Links

Queue Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



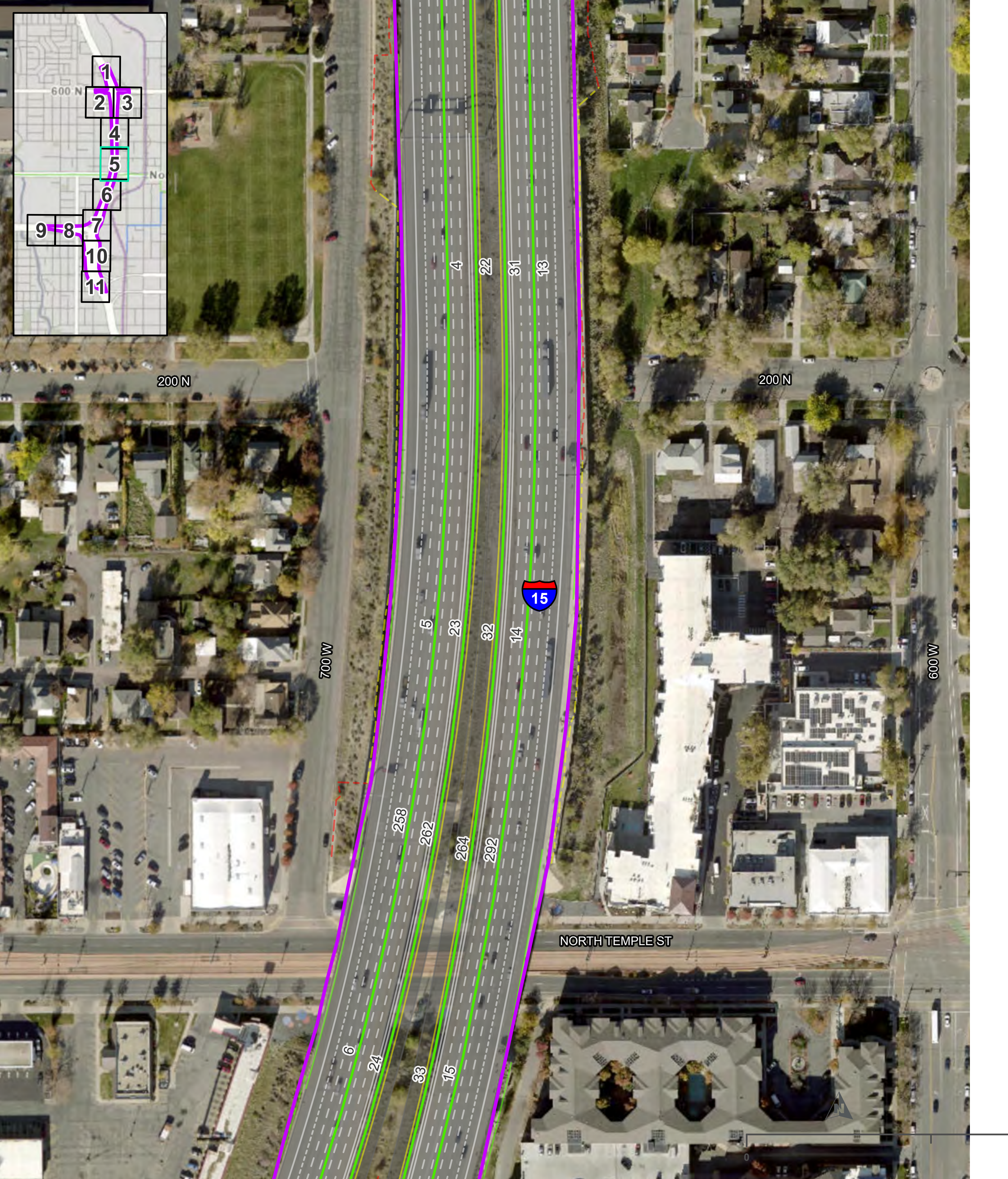
Evaluation Area

Acceleration/Deceleration Link

Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

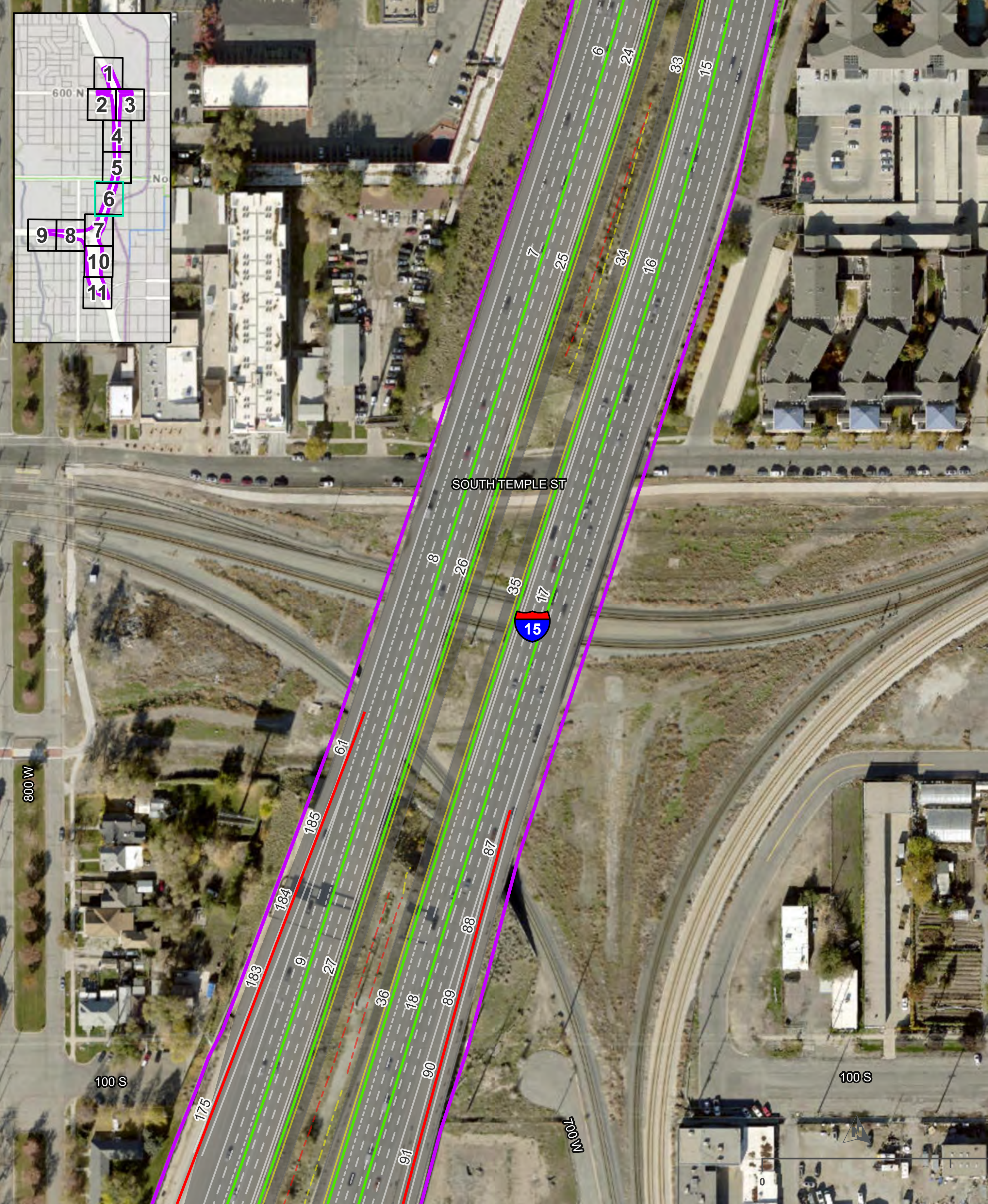
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

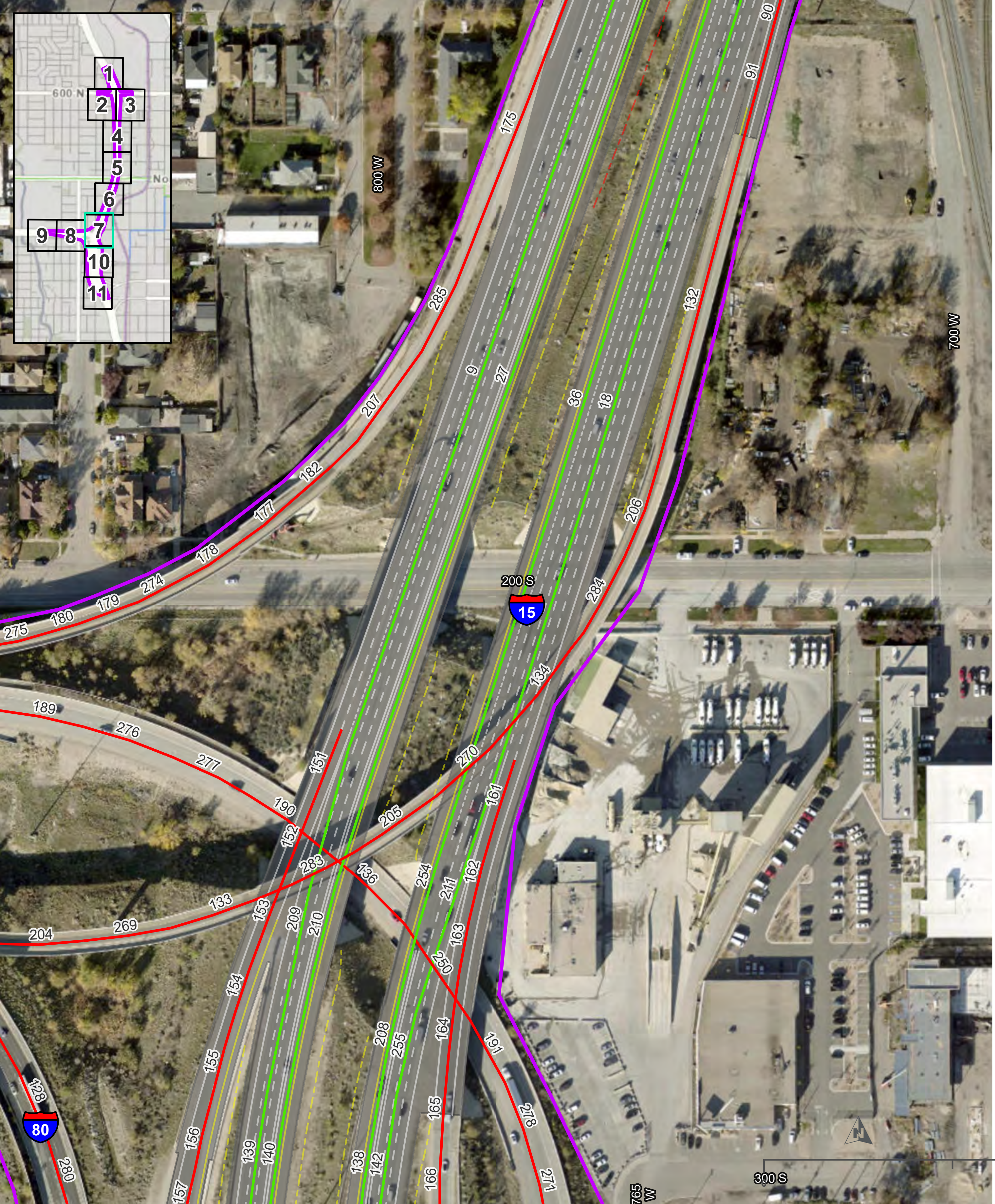
I-15 EIS: FARMINGTON TO SALT LAKE CITY



- Evaluation Area
- Acceleration/Deceleration Link
- Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



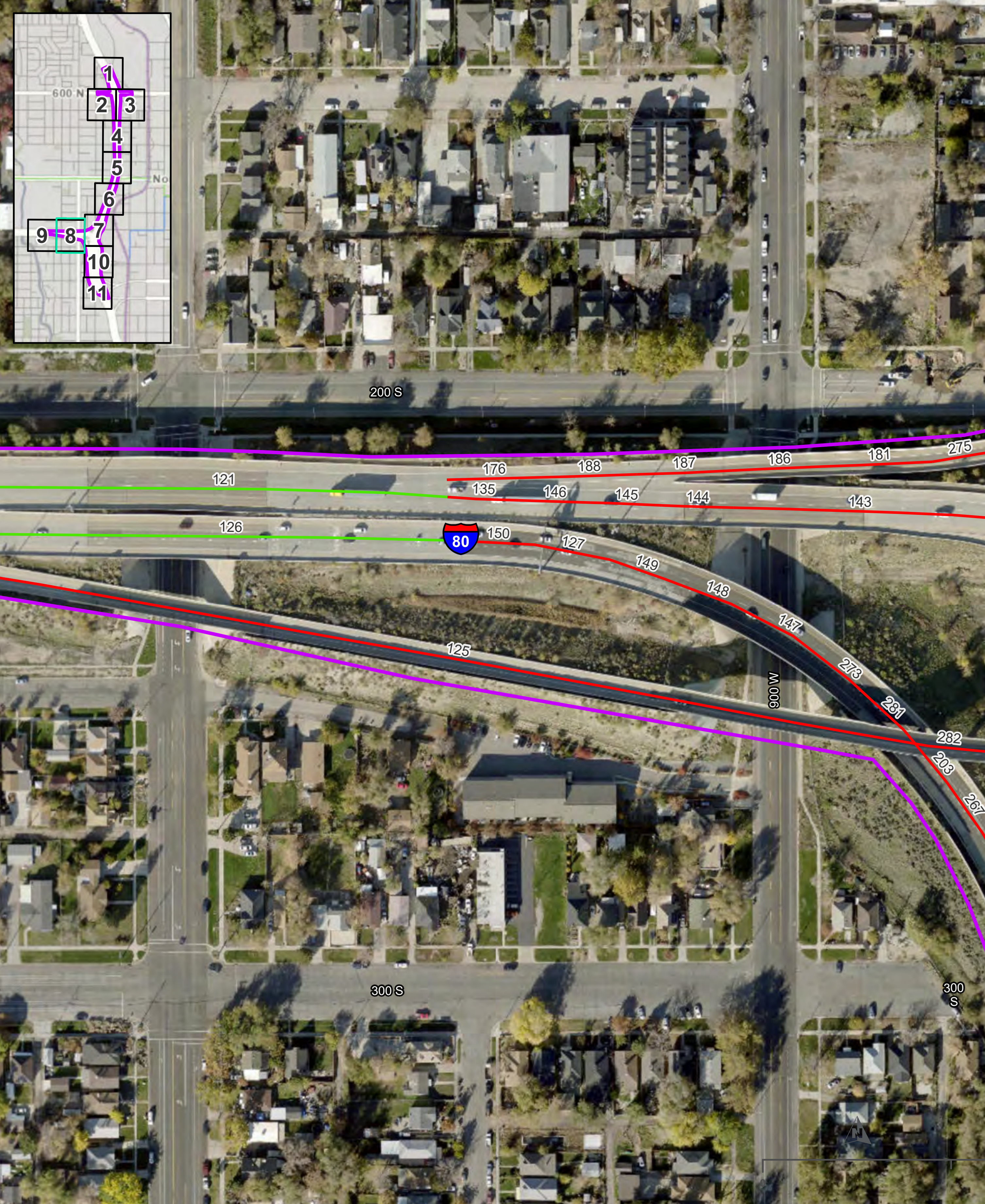
Evaluation Area

Acceleration/Deceleration Link

Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

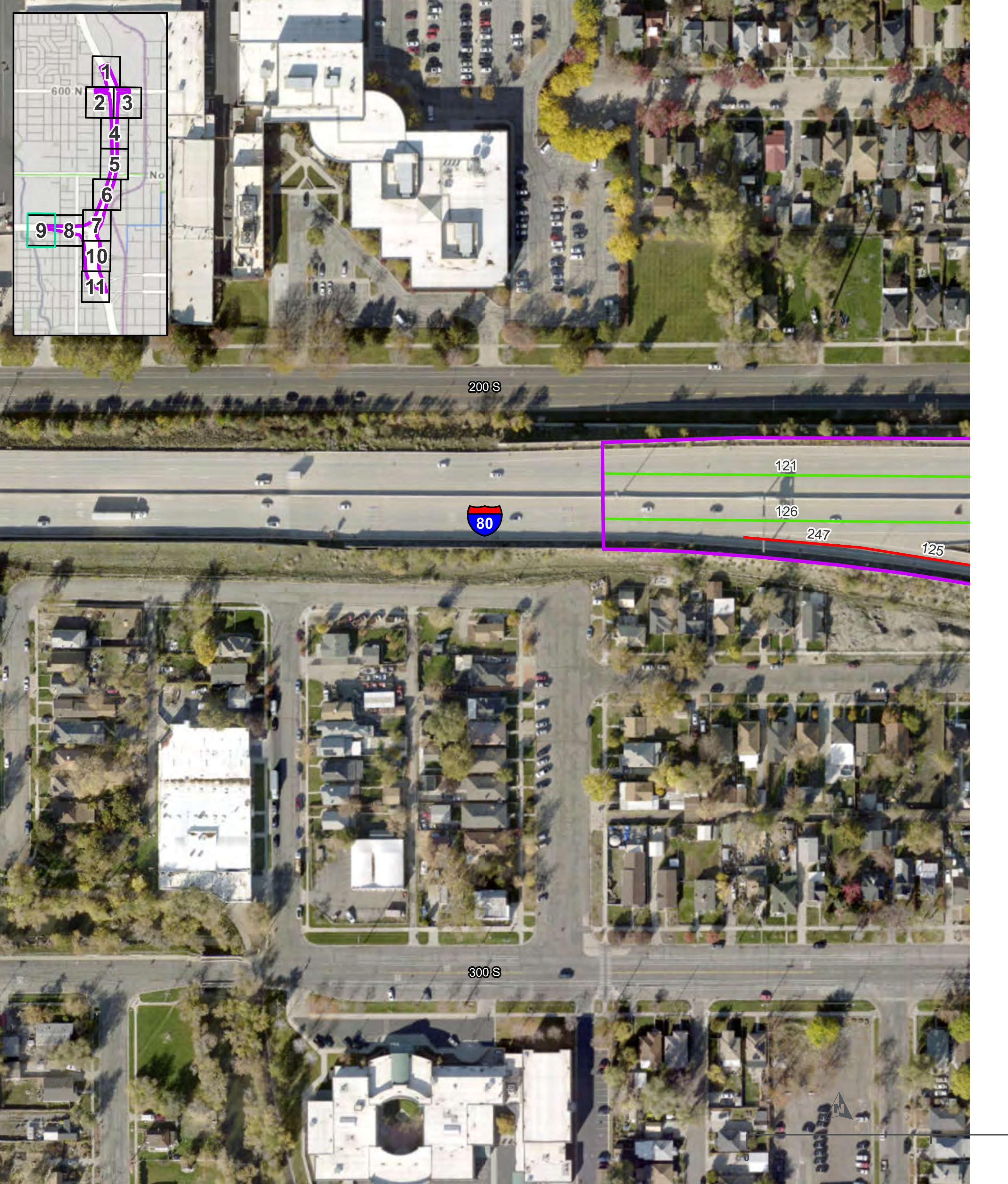
I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Link
Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area
Acceleration/Deceleration Link
Free-Flow Links

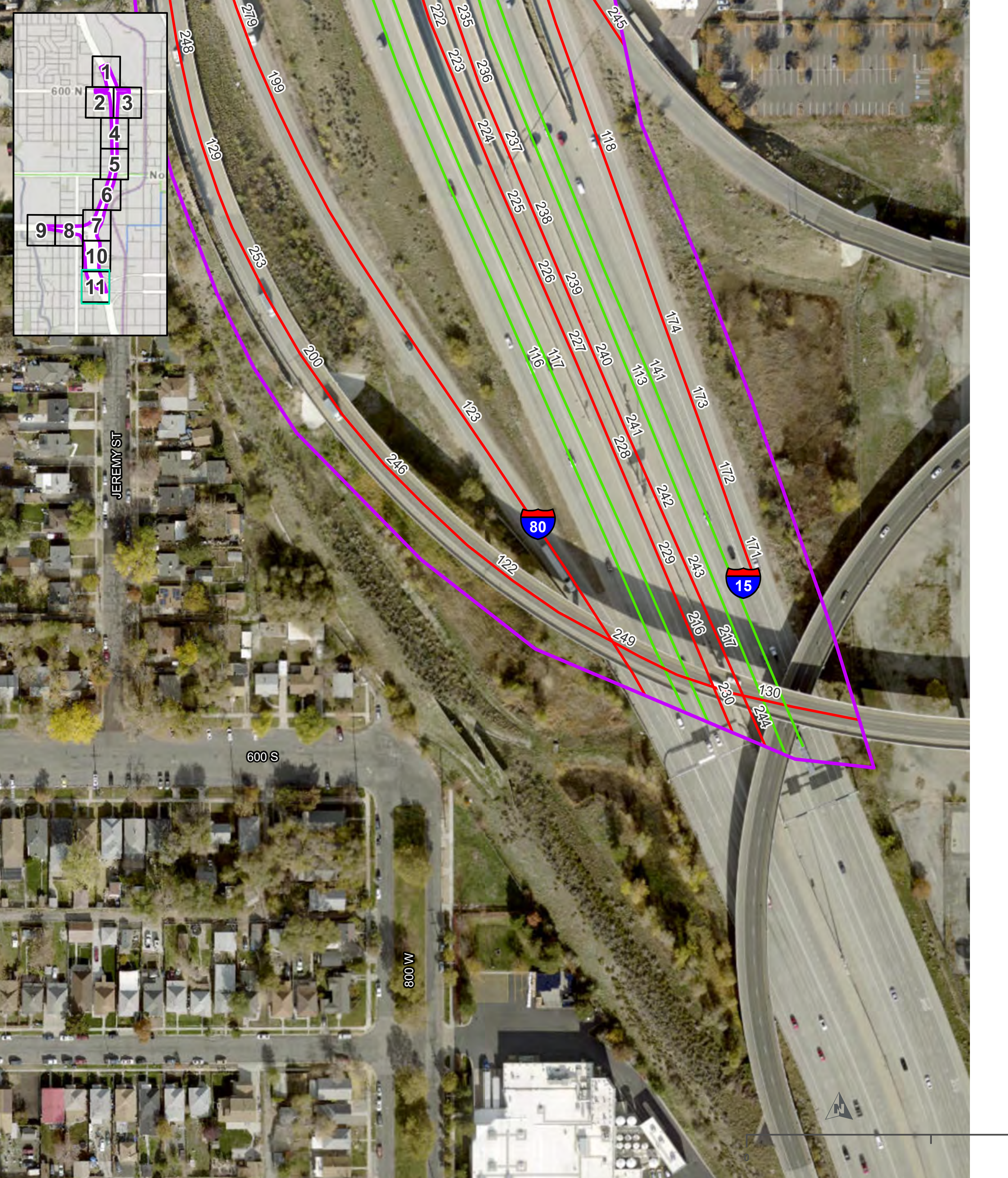
LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY

- Evaluation Area
- Acceleration/Deceleration Link
- Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY



Evaluation Area

Acceleration/Deceleration Link

Free-Flow Links

LINKS FOR THE 600 SOUTH TO 600 NORTH HOT-SPOT ANALYSIS EVALUATION AREA

I-15 EIS: FARMINGTON TO SALT LAKE CITY

This page is intentionally left blank

ATTACHMENT C

I-215 North Salt Lake Interchange Evaluation Area

Link Characteristics

This page is intentionally left blank

Appendix C: I-215 North Salt Lake Interchange Evaluation Area Link Characteristics

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight Hourly AADT 2050
1	I15_NB_5	141.4	4	1	72.4	71.7	27.5	73	5,248	5,780	10,425	2,334	72.1	70.9	23.9	73	5,561	6,137	10,720	2,424
2	I15_NB_1	151.8	4	1	71.8	70.3	34.7	73	5,716	6,233	9,904	2,589	71	69.2	32.9	73	6,121	6,591	10,044	2,692
3	SB_I15_offramp_12	30.5	4	2	10	10	10	10	60	70	43	27	10	10	10	10	62	86	59	33
4	I15_SB_2	499.7	4	1	64	72.3	67.6	73	7,756	5,355	6,983	1,860	61.7	72	65.2	73	8,028	5,636	7,384	1,965
5	NB_I215toI15_EB_ramp_1	249.2	4	3	58.8	58.8	56	58.8	656	662	2,344	235	60	60	52	60	569	694	2,424	239
6	I15_SB_1	307.1	4	1	51.3	70.9	59.1	73	8,883	6,145	8,004	2,147	44.9	70.1	55.8	73	9,349	6,461	8,307	2,281
7	SB_I15toI215_WB_ramp_10	72.4	4	2	55	55	55	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
8	SB_I15toI215_WB_ramp_17	244.1	4	2	57.8	58.4	58.2	58.4	2,111	1,483	1,897	571	57	58.3	58.3	58.4	2,379	1,578	1,738	633
9	US89_SB_13	29.4	5	2	2.5	2.5	2.5	2.5	1,708	1,094	1,444	390	2.5	2.5	2.5	2.5	1,795	1,116	1,493	404
10	US89_SB_12	30.5	5	2	5	5	5	5	1,708	1,094	1,444	390	5	5	5	5	1,795	1,116	1,493	404
11	US89_SB_11	30.5	5	2	10	15	10	15	1,708	1,094	1,444	390	10	15	10	15	1,795	1,116	1,493	404
12	US89_SB_10	30.5	5	2	15	20	15	20	1,708	1,094	1,444	390	15	20	15	20	1,795	1,116	1,493	404
13	US89_SB_9	30.5	5	2	20	25	20	25	1,708	1,094	1,444	390	20	25	20	25	1,795	1,116	1,493	404
14	US89_SB_8	30.5	5	2	20	25	20	30	1,708	1,094	1,444	390	20	25	20	30	1,795	1,116	1,493	404
15	US89_SB_7	30.5	5	2	20	30	25	35	1,708	1,094	1,444	390	20	30	25	35	1,795	1,116	1,493	404
16	US89_SB_6	30.5	5	2	20	30	25	35	1,708	1,094	1,444	390	20	30	25	35	1,795	1,116	1,493	404
17	US89_NB_27	30.6	5	2	2.5	2.5	2.5	2.5	907	1,005	2,331	396	2.5	2.5	2.5	2.5	896	1,022	2,456	401
18	US89_NB_26	30.4	5	2	10	10	5	10	907	1,005	2,331	396	10	10	5	10	896	1,022	2,456	401
19	US89_NB_25	30.6	5	2	20	20	10	20	907	1,005	2,331	396	20	20	10	20	896	1,022	2,456	401
20	US89_NB_24	30.5	5	2	25	25	15	25	907	1,005	2,331	396	25	25	15	25	896	1,022	2,456	401
21	US89_NB_23	30.5	5	2	30	30	20	30	907	1,005	2,331	396	30	30	20	30	896	1,022	2,456	401
22	US89_NB_22	30.5	5	2	35	35	20	35	907	1,005	2,331	396	35	35	20	35	896	1,022	2,456	401
23	US89_NB_21	30.5	5	2	35	35	20	35	907	1,005	2,331	396	35	35	20	35	896	1,022	2,456	401
24	US89_NB_20	36.1	5	2	35	35	25	35	907	1,005	2,331	396	35	35	20	35	896	1,022	2,456	401
25	NB_I215toI15_EB_ramp_2	343.2	4	3	55	55	55	55	489	475	1,701	151	55	55	52	55	411	477	1,757	148
26	Interchange_I215_EB_ramp_16	202.4	4	3	55	55	54.8	55	167	186	643	84	55	55	54.7	55	158	216	667	90
27	NB_I215toI15_EB_ramp_7	95.9	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.6	55	411	477	1,757	148
28	NB_I215toI15_EB_ramp_18	182.8	4	1	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
29	NB_I215toI15_EB_ramp_12	30.8	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
30	NB_I15_offramp_1	31.6	4	1	71.8	70.3	34.7	73	1,077	1,066	1,293	462	71	69.2	32.9	73	1,103	1,076	1,262	475
31	US89_NB_19	30.5	5	2	35	35	20	35	907	1,005	2,331	396	35	35	20	35	896	1,022	2,456	401
32	US89_NB_14	32.9	5	2	20	20	10	20	907	1,005	2,331	396	20	20	10	20	896	1,022	2,456	401
33	US89_SB_14	30.5	5	1	5	5	5	5	464	169	351	35	5	5	5	5	529	186	457	35
34	US89_SB_15	30.5	5	1	15	15	15	15	464	169	351	35	15	15	15	15	529	186	457	35

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight Hourly AADT 2050
35	US89_SB_16	33.1	5	1	20	20	20	20	464	169	351	35	20	20	20	20	529	186	457	35
36	Interchange_I215_WB_ramp_1	38.9	4	2	15	15	15	15	1,324	1,004	1,389	385	15	15	15	15	1,380	1,049	1,474	417
37	Interchange_I215_WB_ramp_2	30.5	4	2	5	5	5	5	1,324	1,004	1,389	385	5	5	5	5	1,380	1,049	1,474	417
38	Interchange_I215_WB_ramp_3	30.5	4	2	2.5	2.5	2.5	2.5	1,324	1,004	1,389	385	2.5	2.5	2.5	2.5	1,380	1,049	1,474	417
39	US89_NB_12	30.5	5	1	2.5	2.5	2.5	2.5	79	107	1,028	20	2.5	2.5	2.5	2.5	103	135	1,201	31
40	US89_NB_11	30.5	5	1	5	5	5	5	79	107	1,028	20	5	5	5	5	103	135	1,201	31
41	US89_NB_10	34.0	5	1	15	15	15	15	79	107	1,028	20	15	15	15	15	103	135	1,201	31
42	US89_SB_17	30.5	5	1	35	35	35	35	464	169	351	35	35	35	35	35	529	186	457	35
43	US89_SB_18	30.5	5	1	40	40	40	40	464	169	351	35	40	40	40	40	529	186	457	35
44	US89_SB_19	30.5	5	1	45	45	45	45	464	169	351	35	45	45	45	45	529	186	457	35
45	US89_SB_20	30.5	5	1	45	45	45	45	464	169	351	35	45	45	45	45	529	186	457	35
46	US89_SB_21	30.5	5	1	45	45	45	45	464	169	351	35	45	45	45	45	529	186	457	35
47	US89_SB_22	19.7	5	1	45	45	45	45	464	169	351	35	45	45	45	45	529	186	457	35
48	US89_NB_9	30.5	5	1	20	20	20	20	79	107	1,028	20	20	20	20	20	103	135	1,201	31
49	US89_NB_8	30.5	5	1	35	35	35	35	79	107	1,028	20	35	35	35	35	103	135	1,201	31
50	US89_NB_7	30.5	5	1	30	30	30	30	79	107	1,028	20	30	30	30	30	103	135	1,201	31
51	US89_NB_6	30.5	5	1	35	35	35	35	79	107	1,028	20	35	35	35	35	103	135	1,201	31
52	US89_NB_5	30.5	5	1	40	40	40	40	79	107	1,028	20	40	40	40	40	103	135	1,201	31
53	US89_NB_4	18.8	5	1	45	45	45	45	79	107	1,028	20	45	45	45	45	103	135	1,201	31
54	US89_SB_23	373.5	5	1	45	45	45	45	464	169	351	35	45	45	45	45	529	186	457	35
55	US89_NB_2	340.8	5	1	45	45	45	45	79	107	1,028	20	45	45	45	45	103	135	1,201	31
56	US89_SB_24	280.2	5	1	45	45	45	45	464	169	351	35	45	45	45	45	529	186	457	35
57	Interchange_I215_EB_ramp_1	20.9	4	2	2.5	2.5	2.5	2.5	909	977	1,598	407	2.5	2.5	2.5	2.5	909	1,006	1,694	418
58	Interchange_I215_EB_ramp_2	30.5	4	2	5	5	5	5	909	977	1,598	407	5	5	5	5	909	1,006	1,694	418
59	Interchange_I215_EB_ramp_3	30.5	4	2	10	10	10	10	909	977	1,598	407	10	10	10	10	909	1,006	1,694	418
60	Interchange_I215_EB_ramp_4	30.5	4	2	15	15	15	15	909	977	1,598	407	15	15	15	15	909	1,006	1,694	418
61	Interchange_I215_WB_ramp_4	22.5	4	2	15	15	15	15	1,641	1,276	1,637	523	15	15	15	15	1,697	1,329	1,551	564
62	Interchange_I215_WB_ramp_5	30.5	4	2	20	20	20	20	1,641	1,276	1,637	523	20	20	20	20	1,697	1,329	1,551	564
63	Interchange_I215_WB_ramp_6	30.5	4	2	25	25	25	25	984	692	876	284	25	25	25	25	1,058	753	816	317
64	Interchange_I215_WB_ramp_7	30.5	4	2	30	30	30	30	984	692	876	284	30	30	30	30	1,058	753	816	317
65	NB_I15_onramp_1	30.5	4	1	10	10	10	10	80	73	52	27	10	10	10	10	97	91	114	33
66	Interchange_I215_EB_ramp_5	10.5	4	2	20	20	20	20	226	256	605	111	20	20	20	20	219	302	623	123
67	Interchange_I215_EB_ramp_6	30.5	4	2	25	25	25	25	226	256	605	111	25	25	25	25	219	302	623	123
68	Interchange_I215_EB_ramp_7	30.5	4	2	30	30	30	30	226	256	605	111	30	30	30	30	219	302	623	123
69	SB_I15_onramp_5	33.0	4	2	30	30	30	30	657	583	843	239	30	30	30	30	639	577	838	247
70	SB_I15_onramp_12	30.5	4	2	55	70	60	70	657	583	843	239	55	70	55	70	639	577	838	247
71	Interchange_I215_WB_ramp_8	26.1	4	4	35	35	35	35	984	692	876	284	35	35	35	35	1,058	753	816	317
72	Interchange_I215_WB_ramp_9	30.5	4	4	40	40	40	40	984	692	876	284	40	40	40	40	1,058	753	816	317

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight Hourly AADT 2050
73	Interchange_I215_WB_ramp_10	30.5	4	4	45	45	45	45	984	692	876	284	45	45	45	45	1,058	753	816	317
74	Interchange_I215_WB_ramp_11	30.5	4	4	50	50	50	50	984	692	876	284	50	50	50	50	1,058	753	816	317
75	Interchange_I215_EB_ramp_15	206.4	4	3	55	55	54.9	55	167	186	643	84	55	55	54.8	55	158	216	667	90
76	SB_I15toI215_WB_ramp_12	82.1	4	2	55	55	54.9	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
77	SB_I15toI215_WB_ramp_16	228.4	4	2	55	55	54.9	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
78	SB_I15toI215_WB_ramp_3	319.8	4	2	55	60	55	65	1,127	791	1,021	287	54.9	60	55	65	1,321	825	922	316
79	SB_I15toI215_WB_ramp_2	30.5	4	2	55	65	55	70	1,127	791	1,021	287	50	65	55	70	1,321	825	922	316
80	SB_I15toI215_WB_ramp_1	30.5	4	2	51.3	70.9	59.1	73	1,127	791	1,021	287	44.9	70.1	55.8	73	1,321	825	922	316
81	I15_NB_HOV_4	642.3	4	1	78.8	78.5	60.5	79	414	726	1,610	266	78.6	78.3	56.9	79	456	713	1,541	250
82	I15_NB_4	643.1	4	1	72.7	72.3	52	73	4,758	5,304	8,724	2,183	72.5	71.9	48.9	73	5,150	5,660	8,963	2,276
83	US89_NB_1	280.5	5	1	45	45	45	45	79	107	1,028	20	45	45	45	45	103	135	1,201	31
84	Interchange_I215_WB_ramp_13	245.8	4	3	50.3	54.5	53.4	55	984	692	876	284	47.9	54.2	54.1	55	1,058	753	816	317
85	Interchange_I215_EB_ramp_8	34.1	4	3	35	35	35	35	167	186	643	84	35	35	35	35	158	216	667	90
86	Interchange_I215_EB_ramp_9	30.5	4	3	40	40	40	40	167	186	643	84	40	40	40	40	158	216	667	90
87	Interchange_I215_EB_ramp_10	30.5	4	3	45	45	45	45	167	186	643	84	45	45	45	45	158	216	667	90
88	Interchange_I215_EB_ramp_11	30.5	4	3	50	50	50	50	167	186	643	84	50	50	50	50	158	216	667	90
89	Interchange_I215_EB_ramp_12	30.5	4	3	55	55	55	55	167	186	643	84	55	55	55	55	158	216	667	90
90	Interchange_I215_EB_ramp_13	30.5	4	3	55	55	55	55	167	186	643	84	55	55	55	55	158	216	667	90
91	Interchange_I215_EB_ramp_14	60.9	4	3	55	55	55	55	167	186	643	84	55	55	55	55	158	216	667	90
92	I15_NB_HOV_3	430.4	4	1	78.8	78.5	60.5	79	414	726	1,610	266	78.6	78.3	56.9	79	456	713	1,541	250
93	I15_NB_3	432.3	4	1	74.6	73.9	44.1	75	4,679	5,231	8,673	2,156	74.2	73.3	41.4	75	5,053	5,568	8,849	2,243
94	I15_SB_HOV_1	306.3	4	1	73.5	78.6	75.6	79	992	609	1,145	211	71	78.4	74.3	79	942	679	1,168	231
95	I15_SB_HOV_2	500.3	4	1	73.5	78.6	75.6	79	992	609	1,145	211	71	78.4	74.3	79	942	679	1,168	231
96	I15_SB_HOV_4	512.1	4	1	73.5	78.6	75.6	79	1,054	673	1,237	232	71	78.4	74.3	79	995	731	1,264	253
97	I15_NB_HOV_1	151.8	4	1	78.8	78.5	60.5	79	454	790	1,672	295	78.6	78.3	56.9	79	492	766	1,608	276
98	I15_NB_HOV_2	811.4	4	1	78.8	78.5	60.5	79	454	790	1,672	295	78.6	78.3	56.9	79	492	766	1,608	276
99	I15_NB_HOV_5	142.2	4	1	78.8	78.5	60.5	79	414	726	1,610	266	78.6	78.3	56.9	79	456	713	1,541	250
100	I15_NB_2	808.3	4	1	74.6	73.9	45.1	75	4,638	5,168	8,611	2,127	74.3	73.4	42.4	75	5,018	5,515	8,782	2,217
101	US89_SB_1	30.5	5	2	20	35	25	35	1,708	1,094	1,444	390	20	35	25	35	1,795	1,116	1,493	404
102	US89_SB_2	30.5	5	2	20	30	25	35	1,708	1,094	1,444	390	20	30	25	35	1,795	1,116	1,493	404
103	US89_SB_3	121.9	5	2	20	30	25	35	1,708	1,094	1,444	390	20	30	25	35	1,795	1,116	1,493	404
104	I15_SB_4	521.2	4	1	61.1	74	66.7	75	7,634	5,220	6,848	1,812	57.8	73.5	63.3	75	7,913	5,497	7,229	1,910
105	SB_I15toI215_WB_ramp_15	60.9	4	2	55	55	54.9	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
106	SB_I15toI215_WB_ramp_14	30.5	4	2	55	55	54.9	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
107	US89_NB_3	30.5	5	1	45	45	45	45	79	107	1,028	20	45	45	45	45	103	135	1,201	31
108	US89_SB_5	36.0	5	2	20	30	25	35	1,708	1,094	1,444	390	20	30	25	35	1,795	1,116	1,493	404
109	US89_SB_4	30.5	5	2	20	30	25	35	1,708	1,094	1,444	390	20	30	25	35	1,795	1,116	1,493	404
110	US89_NB_18	46.2	5	2	35	35	20	35	907	1,005	2,331	396	35	35	20	35	896	1,022	2,456	401

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight Hourly AADT 2050
111	NB_I15_offramp_15	31.6	4	1	2.5	2.5	2.5	2.5	1,077	1,066	1,293	462	2.5	2.5	2.5	2.5	1,103	1,076	1,262	475
112	NB_I15_offramp_14	31.6	4	1	5	5	5	5	1,077	1,066	1,293	462	5	5	5	5	1,103	1,076	1,262	475
113	NB_I15_offramp_13	31.6	4	1	10	10	10	10	1,077	1,066	1,293	462	10	10	10	10	1,103	1,076	1,262	475
114	NB_I15_offramp_12	31.6	4	1	15	15	15	15	1,077	1,066	1,293	462	15	15	15	15	1,103	1,076	1,262	475
115	NB_I15_offramp_11	31.6	4	1	20	20	20	20	1,077	1,066	1,293	462	20	20	20	20	1,103	1,076	1,262	475
116	NB_I15_offramp_10	31.6	4	1	25	25	25	25	1,077	1,066	1,293	462	25	25	25	25	1,103	1,076	1,262	475
117	NB_I15_offramp_9	31.6	4	1	30	30	30	30	1,077	1,066	1,293	462	30	30	30	30	1,103	1,076	1,262	475
118	NB_I15_offramp_8	31.6	4	1	35	35	34.7	35	1,077	1,066	1,293	462	35	35	32.9	35	1,103	1,076	1,262	475
119	NB_I15_offramp_7	31.6	4	1	40	40	34.7	40	1,077	1,066	1,293	462	40	40	32.9	40	1,103	1,076	1,262	475
120	NB_I15_offramp_6	31.6	4	1	45	45	34.7	45	1,077	1,066	1,293	462	45	45	32.9	45	1,103	1,076	1,262	475
121	NB_I15_offramp_5	31.6	4	1	50	50	34.7	50	1,077	1,066	1,293	462	50	50	32.9	50	1,103	1,076	1,262	475
122	NB_I15_offramp_4	379.7	4	1	55	55	34.7	55	1,077	1,066	1,293	462	55	55	32.9	55	1,103	1,076	1,262	475
123	NB_I15_offramp_3	31.6	4	1	60	60	34.7	60	1,077	1,066	1,293	462	60	60	32.9	60	1,103	1,076	1,262	475
124	NB_I15_offramp_2	31.6	4	1	65	65	34.7	65	1,077	1,066	1,293	462	65	65	32.9	65	1,103	1,076	1,262	475
125	SB_I15_onramp_6	30.5	4	2	35	35	35	35	657	583	843	239	35	35	35	35	639	577	838	247
126	SB_I15_onramp_7	30.5	4	2	45	45	45	45	657	583	843	239	45	45	45	45	639	577	838	247
127	SB_I15_onramp_8	30.5	4	2	50	50	50	50	657	583	843	239	50	50	50	50	639	577	838	247
128	SB_I15_onramp_9	30.5	4	2	55	55	55	55	657	583	843	239	55	55	55	55	639	577	838	247
129	SB_I15_onramp_10	121.9	4	2	55	60	55	60	657	583	843	239	55	60	55	60	639	577	838	247
130	SB_I15_onramp_11	30.5	4	2	55	65	55	65	657	583	843	239	55	65	55	65	639	577	838	247
131	SB_I15_onramp_12	30.5	4	2	58.7	71.7	61.8	73	657	583	843	239	55.8	71.2	58	73	639	577	838	247
132	SB_I15_onramp_1	33.0	4	2	10	10	10	10	657	583	843	239	10	10	10	10	639	577	838	247
133	SB_I15_onramp_2	33.0	4	2	15	15	15	15	657	583	843	239	15	15	15	15	639	577	838	247
134	SB_I15_onramp_3	33.0	4	2	20	20	20	20	657	583	843	239	20	20	20	20	639	577	838	247
135	SB_I15_onramp_4	33.0	4	2	25	25	25	25	657	583	843	239	25	25	25	25	639	577	838	247
136	SB_I15_onramp_6	33.0	4	2	40	40	40	40	657	583	843	239	40	40	40	40	639	577	838	247
137	NB_I15_onramp_13	30.5	4	1	72.7	72.3	52	73	80	73	52	27	72.5	71.9	48.9	73	97	91	114	33
138	NB_I15_onramp_12	30.5	4	1	65	65	50	65	80	73	52	27	65	65	45	65	97	91	114	33
139	NB_I15_onramp_11	60.9	4	1	60	60	50	60	80	73	52	27	60	60	45	60	97	91	114	33
140	NB_I15_onramp_10	30.5	4	1	55	55	50	55	80	73	52	27	55	55	45	55	97	91	114	33
141	NB_I15_onramp_9	30.5	4	1	50	50	50	50	80	73	52	27	50	50	45	50	97	91	114	33
142	NB_I15_onramp_8	30.5	4	1	45	45	45	45	80	73	52	27	45	45	45	45	97	91	114	33
143	NB_I15_onramp_7	30.5	4	1	40	40	40	40	80	73	52	27	40	40	40	40	97	91	114	33
144	NB_I15_onramp_6	30.5	4	1	35	35	35	35	80	73	52	27	35	35	35	35	97	91	114	33
145	NB_I15_onramp_5	30.5	4	1	30	30	30	30	80	73	52	27	30	30	30	30	97	91	114	33
146	NB_I15_onramp_4	30.5	4	1	25	25	25	25	80	73	52	27	25	25	25	25	97	91	114	33
147	Interchange_I215_WB_ramp_12	263.0	4	2	55	55	55	55	984	692	876	284	55	55	55	55	1,058	753	816	317
148	NB_I15_onramp_3	30.5	4	1	20	20	20	20	80	73	52	27	20	20	20	20	97	91	114	33

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight Hourly AADT 2050
149	NB_I15_onramp_2	30.5	4	1	15	15	15	15	80	73	52	27	15	15	15	15	97	91	114	33
150	SB_I15_offramp_1	30.5	4	2	64	72.3	67.6	73	60	70	43	27	61.7	72	65.2	73	62	86	59	33
151	SB_I15_offramp_2	30.5	4	2	60	65	60	65	60	70	43	27	60	65	60	65	62	86	59	33
152	SB_I15_offramp_3	30.5	4	2	55	55	55	55	60	70	43	27	55	55	55	55	62	86	59	33
153	SB_I15_offramp_4	30.5	4	2	50	50	50	50	60	70	43	27	50	50	50	50	62	86	59	33
154	SB_I15_offramp_5	30.5	4	2	45	45	45	45	60	70	43	27	45	45	45	45	62	86	59	33
155	SB_I15_offramp_6	30.5	4	2	40	40	40	40	60	70	43	27	40	40	40	40	62	86	59	33
156	SB_I15_offramp_7	30.5	4	2	35	35	35	35	60	70	43	27	35	35	35	35	62	86	59	33
157	SB_I15_offramp_8	30.5	4	2	30	30	30	30	60	70	43	27	30	30	30	30	62	86	59	33
158	SB_I15_offramp_9	30.5	4	2	25	25	25	25	60	70	43	27	25	25	25	25	62	86	59	33
159	SB_I15_offramp_10	30.5	4	2	20	20	20	20	60	70	43	27	20	20	20	20	62	86	59	33
160	SB_I15_offramp_11	30.5	4	2	15	15	15	15	60	70	43	27	15	15	15	15	62	86	59	33
161	SB_I15_offramp_13	30.5	4	2	2.5	2.5	2.5	2.5	60	70	43	27	2.5	2.5	2.5	2.5	62	86	59	33
162	I15_SB_3	403.1	4	1	60.4	73.9	66	75	7,696	5,285	6,940	1,834	57.1	73.4	62.3	75	7,966	5,550	7,326	1,932
163	I15_SB_5	448.9	4	1	58.7	71.7	61.8	73	8,290	5,803	7,691	2,052	55.8	71.2	58	73	8,552	6,074	8,067	2,157
164	I15_SB_HOV_3	404.9	4	1	73.5	78.6	75.6	79	992	609	1,145	211	71	78.4	74.3	79	942	679	1,168	231
165	I15_SB_HOV_5	455.4	4	1	73.5	78.6	75.6	79	1,054	673	1,237	232	71	78.4	74.3	79	995	731	1,264	253
166	US89_NB_17	32.9	5	2	35	35	20	35	907	1,005	2,331	396	35	35	20	35	896	1,022	2,456	401
167	US89_NB_16	32.9	5	2	30	30	20	30	907	1,005	2,331	396	30	30	20	30	896	1,022	2,456	401
168	US89_NB_15	32.9	5	2	25	25	15	25	907	1,005	2,331	396	25	25	15	25	896	1,022	2,456	401
169	US89_NB_13	32.9	5	2	10	10	5	10	907	1,005	2,331	396	10	10	5	10	896	1,022	2,456	401
170	NB_I215toI15_EB_ramp_4	118.4	4	3	55	55	55	55	489	475	1,701	151	55	55	52	55	411	477	1,757	148
171	NB_I215toI15_EB_ramp_3	122.0	4	3	55	55	55	55	489	475	1,701	151	55	55	52	55	411	477	1,757	148
172	NB_I215toI15_EB_ramp_5	99.2	4	3	55	55	55	55	489	475	1,701	151	55	55	52	55	411	477	1,757	148
173	NB_I215toI15_EB_ramp_6	71.6	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.6	55	411	477	1,757	148
174	NB_I215toI15_EB_ramp_8	44.1	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.6	55	411	477	1,757	148
175	NB_I215toI15_EB_ramp_9	58.7	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
176	NB_I215toI15_EB_ramp_10	72.0	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
177	NB_I215toI15_EB_ramp_11	60.5	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
178	NB_I215toI15_EB_ramp_13	30.5	4	3	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
179	NB_I215toI15_EB_ramp_14	78.2	4	1	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
180	NB_I215toI15_EB_ramp_15	80.5	4	1	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
181	NB_I215toI15_EB_ramp_16	78.4	4	1	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
182	NB_I215toI15_EB_ramp_17	73.9	4	1	55	55	53.9	55	489	475	1,701	151	55	55	53.5	55	411	477	1,757	148
183	SB_I15toI215_WB_ramp_6	43.4	4	2	55	55	55	55	1,127	791	1,021	287	54.9	55	55	55	1,321	825	922	316
184	SB_I15toI215_WB_ramp_4	45.7	4	2	55	55	55	60	1,127	791	1,021	287	54.9	55	55	60	1,321	825	922	316
185	SB_I15toI215_WB_ramp_5	62.9	4	2	55	55	55	55	1,127	791	1,021	287	54.9	55	55	55	1,321	825	922	316
186	SB_I15toI215_WB_ramp_7	35.0	4	2	55	55	55	55	1,127	791	1,021	287	54.9	55	55	55	1,321	825	922	316

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight Hourly AADT 2050
187	SB_I15toI215_WB_ramp_8	44.6	4	2	55	55	55	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
188	SB_I15toI215_WB_ramp_9	65.2	4	2	55	55	55	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
189	SB_I15toI215_WB_ramp_11	71.5	4	2	55	55	55	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
190	SB_I15toI215_WB_ramp_13	70.2	4	2	55	55	54.9	55	1,127	791	1,021	287	54.8	55	55	55	1,321	825	922	316
191	I15_SB_0	111.5	4	1	51.3	70.9	59.1	73	8,883	6,145	8,004	2,147	44.9	70.1	55.8	73	9,349	6,461	8,307	2,281
192	I15_SB_HOV_0	110.8	4	1	73.5	78.6	75.6	79	992	609	1,145	211	71	78.4	74.3	79	942	679	1,168	231
193	I15_NB_HOV_6	109.9	4	1	78.8	78.5	60.5	79	414	726	1,610	266	78.6	78.3	56.9	79	456	713	1,541	250
194	I15_NB_6	109.4	4	1	72.4	71.7	27.5	73	5,248	5,780	10,425	2,334	72.1	70.9	23.9	73	5,561	6,137	10,720	2,424

ATTACHMENT D

600 South to 600 North Evaluation Area Link Characteristics

This page is intentionally left blank

Appendix D: 600 South to 600 North Evaluation Area Link Characteristics

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
1	I15SB_3	109.0	4	0	68.1	74.1	66.3	75	6,820	5,031	6,829	1,771	64.9	73.7	62	75	7,223	5,317	7,285	1,866
2	I15SB_4	138.6	4	1	68.1	74.1	66.3	75	6,820	5,031	6,829	1,771	64.9	73.7	62	75	7,223	5,317	7,285	1,866
3	I15SB_6	421.8	4	1	65.8	72.4	63.5	73	7,458	5,250	7,477	1,833	63.9	72	59.1	73	7,716	5,546	7,947	1,929
4	I15SB_7	455.9	4	1	59.7	71.2	52.7	73	8,101	5,922	8,427	2,028	55	70.2	44.7	73	8,525	6,315	8,991	2,150
5	I15SB_8	78.3	4	2	59.7	71.2	52.7	73	8,101	5,922	8,427	2,028	55	70.2	44.7	73	8,525	6,315	8,991	2,150
6	I15SB_10	110.5	4	2	59.8	71.3	52.7	73	8,101	5,922	8,427	2,028	55	70.3	44.7	73	8,525	6,315	8,991	2,150
7	I15SB_11	126.0	4	1	59.8	71.3	52.7	73	8,101	5,922	8,427	2,028	55	70.3	44.7	73	8,525	6,315	8,991	2,150
8	I15SB_12	134.2	4	1	59.7	71.2	52.7	73	8,101	5,922	8,427	2,028	55	70.2	44.7	73	8,525	6,315	8,991	2,150
9	I15SB_13	481.8	4	1	68.3	72.2	63.6	73	6,995	5,396	7,504	1,909	67.2	71.8	61.1	73	7,218	5,708	7,794	2,023
10	I15NB_20	226.3	4	0	74.2	73.7	49.1	75	4,993	5,238	8,271	2,089	73.6	72.9	43.1	75	5,412	5,614	8,664	2,189
11	I15NB_18	156.5	4	1	74.2	73.7	49.1	75	4,993	5,238	8,271	2,089	73.6	72.9	43.1	75	5,412	5,614	8,664	2,189
12	I15NB_16	474.0	4	1	72.5	71.9	47.1	73	5,148	5,593	8,997	2,236	72	71.4	43.8	73	5,561	5,881	9,228	2,296
13	I15NB_15	470.8	4	1	71.4	70.2	33.1	73	5,847	6,245	9,871	2,472	70.3	69	28.9	73	6,320	6,593	10,164	2,542
14	I15NB_14	81.5	4	2	71.4	70.2	33.1	73	5,847	6,245	9,871	2,472	70.3	69	28.9	73	6,320	6,593	10,164	2,542
15	I15NB_12	105.3	4	2	71.4	70.2	33.1	73	5,847	6,245	9,871	2,472	70.3	69	28.9	73	6,320	6,593	10,164	2,542
16	I15NB_11	107.0	4	1	71.4	70.2	33.1	73	5,847	6,245	9,871	2,472	70.3	69	28.9	73	6,320	6,593	10,164	2,542
17	I15NB_10	173.0	4	1	71.4	70.2	33	73	5,847	6,245	9,871	2,472	70.3	69	28.9	73	6,320	6,593	10,164	2,542
18	I15NB_9	468.1	4	1	72.4	72.3	54	73	5,160	5,204	8,462	2,049	72.2	72.1	51.3	73	5,468	5,481	8,662	2,137
19	I15SB_HOV_1	163.4	4	0	75.3	75.7	61.4	77.5	927	609	1,190	213	74.4	75.1	60.3	77.3	884	672	1,234	234
20	I15SB_HOV_4	142.3	4	1	75.3	75.7	61.4	77.5	927	609	1,190	213	74.4	75.1	60.3	77.3	884	672	1,234	234
21	I15SB_HOV_6	421.1	4	1	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
22	I15SB_HOV_7	457.0	4	1	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
23	I15SB_HOV_8	79.0	4	2	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
24	I15SB_HOV_10	104.8	4	2	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
25	I15SB_HOV_11	125.3	4	1	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
26	I15SB_HOV_12	134.9	4	1	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
27	I15SB_HOV_13	481.5	4	1	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
28	I15NB_HOV_20	327.0	4	0	78.8	78.5	60.5	79	464	774	1,566	280	78.6	78.3	56.9	79	503	751	1,511	258
29	I15NB_HOV_18	152.2	4	1	78.8	78.5	60.5	79	464	774	1,566	280	78.6	78.3	56.9	79	503	751	1,511	258
30	I15NB_HOV_16	472.9	4	1	78.8	78.5	60.5	79	365	490	987	162	78.6	78.3	56.9	79	413	551	1,175	179
31	I15NB_HOV_15	469.6	4	1	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
32	I15NB_HOV_14	80.8	4	2	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
33	I15NB_HOV_12	101.0	4	2	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
34	I15NB_HOV_11	107.1	4	1	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
35	I15NB_HOV_10	173.0	4	1	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
36	I15NB_HOV_9	469.2	4	1	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
37	I15SB_600N_off_1	173.0	4	0	45	45	45	45	1,007	612	659	293	45	45	45	45	965	652	640	313
38	I15SB_600N_off_2	31.7	4	1	40	40	40	40	1,007	612	659	293	40	40	40	40	965	652	640	313
39	I15SB_600N_off_3	29.1	4	1	35	35	35	35	1,007	612	659	293	35	35	35	35	965	652	640	313
40	I15SB_600N_off_4	30.4	4	1	30	30	30	30	1,007	612	659	293	30	30	30	30	965	652	640	313
41	I15SB_600N_off_5	31.1	4	3	25	25	25	25	1,007	612	659	293	25	25	25	25	965	652	640	313
42	I15SB_600N_off_6	30.4	4	2	20	20	20	20	1,007	612	659	293	20	20	20	20	965	652	640	313
43	I15SB_600N_off_7	30.6	4	2	15	15	15	15	1,007	612	659	293	15	15	15	15	965	652	640	313
44	I15SB_600N_off_8	29.9	4	3	10	10	10	10	1,007	612	659	293	10	10	10	10	965	652	640	313
45	I15SB_600N_off_9	30.0	4	3	5	5	5	5	1,007	612	659	293	5	5	5	5	965	652	640	313
46	I15SB_600N_off_10	30.9	4	2	2.5	2.5	2.5	2.5	1,007	612	659	293	2.5	2.5	2.5	2.5	965	652	640	313
47	I15SB_600N_on_1	29.2	4	2	15	15	15	15	644	672	950	195	15	15	15	15	809	769	1,044	222
48	I15SB_600N_on_2	30.6	4	3	20	20	20	20	644	672	950	195	20	20	20	20	809	769	1,044	222
49	I15SB_600N_on_3	30.2	4	3	20	25	20	25	644	672	950	195	20	25	20	25	809	769	1,044	222
50	I15SB_600N_on_4	31.0	4	3	20	30	20	30	644	672	950	195	20	30	20	30	809	769	1,044	222
51	I15SB_600N_on_5	29.7	4	3	25	35	25	35	644	672	950	195	25	35	20	35	809	769	1,044	222
52	I15SB_600N_on_6	30.2	4	2	30	40	25	40	644	672	950	195	25	40	25	40	809	769	1,044	222
53	I15SB_600N_on_7	30.5	4	1	30	45	30	45	644	672	950	195	30	45	25	45	809	769	1,044	222
54	I15SB_600N_on_8	59.8	4	1	35	50	30	50	644	672	950	195	30	50	25	50	809	769	1,044	222
55	I15SB_600N_on_9	61.7	4	1	35	55	35	55	644	672	950	195	35	55	25	55	809	769	1,044	222
56	I15SB_600N_on_10	30.6	4	1	40	60	35	60	644	672	950	195	35	60	30	60	809	769	1,044	222
57	I15SB_600N_on_11	31.4	4	1	40	65	40	65	644	672	950	195	40	65	30	65	809	769	1,044	222
58	I15SB_600N_on_12	29.7	4	1	45	70	40	70	644	672	950	195	40	70	30	70	809	769	1,044	222
59	I15SB_600N_on_13	30.5	4	1	50	70	45	70	644	672	950	195	45	70	35	70	809	769	1,044	222
60	I15SB_600N_on_14	94.3	4	1	55	70	50	70	644	672	950	195	50	70	40	70	809	769	1,044	222
61	I15SB_I80WB_1	33.2	4	0	55	65	50	70	1,107	526	923	119	50	65	40	70	1,307	608	1,197	127
62	I15NB_Frontage_1	364.7	4	0	26	26	25.8	26	56	71	147	29	26	26	25.8	26	58	67	228	29
63	I15NB_600N_on_10	133.5	4	1	50	50	50	50	707	734	938	462	50	50	50	50	746	754	887	481
64	I15NB_600N_on_8	30.9	4	2	50	50	50	50	707	734	938	462	50	50	50	50	746	754	887	481
65	I15NB_600N_on_7	18.3	4	1	45	45	45	45	707	734	938	462	45	45	45	45	746	754	887	481
66	I15NB_600N_on_6	30.1	4	2	40	40	40	40	707	734	938	462	40	40	40	40	746	754	887	481
67	I15NB_600N_on_5	30.5	4	3	35	35	35	35	707	734	938	462	35	35	35	35	746	754	887	481
68	I15NB_600N_on_4	30.5	4	3	30	30	30	30	707	734	938	462	30	30	30	30	746	754	887	481
69	I15NB_600N_on_3	30.7	4	3	25	25	25	25	707	734	938	462	25	25	25	25	746	754	887	481
70	I15NB_600N_on_2	30.6	4	2	20	20	20	20	707	734	938	462	20	20	20	20	746	754	887	481
71	I15NB_600N_on_1	28.7	4	2	15	15	15	15	707	734	938	462	15	15	15	15	746	754	887	481
72	I15NB_600N_off_15	30.6	4	2	2.5	2.5	2.5	2.5	699	652	875	237	2.5	2.5	2.5	2.5	760	712	935	246

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
73	I15NB_600N_off_14	30.3	4	2	5	5	5	5	699	652	875	237	5	5	5	5	760	712	935	246
74	I15NB_600N_off_13	30.5	4	2	10	10	10	10	699	652	875	237	10	10	10	10	760	712	935	246
75	I15NB_600N_off_12	30.5	4	3	15	15	15	15	699	652	875	237	15	15	15	15	760	712	935	246
76	I15NB_600N_off_11	30.5	4	3	20	20	20	20	699	652	875	237	20	20	20	20	760	712	935	246
77	I15NB_600N_off_10	30.0	4	3	25	25	25	25	699	652	875	237	25	25	25	25	760	712	935	246
78	I15NB_600N_off_9	30.9	4	3	30	30	30	30	699	652	875	237	30	30	25	30	760	712	935	246
79	I15NB_600N_off_8	30.3	4	2	35	35	30	35	699	652	875	237	35	35	25	35	760	712	935	246
80	I15NB_600N_off_7	30.2	4	1	40	40	30	40	699	652	875	237	40	40	25	40	760	712	935	246
81	I15NB_600N_off_6	30.9	4	0	45	45	30	45	699	652	875	237	45	45	25	45	760	712	935	246
82	I15NB_600N_off_5	91.7	4	1	45	45	30	45	699	652	875	237	45	45	25	45	760	712	935	246
83	I15NB_600N_off_4	60.5	4	1	50	50	30	50	699	652	875	237	50	50	25	50	760	712	935	246
84	I15NB_600N_off_3	30.6	4	1	55	55	30	55	699	652	875	237	55	55	25	55	760	712	935	246
85	I15NB_600N_off_2	30.7	4	1	60	60	30	60	699	652	875	237	60	60	25	60	760	712	935	246
86	I15NB_600N_off_1	18.7	4	1	65	65	30	65	699	652	875	237	65	65	25	65	760	712	935	246
87	I80EB_I15NB_18	34.1	4	0	65	65	30	70	688	1,041	1,409	424	65	65	25	70	852	1,112	1,501	405
88	I80EB_I15NB_17	30.7	4	0	60	60	25	65	688	1,041	1,409	424	60	60	20	65	852	1,112	1,501	405
89	I80EB_I15NB_16	30.2	4	1	55	55	22.7	60	688	1,041	1,409	424	55	55	16.6	60	852	1,112	1,501	405
90	I80EB_I15NB_15	30.5	4	1	54.4	50	22.7	55	688	1,041	1,409	424	53.2	50	16.6	55	852	1,112	1,501	405
91	I80EB_I15NB_14	52.0	4	1	54.4	46.6	22.7	55	688	1,041	1,409	424	53.2	45	16.6	55	852	1,112	1,501	405
92	600N_WB_11	23.5	5	2	2.5	2.5	2.5	2.5	482	607	1,003	247	2.5	2.5	2.5	2.5	553	656	1,064	261
93	600N_WB_10	30.4	5	3	35	35	35	35	482	607	1,003	247	35	35	35	35	553	656	1,064	261
94	600N_WB_9	126.2	5	4	35	35	35	35	482	607	1,003	247	35	35	35	35	553	656	1,064	261
95	600N_WB_8	32.4	5	3	35	35	35	35	716	869	1,295	345	35	35	35	35	842	958	1,363	376
96	600N_WB_7	30.6	5	3	2.5	2.5	2.5	2.5	716	869	1,295	345	2.5	2.5	2.5	2.5	842	958	1,363	376
97	600N_WB_6	33.0	5	2	35	35	35	35	716	869	1,295	345	35	35	35	35	842	958	1,363	376
98	600N_WB_5	46.6	5	1	35	35	35	35	716	869	1,295	345	35	35	35	35	842	958	1,363	376
99	600N_WB_4	30.8	5	0	2.5	2.5	2.5	2.5	912	1,123	1,557	643	2.5	2.5	2.5	2.5	1,051	1,197	1,562	690
100	600N_WB_3	14.0	5	0	20	35	15	25	912	1,123	1,557	643	20	20	15	25	1,051	1,197	1,562	690
101	600N_WB_2	61.3	5	1	30	35	20	30	912	1,123	1,557	643	30	30	20	30	1,051	1,197	1,562	690
102	600N_WB_1	60.5	5	0	35	35	25	35	912	1,123	1,557	643	35	35	25	35	1,051	1,197	1,562	690
103	600N_EB_1	31.3	5	2	35	35	35	35	703	754	1,134	236	35	35	35	35	822	837	1,265	257
104	600N_EB_2	30.0	5	3	35	35	35	35	703	754	1,134	236	35	35	35	35	822	837	1,265	257
105	600N_EB_3	92.5	5	4	35	35	35	35	703	754	1,134	236	35	35	35	35	822	837	1,265	257
106	600N_EB_4	30.9	5	4	2.5	2.5	2.5	2.5	703	754	1,134	236	2.5	2.5	2.5	2.5	822	837	1,265	257
107	600N_EB_5	70.4	5	3	35	35	35	35	1,299	956	1,135	432	35	35	35	35	1,266	1,020	1,161	464
108	600N_EB_6	31.3	5	2	2.5	2.5	2.5	2.5	1,299	956	1,135	432	2.5	2.5	2.5	2.5	1,266	1,020	1,161	464
109	600N_EB_7	37.6	5	1	35	35	35	35	1,299	956	1,135	432	35	35	35	35	1,266	1,020	1,161	464
110	600N_EB_8	54.0	5	0	10	15	10	20	1,488	1,128	1,334	505	10	15	10	20	1,488	1,217	1,407	543

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
111	600N_EB_9	60.8	5	1	15	20	15	25	1,488	1,128	1,334	505	15	20	15	25	1,488	1,217	1,407	543
112	600N_EB_10	51.2	5	0	25	25	25	30	1,488	1,128	1,334	505	25	25	25	30	1,488	1,217	1,407	543
113	I15NB_HOV_1	345.1	4	0	67.1	74.4	65.6	77.4	430	482	1,039	154	65.6	72.5	62.5	77.5	471	646	1,256	208
114	400S_I15NB_1	32.1	4	1	20	20	15	20	750	968	1,489	413	20	20	15	20	748	947	1,362	379
115	I15SB_400S_off_11	32.0	4	1	5	10	10	25	1,243	889	1,014	320	5	10	10	25	1,135	871	971	297
116	I15SB_20	319.1	4	0	70.9	72.5	63.3	73	5,246	4,273	6,331	1,529	68.8	72	59.6	73	5,757	4,660	6,668	1,699
117	I15SB_HOV_20	326.9	4	0	75.5	75.8	61	77.5	730	624	991	195	74.5	74.9	60.8	77.3	838	775	1,115	269
118	I15NB_I80WB_5	150.7	4	0	35	35	30	55	2,459	1,910	2,362	707	35	35	25	55	2,307	2,285	2,238	970
119	500S_I80WB_4	37.3	4	1	54.5	53.7	52.7	55	1,408	1,584	1,739	485	54.1	54.2	48.7	55	1,537	1,506	2,074	465
120	I15NB_500S_I80WB_4	113.3	4	2	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
121	I80_WB_1	334.0	4	0	48.8	64	48.3	73	4,837	3,955	4,706	1,308	66	69.5	58.8	73	5,017	4,488	5,450	1,562
122	I80EB_600S_7	63.0	4	2	54.8	54.7	46.5	55	1,212	1,268	2,051	412	54.4	54.6	36.5	55	1,464	1,336	2,337	463
123	I80EB_I15SB_18	275.6	4	1	28.4	23.2	8.2	54.6	1,231	1,330	1,764	705	22.7	14.3	9.4	54.7	1,303	1,523	1,693	685
124	I80EB_I15SB_13	240.5	4	2	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
125	I80EB_I15NB_2	408.7	4	2	54.8	50.5	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
126	I80EB_1	339.3	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148
127	I80EB_I15SB_2	30.5	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148
128	I80EB_I15SB_10	40.1	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
129	I80EB_600S_3	55.8	4	2	54.9	54.8	46.5	55	1,212	1,268	2,051	412	54.4	54.7	36.5	55	1,464	1,336	2,337	463
130	I80EB_600S_9	77.6	4	0	54.8	54.8	46.5	55	1,212	1,268	2,051	412	54.4	54.6	36.5	55	1,464	1,336	2,337	463
131	I80EB_I15SB_14	56.6	4	1	28.4	23.2	8.2	54.6	1,231	1,330	1,764	705	22.7	14.3	9.4	54.7	1,303	1,523	1,693	685
132	I80EB_I15NB_13	139.6	4	1	54.4	46.6	22.7	55	688	1,041	1,409	424	53.2	42.5	16.6	55	852	1,112	1,501	405
133	I80EB_I15NB_6	45.5	4	0	54.8	50.4	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
134	I80EB_I15NB_10	49.5	4	3	54.8	50.5	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
135	I15NB_500S_I80WB_19	28.9	4	0	45	60	45	70	3,867	3,494	4,101	1,191	65	65	55	70	3,844	3,791	4,311	1,435
136	I15NB_500S_I80WB_10	49.6	4	0	32.5	38.9	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
137	I15NB_500S_I80WB_5	53.1	4	2	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
138	I15NB_HOV_6	71.4	4	0	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
139	I15SB_15	141.6	4	1	68.9	72.2	61.7	73	5,751	4,508	6,491	1,590	66.9	71.7	57.6	73	6,083	4,837	6,823	1,727
140	I15SB_HOV_15	140.3	4	0	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
141	I15NB_1	343.9	4	0	72.4	72.6	60.3	73	4,397	4,182	6,649	1,611	72	72.2	52.5	73	4,742	4,564	7,224	1,760
142	I15NB_6	72.0	4	0	72.4	72.5	56.1	73	4,410	4,236	6,973	1,635	72	72.2	50.8	73	4,720	4,533	7,300	1,758
143	I15NB_500S_I80WB_15	102.3	4	2	32.5	40	25	55	3,867	3,494	4,101	1,191	45	45	35	55	3,844	3,791	4,311	1,435
144	I15NB_500S_I80WB_16	28.9	4	1	32.5	45	30	55	3,867	3,494	4,101	1,191	50	50	40	55	3,844	3,791	4,311	1,435
145	I15NB_500S_I80WB_17	28.9	4	0	35	50	35	60	3,867	3,494	4,101	1,191	55	55	45	60	3,844	3,791	4,311	1,435
146	I15NB_500S_I80WB_18	28.9	4	0	40	55	40	65	3,867	3,494	4,101	1,191	60	60	50	65	3,844	3,791	4,311	1,435
147	I80EB_I15SB_5	32.7	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148
148	I80EB_I15SB_4	30.5	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
149	I80EB_I15SB_3	30.5	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148
150	I80EB_I15SB_1	29.6	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148
151	I15SB_400S_off_1	32.0	4	0	55	60	55	65	1,243	889	1,014	320	55	60	55	65	1,135	871	971	297
152	I15SB_400S_off_2	32.0	4	0	50	50	50	60	1,243	889	1,014	320	50	50	50	60	1,135	871	971	297
153	I15SB_400S_off_3	32.0	4	0	40	45	45	55	1,243	889	1,014	320	40	45	45	55	1,135	871	971	297
154	I15SB_400S_off_4	32.0	4	0	35	40	40	50	1,243	889	1,014	320	35	40	40	50	1,135	871	971	297
155	I15SB_400S_off_5	32.0	4	0	30	35	35	45	1,243	889	1,014	320	30	35	35	45	1,135	871	971	297
156	I15SB_400S_off_6	32.0	4	1	25	30	30	40	1,243	889	1,014	320	25	30	30	40	1,135	871	971	297
157	I15SB_400S_off_7	32.0	4	1	20	25	25	35	1,243	889	1,014	320	20	25	25	35	1,135	871	971	297
158	I15SB_400S_off_8	32.0	4	1	15	20	20	30	1,243	889	1,014	320	15	20	20	30	1,135	871	971	297
159	I15SB_400S_off_9	32.0	4	1	10	15	15	25	1,243	889	1,014	320	10	15	15	25	1,135	871	971	297
160	I15SB_400S_off_10	32.0	4	1	10	15	10	25	1,243	889	1,014	320	10	15	10	25	1,135	871	971	297
161	400S_I15NB_11	32.1	4	1	70	70	50	70	750	968	1,489	413	70	70	50	70	748	947	1,362	379
162	400S_I15NB_10	32.1	4	1	65	65	45	65	750	968	1,489	413	65	65	45	65	748	947	1,362	379
163	400S_I15NB_9	32.1	4	1	60	60	45	60	750	968	1,489	413	60	60	45	60	748	947	1,362	379
164	400S_I15NB_8	32.1	4	1	55	55	40	55	750	968	1,489	413	55	55	45	55	748	947	1,362	379
165	400S_I15NB_7	32.1	4	1	50	50	40	50	750	968	1,489	413	50	50	40	50	748	947	1,362	379
166	400S_I15NB_6	32.1	4	1	45	45	35	45	750	968	1,489	413	45	45	40	45	748	947	1,362	379
167	400S_I15NB_5	32.1	4	1	40	40	35	40	750	968	1,489	413	40	40	35	40	748	947	1,362	379
168	400S_I15NB_4	32.1	4	1	35	35	30	35	750	968	1,489	413	35	35	30	35	748	947	1,362	379
169	400S_I15NB_3	32.1	4	1	30	30	25	30	750	968	1,489	413	30	30	25	30	748	947	1,362	379
170	400S_I15NB_2	32.1	4	1	25	25	20	25	750	968	1,489	413	25	25	20	25	748	947	1,362	379
171	I15NB_I80WB_1	33.0	4	0	65	65	55	70	2,459	1,910	2,362	707	65	65	45	70	2,307	2,285	2,238	970
172	I15NB_I80WB_2	33.0	4	0	55	55	45	65	2,459	1,910	2,362	707	55	55	40	65	2,307	2,285	2,238	970
173	I15NB_I80WB_3	33.0	4	0	45	45	40	60	2,459	1,910	2,362	707	45	45	35	60	2,307	2,285	2,238	970
174	I15NB_I80WB_4	33.0	4	0	40	40	35	55	2,459	1,910	2,362	707	40	40	30	55	2,307	2,285	2,238	970
175	I15SB_I80WB_5	144.1	4	1	45.8	54.9	49.3	55	1,107	526	923	119	33.6	54.8	36.2	55	1,307	608	1,197	127
176	I15SB_I80WB_19	38.5	4	0	51.7	55	54.9	70	970	461	605	117	65	65	55	70	1,173	697	1,138	127
177	I15SB_I80WB_9	32.9	4	0	51.7	55	54.8	55	970	461	605	117	43.1	54.6	40.4	55	1,173	697	1,138	127
178	I15SB_I80WB_10	25.9	4	0	51.7	55	54.8	55	970	461	605	117	43.1	54.6	40.4	55	1,173	697	1,138	127
179	I15SB_I80WB_12	15.0	4	0	51.7	55	54.8	55	970	461	605	117	43.1	54.6	40.4	55	1,173	697	1,138	127
180	I15SB_I80WB_13	24.5	4	0	51.7	55	54.8	55	970	461	605	117	43.1	54.6	40.4	55	1,173	697	1,138	127
181	I15SB_I80WB_15	42.6	4	2	51.7	55	54.9	55	970	461	605	117	45	54.6	40.4	55	1,173	697	1,138	127
182	I15SB_I80WB_8	16.0	4	0	45.8	54.9	49.3	55	1,107	526	923	119	33.6	54.8	36.2	55	1,307	608	1,197	127
183	I15SB_I80WB_4	33.2	4	1	45.8	54.9	49.3	55	1,107	526	923	119	35	54.8	36.2	55	1,307	608	1,197	127
184	I15SB_I80WB_3	33.2	4	0	45.8	55	49.3	60	1,107	526	923	119	40	55	36.2	60	1,307	608	1,197	127
185	I15SB_I80WB_2	33.2	4	0	50	60	49.3	65	1,107	526	923	119	45	60	36.2	65	1,307	608	1,197	127
186	I15SB_I80WB_16	38.5	4	3	51.7	55	54.9	55	970	461	605	117	50	54.6	40.4	55	1,173	697	1,138	127

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
187	I15SB_I80WB_17	38.5	4	2	51.7	55	54.9	60	970	461	605	117	55	55	45	60	1,173	697	1,138	127
188	I15SB_I80WB_18	38.5	4	1	51.7	55	54.9	65	970	461	605	117	60	60	50	65	1,173	697	1,138	127
189	I15NB_500S_I80WB_14	36.3	4	2	32.5	38.9	23.6	55	3,867	3,494	4,101	1,191	40	40	30	55	3,844	3,791	4,311	1,435
190	I15NB_500S_I80WB_11	35.3	4	0	32.5	38.9	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
191	I15NB_500S_I80WB_8	32.5	4	0	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
192	I15NB_500S_I80WB_3	55.3	4	1	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
193	I15NB_I80WB_6	80.1	4	0	35	35	25	55	2,459	1,910	2,362	707	35	35	20	55	2,307	2,285	2,238	970
194	500S_I80WB_2	32.9	4	1	54.5	53.7	52.7	55	1,408	1,584	1,739	485	54.1	54.2	48.7	55	1,537	1,506	2,074	465
195	I15SB_18	100.4	4	0	70.9	72.5	63.3	73	5,246	4,273	6,331	1,529	68.8	72	59.6	73	5,757	4,660	6,668	1,699
196	I15SB_HOV_18	92.3	4	0	75.5	75.8	61	77.5	730	624	991	195	74.5	74.9	60.8	77.3	838	775	1,115	269
197	I15NB_HOV_2	167.7	4	0	67.1	74.4	65.6	77.4	430	482	1,039	154	65.6	72.5	62.5	77.5	471	646	1,256	208
198	I15NB_2	165.4	4	0	72.4	72.6	60.3	73	4,397	4,182	6,649	1,611	72	72.2	52.5	73	4,742	4,564	7,224	1,760
199	I80EB_I15SB_17	42.7	4	1	28.4	23.2	8.2	54.6	1,231	1,330	1,764	705	22.7	14.3	9.4	54.7	1,303	1,523	1,693	685
200	I80EB_600S_5	53.6	4	2	54.8	54.7	46.5	55	1,212	1,268	2,051	412	54.4	54.6	36.5	55	1,464	1,336	2,337	463
201	I80EB_600S_1	102.0	4	1	54.9	54.8	35	55	1,212	1,268	2,051	412	54.4	54.7	30	55	1,464	1,336	2,337	463
202	I80EB_I15SB_12	36.4	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
203	I80EB_I15SB_8	27.6	4	1	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
204	I80EB_I15NB_4	36.1	4	2	54.8	50.4	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
205	I80EB_I15NB_8	40.5	4	1	54.8	50.5	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
206	I80EB_I15NB_12	37.5	4	1	54.4	46.6	22.7	55	688	1,041	1,409	424	53.2	42.5	16.6	55	852	1,112	1,501	405
207	I15SB_I80WB_7	59.2	4	0	45.8	54.9	49.3	55	1,107	526	923	119	33.6	54.8	36.2	55	1,307	608	1,197	127
208	I15NB_HOV_7	67.6	4	0	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
209	I15SB_14	145.3	4	1	68.9	72.2	61.7	73	5,751	4,508	6,491	1,590	66.9	71.7	57.6	73	6,083	4,837	6,823	1,727
210	I15SB_HOV_14	144.4	4	0	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
211	I15NB_8	71.0	4	0	72.4	72.5	56.1	73	4,410	4,236	6,973	1,635	72	72.2	50.8	73	4,720	4,533	7,300	1,758
212	I15NB_HOV_4	89.8	4	0	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
213	I15SB_16	74.7	4	1	68.9	72.2	61.7	73	5,751	4,508	6,491	1,590	66.9	71.7	57.6	73	6,083	4,837	6,823	1,727
214	I15SB_HOV_16	77.1	4	0	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
215	I15NB_4	88.4	4	0	72.4	72.5	56.1	73	4,410	4,236	6,973	1,635	72	72.2	50.8	73	4,720	4,533	7,300	1,758
216	400S_I15NB_HOV_13	31.6	4	0	70	70	60	70	65	84	340	30	70	70	60	70	83	98	257	34
217	I15NB_HOV_400S_2	31.8	4	0	60	65	60	70	131	56	185	14	60	65	55	70	125	82	174	19
218	400S_I15NB_HOV_1	31.6	4	1	15	15	15	15	65	84	340	30	15	15	15	15	83	98	257	34
219	400S_I15NB_HOV_2	31.6	4	1	20	20	20	20	65	84	340	30	20	20	20	20	83	98	257	34
220	400S_I15NB_HOV_3	31.6	4	1	25	25	25	25	65	84	340	30	25	25	25	25	83	98	257	34
221	400S_I15NB_HOV_4	31.6	4	1	30	30	30	30	65	84	340	30	30	30	30	30	83	98	257	34
222	400S_I15NB_HOV_5	31.6	4	1	35	35	35	35	65	84	340	30	35	35	35	35	83	98	257	34
223	400S_I15NB_HOV_6	31.6	4	1	40	40	40	40	65	84	340	30	40	40	40	40	83	98	257	34
224	400S_I15NB_HOV_7	31.6	4	1	45	45	45	45	65	84	340	30	45	45	45	45	83	98	257	34

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
225	400S_I15NB_HOV_8	31.6	4	0	50	50	50	50	65	84	340	30	50	50	50	50	83	98	257	34
226	400S_I15NB_HOV_9	31.6	4	0	55	55	55	55	65	84	340	30	55	55	55	55	83	98	257	34
227	400S_I15NB_HOV_10	31.6	4	0	60	60	60	60	65	84	340	30	60	60	60	60	83	98	257	34
228	400S_I15NB_HOV_11	63.2	4	0	65	65	60	65	65	84	340	30	65	65	60	65	83	98	257	34
229	400S_I15NB_HOV_12	31.6	4	0	70	70	60	70	65	84	340	30	70	70	60	70	83	98	257	34
230	400S_I15NB_HOV_14	31.6	4	0	70	70	60	70	65	84	340	30	70	70	60	70	83	98	257	34
231	I15NB_HOV_400S_15	31.8	4	1	5	5	5	5	131	56	185	14	5	5	5	5	125	82	174	19
232	I15NB_HOV_400S_14	31.8	4	1	10	10	10	10	131	56	185	14	10	10	10	10	125	82	174	19
233	I15NB_HOV_400S_13	31.8	4	1	15	15	15	15	131	56	185	14	15	15	15	15	125	82	174	19
234	I15NB_HOV_400S_12	31.8	4	1	20	20	20	20	131	56	185	14	20	20	20	20	125	82	174	19
235	I15NB_HOV_400S_11	31.8	4	1	25	25	25	25	131	56	185	14	25	25	25	25	125	82	174	19
236	I15NB_HOV_400S_10	31.8	4	1	30	30	30	30	131	56	185	14	30	30	30	30	125	82	174	19
237	I15NB_HOV_400S_9	31.8	4	1	30	30	30	35	131	56	185	14	30	30	30	35	125	82	174	19
238	I15NB_HOV_400S_8	31.8	4	0	30	35	30	40	131	56	185	14	30	35	30	40	125	82	174	19
239	I15NB_HOV_400S_7	31.8	4	0	35	40	35	45	131	56	185	14	35	40	35	45	125	82	174	19
240	I15NB_HOV_400S_6	31.8	4	0	40	45	40	50	131	56	185	14	40	45	40	50	125	82	174	19
241	I15NB_HOV_400S_5	31.8	4	0	45	50	45	55	131	56	185	14	45	50	45	55	125	82	174	19
242	I15NB_HOV_400S_4	31.8	4	0	50	55	50	60	131	56	185	14	50	55	50	60	125	82	174	19
243	I15NB_HOV_400S_3	31.8	4	0	55	60	55	65	131	56	185	14	55	60	55	65	125	82	174	19
244	I15NB_HOV_400S_1	31.8	4	0	65	70	65	75	131	56	185	14	65	70	60	75	125	82	174	19
245	500S_I80WB_1	32.0	4	1	54.5	53.7	52.7	55	1,408	1,584	1,739	485	54.1	54.2	48.7	55	1,537	1,506	2,074	465
246	I80EB_600S_6	60.7	4	2	54.8	54.7	46.5	55	1,212	1,268	2,051	412	54.4	54.6	36.5	55	1,464	1,336	2,337	463
247	I80EB_I15NB_1	61.8	4	1	54.8	50.5	33.6	55	619	946	1,267	432	53.4	45	20.4	55	845	1,157	1,429	456
248	I80EB_600S_2	54.8	4	2	54.9	54.8	40	55	1,212	1,268	2,051	412	54.4	54.7	35	55	1,464	1,336	2,337	463
249	I80EB_600S_8	53.1	4	1	54.8	54.8	46.5	55	1,212	1,268	2,051	412	54.4	54.6	36.5	55	1,464	1,336	2,337	463
250	I15NB_500S_I80WB_9	43.8	4	0	32.5	38.9	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
251	I15NB_500S_I80WB_2	33.6	4	1	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
252	I15SB_HOV_19	82.9	4	0	75.5	75.8	61	77.5	730	624	991	195	74.5	74.9	60.8	77.3	838	775	1,115	269
253	I80EB_600S_4	41.8	4	2	54.8	54.7	46.5	55	1,212	1,268	2,051	412	54.4	54.6	36.5	55	1,464	1,336	2,337	463
254	I15NB_HOV_8	64.8	4	0	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
255	I15NB_7	61.4	4	0	72.4	72.5	56.1	73	4,410	4,236	6,973	1,635	72	72.2	50.8	73	4,720	4,533	7,300	1,758
256	I15SB_1	160.6	4	0	68.1	74.1	66.3	75	6,820	5,031	6,829	1,771	64.9	73.7	62	75	7,223	5,317	7,285	1,866
257	I15SB_5	171.3	4	1	65.8	72.4	63.5	73	7,458	5,250	7,477	1,833	63.9	72	59.1	73	7,716	5,546	7,947	1,929
258	I15SB_9	85.5	4	2	59.8	71.3	52.7	73	8,101	5,922	8,427	2,028	55	70.3	44.7	73	8,525	6,315	8,991	2,150
259	I15NB_19	99.2	4	0	74.2	73.7	49.1	75	4,993	5,238	8,271	2,089	73.6	72.9	43.1	75	5,412	5,614	8,664	2,189
260	I15NB_17	106.0	4	1	72.5	71.9	47.1	73	5,148	5,593	8,997	2,236	72	71.4	43.8	73	5,561	5,881	9,228	2,296
261	I15SB_HOV_3	111.9	4	0	75.3	75.7	61.4	77.5	927	609	1,190	213	74.4	75.1	60.3	77.3	884	672	1,234	234
262	I15SB_HOV_9	93.3	4	2	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196

(*Continued on next page*)

Link ID	Link Description	Link Length (Meters)	MOVES4 Road Type	Link Average Grade	AM Peak Speed 2035	Midday Speed 2035	PM Peak Speed 2035	Overnight Speed 2035	AM Peak Hourly AADT 2035	Midday Hourly AADT 2035	PM Peak Hourly AADT 2035	Overnight Hourly AADT 2035	AM Peak Speed 2050	Midday Speed 2050	PM Peak Speed 2050	Overnight Speed 2050	AM Peak Hourly AADT 2050	Midday Hourly AADT 2050	PM Peak Hourly AADT 2050	Overnight AADT Hourly 2050
263	I15NB_HOV_19	98.1	4	0	78.8	78.5	60.5	79	464	774	1,566	280	78.6	78.3	56.9	79	503	751	1,511	258
264	I15NB_HOV_13	99.7	4	2	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
265	I15NB_600N_on_9	127.3	4	1	50	50	50	50	707	734	938	462	50	50	50	50	746	754	887	481
266	500S_I80WB_3	32.5	4	1	54.5	53.7	52.7	55	1,408	1,584	1,739	485	54.1	54.2	48.7	55	1,537	1,506	2,074	465
267	I80EB_I15SB_9	36.1	4	1	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
268	I80EB_I15SB_15	45.2	4	1	28.4	23.2	8.2	54.6	1,231	1,330	1,764	705	22.7	14.3	9.4	54.7	1,303	1,523	1,693	685
269	I80EB_I15NB_5	35.5	4	1	54.8	50.4	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
270	I80EB_I15NB_9	39.4	4	2	54.8	50.5	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
271	I15NB_500S_I80WB_6	43.5	4	2	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
272	I15NB_5	61.2	4	0	72.4	72.5	56.1	73	4,410	4,236	6,973	1,635	72	72.2	50.8	73	4,720	4,533	7,300	1,758
273	I80EB_I15SB_6	28.3	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51.1	50.7	25.5	55	2,767	2,858	4,030	1,148
274	I15SB_I80WB_11	25.3	4	0	51.7	55	54.8	55	970	461	605	117	43.1	54.6	40.4	55	1,173	697	1,138	127
275	I15SB_I80WB_14	38.7	4	1	51.7	55	54.9	55	970	461	605	117	43.1	54.6	40.4	55	1,173	697	1,138	127
276	I15NB_500S_I80WB_13	35.0	4	2	32.5	38.9	23.6	55	3,867	3,494	4,101	1,191	35	35	25	55	3,844	3,791	4,311	1,435
277	I15NB_500S_I80WB_12	34.2	4	1	32.5	38.9	23.6	55	3,867	3,494	4,101	1,191	32.3	33	20	55	3,844	3,791	4,311	1,435
278	I15NB_500S_I80WB_7	31.4	4	1	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
279	I80EB_I15SB_16	40.5	4	1	28.4	23.2	8.2	54.6	1,231	1,330	1,764	705	22.7	14.3	9.4	54.7	1,303	1,523	1,693	685
280	I80EB_I15SB_11	28.1	4	0	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
281	I80EB_I15SB_7	18.1	4	1	53.3	52.5	32.6	55	2,443	2,597	3,815	1,117	51	50.7	25.5	55	2,767	2,858	4,030	1,148
282	I80EB_I15NB_3	29.5	4	3	54.8	50.4	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
283	I80EB_I15NB_7	35.2	4	0	54.8	50.5	33.6	55	619	946	1,267	432	53.4	40.3	20.4	55	845	1,157	1,429	456
284	I80EB_I15NB_11	34.9	4	2	54.4	46.6	22.7	55	688	1,041	1,409	424	53.2	42.5	16.6	55	852	1,112	1,501	405
285	I15SB_I80WB_6	43.9	4	1	45.8	54.9	49.3	55	1,107	526	923	119	33.6	54.8	36.2	55	1,307	608	1,197	127
286	I15NB_HOV_3	42.5	4	0	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
287	I15SB_17	58.9	4	1	68.9	72.2	61.7	73	5,751	4,508	6,491	1,590	66.9	71.7	57.6	73	6,083	4,837	6,823	1,727
288	I15SB_HOV_17	56.2	4	0	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
289	I15NB_3	43.5	4	0	72.4	72.5	56.1	73	4,410	4,236	6,973	1,635	72	72.2	50.8	73	4,720	4,533	7,300	1,758
290	I15NB_500S_I80WB_1	21.0	4	1	32.5	38.8	23.6	55	3,867	3,494	4,101	1,191	32.3	33	19.1	55	3,844	3,791	4,311	1,435
291	I15NB_HOV_5	63.0	4	0	67.4	74.3	64.8	77.5	365	490	987	162	65.6	72.7	61.9	77.5	413	551	1,175	179
292	I15NB_13	97.6	4	2	71.4	70.2	33.1	73	5,847	6,245	9,871	2,472	70.3	69	28.9	73	6,320	6,593	10,164	2,542
293	I15NB_HOV_17	107.5	4	1	78.8	78.5	60.5	79	365	490	987	162	78.6	78.3	56.9	79	413	551	1,175	179
294	I15SB_HOV_2	50.9	4	0	75.3	75.7	61.4	77.5	927	609	1,190	213	74.4	75.1	60.3	77.3	884	672	1,234	234
295	I15SB_2	54.9	4	0	68.1	74.1	66.3	75	6,820	5,031	6,829	1,771	64.9	73.7	62	75	7,223	5,317	7,285	1,866
296	I15SB_HOV_5	171.7	4	1	75.3	75.7	61.4	77.5	375	462	859	174	74.4	75.1	60.3	77.3	482	522	985	196
297	I15SB_19	78.3	4	0	70.9	72.5	63.3	73	5,246	4,273	6,331	1,529	68.8	72	59.6	73	5,757	4,660	6,668	1,699

ATTACHMENT E

Variable Emission Generator Methodology

This page is intentionally left blank

Attachment E. Variable Emission Generator Methodology

To create an air dispersion modeling analysis that uses temporally varying emission rates for each source of emissions, variable emissions keywords were used in the SO pathway of the AERMOD input files. A Microsoft Excel workbook was used to generate the appropriate text to be added into the input file for each AERMOD run.

List of Steps for Variable Emission File

1. Each MOVES output file was added to a separate tab of an Excel workbook (2 pollutants × 4 times of day = 8 tabs of output data).
2. In each of the summary tabs, four columns were created for each period of the day (AM peak, midday, PM peak, and overnight). Cells under these columns referenced the corresponding MOVES output tab to produce emission rates in grams per second (g/s) for each linkID for each period of the day.
3. To create a daily profile of emission factors by hour, 24 rows were created (one for each hour of the day) along with separate columns that represented the period of the day for each modeled link. Each cell in these columns referenced the emission factor corresponding to the appropriate link and period of the day from the four columns described in step 2. The time of day was divided as follows:
   - Hours 1–6: Overnight
   - Hours 7–9: AM peak
   - Hours 10–15: Midday
   - Hours 16–18: PM peak
   - Hours 19–24: Overnight
4. To create text that could be added to an AERMOD input file, a concatenate function was used to string together the keyword “EMISFACT,” the link/sourceID, “HROFDY,” and the 24 cells of g/s emission rates.
5. The resulting lines of text were copied from the workbook and pasted into an AERMOD input file that had emission rates of 1 g/s assigned to each source. Area source emission rates of 1.0 g/s were divided by the area of the source to produce values in units of grams per second per square (g/sec-m^2).
6. An input file was produced in the Lakes Environmental’s AERMOD View (version 9.8.3), and file paths were updated to reference the appropriate folders for receptor files, meteorological data, and the output pathway.

This page is intentionally left blank

ATTACHMENT F

Atypical Events Selection and Justification

This page is intentionally left blank.

I-15 ENVIRONMENTAL IMPACT STATEMENT
Farmington to Salt Lake City

Atypical Wildfire Events Justification Report

I-15 Environmental Impact Statement Farmington to Salt Lake City

Lead agency:
Utah Department of Transportation

August 15, 2024

Contents

1.0 Introduction 1

2.0 Regulatory Considerations and Guidance 2

3.0 Data Showing $PM_{2.5}$ Concentrations Departure from Typical Monitor Observations.......................................2

4.0 Evidence of Wildfire-related Events and Smoke Transport to the Rose Park Monitoring Station....................5

4.1 August and September 2020 Atypical Events 6

4.1.1 August and September 2020 Wildfire Information..6
4.1.2 Smoke Transport on August 21 and August 22, 2020..8
4.1.3 Smoke Transport on September 6, 2020 14

4.2 July through September 2021...22

4.2.1 July, August, and September 2021 Wildfire Information 22
4.2.2 Smoke Transport on July 11 and 12, 2021..23
4.2.3 Smoke Transport on July 25, 2021..31
4.2.4 Smoke Transport on August 6, 7, 8, 9, and 10, 2021...38
4.2.5 Smoke Transport on August 15, 16, and 18, 2021..48
4.2.6 Smoke Transport on August 27 and 28, 2021...58
4.2.7 Smoke Transport on September 7, 2021 65

5.0 References...71

Tables

Table 1-1. Days Affected by Heavy Wildfire Smoke and Removed from the Background Data for $PM_{2.5}$.................1
Table 3-1. 24-hour $PM_{2.5}$ Statistical Data for the Rose Park Monitoring Station from 2019 to 2023 2
Table 4-1. Large Wildfires in Northern and Central California and Oregon in August and September 2020 6
Table 4-2. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 18–25, 2020 8
Table 4-3. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from September 1–7, 2020 15
Table 4-4. Large Wildfires in Northern California and Oregon during July, August, and September 2021 22
Table 4-5. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Sation from July 8–15, 2021 24
Table 4-6. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from July 23–27, 2021...............................32
Table 4-7. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 1–11, 2021 38
Table 4-8. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 12–20, 2021 49
Table 4-9. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 23–31, 2021 59
Table 4-10. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from September 4–10, 2021 66

Figures

Figure 3-1. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station in July 2019 through 2023 4
Figure 3-2. 24-hour PM2.5 Values at the Rose Park Monitoring Station in August 2019 through 2023 4
Figure 3-3. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from September 1–10 in 2019 through 2023 5
Figure 4-1. Wildfire Reference Map for August and September 2020 7
Figure 4-2. HMS Map from 8/19/2020 9
Figure 4-3. HMS Map from 8/20/2020 9
Figure 4-4. HMS Map from 8/21/2020 10
Figure 4-5. HMS Map from 8/22/2020 10
Figure 4-6. HMS Map from 8/23/2020 11
Figure 4-7. JSTAR Image from 8/20/2020 12
Figure 4-8. JSTAR Image from 8/21/2020 12
Figure 4-9. JSTAR Image from 8/22/2020 13
Figure 4-10. HYSPLIT Backward Trajectories on 8/21/2020 14
Figure 4-11. HYSPLIT Forward Trajectories on 8/19/2020 14
Figure 4-12. HMS Map from 9/5/2020 16
Figure 4-13. HMS Map from 9/6/2020 17
Figure 4-14. HMS Map from 9/7/2020 17
Figure 4-15. HMS Map from 9/8/2020 18
Figure 4-16. JSTAR Image from 9/5/2020 19
Figure 4-17. JSTAR Image from 9/6/2020 19
Figure 4-18. JSTAR Image from 9/7/2020 20
Figure 4-19. JSTAR Image from 9/8/2020 20
Figure 4-20. HYSPLIT Backward Trajectories on 9/6/2020 21
Figure 4-21. HYSPLIT Forward Trajectories on 9/4/2020 21
Figure 4-22. Wildfire Reference Map for July, August, and September 2021 23
Figure 4-23. HMS Map from 7/9/2021 25
Figure 4-24. HMS Map from 7/10/2021 25
Figure 4-25. HSM Map from 7/11/2021 26
Figure 4-26. HMS Map from 7/12/2021 26
Figure 4-27. HMS Map from 7/13/2021 27
Figure 4-28. JSTAR Image from 7/9/2021 28
Figure 4-29. JSTAR Image from 7/10/2021 28
Figure 4-30. JSTAR Image from 7/11/2021 29
Figure 4-31. JSTAR Image from 7/12/2021 29
Figure 4-32. HYSPLIT Backward Trajectories on 7/11/2021 30
Figure 4-33. HYSPLIT Forward Trajectories on 7/9/2021 and 7/10/2021 31
Figure 4-34. HYSPLIT Forward Trajectories on 7/10/2021 31
Figure 4-35. HMS Map from 7/23/2021 33
Figure 4-36. HMS Map from 7/24/2021 33
Figure 4-37. HMS Map from 7/25/2021 34

Figure 4-38. HMS Map from 7/26/2021 34
Figure 4-39. JSTAR Image from 7/23/2021 35
Figure 4-40. JSTAR Image from 7/24/2021 35
Figure 4-41. JSTAR Image from 7/25/2021 36
Figure 4-42. JSTAR Image from 7/26/2021 36
Figure 4-43. HYSPLIT Backward Trajectories on 7/25/2021 37
Figure 4-44. HYSPLIT Forward Trajectories on 7/23/2021 37
Figure 4-45. HMS Map from 8/5/2021 39
Figure 4-46. HMS Map from 8/6/2021 40
Figure 4-47. HMS Map from 8/7/2021 40
Figure 4-48. HMS Map from 8/8/2021 41
Figure 4-49. HMS Map from 8/9/2021 41
Figure 4-50. HMS Map from 8/10/2021 42
Figure 4-51. HMS Map from 8/11/2021 42
Figure 4-52. JSTAR Image from 8/5/2021 43
Figure 4-53. JSTAR Image from 8/6/2021 43
Figure 4-54. JSTAR Image from 8/7/2021 44
Figure 4-55. JSTAR Image from 8/8/2021 44
Figure 4-56. JSTAR Image from 8/9/2021 45
Figure 4-57. JSTAR Image from 8/10/2021 45
Figure 4-58. HYSPLIT Backward Trajectories on 8/6/2021 47
Figure 4-59. HYSPLIT Forward Trajectories on 8/4/2021 47
Figure 4-60. HYSPLIT Forward Trajectories on 8/5/2021 47
Figure 4-61. HYSPLIT Forward Trajectories on 8/6/2021 47
Figure 4-62. HYSPLIT Forward Trajectories on 8/7/2021 48
Figure 4-63. HYSPLIT Forward Trajectories on 8/8/2021 48
Figure 4-64. HMS Map from 8/13/2021 50
Figure 4-65. HMS Map from 8/14/2021 50
Figure 4-66. HMS Map from 8/15/2021 51
Figure 4-67. HMS Map from 8/16/2021 51
Figure 4-68. HSM Map from 8/17/2021 52
Figure 4-69. HMS Map from 8/18/2021 52
Figure 4-70. HMS Map from 8/19/2021 53
Figure 4-71. JSTAR Image from 8/14/2021 54
Figure 4-72. JSTAR Image from 8/15/2021 54
Figure 4-73. JSTAR Image from 8/16/2021 55
Figure 4-74. JSTAR Image from 8/17/2021 55
Figure 4-75. JSTAR Image from 8/18/2021 56
Figure 4-76. HYSPLIT Backward Trajectories on 8/15/2021 57
Figure 4-77. HYSPLIT Backward Trajectories on 8/16/2021 57
Figure 4-78. HYSPLIT Forward Trajectories on 8/13/2021 57
Figure 4-79. HYSPLIT Forward Trajectories on 8/14/2021 57
Figure 4-80. HYSPLIT Forward Trajectories on 8/16/2021 58

Figure 4-81. HMS Map from 8/25/2021 60
Figure 4-82. HMS Map from 8/26/2021 60
Figure 4-83. HMS Map from 8/27/2021 61
Figure 4-84. HMS Map from 8/28/2021 61
Figure 4-85. HMS Map from 8/29/2021 62
Figure 4-86. HMS Map from 8/30/2021 62
Figure 4-87. JSTAR Image from 8/26/2021 63
Figure 4-88. JSTAR Image from 8/27/2021 63
Figure 4-89. JSTAR Image from 8/28/2021 64
Figure 4-90. HYSPLIT Backward Trajectories on 8/27/2021 65
Figure 4-91. HYSPLIT Forward Trajectories on 8/25/2021 65
Figure 4-92. HMS Map from 9/5/2021 67
Figure 4-93. HMS Map from 9/6/2021 67
Figure 4-94. HMS Map from 9/7/2021 68
Figure 4-95. HMS Map from 9/8/2021 68
Figure 4-96. JSTAR Image from 9/6/2021 69
Figure 4-97. JSTAR Image from 9/7/2021 69
Figure 4-98. HYSPLIT Backward Trajectories on 9/7/2021 70
Figure 4-99. HYSPLIT Forward Trajectories on 9/5/2021 70

Exhibits

Exhibit A. Letter from UDAQ to FHWA

Acronyms and Abbreviations

CAL FIRE	California Department of Forestry and Fire Protection
EPA	U.S. Environmental Protection Agency
HMS	Hazard Mapping System
JSTAR	Joint Polar Satellite System Science Team Satellite Technology and Research
NIFC	National Interagency Fire Center
NOAA	National Oceanic and Atmospheric Administration
$PM_{2.5}$	particulate matter that is 2.5 microns or less in diameter
UDAQ	Utah Division of Air Quality
UDOT	Utah Department of Transportation
VIIRS	visible infrared imaging radiometry suite

This page is intentionally left blank.

1.0 Introduction

Wildfires can increase particulate matter ($PM_{2.5}$) concentrations, which can cause atypical events in background air quality data. For this reason, the air quality interagency consultation team for the Interstate 15 (I-15): Farmington to Salt Lake City Project determined that the Utah Department of Transportation (UDOT) would remove any days that were affected by heavy wildfire smoke (atypical events) from the background data for the air quality hot-spot analysis for the Final Environmental Impact Statement (EIS) (see Section 3.5, *Background Concentrations*, of the report *Air Quality Technical Report: Hot-spot Analysis* or Table 1-1, below).

Background data were collected from the U.S. Environmental Protection Agency's (EPA) Air Data website (https://www.epa.gov/outdoor-air-quality-data) for 2020–2022 and processed as described in EPA's hot-spot guidance (EPA 2021a). A total of 17 days in 2020 or 2021 were influenced by heavy wildfire smoke, and these days were removed from the background data for $PM_{2.5}$; no days were removed from the background data for 2022.

Table 1-1. Days Affected by Heavy Wildfire Smoke and Removed from the Background Data for $PM_{2.5}$

2020		2021				
August	September	July	August		September	
8/21/2020	9/6/2020	7/11/2021	8/6/2021	8/15/2021	9/7/2021	
8/22/2020		7/12/2021	8/7/2021	8/16/2021		
		7/25/2021	8/8/2021	8/18/2021		
			8/9/2021	8/27/2021		
			8/10/2021	8/28/2021		

The Utah Division of Air Quality (UDAQ) determined which days were affected by heavy wildfire smoke. To classify the days, UDAQ followed the process described in the June 10, 2024, letter from UDAQ to the Federal Highway Administration (see Exhibit A, *Letter from UDAQ to FHWA*).

EPA responded to UDAQ's June 10, 2024, letter, on June 18, 2024. In its response, EPA requested additional supporting evidence for the high $PM_{2.5}$ concentrations and supporting evidence for the atypical wildfire-related events (evidence such as names, dates, and data related to specific atypical wildfires and evidence that shows smoke transport from the wildfires to the Rose Park monitoring station in Salt Lake City).

EPA's June 18, 2024, letter also provided an example of supporting information. Copies of the EPA June 18, 2024, letter and enclosure with examples are included in Attachment G, *ICT Meeting Minutes and Pertinent Correspondence*, of the report *Air Quality Technical Report: Hot-spot Analysis*.

This report is a response to EPA's request and provides supporting information for the 17 atypical days (Table 1-1, above) that were removed from the background data for $PM_{2.5}$.

2.0 Regulatory Considerations and Guidance

Removing atypical events from the background data is consistent with 40 Code of Federal Regulations Part 51, Appendix W, Section 8.3, which allows for the "…removal of [background] data from specific days or hours when a monitor is being impacted by activities that are not typical or not expected to occur again in the future (for example, construction, roadway repairs, forest fires, or unusual agricultural activities)."

This report used data sources and guidance specific to removing atypical background data from the EPA Office of Air Quality Planning and Standards' guidance on A*dditional Methods, Determinations, and Analyses to Modify Air Quality Data Beyond Exception Events* (EPA 2019) and EPA Region 10's memorandum on *Wildfire Smoke Atypical Event Ambient Record Modification Guidance* (EPA 2021).

3.0 Data Showing $PM_{2.5}$ Concentrations Departure from Typical Monitor Observations

To illustrate departures from typical monitoring observations for the same times of the year, UDOT evaluated historic 24-hour $PM_{2.5}$ monitoring data between 2019 and 2023.

Table 3-1 shows the monthly averages for 24-hour $PM_{2.5}$ values for July, August, and September 1–10 between 2019 and 2023.

The atypical events being evaluated in this report occurred in August and September 2020 and July, August, or September 2021. The National Ambient Air Quality Standards (NAAQS) standard for 24-hour $PM_{2.5}$ is 35 micrograms per cubic air meter (µg/m^3). As shown in Table 3-1, most days had 24-hour $PM_{2.5}$ values that were much lower than 35 µg/m^3. The data from 2019, 2022, and 2023 represent normal conditions when smoke from large wildfires is not present.

Table 3-1. 24-hour $PM_{2.5}$ Statistical Data for the Rose Park Monitoring Station from 2019 to 2023

In µg/m^3

Date Range (# of days)	µg/m^3 Statistics	2019	2020	2021	2022	2023	2019 to 2023
July 1–31 (31 days)	Average	7.7	8.4	13.0	7.2	7.7	8.8
	Minimum	3.9	4.5	4.1	3.7	4.8	3.7
	Maximum	15.4	38.1	37.5	10.9	20.5	38.1
	<10.0	26 days	28 days	17 days	29 days	28 days	128 days
	>20.0	0 days	1 day	6 days	0 days	1 day	8 days

(*continued on next page*)

Table 3-1. 24-hour $PM_{2.5}$ Statistical Data for the Rose Park Monitoring Station from 2019 to 2023

In µg/m³

Date Range (# of days)	µg/m³ Statistics	2019	2020	2021	2022	2023	2019 to 2023
August 1–31 (31 days)	Average	6.7	12.1	20.7	6.1	6.9	10.5
	Minimum	4.8	5.3	3.2	3.1	3.2	3.1
	Maximum	10.6	46.5	48.2	13.3	26.1	48.2
	<10.0	29 days	15 days	7 days	29 days	29 days	109 days
	>20.0	0 days	3 days	16 days	0 days	1 day	20 days
September 1–10 (10 days)	Average	8.6	12.6	15.5	13.6	4.9	10.9
	Minimum	5.0	3.5	8.5	6.6	3	3
	Maximum	14.9	34	22.6	34.6	6.7	34.6
	<10.0	8 days	5 days	1 day	7 days	10 days	31 days
	>20.0	0 days	2 days	2 days	2 days	0 days	6 days
July 1–September10 (72 days)	Average	7.4	10.5	16.7	7.6	6.9	9.8
	Minimum	3.9	3.5	3.2	3.1	3	3
	Maximum	15.4	46.5	48.2	34.6	26.1	48.2
	<10.0	63 days	48 days	25 days	65 days	67 days	268 days
	>20.0	0 days	6 days	24 days	2 days	2 days	34 days

Source: EPA 2024

Figure 3-1, Figure 3-2, and Figure 3-3 show the five-year 24-hour $PM_{2.5}$ values for July, August, and September 1-10 for 2019 through 2023. The 17 atypical days that were removed from the background data are circled in yellow on the figures. As shown on these figures, the atypical days are above the average values for these time periods, and these departures from the average indicate possible air quality influences from atypical events such as wildfires. The increases related to atypical events are discussed in more detail in Section 4 of this report.

Figure 3-1. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station in July 2019 through 2023

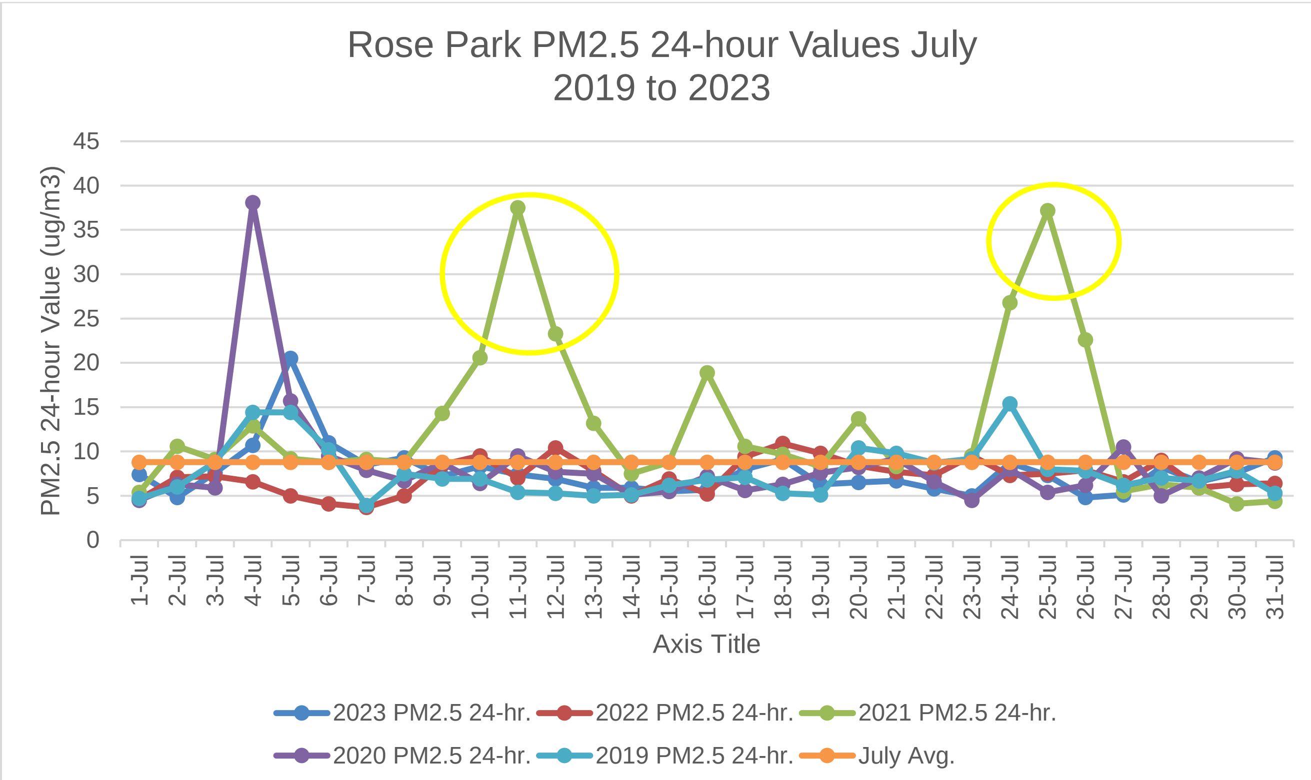


Figure 3-2. 24-hour PM2.5 Values at the Rose Park Monitoring Station in August 2019 through 2023

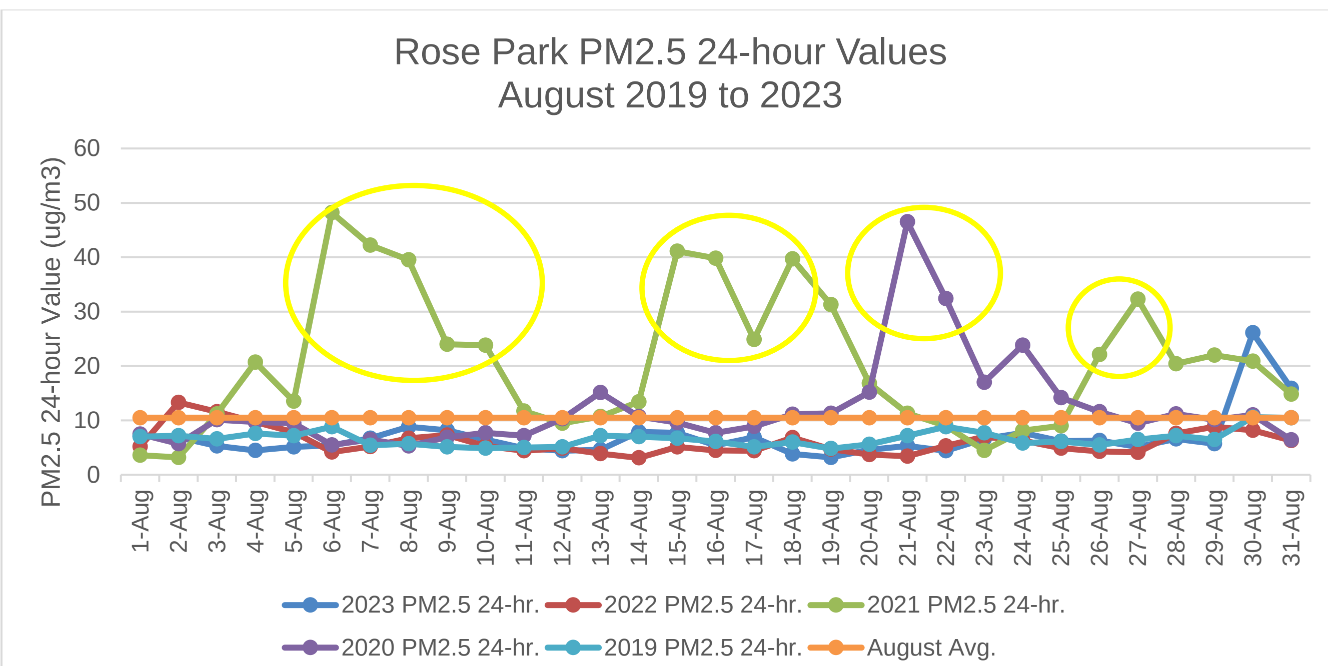
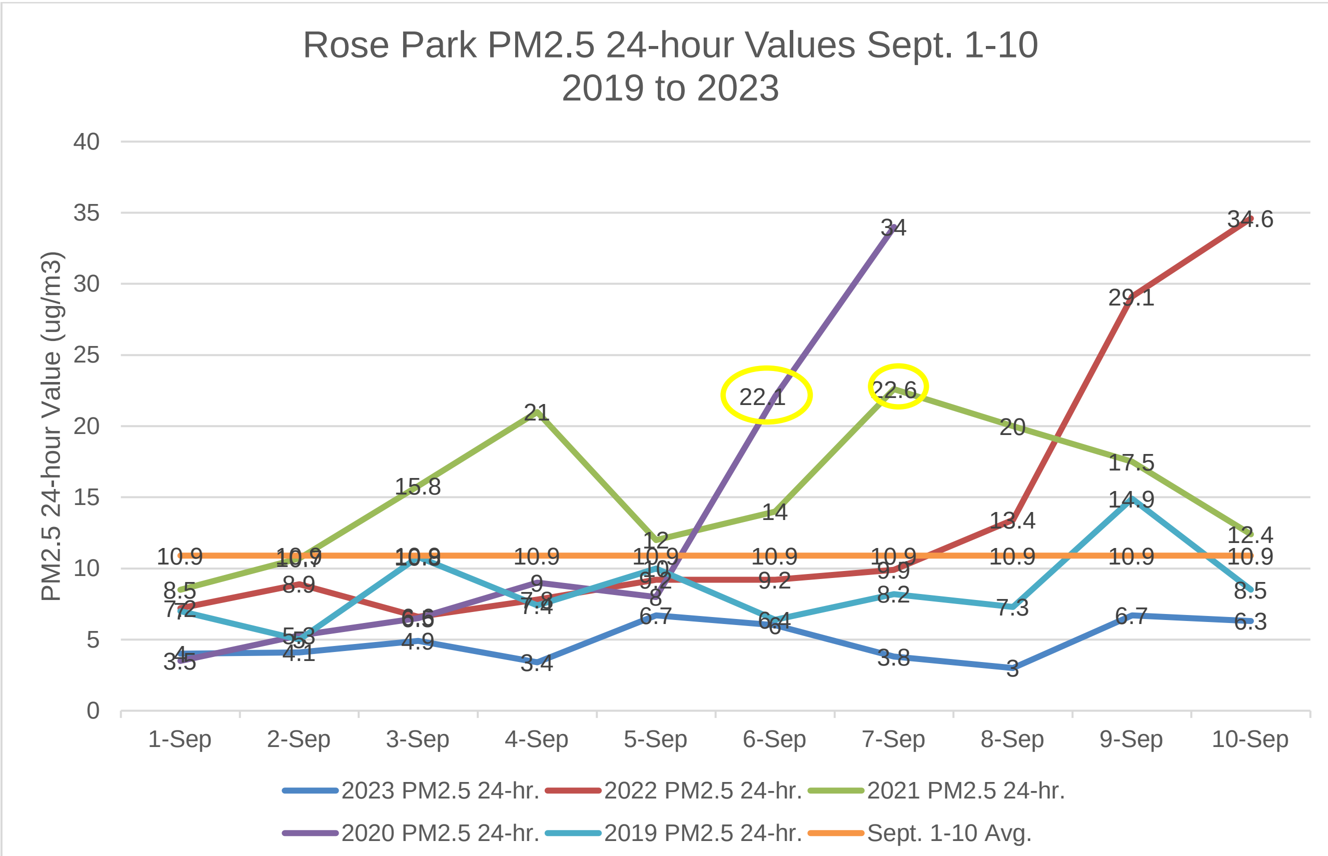


Figure 3-3. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from September 1–10 in 2019 through 2023



4.0 Evidence of Wildfire-related Events and Smoke Transport to the Rose Park Monitoring Station

Data sources from the National Interagency Fire Center (NIFC) and the California Department of Forestry and Fire Protection (Cal Fire) (Cal Fire 2024; NIFC 2023) were used to identify large wildfires that were active before or on the atypical dates listed in Table 1-1.

The National Oceanic and Atmospheric Administration's (NOAA) Hazard Mapping System (HMS) Smoke Explorer Product (NOAA 2024a) was used to identify historic smoke plumes and patterns for the atypical-day analysis.

The NOAA Joint Polar Satellite System Science Team Satellite Technology and Research (JSTAR) tool was used for historic satellite imagery (NOAA 2024b). The JSTAR filter with the visible infrared imaging radiometry suite (VIIRS) layer was used to identify smoke plumes from wildfires that have long-range transport.

The NOAA HYSPLIT model (NOAA 2024c) was used to evaluate smoke transport from large wildfires in the atypical day analysis.

The following subsections provide a summary of the wildfires that led to atypical events in the $PM_{2.5}$ background data at the Rose Park monitoring station, a discussion of weather and meteorological patterns before and during the atypical readings, documentation of the HMS and JSTAR evaluations, and the HYSPLIT modeling for each atypical event.

4.1 August and September 2020 Atypical Events

4.1.1 August and September 2020 Wildfire Information

In 2020, California had 22 of the 50 largest wildfires (fires bigger than 40,000 acres) in the United States, and 38% of the United States' total burned acres burned in California. It was a historic wildfire year for California in terms of acres burned (about 2.8 million acres) and number of large wildfires. In northern California, the total acres burned were 611% higher than the 10-year averages, and in southern California, the total acres burned were 446% higher than 10-year averages (NIFC 2020).

Table 4-1 lists the large wildfires that were active in California and Oregon between August 15 and September 15, 2020. The wildfire locations are shown in Figure 4-1. These wildfires included 8 of the 15 largest fires in the United States in 2020. The August Complex Fire was the first-ever reported wildfire incident to exceed 1 million acres (NIFC 2020). In addition to the large sizes in acreage, these wildfires also produced an exceptional amount of smoke because most of the acres burned during these large wildfires were forestland, which produces higher volumes of smoke compared to grassland or brush fires.

Table 4-1. Large Wildfires in Northern and Central California and Oregon in August and September 2020

Wildfire Name	General Location	Duration (Date Started to Contain Date)	Acres Burned
Loyalton Fire	Northwest of Reno, Nevada	8/14/2020 to 9/4/2020	47,029
August Complex (also called the Doe Fire)	West of Chico, California	8/16/2020 to 11/11/2020	1,032,648
SCU Lightning Complex (also called Del Puerto)	East of San Jose, California	8/16/2020 to 9/14/2020	396,624
CZU Lightning Complex	Southwest of San Jose, California	8/16/2020 to 9/21/2020	86,509
River Fire	East of Monterey, California	8/16/2020 to 9/4/2020	48,088
Lionshead Fire	East of Salem, Oregon	8/16/2020 to 11/12/2020	204,469
Beachie Creek	East of Salem, Oregon	8/16/2020 to 10/28/2020	193,573

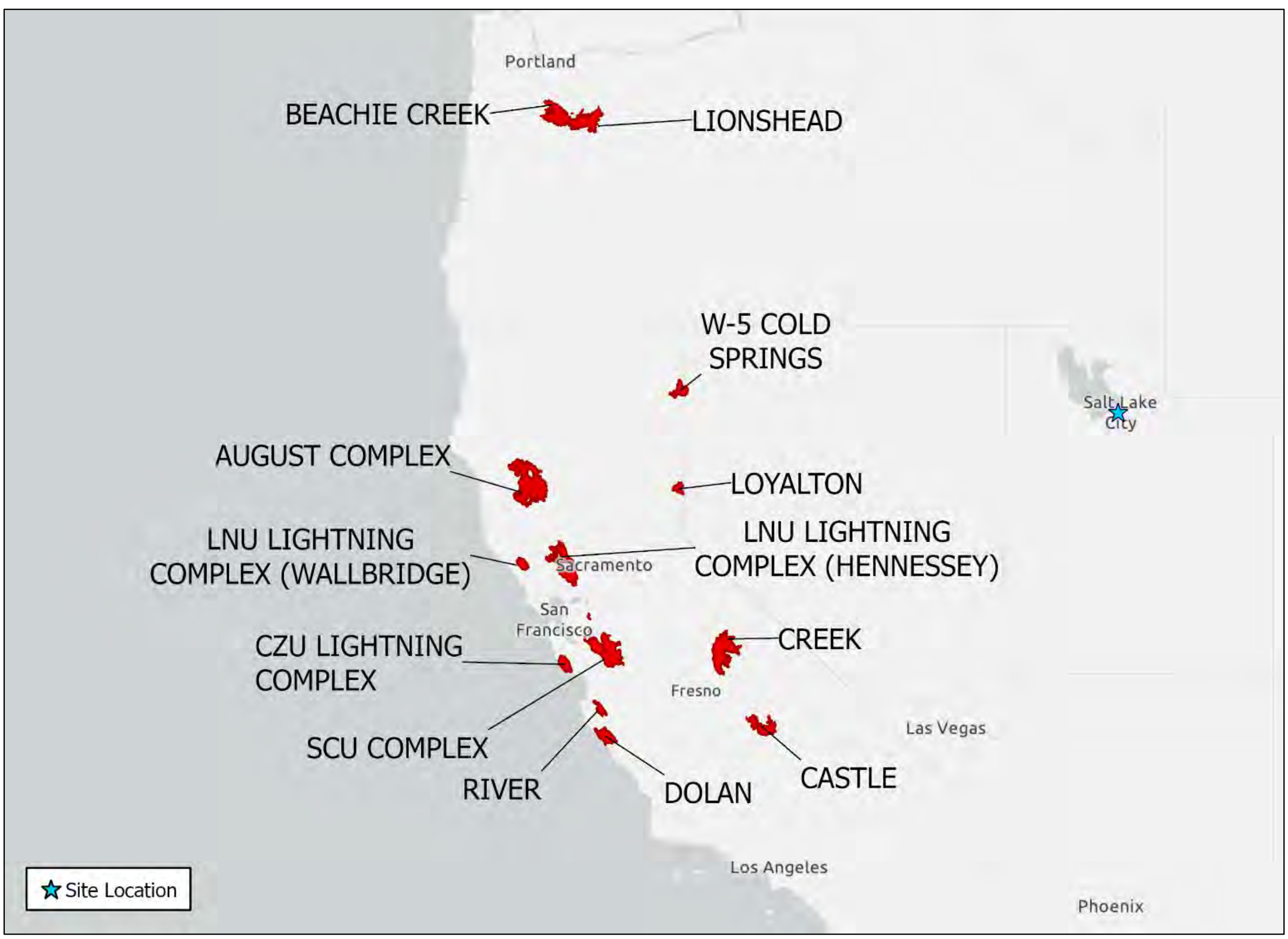
(*continued on next page*)

Table 4-1. Large Wildfires in Northern and Central California and Oregon in August and September 2020

Wildfire Name	General Location	Duration (Date Started to Contain Date)	Acres Burned
LNU Lightning Complex (also called Hennessey and Wallbridge Fires)	North of Vallejo, California	8/17/2020 to 10/1/2020	363,220
Dolan Fire	South of Big Sur, California	8/18/2020 to 12/24/2020	124,527
W-5 Cold Springs	Northeast of Susanville, California	8/18/2020 to 9/13/2020	84,817
Castle Fire/SQF Complex	East of Porterville, California	8/19/2020 to 12/17/2020	170,647
Creek Fire	Northeast of Fresno, California	9/4/2020 to 12/17/2020	379,895

Sources: Cal Fire 2020; NIFC 2020.

Figure 4-1. Wildfire Reference Map for August and September 2020



4.1.2 Smoke Transport on August 21 and August 22, 2020

Monitoring Data Observations

As shown in Table 4-2, monitoring data from the Rose Park monitoring station in Salt Lake City shows a spike in 24-hour $PM_{2.5}$ values that began on 8/20/2020, and 24-hour $PM_{2.5}$ concentrations peaked on 8/21/2020 (46.5 μg/m^3). The 24-hour $PM_{2.5}$ values decreased to 32.4 μg/m^3 on 8/22/2020. Then, concentrations were below 25 μg/m^3 after 8/23/2020.

As shown on Table 3-1 and Figure 3-2, these 8/21/2020 and 8/22/2020 24-hour $PM_{2.5}$ values are outliers for August, which had an average 24-hour $PM_{2.5}$ value of 10.5 μg/m^3 for the 5-year period from 2019 to 2023. In August 2019, 2022, and 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's $PM_{2.5}$ 24-hour values averaged less than 7 μg/m^3.

Table 4-2. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 18–25, 2020

In μg/m^3

Date	24-hour $PM_{2.5}$ Value
8/18/2020	11.1
8/19/2020	11.3
8/20/2020	15.2
8/21/2020	46.5
8/22/2020	32.4
8/23/2020	17.0
8/24/2020	23.8
8/25/2020	14.2

Source: EPA 2024

Wildfire and Weather Summary

Lightning storms on 8/16/2020 and 8/17/2020 triggered several large wildfires in central and northern California, which are summarized in Table 4-1 above. Beginning on 8/19/2020, these wildfires expanded rapidly. On 8/19/2020 and 8/20/2020, the prevailing high-level winds came from the southwest and blew transported smoke from these wildfires into southeastern Oregon and Idaho. On 8/21/2020 and 8/22/2020, the winds shifted to come from the west and transported smoke from these wildfires into Utah.

HMS Maps

NOAA's HMS smoke product maps show evidence of long-range smoke transport from the large wildfires in central and northern California to the Rose Park monitoring station in Salt Lake City.

On 8/19/2020, the HMS maps show the heavy smoke plumes from the central and northern California fires being blown to the northeast into eastern Oregon and Idaho (Figure 4-2). Beginning on 8/20/2020

(Figure 4-3), and continuing on 8/21/2020 (Figure 4-4) and 8/22/2020 (Figure 4-5), the HMS maps show the heavy smoke plumes from the central and northern California fires being blown from the west-southwest to east-northeast, with the entire state of Utah covered in the heavy smoke plumes. Beginning on 8/23/2020 (Figure 4-6), the HMS maps show the heavy smoke plumes being blown to the north into eastern Oregon and Idaho.

Figure 4-2. HMS Map from 8/19/2020

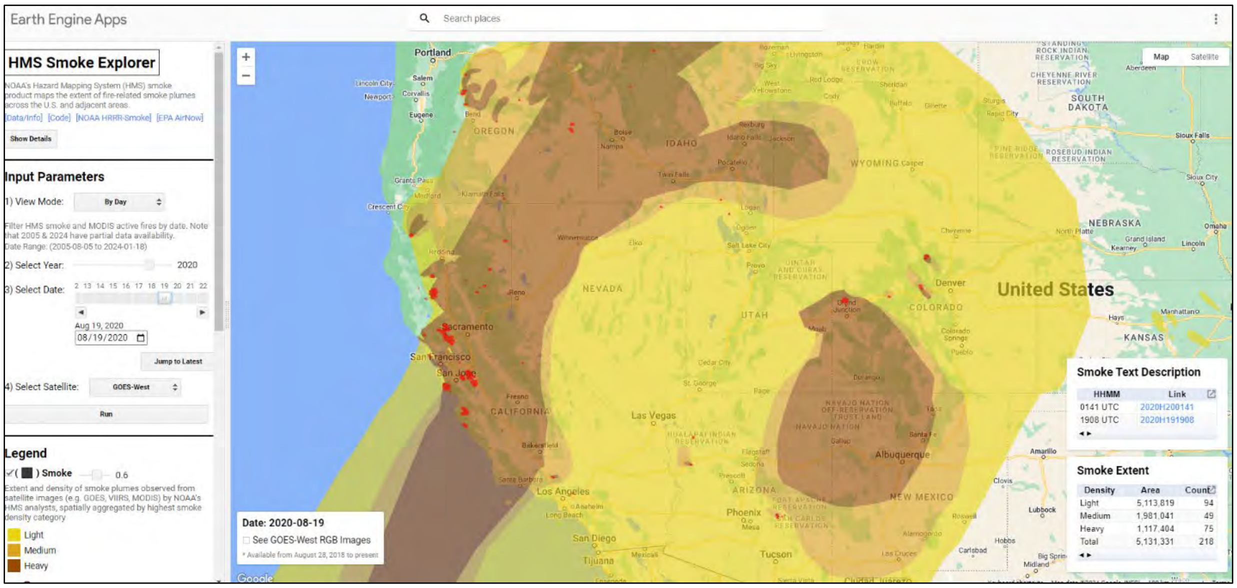


Figure 4-3. HMS Map from 8/20/2020

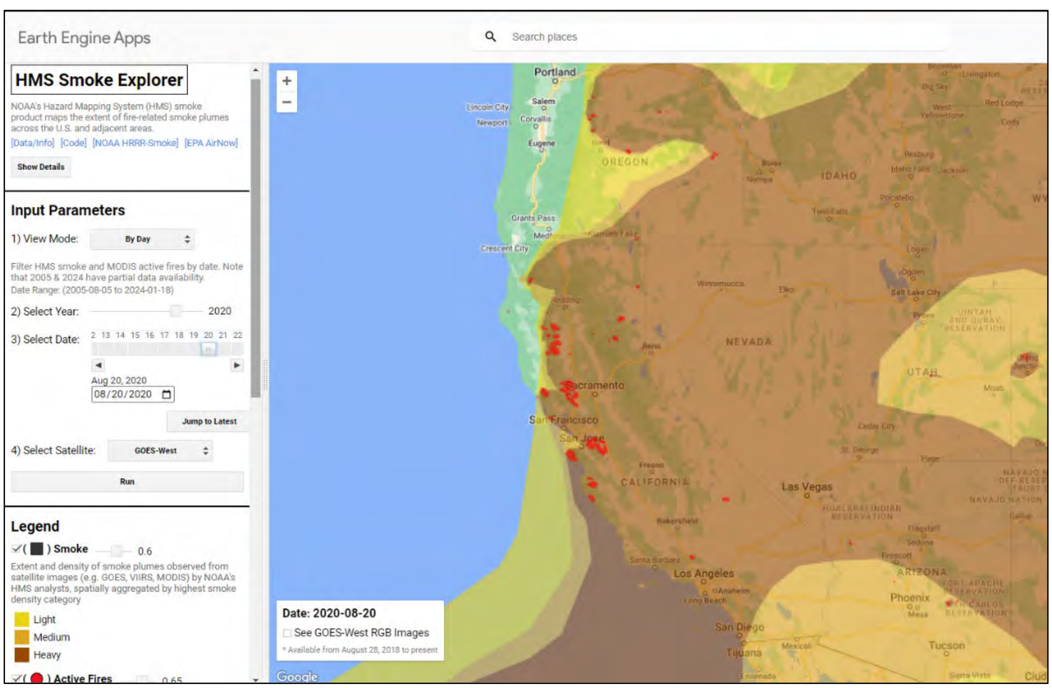


Figure 4-4. HMS Map from 8/21/2020

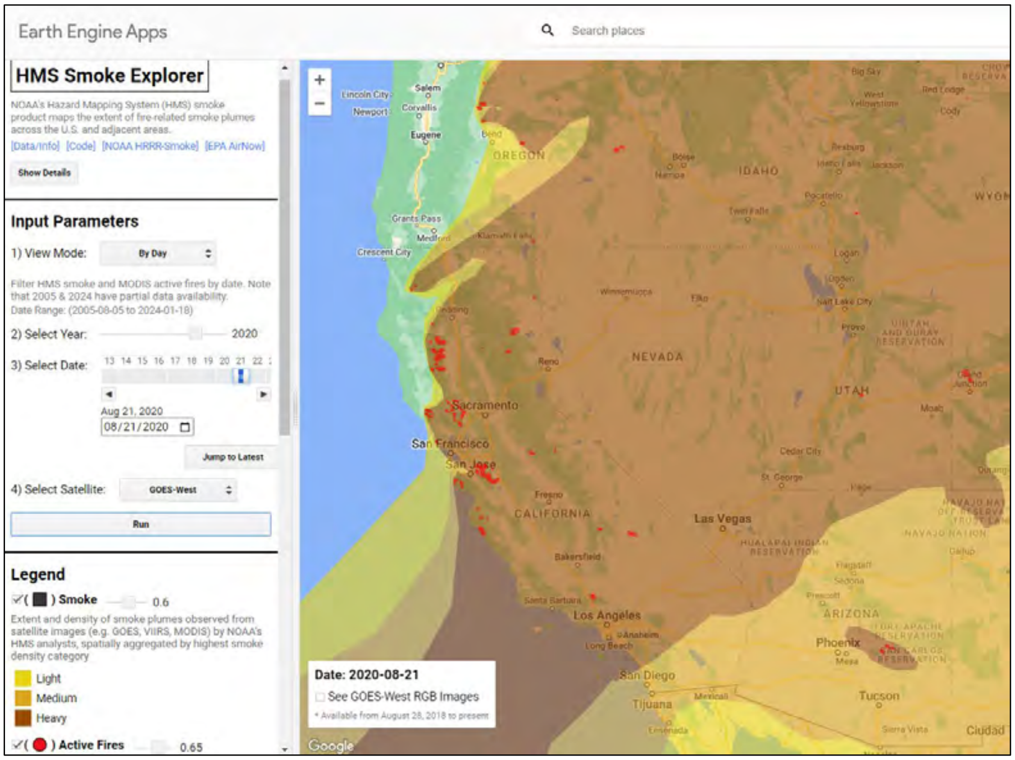


Figure 4-5. HMS Map from 8/22/2020

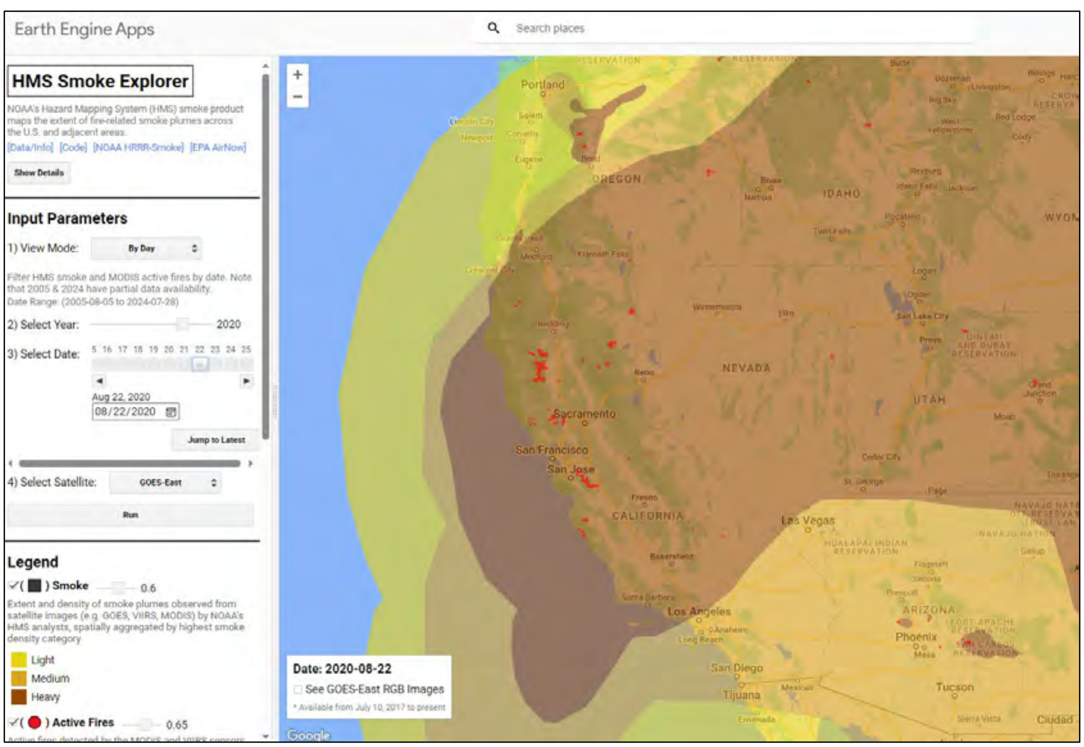
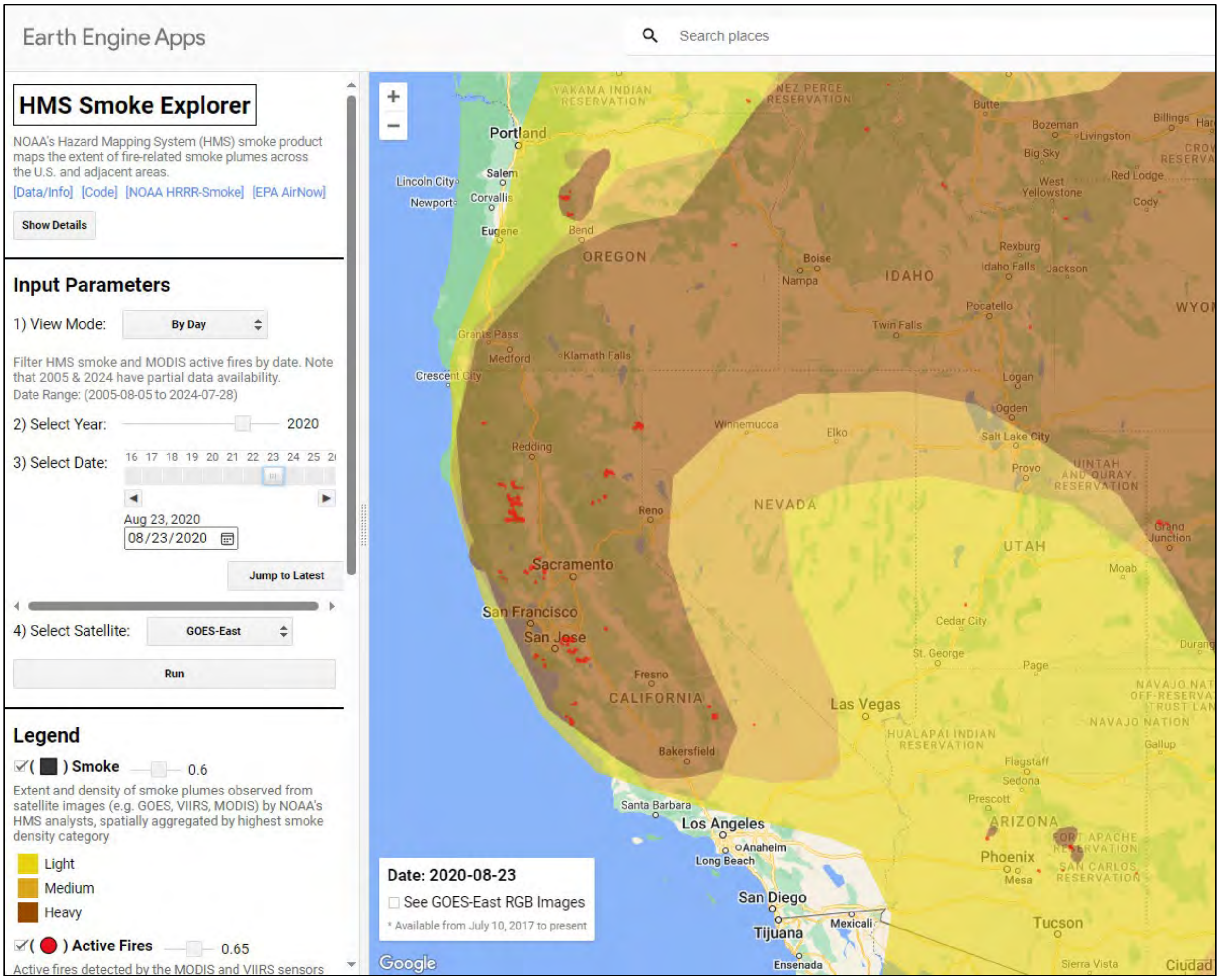


Figure 4-6. HMS Map from 8/23/2020



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on August 21 and August 22, 2020 (see Figure 4-7, Figure 4-8, and Figure 4-9 below).

Figure 4-7. JSTAR Image from 8/20/2020

Figure 4-8. JSTAR Image from 8/21/2020

Figure 4-9. JSTAR Image from 8/22/2020

Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 8/21/2020 and 8/22/2020 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City on August 21 and August 22, 2020. HYSPLIT 48-hour backward trajectories from the Rose Park monitoring station indicated likely transport of particles from the northern California wildfires to near-surface ambient air in Salt Lake City. HYSPLIT modeled particles arrived in Salt Lake City during the evening of 8/21/2020 (see Figure 4-10).

HYSPLIT forward ensemble trajectories originating from the LNU Lightning Complex on 8/19/2020 (Figure 4-11) also suggest long-range transport of wildfire smoke to the Salt Lake City area by 8/21/2020.

Because several other large fires (such as the August Complex, SCU Lightning Complex, CZU Lightning Complex, Loyalton Fire, W-5 Cold Springs Fire, and River Fire) were burning in northern California on these same dates (see Figure 4-2 through Figure 4-9), the prevailing winds likely provided long-range smoke transport from multiple fires in northern California to the Rose Park monitoring station during this time.

Figure 4-10. HYSPLIT Backward Trajectories on 8/21/2020

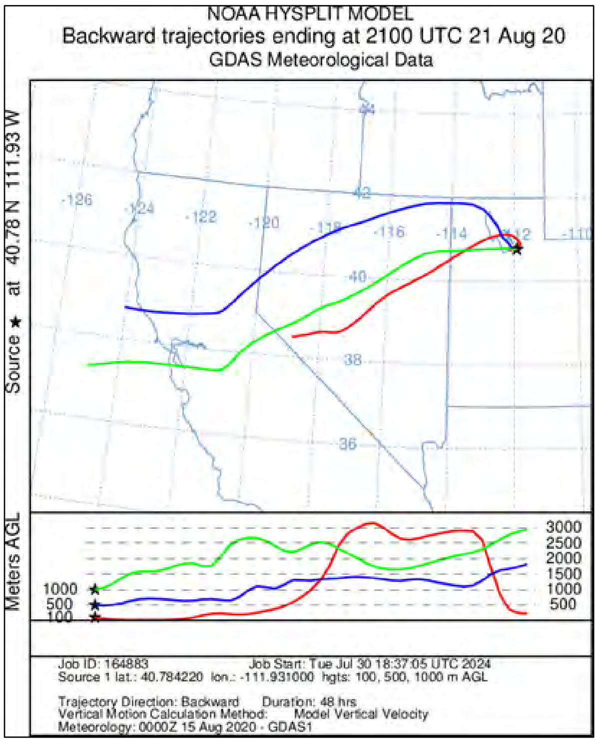
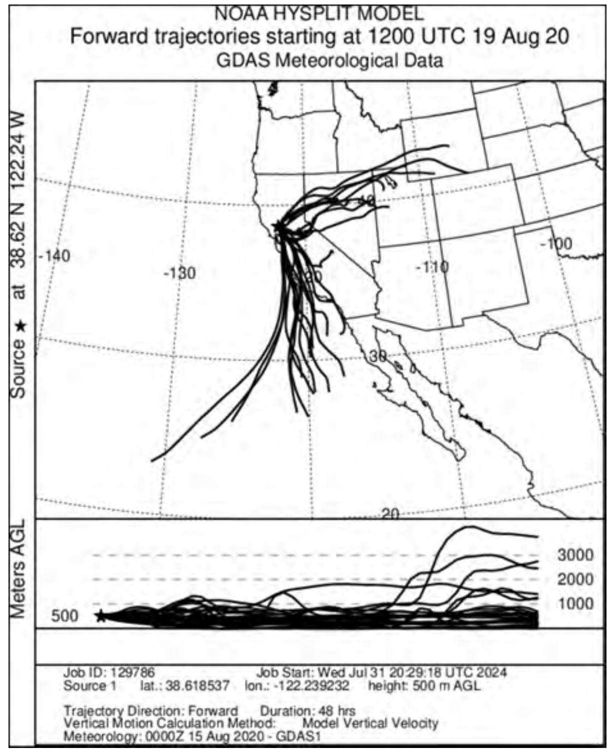


Figure 4-11. HYSPLIT Forward Trajectories on 8/19/2020



4.1.3 Smoke Transport on September 6, 2020

Monitoring Data Observations

As shown in Table 4-3, monitoring data from the Rose Park monitoring station show a spike in 24-hour $PM_{2.5}$ values that began on 9/6/2020 with the highest 24-hour $PM_{2.5}$ concentration on 9/7/2020 (34.0 μg/m^3). The 24-hour $PM_{2.5}$ values were below 10 μg/m^3 between 9/1/2020 and 9/5/2020.

As shown in Table 3-1 and Figure 3-3 above, the 9/6/2020 and 9/7/2020 24-hour $PM_{2.5}$ values are outliers for the first 10 days of September, which had an average 24-hour $PM_{2.5}$ value of 10.9 μg/m^3 for 5-year period from 2019 to 2023. The 9/7/2020 reading likely resulted from earlier values in the 24-hour period containing wildfire smoke that was transported on 9/6/2020. As discussed in the Wildfire and Weather Summary section below, a cold front with winds from the northwest came into Utah on 9/7/2020, and it blew the wildfire smoke out of Utah by 9/8/2020.

Table 4-3. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from September 1–7, 2020

In μg/m³

Date	24-hour $PM_{2.5}$ Value
9/1/2020	3.5
9/2/2020	5.3
9/3/2020	6.5
9/4/2020	9.0
9/5/2020	8.0
9/6/2020	22.1
9/7/2020	34.0

Source: EPA 2024

Wildfire and Weather Summary

With the exception of the Loyalton Fire and the River Fire, the large wildfires in central and northern California (Table 4-1) were still burning during the first week of September 2020. The following is a summary of how the fires, and their smoke, progressed:

- On 9/4/2020, the predominant high-level winds came from the south and blew the remaining smoke out of Salt Lake City.
- On 9/4/2020, the Creek Fire started northeast of Fresno, California, in the Sequoia National Forest and grew rapidly throughout the following week.
- On 9/5/2020, the predominant high-level winds came from the southwest and blew smoke from California's fires into southeastern Oregon and Idaho.
- On 9/6/2020, the predominant high-level winds shifted to come from the west; this shift blew smoke from the active fires in central and northern California to Nevada and Utah.
- On 9/7/2020, the winds shifted to come from the northwest in front of a large cold front that was moving into the western United States.
- On 9/8/2020, after the cold front had moved in, the winds shifted to come from the east and pushed the wildfires and smoke offshore to the west.

HMS Maps

NOAA HMS smoke product maps show evidence of long-range smoke transport from the fires in central and northern California to the Rose Park monitoring station in Salt Lake City.

On 9/5/2020, the HMS maps show the heavy smoke plumes from the central and northern California fires being blown to the northeast into eastern Oregon and Idaho (Figure 4-12).

On 9/6/2020, the HMS maps show the heavy smoke plumes from the central and northern California fires being blown from the west to east, and the northern part of Utah was covered the heavy smoke plumes (Figure 4-13).

On 9/7/2020, the HMS maps show the heavy smoke plumes being blown more to the southwest (Figure 4-14), and on 9/8/2020, the HMS maps show the heavy smoke plumes being blown to the west into the Pacific Ocean (Figure 4-15).

Figure 4-12. HMS Map from 9/5/2020

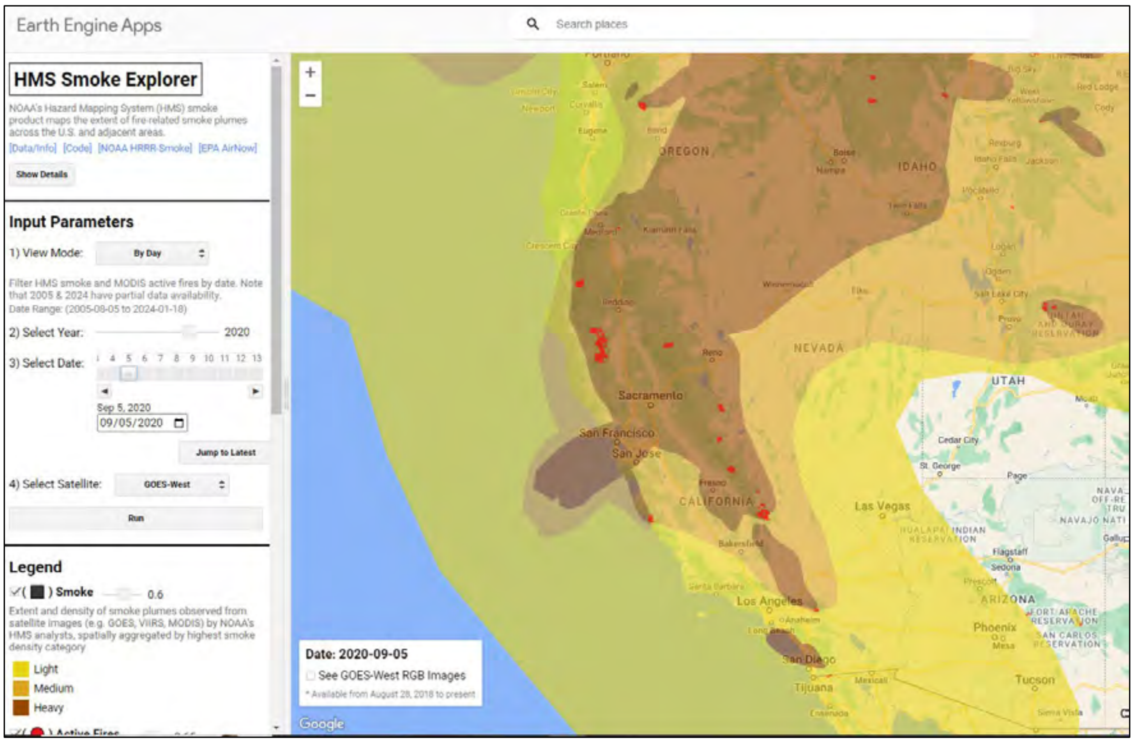


Figure 4-13. HMS Map from 9/6/2020

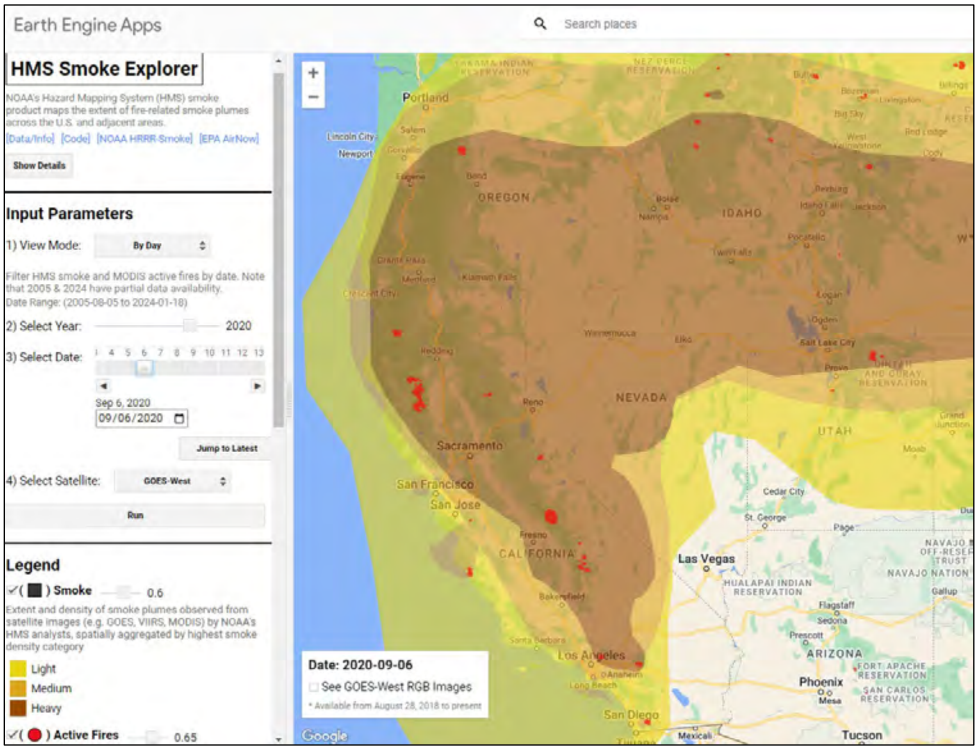
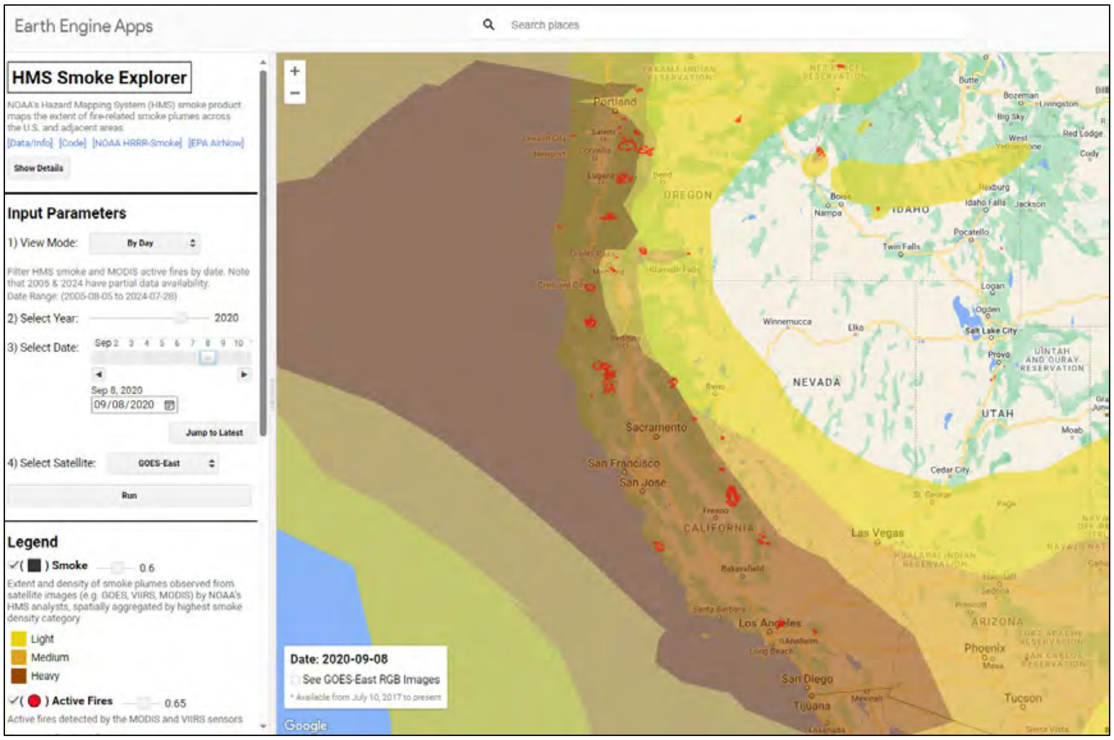


Figure 4-14. HMS Map from 9/7/2020

Figure 4-15. HMS Map from 9/8/2020



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on September 6, 2020 (see Figure 4-16, Figure 4-17, Figure 4-18, and Figure 4-19 below).

Figure 4-16. JSTAR Image from 9/5/2020

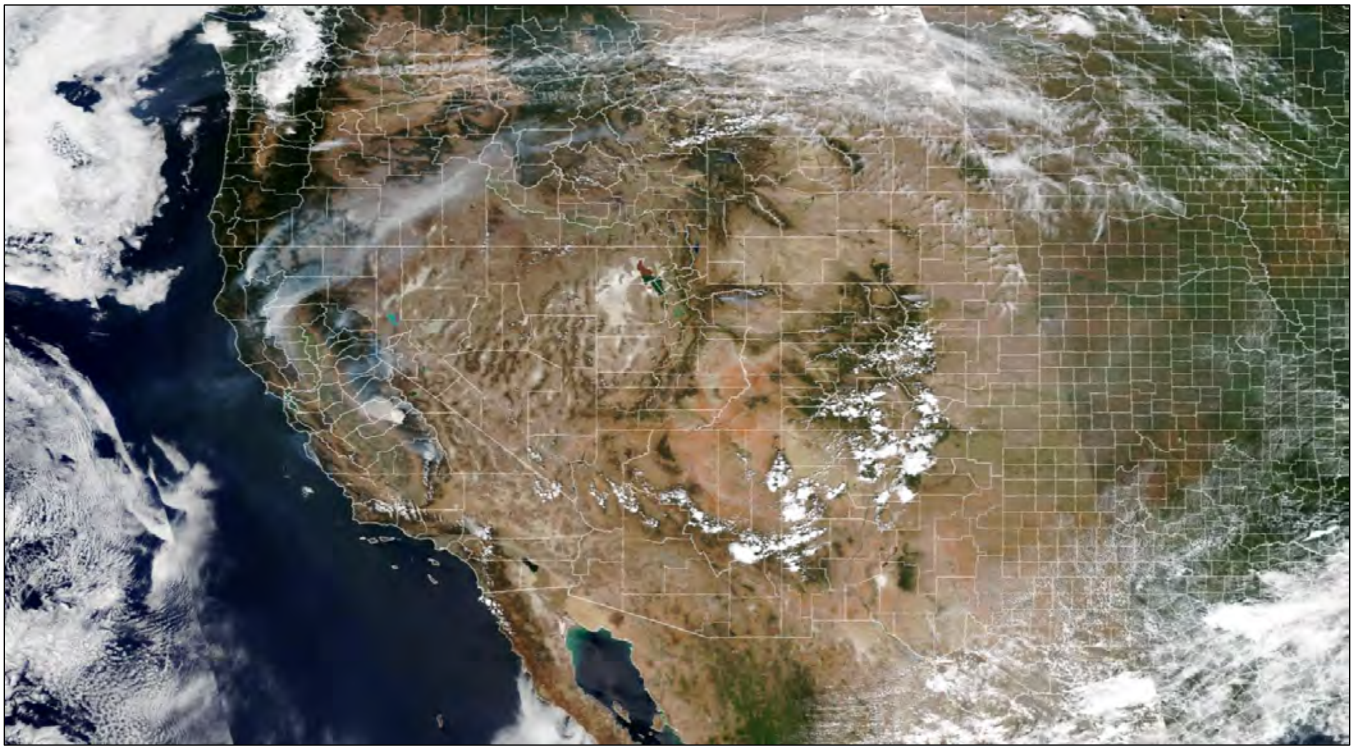
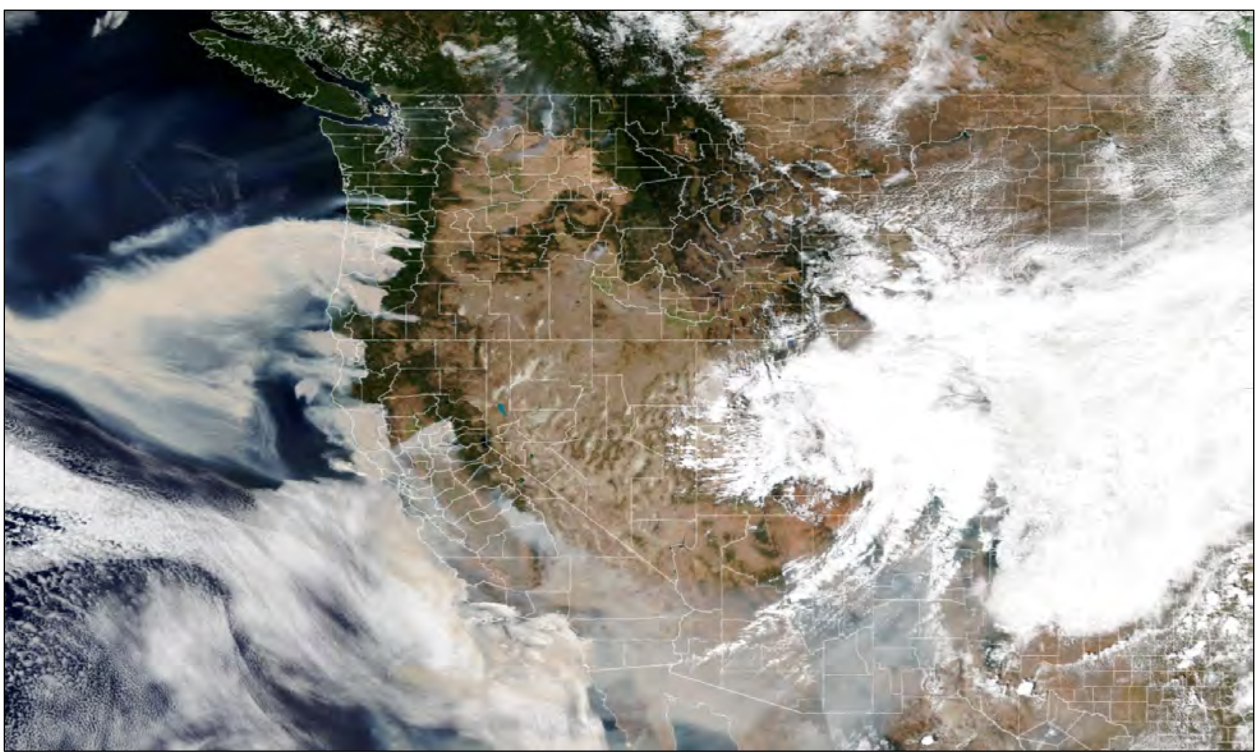


Figure 4-17. JSTAR Image from 9/6/2020

Figure 4-18. JSTAR Image from 9/7/2020

Figure 4-19. JSTAR Image from 9/8/2020



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 9/6/2020 and 9/7/2020 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model shows that the August Complex and CZU Lightning Complex were primary sources of smoke that was blown into Salt Lake City on 9/6/2020.

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City. HYSPLIT 48-hour backward trajectories from the Rose Park monitoring station indicated likely transport of particles from the northern California wildfires to near-surface ambient air in Salt Lake City. HYSPLIT modeled particles arrived in Salt Lake City during the evening of 9/6/2020 (Figure 4-20).

HYSPLIT forward ensemble trajectories originating from the August Complex on 9/4/2020 (Figure 4-21) also suggest long-range transport of wildfire smoke to the Salt Lake City area by 9/6/2020.

Because several other large fires (such as the SCU Lightning Complex, CZU Lightning Complex, W-5 Cold Springs Fire, and Creek Fire) were burning in northern California on these same dates (see Figure 4-12 through Figure 4-19), the prevailing winds also likely provided long-range smoke transport from multiple fires in northern California to the Rose Park monitoring station during this time.

Figure 4-20. HYSPLIT Backward Trajectories on 9/6/2020

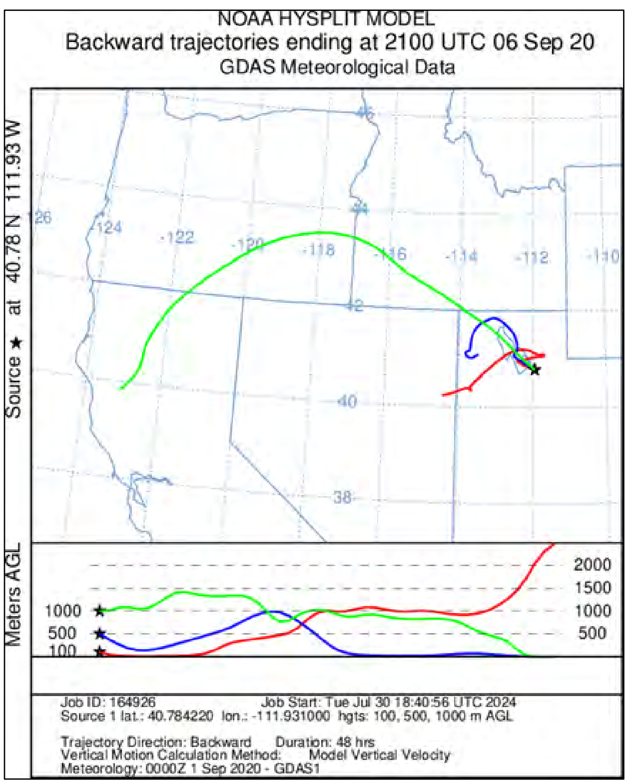
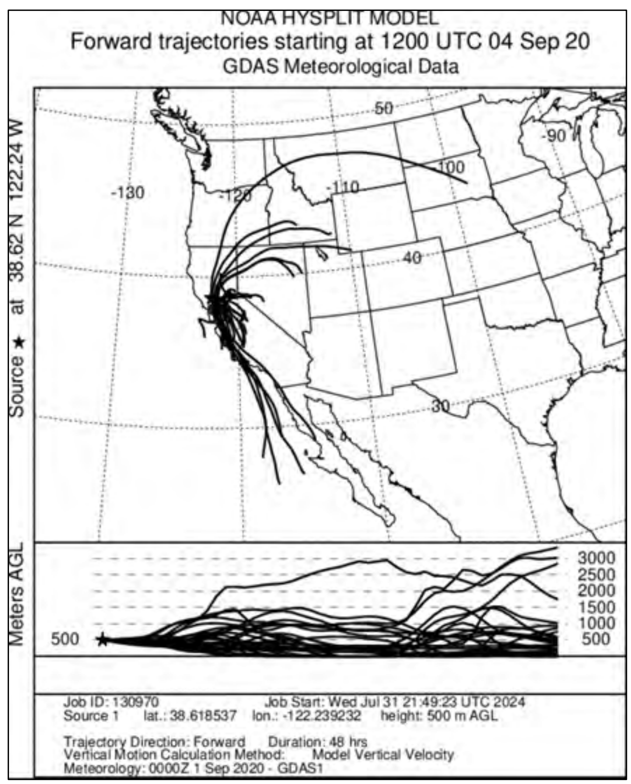


Figure 4-21. HYSPLIT Forward Trajectories on 9/4/2020



4.2 July through September 2021

4.2.1 July, August, and September 2021 Wildfire Information

2021 was a historic wildfire year for California and the Pacific Northwest. Northern California had a near-normal number of wildfires; however, several wildfires were large, and the number of acres burned substantially exceeded the area's 10-year average (NIFC 2021). The Pacific Northwest had an above-average number of both wildfires and acres burned compared to the area's 10-year average.

In June 2021, a historic heat wave occurred in the Pacific Northwest, northern California, and Great Basin areas, which resulted in 90% of the western United States being in drought conditions (NIFC 2021). During July and August 2021, the largest wildfires of the 2021 season ignited in northern California and Oregon.

Table 4-4 lists the large wildfires that were active between 7/9/2021 and 9/15/2021 in California and Oregon. Five large wildfires (River Complex, Caldor, Monument, Bootleg, and Dixie Fires) combined to burn more than 2 million acres in 2021. The wildfire locations are shown on Figure 4-22. Notably, the Dixie Fire burned 963,000 of those acres. In addition to the large sizes, these wildfires also produced an exceptional amount of smoke because most of the burned acres consisted of forestland, which produces higher volumes of smoke compared to grassland or brush fires.

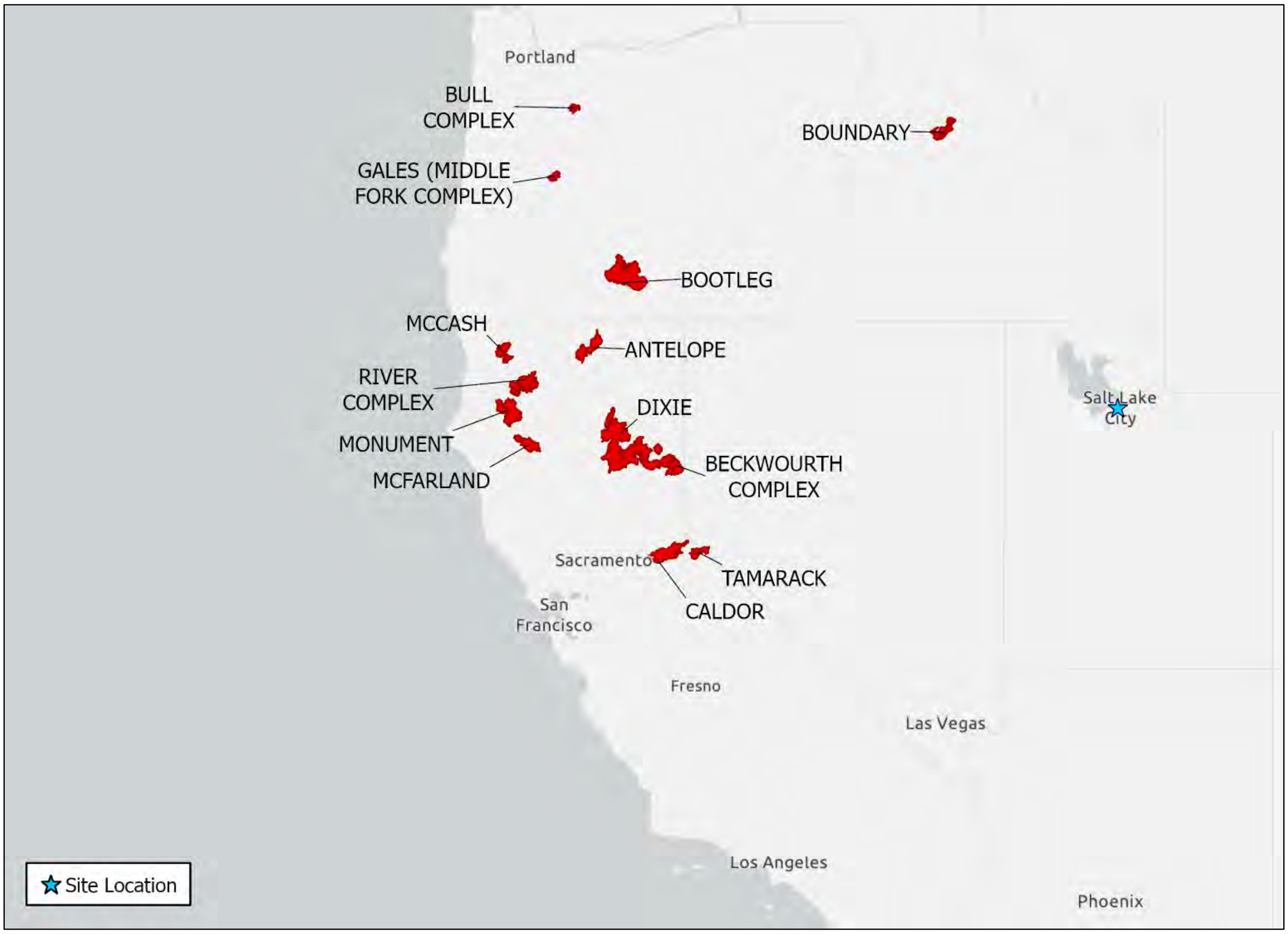
With the exception of the Bootleg Fire, which was contained on 8/13/2021, the rest of these large fires began in July or August 2021 and continued to burn until late September or October 2021.

Table 4-4. Large Wildfires in Northern California and Oregon during July, August, and September 2021

Wildfire Name	General Location	Duration (Date Started to Contain Date)	Acres Burned
Beckwourth Complex	Northwest of Reno, Nevada	7/3/2021 to 9/21/2021	105,670
Bootleg Fire	Northeast of Klamath Falls, Oregon	7/6/2021 to 8/13/2021	413,717
Dixie	Southwest of Susanville, California	7/13/2021 to 10/23/2021	963,309
Tamarack	Southeast of Lake Tahoe, California and Nevada	7/16/2021 to 10/7/2021	68,637
Gales Fire	East of Eugene, Oregon	7/27/2021 to 10/28/2021	29,356
River Complex	Northwest of Redding, California	7/30/2021 to 10/24/2021	199,359
Monument Fire	West of Redding, California	7/30/2021 to 10/25/2021	223,124
McFarland Fire	West of Red Bluff, California	7/30/2021 to 9/15/2021	122,653
McCash Fire	West of Weed, California	7/31/2021 to 10/27/2021	94,962
Antelope Fire	East of Weed, California	8/1/2021 to 10/14/2021	145,632
Bull Complex	East of Salem, Oregon	8/1/2021 to 9/14/2021	24,894
Boundary Fire	Northwest of Stanley, Idaho	8/10/2021 to 10/21/2021	88,757
Caldor Fire	Southwest of Lake Tahoe, California	8/14/2021 to 10/20/2021	221,835

Source: Cal Fire 2021; NIFC 2021

Figure 4-22. Wildfire Reference Map for July, August, and September 2021



4.2.2 Smoke Transport on July 11 and 12, 2021

Monitoring Data Observations

As shown in Table 4-5, monitoring data from the Rose Park monitoring station show a spike in 24-hour $PM_{2.5}$ values that began on 7/9/2021, and 24-hour $PM_{2.5}$ concentrations peaked on 7/11/2021 (37.5 μg/m^3). Then, the 24-hour $PM_{2.5}$ values decreased to 23.3 μg/m^3 on July 12, 2021, and concentrations were below 15 μg/m^3 after 7/13/2021.

As shown on Table 3-1 and Figure 3-2, the 7/11/2021 and 7/12/2021 24-hour $PM_{2.5}$ values are outliers for July, which had an average 24-hour $PM_{2.5}$ value of 8.8 μg/m^3 for the 5-year period from 2019 to 2023. In July 2019, 2022, and 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's 24-hour $PM_{2.5}$ values averaged less than 8 μg/m^3.

Table 4-5. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Sation from July 8–15, 2021

In µg/m^3

Date	24-hour $PM_{2.5}$ Value
7/8/2021	8.8
7/9/2021	14.3
7/10/2021	20.6
7/11/2021	37.5
7/12/2021	23.3
7/13/2021	13.2
7/14/2021	7.5
7/15/2021	8.8

Source: EPA 2024

Wildfire and Weather Summary

The Beckwourth Complex wildfire northwest of Reno, Nevada, and the Bootleg Fire northeast of Klamath Falls, Oregon, both ignited in early July and rapidly grew throughout the first two weeks of July (for more details, see Table 4-4 above.) On 7/9/2021, prevailing winds began to come from the west and blew smoke from these wildfires east toward Utah and Idaho.

Beginning on 7/10/2021, and continuing on 7/11/2021 and 7/12/2021, the prevailing high-level winds coming into northern Utah came from the west-northwest to east-southeast, and the smoke from the Beckwourth Complex Fire and Bootleg Fire blew into northern Utah. Winds shifted to come from the southwest on 7/13/2021 and blew the heaviest plumes of smoke from these wildfires north into Idaho.

HMS Maps

NOAA's HMS smoke product maps show evidence of long-range smoke transport from these fires to the Rose Park monitoring station in Salt Lake City on July 11 and 12, 2021.

On 7/9/2021, the HMS maps show the heavy smoke plumes from the Beckwourth Complex Fire being blown to the east into northern Nevada (Figure 4-23).

Beginning on 7/10/2021 and continuing on 7/11/2021 and 7/12/2021, the HMS maps show that heavy smoke plumes from the Beckwourth Complex Fire and Bootleg Fire were blown from the west to east or northwest to southeast (Figure 4-24 through Figure 4-26).

The HMS smoke product maps show the Rose Park monitoring station was located in the heavy smoke plumes from 7/10/2021 to 7/12/2021, and a medium smoke plume on 7/13/2021(Figure 4-27).

Figure 4-23. HMS Map from 7/9/2021

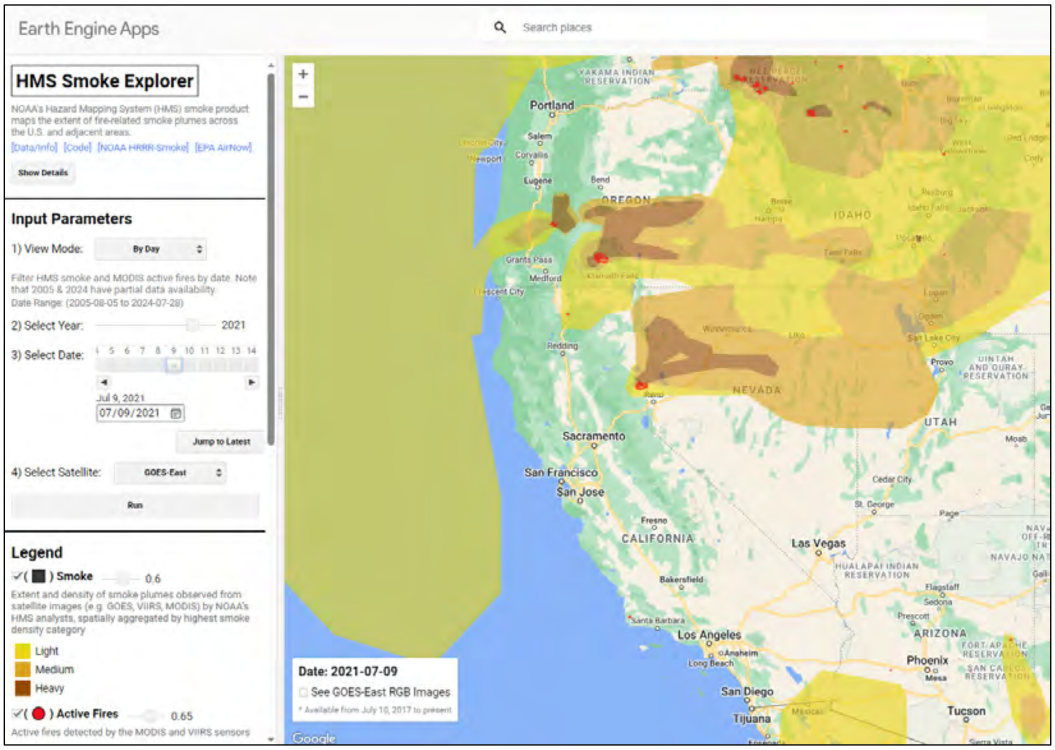


Figure 4-24. HMS Map from 7/10/2021

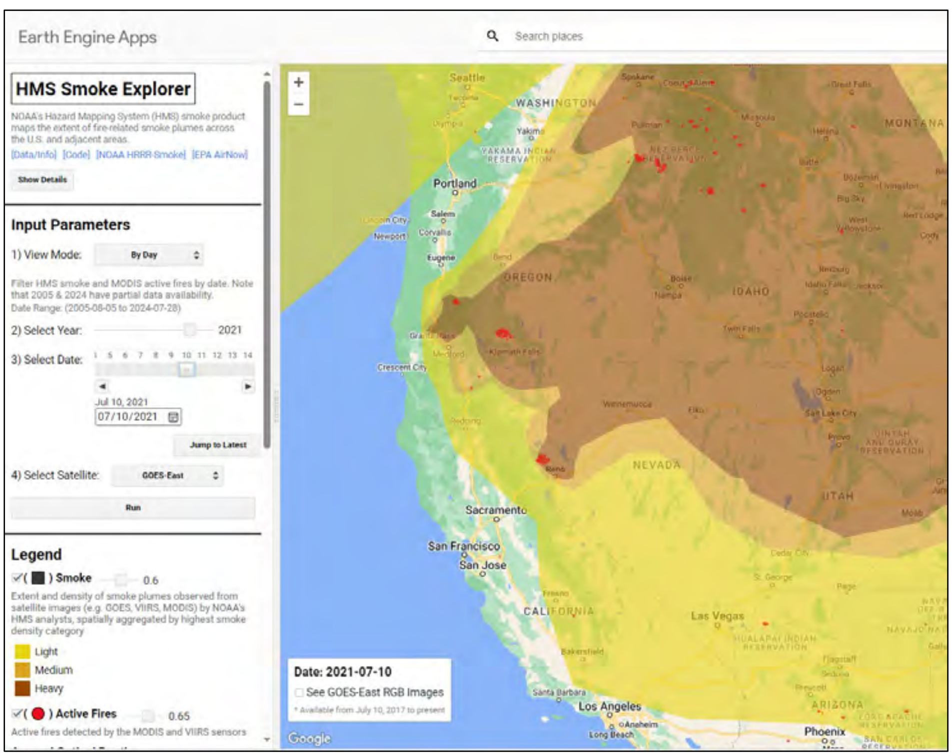


Figure 4-25. HSM Map from 7/11/2021

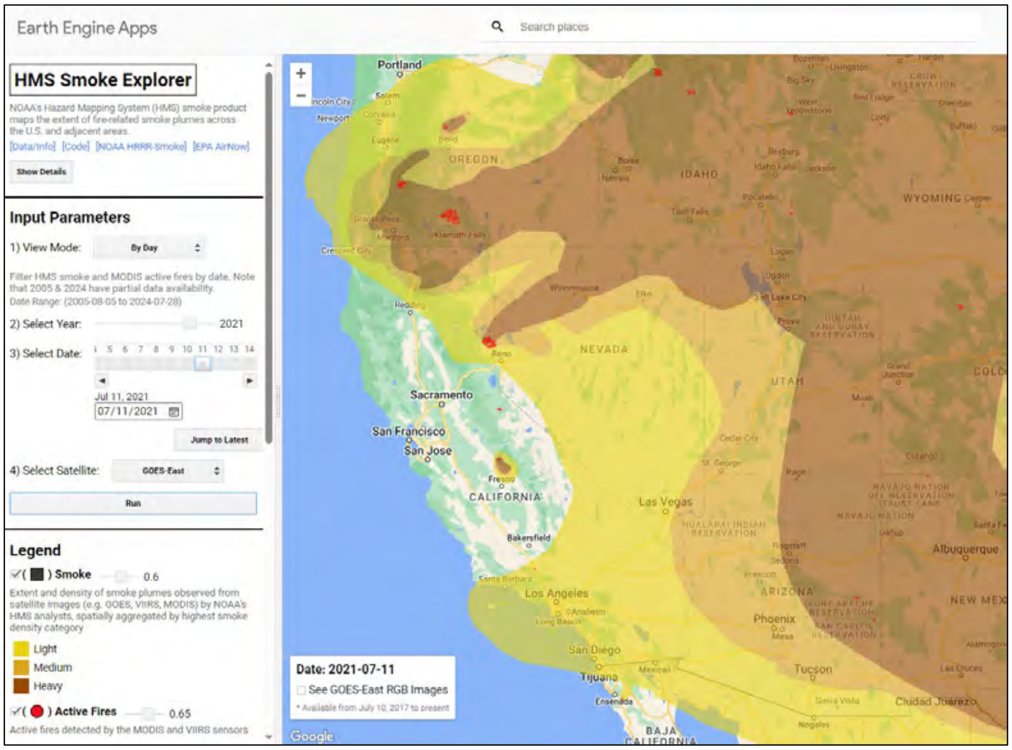


Figure 4-26. HMS Map from 7/12/2021

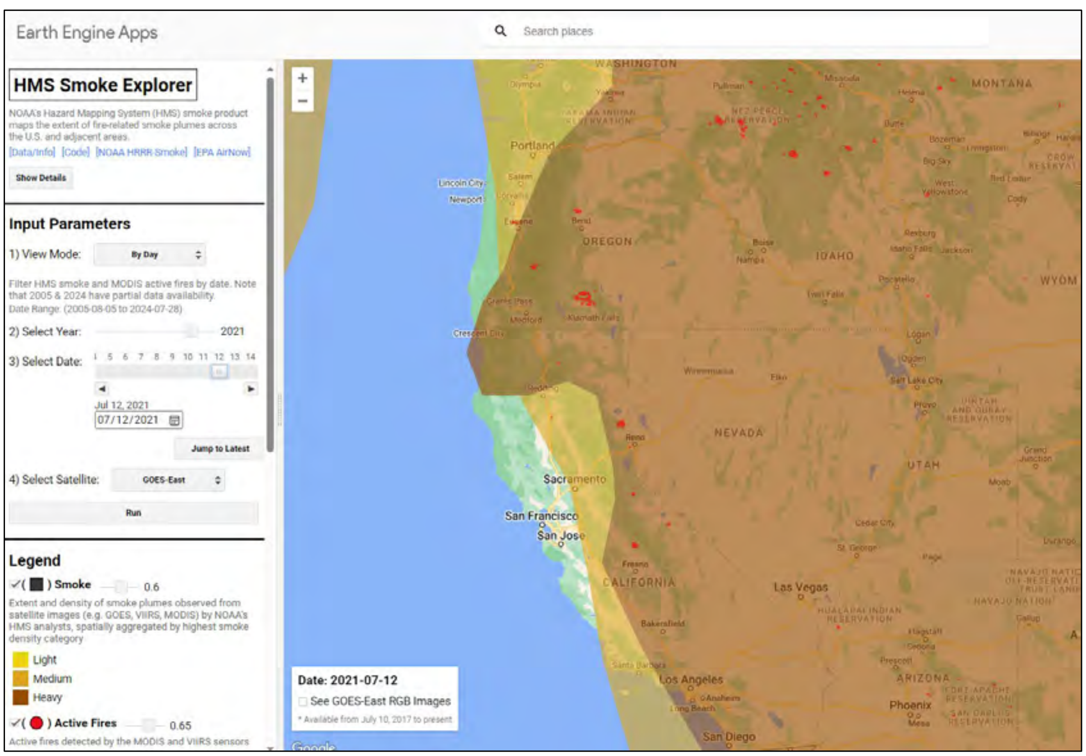
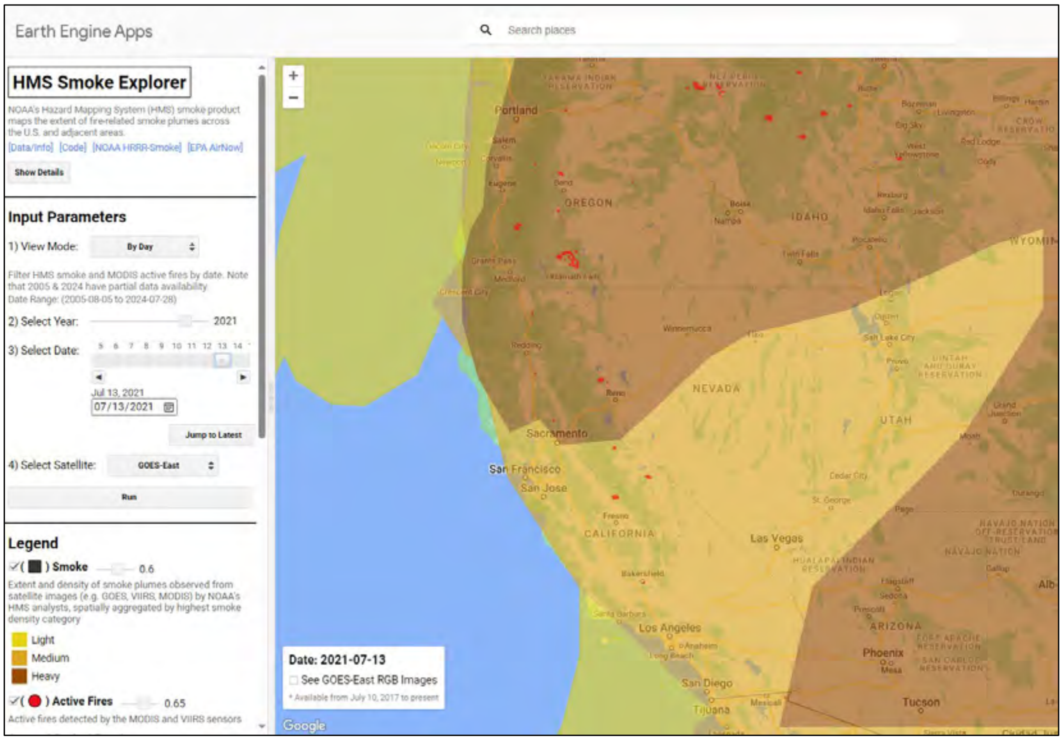


Figure 4-27. HMS Map from 7/13/2021



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on July 11 and 12, 2021 (see Figure 4-28, Figure 4-29, Figure 4-30, and Figure 4-31 below).

Figure 4-28. JSTAR Image from 7/9/2021

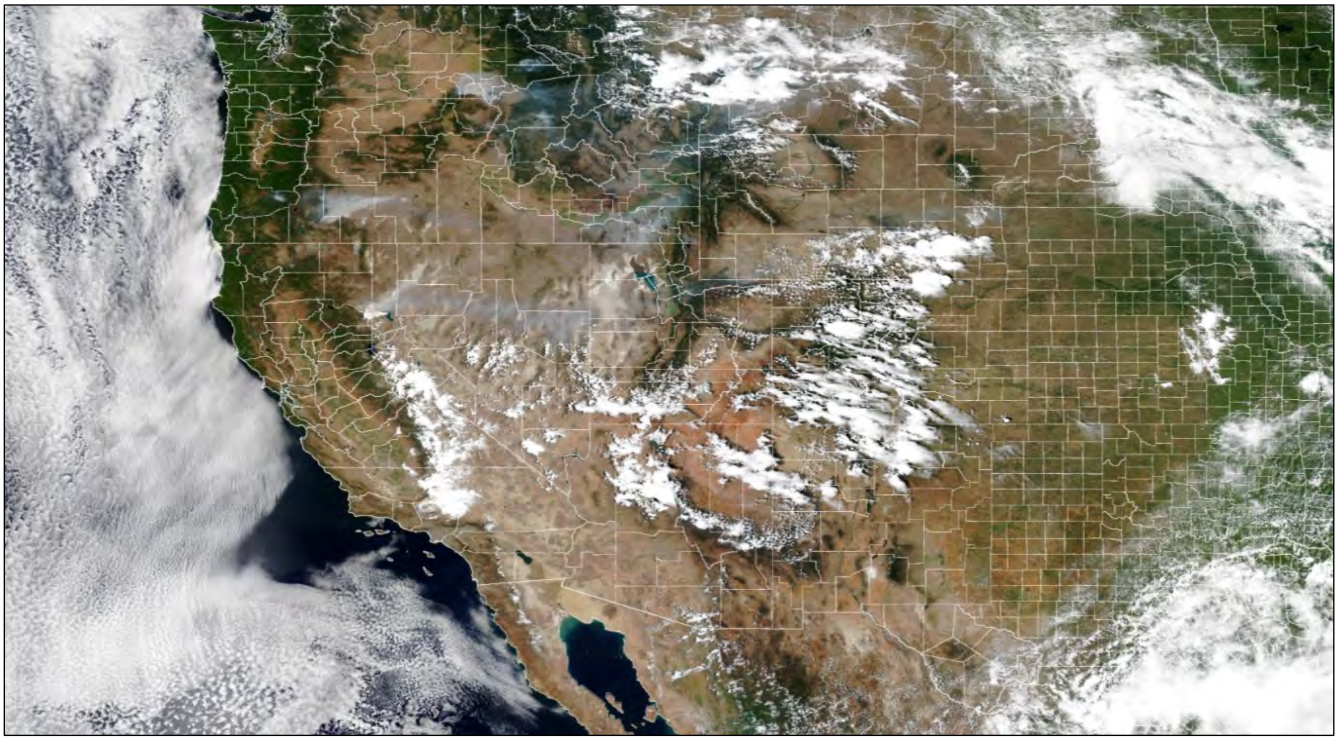


Figure 4-29. JSTAR Image from 7/10/2021

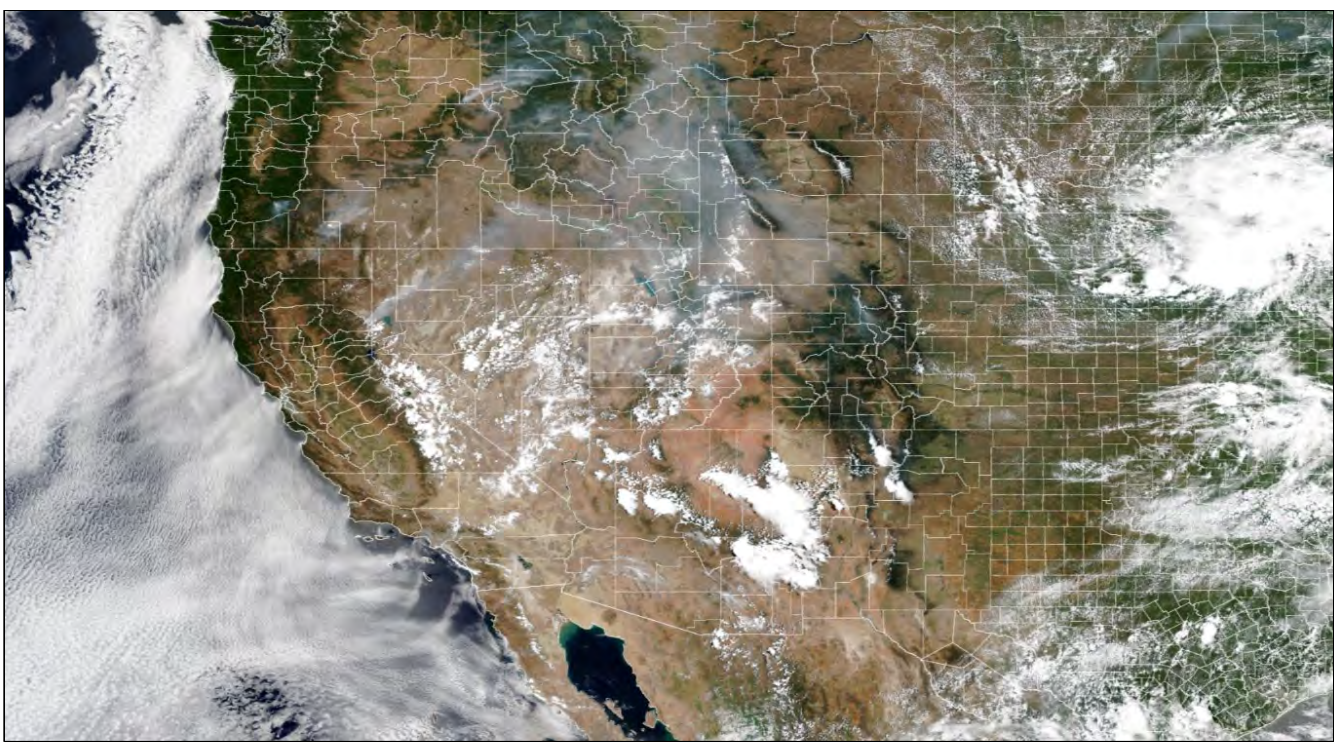
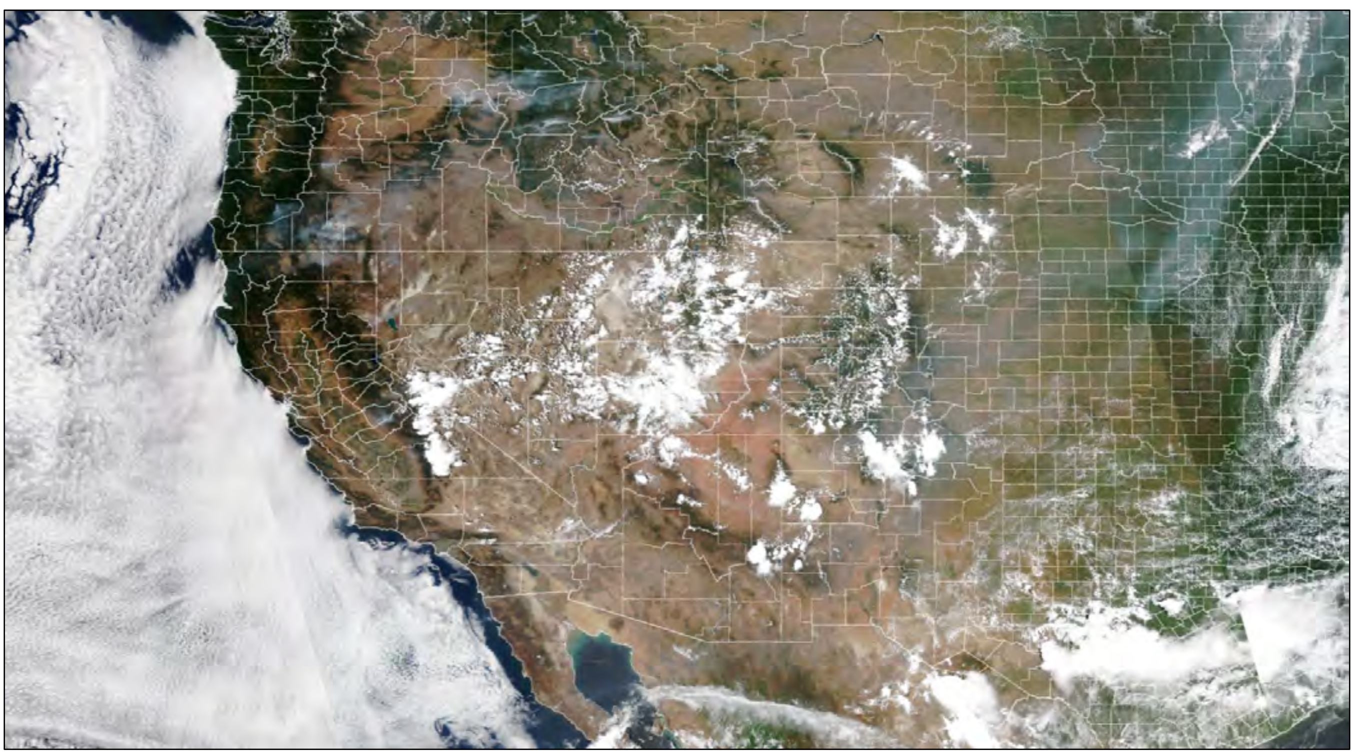


Figure 4-30. JSTAR Image from 7/11/2021

Figure 4-31. JSTAR Image from 7/12/2021



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 7/11/2021 and 7/12/2021at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the Beckwourth Complex Fire to the Rose Park monitoring station in Salt Lake City on July 11 and 12, 2021. HYSPLIT 48-hour backward trajectories from the Rose Park monitoring station indicated likely transport of particles from the Beckwourth Complex Fire to near-surface ambient air in Salt Lake City. HYSPLIT modeled particles arrived in Salt Lake City during the evening of 7/11/2021 (Figure 4-32).

HYSPLIT forward ensemble trajectories originating from the Beckwourth Complex Fire on 7/9/2021 and 7/10/2021 (Figure 4-33 and Figure 4-34) also suggest long-range transport of wildfire smoke to the Salt Lake City area by 7/12/2021. Both the HMS maps and JSTAR images (Figure 4-23 through Figure 4-31) show that the prevailing winds also likely provided long-range smoke transport from the Bootleg Fire in Oregon to the Rose Park monitoring station during this time.

Figure 4-32. HYSPLIT Backward Trajectories on 7/11/2021

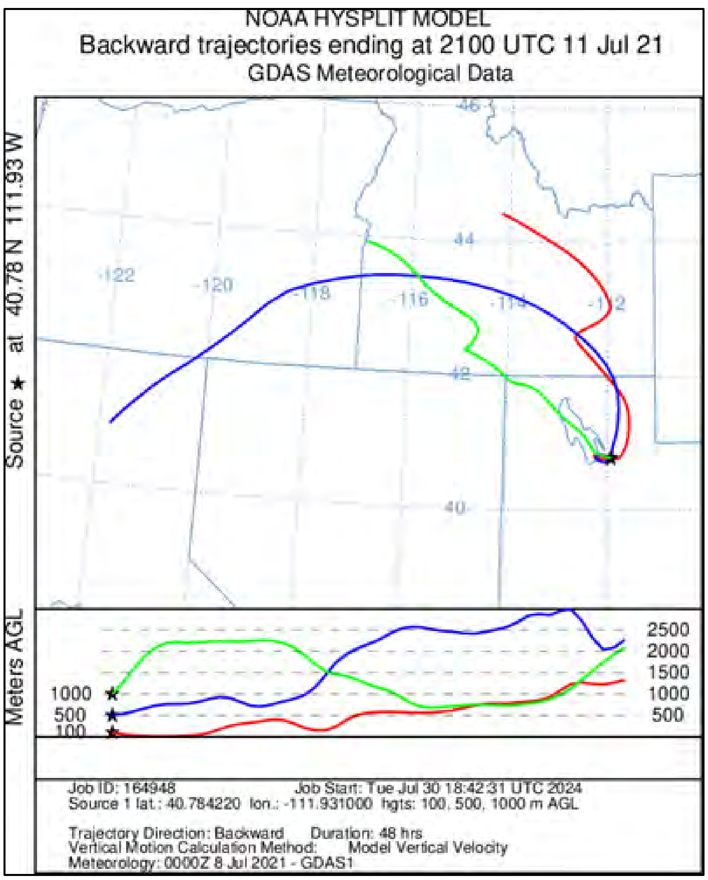


Figure 4-33. HYSPLIT Forward Trajectories on 7/9/2021 and 7/10/2021

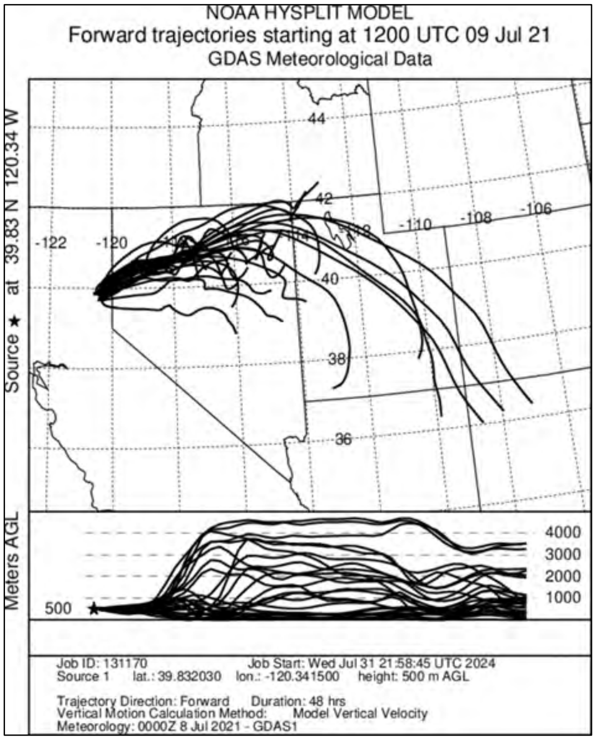
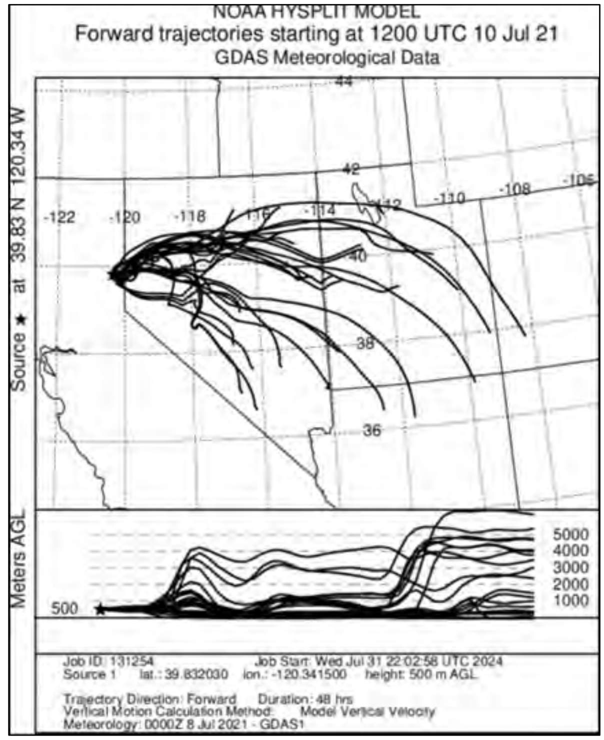


Figure 4-34. HYSPLIT Forward Trajectories on 7/10/2021



4.2.3 Smoke Transport on July 25, 2021

Monitoring Data Observations

As shown in Table 4-6, monitoring data from the Rose Park monitoring station show a spike in 24-hour $PM_{2.5}$ values that began on 7/24/2021, and 24-hour $PM_{2.5}$ concentrations peaked on 7/25/2021 (37.2 μg/m^3). The 24-hour $PM_{2.5}$ values decreased to 22.6 μg/m^3 on 7/26/2021. Then, concentrations were below 10 μg/m^3 after 7/27/2021.

As shown on Table 3-1 and Figure 3-2, the 7/24, 7/25, and 7/26/2021 24-hour $PM_{2.5}$ values were outliers for July, which had an average 24-hour $PM_{2.5}$ value of 8.8 μg/m^3 for the 5-year period from 2019 to 2023. During July 2019, 2022, and 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's 24-hour $PM_{2.5}$ values averaged less than 8 μg/m^3.

Table 4-6. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from July 23–27, 2021

In μg/m^3

Date	24-hour $PM_{2.5}$ Value
7/23/2021	9.5
7/24/2021	26.8
7/25/2021	37.2
7/26/2021	22.6
7/27/2021	5.5

Source: EPA 2024

Wildfire and Weather Summary

The active wildfires that produced long-range smoke from 7/23/2021 through 7/27/2021 were the Tamarack Fire (south of Reno, Nevada), Dixie Fire (north of Sacramento, California), and Bootleg Fire (northeast of Klamath Falls, Oregon), which are summarized in Table 4-4 above. By 7/23/2021, the Tamarack and Dixie Fires had already been burning for 2 or 3 weeks, and they were still actively growing.

The Tamarack Fire began on 7/16/202, and also expanded rapidly during this time. On 7/23/2021, the prevailing high-level winds were from the southwest, and the smoke from these wildfires blew into eastern Oregon and Idaho. Winds shifted to come from the west on 7/24/2021. On 7/25/2021 and 7/26/2021, the winds blew smoke from these wildfires into Utah.

HMS Maps

NOAA HMS smoke product maps show evidence of long-range smoke transport from these fires to the Rose Park monitoring station in Salt Lake City on July 25, 2021.

On 7/23/2021, the HMS maps show the heavy smoke plumes from the Tamarack Fire, Dixie Fire, and Bootleg Fire being blown to the northeast into eastern Oregon and Idaho (Figure 4-35). Beginning on 7/24/2021, the winds shifted to come more from the west, and heavy smoke plumes blew into southern Idaho (Figure 4-36). On 7/25/2021 and 7/26/2021, the HMS maps show the heavy smoke plumes from the Tamarack, Dixie, and Bootleg Fires being blown from the west to east, with northern Utah covered in the heavy smoke plumes, which likely came from the Dixie and Tamarack Fires (Figure 4-37 and Figure 4-38).

Figure 4-35. HMS Map from 7/23/2021

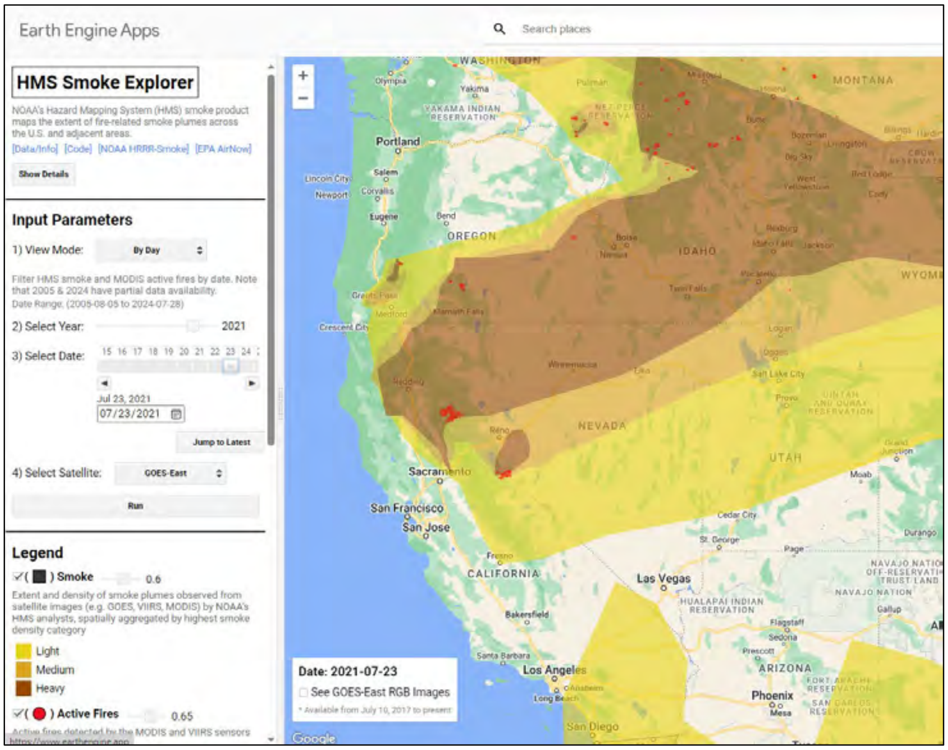


Figure 4-36. HMS Map from 7/24/2021

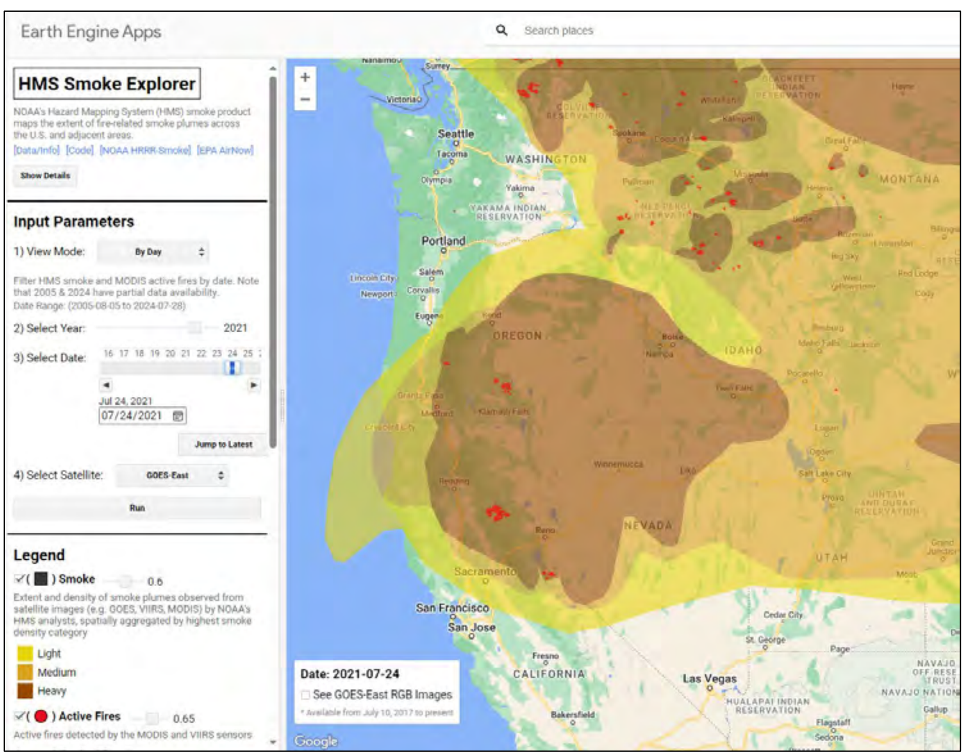


Figure 4-37. HMS Map from 7/25/2021

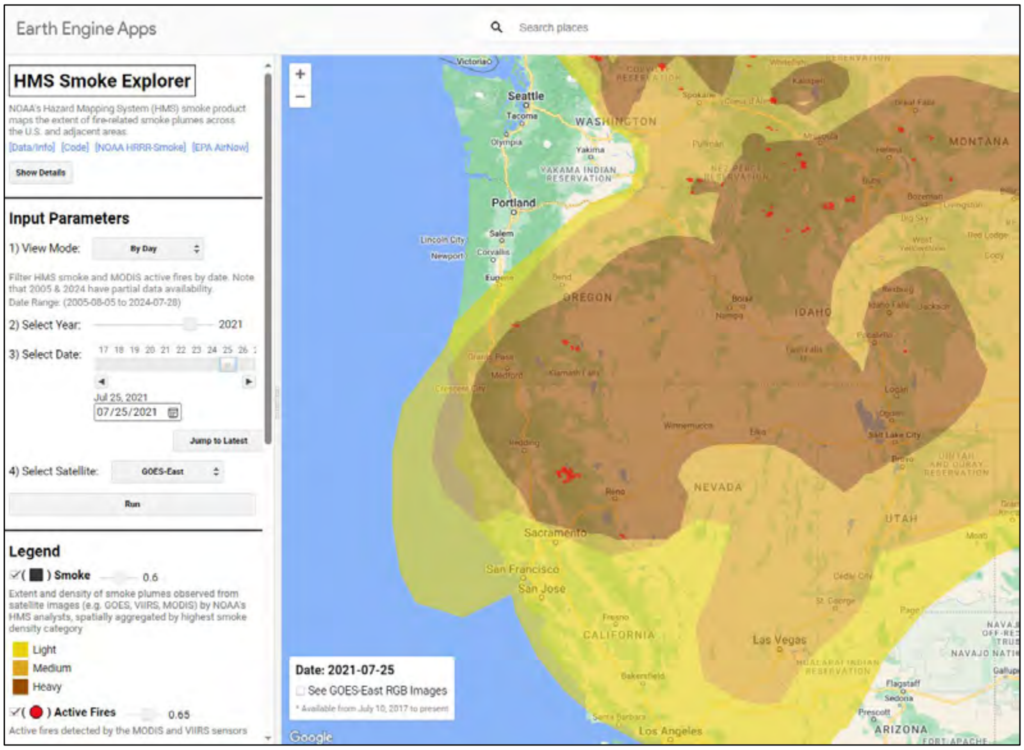
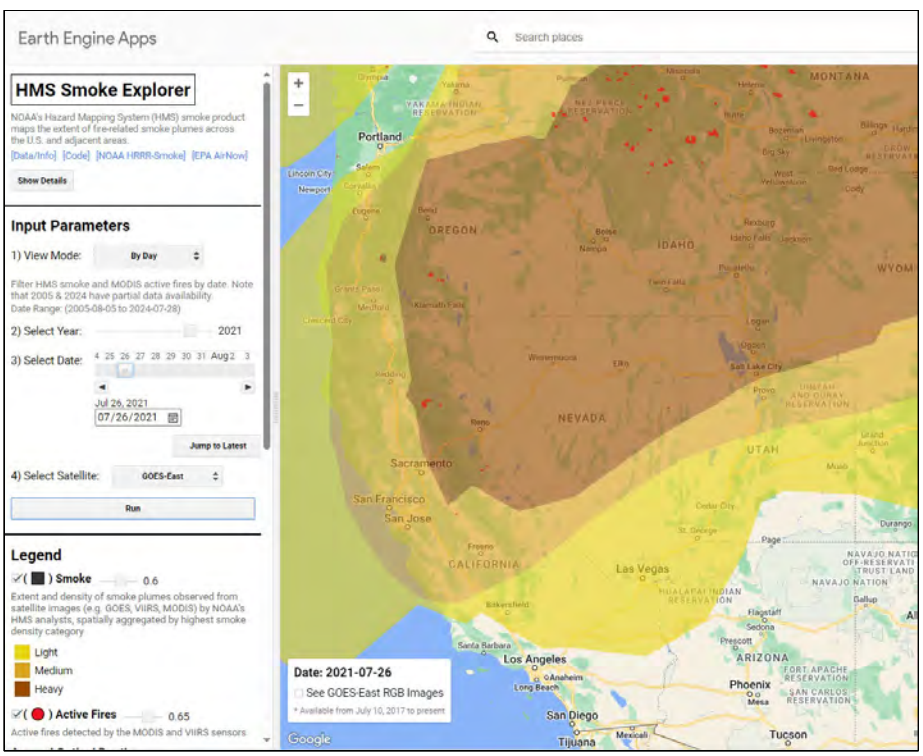


Figure 4-38. HMS Map from 7/26/2021



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on July 25, 2021 (see Figure 4-39, Figure 4-40, Figure 4-41, and Figure 4-42 below).

Figure 4-39. JSTAR Image from 7/23/2021

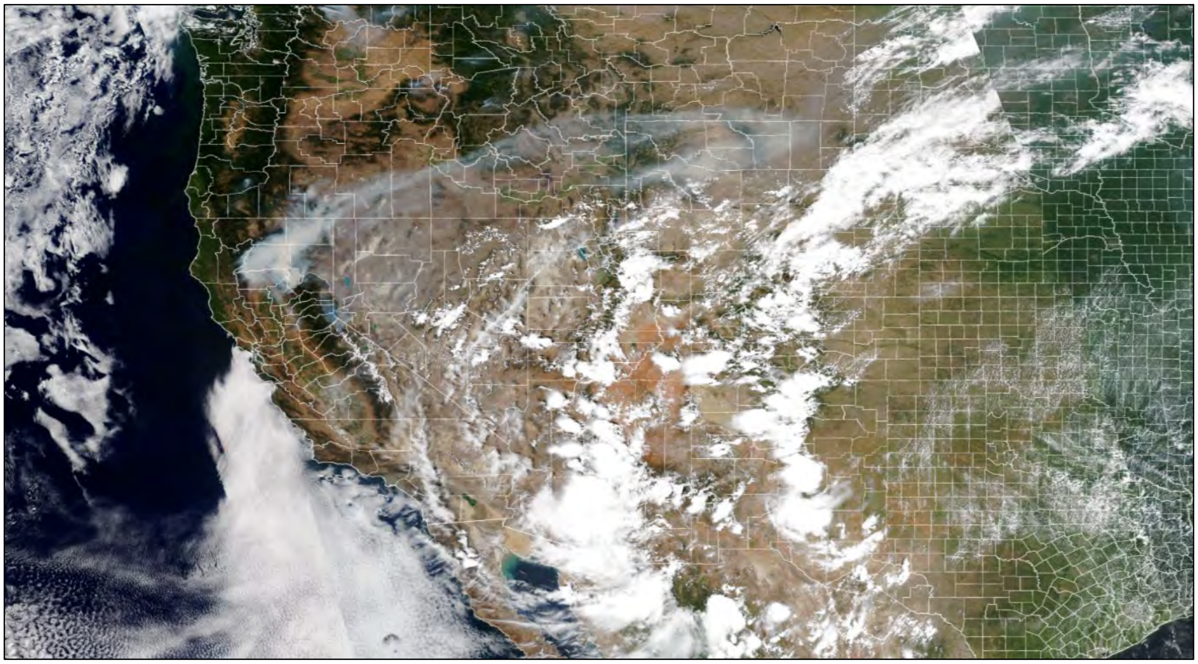


Figure 4-40. JSTAR Image from 7/24/2021

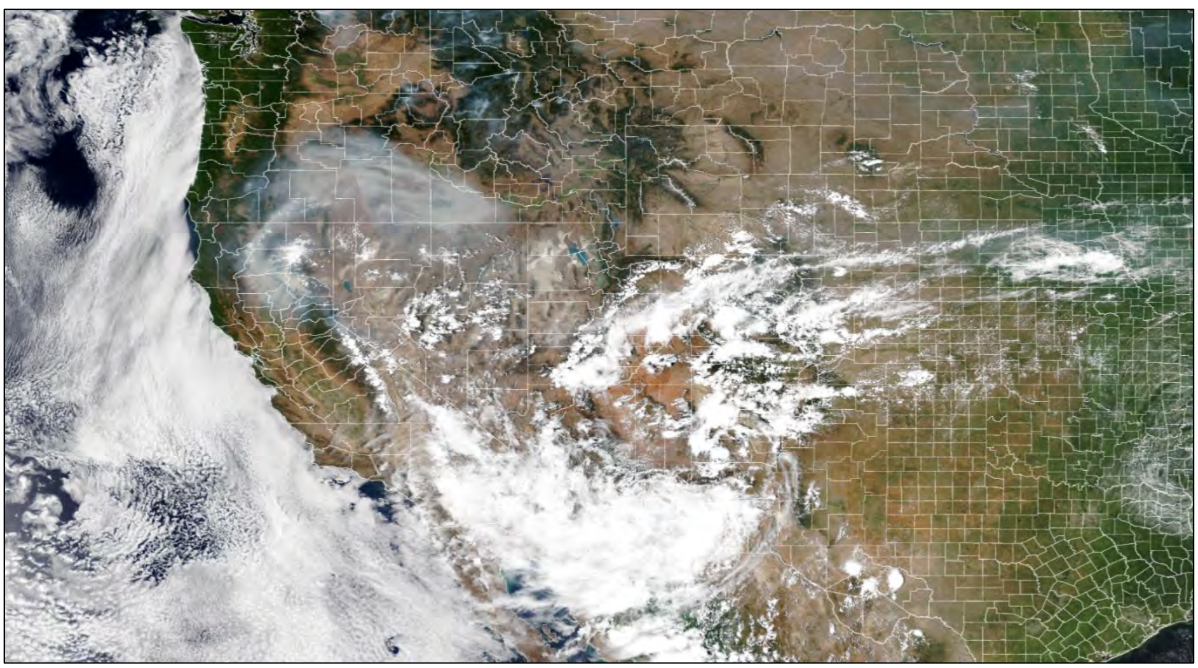


Figure 4-41. JSTAR Image from 7/25/2021

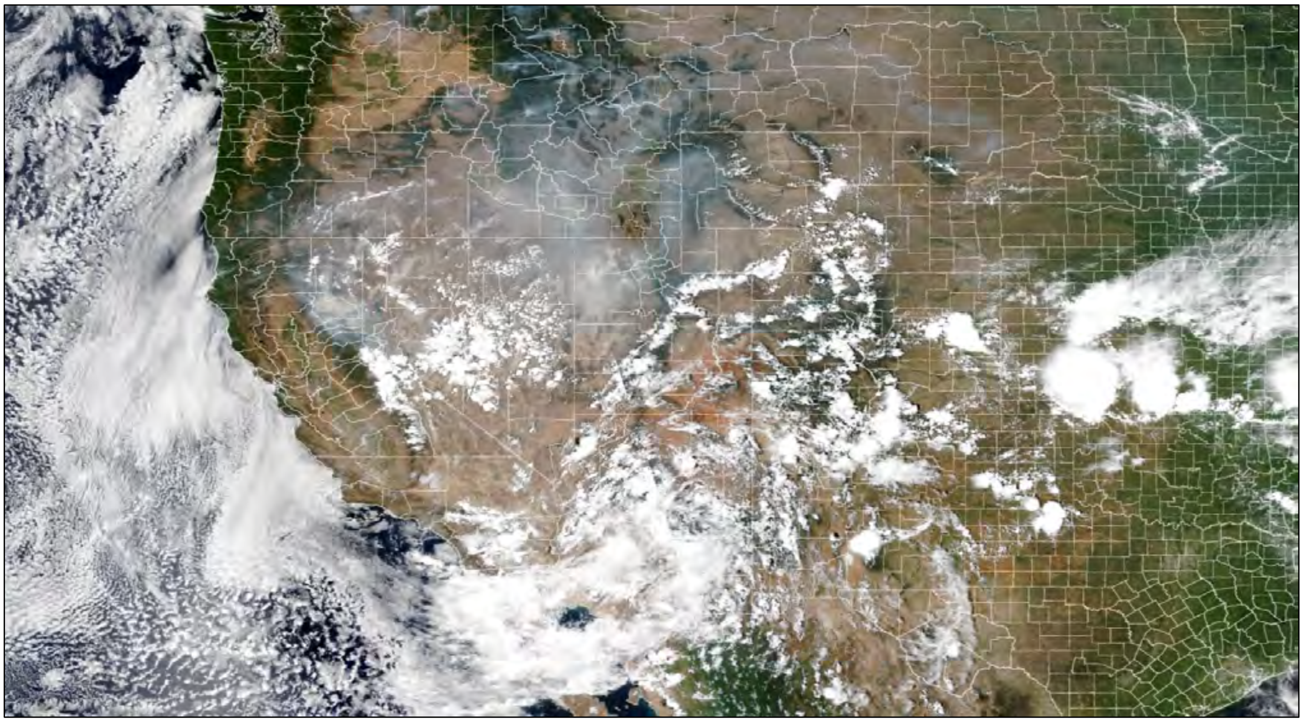
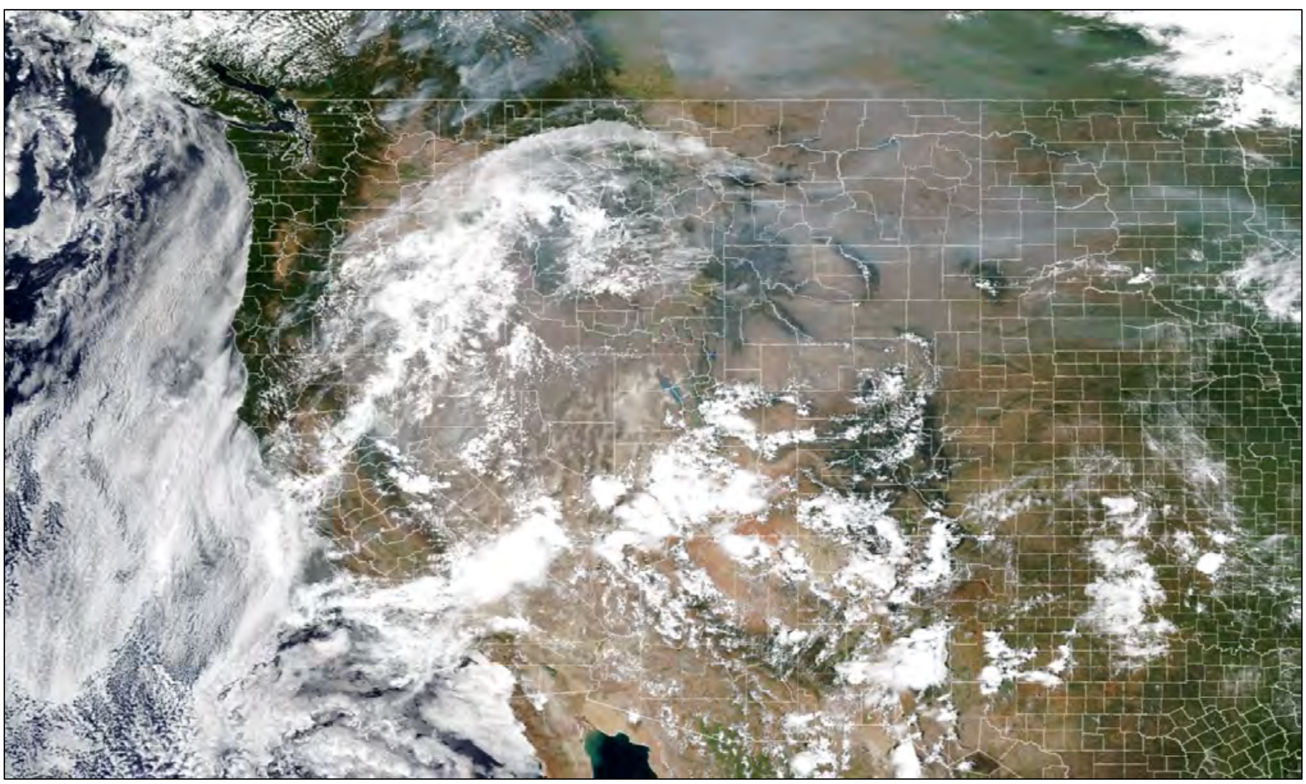


Figure 4-42. JSTAR Image from 7/26/2021



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 7/25/2021 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City on July 25, 2021. HYSPLIT 48-hour backward trajectories from the Rose Park station indicate likely transport of particles from the Dixie Fire to near-surface ambient air in Salt Lake City. HYSPLIT modeled particles arrived in Salt Lake City during the evening of 7/25/2021 (Figure 4-43).

HYSPLIT forward ensemble trajectories originating from the Dixie Fire on 7/23/2021 also suggest long-range transport of wildfire smoke to the Salt Lake City area by 7/25/2021 (Figure 4-44). Both the HMS maps and JSTAR images (Figure 4-35 through Figure 4-42) suggest that the prevailing winds also likely provided long-range smoke transport from the Tamarack Fire to the Rose Park monitoring station during this time.

Figure 4-43. HYSPLIT Backward Trajectories on 7/25/2021

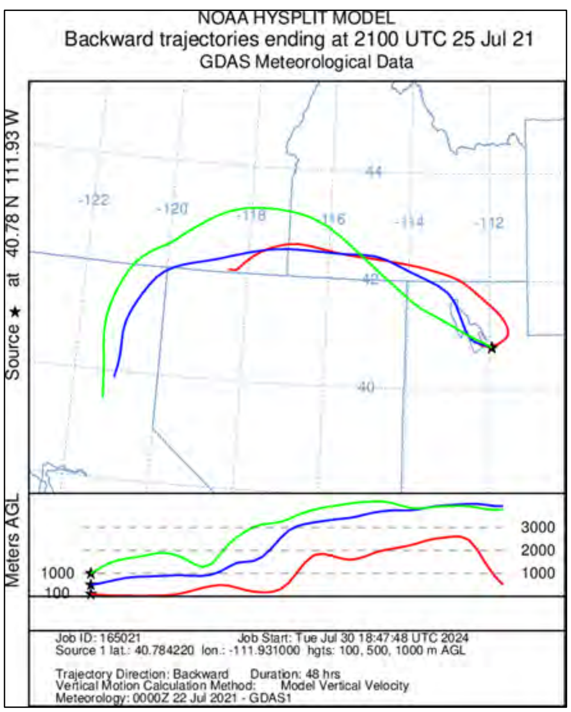
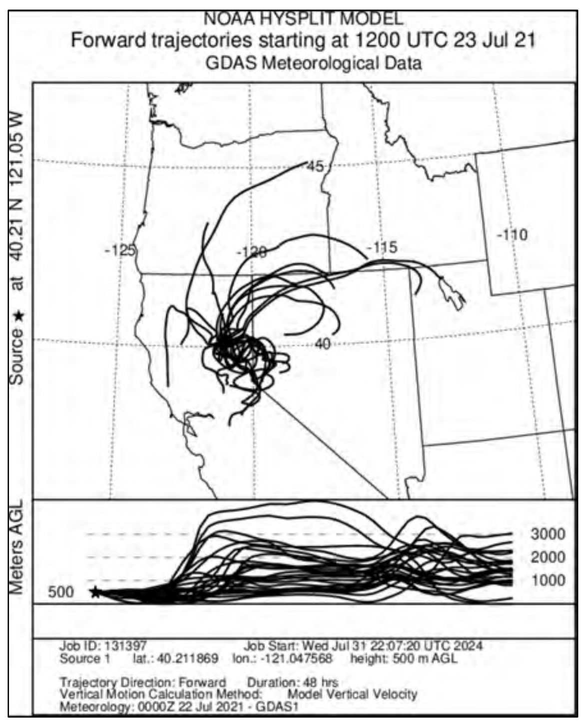


Figure 4-44. HYSPLIT Forward Trajectories on 7/23/2021



4.2.4 Smoke Transport on August 6, 7, 8, 9, and 10, 2021

Monitoring Data Observations

As shown in Table 4-7, monitoring data from the Rose Park monitoring station show an initial smaller spike in 24-hour $PM_{2.5}$ values on 8/4/2021. Then, the data show a larger spike in 24-hour $PM_{2.5}$ values that began on 8/6/2021, and daily $PM_{2.5}$ concentrations peaked on 8/6/2021 (48.2 μg/m^3). The 24-hour $PM_{2.5}$ values decreased each day after that and were below 15 μg/m^3 between 8/11/2021 and 8/15/2021. For more information about 8/15/2021 through 8/20/2021, see Section 4.2.5, *Smoke Transport on August 15, 16, and 18, 2021*.

As shown on Table 3-1 and Figure 3-2, the 8/6/2021 through 8/10/2021 24-hour $PM_{2.5}$ values were outliers for August, which had an average 24-hour $PM_{2.5}$ value of 10.5 μg/m^3 for the 5-year period from 2019 to 2023. In August 2019, 2022, and 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's 24-hour $PM_{2.5}$ values averaged less than 7 μg/m^3.

Table 4-7. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 1–11, 2021

In μg/m^3

Date	24-hour $PM_{2.5}$ Value
8/1/2021	3.6
8/2/2021	3.2
8/3/2021	11.2
8/4/2021	20.7
8/5/2021	13.5
8/6/2021	48.2
8/7/2021	42.2
8/8/2021	39.5
8/9/2021	24.0
8/10/2021	23.8
8/11/2021	11.7

Source: EPA 2024

Wildfire and Weather Summary

In early August 2021, the Dixie Fire was still actively burning northeast of Sacramento. On 7/30/2021 and 7/31/2021, five large fires ignited in northern California: the Monument, McFarland, River Complex, McCash, and Antelope Fires, which are summarized in Table 4-1 above. These wildfires expanded rapidly throughout August 2021. On 8/5/2021, the prevailing high-level winds came from the south, and the smoke from these wildfires blew into Oregon. Beginning on 8/6/2021 and continuing through 8/10/2021, winds shifted to come from the west and blew smoke from these wildfires into Utah.

HMS Maps

NOAA HMS smoke product maps show evidence of long-range smoke transport from the fires to the Rose Park monitoring station in Salt Lake City on August 6, 7, 8, 9, and 10, 2021.

On 8/5/2021, the HMS maps show that the heavy smoke plumes from the Dixie, Monument, McFarland, River Complex, McCash and Antelope Fires (all located in northern California) being blown to the north into Oregon (Figure 4-45). Beginning on 8/6/2021, and continuing through 8/10/2021, the HMS maps show the heavy smoke plumes from the Dixie, Monument, McFarland, River Complex, and Antelope Fires being blown from the west to east, and northern Utah was covered in the heavy smoke plumes from these fires (Figure 4-46, Figure 4-47, Figure 4-48, Figure 4-49, and Figure 4-50). Beginning on 8/11/2021, the HMS maps show the heavy smoke plumes being blown more to the southeast into southern Utah (Figure 4-51).

Figure 4-45. HMS Map from 8/5/2021

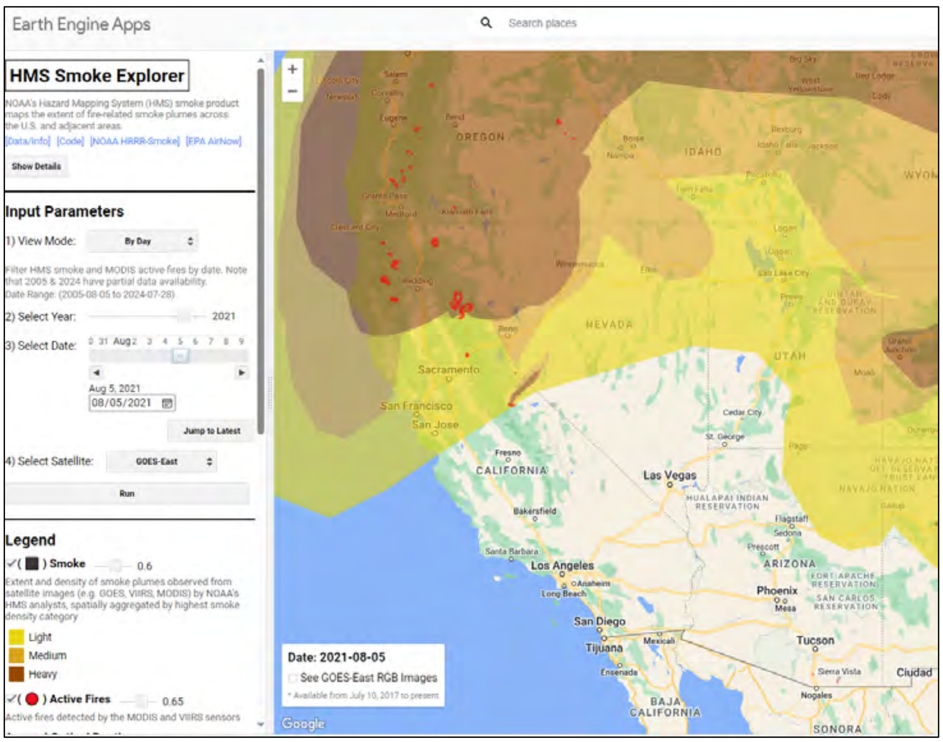


Figure 4-46. HMS Map from 8/6/2021

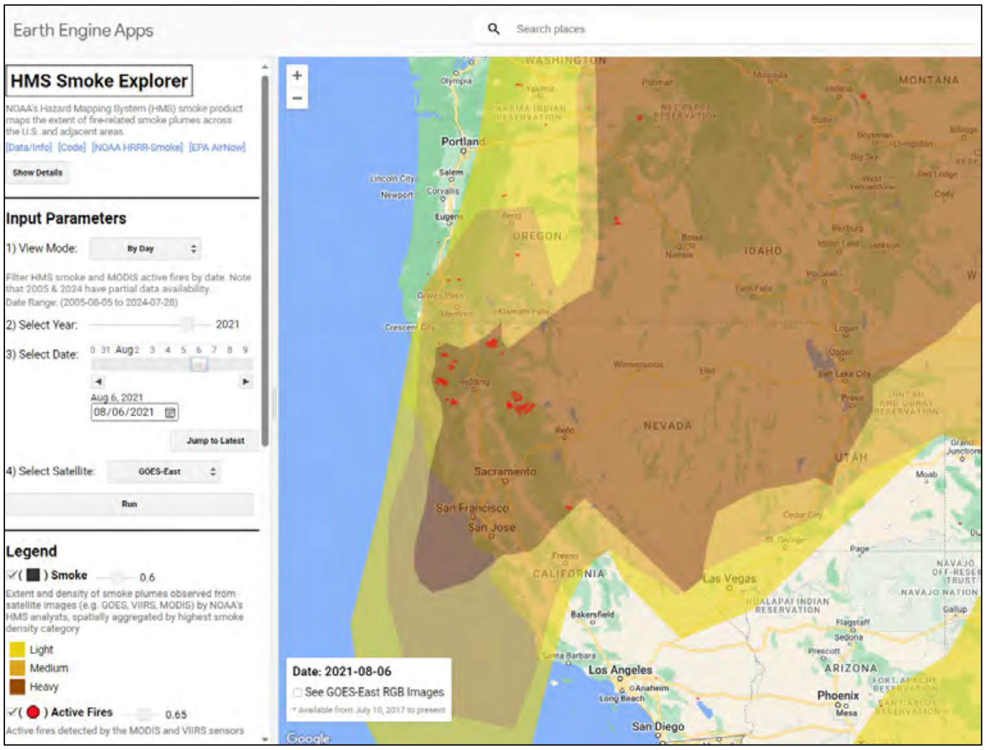


Figure 4-47. HMS Map from 8/7/2021

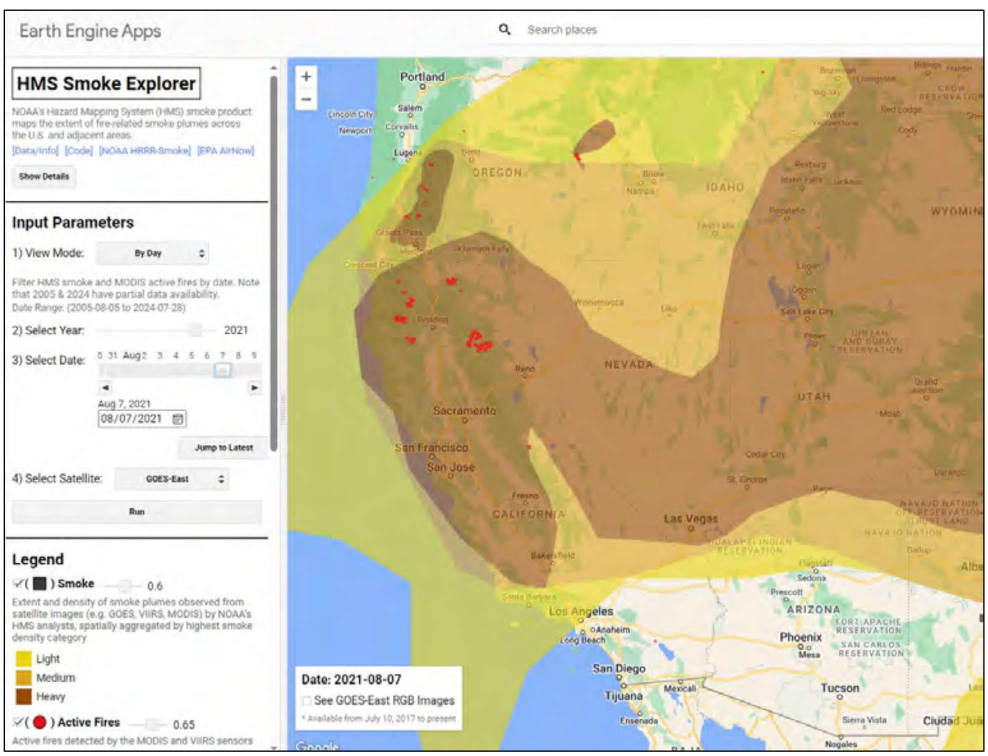


Figure 4-48. HMS Map from 8/8/2021

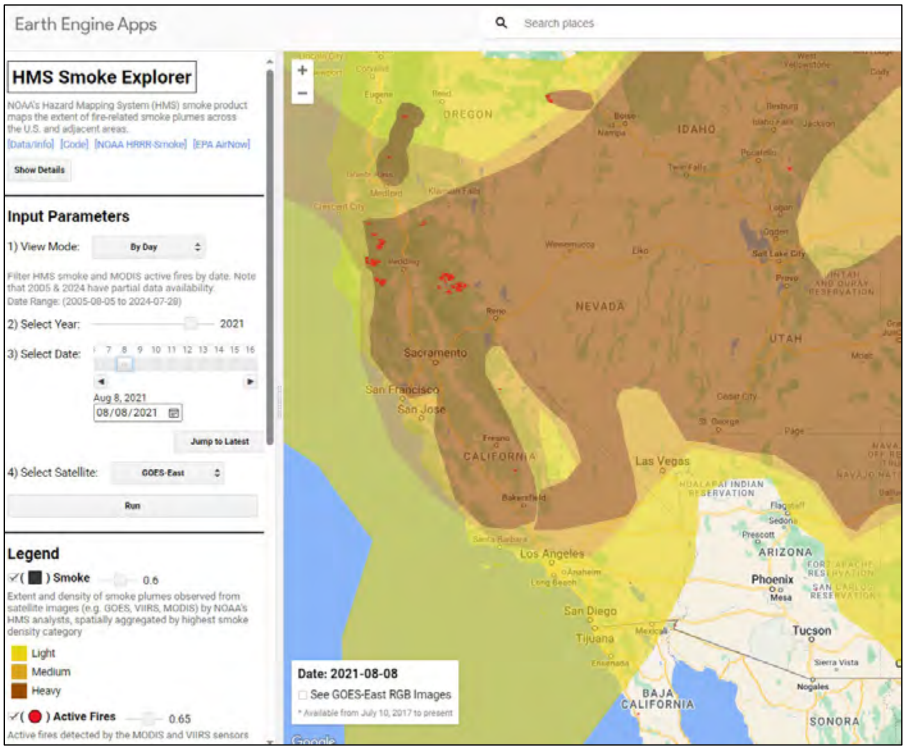


Figure 4-49. HMS Map from 8/9/2021

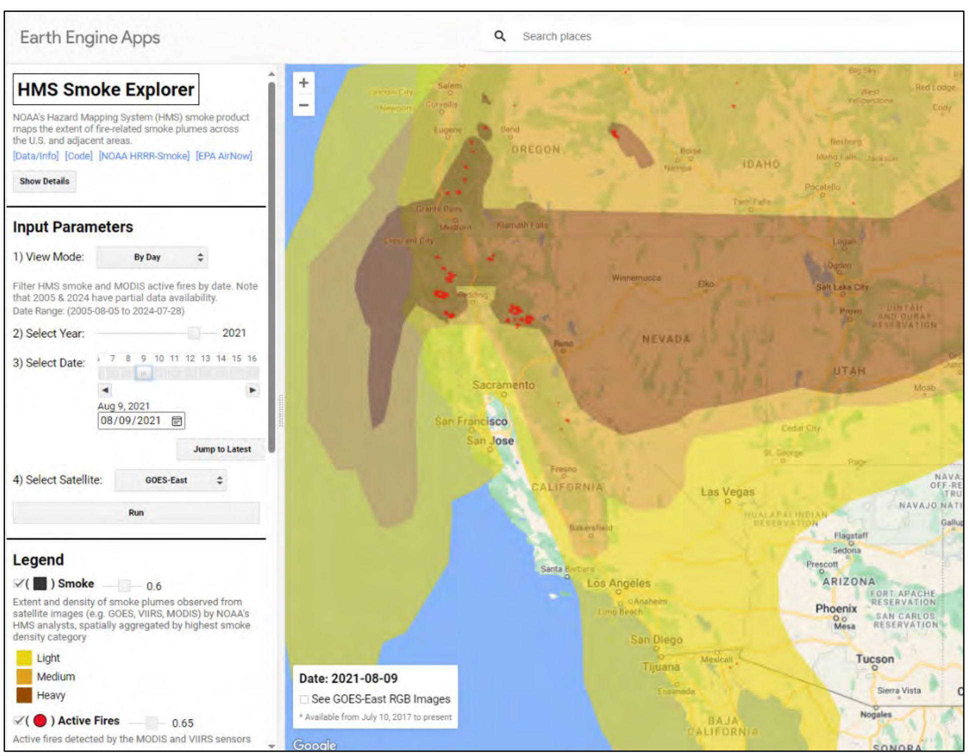


Figure 4-50. HMS Map from 8/10/2021

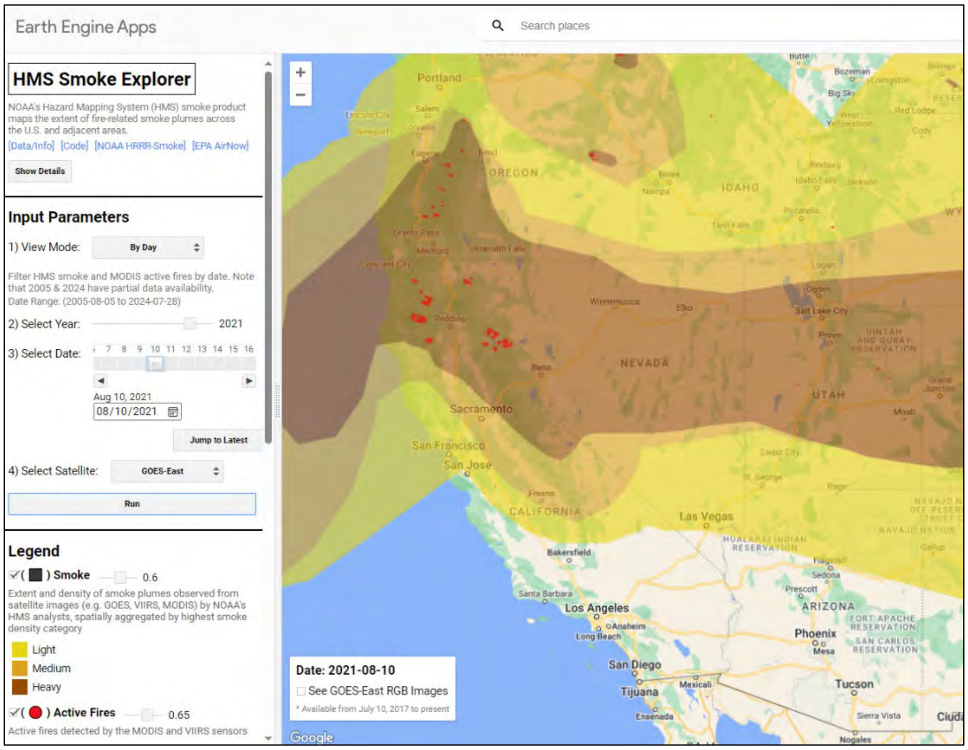
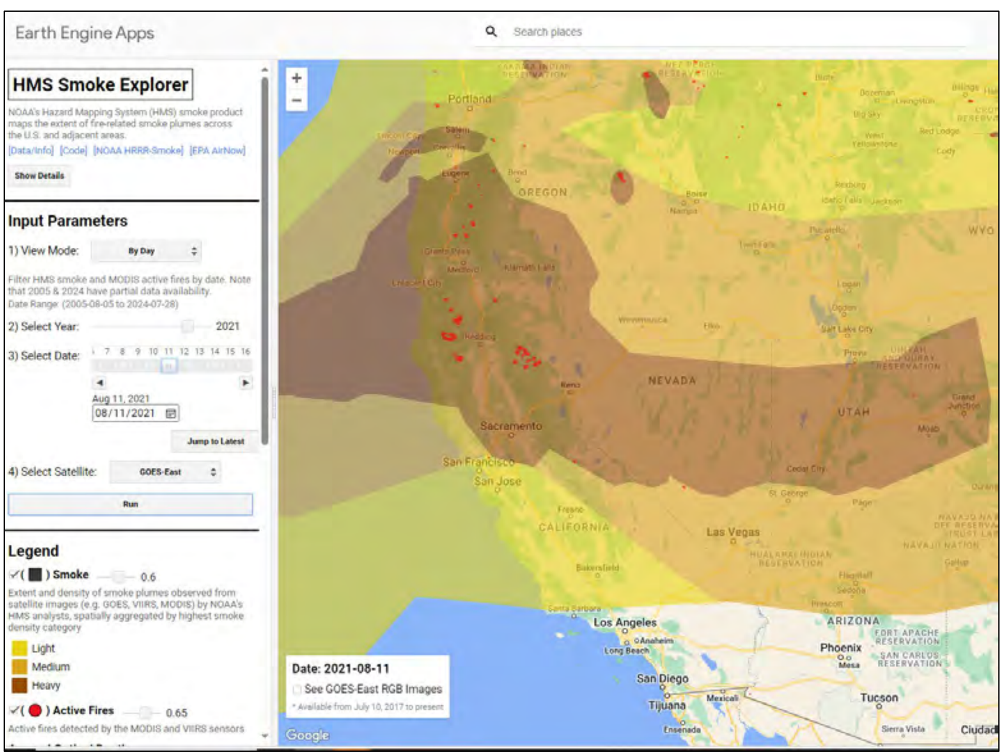


Figure 4-51. HMS Map from 8/11/2021



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on August 6, 7, 8, 9, and 10, 2021 (Figure 4-52, Figure 4-53, Figure 4-54, Figure 4-55, Figure 4-56, and Figure 4-57).

Figure 4-52. JSTAR Image from 8/5/2021

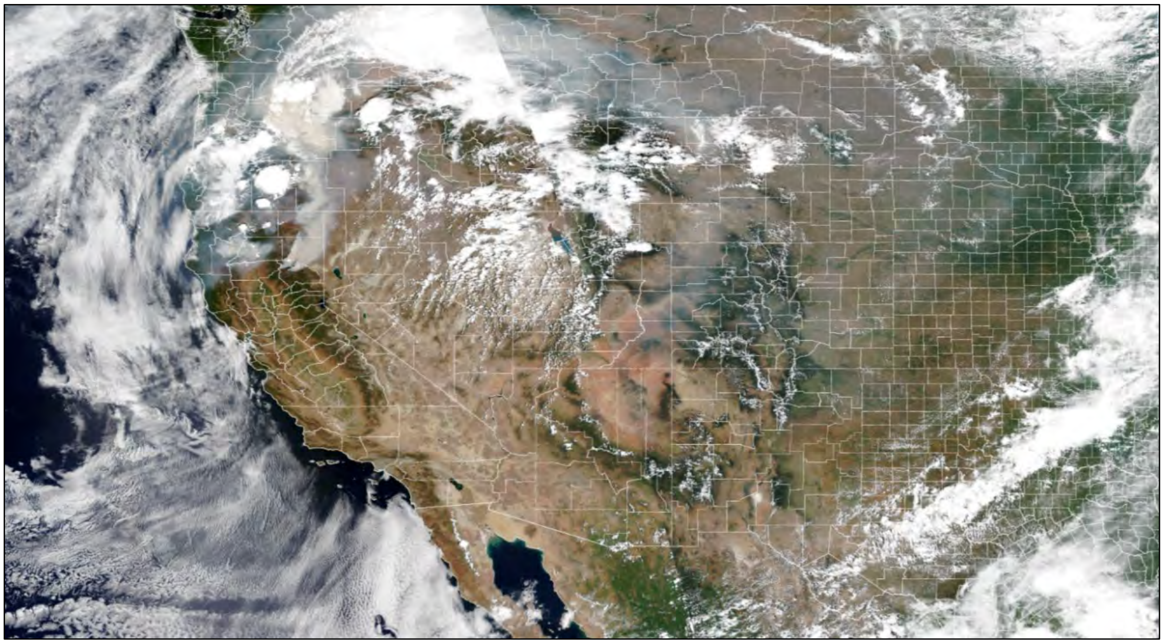


Figure 4-53. JSTAR Image from 8/6/2021

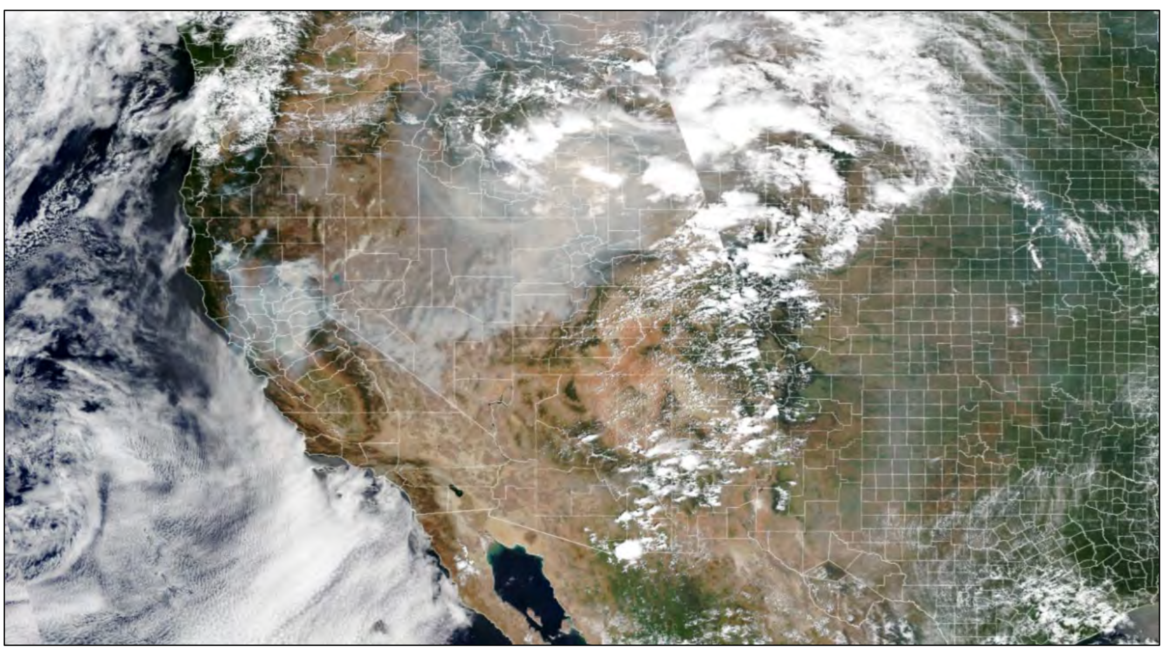


Figure 4-54. JSTAR Image from 8/7/2021

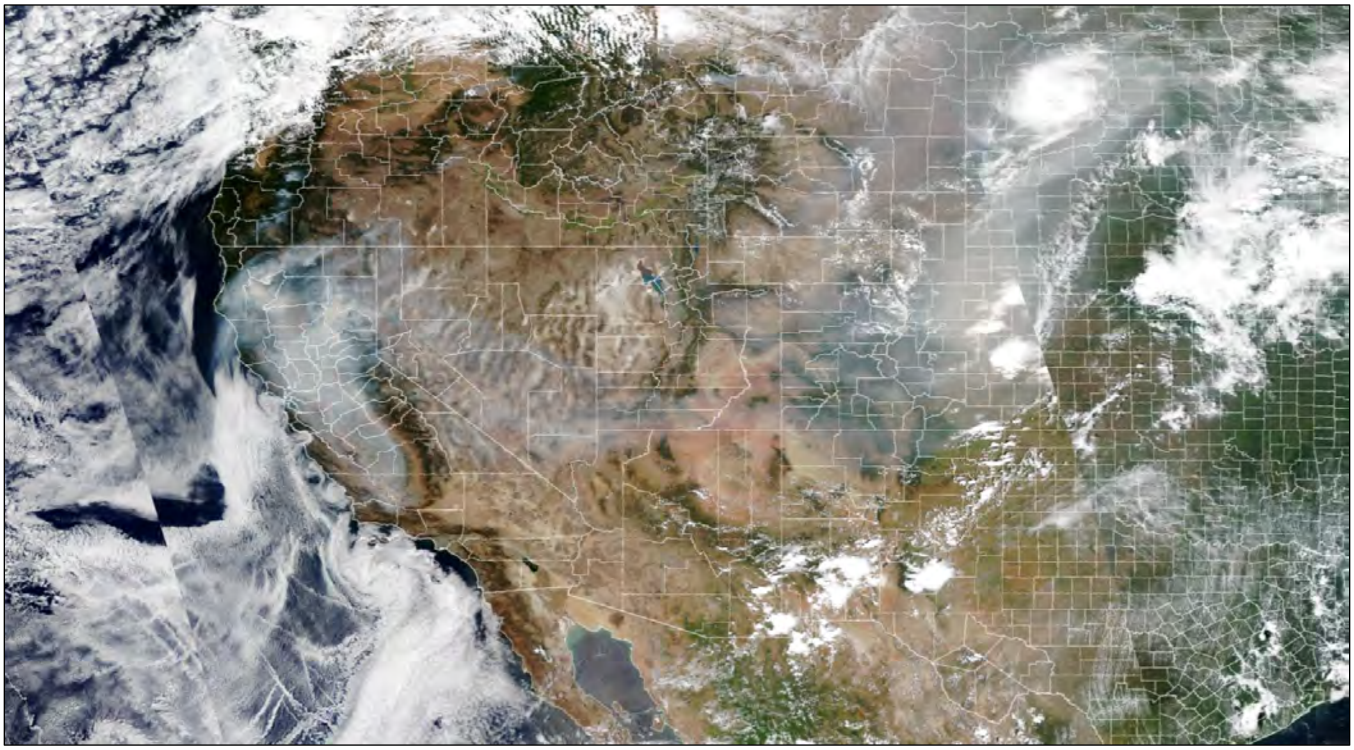


Figure 4-55. JSTAR Image from 8/8/2021

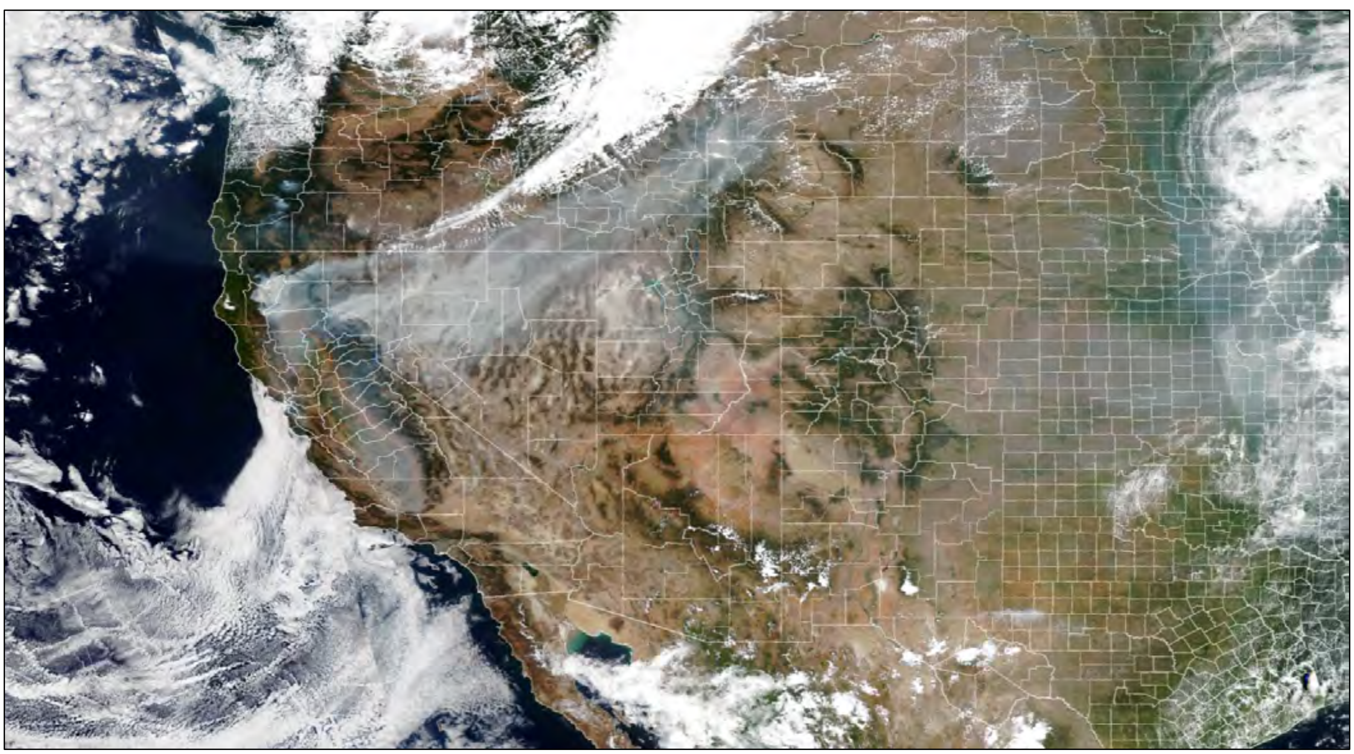


Figure 4-56. JSTAR Image from 8/9/2021

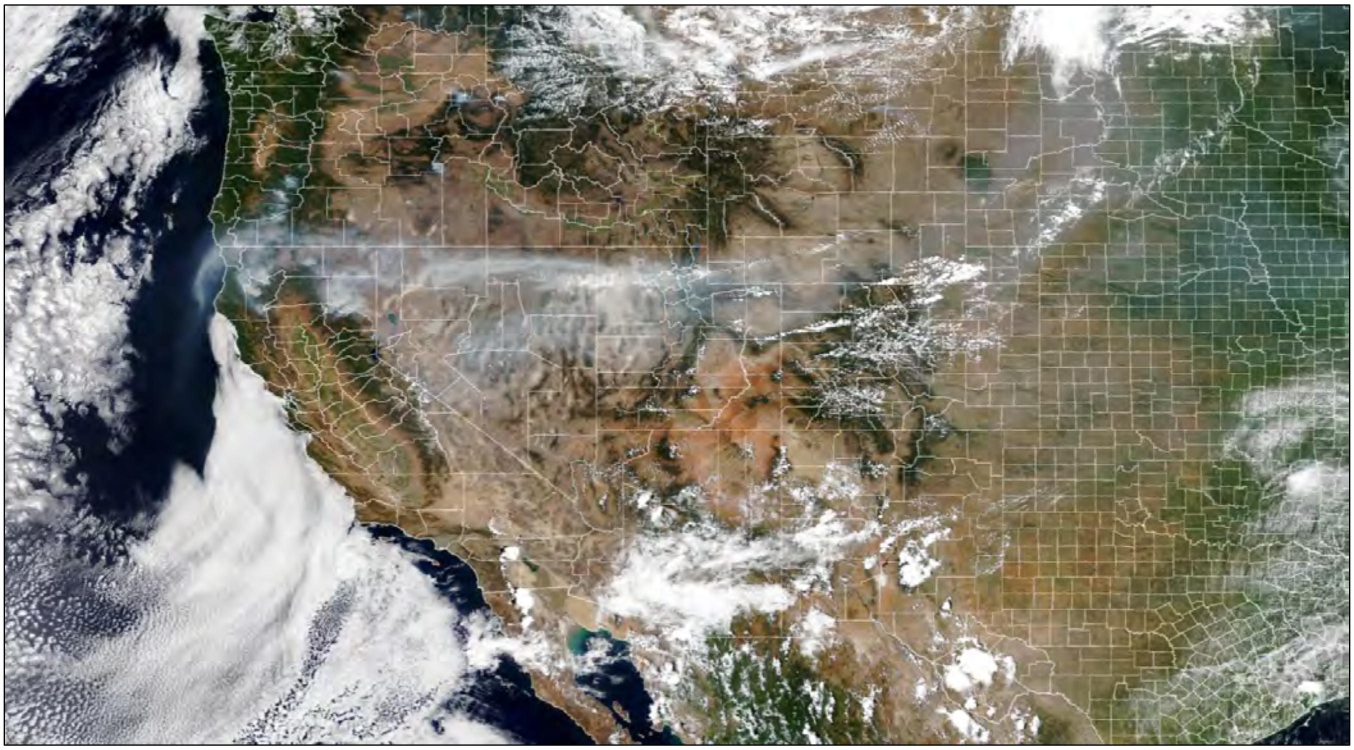
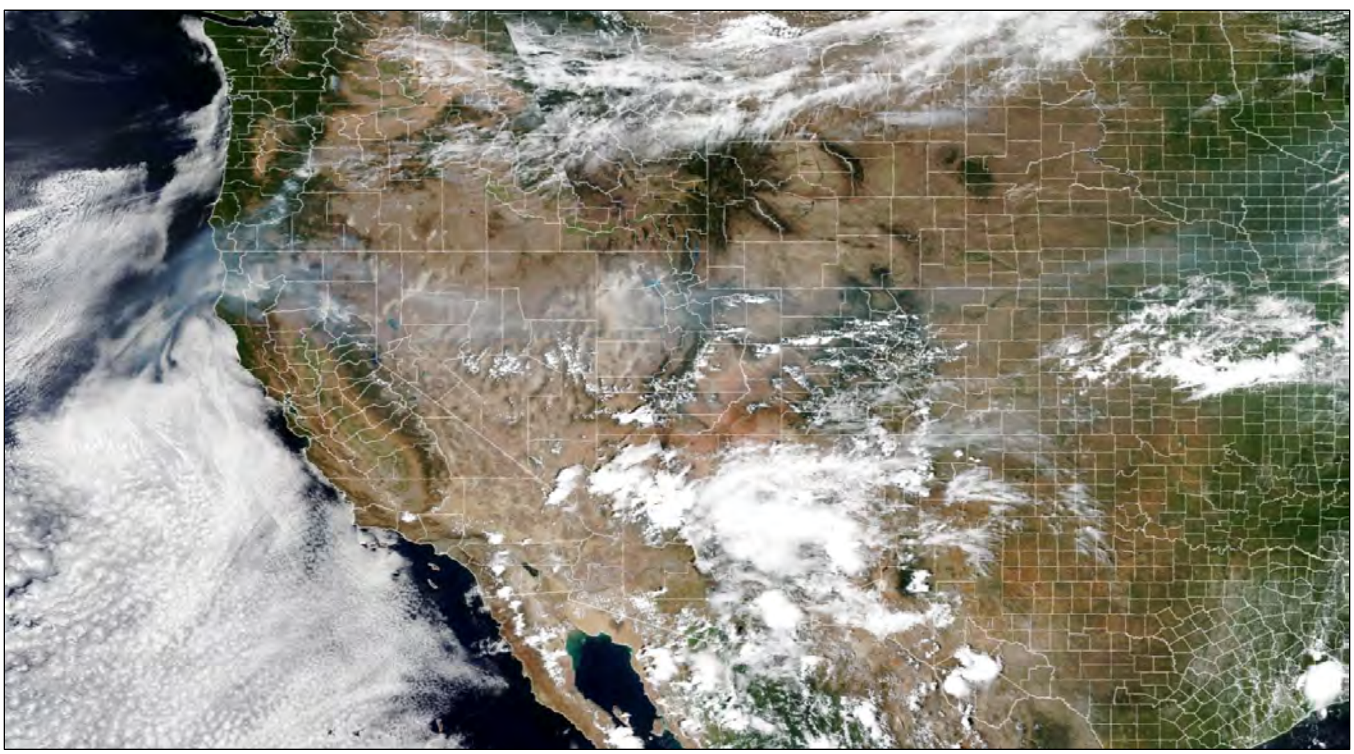


Figure 4-57. JSTAR Image from 8/10/2021



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values between 8/6/2021 through 8/10/2021 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City on August 6, 7, 8, 9, and 10, 2021. HYSPLIT 48-hour backward trajectories from the Rose Park monitoring station indicate likely transport of particles from the Dixie Fire to near-surface ambient air in Salt Lake City. HYSPLIT modeled particles arrived during the evening of 8/6/2021 (see Figure 4-58).

HYSPLIT forward ensemble trajectories originating from the Dixie Fire on 8/4/2021, 8/5/2021, and 8/7/2021 also suggest long-range transport of wildfire smoke to the Salt Lake City area on 8/6/2021, 8/7/2021, and 8/9/2021 (Figure 4-59, Figure 4-60, and Figure 4-62).

Although the HYSPLIT models do not directly support the transport of smoke on 8/8/2021 (Figure 4-61) and 8/10/2021 (Figure 4-63), the HYSPLIT models show clear transport patterns on the preceding days (8/6/2021, 8/7/2021, and 8/9/2021), and the HMS smoke maps and JSTAR Images show evidence of high smoke plume intensities on these dates, which suggests likely transport of smoke from these large fires in northern California to the Rose Park monitoring station in Salt Lake City.

Because several other large fires (such as the Monument, McFarland, River Complex, McCash, and Antelope Fires) were burning in northern California on these same dates, both the HMS maps and JSTAR images (Figure 4-45 through Figure 4-56) suggest that the prevailing winds also likely provided long-range smoke transport from multiple fires in northern California to the Rose Park monitoring station during this time.

Figure 4-58. HYSPLIT Backward Trajectories on 8/6/2021

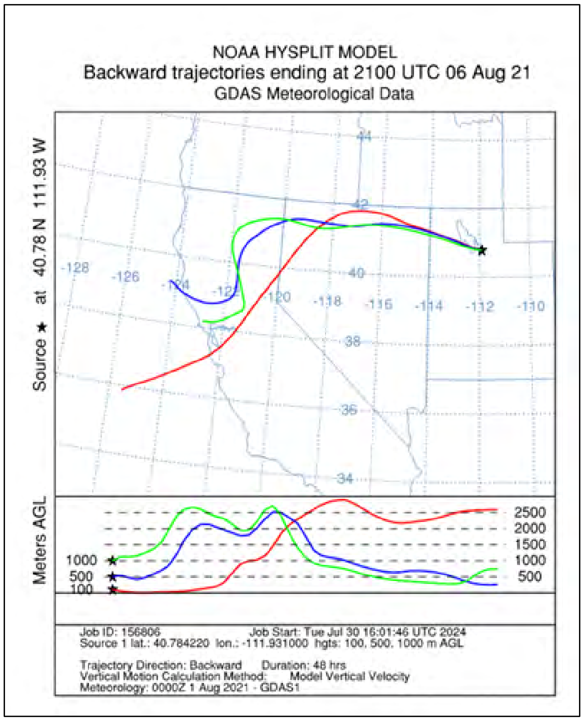


Figure 4-59. HYSPLIT Forward Trajectories on 8/4/2021

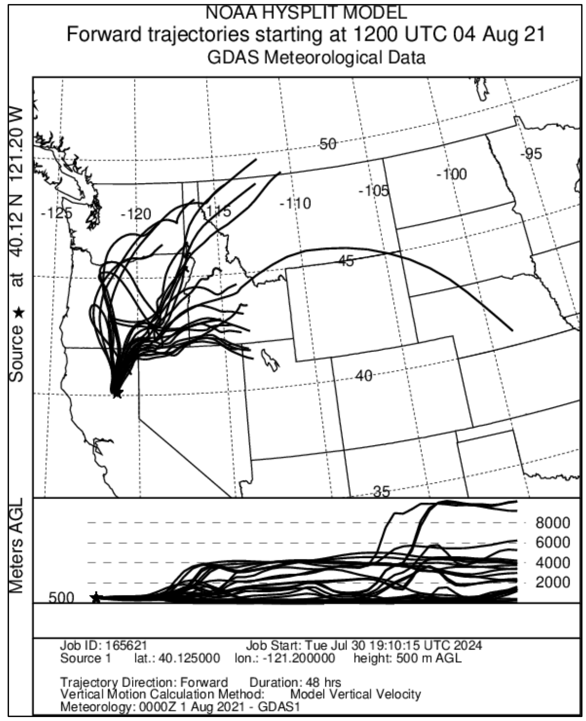


Figure 4-60. HYSPLIT Forward Trajectories on 8/5/2021

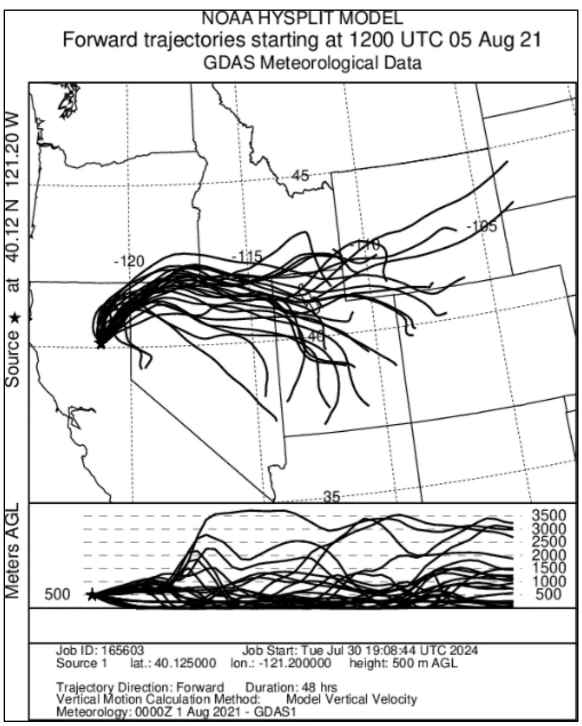


Figure 4-61. HYSPLIT Forward Trajectories on 8/6/2021

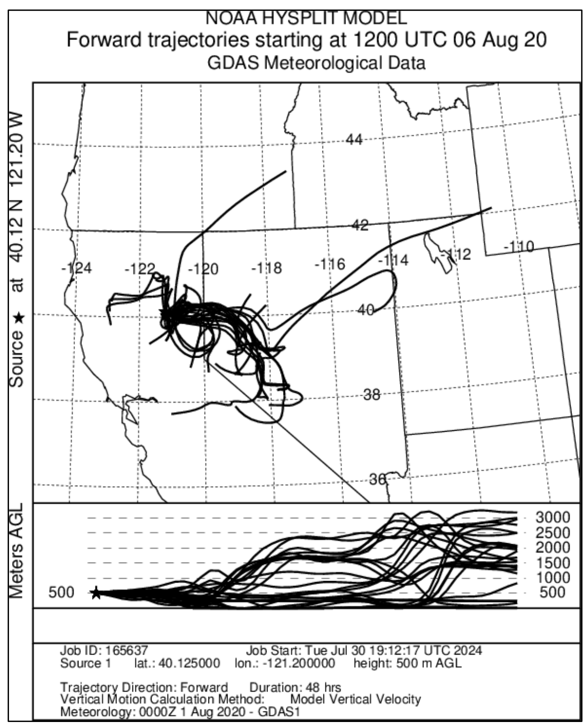


Figure 4-62. HYSPLIT Forward Trajectories on 8/7/2021

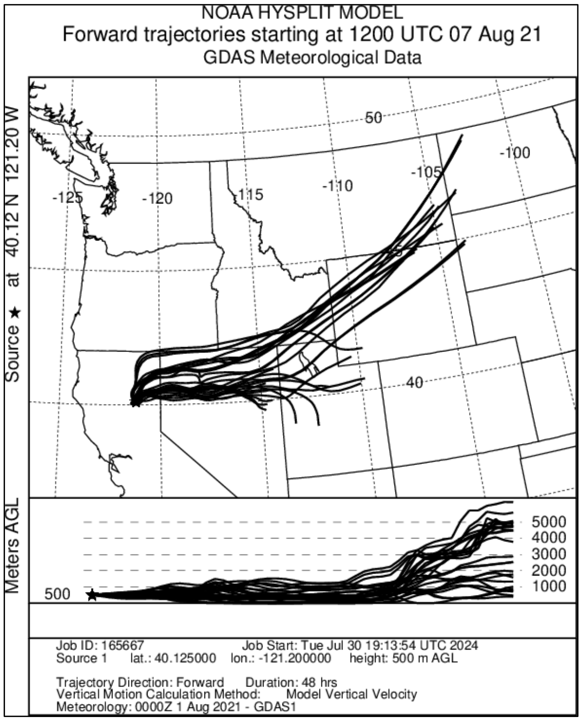
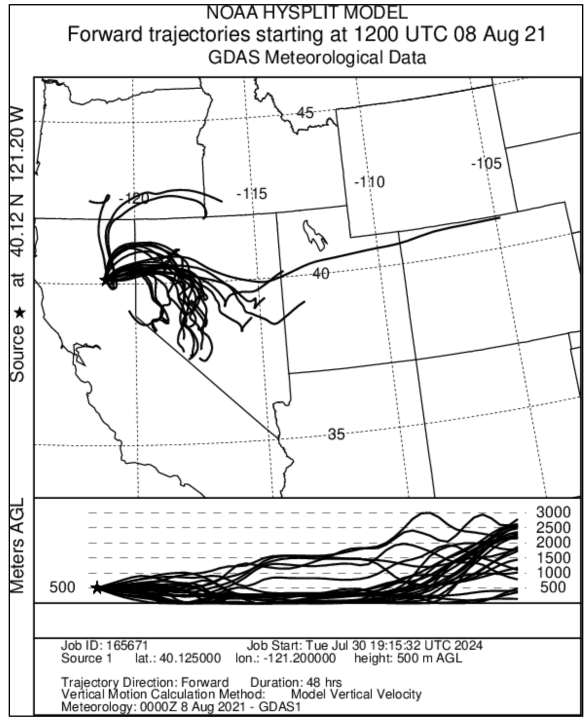


Figure 4-63. HYSPLIT Forward Trajectories on 8/8/2021



4.2.5 Smoke Transport on August 15, 16, and 18, 2021

Monitoring Data Observations

As shown in Table 4-8, monitoring data from the Rose Park monitoring station show a spike in 24-hour $PM_{2.5}$ values between 8/15/2021 and 8/19/2021. The spike in 24-hour $PM_{2.5}$ values began on 8/15/2021, and 24-hour $PM_{2.5}$ concentrations peaked on 8/15/2021 (41.1 μg/m^3). The 24-hour $PM_{2.5}$ values decreased to 39.8 μg/m^3 on 8/16/2021, decreased to 24.9 μg/m^3 on 8/17/2021, and then spiked back up to 39.7 μg/m^3 on 8/18/2021. After 8/18/2021, the 24-hour $PM_{2.5}$ values decreased and dropped below 15 μg/m^3 after 8/21/2021. For more information on 8/25/2021 through 8/30/2021, see Section 4.2.6, *Smoke Transport on August 27 and 28, 2021*.

As shown on Table 3-1 and Figure 3-2, these 8/15/2021 through 8/19/2021 24-hour $PM_{2.5}$ values are outliers for August, which had an average 24-hour $PM_{2.5}$ value of 10.5 μg/m^3 for the 5-year period from 2019 to 2023. In August 2019, 2022, and 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's 24-hour $PM_{2.5}$ values averaged less than 7 μg/m^3.

Table 4-8. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 12–20, 2021

In µg/m[3]

Date	24-hour $PM_{2.5}$
8/12/2021	9.5
8/13/2021	10.7
8/14/2021	13.4
8/15/2021	41.1
8/16/2021	39.8
8/17/2021	24.9
8/18/2021	39.7
8/19/2021	31.3
8/20/2021	16.8

Source: EPA 2024

Wildfire and Weather Summary

The Dixie, Monument, McFarland, River Complex, McCash and Antelope Fires were still actively burning between 8/14/2021 and 8/20/2021. Additionally, the Caldor Fire ignited on 8/14/2021 south of Lake Tahoe, California, and expanded rapidly starting in mid-August 2021. The Gales and Bull Complex Fires in Oregon (which both started between 7/27/2021 and 8/1/2021) and the Boundary Fire in Idaho (which started on 8/10/2021) were also actively burning forestland and contributing to smoke in Utah when winds were coming from the northwest or north. On 8/13/2021, the prevailing high-level winds came from the southwest, and the smoke from these wildfires blew into southeastern Oregon and Idaho. Winds shifted to come predominantly from the west or northwest on 8/14/2021 until 8/18/2021, and these winds blew smoke from these wildfires into Utah.

HMS Maps

NOAA HMS smoke product maps show evidence of long-range smoke transport from the Dixie, Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires, as well as the smaller Oregon fires, to the Rose Park monitoring station in Salt Lake City August 15, 16, and 18, 2021.

On 8/13/2021, the HMS maps show the heavy smoke plumes being blown to the northeast into eastern Oregon and Idaho (Figure 4-64). Beginning on 8/14/2021 and continuing to 8/18/2021 (Figure 4-65, Figure 4-66, Figure 4-67, Figure 4-68, and Figure 4-69), the HMS maps show the heavy smoke plumes from the Dixie, Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires, as well as the smaller Oregon and Idaho, being blown into northern Utah, and the northern part of Utah was covered in the heavy smoke plumes throughout each of these days except for 8/17/2021.

On 8/17/2021, the Rose Park monitoring station was in a medium smoke plume that was about 5 miles south of the boundary of the heavy smoke plume just north of Salt Lake City. This reduction in smoke density corresponds with the 24-hour $PM_{2.5}$ value of 24.9 µg/m^3 on 8/17/2021 (which was lower than the 24-hour $PM_{2.5}$ values on 8/15/2021, 8/16/2021, and 8/18/2021). Beginning on 8/19/2021, the HMS maps show the heavy smoke plumes being blown to the north into Oregon (Figure 4-70).

Figure 4-64. HMS Map from 8/13/2021

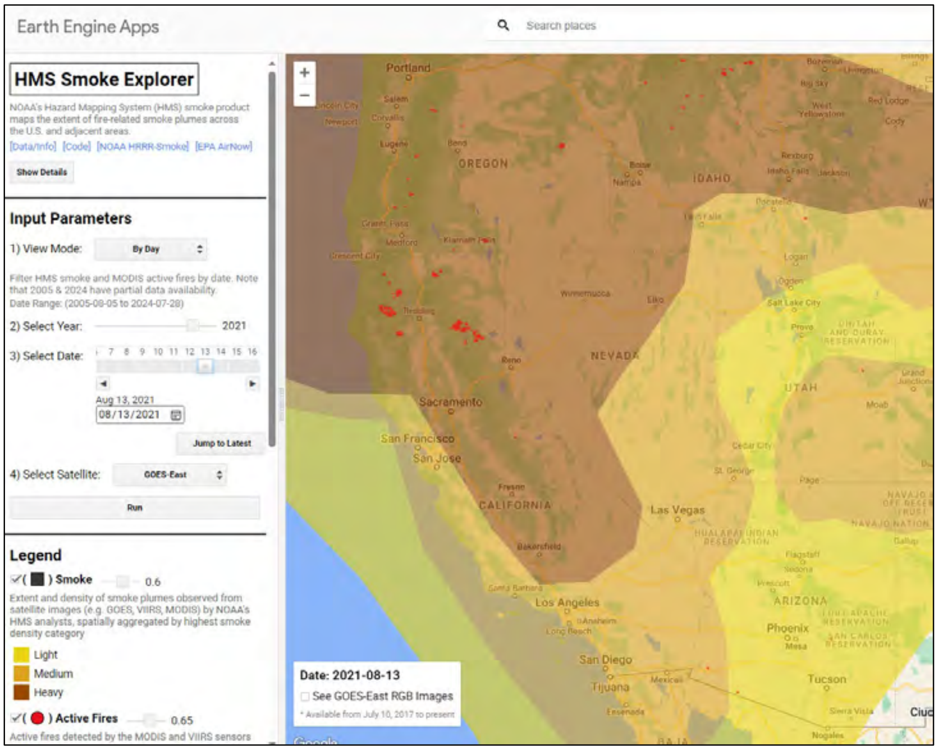


Figure 4-65. HMS Map from 8/14/2021

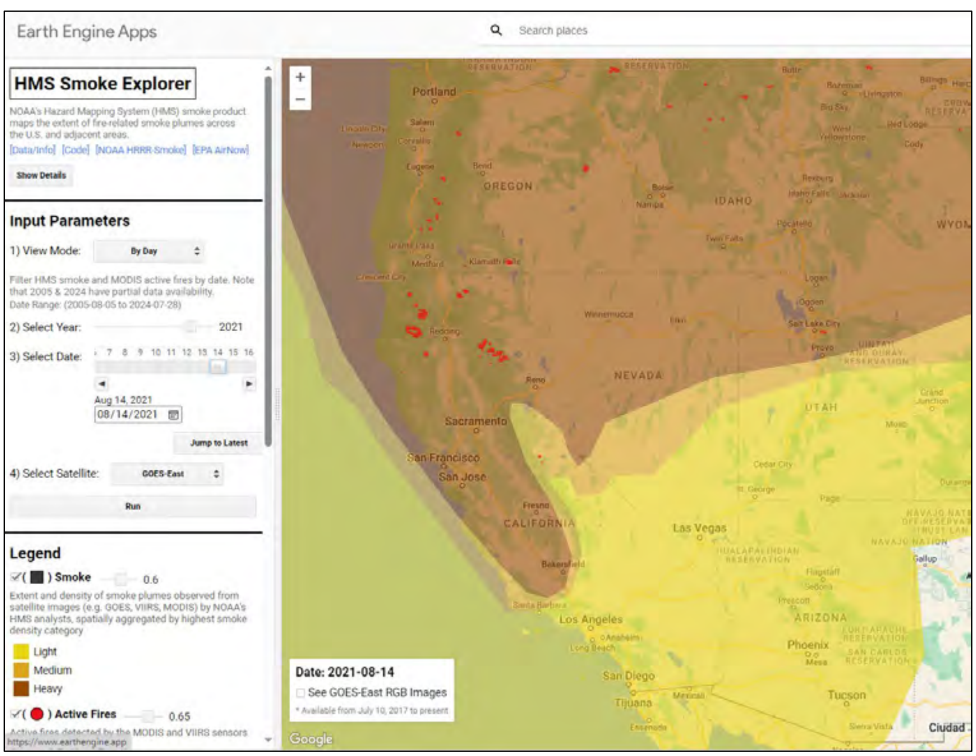


Figure 4-66. HMS Map from 8/15/2021

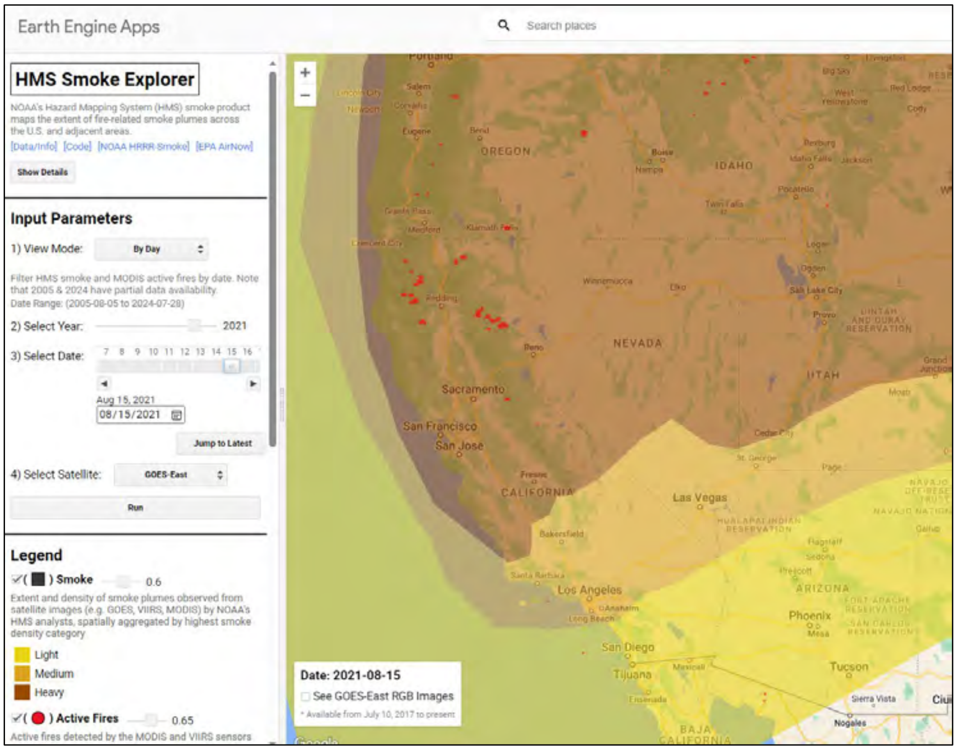


Figure 4-67. HMS Map from 8/16/2021

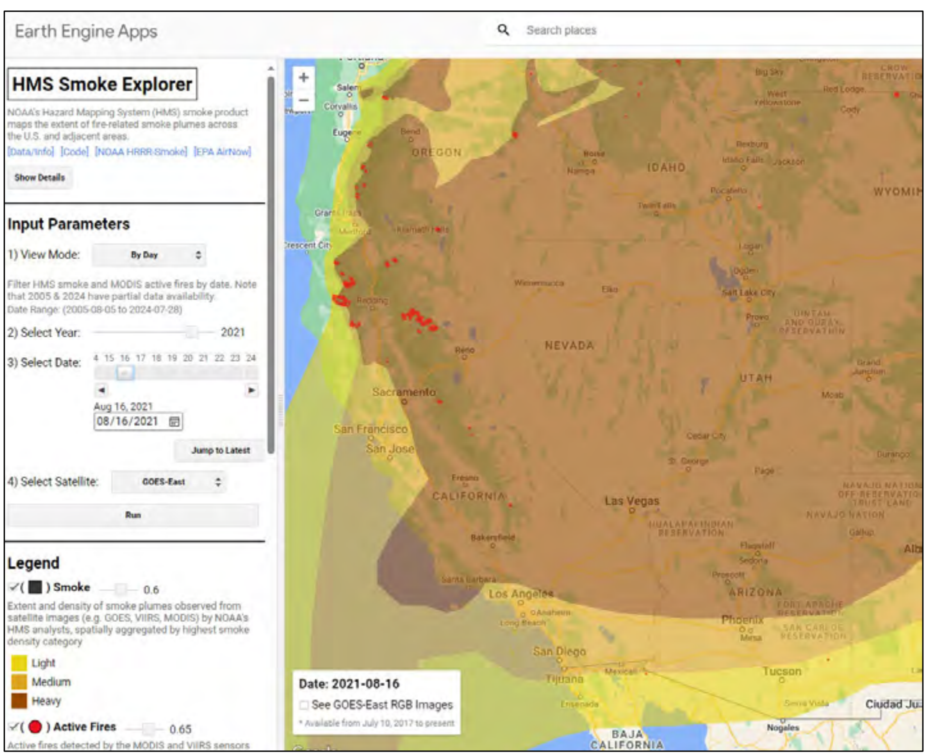


Figure 4-68. HSM Map from 8/17/2021

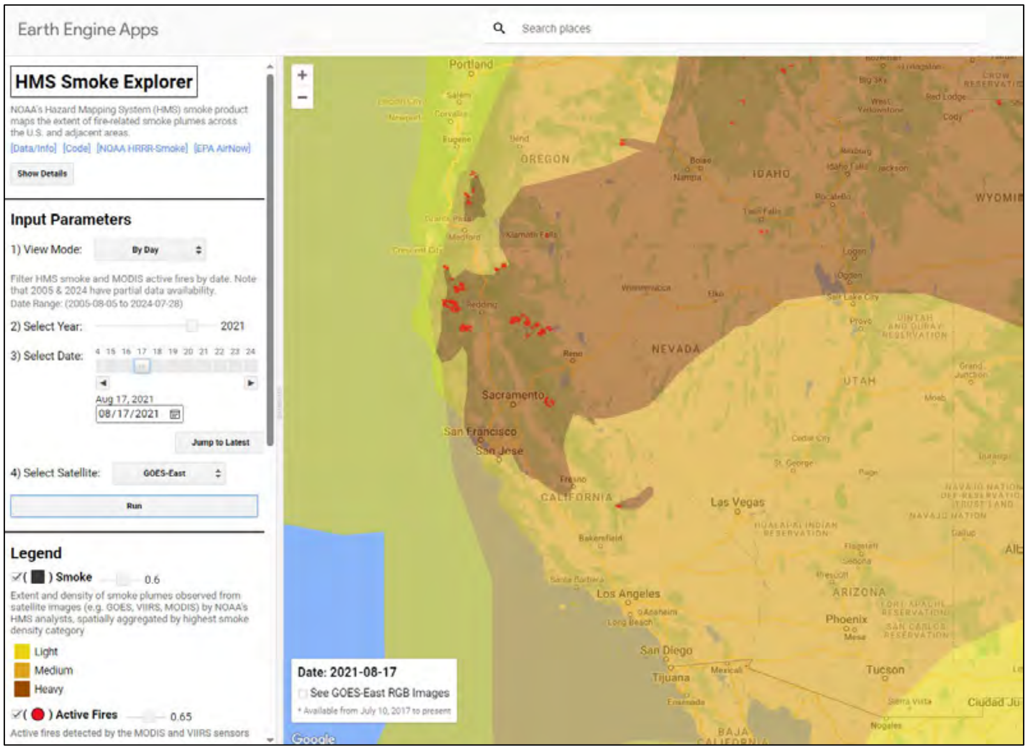


Figure 4-69. HMS Map from 8/18/2021

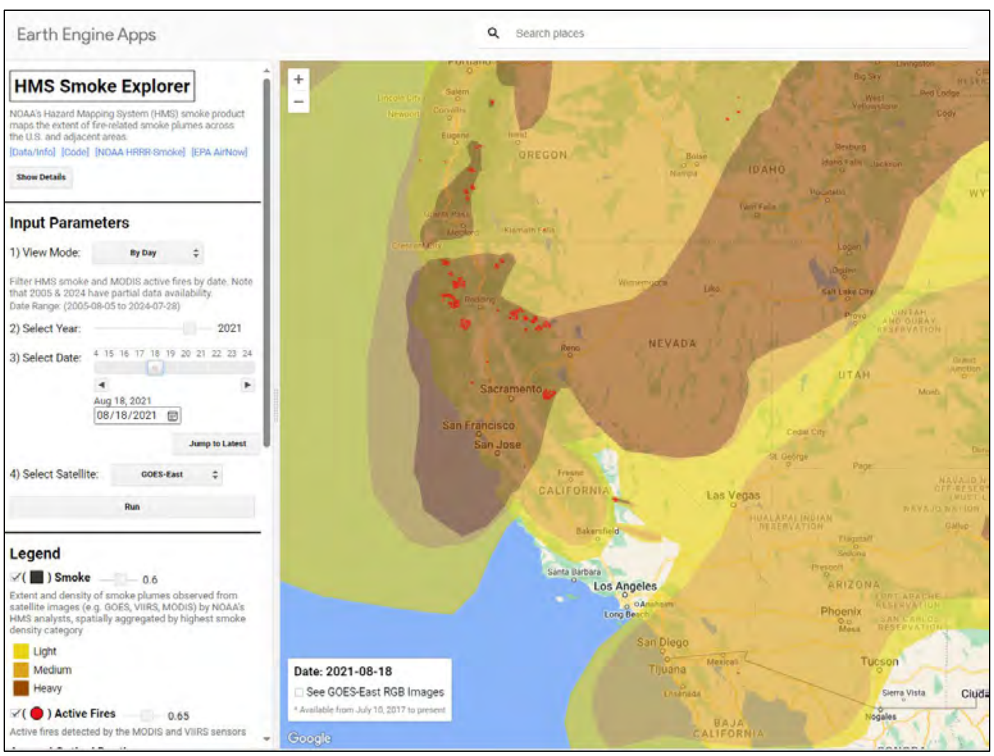
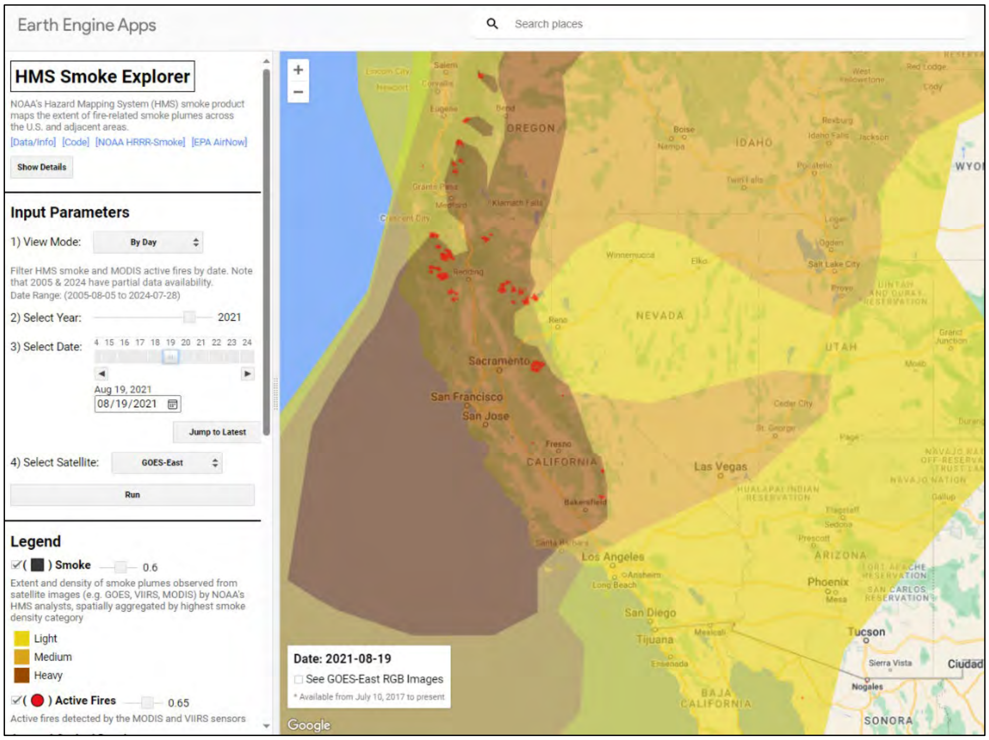


Figure 4-70. HMS Map from 8/19/2021



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on August 15, 16, and 18, 2021 (see Figure 4-71, Figure 4-72, Figure 4-73, Figure 4-74, and Figure 4-75 below).

Figure 4-71. JSTAR Image from 8/14/2021

Figure 4-72. JSTAR Image from 8/15/2021

Figure 4-73. JSTAR Image from 8/16/2021

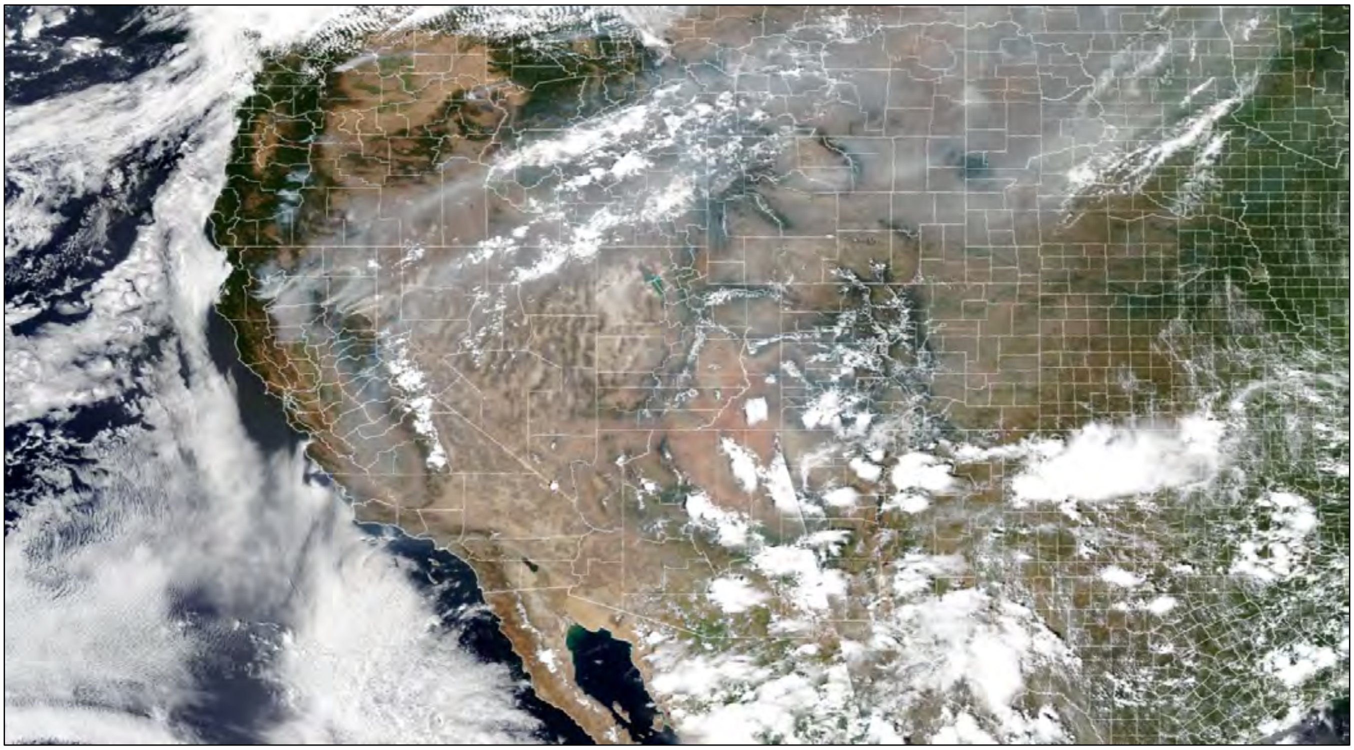


Figure 4-74. JSTAR Image from 8/17/2021

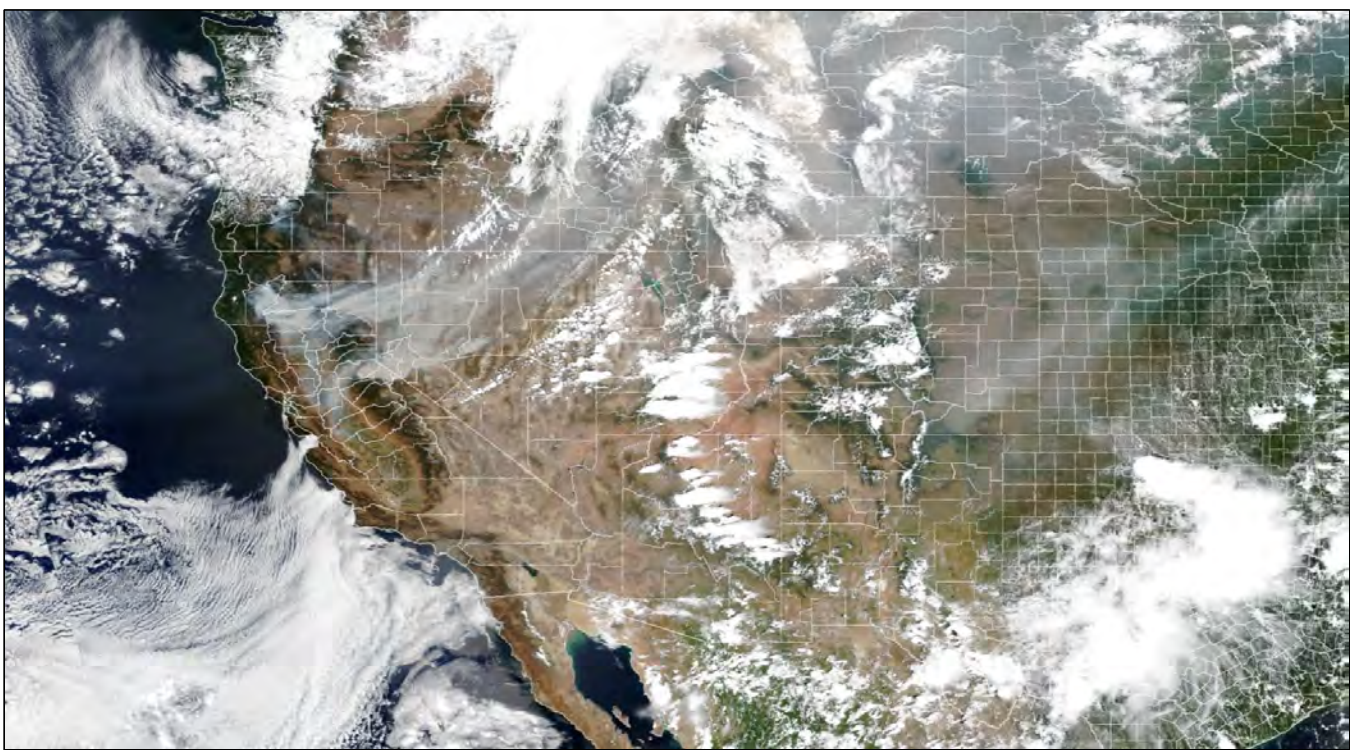
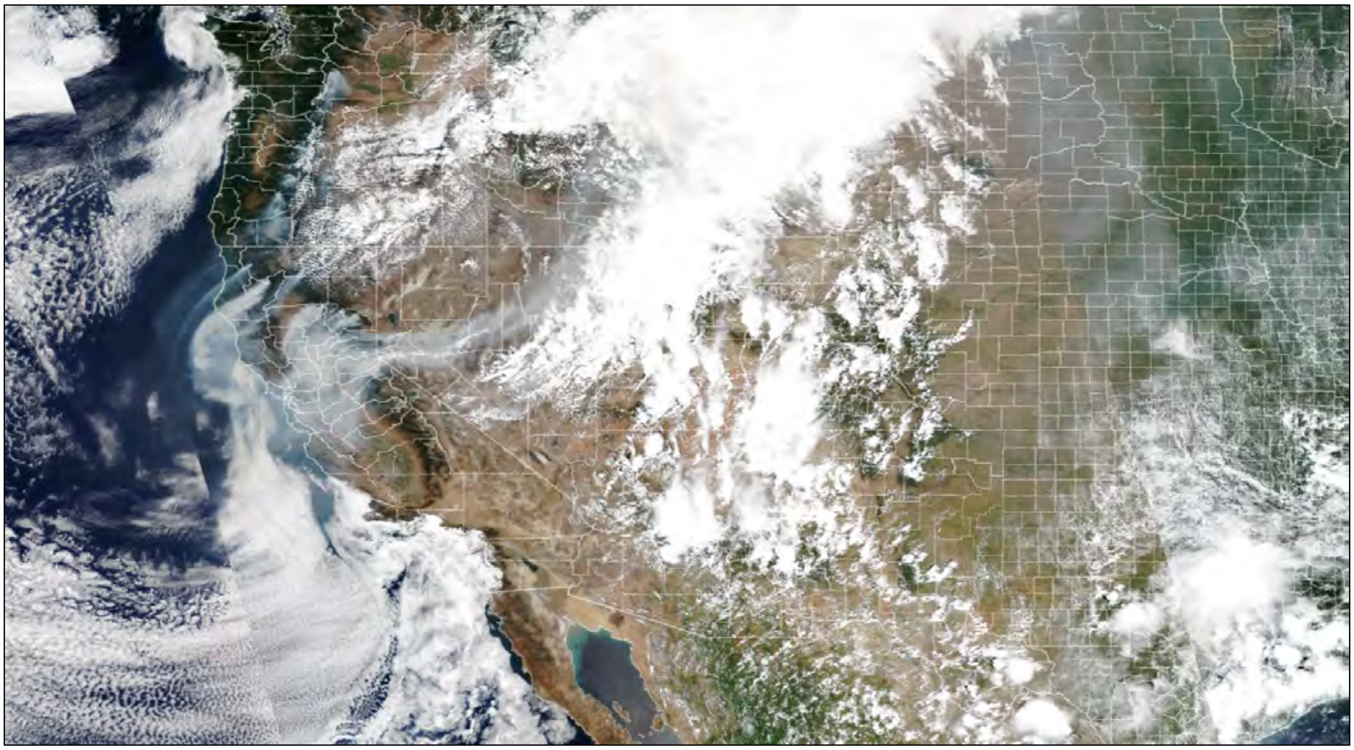


Figure 4-75. JSTAR Image from 8/18/2021



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 8/15/2021, 8/16/2021, 8/18/2021 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City on August 15, 16, and 18, 2021. HYSPLIT 48-hour backward trajectories from the Rose Park monitoring station modeled likely transport of particles to Salt Lake City from the following fires on the following dates:

- The Bull Complex Fire in Oregon smoke and particles from 8/13/2021 were modeled to arrive during the evening of 8/15/2021 (Figure 4-76 though Figure 4-78).
- The Boundary Fire in Idaho smoke and particles from 8/14/2021 were modeled to arrive in Salt Lake City during the evening of 8/16/2021 (Figure 4-77 though Figure 4-79).
- The Dixie Fire in California smoke and particles from 8/16/2021 were modeled to arrive in Salt Lake City during the evening of 8/18/2021 (Figure 4-80).

Several other large fires (such as the Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires) in northern California were burning on these same dates, along with several smaller fires in Oregon and Idaho. Both the HMS maps and JSTAR images (Figure 4-64 through Figure 4-75) suggest that the prevailing winds also likely provided long-range smoke transport from multiple fires to the Rose Park monitoring station during this time.

Figure 4-76. HYSPLIT Backward Trajectories on 8/15/2021

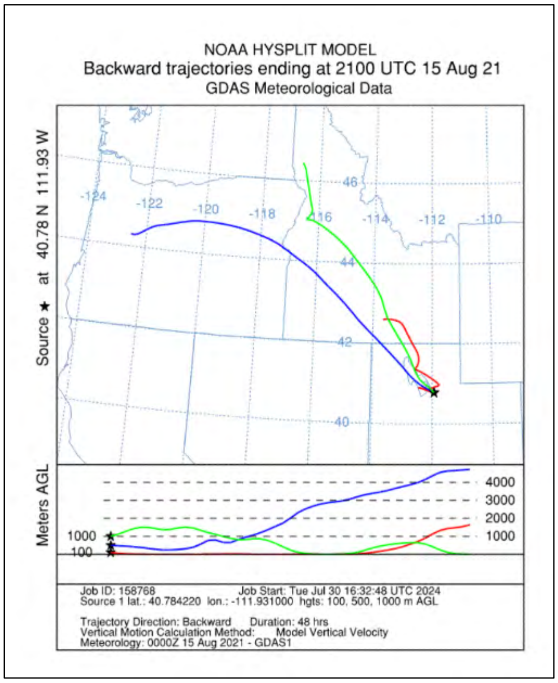


Figure 4-77. HYSPLIT Backward Trajectories on 8/16/2021

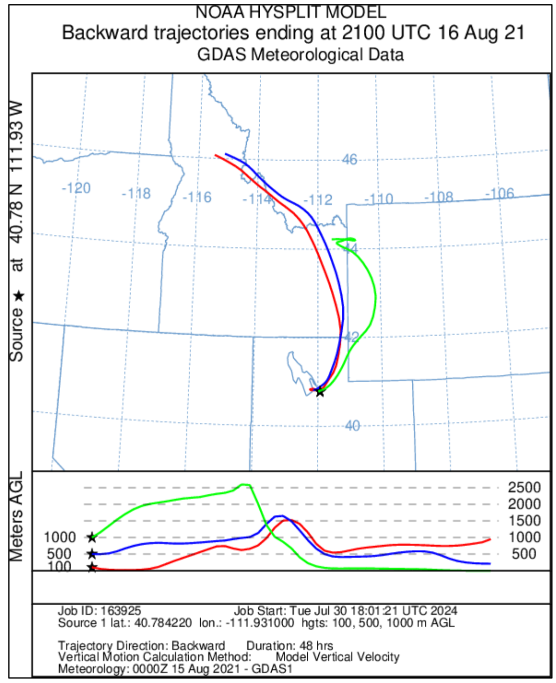


Figure 4-78. HYSPLIT Forward Trajectories on 8/13/2021

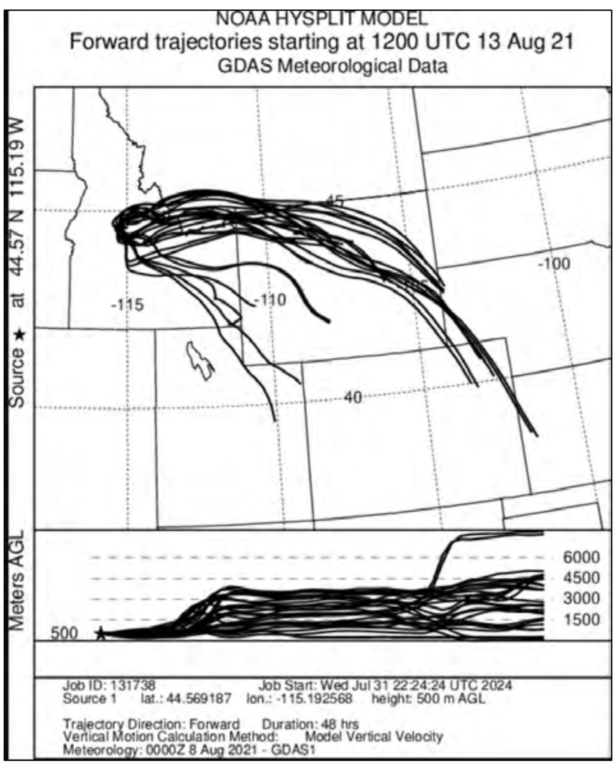


Figure 4-79. HYSPLIT Forward Trajectories on 8/14/2021

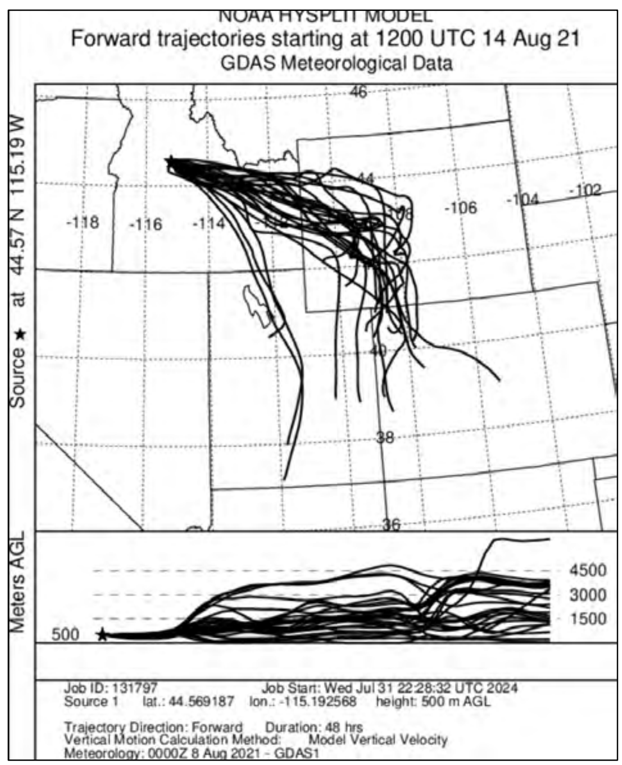
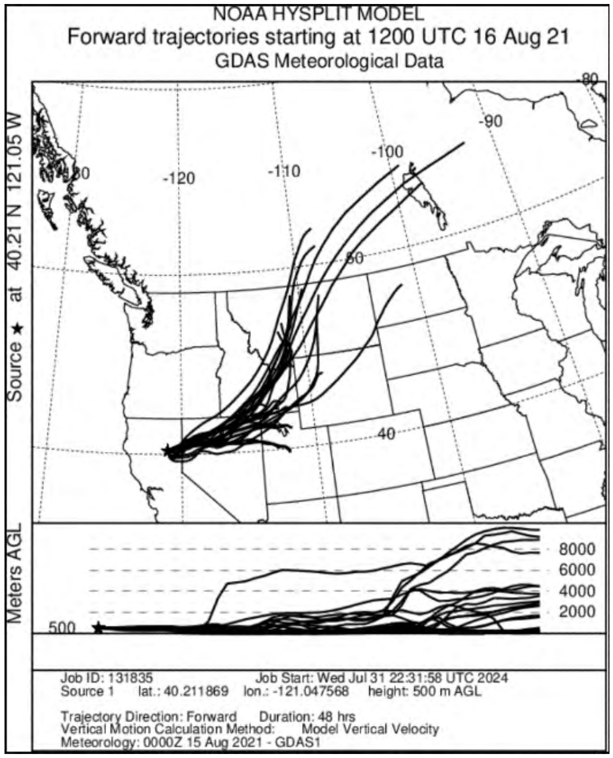


Figure 4-80. HYSPLIT Forward Trajectories on 8/16/2021



4.2.6 Smoke Transport on August 27 and 28, 2021

Monitoring Data Observations

As shown in Table 4-9, monitoring data from the Rose Park monitoring station show a spike in 24-hour $PM_{2.5}$ values between 8/26/2021 and 8/30/2021. The spike in 24-hour $PM_{2.5}$ values began on 8/26/2021, and 24-hour $PM_{2.5}$ concentrations peaked on 8/27/2021 (32.3 μg/m^3). The 24-hour $PM_{2.5}$ values decreased to below 25 μg/m^3 on 8/28/2021. Then, concentrations dropped to below 15 μg/m^3 on 8/31/2021.

As shown on Table 3-1 and Figure 3-2, the 8/26/2021 through 8/30/2021 24-hour $PM_{2.5}$ values are outliers for August, which had an average 24-hour $PM_{2.5}$ value of 10.5 μg/m^3 for the 5-year period from 2019 to 2023. In August 2019, 2022, and 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's 24-hour $PM_{2.5}$ values averaged less than 7 μg/m^3.

Table 4-9. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from August 23–31, 2021

In μg/m³

Date	24-hour $PM_{2.5}$ Value
8/23/2021	4.5
8/24/2021	8.1
8/25/2021	9.0
8/26/2021	22.1
8/27/2021	32.3
8/28/2021	20.4
8/29/2021	22.0
8/30/2021	20.9
8/31/2021	14.8

Source: EPA 2024

Wildfire and Weather Summary

The Dixie, Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires were still actively burning between 8/23/2021 and 8/31/2021. Between 8/26/2021 and 8/30/2021, the prevailing high-level winds came from the west-southwest and blew smoke from these wildfires into northern Utah.

HMS Maps

NOAA's HMS smoke product maps show evidence of long-range smoke transport from these fires to the Rose Park monitoring in Salt Lake City on August 27 and 28, 2021.

On 8/25/2021, the HMS maps show the heavy smoke plumes from the northern California fires being blown to the northeast into eastern Oregon and Idaho (Figure 4-81). Beginning on 8/26/2021, and continuing through 8/30/2021, the HMS maps show the heavy smoke plumes from the northern California fires being blown from the west-southwest to east-northeast, with the entire state of Utah covered in the heavy smoke plumes (Figure 4-82, Figure 4-83, Figure 4-84, Figure 4-85, and Figure 4-86).

Figure 4-81. HMS Map from 8/25/2021

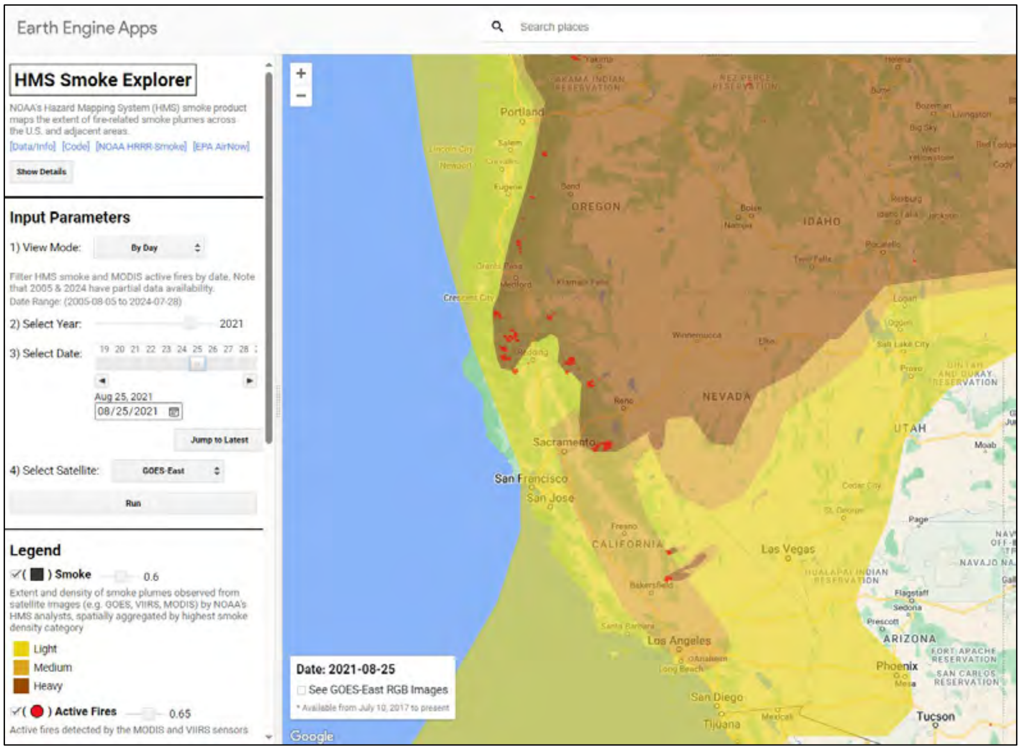


Figure 4-82. HMS Map from 8/26/2021

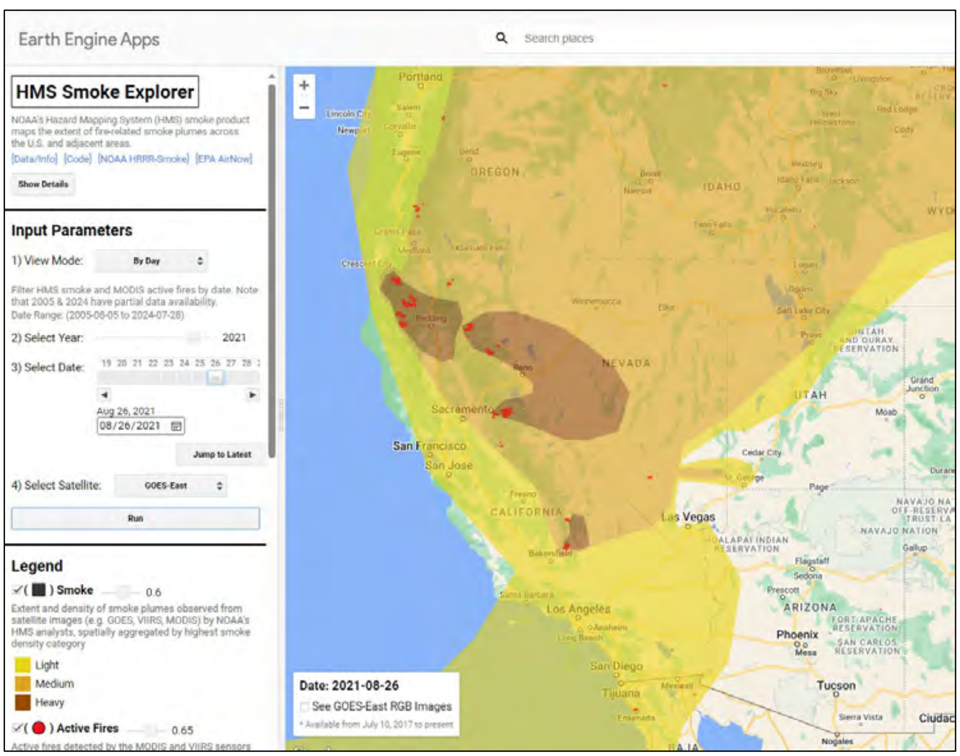


Figure 4-83. HMS Map from 8/27/2021

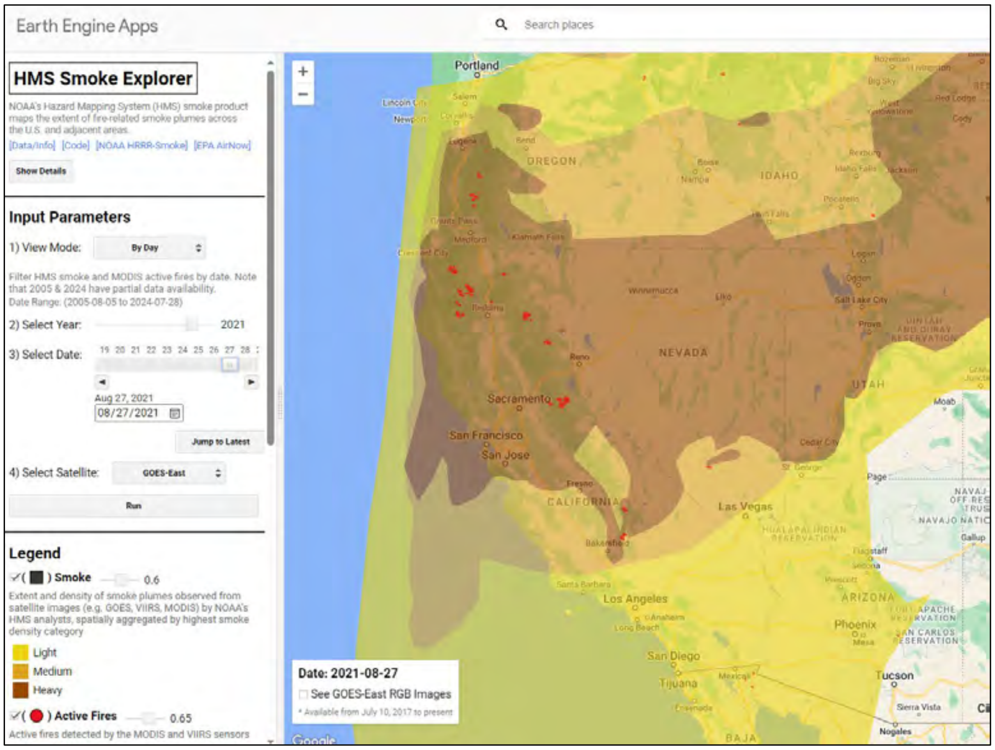


Figure 4-84. HMS Map from 8/28/2021

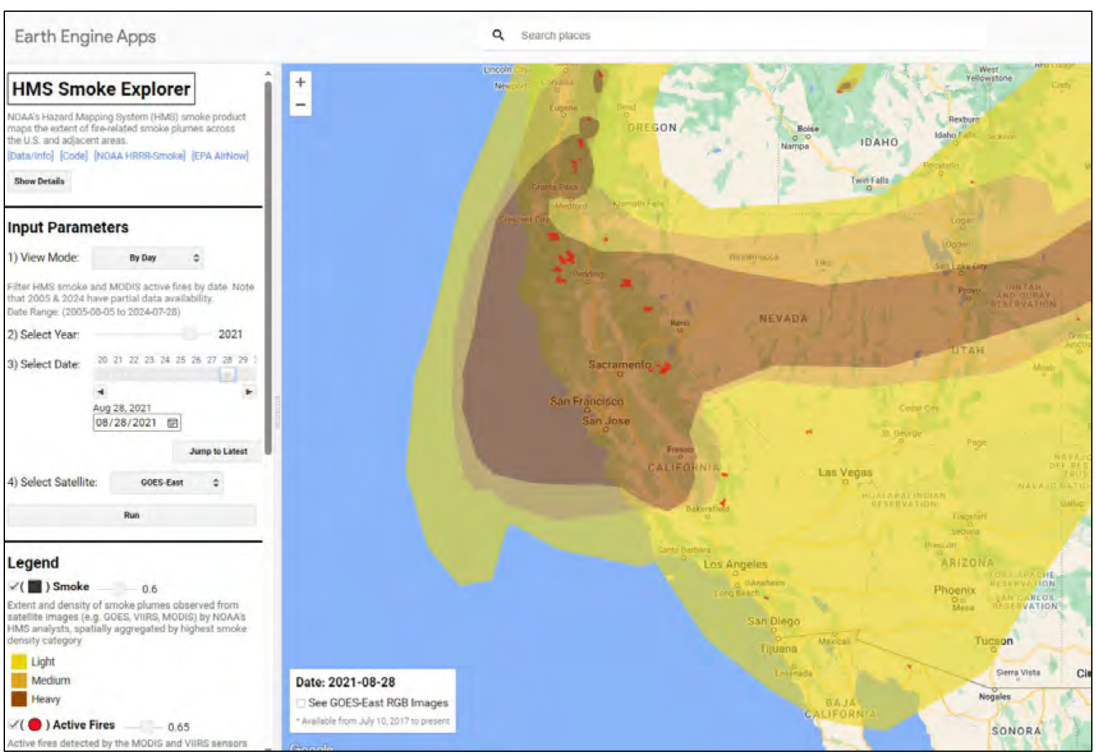


Figure 4-85. HMS Map from 8/29/2021

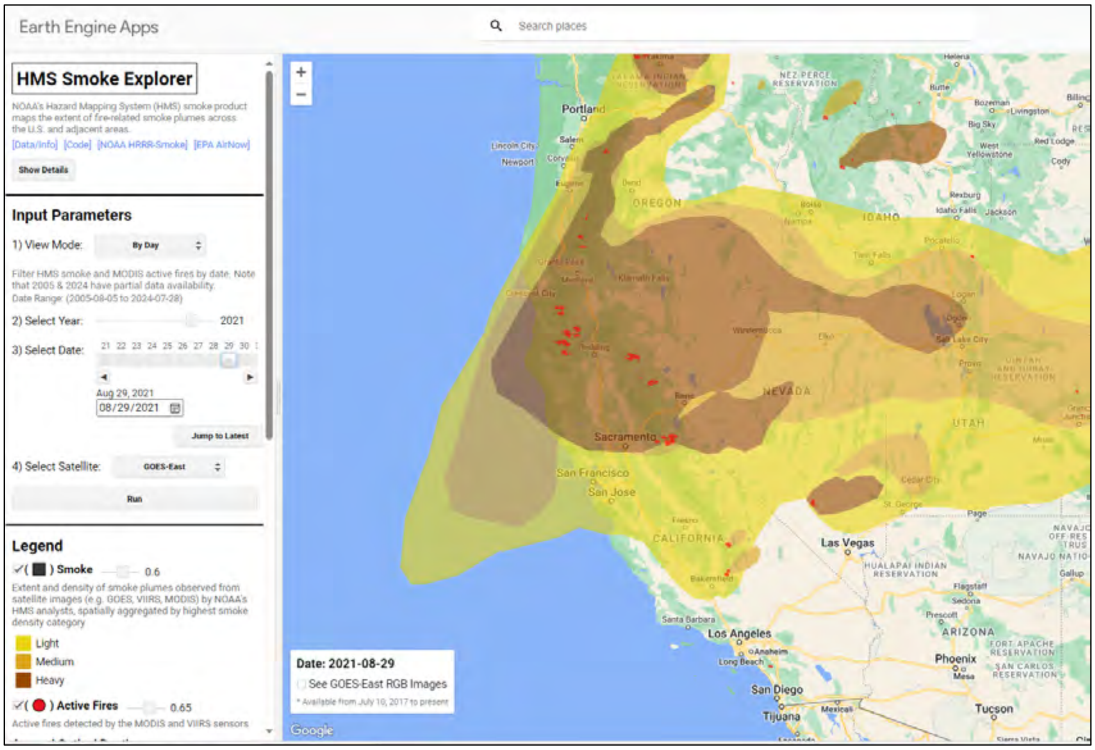
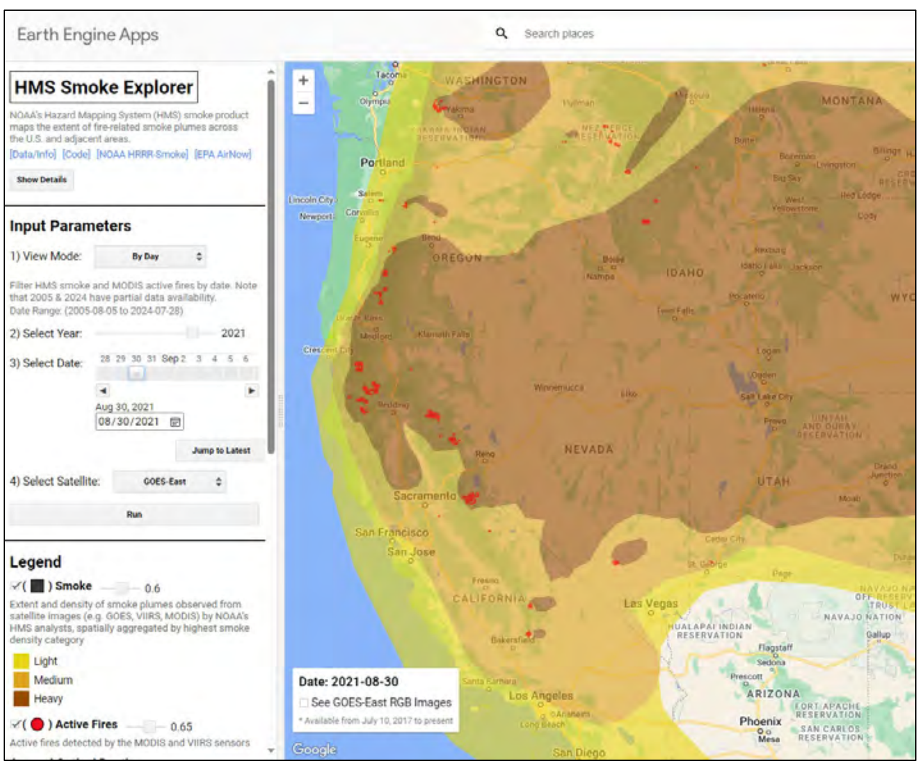


Figure 4-86. HMS Map from 8/30/2021



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on August 27 and 28, 2021 (see Figure 4-87, Figure 4-88, and Figure 4-89 below).

Figure 4-87. JSTAR Image from 8/26/2021

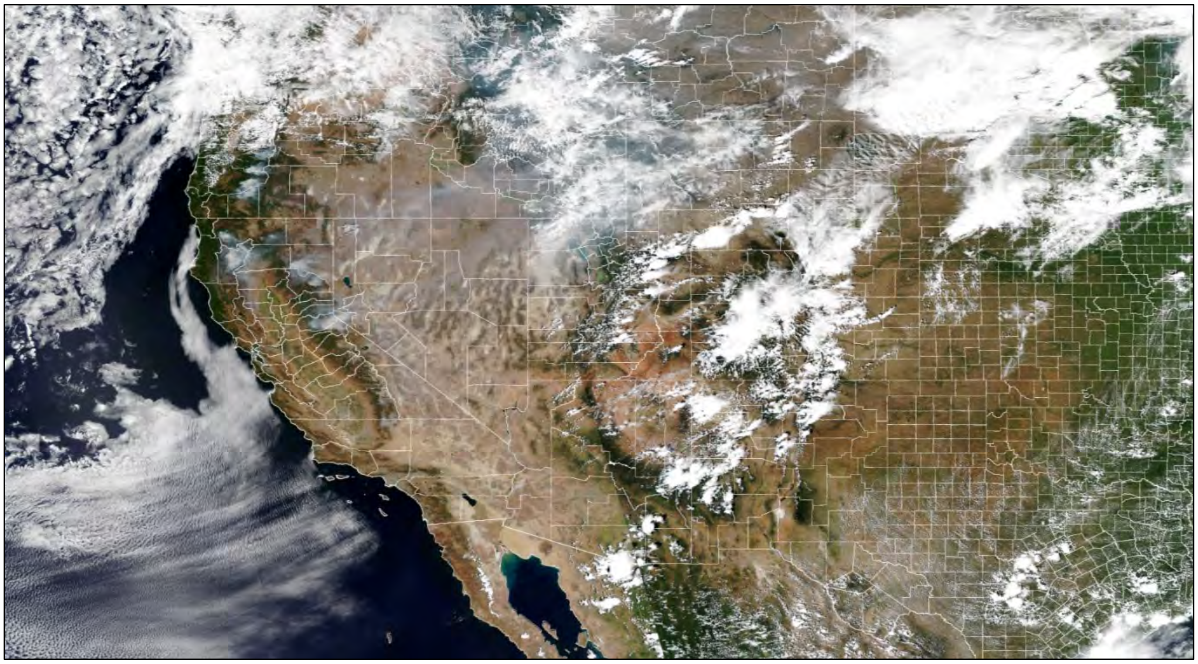
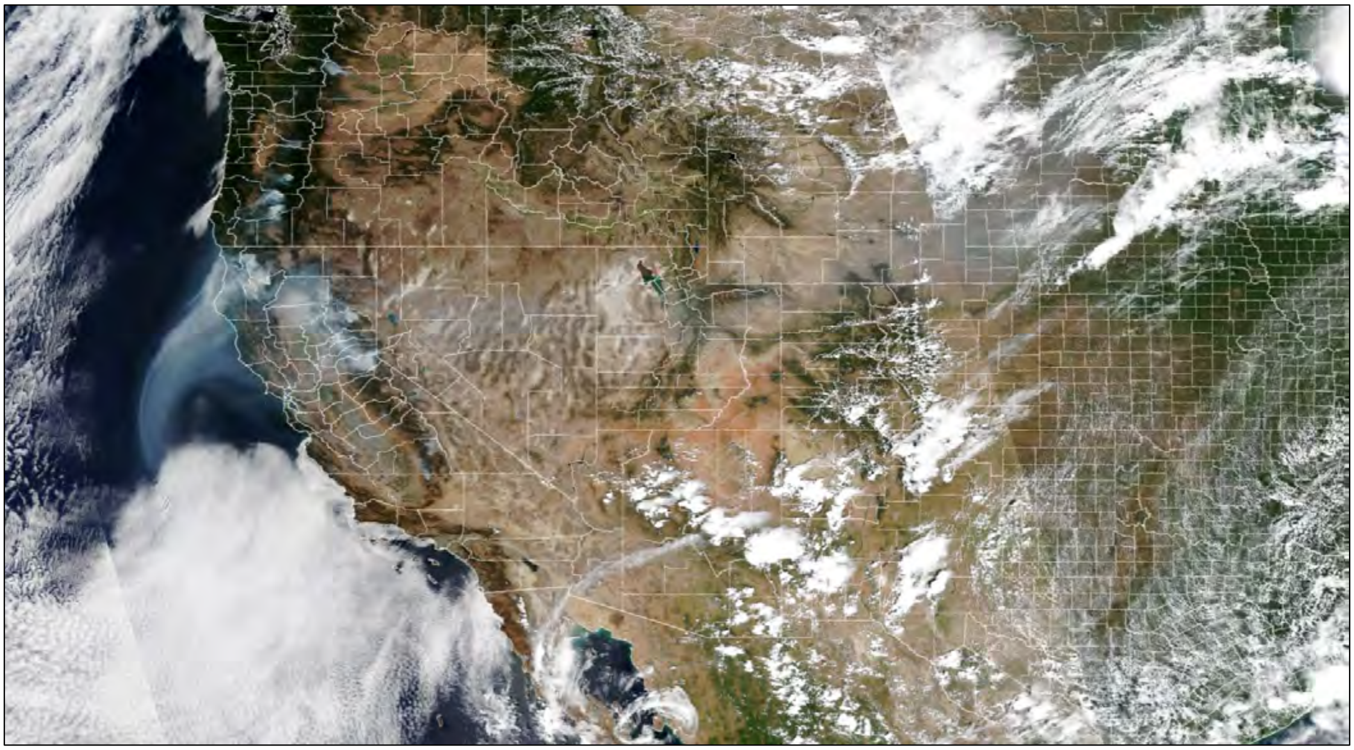


Figure 4-88. JSTAR Image from 8/27/2021

Figure 4-89. JSTAR Image from 8/28/2021



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 8/27/2021 and 8/28/2021 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City on August 27 and 28, 2021. The HYSPLIT backward trajectories model was inconclusive for linking smoke transport from the Dixie Fire to the Rose Park monitoring station on 8/27/2021(Figure 4-90).

HYSPLIT forward ensemble trajectories originating from the Dixie Fire on 8/25/2021 more clearly suggest long-range transport of wildfire smoke to the Salt Lake City area by 8/27/2021 (Figure 4-91).

Several other large fires (such as the Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires) in northern California were burning on these same dates. Both the HMS maps and JSTAR images (Figure 4-81 through Figure 4-89), suggest that the prevailing winds also likely provided long-range smoke transport from multiple fires in northern California to the Rose Park monitoring station during this time.

Figure 4-90. HYSPLIT Backward Trajectories on 8/27/2021

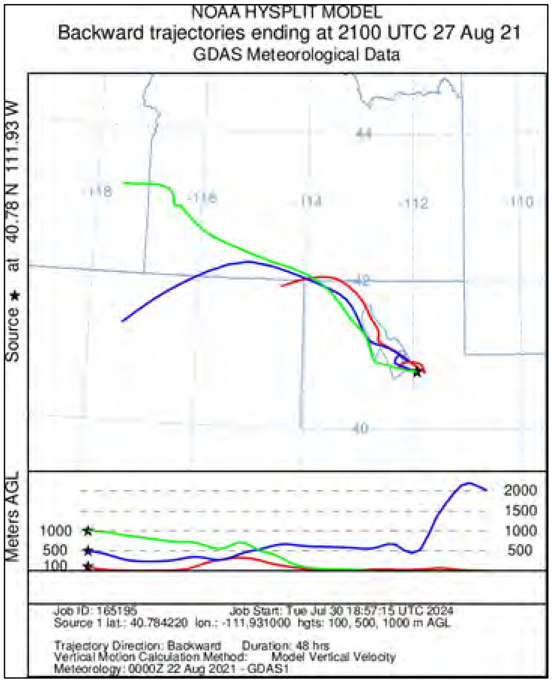
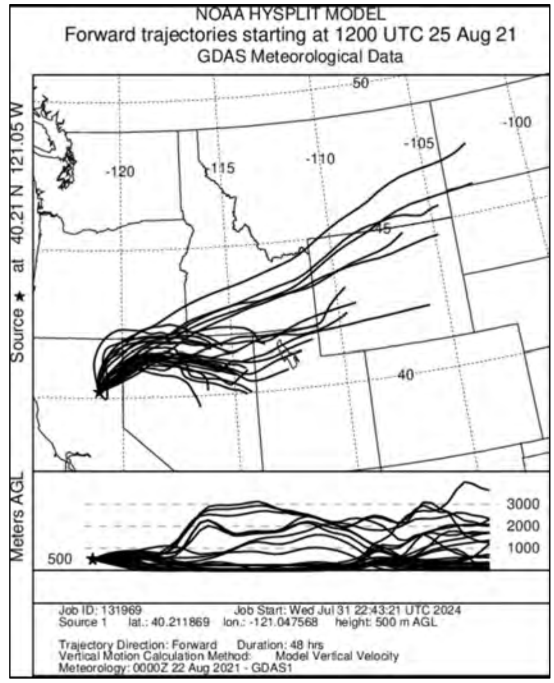


Figure 4-91. HYSPLIT Forward Trajectories on 8/25/2021



4.2.7 Smoke Transport on September 7, 2021

Monitoring Data Observations

As shown in Table 4-10, monitoring data from the Rose Park monitoring station shows higher-than-average 24-hour $PM_{2.5}$ values between 9/4/2021, and 24-hour $PM_{2.5}$ values peaked on 9/7/2021 (22.6 μg/m^3). The 24-hour $PM_{2.5}$ values were below 15 μg/m^3 after 9/10/201 for the rest of September 2021.

As shown on Table 3-1 and Figure 3-2, the 9/7/2021 24-hour $PM_{2.5}$ value is an outlier for the first 10 days of September, which had an average 24-hour $PM_{2.5}$ value of 10.9 μg/m^3 for 5-year period from 2019 to 2023. During September 1–10, 2019, and September 1–10, 2023 (months with no or minimal wildfire activity), the Rose Park monitoring station's 24-hour $PM_{2.5}$ values averaged less than 9 μg/m^3.

Table 4-10. 24-hour $PM_{2.5}$ Values at the Rose Park Monitoring Station from September 4–10, 2021

In μg/m³

Date	24-hour $PM_{2.5}$ Value
9/4/2021	21.0
9/5/2021	12.0
9/6/2021	14.0
9/7/2021	22.6
9/8/2021	20.0
9/9/2021	17.5
9/10/2021	12.4

Source: EPA 2024

Wildfire and Weather Summary

The Dixie, Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires were still actively burning between 9/5/2021 and 9/9/2021. Between 9/6/2021 and 9/8/2021, the prevailing high-level winds were from the west-southwest, and the smoke from these wildfires blew into northern Utah. The most direct transport of smoke from the fires to the Rose Park monitoring station in Salt Lake City occurred on 9/7/2021.

HMS Maps

NOAA HMS smoke product maps show evidence of long-range smoke transport from these fires to the Rose Park monitoring station in Salt Lake City on September 7, 2021.

On 9/5/2021, the HMS maps show the heavy smoke plumes from the northern California fires being blown to the northeast into Oregon and Idaho (Figure 4-92). Beginning on 9/6/2021, and continuing through 9/8/2021, the HMS maps show the heavy smoke plumes from the northern California fires shifting. First, on 9/6/2021, the winds came from the west (Figure 4-93). Then, on 9/7/2021, the winds came from the northwest (Figure 4-94). Finally, on 9/8/2021, the winds returned to coming from the southwest (Figure 4-95). The HMS maps show that the Rose Park monitoring was included in the heavy smoke plumes on 9/5/2021, 9/7/2021, and 9/8/2021.

Figure 4-92. HMS Map from 9/5/2021

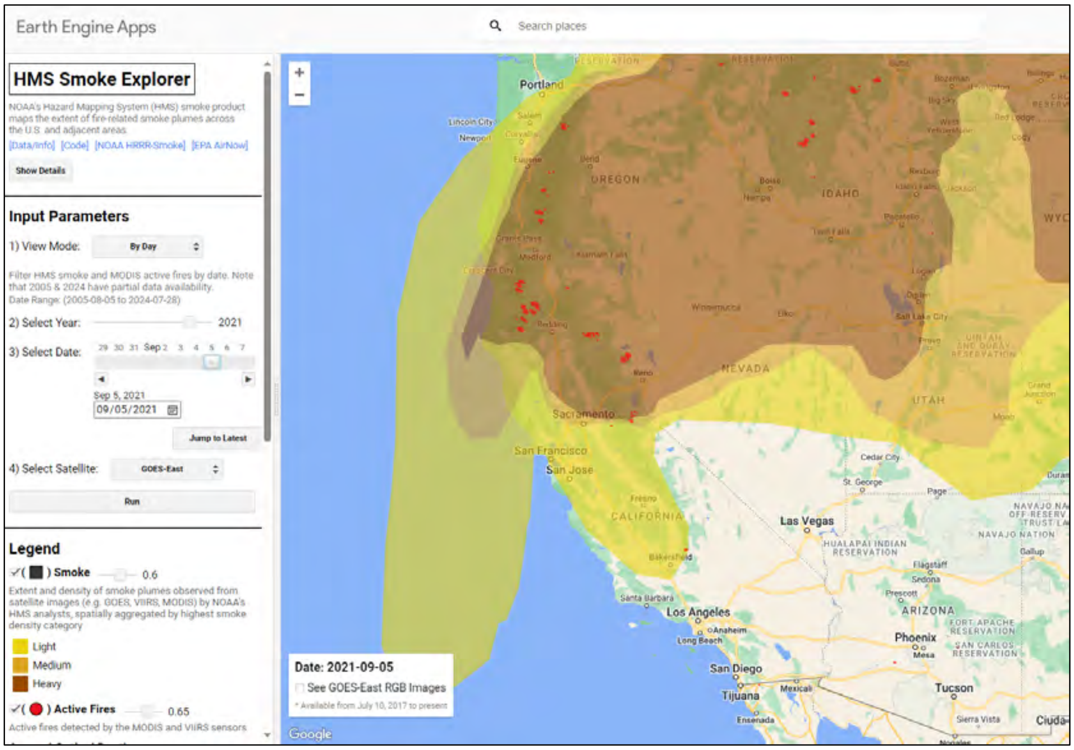


Figure 4-93. HMS Map from 9/6/2021

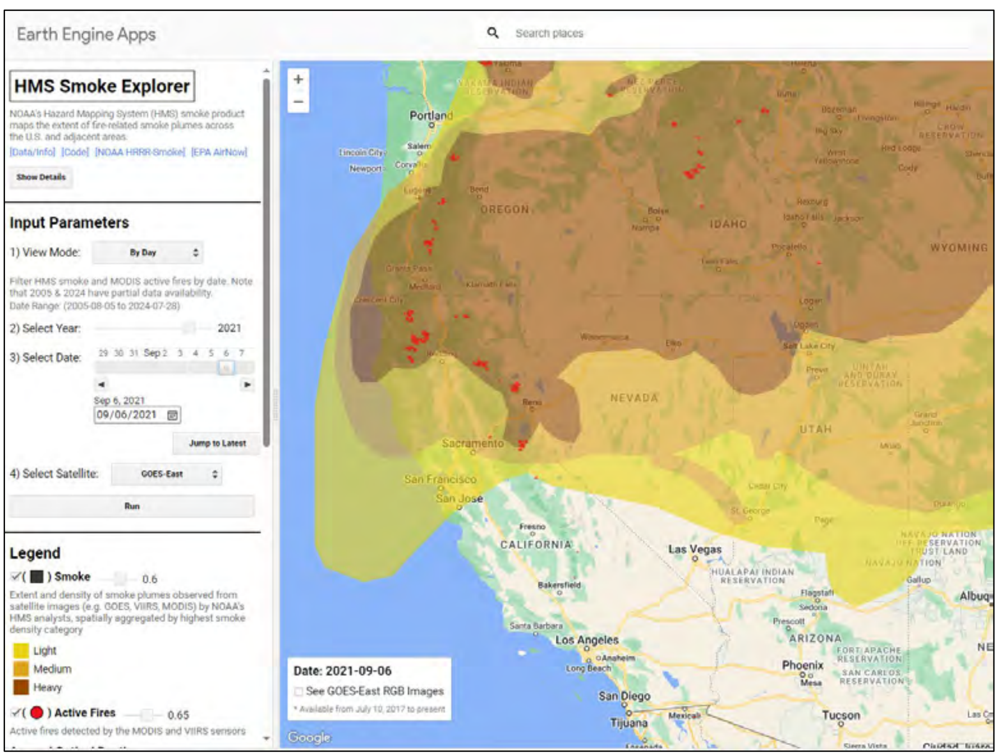


Figure 4-94. HMS Map from 9/7/2021

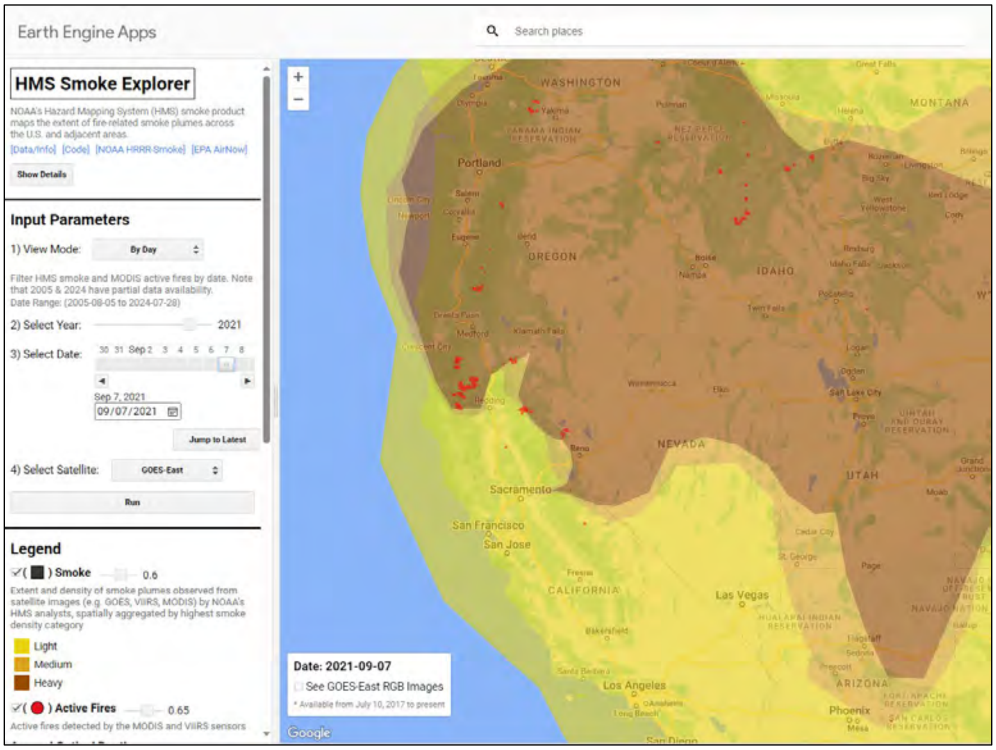
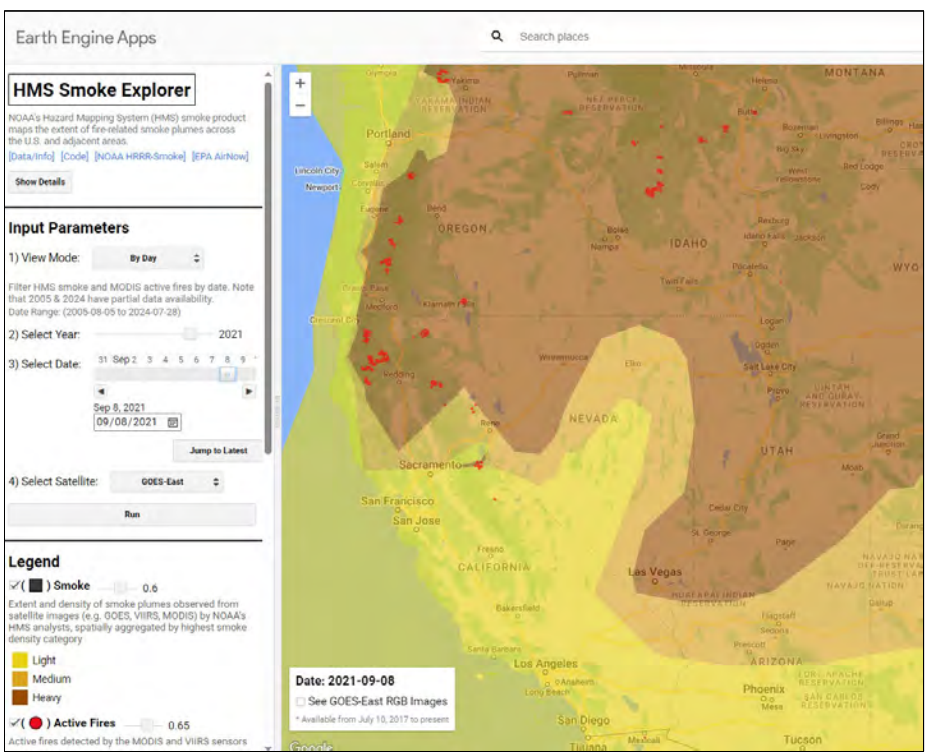


Figure 4-95. HMS Map from 9/8/2021



NOAA JSTAR Imagery

The historic NOAA JSTAR VIIRS satellite images also show evidence of the long-range smoke plumes moving over Utah on September 7, 2021 (Figure 4-96 and Figure 4-97).

Figure 4-96. JSTAR Image from 9/6/2021

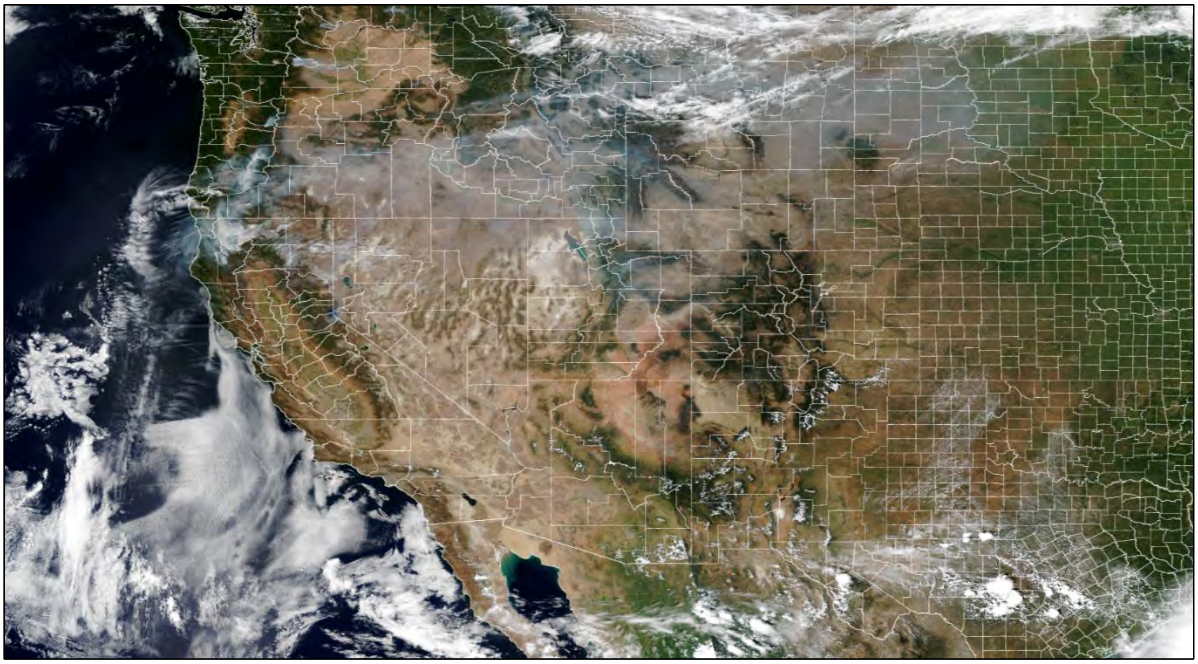
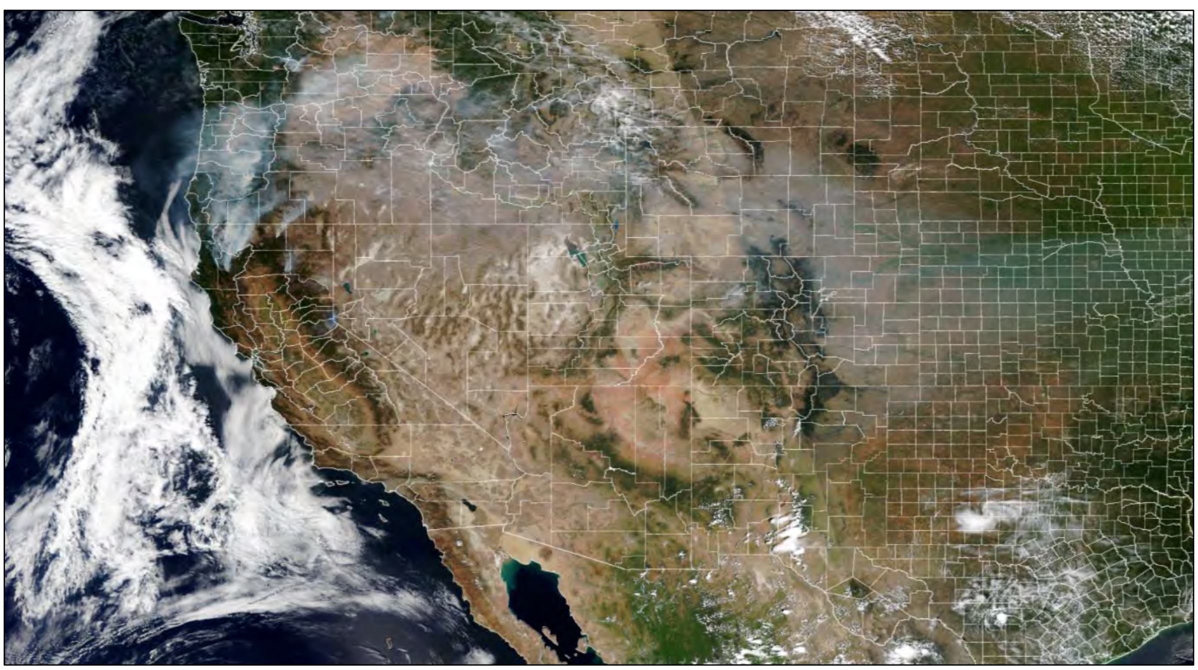


Figure 4-97. JSTAR Image from 9/7/2021



Both the HMS maps and JSTAR images correlate and corroborate the spike in 24-hour $PM_{2.5}$ values on 9/7/2021 at the Rose Park monitoring station.

HYSPLIT Modeling

The HYSPLIT model provided additional evidence for the long-range smoke transport from the California fires to the Rose Park monitoring station in Salt Lake City on September 7, 2021. HYSPLIT 48-hour backward trajectories from the Rose Park monitoring station indicate likely transport of particles from the Dixie Fire to near-surface ambient air in Salt Lake City. HYSPLIT modeled particles arrive during the evening of 9/7/2021 (Figure 4-98).

HYSPLIT forward ensemble trajectories originating from the Dixie Fire on 9/5/2021 also suggest long-range transport of wildfire smoke to the Salt Lake City area by 9/7/2021 (Figure 4-99).

Several other large fires (such as the Monument, McFarland, River Complex, McCash, Antelope, and Caldor Fires) in northern California were burning on these same dates. Both the HMS maps and JSTAR images (Figure 4-92 through Figure 4-97) show that the prevailing winds also likely provided long-range smoke transport from multiple fires in northern California to the Rose Park monitoring station during this time.

Figure 4-98. HYSPLIT Backward Trajectories on 9/7/2021

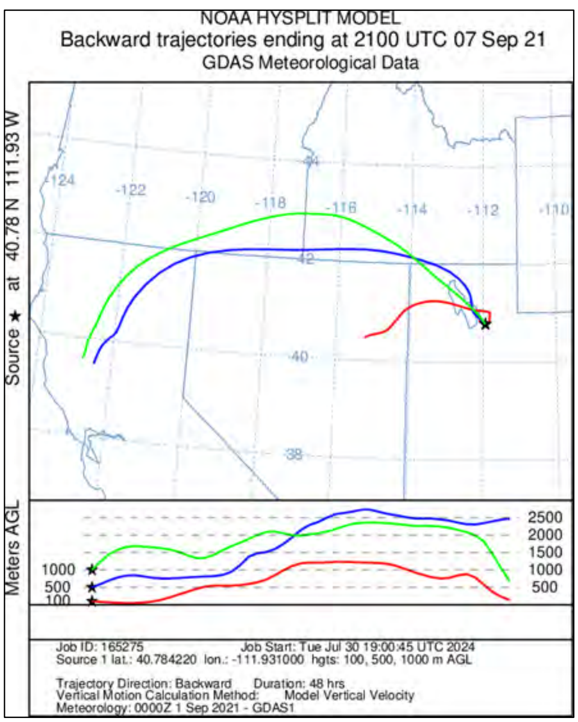
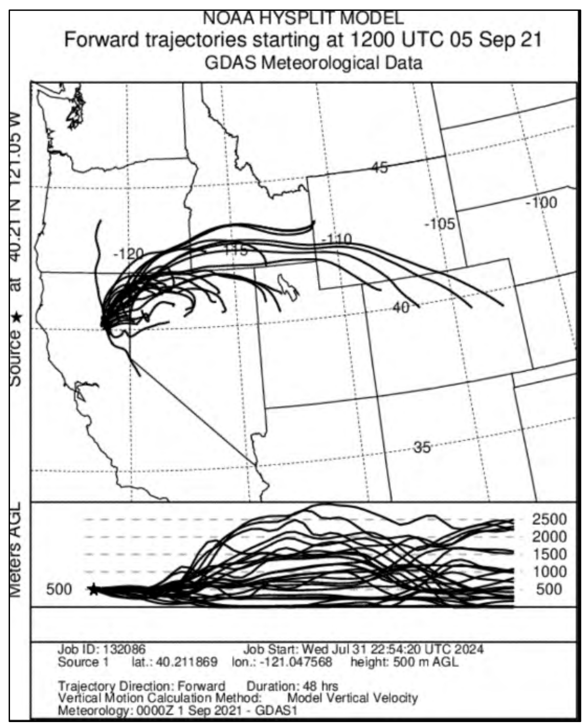


Figure 4-99. HYSPLIT Forward Trajectories on 9/5/2021



5.0 References

[Cal Fire] California Department of Forestry and Fire Protection

2020 2020 Incident Archive. https://www.fire.ca.gov/incidents/2020. Accessed August 5, 2024.

2021 2021 Incident Archive. https://www.fire.ca.gov/incidents/2021. Accessed August 5, 2024.

2024 Current Emergency Incidents. Ongoing Emergency Responses in California, Including all 10+ acre wildfires. https://www.fire.ca.gov/incidents.

[EPA] U.S. Environmental Protection Agency

2019 Additional Methods, Determinations, and Analyses to Modify Air Quality Data beyond Exceptional Events. April 4.

2021 Wildfire Smoke Atypical Event Ambient Record Modification Guidance.

2024 Air Data: Air Quality Data Collected at Outdoor Monitors Across the U.S. https://www.epa.gov/outdoor-air-quality-data.

[NOAA] National Oceanic and Atmospheric Administration

2024a HMS Smoke Explorer. https://globalfires.earthengine.app/view/hms-smoke. Accessed August 5, 2024.

2024b JSTAR Mapper. https://www.star.nesdis.noaa.gov/mapper/index.php. Accessed https://globalfires.earthengine.app/view/hms-smoke. Accessed August 5, 2024.

2024c HYSPLIT. https://www.arl.noaa.gov/hysplit/. Accessed July 29, 2024.

[NIFC] National Interagency Fire Center

2020 National Interagency Coordination Center *Wildland Fire Summary and Statistics Annual Report 2020*.

2021 National Interagency Coordination Center *Wildland Fire Summary and Statistics Annual Report 2021*.

2023 WFIGS Interagency Fire Perimeters. WFIGS Interagency Fire Perimeters | WFIGS Interagency Fire Perimeters | National Interagency Fire Center (arcgis.com). Accessed August 5, 2024.

This page is intentionally left blank.

Exhibit A. Letter from UDAQ to FHWA

State of Utah
SPENCER J. COX
Governor

DEIDRE HENDERSON
Lieutenant Governor

Department of
Environmental Quality

Kimberly D. Shelley
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQP-046-24

June 10, 2024

Federal Highway Administration, Utah Division
2520 West 4700 South, Suite 9A
Salt Lake City, Utah 84129

US EPA, Region 8
1595 Wynkoop Street
Denver, Colorado 80202

RE: Methods, Determination, and Support of Atypical Events Selection within UDOT's Hot Spot Analysis for the 2020-2023 Period

Introduction

This letter provides information regarding Utah Division of Air Quality's (UDAQ) support of the methodology, determination, and selection of atypical events for the Utah Department of Transportation's (UDOT) 2020-2023 hot spot analysis. This includes an explanation of the atypical event selection methodology devised, with assistance and support from UDAQ, on days when the Salt Lake Valley airshed was impacted by wildfire smoke emissions. Due to the uncontrollable and unrepresentative nature of wildfire smoke emissions, the rationale UDOT and UDAQ have deemed such wildfire impacted dates as atypical is also given within this letter. Last, this letter outlines how these anomalous events diverge from the typical air quality in the Salt Lake Valley and therefore should be excluded from any further air quality parameter calculations.

Determination and selection of atypical events

To identify the influence of wildfire smoke at surface monitoring sites, UDAQ employs air quality monitoring observations of PM2.5 at an hourly frequency. Observations of PM2.5 concentrations at monitors indicate the presence of wildfire smoke emissions at the surface. Additionally, UDAQ utilizes the National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite, Data, and Information Service (NESDIS) Hazard Mapping System (HMS) smoke product[1] to distinguish the residence of wildfire smoke over the Wasatch Front. The HMS smoke product is derived from visible satellite imagery from seven satellites and provides information regarding whether a smoke plume resides in the column overhead a monitor location (Ruminski et al. 2006).

By employing the combination of surface observations of PM2.5 and satellite derived smoke fields (HMS smoke product) described previously, UDAQ determines if wildfire smoke impacted a monitoring location using a two-factor screening methodology. This methodology is based on a number of previous studies investigating wildfire smoke impacts on air quality (e.g. Lee and Jaffe, 2024; Liu et al. 2023; Brey et al., 2018; Larsen et al. 2018; McClure and Jaffe, 2018; Preisler et al. 2015), with one such study completed in the Salt Lake Valley in 2022-2023.[2] First, using shapefiles containing satellite derived HMS smoke fields,[3] geospatial analysis is conducted using Python to determine if a monitor location (latitude/longitude) is bounded within a smoke-field polygon. If a monitor is contained within a smoke polygon, that day is noted to have smoke present in the atmospheric column overhead and marked as an HMS smoke day. A monitor specific baseline monthly 24-hour average PM2.5 concentration ($\underline{PM2.5}_{month}$) is then calculated for all non-HMS smoke dates by excluding HMS smoke dates for each month of the wildfire season (May-October). Second, monitored 24-hr PM2.5 concentrations ($\underline{PM2.5}_{24hr}$) are calculated for all days (HMS smoke and HMS non-smoke). If the monitored 24-hr PM2.5 concentration exceeds one standard deviation above the monthly mean PM2.5 concentration ($\underline{PM2.5}_{24hr} > \underline{PM2.5}_{month} + \sigma$), that date is flagged as wildfire smoke impacted. The motivation of using one standard deviation above the monthly mean PM2.5 as a flagging criterion is based on previous research that has determined that one standard deviation is a reasonable and appropriate cutoff point for identifying dates with abnormal PM2.5 concentrations compared to baseline variability (e.g. Lee and Jaffe, 2024; Brey et al., 2018). This two-factor screening process ensures that biases and weaknesses in any one flagging method (e.g. satellite or surface observations) are minimized (i.e. identification of a smoke plume overhead does not necessarily translate to elevated ground-level PM2.5 concentrations or vice versa).

Using the above HMS and PM2.5 criteria to detect the presence of wildfire smoke at UDAQ monitors, the sixteen dates shown in Table 1 were flagged and selected as wildfire smoke impacted at the Hawthorne monitor. Furthermore, to add confidence to the atypical date selection, the 24hr PM2.5 concentrations on each of these flagged dates were compared to the monitor specific Tier 2 and Tier 1 PM2.5 threshold values of 25.3 (ug/m^3) and 37.95 (ug/m^3), respectively. These threshold concentrations were formulated using EPA's PM2.5 Tiering Tool for Exceptional Events[4] and EPA guidance which states:

> "The tier thresholds are based on the lesser value of either (a) the most recent 5-year month specific 98th percentile for 24-hour PM2.5 data, or (b) the minimum annual 98th percentile for 24- hour PM2.5 data for the most recent 5-year period."[5]

[1] https://www.ospo.noaa.gov/Products/land/hms.html#0
[2] https://deq.utah.gov/air-quality/the-salt-lake-regional-smoke-ozone-and-aerosol-study-samoza
[3] https://www.ospo.noaa.gov/Products/land/hms.html#data
[4] https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis
[5] https://www.epa.gov/system/files/documents/2024-04/final-pm-fire-tiering-4-30-24.pdf

In this analysis, the Tier 2 threshold is delineated by the lowest 98th percentile within the 5-year period 2019-2023, and the Tier 1 threshold is distinguished as 1.5 times the Tier 2 threshold (lowest 98th percentile). Twelve of the sixteen flagged atypical events exceeded either the Tier 2 or Tier 1 threshold PM2.5 concentrations (Table 1), with the remaining four events marginally below the Tier 2 threshold (<3 ug/m^3 lower). Based on 24hr surface PM2.5 concentrations at the UDAQ monitor, a light (<10 ug/m^3), medium (10-22 ug/m^3), or heavy (>22 ug/m^3) smoke density rating was given to each flagged atypical event day (Table 1). This PM2.5 smoke density scale was derived from previous research, which investigated the differences in surface and satellite-based wildfire smoke density detection (e.g. Fadadu et al. 2020; Vargo, 2020). In order to add further weight and trust in the atypical event selection, dates were only selected where wildfire smoke was analyzed as both heavy from surface PM2.5 and analyzed as heavy from the HMS smoke product. The combination of HMS, tiering threshold comparison, and surface derived smoke density adds significant weight in the dates designated as atypical.

Conclusion

UDAQ fully supports the process outlined above for selecting atypical events in UDOT's hotspot analysis. UDOT with the aid of UDAQ's wildfire smoke analysis has established with confidence that the dates put forth as atypical are deemed unrepresentative of typical air quality conditions in the Salt Lake Valley due to the impact of wildfire smoke emissions. Therefore, these dates should be excluded from further hot-spot analysis for the period 2020-2023.

Sincerely,

Bryce C. Bird
Director

Tables

Analysis for Hawthorne: Sfc PM2.5 and HMS smoke screening 2020-2023				EPA PM2.5 Tiering Thresholds (ug/m^3)	
Date	**24hr PM2.5 (ug/m^3)**	**PM2.5 smoke density**	**HMS smoke density**	**EPA Tier 2**	**EPA Tier 1**
8/21/2020	41.5	Heavy	Heavy	25.3	37.95
8/22/2020	28.15	Heavy	Heavy	25.3	37.95
9/6/2020	23.35	Heavy	Heavy	25.3	37.95
7/11/2021	26.26	Heavy	Heavy	25.3	37.95
7/12/2021	22.74	Heavy	Heavy	25.3	37.95
7/25/2021	29.88	Heavy	Heavy	25.3	37.95
8/6/2021	44.2	Heavy	Heavy	25.3	37.95
8/7/2021	42.75	Heavy	Heavy	25.3	37.95
8/8/2021	42.18	Heavy	Heavy	25.3	37.95
8/9/2021	29.3	Heavy	Heavy	25.3	37.95
8/10/2021	26.48	Heavy	Heavy	25.3	37.95
8/15/2021	45.52	Heavy	Heavy	25.3	37.95
8/16/2021	36.57	Heavy	Heavy	25.3	37.95
8/18/2021	45.71	Heavy	Heavy	25.3	37.95
8/27/2021	29.39	Heavy	Heavy	25.3	37.95
8/28/2021	22.49	Heavy	Heavy	25.3	37.95
9/7/2021	23.8	Heavy	Heavy	25.3	37.95

Table 1. Selected atypical event dates from 2020-2023 using the UDAQ Hawthorne monitor, with 24 hour PM2.5 concentrations, surface PM2.5 derived smoke density (light <10 ug/m^3, medium 10-22 ug/m^3, or heavy >22 ug/m^3), HMS derived smoke density, and EPA PM2.5 Tier 2 (lowest 98th PM2.5 percentile) and Tier 1 (1.5*Tier2) thresholds formulated form EPA's PM2.5 Tiering Tool[6] and PM2.5 Wildfire Tiering guidance.[7]

---

[6] https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis

[7] https://www.epa.gov/system/files/documents/2024-04/final-pm-fire-tiering-4-30-24.pdf

References

Brey, S. J., Ruminski, M., Atwood, S. A., & Fischer, E. V. (2018). Connecting smoke plumes to sources using Hazard Mapping System (HMS) smoke and fire location data over North America. *Atmospheric Chemistry and Physics*, *18*(3), 1745-1761.

Fadadu, R. P., Balmes, J. R., & Holm, S. M. (2020). Differences in the estimation of wildfire-associated air pollution by satellite mapping of smoke plumes and ground-level monitoring. *International journal of environmental research and public health*, *17*(21), 8164.

Larsen, A. E., Reich, B. J., Ruminski, M., & Rappold, A. G. (2018). Impacts of fire smoke plumes on regional air quality, 2006–2013. *Journal of exposure science & environmental epidemiology*, *28*(4), 319-327.

Lee, H., & Jaffe, D. A. (2024). Impact of wildfire smoke on ozone concentrations using a Generalized Additive Model in Salt Lake City, Utah, USA, 2006–2022. *Journal of the Air & Waste Management Association*, *74*(2), 116-130.

Liu, T., Panday, F. M., Caine, M. C., Kelp, M., Pendergrass, D. C., & Mickley, L. (2023). Is the smoke aloft? Caveats regarding the use of the Hazard Mapping System (HMS) smoke product as a proxy for surface smoke presence across the United States.

McClure, C. D., & Jaffe, D. A. (2018). Investigation of high ozone events due to wildfire smoke in an urban area. *Atmospheric Environment*, *194*, 146-157.

Preisler, H. K., Schweizer, D., Cisneros, R., Procter, T., Ruminski, M., & Tarnay, L. (2015). A statistical model for determining impact of wildland fires on Particulate Matter (PM2. 5) in Central California aided by satellite imagery of smoke. *Environmental Pollution*, *205*, 340-349.

Ruminski, M., Kondragunta, S., Draxler, R., & Zeng, J. (2006, May). Recent changes to the hazard mapping system. In Proceedings of the 15th International Emission Inventory Conference (Vol. 15, p. 18). National Oceanic and Atmospheric Administration.

Vargo, J. A. (2020). Time series of potential US wildland fire smoke exposures. *Frontiers in public health*, *8*, 513567.

ATTACHMENT G

ICT Meeting Minutes and Pertinent Correspondence

Interagency Consultation Team
Meeting Minutes

June 14, 2023

10:00 AM – 11:30 AM

Virtual Meeting

<u>Attending</u>:

Jay Aguilar, UDOT
Ryan Bares, DAQ
Wayne Bennion, WFRC
Kip Billings, WFRC
Jeff Gilbert, Cache MPO
Autumn Hu, UTA
Naomi Kisen, UDOT
Greg Lohrke, EPA
Rick McKeague, DAQ
Shauna Mecham, MAG
Greg Mortensen, DAQ

1. Welcome and Introductions

2. Meeting minutes April 12, 2023

   Ryan Bares noted that the public comment period for the Northern Wasatch Front moderate ozone SIP has changed since the April 12 meeting. The comment period will be June 1 - July 17, 2023.

   Motion - Ryan Bares, DAQ

   Second - Greg Mortensen, DAQ

   APPROVED

3. TIP Update: Little Cottonwood Canyon EIS - Naomi Kisen

   This project, with funds from the State legislature, will be added to 2023-2028 TIP at the WFRC Transcom meeting tomorrow. This project was included in the 2023-2050 RTP and AQ Memo 41 conformity analysis. The project includes enhanced bus operations, tolling, mobility hub, and improved bus stops and shelters for both LCC and BCC. UDOT presented the proposed amendment to the ICT and no objections were received.

4. I-15 Farmington to Salt Lake City POAQC - Naomi Kisen

   UDOT is preparing an EIS to evaluate expanding I-15. EPA had concerns whether this increases diesel vehicle activity in this area. What are the impacts of the proposed UIPA activity on the I-15 project? How will the air quality impacts be evaluated? Does this reach the 10,000 additional diesel vehicle threshold for a POAQC? Worst performing intersections would be outside the I-15 EIS footprint. Jennifer Elsken was not present for this discussion.

Naomi suggested UDOT, EPA, and FHWA continue discussions on this matter including more detailed UIPA development plans and impacts.

5. Other

   None.

6. Next Meeting – September 13, 2023

Interagency Consultation Team
Meeting Minutes

September 13, 2023
10:00 AM – 11:30 AM
Virtual Meeting

Attending:
Ryan Bares, DAQ
Wayne Bennion, WFRC
Kip Billings, WFRC
Becky Close, DAQ
Jennifer Elsken, FHWA
Jeff Gilbert, Cache MPO
Naomi Kisen, UDOT
Robyn Kullas, FTA
Greg Lohrke, EPA
Rick McKeague, DAQ
Shauna Mecham, MAG
Greg Mortensen, DAQ

1. Welcome and Introductions

Jennifer Elsken announced that she has accepted a position with the Army Corps of Engineers and will be leaving her current FHWA position October 20th. Thank you Jennifer for your contributions to our air quality and transportation planning.

2. NWF Ozone SIP – Ryan Bares

Ryan reported that the UAQB approved the moderate Ozone SIP at the meeting yesterday. DAQ will send the Ozone SIP to EPA by the end of September 2023. One section of the SIP will be sent to EPA by the end of October 2023. According to the Clean Air Act, Section 110.K, the EPA has 6 months to review the SIP for completeness, and 12 months after that date to approve or disapprove the SIP.

In the meantime, WFRC, UDOT and UTA are working together to identify critical transportation projects to be amended into the RTP prior to an anticipated “Conformity Freeze”. Prior to initiating work on an updated Ozone SIP under the anticipated “serious” designation, it was suggested that DAQ and WFRC meet to discuss the prospects of a successful serious Ozone SIP and other potential conformity freeze remedies.

3. Documentation for Conformity – Kip Billings

a. Conformity WFRC 2023

Kip shared with the Team some additional folders on the “Utah ICT Shared Drive” for convenience in documenting conformity activities. Kip shared the “Conformity WFRC 2023” folder which included a copy of the Air Quality Memorandum #41a and the accompanying email that was sent to ICT members for their comment. Conformity documents and email communications to the ICT regarding conformity when a virtual meeting is not held will be documented by WFRC in this folder. When there are responses to these emails, the responses will also be saved in this folder. Similar folders were created for MAG and CMPO and they expressed a similar desire to use the shared drive forum in response to FHWA's request to document these emails to the ICT regarding conformity.

b. **POAQC**

UDOT likewise has a folder for Projects of Air Quality Concern and has begun using that site for documentation of POAQC emails.

UDOT indicated that a meeting with EPA's OTAQ to discuss their opinion that the I-15 Farmington to Salt Lake EIS is a POAQC is in the process of being arranged and that UDOT would update the ICT on the results of the meeting. UDOT also indicated that the notes from the August meeting would be sent shortly and confirmed that the other ICT members have questions or concerns regarding EPA's position regarding the I-15 Project as a POAQC. From UDOT's perspective, the I-15 project is not a good fit with the example POAQCs in EPA's guidance and the "precedent" projects EPA referenced in the August meeting were shown not to contribute to or create new violations of the NAAQS.

4. **MOVES4 Release**

a. **Download** **https://www.epa.gov/moves**

MOVES4 is available for download. Initial indications show significant emission reductions long term with more EVs entering the fleet and the 2027 heavy duty diesel rule.

b. **Register for today's Webinar**

c. **UDOT training opportunity – Naomi Kisen**

UDOT is hosting FHWA training on air quality analysis and conformity on November 4th and 6th. Invitations will be sent out and virtual attendance will be available on one of the days.

5. **Other: Next meeting discussion and assignments**

a. *Amendment process, Exempt projects*

Jennifer Elsken asked about the process for identifying "exempt" projects in terms of air quality conformity requirements. Each agency has similar yet varied procedures in place. MPOs and FHWA will meet prior to the next ICT meeting in November to review TIP and RTP amendment procedures including the identification of exempt projects in an effort to ensure that MPO procedures satisfy conformity requirements.

b. *MOVES4, local inputs, comparisons*

With the advent of the new MOVES4, a new version of the travel demand model, and the increasing age of some of the local inputs to the MOVES model; it would be a good time to review and refresh the data inputs that are being used such as fuels, AVFT, vehicle age, and vehicle mix to name a few. This should be the subject of some additional technical meetings and data development prior to reporting back to the ICT.

c. *Ozone SIP and Conformity Freeze*
   - ☐ *Most of the discussion to date has been about minimizing the short term impact of a conformity freeze by amending WFRC's RTP and TIP with critical projects prior to that event. Further discussions are needed to seek long term solutions to the likely conformity freeze for the NWF area if the SIP is unable to demonstrate attainment of the ozone standard.*

6. Next Meeting – November 8

Participants (12)

Find a participant

Joined (12)

- Kip Billings (Host, me)
- Jennifer Elsken FHWA (Guest)
- Naomi Kisen (Guest)
- Wayne Bennion, WFRC (Guest)
- Becky Close (Guest)
- Greg L EPA (Guest)
- Greg M UDAQ (Guest)
- Jeff Gilbert (Guest)
- R McKeague (Guest)
- rbares (Guest)
- robyn.kullas (Guest)
- Shauna Mecham MAG (Guest)

Not Joined (13)

UDOT I-15 EIS Hotspot Meeting

Date:1/25/2024

Time: 11 am to 11:45 am MST

Location: Virtual – Teams Meeting

Attendees:

- Naomi Kisen, UDOT
- Brandon Weston, UDOT
- Tiffany Pocock, UDOT
- Ed Woolford, FHWA
- Rex Harris, FHWA
- George Noel, FHWA
- Chris Dresser, FHWA
- Brigitte Mandel, FHWA
- Greg Lohrke, EPA
- Laura Berry, EPA
- Aaron Letterly, EPA
- Kevin Kilpatrick, HDR (UDOT Consultant Team)
- Amy Croft, HDR (UDOT Consultant Team)

Discussion Items/Topics:

- Naomi recapped the coordination that occurred in 2023 between UDOT, the ICT, and EPA with regarding the project of air quality concern evaluation.
  - o UDOT noted that EPA had disagreed with UDOT's POAQC determination in the Draft EIS and requested hotspot analysis for the FEIS.
  - o Based on additional coordination with EPA and FHWA, UDOT has agreed to do hotspot modeling for the Final EIS.
  - o UDOT provided a memo documenting the basis for a hotspot analysis location for EPA review on 11/14/2023.
  - o EPA provided comments on this memo on 11/27/2023.
  - o UDOT has had additional coordination with FHWA on how to respond to EPA's comments in December 2023 and January 2024.
- The purpose of the 1/25/24 meeting is to discuss EPA's comments and try to get concurrence on an approach for the I-15 EIS hotspot modeling.
- The group discussed the potential for the project to cause an increase in emissions from other non-roadway point sources such as the railyard or refineries.
  - o UDOT noted that I-15 is an existing facility and the proposed I-15 EIS project would not change access or add any new accesses to the railyard or any refineries. UDOT does not anticipate any changes to the railroad or refinery emissions due to the I-15 project.
  - o Any emissions from the railroad, railyard, or refineries is accounted for in current background values.
- The group discussed several of EPA's comments from 11/27.
- Overall, UDOT and FHWA asserted that the proposed hotspot location on the segment of I-15 between I-80 and 600 North in Salt Lake City/Salt Lake County would provide a worst-case scenario in regard to potential emissions and would be the best location for a hotspot analysis for the following reasons:

Interagency Consultation Team
Meeting Minutes - <u>draft</u>

February 14, 2024
11:00 AM – 12:00 PM
Virtual Meeting

<u>Attendees</u>:
Kip Billings, WFRC
Becky Close, DAQ
Jay Aguilar, UDOT
Rex Harris, FHWA
Autumn Hu, UTA
Robyn Kullas, FTA
Greg Lohrke, EPA
Ryan Bares, DAQ
Naomi Kisen, UDOT
Wayne Bennion, WFRC
Shauna Mecham, MAG
Rick McKeague, DAQ
Jeff Gilbert, Cache MPO
George Noel, FHWA Resource
Ed Woolford, FHWA
Tiffany Pocock, UDOT

1. Welcome and Introductions
   George Noel of FHWA Resource was welcomed.

2. MAG Regional Transportation Plan Amendment

   Shauna Mecham of MAG presented details of a proposed amendment to the MAG Regional Transportation Plan. The amendment includes projects that were identified in the needs-based list of projects that had not been included in the previous regional emissions analysis. MAG will prepare a new regional emissions analysis including these projects and request a new conformity determination from FHWA and FTA.

   MAG will amend TransPlan50, their Long Range Plan, in May 2024 with an updated conformity determination, including new air quality model runs. MAG will add transit projects, including the new Draper Frontrunner station and POM BRT changing to light rail. MAG will also be including projects that are in the current Long Range Plan, but were only modeled in the "vision" network and need to be modeled within the fiscally constrained network to address the corrective action in MAG's FHWA certification. MAG will share the draft conformity determination and notify the ICT when the public comment period opens.

   The presentation Shauna shared about the MAG Plan amendments can be found at this link.

3. Projects of Air Quality Concern (POAQC)

   Naomi Kisen of UDOT reported on two project of air quality concern.

I-15/24th Street Interchange – Naomi explained that this project was not a POAQC because the project does not increase diesel vehicle traffic at this location. There were no objections expressed by members of the ICT when asked about this response from UDOT.

I-15 Farmington to Salt Lake – UDOT responded to comments from EPA about the air quality impacts of this project. UDOT reported that this project does not create any new connections to emission sources, and that diesel emissions do not increase as a result of this project.

The AADT and diesel volumes increased in terms of percentage at some locations, but the locations with the highest volumes of diesel traffic which might cause concern for emission impacts exhibited a negligible increase in diesel traffic.

EPA also had comments about the critical air quality monitoring station to use in the analysis of PM2.5 and PM10 emissions. The Rose Park station was the closest monitor to the PM2.5 receptor site. For the PM10 receptor site, the closest monitor only measures PM2.5, so the Rose Park monitor was used for this location also. UDOT coordinated with DAQ in identifying the appropriate monitor data to be used.

UDOT used 2021 monitor data for the background emissions analysis, including several exceedance days that were flagged due to wildfires. Ryan Bares noted that 2021 was an exceptional year for wildfire impacts to ambient air quality.

Greg Lohrke said that EPA would like up to two more weeks to review UDOT's response in light of other meetings and discussions that have transpired before endorsing the response from UDOT. Becky Close said that DAQ would withhold their acceptance of the UDOT response until a final opinion from EPA was made. Naomi said that she would bring this item back to the ICT if EPA desires major revisions.

Motion - Wayne Bennion:

> Barring objections from EPA and DAQ within the next two weeks, the ICT accepts the response from UDOT to EPA comments on the projects of air quality concern: I-15/24th Street Interchange, and I-15 Farmington to Salt Lake City.

Second – Shauna Mecham

APPROVED

4. Next Meeting – April 10, 2024, 10:00-11:00 AM.

  - This area has the highest background concentrations for PM2.5 and PM10.
  - In a nonattainment area for PM2.5 and maintenance area for PM10.
  - This area has the highest projected 2050 traffic volumes (AADT) and would correspondingly have the highest levels of vehicle emissions.
  - Therefore, a hotspot analysis here would show the highest potential PM emissions and within the project area.
  - This segment of I-15 has residential receptors on both sides of I-15. Most other areas of the project have industrial uses on one or both sides of I-15.
  - This segment is located in an area with adjacent environmental justice populations.
- FHWA noted, overall, the goal is to try to select and focus the modeling on a location with the potential for maximum concentrations.
- The group also discussed a potential second location for a hotspot location in Davis County at the I-15/I-215 interchange area.
  - At this area, there are two refineries (Chevron and Big West Oil) located west of I-15 and north and south of I-215. To include this information in the hotspot analysis, UDOT would need to obtain point-source data from Utah DAQ.
  - FHWA noted that the point source emissions from these refineries are likely not fully accounted for in the Rose Park or Bountiful #2 monitoring background data.
  - There are residential receptors east of I-15 in this location that could be affected by the combined refinery and I-15/I-215 emissions.
- EPA stated that hotspot guidance assumes the whole project or multiple locations for the hotspot analysis, not just one location.
- EPA requested UDOT provide the following information:
  - documentation supporting the selection of the two sites for hotspot analysis
  - documentation supporting why additional sites were not selected for hotspot analysis
  - documentation with responses to the comments provided on 11/27/2023
- When discussing EPA's request for a written response to the 11/27/2023 email and additional documentation supporting UDOT's position, Naomi stated that UDOT's response and additional discussion would be consistent with the points presented in the meeting - that UDOT and FHWA are confident that modeling is being proposed for the area(s) with the highest emissions and that the point sources and other intersections do not need to be modeled because they are already accounted for/ do not have a significant number of diesel vehicles.
  - Naomi inquired after EPA's likelihood of agreeing with this rationale and while EPA would not provide a direct answer, Laura Berry indicated that she thought our rationale was "reasonable".

Action items

- UDOT to submit the following documentation to EPA by 1/29/2024
  - documentation supporting the selection of the two sites for hotspot analysis
  - documentation supporting why additional sites were not selected for hotspot analysis
  - documentation with responses to the comments provided on 11/27/2023
- EPA to review documentation and responses week of 2/5 to 2/9.
- EPA to contact UDOT and FHWA if there are items that need additional discussion or information.

Meeting Notes

Project: UDOT I-15 Farmington to Salt Lake City EIS

Subject: Hotspot-model model locations and extent

Date: Thursday, March 14, 2024

Location: Virtual

Attendees:

Name	Agency		Name	Agency	
Greg Lohrke	EPA	x	Amy Croft	UDOT (HDR)	x
Chris Dresser	FHWA	x	Ronald Ying	UDOT (HDR)	x
George Noel	FHWA	x	Naomi Kisen	UDOT	x
Kevin Kilpatrick	UDOT (HDR)	x			

Meeting Topics

1. Geographic Scope of the Hot-spot Analysis
    a. Southern analysis area
        i. Area includes I-15 south of I-80 interchange, I-80 at this location and I-15 to 600 North)
        ii. This area has the highest over all AADT and highest diesel AADT by a significant margin (more than 60%). It is also located closer to other major PM emission sources than other portions of the project area. While other sections could have slightly slower travel speeds/more congestion (i.e. I-15 near 1000 North), the higher AADT levels at the proposed model location more than offset any emissions increases that would result from moderate increases in congestion. This was demonstrated by George using an example lookup table of rates for various speeds and associated emissions. In this example a difference of 50 mph versus 65 mph (with AADT constant) results in an emissions difference of roughly 20-40%.
        iii. It is reasonable to conclude that the emissions density of this area is greater than that of other areas, even if these areas were to experience more congestion.

b. Northern analysis area
    i. The northern analysis area, located along I-15 in the vicinity of the Big West Oil and Chevron refineries, has lower AADT volumes and emissions but is being included because of the potential for public concern. Additionally, the EPA's guidance discusses including nearby sources in the model when they are/may not be captured in the background concentrations.
c. One change was made to the southern analysis area. The analysis area along I-80 west of I-15 was extended several hundred meters to the west to ensure emissions associated with the project would be captured under various meteorological conditions.
d. EPA indicated that their concerns regarding the section between 600 and 1000 North had been addressed by FHWA's demonstration of congestion/travel speeds differences on that segment being less significant than the differences of diesel AADT in producing modeled PM emissions. FHWA and EPA agreed that the proposed geographic scope of the analysis is an appropriate starting point for the analysis.

2. Preliminary Receptor Locations
    a. Preliminary review of the receptor locations indicates that FHWA and EPA support the logic used to determine locations, as a conservative first pass. These include:
        i. Modeling everything at one elevation
        ii. Placing receptors in locations the public could physically access even if they are not permitted to.
    b. If violations occur using the above assumptions, the model could be adjusted to include variables such as elevation or access restrictions.

3. Next Steps
    a. UDOT/HDR will provide the travel speeds associated with locations near 1000 North and near the I-80 and I-15 interchange to verify travel speeds are not substantial different (less than 10 mph).
    b. UDOT/HDR will explore sharing of the webmap with FHWA and EPA (or KMZ) to facilitate review.

c. The group will reconvene (on March 26th) once the model is built to review the model (including documentation and files) and recommend adjustments, if needed.
d. Amy will reach out to George and Chris separately to review MOVES assumptions.

Meeting Notes

Project: UDOT I-15 Farmington to Salt Lake City EIS

Subject: Hotspot-model model receptor placement

Date: Tuesday, March 26, 2024

Location: Virtual

Attendees:

Name	Agency		Name	Agency	
Greg Lohrke	EPA	x	Amy Croft	UDOT (HDR)	x
Chris Dresser	FHWA		Ronald Ying	UDOT (HDR)	x
George Noel	FHWA	x	Naomi Kisen	UDOT	x
Kevin Kilpatrick	UDOT (HDR)	x			

Meeting Topics

1. Previous meeting action items
    - i. Travel Speeds- HDR has requested travel speeds associated with locations near 1000 North and near the I-80 and I-15 interchange.
    - ii. Webmap
        1. Link to webmap containing analysis areas, links and receptor locations: https://hdr.maps.arcgis.com/apps/mapviewer/index.html?webmap=7b870509fd484f7abe452774cae2f86c
        2. Note: In general, receptors were placed with finer spacing (25 meters apart) closer to the roadway edge of pavement to cover a distance of at least 100 meters from the roadway edge of pavement and then they were placed with wider spacing (100 meters apart) after the first 100 meters and up to 500 meters from the roadway edge of pavement. The first row of receptors were placed 5 meters from the roadway edge of pavement unless a noise wall (an existing noise wall or noise wall planned as part of the project) or a right-of-way fence were located further than 5 meters from the roadway edge of pavement. In cases where a noise wall or right-of-way fence were located further than 5 meters from the roadway edge of pavement, then the first row of receptors were placed on the noise wall or right-of-way fence. Five rows of receptors spaced 25 meters apart were placed around the project. Receptors were placed in areas that are considered ambient air, where the public generally has access. Receptors were omitted from roadway right-of-way areas, railroad property, and large industrial areas.

Interagency Consultation Team
Meeting Minutes - <u>draft</u>
April 10, 2024
10:00 AM – 11:00 AM
Virtual Meeting

<u>Attendees:</u>

Kip Billings, WFRC	Becky Close, DAQ	Ed Woolford, FHWA
Wayne Bennion, WFRC	Ryan Bares, DAQ	Rex Harris, FHWA
Shauna Mecham, MAG	Rick McKeague, DAQ	Chris Dresser, FHWA Resource
Jeff Gilbert, Cache MPO	Naomi Kisen, UDOT	George Noel, FHWA Resource
	Jay Aguilar, UDOT	Greg Lohrke, EPA
	Autumn Hu, UTA	

1. **Welcome and Introductions**
2. **Minutes form February 14, 2024 meeting**

    Motion – Jay Aguilar
    Second – Shauna Mecham
    APPROVED

3. **WFRC Potential Ozone Conformity Freeze Memo**

    Kip Billings reported to the Committee that WFRC had sent an updated memo on March 29, 2024 to transportation planning partners including many of the ICT members regarding the dates and implications of a potential conformity freeze. A previous memo from February 2023 on this topic cited Jualy 2024 as the target date of a potential conformity freeze. In the updated memo, this date has been moved back to October 2024 or later pending action by EPA on the Utah DAQ Moderate Ozone SIP.

    It was also noted that Level 2 amendments to the RTP, those involving projects that are not exempt nor are they regionally significant, would <u>not</u> be possible under a conformity freeze. This is a change in understanding from what was stated in the 2023 memo. Level 2 amendments do not require a regional emissions analysis, but they do require a letter of record from FHWA that the proposed amendment conforms and under a freeze FHWA would not be permitted to issue that letter.

4. **Ozone RFP Requirements**

    Greg Lohrke of EPA clarified that the WFRC Ozone memo states that DAQ needs to show in the SIP that attainment of the ozone standard is achieved in order to avoid or to resolve the conformity freeze situation. A more complete understanding is that DAQ needs to also show reasonable further progress for emission reductions including VOC emissions.

5. **UDOT I-15 Farmington to SLC Hotspot Model Update**

   Naomi Kisen of UDOT reported on the hotspot modeling assumptions for the I-15 Farmington to Salt Lake project.

   Two hotspot locations were identified: 1. I-15/I-80 interchange in North Salt Lake which has the greatest traffic volume withing the project, and 2. I-15/I-215 interchange which is also adjacent to a refinery which compounds the ambient emissions.

   Receptor locations were identified at hundreds of points including intervals of 5, 25, and 100 meters up to ¼ mile from the roadway, and locations such as schools frequented by the public (even if slightly outside the ¼ boundary). UDOT located receptors following EPA guidance using conservative assumptions including receptor locations that meet the spacing requirements but may be unlikely to have human exposure due to fencing or other access limitations. Pending the outcome of the exposure analysis, UDOT may re-evaluate some receptor locations.

   Naomi shared the link below of a map of receptor locations for this analysis.

   https://experience.arcgis.com/experience/80031826d4f842c29cf264f5cb0e15d9

6. **Next Meeting – June 12, 2024, 10:00-11:00 AM.**

Participants (15)

Find a participant

- Kip Billings (Host, me)
- NK Naomi Kisen (Guest)
- RM R McKeague (Guest)
- WB Wayne Bennion, WFRC (Guest)
- AH Autumn Hu (Guest)
- C christopher.dresser (Guest)
- E Edward.Woolford (Guest)
- G George.Noel (Guest)
- GL Greg L EPA R8 (Guest)
- GM Greg Mortensen (Guest)
- JA Jay Aguilar, UDOT (Guest)
- JG Jeff Gilbert (Guest)
- R Rex.Harris (Guest)
- RB Ryan Bares (Guest)
- SM Shauna Mecham (MAG) (Guest)

2. Proposed MOVES inputs and modeling periods

   The team discussed and agreed it is appropriate to use the MOVES inputs and periods as described below:

   a. AVFT files from DAQ for location specific areas, project speed and source type; County specific age distribution; MOVES defaults for MET days and other fuel inputs.
      i. Amy will send a summary of this approach to the group for review.
   b. AM and PM peak, midday, and overnight periods for 2035 and 2050 in January will be modeled.
      i. EPA requested to see the supporting information for the determination that January is the "worst case month".

3. Receptor locations and elevations
   a. FHWA and EPA will use the webmap provided in the link to review the receptor locations. The agencies will aim to have the review completed by April 9th, in anticipation of the ICT meeting on the 10th. However, EPA could need until the 12th to accommodate a second reviewer if there are more specific concerns.
   b. Receptors will be placed 5 meters from I-15 for sidewalk receptors at 200 South, South Temple, and North Temple.
   c. Elevation is planned to be evaluated assuming everything is at-grade. If there is an area approaching or experiencing a violation, elevation will be added locally to that area.
      i. EPA has one arc-second elevation data
      ii. The project has project- specific survey elevation data

4. 600 North Study Area
   a. Amy shared the 600 North Study Area receptor locations.
   b. The team discussed if the southern extent of the receptors (to 400 South) was appropriate or if it might be extended further.
      i. The team agreed that because the placement of the receptors extended past the limits of the physical improvements, and because these improvements between 200 S to the end of the southern project limit consist primarily of lane restriping, the current extend of receptors is appropriate.

5. Action Items
   a. UDOT/HDR to follow up on travel speeds.
   b. UDOT/HDR to provide summary to approach/supporting documentation to MOVES inputs and worse case month determination.
   c. FHWA and EPA to review receptor locations in webmap and provide comments.
   d. Next meeting planned for April 9th at 11 am.

Meeting Notes

Project: UDOT I-15 Farmington to Salt Lake City EIS

Subject: Hotspot-model Receptor Locations, Atypical Days and Preliminary Model Results

Date: Thursday, April 25, 2024

Location: Virtual

Attendees:

Name	Agency		Name	Agency	
Greg Lohrke	EPA	x	Amy Croft	UDOT (HDR)	x
Chris Dresser	FHWA	x	Ronald Ying	UDOT (HDR)	x
George Noel	FHWA	x	Naomi Kisen	UDOT	x
Kevin Kilpatrick	UDOT (HDR)	x			

Meeting Topics

1. Previous meeting action items
    a. ICT Presentation
        i. The location of receptors and associated rationale was shared with the ICT, along with minor changes that had been made to the model area since last presented. No questions of concerns were shared during or after the meeting.
    b. EPA Additional Review of Receptor Placement
        i. EPA did not have additional comments on the location of the receptors, other than to affirm that the rationale for identifying the location of additional "sensitive receptor" locations should be formalized in the methodology write-up.
2. Atypical Event Days
    a. UDOT expressed that the example atypical events memo provided by FHWA was very lengthy and would be hard for UDOT and Utah DAQ to emulate. UDOT inquired if this type of detail was needed. FHWA responded that it may not be, and that the memo reflected Arizona DOT/DAQ already having much of the information as they had been pursuing exceptional event exceptions. The team discussed developing a checklist of minimum requirements, which would include a bullet point type list of what needs to be demonstrated and what supporting documentation needs to be included. FHWA and EPA indicated they would coordinate further on this topic.
    b. The team discussed if only the atypical days needed to meet the NAAQS should be removed or if all the atypical days should be removed. In Arizona, only the needed days were removed. UDOT expressed their preference for removing all days, both because it is more straightforward and due to concerns with public

controversy if pollutant values are shown as "just" under the standard. FHWA indicated that either could be possibility, and that additional input from EPA was needed.

3. Preliminary Results
    a. HDR shared preliminary results from the hot-spot model. A small number of receptors in the 600 N study area, in the first row of receptors located along the I-15 and I-80 Interchange, showed violations for PM 10. The team determined that it would be appropriate to add elevation to the model for the southern analysis area and rerun the entire model for this area. (The northern analysis area did not show violations.)
    b. The team also discussed other potential model adjustments that could be considered later, if needed. This included using R-Line, switching to volume source, and incorporating weekday/weekend splits in the traffic data.
    c. The team also discussed how the Hawthorne monitoring location may be more representative of the project area than the Utah Technical Center location and briefly deliberated interpolating values from the two monitors.
4. Action Items
    a. UDOT will add elevation to the southern modeling area and rerun the hot-spot model for this area.
    b. FHWA and EPA will coordinate on developing an atypical events checklist.

   iii. This methodology follows the approach taken by Jaffe et al. in their 2023 SAMOZA study final report. Thresholds identifying light, moderate/medium and heavy days are based on thresholds identified in other research papers.

3. Discussion and conclusion
   a. The group discussed at length the appropriateness of this approach for identifying atypical days and how this effort varies from the more extensive documentation associated with the exceptional event process. The group determined that the I-15 project may remove the DAQ identified atypical event days with the following adjustments:
      i. EPA requested additional information regarding days within the 95th percentile for PM 2.5
      ii. FHWA determined that only days which showed as heavy in both HMS and PM 2.5 surface data would be removed from the model.
4. Action Items
   a. DAQ, pending consent from their Director, will produce a memo outlining:
      i. Their support for the approached discussed at the meeting
      ii. A general discussion of their methodology with references (and links) to Jaffe et al. and the other research used to determine the thresholds.
      iii. The script and corresponding documentation DAQ used to identify the atypical days.
   b. UDOT will update the ICT

Meeting Notes

Project: UDOT I-15 Farmington to Salt Lake City EIS

Subject: Hotspot-model PM 10 Monitor and Atypical Days

Date: Thursday, May 30, 2024

Location: Virtual

Attendees:

Name	Agency		Name	Agency	
Greg Lohrke	EPA	x	Mark Sghiatti	UDAQ	x
Chris Dresser	FHWA	x	Chris Pennell	UDAQ	x
George Noel	FHWA	x	Brandon Weston	UDOT	x
Kevin Kilpatrick	UDOT (HDR)		Naomi Kisen	UDOT	x
Amy Croft	UDOT (HDR)	x			
Ronald Ying	UDOT (HDR)	x			

Meeting Topics

1. Use of Hawthorn Monitor For PM 10
    a. The group briefly discussed use of the Hawthorn Monitor to PM 10 background values and agreed to use this monitor for PM 10 background values because it is most representative of the background at the hot-spot model location. The team also agreed that a PM 10 value of 154 µg/m3 or lower would be rounded down to 150 (which is the standard).

2. Atypical Days Approach
    a. FHWA and EPA requested additional information from DAQ regarding their process for identifying wildfire affected days. DAQ explained that the spreadsheet of days was product of a scripted screening tool developed based on:
        i. Identifying days that experience wildfire smoke based on NOAA's HMS tool. Although the smoke intensity of these days is identified as heavy, medium or light, DAQ's methodology allows for all HMS identified days to be considered as smoke affected due to limitations in underlying satellite data temporal resolution and cloud cover/noise .
        ii. HMS identified days are then evaluated based on the smoke intensity at the surface, where days that are more than one standard deviation from the mean are identified as smoke affected.

Interagency Consultation Team

Meeting Minutes - draft

June 12, 2024

10:00 AM – 11:30 AM

Virtual Meeting

Jun 12, 2024 | ICT Meeting

Attendees: Autumn Hu Becky Close Chay Mosqueda Ed Woolford Greg Mortensen Jay Aguilar Jeff Gilbert Jory Johner Julie Bjornstad Kip Billings Lohrke, Gregory Naomi Kisen Ryan Bares Rex Harris Rick McKeague Robyn Kullas Shauna Mecham Sheila Vance Wayne Bennion ~~Hugh Van Wagenen~~

1. Welcome and Introductions

2. I-15 Farmington to Salt Lake - Naomi Kisen

   UDOT's agenda item includes a discussion of the approach to removing wildfire affected days from the PM background for the I-15 hotspot model. This approach was developed by DAQ; Please use this link to view the memo describing the approach.

Hot spot modeling at two locations. PM10 hot spot modeling is close to the NAAQS when compared to levels at the Rose Park monitor. Rose Park monitor is close to I-215 and the airport and is not representative of the project environment. UDOT suggests using the Hawthorne station as the definitive monitor site for hot spot modeling on this project.

Exceptional events involving wildfires need to be flagged to address the number of exceedance days. See the DAQ memo referenced above. EPA supports the exceptional event approach presented in the DAQ memo. EPA asked for the Python script used to support the analysis in the DAQ memo. The memo includes 2020-2023 data, and should be revised to include 2020-2023 data only.

3. WFRC RTP Amendment #2 – Jory Johner

   Jory described the conformity process found in the WFRC Amendment Process for Level 1, 2, and 3 type amendments.

   Level 1- Amendment #2 includes 10 active transportation projects which are exempt from conformity requirements.

   Level 2 - Jory described six roadway projects on minor arterials and collectors. These will not require a new regional emissions analysis.

It was suggested that a streamlined approach could be applied to exempt projects, possibly by email to review the exempt project list and descriptions.

4. Other Business
   Send meeting draft minutes for review and approval for past meetings.

5. Next Meeting – September 11, 2024

Meeting Chat
10:17:10 From Jory Johner to Everyone:

https://wfrc.org/VisionPlans/RegionalTransportationPlan/2023_2050Plan/RTPAmendmentProcess_March2024.pdf
10:17:18 From Jory Johner to Everyone:

https://docs.google.com/spreadsheets/d/1EhaufSjd6BwkACr1Um9Cn0L5qKqBk4VEj9E8EvoJw1c/edit#gid=0
10:36:10 From Jay Aguilar, UDOT/Long Range Planning to Kip Billings(direct message):
Do you need a concurrence letter from UDOT?
10:37:01 From Kip Billings to Jay Aguilar, UDOT/Long Range Planning(direct message):
No, but we can discuss after.

Naomi Kisen <nkisen@utah.gov>

Rose Park Monitoring Data Atypical Events

15 messages

Naomi Kisen <nkisen@utah.gov> Tue, Jan 30, 2024 at 4:37 PM
To: Becky Close <bclose@utah.gov>

Hi Becky,

I wanted to follow up on my voicemail I left recently. UDOT is developing our approach to the hot-spot model for the I-15 Farmington to SLC project. Currently we are planning to use data from the Rose Park monitoring station as the background data. We are wondering if DAQ has gone through the process of removing atypical events from the data and if so, if you could share this data with us. There are some other aspects of the data request that I think would be easiest to discuss over the phone if possible.

Thanks,

Naomi

--
Naomi Kisen
Environmental Program Manager
Utah Department of Transportation
Office: 801.965.4005 I Cell: 385.226.7614

Becky Close <bclose@utah.gov> Wed, Jan 31, 2024 at 9:26 AM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Christopher Pennell <cpennell@utah.gov>

Hi Naomi-
I think a short meeting with me and our technical analysis manager to start would be best. Do you have availability over the next few days and I can set up a quick meeting?

Thanks,
Becky
[Quoted text hidden]

Naomi Kisen <nkisen@utah.gov> Wed, Jan 31, 2024 at 10:17 AM
To: Becky Close <bclose@utah.gov>
Cc: Christopher Pennell <cpennell@utah.gov>

Thanks Becky and Christopher,

I'm available today between 12-1pm and 4-5pm, tomorrow between 10am-noon, and Friday anytime before 2:30, except between 10-11am.
[Quoted text hidden]

Christopher Pennell <cpennell@utah.gov> Wed, Jan 31, 2024 at 10:59 AM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Becky Close <bclose@utah.gov>

HI Naomi,

I'm available 4 - 5 pm today and all day Friday.

Thanks,
[Quoted text hidden]
--

Chris Pennell
Program Manager, Technical Analysis Section
(385) 332-0949

airquality.utah.gov

Naomi Kisen <nkisen@utah.gov> Thu, Feb 1, 2024 at 12:53 PM
To: Christopher Pennell <cpennell@utah.gov>
Cc: Becky Close <bclose@utah.gov>

Hi Becky and Chris,

As a follow up to our conversation yesterday, UDOT's proposed approach for background values in the hot-spot analyses for the I-15 EIS includes modeling the 24-hour standard for PM 2.5 at the I-15/I-80 and I-15/I-215 interchanges using the three-year average of the 98th percentile values for 2021-2023 from the Rose Park monitor, with atypical events related to wildfires removed, as the background value. UDOT also plans to model the 24-hour PM 10 standard at the I-15/I-80 interchange using data from the Utah Air Monitoring Station as the background value because the Rose Park Monitor does not collect PM 10. This station is located approximately 1.5 miles SSW of the Rose Park monitor.

Values from the Rose Park monitor are proposed to be used as the background for the I-15/I-80 interchange because its close proximity to the interchange effectively captures background values at this location. These values are also proposed to be used at the I-15/I-215 interchange because they can reasonably be expected to exceed any that would occur at this location. For context, while the I-15/I-215 interchange is located in close proximity to two refineries (Big West and Chevron), these refineries together produce about 44 tons of PM 2.5 a year. The Tesoro refinery, located approximately 1 mile east of the Rose Park monitor, produces almost 72 tons of PM 2.5 a year and is also influenced by the airport located approximately 1.5 miles to the west.

UDOT requests that DAQ review this proposal and share any concerns or input it may have. If DAQ finds this approach appropriate, UDOT requests that DAQ provide a response indicating its support for this approach.

Thank you both!

Naomi
[Quoted text hidden]

Naomi Kisen <nkisen@utah.gov> Fri, Feb 2, 2024 at 1:16 PM
To: Christopher Pennell <cpennell@utah.gov>
Cc: Becky Close <bclose@utah.gov>

Hi Becky and Chris,

I wanted to follow-up to see if you have had a chance to look into how long it would take to get a list of the atypical event days and to also ask if you had any questions regarding our proposed approach to establishing background values.

Thanks and hope you enjoy the weekend,

Naomi
[Quoted text hidden]

Christopher Pennell <cpennell@utah.gov> Fri, Feb 2, 2024 at 3:00 PM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>

Hi Naomi,

We used a two-step process to determine if a day's PM2.5 concentrations in the Salt Lake Valley are likely influenced by wildfire: 1) The day's PM2.5 is greater than 1 standard deviation from mean PM2.5, and 2) if NOAA's HMS Fire and Smoke utility identified the day as smoke-impacted. A list of days (2020 - 2022) that meet both criteria is attached.

Thanks,
[Quoted text hidden]

WF_py_hms_combined_smoke_dates_2020_2022.xlsx
13K

Naomi Kisen <nkisen@utah.gov> Mon, Feb 5, 2024 at 1:40 PM
To: Christopher Pennell <cpennell@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>

Thanks for putting this together, this will be very helpful. We are currently using 2021-2023 as background data, but based on the availability of information about wildfire influenced days, do you think it would be best to change the years to 2020-2022?

Also, does DAQ have any questions or concerns regarding the other aspects of our approach to background values, as described in my Feb 1 email? If not, and DAQ is comfortable with this approach, could DAQ provide email concurrence?

Thanks again,

Naomi

[Quoted text hidden]

Christopher Pennell <cpennell@utah.gov> Mon, Feb 5, 2024 at 5:19 PM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>

Hi Naomi,

I suggest using 2020-2022 PM2.5/10 data since 2023 air quality data at Rose Park (PM2.5) or the Utah Technical Support Center (PM10) hasn't been certified yet. This certification could happen later this month or as late as April.

Other than that, I think your approach to background PM2.5/10 values as described in your Feb 1 email sounds reasonable.

Thanks,

[Quoted text hidden]

Naomi Kisen <nkisen@utah.gov> Thu, May 9, 2024 at 1:29 PM
To: Christopher Pennell <cpennell@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>

Hello Chris,

In our hotspot model for the 600 N area, we are running into some challenges with using the Utah Technical Center for PM 10 background values. We are concerned that the monitor is picking up high levels of PM 10 associated with the airport that are not very representative of the background values of our project area. I wanted to get your thoughts on using the Hawthorne monitor as background instead of the Technical Center. Do you think this monitor would appropriately represent the project area? I'm available today or tomorrow if you would like to chat.

Thanks for your help with this,

Naomi

Naomi Kisen
Senior Environmental Program Manager
Utah Department of Transportation
Office: 801.965.4005 I Cell: 385.226.7614

[Quoted text hidden]

Christopher Pennell <cpennell@utah.gov> Thu, May 9, 2024 at 6:20 PM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>, Bart Cubrich <bcubrich@utah.gov>

Hi Naomi,

I think that would be fine. Bart on my team looked at recent data and it seems there is ~10% higher PM10 at the Utah Technical Center (UTC) compared to Hawthorne. The highest values at UTC are possibly related to high-wind dust events, which don't affect Hawthorne as much. I wouldn't think the airport would influence PM10 at the UTC. But, I would expect more PM10 at UTC due to diesel vehicle exhaust since it's pretty close to the I-215.

- Chris

[Quoted text hidden]

Naomi Kisen <nkisen@utah.gov> Fri, May 10, 2024 at 10:42 AM
To: Christopher Pennell <cpennell@utah.gov>

Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>, Bart Cubrich <bcubrich@utah.gov>

Thanks Chris, I appreciate the quick reply. I think your explanation of PM 10 values at the UTC vs. Hawthorne is straightforward and provides the information we need to support using the Hawthorne monitor.

One other item that has come up in discussions with EPA and FHWA is the methodology used to identify the wildfire affected days (one standard deviation from mean PM 2.5 and the NOAA HMS analysis). The federal agencies would like more supporting rationale/documentation to support this being a reasonable approach to identifying atypical events due to wildfires and have proposed that I arrange a meeting with DAQ and multiple staff members from their agencies to discuss this.

Would DAQ be able to provide additional background/documentation on the wildfire identified days, or point UDOT in the right direction to gather this information? I'm hoping we might be able to address the federal agencies concerns without the schedule implications of coordinating a multi-agency meeting.

Thanks again,

Naomi

Naomi Kisen
Senior Environmental Program Manager
Utah Department of Transportation
Office: 801.965.4005 I Cell: 385.226.7614

[Quoted text hidden]

Christopher Pennell <cpennell@utah.gov> Fri, May 10, 2024 at 11:21 AM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>, Bart Cubrich <bcubrich@utah.gov>

I attached a final report provided to DAQ by Dr. Dan Jaffe (Univ. of Washington) that describes identifying "smoke days" in the Salt Lake Valley using this same technique. The discussion starts on page 11.

Mark, do you have anything else you can provide (e.g. manuscripts)?

- Chris
[Quoted text hidden]

DAQ-2024-004526.pdf
2819K

Naomi Kisen <nkisen@utah.gov> Tue, May 21, 2024 at 2:50 PM
To: Christopher Pennell <cpennell@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>, Bart Cubrich <bcubrich@utah.gov>

Hi Chris,

Thanks for sending over the report- I shared this information with FHWA and EPA and they would still like to meet to discuss the approach to identifying atypical days. Could you provide me with some dates/times that work from this week until the end of the month? I can also pull up your calendar if you are OK with that approach.

Thank you,

Naomi

Naomi Kisen
Senior Environmental Program Manager
Utah Department of Transportation
Office: 801.965.4005 I Cell: 385.226.7614

[Quoted text hidden]

Christopher Pennell <cpennell@utah.gov> Tue, May 21, 2024 at 4:00 PM
To: Naomi Kisen <nkisen@utah.gov>
Cc: Becky Close <bclose@utah.gov>, Mark Sghiatti <msghiatti@utah.gov>, Bart Cubrich <bcubrich@utah.gov>

Hi Naomi,

Other than myself, I think it would be good to invite Mark Sghiatti on my team. Our availability is:

Wednesday (5/22): 11 am
Thursday (5/23): 10 - 2:30 pm

Tuesday (5/28): 11 - 2 pm
Wednesday (5/29): 11 - 2:30 pm
Thursday (5/30): 10 - 2:30 pm
Friday (5:31): 10 - 2:30 pm

Thanks,

Chris
[Quoted text hidden]

From: Jason Krebs
To: Croft, Amy
Cc: Dave Prey; Becky Close; Christopher Pennell; Kilpatrick, Kevin; Naomi Kisen
Subject: Re: I-15 Farmington to SLC EIS - Air Quality Analysis - MET data
Date: Thursday, March 7, 2024 12:05:35 PM
Attachments: KSLC - Salt Lake City Airport.zip

You don't often get email from jkrebs@utah.gov. Learn why this is important

CAUTION: [EXTERNAL] This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Amy - I've attached the most recent 5 years that we have processed for KSLC. This is what we've been using in our AERMOD projects for the last couple years, including projects for sources in that general area. Let us know if you need anything else.

Thanks,

Jason

Jason Krebs | Environmental Scientist | Utah Division of Air Quality

Phone: 385.306.6531

195 North 1950 West, Salt Lake City, UT 84116

On Thu, Mar 7, 2024 at 11:26 AM Croft, Amy <Amy.Croft@hdrinc.com> wrote:

> Hello Jason and Dave,
>
> This is Amy Croft again, the consultant working with UDOT on the air quality hot-spot analysis for the I-15 Farmington to Salt Lake City Environmental Impact Statement. I've got another data request I'm hoping you might be able to help me with. We are looking for a preprocessed and vetted 5-year MET dataset that we can use in the AERMOD portion of our analysis. We had previously obtained the most recent 5 years of MET data from the SLC airport and processed it using AERMET, but FHWA recommended we reach out to UDAQ to see if there is a MET dataset you would recommend (that you use for your models). Our analysis area is in North Salt Lake, so data from the airport is ideal.
>
> Thank you,
>
> Amy Croft, PhD

Biologist/Environmental Scientist

HDR

2825 East Cottonwood Parkway, Suite 200
Salt Lake City, UT 84121-7077
D 801.743.7832 **M** 801.440.5872
amy.croft@hdrinc.com

hdrinc.com/follow-us

From: Richard McKeague III
To: Croft, Amy; Kip Billings; Naomi Kisen; Shauna Mecham
Cc: Dresser, Christopher (FHWA); Greg Mortensen; Ryan Bares
Subject: Re: I-15 EIS hot-spot analysis
Date: Tuesday, March 19, 2024 1:11:17 PM
Attachments: 49035 2035 age dist.csv
49011 2050 age dist.csv
49011 2035 age dist.csv
49035 avft.csv
49035 2050 age dist.csv
49011 avft.csv

Amy,

I had a discussion with Chris Dresser this morning regarding providing assistance to your MOVES modeling efforts. Attached below you will find the following files to assist you with your model efforts. These files cover Davis and Salt Lake County for 2035 and 2050 as requested.

AVFT files for 2035 and 2050:
Davis County: 49011 avft.csv
Salt Lake County: 49035 avft.csv

Snippet for your TSD:
AVFT files are based on Utah DMV data for sourcetype 21, 31, and 32 utilizing the following avft tool settings: zero gap filling and Proportional growth rate. Sourcetypes 41, 42, 42, 43, 51, 52, 53, 54, 61, 62 are using MOVES4 Default AVFT values. The model years covered are 1992-2060.

Age Distribution files for 2035 and 2050:
Davis County 2035 age: 49011 2035 age dist.csv
Davis County 2050 age: 49011 2050 age dist.csv
Salt Lake County 2035 age: 49035 2035 age dist.csv
Salt Lake County 2050 age: 49035 2050 age dist.csv

Snippet for your TSD:
Age Distribution files are based on Utah DMV data for sourcetypes 21, 31, 32, 41, 42, 42, 43, 51, 52, 54, and 61 and have been processed by EPA's age distribution tool. Sourcetypes 53 and 62 are using MOVES4 Default.

Please let me know if you have any questions.

Thanks
Rick

From:	Kip Billings
To:	Croft, Amy
Subject:	Re: I-15 EIS Air Quality Analysis
Date:	Thursday, July 6, 2023 12:14:26 PM
Attachments:	Amy Croft conf23_sl_da_2050_in.zip

Amy,

Thanks for getting back to me. Your email caught me at a bad time and I dropped the ball on this. The attached ZIP file has the MOVES3 inputs for SL & DA, winter and summer, for 2050.

Buckle Up!

Kip Billings, PE Transportation Engineer O 801-363-4250 C 801-309-9860
WFRC Logo
wfrc.org

On Thu, Jul 6, 2023 at 12:04 PM Croft, Amy <Amy.Croft@hdrinc.com> wrote:

> Hi Kip,
>
> I am following up on the email below to see if you could share the MOVES data inputs consistent with what was used for the conformity analysis for Salt Lake County and Davis County for the year 2050?
>
> In particular, I am looking for the Source Type Population, Age Distribution, and IM program files but I can pick those out of the larger input file if you want to send it all as one file.

Thank you!

Amy Croft, PhD

D 801.743.7832 **M** 801.440.5872

hdrinc.com/follow-us

From: Croft, Amy
Sent: Tuesday, June 27, 2023 6:39 PM
To: Kip Billings <kip@wfrc.org>
Cc: Kilpatrick, Kevin <kevin.kilpatrick@hdrinc.com>
Subject: RE: I-15 EIS Air Quality Analysis

Hello Kip,

This is Amy Croft with HDR. I am working on the MSAT analysis for the I-15 EIS. I had previously asked you for MOVES data inputs consistent with what was used for the conformity analysis for Salt Lake County and Davis County for the years 2019, 2030, and 2040. Now I'm wondering if you could send me the MOVES inputs for 2050?

Thank you,

Amy Croft, PhD

D 801.743.7832 **M** 801.440.5872

hdrinc.com/follow-us

From: Kip Billings <kip@wfrc.org>
Sent: Thursday, March 23, 2023 3:14 PM
To: Croft, Amy <Amy.Croft@hdrinc.com>
Subject: Re: I-15 EIS Air Quality Analysis

Amy,

Attached are ZIP files of the MOVES input databases used for conformity analysis in Davis and Salt Lake Counties, winter and summer, for the years 2019, 2032, and 2042. I fought to have analysis years 2030 and 2040 and you can see how that battle turned out. The meteorology data may only be February and July. If you need the other months you will need to get them from DAQ - ask for Rick McKeague.

Buckle Up!

Kip Billings, PE **Transportation Engineer** O 801-363-4250 C 801-309-9860

wfrc.org

On Thu, Mar 23, 2023 at 2:02 PM Croft, Amy <Amy.Croft@hdrinc.com> wrote:

> Hello Kip,
>
> This is Amy Croft with HDR. I will be working on an MSAT analysis for the I-15 EIS and I'm wondering if you can help me with some MOVES data inputs consistent with what was used for the latest SIP or regional conformity analysis for Salt Lake County and Davis County. I am specifically looking for the following data for the years 2019, 2030, and 2040:
>
> - Meteorology data (temperature and humidity inputs for every month and hour
> - Source type population (number of local vehicles operating in the area)
> - Age distribution (age fractions of fleet by age and source type)
> - Fuel (FuelSupply, FuelFormulation, FuelUsage, and AVFT)
> - I/M Programs
>
> Please let me know if you have any questions or concerns.

Thank you,

Amy Croft, PhD

Environmental Scientist/Biologist

HDR

2825 East Cottonwood Parkway, Suite 200
Salt Lake City, Utah 84121
D 801.743.7832 **M** 801.440.5872
amy.croft@hdrinc.com

hdrinc.com/follow-us

TO: Bryce C. Bird
Director
Utah Division of Air Quality

FROM: Gregory Lohrke, EPA Region 8, Air and Radiation Division

SUBJ: EPA R8 Comments on Background Concentration and Atypical Events Justification

RE: Memo DAQP-046-24, "Methods, Determination, and Support of Atypical Events Selection within UDOT's Hot Spot Analysis for the 2020-2023 Period"

EPA Region 8 appreciates the opportunity to review the June 10, 2024, Utah Division of Air Quality (UDAQ) memo filed under document ID: DAQP-046-24. While we agree in general that the dates identified within that memo are likely days when local air quality monitoring data was substantively impacted by wildfire smoke, we request UDAQ revise the memo in consideration of the comments found in this document. Revisions made considering the comments contained herein will ultimately strengthen evidence for justified removal of monitoring data for establishing a representative background concentration for hot-spot conformity determination purposes according to available EPA guidelines and working procedures. The requested revisions will also enhance clarity of this data exception for purposes of public and cooperating agency review within the NEPA and transportation conformity processes. We expect that hot-spot modeling should be able to proceed while the requested revisions are made, barring any late discovery that the dates initially identified in the memo cannot be associated with atypical, extreme, or unusual PM producing events.

General Comments

References to the multi-year period of air monitoring observations used to establish the hot-spot model background concentration should be corrected. Relatedly, reference to the project level conformity analysis as the "2020-2023 hot spot analysis" should also be corrected. First, the memo should be revised to correctly identify calendar years 2020, 2021 and 2022 as the years from which a background concentration will be established. Second, the memo should avoid conflating the years from which the background concentration will be derived with the years for which UDOT will be performing a project level conformity analysis. EPA recommends referring to the 3-year background concentration data period as the "2020-2022" period and removing such time-period descriptors from discussion of or reference to the larger hot-spot modeling exercise.

Presentation of Data and Methodology

The memo references the hourly frequency of PM2.5 monitor observations on page 1, section 2. EPA requests that for each one-day or contiguous multi-day period of suspected wildfire smoke impacts on ambient air PM2.5 concentration, UDAQ provide a figure showing the hour-by-hour increase in observed PM2.5 concentration at the start of such a period. Graphical depiction of a high rate of change in PM2.5 concentration at the monitor and association of such rapid change with other evidence of wildfire smoke presence (i.e., satellite remote sensing observations, etc.) would strengthen the evidence for an atypical event claim. EPA recommends such figures be contained in a technical appendix to the memo. If hourly observation data is not available, EPA requests a figure depicting day-over-day sudden increases of PM concentration. Such a figure could show single-day increases, or monthly or multi-month spans showing "atypical" days and their departure from the mean. Visual representation of suspected atypical days with respect to thresholds mentioned in the memo (i.e., mean + std. dev., Tier 1, Tier 2) would ease public review and strengthen the justification memo. This comment is discussed further, below and in the enclosure associated with this comment document.

The memo references "geospatial analysis […] conducted using Python" on page 2, paragraph 2. EPA requests that the memo make available and document the Python code employed for this geospatial analysis. EPA suggests documentation and code be made available in an online repository and cited in the memo or be provided directly in a technical appendix. Including referenced code would enhance transparency and assist in review and replication of the air monitor data screening process.

The memo references on page 2, paragraph 2, a "flagging criterion […] based on previous research" for identifying "abnormal PM2.5 concentrations compared to baseline variability." EPA requests clarification of this criterion. The cited research papers supporting this criterion differ slightly in their flagging methodology, both from one another and from what is described in the memo. One paper states that the threshold criterion is set at the sum of the "mean plus one standard deviation of PM2.5 for no identified overhead smoke [for the fire season] each year".[1] The other paper sets the threshold at the "mean plus one standard deviation value for the monitors [*sic*] mean value in June-September" and seems to calculate the mean from a multi-year (2007-2014) period.[2] These methods differ in whether they incorporate "smoke days" into the summertime mean and the timespan over which they establish a mean. The memo should state whether the "$PM2.5_{month}$" value and standard deviation are calculated from the no-smoke days of a given month during a single year or over multiple years. The memo should also state why the screening threshold is calculated from the mean and standard deviation for each month, rather than for the fire-season as is done in the supporting research. Additionally, the memo should clarify the relationship of these practical thresholds to the "tier" thresholds tied to regulatory exceptional events guidance.

Strengthening Evidence for Atypical, Wildfire-related Events

EPA has distributed non-binding guidance describing the general purpose and character of data modification for modeling analyses in cases where the Exceptional Events Rule is non-applicable.[3] Project-level transportation conformity analyses are one of the cases in which monitoring data may be modified to develop a representative PM background concentration. According to the "Additional Methods" memo, monitoring data for certain modeling analyses may be modified if the data has been "influenced by atypical, extreme, or unrepresentative *events* [emphasis added]" (p. 2). While EPA agrees that the Division's screening tool for smoke-influenced days has identified days with likely smoke impacts on near-ground air quality, we request UDAQ more conclusively tie such smoke impacts to "atypical,

---

[1] Lee, Haebum, and Daniel A. Jaffe. "Impact of wildfire smoke on ozone concentrations using a Generalized Additive Model in Salt Lake City, Utah, USA, 2006–2022." *Journal of the Air & Waste Management Association* 74.2 (2024): 119.
[2] Brey, Steven J., et al. "Connecting smoke plumes to sources using Hazard Mapping System (HMS) smoke and fire location data over North America." *Atmospheric Chemistry and Physics* 18.3 (2018): Figure 1.
[3] U.S. EPA. "Additional Methods Determinations, and Analyses to Modify Air Quality Data Beyond Exceptional Events." EPA-457/B-19-002 (2019).

extreme, or unrepresentative" wildfire *events* and their related smoke emissions. EPA requests the following evidence relating smoke-influenced monitoring periods to atypical wildfire events:

- For each single-day, multi-day, or month-long period of heavy smoke influence, EPA requests that an atypical events justification report provide narrative context of the atypical, extreme, or unrepresentative events which have led to atypical monitor observations. Context may include a short description of widespread or unusually severe wildfire events which have been properly documented by government or non-governmental organizations which track such events.
- For each single-day, multi-day, or month-long period of heavy smoke influence, EPA requests the report provide general location and names (if available) of wildfire events suspected of emitting the smoke that was transported to the general monitor location on the day of suspected heavy smoke influence. Location and name of fires may be represented in maps showing fire perimeters or remote sensor detections of fires on the dates preceding high PM monitor observations. See appendix for example.
- For each single-day, multi-day, or month-long period of heavy smoke influence, EPA requests the report provide evidence of smoke transport from the known atypical wildfire event to the general location of the monitor in the days and hours preceding the high PM monitor observations. Evidence of smoke transport may include on or several of the following: multi-day/hour timelapse depiction of atmospheric smoke observations from remote sensing satellites showing smoke plume migration to the monitor area; multi-day/hour timelapse depiction of landsat imagery showing smoke plume migration; Back and forward particle trajectory modeling showing transport path connection between the monitor area and the known, documented atypical event. See appendix for example.

Again, EPA appreciates the opportunity to review UDAQ's data exclusion justification memo. We appreciate the efforts the Division has made to advance the progress of the related hot-spot modeling exercise and the Division's continued involvement with the conformity consultation process. If you or your staff have any questions or requests for technical assistance related to the comments contained in this document or the contents of the enclosed appendix, please do not hesitate to contact me: telephone- (303) 312-6396; email- lohrke.gregory@epa.gov.

Sincerely,

Gregory Lohrke
EPA Region 8, ARD

[Enclosure]

Enclosure

Appendix to item, "EPA R8 Comments on Background Concentration and Atypical Events Justification"

Example Additional Weight of Evidence Showing for Exclusion of Atypical Events

This appendix presents simplified examples of how the responsible party to a project-level conformity demonstration may show connection between atypical wildfire events and suspected atypical, heavily smoke-influenced PM2.5 air quality monitor observations. This appendix is meant to accompany broader comments on the June 10, 2024, proposed atypical events report titled, "Methods, Determination, and Support of Atypical Events Selection within UDOT's Hot Spot Analysis for the 2020-2023 Period". The following showing of evidence is meant to support an example case of a multi-day period affected by atypical wildfires by showing both evidence of atypical local monitor observations and the observations' connection to atypical events.

Case: August 6-8, 2021; Salt Lake City

Showing Departure from Typical Monitor Observations

Figure 1 displays historical daily PM2.5 observations from the Rose Park monitoring station for August for years 2019-2023. Highlighted August 2021 observations (red) show a marked departure from the 5-year month's daily averages (black; note- average in this figure excludes 2021 observations). Specific to this example, monitor observations for the August 6-8 period are near five times the typical value for the period. This departure from the average indicates possible air quality influences from an atypical event.

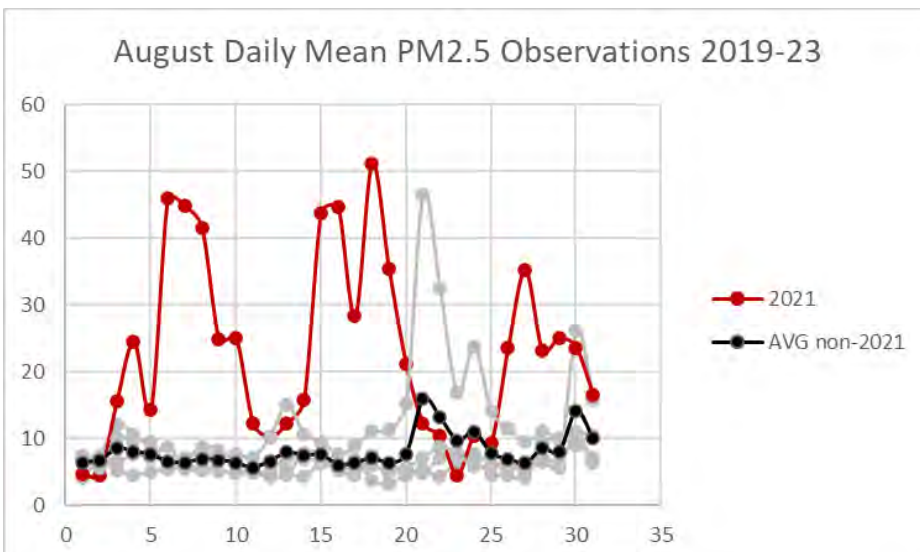


Figure 1 – Multi-year, August PM2.5 daily average observations from the Rose Park monitoring station (AQS station ID 490353010). Data sourced from https://www.epa.gov/outdoor-air-quality-data.

Alternatively, the EPA exceptional events tiering tool could be used to show observations well above typical values. Figure 2 displays AQS data for Rose Park within the Exceptional Events tiering tool (red stars identify observations during the August 6-8 period as eligible for either Tier 1 or Tier 2 EE demonstration requirements).

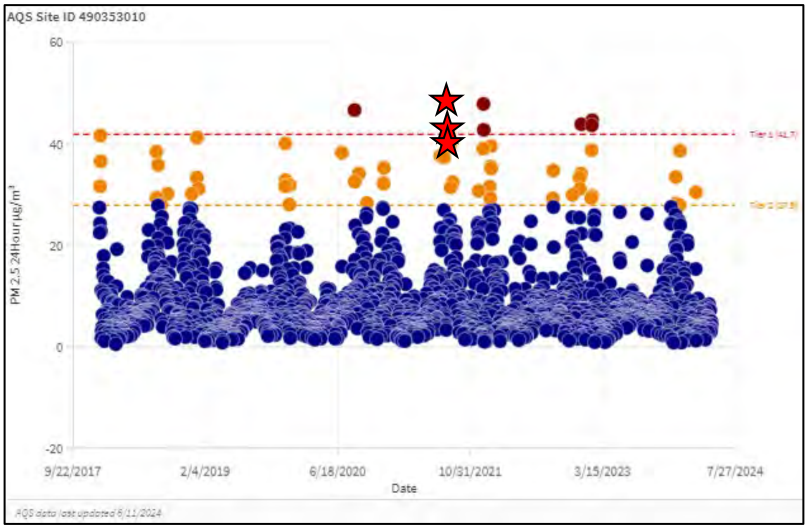


Figure 2 – EE tiering tool presentation of 5-year PM2.5 observations with Tier 1 and Tier 2 thresholds displayed for reference. Data and figure sourced from https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis.

Develop Context of Atypical Monitoring Observations

Association of suspected atypical monitor observations should be easily associated with atypical or extreme PM producing events, such as large wildfires. Figure 3 (left) illustrates fire perimeters for 500+ acre fires which began during summer 2021 which had not been contained, controlled, and extinguished by August 6, 2021. The perimeter area threshold could be set higher to show objectively atypical “megafires” (~100,000 acres burn extent). Such fires would be an expected possible origin of sudden, elevated ambient air PM concentrations. Perimeters shown in Figure 3, left, include the Dixie, Monument and Bootleg megafires, which were at various stages of development during early August 2021. Narrative documentation of the severity and atypical nature of these fires is readily available from fire management, weather, and other governmental and quasi-governmental agencies. Fire perimeter datasets were retrieved from the National Interagency Fire Center (NIFC) historic fires data repository (accessed from data-nifc.opendata.arcgis.com). Figure 3 (right) includes active fire detections, represented by point features, during the days preceding the Aug 6-8 high PM event. Fire detections were extracted from the Hazard Management System (HMS) Fire product dataset for the early August time window and filtered for coincidence with a large, known wildfire (via co-location with the known fires perimeter polygons). The Rose Park monitor location is represented by a blue point feature in Figure 3.

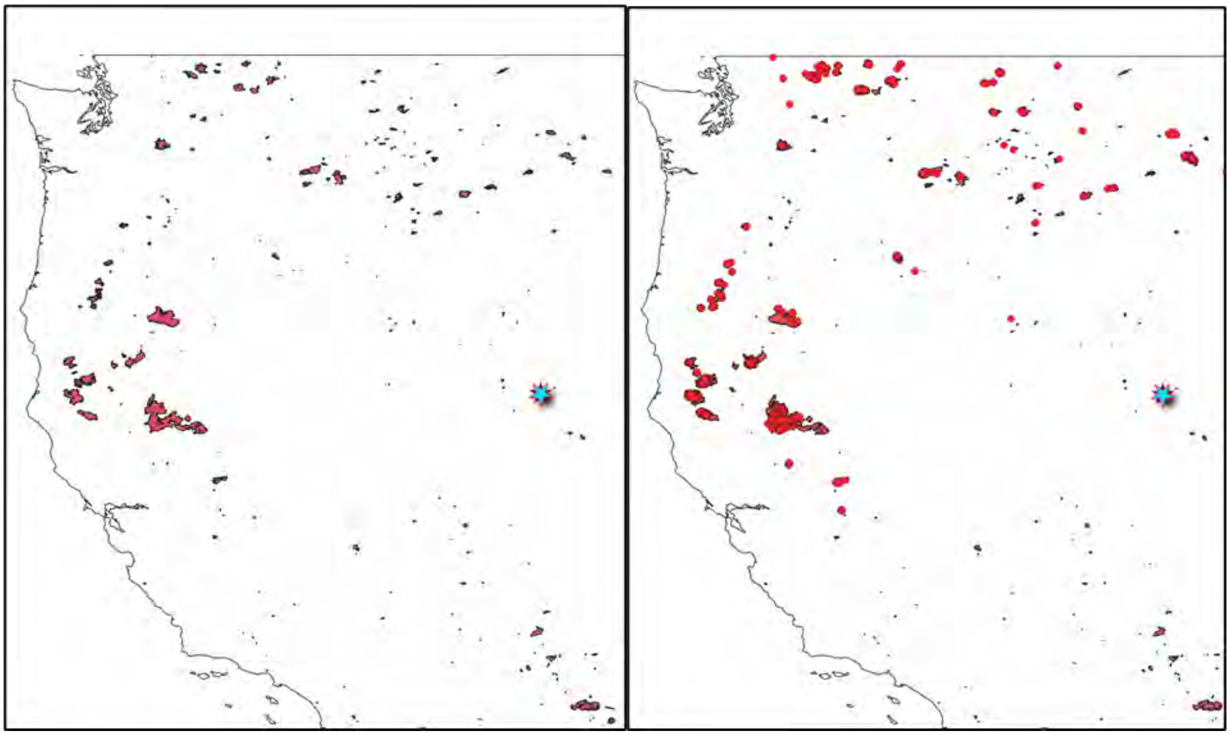


Figure 3 – (left): NIFC wildland fire perimeters for summer 2021 fires from the WFIGS Interagency Fire Perimeters dataset; (right): Active fire detections for early August, 2021, from the HMS Fire product overlayed on WFIGS fire perimeter polygons.

Fire detections indicate that the Dixie, Monument and Bootleg fires, among several others in the Pacific Northwest, were active during the days preceding the August 6-8 high PM event (i.e., over the August 3-5 period). A lack of fires in the near vicinity of the monitor indicates that if the high PM period was influenced by atypical levels of wildfire smoke, it must be a consequence of long-range transport. Such long-range transport should be demonstrable using one or several other mapping tools.

Demonstrate Smoke Transport to Monitor

Demonstrating long-range transport of smoke may be done using time-lapsed atmospheric smoke detection maps or via modeled particle forward and back trajectories, and correlation of such transport with the available surface observations. Figure 4 shows regional smoke transport progression over a 3-day period- August 4 (far left) to August 6 (right)- using daily HMS Smoke datasets for the period. Smoke density is differentiated by color gradation- from light yellow (light smoke) to red (heavy smoke).

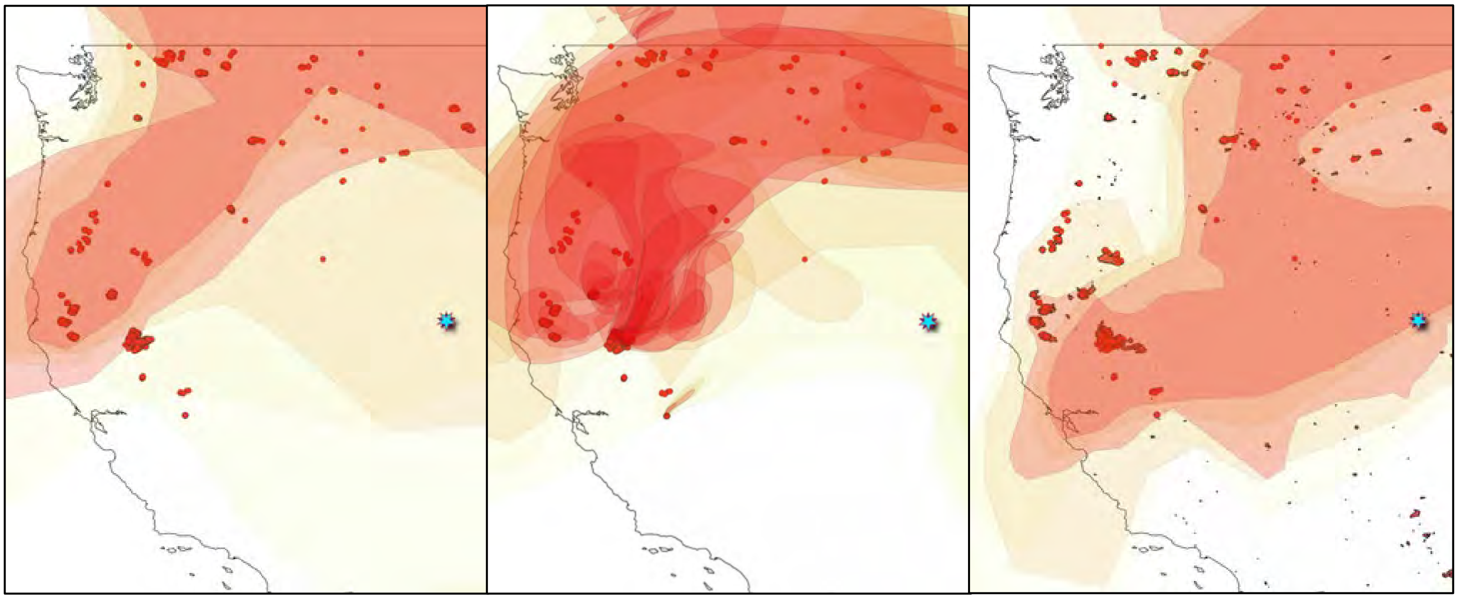
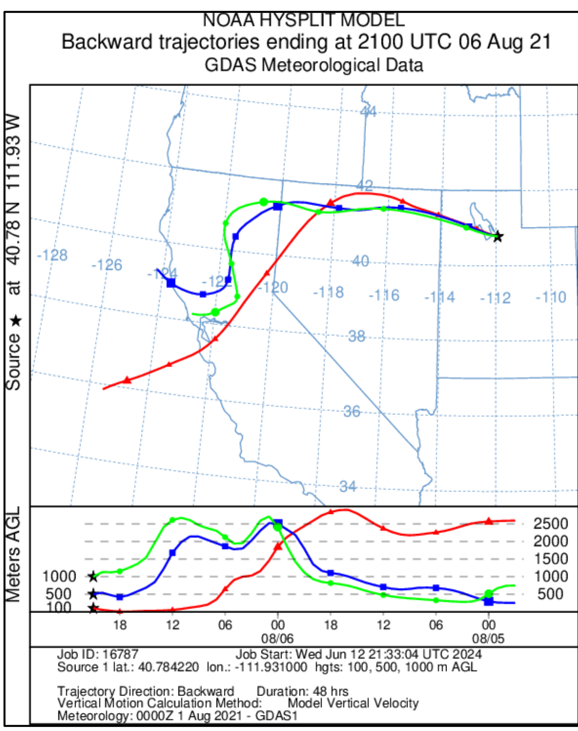
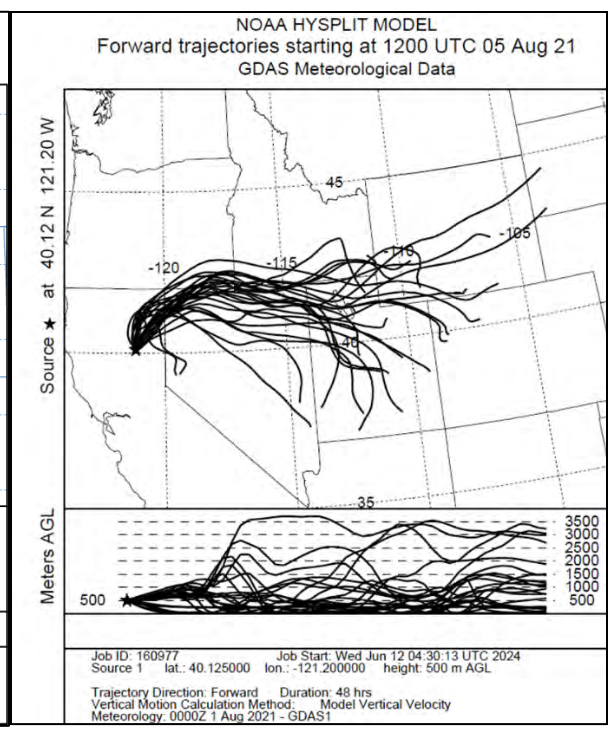


Figure 4 – Atmospheric smoke detection from the HMS Smoke product for days between August 4, 2021 (left), and August 6, 2021 (right). 24- and 48-hour smoke transport progression toward the Rose Park monitor vicinity is apparent when arranging HMS Smoke maps in a linear time-lapse. Datasets accessed from https://www.ospo.noaa.gov/Products/land/hms.html.

HMS Smoke observations from August 5 (Figure 4, center) imply a heavy production of smoke from the Dixie fire in northern California on that date. HYSPLIT 48-hr back trajectories from the Rose Park station indicate likely transport of particles from northern California wildfires to near-surface ambient air in Salt Lake City, arriving in the afternoon of August 6, 2021 (see Figure 5). HYSPLIT forward ensemble trajectories originating from the Dixie fire on August 5 also suggest long-range transport of wildfire smoke to the SLC area by August 6 (Figure 6).





Figures 5 – 6 – Figure 5 (left) displays 48-hr particle back trajectories arriving at 100, 500 and 1000 m heights above the Rose Park monitor by the evening of August 6, 2021. Figure 6 (right) displays 48-hr forward ensemble trajectories from 500 m above the centroid of the Dixie fire, arriving in the Salt Lake City area on or before August 6, 2021. Model parameters displayed in figures.

Heat mapping of time series points generated by the HYSPLIT forward trajectory originating at the Dixie fire further indicates a strong likelihood that that fire is an origin of smoke transported to the SLC area (Figure 7).

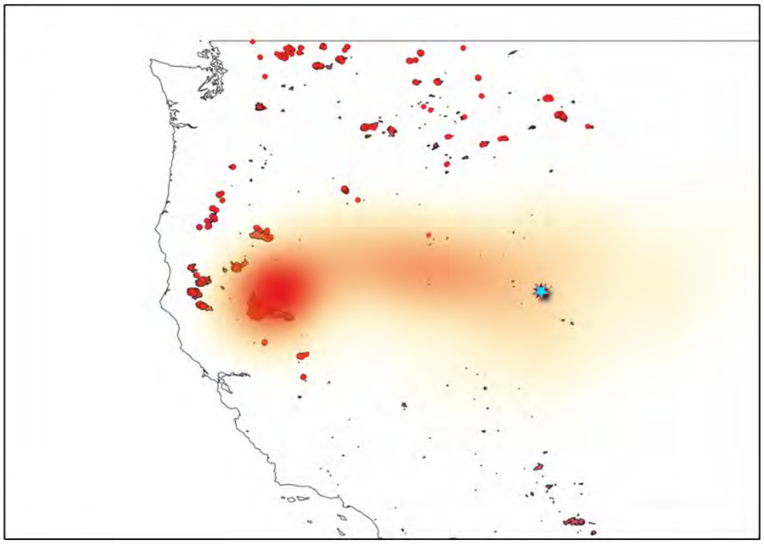


Figure 7 – HYSPLIT 48-hr forward trajectory of Figure 6 exported as time series datapoints and mapped to show density of points within the ensemble to demonstrate the most likely paths of particle transport.