

# Oakridge 2020 PM<sub>10</sub> Exceptional Event EPA Concurrence Request

Submitted to: EPA, Region 10

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## Executive Summary

To address high monitor values resulting from exceptional events not reasonably controllable or preventable, the U.S. Environmental Protection Agency promulgated the Exceptional Events Rule pursuant to Section 319 of the Clean Air Act. Major changes to the 2007 EER contained in the Code of Federal Regulations, Title 40, Parts 50 and 51 (40 CFR 50 and 51) were promulgated on October 3, 2016 (72 FR 13560) to clarify the scope of the rules, analyses, content, and organization for exceptional events demonstrations, and fire related definitions and demonstration components. The EER allows states to flag air quality data as exceptional and exclude those data from use in determining compliance with the National Ambient Air Quality Standards if EPA concurs with the state's demonstration that it satisfies the rule requirements.

Following the EER procedures, Oregon Department of Environmental Quality and Lane Regional Air Protection Agency flagged values at the Oakridge monitor and are requesting concurrence that certain flagged values (**Table 2** and **Table 4**) are exceptional events. The PM10 flagged values equal to or greater than 150 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) affect Oregon's compliance with the 24-hour limited maintenance plan criteria and NAAQS. ODEQ and LRAPA demonstrates in this report and requests EPA concurrence that these exceptional concentration values occurred as a result of wildfires, they were not reasonably controllable or preventable by the State of Oregon, not likely to reoccur, and they fully meet the EER criteria for excluding monitor values from the data used to determine compliance with NAAQS. At this point, we are only requesting concurrence for days that are of regulatory significance, and are providing additional information for days that may become regulatorily significant in the future.

**Table 1** shows the key fires or fire complexes that are the likely major contributors to the event days in Oakridge associated with our request of EPA to concur with our findings. The 2020 wildfire season in Oregon was extensive and it is likely that many fires had an impact on the PM10 levels seen in Oakridge.

<b>Table 1. Monitor values at Oakridge for which ODEQ is requesting EPA concurrence</b>		
<b>Date</b>	<b>24-hour average PM10 (<math>\mu\text{g}/\text{m}^3</math>) EPA # 41-039-2013, POC 1</b>	<b>Most likely source</b>
9/12/2020	591	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/13/2020	423	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/15/2020	314	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/14/2020	305	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/11/2020	274	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/16/2020	237	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/10/2020	200	Multiple Fires, Including Holiday Farm, and Thielsen Fires
9/17/2020	172	Multiple Fires, Including Holiday Farm, and Thielsen Fires

In addition, **Table 2** shows that the requested values are the highest values recorded at the Oakridge monitor for summer days (June 1 to September 30) from 2011-2020.

<b>Table 2. Rank Percent of requested values, 2011-2020; June 1-Sept 30; Oakridge monitor</b>						
<b>Monitor</b>	<b>Date</b>	<b>YR</b>	<b>PM10</b>	<b>Flagged</b>	<b>Rank (N=1794)</b>	<b>PCTL</b>
OAK	9/12/2020	2020	591	RT	1794	100.00%
OAK	9/13/2020	2020	423	RT	1793	99.97%
OAK	9/15/2020	2020	314	RT	1792	99.94%
OAK	9/14/2020	2020	305	RT	1791	99.91%
OAK	9/11/2020	2020	274	RT	1790	99.88%

OAK	9/16/2020	2020	237	RT	1789	99.86%
OAK	9/4/2017	2017	210	IT	1788	99.83%
OAK	9/10/2020	2020	200	IT	1787	99.80%
OAK	9/5/2017	2017	173	IT	1786	99.77%
OAK	9/3/2017	2017	172	IT	1785	99.74%
OAK	9/17/2020	2020	172	IT	1784	99.72%
OAK	9/2/2017	2017	156	IT	1783	99.69%
OAK	8/28/2017	2017	126		1782	99.66%
OAK	8/29/2017	2014	102		1781	99.63%
OAK	9/7/2020	2020	98		1780	99.60%
OAK	9/1/2017	2017	96		1779	99.58%
OAK	9/6/2017	2017	84		1778	99.55%
OAK	8/27/2017	2017	83		1777	99.52%
OAK	8/21/2018	2018	76		1776	99.49%
OAK	9/7/2017	2017	61		1775	99.47%

An evaluation of the 24-hour PM10 NAAQS design value for 2020 at the Oakridge monitor, with and without the requested exceptional event days (see **Table 3**), shows that six days, 9/11/2020 through 9/16/2020, require removal from the dataset to lower the design value to be equal to or below the NAAQS for PM10 of no more than one exceedance per year over a 3-year average (see **Table 4**).

During the summer of 2017 Oakridge was impacted by wildfire smoke that caused an exceedance of the PM10 NAAQS. ODEQ and LRAPA did not submit the 2017 PM10 EE request in time for the 2017 values to have regulatory significance. Thus, the 2017 wildfire influenced data remains in AQS causing the PM10 exceedances in 2018 and 2019. If the 2020 PM10 EE request is approved, Oakridge will again be in attainment of the PM10 standard.

Year	2018*	2019*	2020
3-year average, all wildfire data included	1.4	1.4	2.7
3-year average, RS wildfire data removed	1.4	1.4	0.7

\*exceedance caused by 2017 wildfire smoke. 2017 EE request not submitted in time for RS.

Monitor Reading Rank (highest to lowest)	24-hour average PM10 ( $\mu\text{g}/\text{m}^3$ )	Date	Data flagged?	Resulting 3-year average exceedances if value removed from dataset	% of standard
351	591	9/12/2020	Y	2.4	240%
350	423	9/13/2020	Y	2.1	210%
349	314	9/15/2020	Y	1.7	170%
348	305	9/14/2020	Y	1.4	140%
347	274	9/11/2020	Y	1.1	110%
346	237	9/16/2020	Y	0.7*	70%
345	200	9/10/2020	Y	0.4	40%
344	172	9/17/2020	Y	0.0 <sup>†</sup>	0%

\* Design value if 6 values removed

<sup>†</sup> Design value if all wildfire influenced values removed

## Required Elements of the Exceptional Event Rule

The EER requires that demonstrations justifying data exclusion as exceptional event must include the following:

- (a) A narrative conceptual model that describes the event(s) causing the exceedance of violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
- (b) A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
- (c) Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the clear causal relationship requirement;
- (d) A demonstration that the event was both not reasonably controllable and not reasonably preventable;
- (e) A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event; and
- (f) Documentation that the State followed the public comment process and conducted at least a 30-day comment period.

In addition, a state must submit the public comments with the demonstration and address in the demonstration those comments disputing or contradicting factual evidence provided in the demonstration (40 CFR 50.14).

We organized the demonstrations by sections that address each element of the EER (*Table 5*).

<b>Table 5. Summary of elements included in this demonstration</b>		
<b>EER Element</b>	<b>Section</b>	<b>Summary</b>
Conceptual Model	1	The conceptual model describes the affected area, meteorological conditions of the region, and the source causing the violation. It includes a discussion of how emissions from the wildfire event led to the violation at the Oakridge monitor.
Clear Causal Relationship	2	Data are presented to demonstrate that the event affected air quality and that there is a clear causal relationship between the event and the exceedances: <ol style="list-style-type: none"> <li>(1) Meteorological evidence: transport of emissions to monitor</li> <li>(2) Satellite and back trajectory evidence: spatial relationship between source and monitor</li> <li>(3) Time series evidence: temporal description of event days</li> <li>(4) Alternative sources</li> </ol>
Historical Concentrations	3	Analyses are provided comparing the event-influenced concentrations at Oakridge to historical concentrations.
Not Reasonably Controllable or Preventable	4	A wildfire event meets the EER for this element (40 CFR 50.14(b)(4))



Human Activity Unlikely to Recur at a Particular Location or a Natural Event	5	The criterion meets the EER definition that wildfires predominantly occurring on wildland are natural events.
Mitigation	6	Evidence presented of prompt public notification of the event, public education so that individuals could make behavioral changes to reduce exposure to unhealthy air, and implementation of appropriate measures to protect public health from the impacts of exceptional events.
Initial Notification	7	Demonstration of initial notification to EPA.
Public Comments	8	Documentation of the public comment process, public comments received and response to comments.

## Introduction

The Oregon Department of Environmental Quality and Lane Regional Air Protection Agency request an exclusion of the wildfire measured exceedances of the 24-hour PM10 National Ambient Air Quality Standards at Oakridge, Oregon for six days, 9/11/2020 through 9/16/2020. This demonstration provides evidence and narrative satisfying all the requirements set forth in the Exceptional Events Rule. The exceedances were the direct result of wildfire events that affected air quality at the Oakridge monitor.

The conceptual model describes the event and how the emissions from the events led to the exceedances at the monitor at AQS site# 410392013 on each day. It demonstrates that a clear causal relationship exists between the event and the monitored exceedance. We compared the historical concentrations at the Oakridge monitor to the exceedance concentrations to support the clear causal relationship requirement. The wildfire event was both not reasonably controllable and not reasonably preventable, and it was a natural event. ODEQ and LRAPA provided prompt public notification of the event, provided for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during the event, and provided for the implementation of appropriate measures to protect public health from the exceedances caused by the event. Public comments on the demonstration and ODEQ and LRAPA responses will be included in *Section 8*.

## 1 Conceptual Model

In September 2020, smoke from regional wildfires was transported to the Oakridge monitor. The Oakridge monitor recorded exceedances of the 24-hour PM10 NAAQS on 9/10/2020 through 9/17/2020, for a total of 8 exceedances as a result of wildfire smoke. The conceptual model describes the source of the particulate matter that impacted the monitor, the transport weather conditions that brought aerosols to the monitor, the estimated emissions of the wildfire sources, and the timing and magnitude of the events impacts on the monitor.

### 1.1 Overview

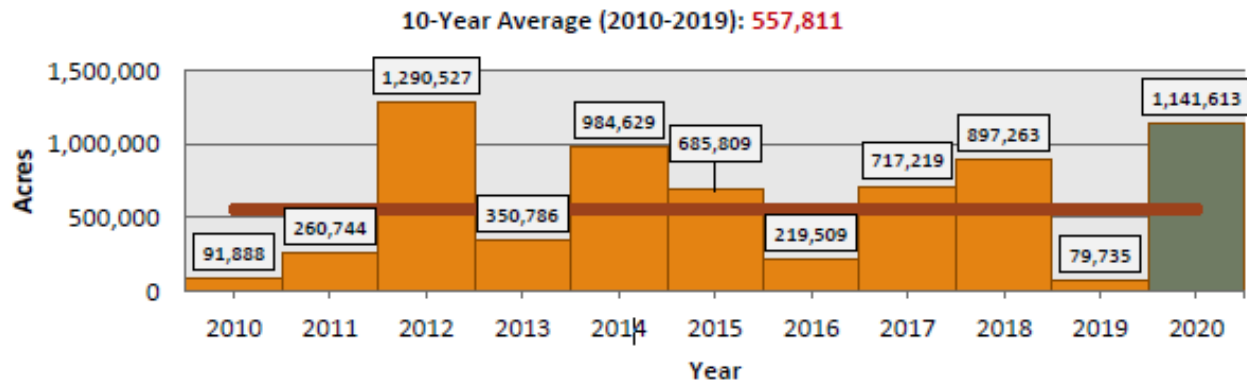
Wildfires occur every year in the western United States during summer and fall. The 2020 wildfire season was, like most years, hot, dry, and smoky. Over 1.98 million acres burned in Oregon, Washington, and Idaho during the 2020 wildfire season. Oregon alone saw over 1.14 million acres burn.<sup>1</sup> From September

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<sup>1</sup> Northwest Interagency Coordination Center. April 9, 2020. Northwest Annual Fire Report 2020. Portland, OR. [https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020\\_NWCC\\_Annual\\_Fire\\_Report.pdf](https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020_NWCC_Annual_Fire_Report.pdf) (Accessed April 2020).

7<sup>th</sup> through the 18<sup>th</sup>, smoke from many of these fires was trapped in a multiday stagnation event. Smoke accumulated during that 12-day period and negatively affected the air quality throughout the northwestern United States. In addition, the larger wildfires that burned in 2020 were closer to human habitation than in previous years.

**Figure 1. Wildfire acres burned in Oregon, 2010-2020.**



## 1.2 Transport Weather Conditions

According to the 2020 Northwest Annual Fire Report,<sup>2</sup> Despite cool and wet periods early in fire season 2020, persistent warmth and very low rainfall in the second half of the summer boosted fire danger sufficiently to make many areas more susceptible to fires by late August and early September. While lightning was much less than average during fire season 2020, a few lightning-caused large fires helped set the stage for the fire outbreak that accompanied a historic windstorm in early September.

### Weather Trends

The very dry trend observed in July and August 2020 across the region continued for the first half of September. Daily values of minimum relative humidity and corresponding overnight recoveries maintained a worsening trend from late August through mid-September, falling steadily below average.

### Historic Windstorm on September 7th and 8th

On September 7th and 8th, a strong dry cold front moving south from Canada pushed across the NW geographic area bringing record breaking strong winds and low relative humidity to much of the region. As winds calmed behind the front, smoke from multiple large fires settled into western Oregon and Washington creating unhealthy air quality and poor visibility that spread over the next ten days and covered regions on both sides of the Cascades.

Strong winds diminished in the aftermath of the cold front, but the dry air and heavy smoke lingered until several Pacific frontal systems brought rain on September 18th, and again on the 24th. It was concentrated mainly in western Washington and most of northwest Oregon, where rainfall totals went well above normal for the month. However, eastern Washington, eastern Oregon, and southwest Oregon did not accumulate as much precipitation and rainfall totals remained below average for the month.

Air quality improved considerably with the arrival of the Pacific frontal systems. Despite the arrival of cold fronts, temperatures were above normal for September over the entire Northwest Geographic Area.

<sup>2</sup> Northwest Interagency Coordination Center. April 9, 2020. Northwest Annual Fire Report 2020. Portland, OR. [https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020\\_NWCC\\_Annual\\_Fire\\_Report.pdf](https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020_NWCC_Annual_Fire_Report.pdf) (Accessed April 2020).

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## September Fire Activity

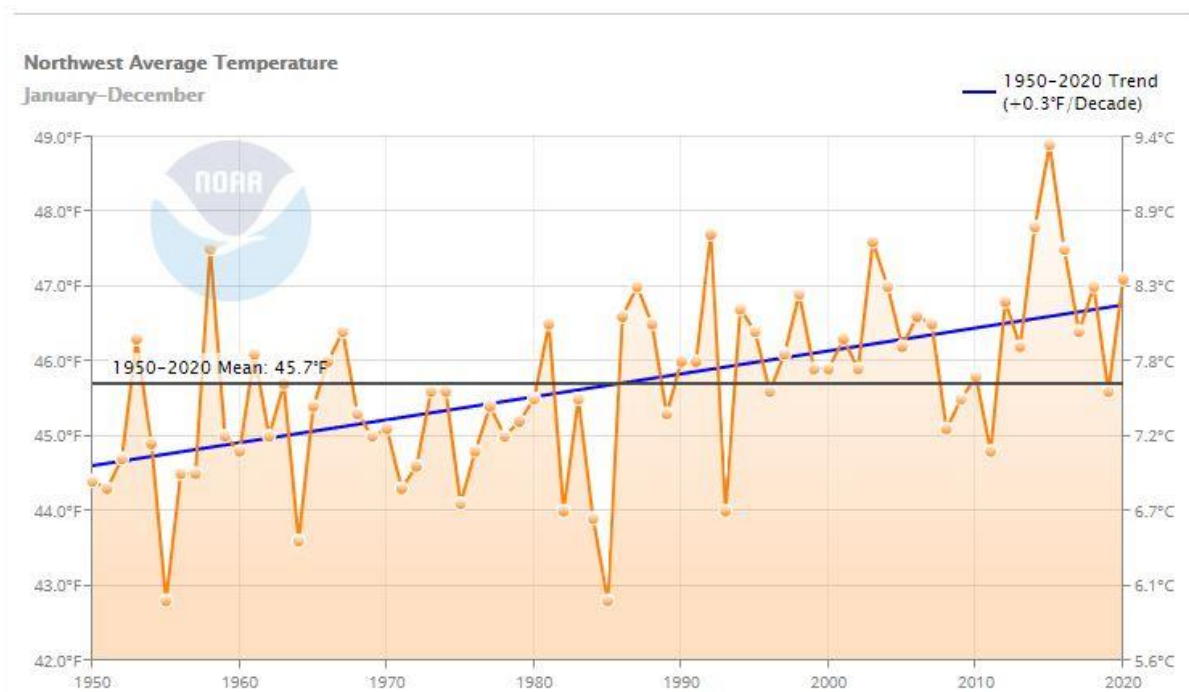
The Northwest Geographic Area was already busy at Preparedness Level 4 in early September 2020 with a dozen large incidents receiving support in both Oregon and Washington. On September 7th and 8th, a dry cold front swept in from Canada with strong winds that accelerated the already busy fire activity in the Northwest. Eastern Washington and the Cascades of western and southern Oregon saw the greatest impacts from this cold front.

The resulting fast-moving firestorms in timber, brush, and grasses burned over 1.76 million acres on new and existing large fires across the geographic area from September 7th through 13th, during and shortly after the wind event. The event proved to be an unprecedented disaster for communities and there was significant resource loss in and near the Oregon Cascades.

Fire activity was well above average for the region for September both in terms of numbers of fires and acreage burned; 90% of acres burned in the geographic area in 2020 occurred during September.<sup>3</sup>

Temperatures in the Northwest during the 2020 wildfire season were significantly higher than normal (*Figure 2* and *Figure 3*). PNW average precipitation (*Figure 4* and *Figure 5*) was lower than average.

**Figure 2. NW Average Temperatures**



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<sup>3</sup> Northwest Interagency Coordination Center. April 9, 2020. Northwest Annual Fire Report 2020. Portland, OR. [https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020\\_NWCC\\_Annual\\_Fire\\_Report.pdf](https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020_NWCC_Annual_Fire_Report.pdf) (Accessed April 2020).

Figure 3. NW Mean Temperatures

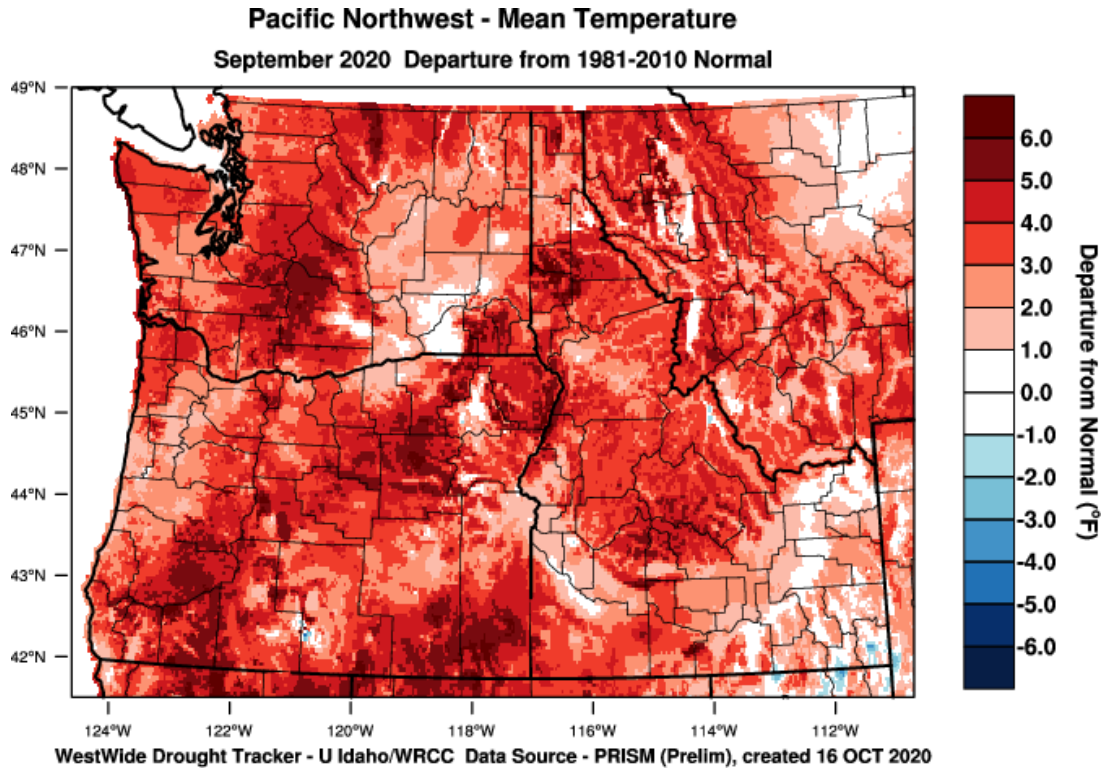


Figure 4. NW Precipitation

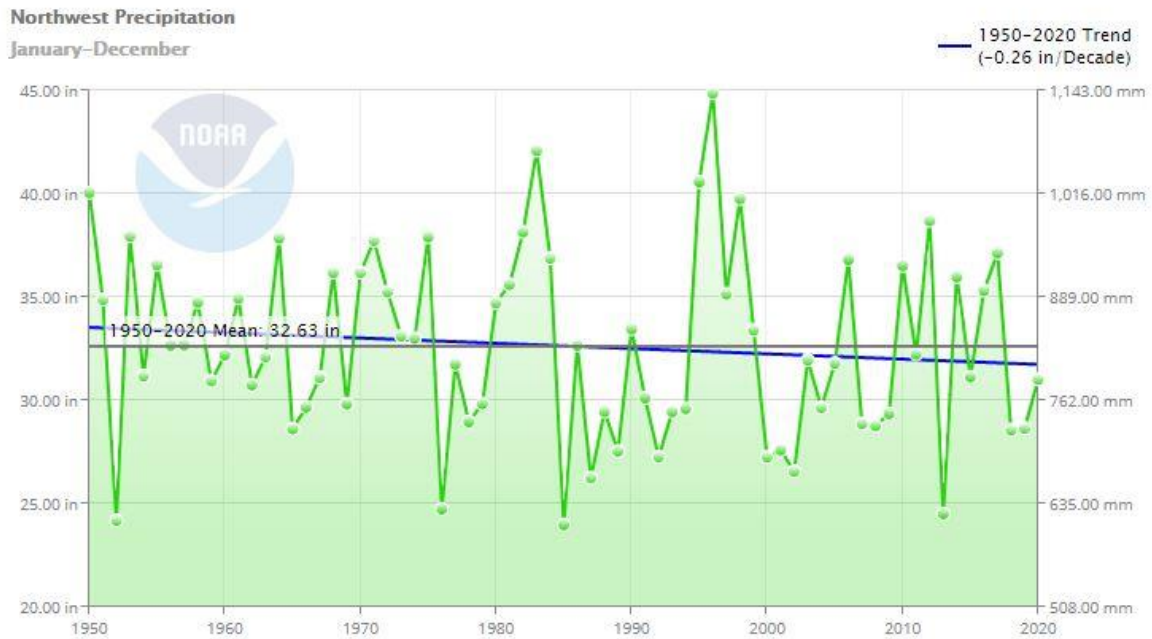
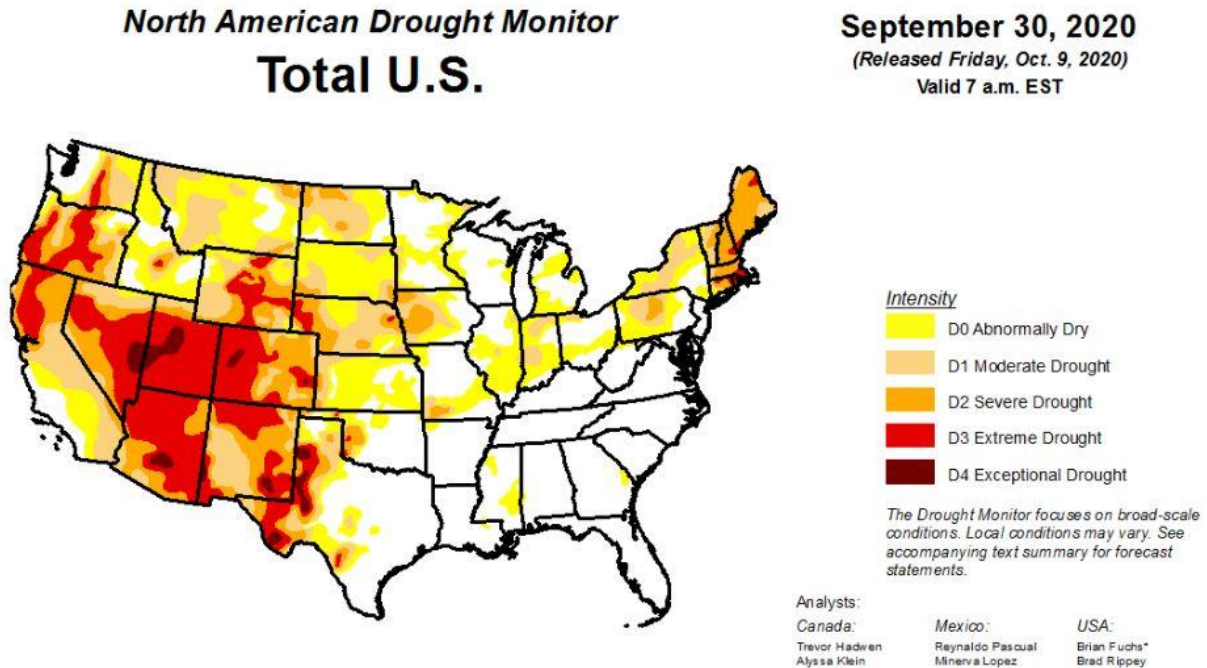


Figure 5. NW Drought Map



### 1.3 Source Area and Affected Region

#### Oakridge

The Oakridge community in Lane County, Oregon, has steadily improved air quality over the past 25+ years. Oakridge is a forest-oriented community (population 3,240<sup>4</sup>) in a valley of the Middle Fork Willamette River in the foothills of the Cascade Mountains about 45 miles southeast of Eugene-Springfield. Many of the homes are heated by wood as the primary or secondary heat source, or even sole source in some cases. As a result, the major contributor to the historical particulate air pollution has been home wood heating, especially on stagnant winter days when temperature inversions form over the small valley.

The Lane Regional Air Protection Agency has been monitoring in Oakridge for inhalable particulate matter (PM10 – particles 10 microns and smaller) since 1988 and for respirable particulate matter (PM10 – particles 2.5 microns and smaller) since 1999. The U.S. Environmental Protection Agency designated Oakridge as a moderate PM10 nonattainment area in 1994. The City of Oakridge, LRAPA, and the Oregon Environmental Quality Commission adopted the Oakridge PM10 attainment strategy in 1996 and submitted to EPA as part of the State Implementation Plan. EPA approved the plan in 1999. The Oakridge PM10 strategy focused primarily on control of residential wood combustion. The attainment strategy was

<sup>4</sup> ["Population and Housing Unit Estimates"](#). United States Census Bureau. May 24, 2020. Retrieved May 27, 2020.

successful in achieving the PM10 standards in Oakridge on schedule. In 2001, EPA published a finding of attainment for the Oakridge PM10 area.

The 1996 Oakridge PM10 attainment plan was successful in not only meeting the PM10 standards on schedule, but also meeting the initial national PM2.5 standard of 65 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) adopted by EPA in 1997.

In 2020, wildfire smoke events in Oakridge started on 9/7/2020 with smoke from the Holiday Farm fire and on 9/9/2020 with smoke from the Thielson Fire. From 9/10/2020 through 9/18/2020 the smoke from multiple fires mixed and settled over the western parts of Oregon, including the Willamette Valley and Oakridge. Following is a map of Oregon wildfires for the 2020 season (*Figure 6*).

**Figure 6. Map of 2020 Oregon large wildfires.**



### 1.3.1 Holiday Farm Fire

The Holiday Farm Fire began on September 7, 2020 at approximately 7:45 p.m. during a strong east wind event that passed through the area. The fire started approximately 3 miles west of McKenzie Bridge, OR. Pushed westward by strong winds, the fire moved through the communities of Blue River, Finn Rock,

<sup>5</sup> Northwest Interagency Coordination Center. April 9, 2020. Northwest Annual Fire Report 2020. Portland, OR. [https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020\\_NWCC\\_Annual\\_Fire\\_Report.pdf](https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020_NWCC_Annual_Fire_Report.pdf) (Accessed April 2020). P. 34.

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Nimrod, Vida and Leaburg, damaging and destroying homes, businesses and facilities in its path. The fire (as of 10/12/2020) encompassed 173,439 acres primarily in a mixed conifer forest. The fire burned a mosaic pattern through most of the area, and the majority burned with low and moderate severity.<sup>6</sup>

### 1.3.2 Holiday Farm Fire

The Holiday Farm Fire began on September 7, 2020 at approximately 7:45 p.m. during a strong east wind event that passed through the area. The fire started approximately 3 miles west of McKenzie Bridge, OR. Pushed westward by strong winds, the fire moved through the communities of Blue River, Finn Rock, Nimrod, Vida and Leaburg, damaging and destroying homes, businesses and facilities in its path. The fire (as of 10/12/2020) encompassed 173,439 acres primarily in a mixed conifer forest. The fire burned a mosaic pattern through most of the area, and the majority burned with low and moderate severity.<sup>7</sup>

### 1.3.3 Thielsen Fire

The Thielsen Fire was detected on September 8, 2020 at approximately 8:30 a.m. after lightning passed through the area. The fire was on the Diamond Ranger District of the Umpqua National Forest, approximately 5 miles north of Crater Lake National Park. It burned within one mile of the Diamond Lake Resort, along both sides of Oregon Highway 138, and a small portion of the Mount Thielsen Wilderness. The fire (as of 10/6/2020) encompassed 9,951 acres primarily in a mixed conifer forest. The fire burned a mosaic pattern through most of the area, and the majority burned with low and moderate severity.<sup>8</sup>

### 1.3.4 Multiple Fires Smoke Event

Starting on 9/10/2020 and continuing through 9/18/2020, smoke from the Holiday Farm and Thielsen fires, combined with multiple other fires in Oregon (see *Figure 7*) to inundate the western half of the state, including the Oakridge area, with wildfire smoke. Smoke from the fires caused air quality levels in the region to climb to hazardous levels, at points going beyond the limits of the AQI scale and well above the NAAQS.

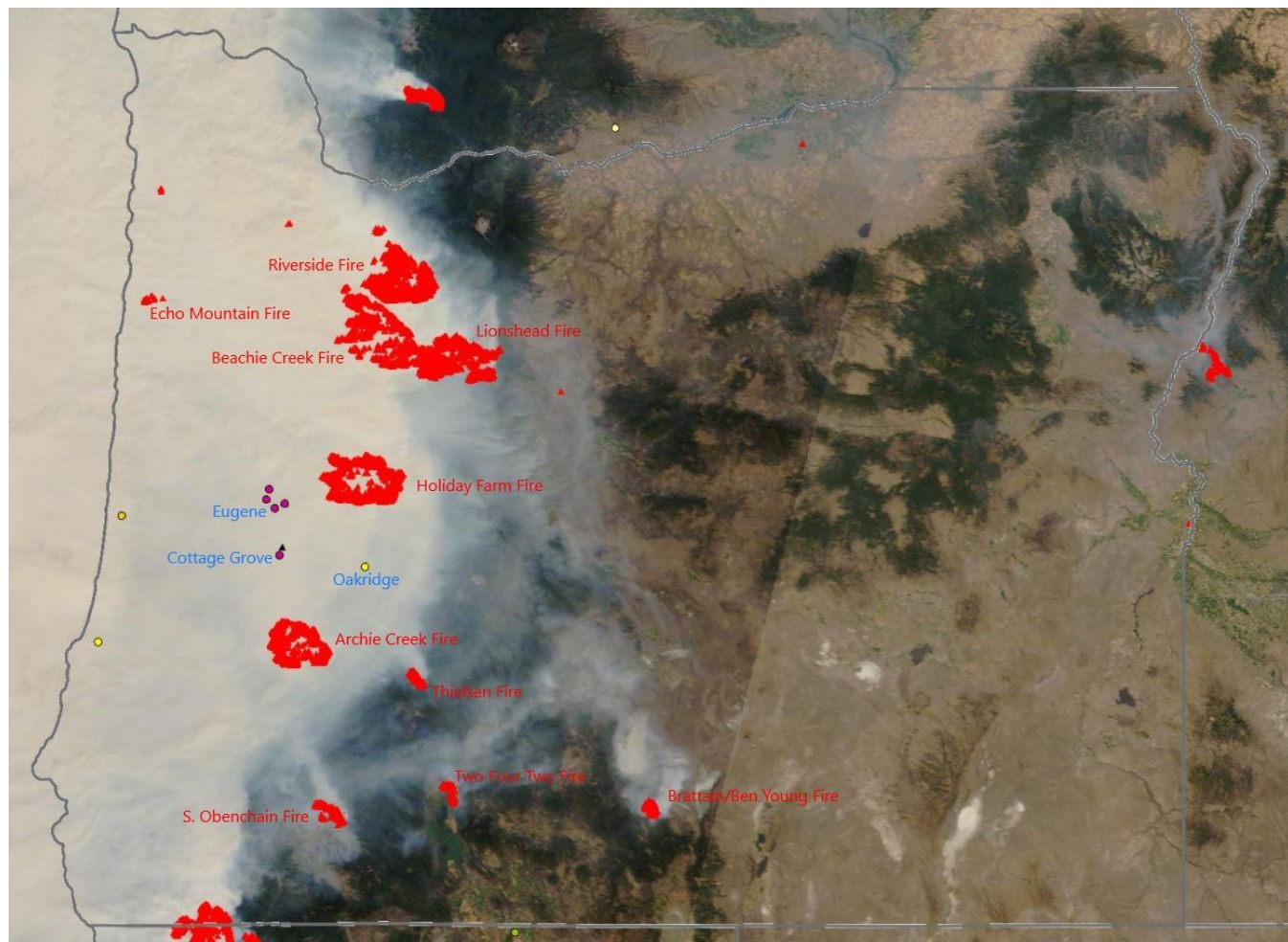
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<sup>6</sup> 2020 – Burned Area Emergency Response Summary – Holiday Farm Fire, [http://inciweb.nwcg.gov/photos/ORUPF/2020-09-27-1710-Western-Oregon-USFS-BAER/related\\_files/pict20201002-102952-0.pdf](http://inciweb.nwcg.gov/photos/ORUPF/2020-09-27-1710-Western-Oregon-USFS-BAER/related_files/pict20201002-102952-0.pdf)

<sup>7</sup> 2020 – Burned Area Emergency Response Summary – Holiday Farm Fire, [http://inciweb.nwcg.gov/photos/ORUPF/2020-09-27-1710-Western-Oregon-USFS-BAER/related\\_files/pict20201002-102952-0.pdf](http://inciweb.nwcg.gov/photos/ORUPF/2020-09-27-1710-Western-Oregon-USFS-BAER/related_files/pict20201002-102952-0.pdf)

<sup>8</sup> 2020 – Burned Area Emergency Response Summary – Thielsen Fire, [http://inciweb.nwcg.gov/photos/ORUPF/2020-09-27-1710-Western-Oregon-USFS-BAER/related\\_files/pict20200923-143740-0.pdf](http://inciweb.nwcg.gov/photos/ORUPF/2020-09-27-1710-Western-Oregon-USFS-BAER/related_files/pict20200923-143740-0.pdf)

**Figure 7. September 10, 2020 - Western Oregon Wildfire Smoke Event**



### **1.3.5 Methodology**

Wind speed, wind direction and hourly PM10 readings were taken from monitors and plotted against the time of day for the previous evening and 24 hour period of the impacted day.

Satellite smoke images from MODIS Terra and MODIS Aqua satellites were examined for the day of the impacted monitor reading, for the central Oregon region. These satellites tend to pass over the area that covers Oakridge from 10 am to 1 pm of each day.

HYSPLIT back trajectories were calculated in AirNow-Tech, using the PM10-88502 parameter and 1-hour duration. The date and time was set to the time of day where the monitor reading was at its peak. Heights were set at 500 m, 1000 m, and 1500 m to capture near ground and higher altitude wind transport, and the model was usually run for 8-12 hour. See Appendix A for more details.



### 1.3.5. Oakridge Monitor Wildfire Smoke Impacted Days

9/10/2021 through 9/17/2020

From 9/10/2020 through 9/17/2020 the Holiday Farm and Thielsen Fires combined with smoke from multiple other Oregon wildfires (see **Figure 7**) to inundate western Oregon with smoke causing exceedences of the NAAQS for PM10 in Oakridge. **Figure 8** and **Figure 9** show the time series and MODIS satellite images with fire and HYSPLIT back trajectory overlay and is an example of the impact from the first day of the 8-day combined smoke event. The time series and images for all the dates of impact are located in **Appendix B**.

**Figure 8. Time Series, 9/10/2020**

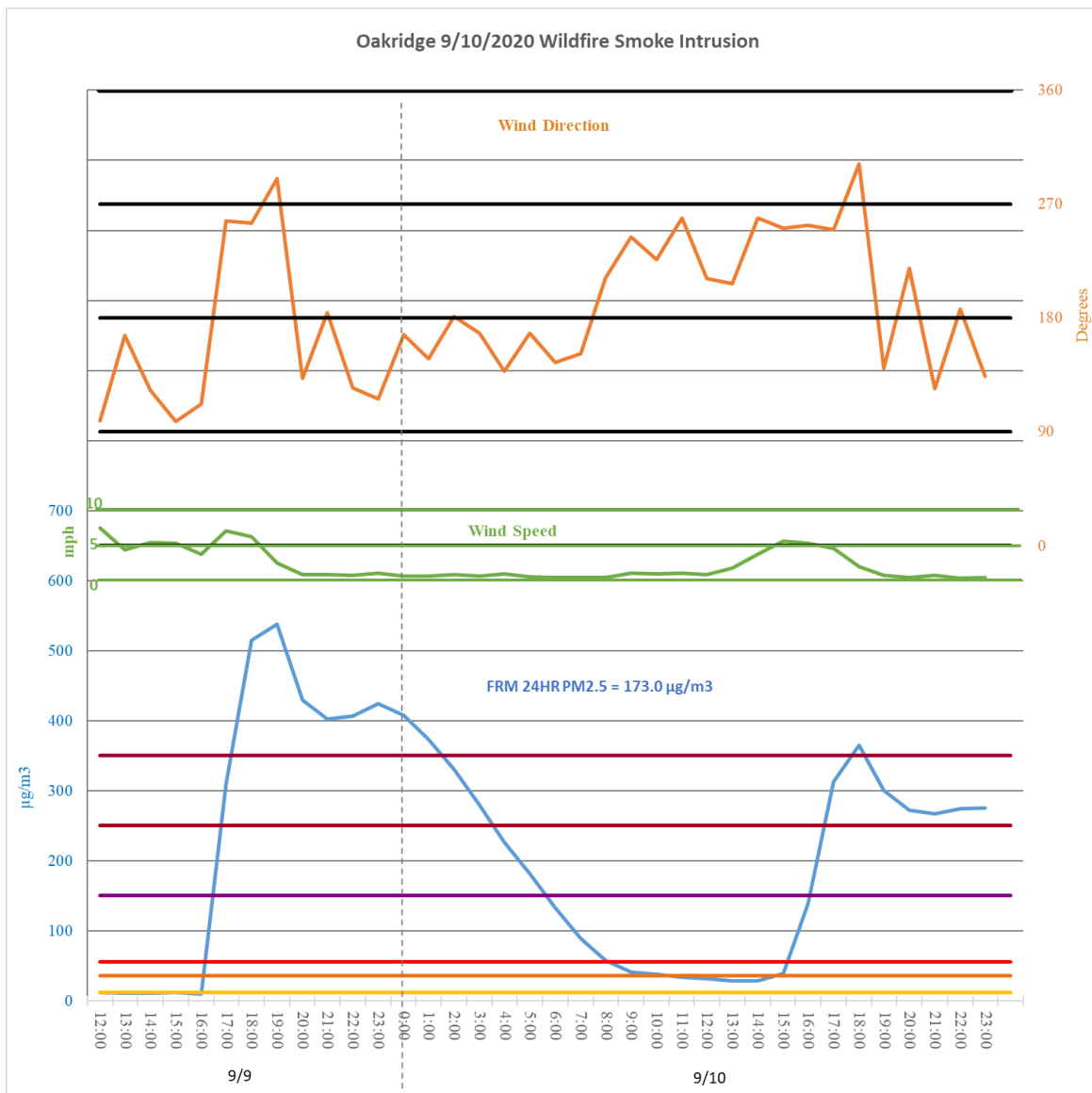
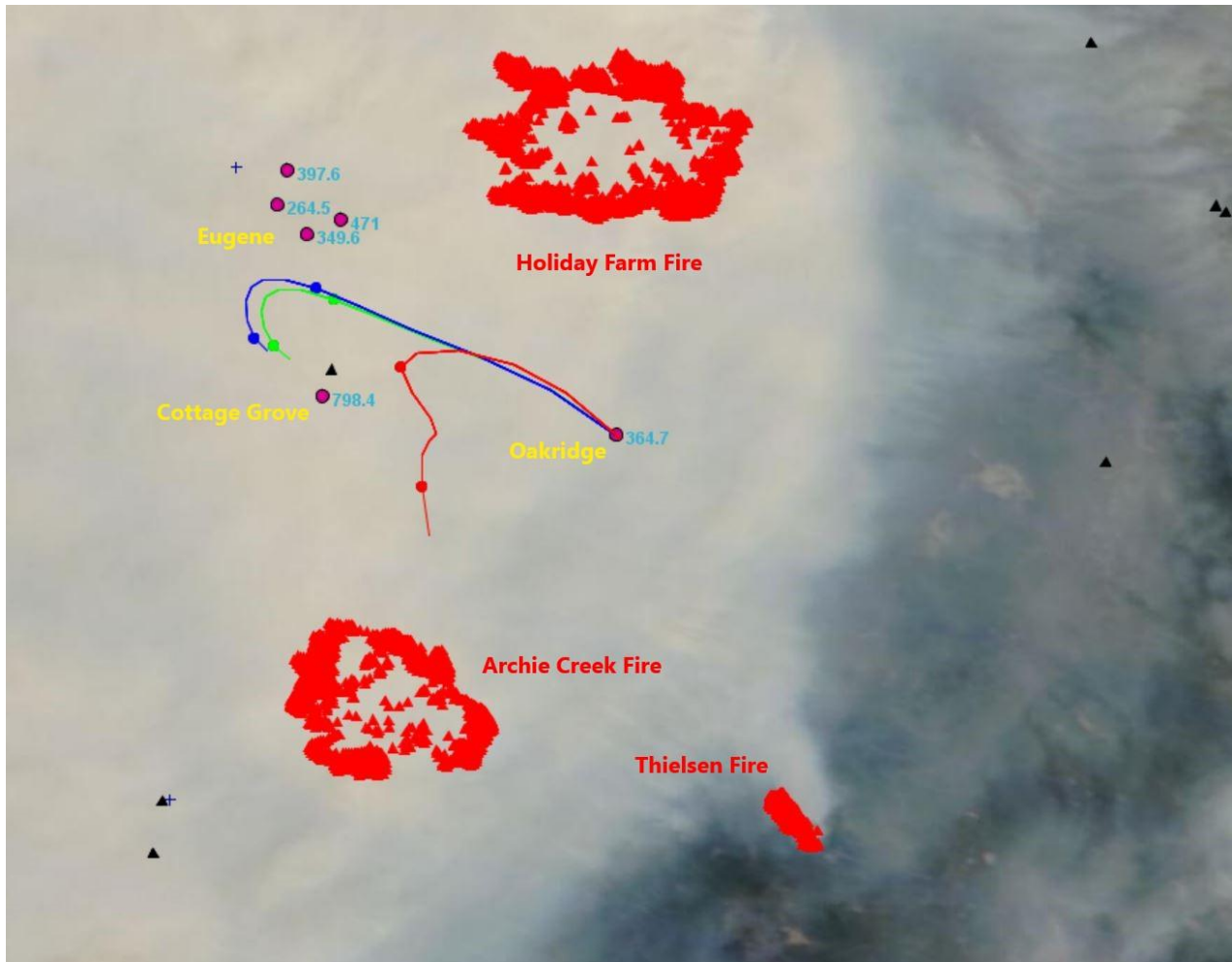


Figure 9. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/10/2020



## 2 Clear causal relationship

A clear causal relationship between a source and monitor is demonstrated with multiple strands of evidence linking the source of the event to the monitored exceedance. ODEQ and LRAPA provides a concise description of how the evidence for each day demonstrates the clear causal relationship. In addition, alternative sources of PM10 are explored.

Specifically,

- (1) Meteorological evidence (time series): transport of emissions to monitor
- (2) Satellite, back trajectory, and/or wind rose evidence: spatial relationship between source and monitor
- (3) Alternative sources

---

## 2.1 Meteorological data and time series

Meteorological data was gathered from the Oakridge monitoring site. Wind speed and wind direction at the monitoring site as well as the hourly PM10 reading at the monitor to develop a three-tiered time series graph that shows the relationship of PM10 reading with wind speed and direction on the days of interest. We used that data to backtrack the wildfires that most likely contributed to the high readings of the days of interest. See appendix B for all time series.

## 2.2 Satellite Data, Back Trajectories

We examined MODIS Terra and MODIS Aqua satellite photos provided through NASA's EOSDIS WorldView for smoke images related to monitor sites on the flagged wildfire days. MODIS satellite photos give visual evidence of the size and direction of the smoke plume on affected days.

HYSPLIT back trajectory was conducted through EPA's AirNowTech website (see *Appendix A* for details). The HYSPLIT model shows the back trajectory from the monitor to show that smoke traveled from the direction of the wildfires in questions to the monitor. The HYSPLIT model also shows the trajectory of smoke at varying heights. See appendix B for satellite and HYSPLIT images.

## 2.3 Alternative Source Hypotheses

An important element of the clear causal relationship demonstration is to explore alternative hypotheses for sources of PM10. Anthropogenic sources include prescribed fires, crop residue burning (CRB), residential wood combustion (RWC), open burning, and vehicle emissions. These anthropogenic sources maintain relatively steady emissions from year to year and are included in historical monitor values.

### 2.3.1 Prescribed Burning

Oregon Department of Forestry reported no prescribed burns in Oakridge for the impacted monitor days.

### 2.3.2 Crop Residue & Agricultural Burning

Crop residue burning is regulated in Oregon by the Oregon Department of Agriculture in conjunction with multi-agency smoke management efforts, including the Oregon Department of Forestry, Oregon Department of Environmental Quality, and the Oregon State Fire Marshal. ODA's field burning rules are listed in OAR 603-077, "Field Burning Rules," for the Willamette Valley only.<sup>9</sup> The open burning of all other agricultural waste is governed by OAR 340-264, "Rules for Open Burning."

Field burning in the Willamette Valley is only allowed northeast of Salem where the terrain is too difficult to manage in any other way. Field burning was not done in this area because it was adjacent to the Beachie Creek Fire and in Hazardous AQI conditions.

### 2.3.3 Residential Wood Combustion

Residential wood combustion (RWC) can be a significant source of PM10 emissions in Oregon communities during the winter months. The temperatures in Oakridge on the dates in question were well above the temperatures at which anyone would be burning wood for residential heating purposes (see *Table 6*). RWC was not a likely source of PM10 emissions during this time period.

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<sup>9</sup> The Willamette Valley is extremely distant from the monitors in question, for those not familiar with the geography of Oregon.

Table 6. Max and Min daily temperatures at Oakridge monitor on impacted days, 2020							
Oakridge							
Date	PM10 µg/m <sup>3</sup>	Max Temp (F)	Min Temp (F)	Date	PM10 µg/m <sup>3</sup>	Max Temp (F)	Min Temp (F)
9/10/2020	200	80.6	46.3	9/14/2020	305	73.4	47.5
9/11/2020	274	68.2	45.6	9/15/2020	314	79.1	45.8
9/12/2020	591	71.4	45.2	9/16/2020	237	76.0	45.5
9/13/2020	423	68.5	44.0	9/17/2020	172	74.9	51.2

### 2.3.4 Outdoor Burning

Open burning in Oregon is regulated by OAR 340-264.<sup>10</sup> Oregon

“Classifies all open burning into one of seven classes: Agricultural; Commercial; Construction; Demolition (which includes land clearing); Domestic (which includes burning commonly called "backyard burning" and burning of yard debris); Industrial; or Slash. Except for field burning within the Willamette Valley regulated through OAR 340 division 266 and slash burning administered by the forest practices smoke management plan of the Oregon Department of Forestry, this division prescribes requirements for and prohibitions of open burning for every location in the state. Generally, if a class of open burning is not specifically prohibited in a given location, then it is authorized subject to OAR 340-264-0050 and 340-264-0060 and the requirements and prohibitions of local jurisdictions and the State Fire Marshal.”<sup>11</sup>

In addition, according to OAR 340-262-0900, “Materials Prohibited from Burning,”

No person may cause or allow any of the following materials to be burned in a solid fuel burning device, fireplace, a trash burner or any other device described in ORS 468A.485(4)(b):

(1)(a) Garbage; (b) Treated wood; (c) Plastic or plastic products; (d) Rubber or rubber products; (e) Animal carcasses; (f) Products that contain asphalt; (g) Waste petroleum products; (h) Paint; (i) Chemicals; (j) Products containing lead, mercury or other heavy or toxic metals; (k) Materials containing asbestos; and (l) Particleboard.

(2) Paper or paper products, except for paper used to kindle a fire.

The outdoor burning period in Oakridge is only allowed during the months of October, March through June 15 (LRAPA Section 47-015(2)(f)). Thus, open burning was prohibited on the impacted monitor days in question. Barrel burns are also prohibited year round in Lane County.

According to the Oregon Department of Forestry, no prescribed burns or open burns were registered on any of the impacted days in Oakridge.

<sup>10</sup> Oregon Secretary of State website. “Rules for Open Burning.” (Accessed 3/5/2019) [https://secure.sos.state.or.us/oard/displayDivisionRules.action;JSESSIONID\\_OARD=cC9P1ta7Uus8P2xtYZlahJLg\\_hrbyYGUCt0sDOMyytWOOg9umWVOF!1318524005?selectedDivision=1568](https://secure.sos.state.or.us/oard/displayDivisionRules.action;JSESSIONID_OARD=cC9P1ta7Uus8P2xtYZlahJLg_hrbyYGUCt0sDOMyytWOOg9umWVOF!1318524005?selectedDivision=1568)

<sup>11</sup> OAR 340-262-0010 (1).

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### 2.3.5 Vehicle Emissions

Vehicle emissions and road dust produce PM10 emissions and are included in the onroad mobile source category in the 2017 NEI<sup>12</sup>. The annual PM10 emissions in this category are a small fraction of the emissions produced by wildfires, especially in rural areas like Oakridge, with few vehicles.

The Oakridge PM10 Attainment Plan was submitted on December 9, 1996 and approved on March 15, 1999<sup>13</sup>. The attainment plan included a 1991 emission inventory (EI) data showing that vehicle emissions for transportation sources contributes approximately 2% of the PM10 in the Oakridge area. On July 26, 2001, EPA published a finding of attainment for the Oakridge PM10 area<sup>14</sup>.

### 3 Comparison to historical fluctuations

To support the clear causal relationship requirement of the EER, analyses are presented here comparing the event-influenced concentrations at Oakridge to historical concentrations. Evidence supports the conclusion that PM10 concentrations at the monitor on the flagged days were elevated due to wildfire smoke.

**Figure 10** shows the PM10 concentrations measured at Oakridge for 2016 through 2020. This data shows that during wildfire season (June through September) PM10 measurements typically remain below 30 ug/m<sup>3</sup> with higher concentrations related to wildfire events. Higher numbers in the wintertime are attributed to residential wood combustion and wintertime inversions in our mountain valleys.

The exception is when there are wildland fire smoke incursions during the summer months. June through September data was analyzed for 2011 through 2019 to establish a background level. **Table 9** shows that 2020 PM10 readings were exceptional, within the 2011-2020 years, at the Oakridge monitor.

Table 7. Statistics for 24-hr PM10 concentrations, June 1 – September 30, 2011 - 2020		
	2011-2019	2020
Minimum, ug/m <sup>3</sup>	0.0	1.0
Maximum, ug/m <sup>3</sup>	210*	591
Median, ug/m <sup>3</sup>	11.0	10.5
Mean, ug/m <sup>3</sup>	15.2	32.3
Std.Dev., ug/m <sup>3</sup>	18.4	83.3
N	598	120

\*Wildfire smoke influence from 2017 wildfires.

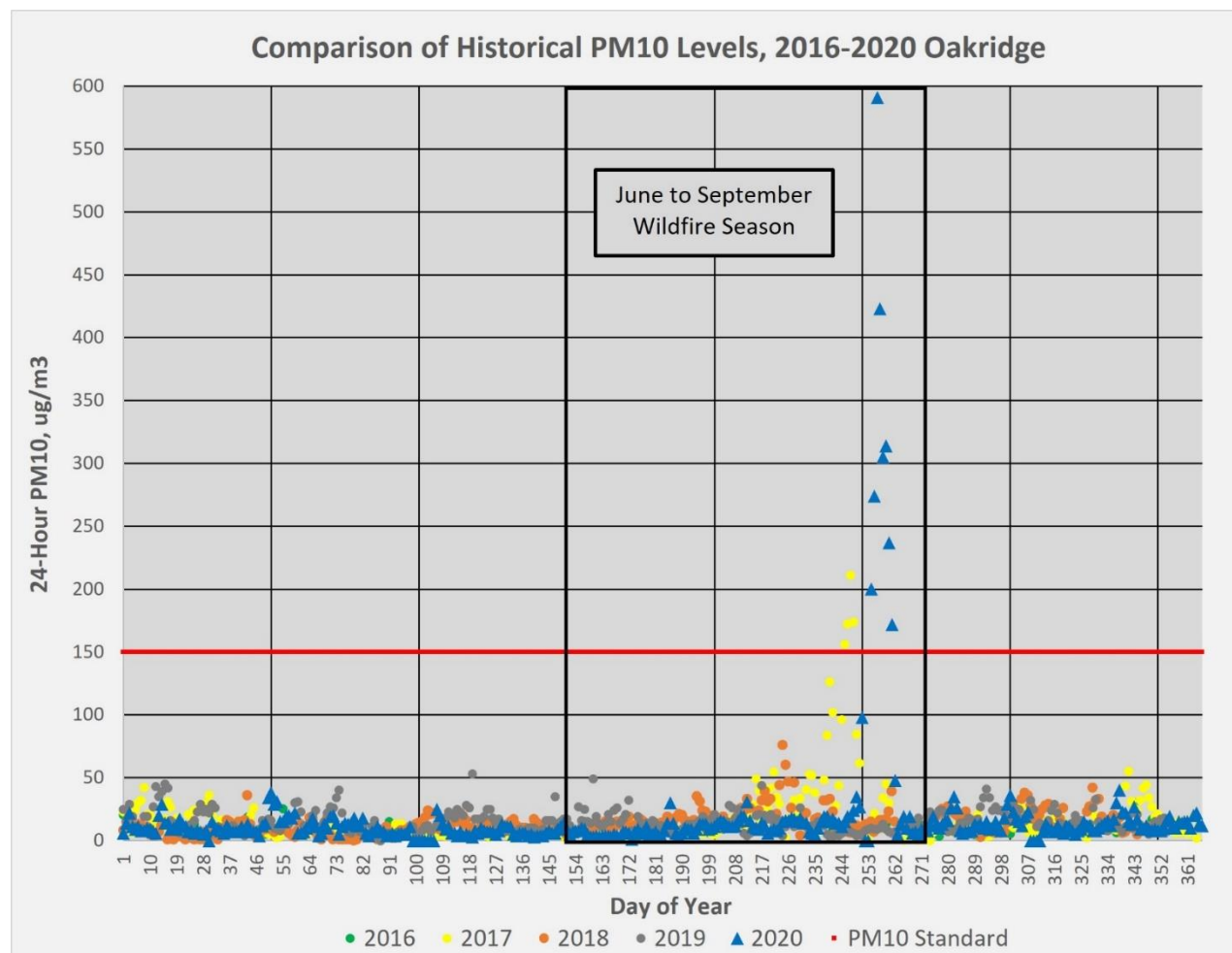
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<sup>12</sup> 2017 NEI Data. <https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data>

<sup>13</sup> Oakridge PM10 Attainment Plan. <https://www.lrapa.org/DocumentCenter/View/5690/Oregon-PM10-Nonattainment-Area---1996>

<sup>14</sup> Summary of Oakridge PM10 Attainment Plan. <https://www.epa.gov/sips-or/summary-oakridge-pm-10-attainment-plan>

Figure 10. Historical Comparison of PM10 at Oakridge Monitor



#### 4 Not reasonably controllable or preventable

This EER element requires a demonstration that the event was neither reasonable controllable nor preventable, and this requirement has been met for wildfire events (40 CFR 50.14(b)(4)). ODEQ and LRAPA presents sufficient evidence in this demonstration showing the source of the event was indeed wildfires (*Section 1, Section 2*). ODEQ and LRAPA contend that the events of September 2020 at Oakridge were both not reasonably controllable or preventable.

#### 5 Natural Event or Human Activity Unlikely to Recur (NE/HAUR)

The EER requires that agencies must document that the identified source of an exceptional event is either a natural event (NE) or a human activity unlikely to recur at the same location (HAURL) such as to affect the monitors in question again. EPA’s 2016 Exceptional Events rule indicates that if an agency has adequately demonstrated that the source is a *natural event* or, if not natural, is a human activity unlikely to recur at the same location and that there is a *clear causal relationship* between the identified source (s) and the affected monitor, then the HAURL/Natural Event criterion is also satisfied.

In the late summer of 2020, unusually low humidity and high temperatures in western Oregon dried out the thick layer of duff, branches and sticks, that lay on the forest floor. This set the stage for a rare and

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powerful wind event that erupted on September 7th, 2020, bringing dry, hot winds, up to 75 miles per hour, that quickly spread any fire that started or was already burning. Humidity was measured in the single digits, previously only seen in particularly dry areas in the height of summer.<sup>15</sup> The data included in Sections 1 and 2 demonstrate the clear causal relationship between the source of the smoke and monitor data for each day that ODEQ and LRAPA requests concurrence. Thus, the NE/HAUR criterion is satisfied.

## 6 Mitigation

The EER requires states to take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS (40CFR 51.930). ODEQ and LRAPA presents evidence of prompt public notification of the event, public education so that individuals could make behavioral changes to reduce exposure to unhealthy air, and implementation of appropriate measures to protect public health from the impacts of exceptional events.

Control of wildland fires is coordinated under the National Interagency Fire Center. Their fire control policy states:

Five federal agencies, including the Department of the Interior's Bureau of Land Management, Bureau of Indian Affairs, National Park Service, and U.S. Fish and Wildlife Service, along with the Department of Agriculture's Forest Service, manage and have primary fire program responsibilities on more than 676 million acres. The U.S. Fire Administration works with county and local fire departments; while the states are represented by the National Association of State Foresters. The state, county, and local jurisdictions provide primary fire protection on public and private lands covering additional hundreds of millions of acres across all 50 states.

As partners, they work together on fire management issues covering the spectrum from safety and planning, to science, preparedness, operations, strategy development, logistics, intelligence, emergency response, and more. They also collaborate on interagency strategies to manage wildfires, not only for single incidents but as a matter of policy.

In addition to the total effort of the various natural resource agencies, the specific USFS districts prepare fire management plans.<sup>16</sup>

Oregon DEQ, Lane Regional Air Pollution Authority, Oregon Health Authority, Oregon OSHA, Oregon Emergency Management, Oregon Department of Forestry, and the US Forest Service developed a wildfire response protocol which outlines the state, federal, and local response to dangerous smoke levels impacting Oregon communities.<sup>17</sup> The protocol defines which agency is responsible for which activity and provides a guide for the coordination of emergency communication during extreme smoke events.

The major areas of agency actions and the lead agencies responsible for the event of a severe smoke episode related to wildfire are presented in detail in **Table 8**.

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<sup>15</sup> OSU Extension Fire Program, After the Fire report, [After the Fire](#)

<sup>16</sup> For more details for fire management and community outreach practices during the 2017 fire season, see: USDA Forest Service and DOI Bureau of Land Management. *2017 Pacific Northwest Fire Narrative*. [https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/fseprd572804.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd572804.pdf) (Accessed March 4, 2019)

<sup>17</sup> Oregon DEQ et al. 2018. *Oregon Wildfire Response Protocol for Severe Smoke Episodes*. V5.3. June 28, 2018. <https://www.oregon.gov/deq/FilterDocs/WFresponse.pdf> (Accessed March 4, 2019).

<b>Table 8. Wildfire response protocol: actions and agencies responsible.<sup>18</sup></b>		
<b>Action Needed</b>	<b>Lead Agency and Action Taken</b>	<b>Desired Outcome</b>
<b>1. Air Monitoring</b>		
Measuring ambient air quality	Mostly DEQ as lead agency. Air Resource Advisors (ARA) may provide additional monitoring equipment via national cache resources and assist in deployment and data collection.	Ability to track ambient air quality levels in communities receiving the heaviest impact, and identify smoke-free areas where air quality is good.
Indoor air quality exposure	Oregon OSHA is lead agency to evaluate air quality concerns for workers. DEQ and OHA can provide advice to schools.	Ability to monitor indoor smoke levels in work environments and schools.
<b>2. Smoke Forecasting and Modeling</b>		
Smoke weather forecast	ODF is the lead agency, with back-up and assistance from NWS Meteorologists as requested. DEQ assists in coordination. National Weather Service can be contacted to provide “spot weather forecasts” for wildfire.	Provide advance notice of possible smoke movement and impacts, improve public notification, lower risk of public exposure to high smoke levels
Smoke modeling	ARAs can provide smoke modeling forecasts if requested.	Complementary to above
<b>3. Issuing Health Warnings</b>		
Provide public with frequent smoke updates on potential health risk and recommended public health actions via the web and media	Coordination between the Incident Management Team, DEQ, LRAPA, ARA, OHA, county health departments, local government, tribes and 211 info. Assistance from federal land managers on fire status, and from ODF wildfire forecasting.	Frequent coordinated updates provided to the public via Oregon Smoke Blog, DEQ, OHA, local government websites, press releases and media outreach. 211 info is provided with up-to-date health-related information.
<b>4. Website management</b>		
Updating the Oregon Smoke Blog and social media (see description under section 6)	Blog initiated by federal land managers or DEQ, and updated by DEQ Public Affairs who will act as a “gate keeper” to avoid duplicative messaging and crowding of the smoke blog.	Provide the public with comprehensive “one-stop” website/social media on wildfire status, air quality levels, leath risk, cleaner air spaces, press releases and other critical info.
Updating DEQ, OHA, ODF and local websites	Managed by respective agency. Supplements the Oregon Smoke Blog website.	Complements the above website.
<b>5. Public Actions</b>		
Cancel or modify public events, outdoor and business activities	Decision made within affected jurisdiction, by local or tribal health authorities in consultation	Prompt action taken, via notification of media, 211 info,

<sup>18</sup> Oregon DEQ et al. 2018. *Oregon Wildfire Response Protocol for Severe Smoke Episodes*. V5.3. (June 28, 2018) pages 5-6. <https://www.oregon.gov/deq/FilterDocs/WFresponse.pdf> (Accessed March 4, 2019).



	with DEQ, LRAPA, ARA, local public health, OHA, federal land managers, and possibly or OR-OSHA as needed.	and posting info on Oregon Smoke Blog and other websites
Consult with schools on limited hours or closure. Decisions about protecting schools or other public buildings from smoke intrusion	Decision made within affected jurisdiction, by local or tribal health authorities in consultation with DEQ, LRAPA, ARA, local public health, OHA, or OR-OSHA as needed.	Identification of measures to protect schools and users of public buildings from smoke
Set up general population shelters	Red Cross may support the setup and management of general population shelters based on decisions by local health officials.	When determined necessary, general population shelters will be established and opened in coordination with local public health and emergency management.
Establish or identify public cleaner air spaces	Decisions made within affected jurisdiction, by local or tribal health authorities in consultation with DEQ, LRAPA, ARA, OHA, or OR-OSHA as needed.	When determined necessary, prompt action taken to set up or identify cleaner air spaces, using guidance for “Identifcation of Cleaner Air Spaces for Protection from Wildfire Smoke” <sup>1</sup>
Recommended evacuation/relocation of sensitive populations	Decision made at local level, by health officials and tribal/local government (Sheriff or local emergency management), OEM, in consultation with DEQ, LRAPA, ARA, OHA, federal land managers and possibly OR-OSHA	Prompt action taken if dangerous smoke levels are expected to persis for a prolonged period. Requires close communication with DEQ, OHA, federal land managers, OEM, OR-OSHA, 211 info, and possibly Red Cross, State Fire Marshal and State Police.

## 7 Initial Notification

The EER establishes specific procedural requirements that an air agency must follow to request data exclusion. Those requirements and ODEQ’s actions to meet them are summarized in the table below.

Table 9. Exceptional Event Rule Procedure Requirements	
Exceptional Event Rule Procedural Requirement	ODEQ Action/Intended Action
<p>A State shall notify EPA of its intent to exclude one or more measured exceedances of an applicable ambient air quality standard as being due to an exceptional event by placing a flag in the appropriate field for the data record of concern which has been submitted to the AQS database...</p> <p>40 CFR § 50.14(c)(2)(i).</p>	<p>ODEQ notified EPA that it placed flags on numerous the monitor values originally thought to be affected by wildfires above the level of concern in Oregon for PM10 of 25µg/m3 and that we intended to request EPA concurrence to exclude some or all of them from the AQS database.</p>

<p>A State that has flagged data as being due to an exceptional event and is requesting exclusion of the affected measurement data shall, after notice and opportunity for public comment, submit a demonstration to justify data exclusion to EPA. EPA shall respond with a due date for demonstration submittal that considers the nature of the event and the anticipated timing of the associated regulatory decision.</p> <p>40 CFR § (50.14(c)(3)(i)).</p>	<p>DEQ made this package available for public comment and subsequently submitted it to EPA by {DATE HERE} so that it continues to demonstrate Oakridge is meeting the 24-hour PM10 standard.</p>
<p>With the submission of the demonstration, the air agency must document that the public comment process was followed.</p> <p>40 CFR § (50.14(c)(3)(iv) and (v)).</p>	<p>This document was available for a 30-day public comment from {DATE} through {DATE}. See <i>Section 8</i> for Public comments.</p>

## 8 Public Comment

DEQ posted notice of this exceptional events demonstration on April 19, 2019 on the DEQ website. No comments were received.

## 9 Summary

With the weight of evidence discussed throughout this report, ODEQ and LRAPA have shown that the fires in western Oregon impacted the monitor at Oakridge. ODEQ and LRAPA requests EPA’s concurrence for six days, 9/11/2021 through 9/16/2021, to be flagged RT and that these values not be used to calculate the relevant design values for the Oakridge State Implementation Plan and attainment status. We also request that Oakridge continue as a PM10 attainment area and that the Oakridge PM10 Maintenance Plan be approved.

ODEQ and LRAPA are also submitting some dates for which EPA will not concur at the moment, but for which the information may become of regulatory significance in the future.

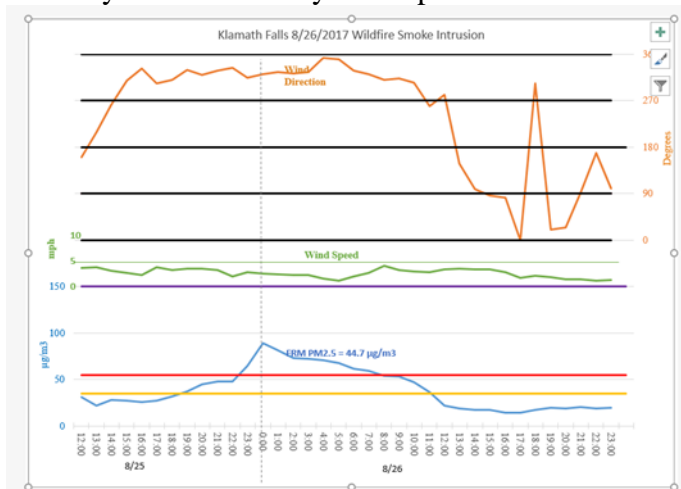
## Appendix A – HYSPLIT Protocol

HYSPLIT back trajectory protocol for exceptional events in AirNow-Tech, developed by Anthony Barnack. Protocol instructions are based on the 2017 wildfire event but are still applicable for 2020 event.

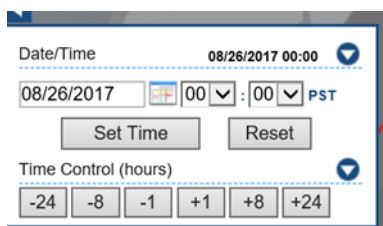
Instructions:

Log onto Airnow Tech and go to the Navigator tab. You will need an account to log on.

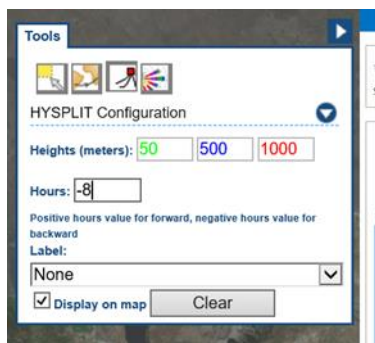
1. Under the Parameter Tab Select:  
PM10-88502  
Duration 1 hr  
Display – parameter, HMS fire, and HMS smoke if you want
2. Under the Site Tab Select:  
By Parameter - PM10-88502  
By Duration – 1 HR
3. Under the Layers Tab Select:  
I usually add the states border. You can also add the MODIS satellite images if it helps.
4. My maps – Leave as Standard
5. Setting the time and date on the map.  
I usually look at the time series to see what time of day the biggest impact was and the WD and WS at the time.  
For K Falls, 8/26/17, the impact was at 0:00 PST with winds from the NNW. This tells you when to set your map time and what fires you will be looking at.



6. Set the map time



7. Under the lower arrow at the upper right is the tool box.  
Select the red box for Hysplit. I use 50, 500, and 1000 meters.  
You can do a back trajectory by putting negative hours in and clicking on the site.  
Forward trajectory is from the forest fire and positive hours.  
When ready click on the site or fire you want a trajectory for.



Notes:

I use the HMS smoke discussed in step 1 to see where the old smoke is and get an idea of where the smoke is heading. I turn it off to see the map. It usually takes many iterations of changing the trajectory hours to see where the impact came from.

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# Appendix B – Wildfire Impact Figures

Figure 11. Time Series, 9/10/2020

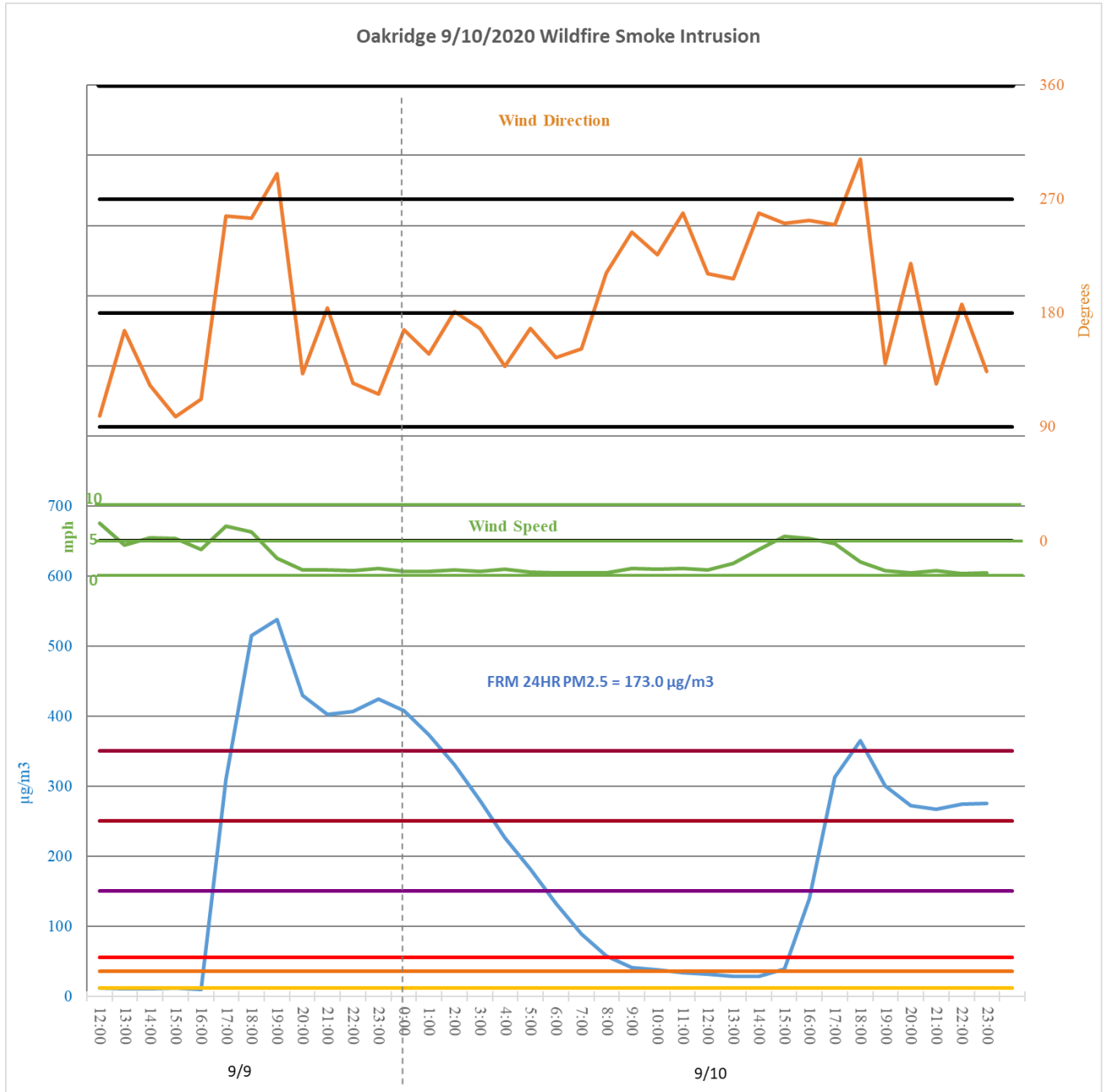
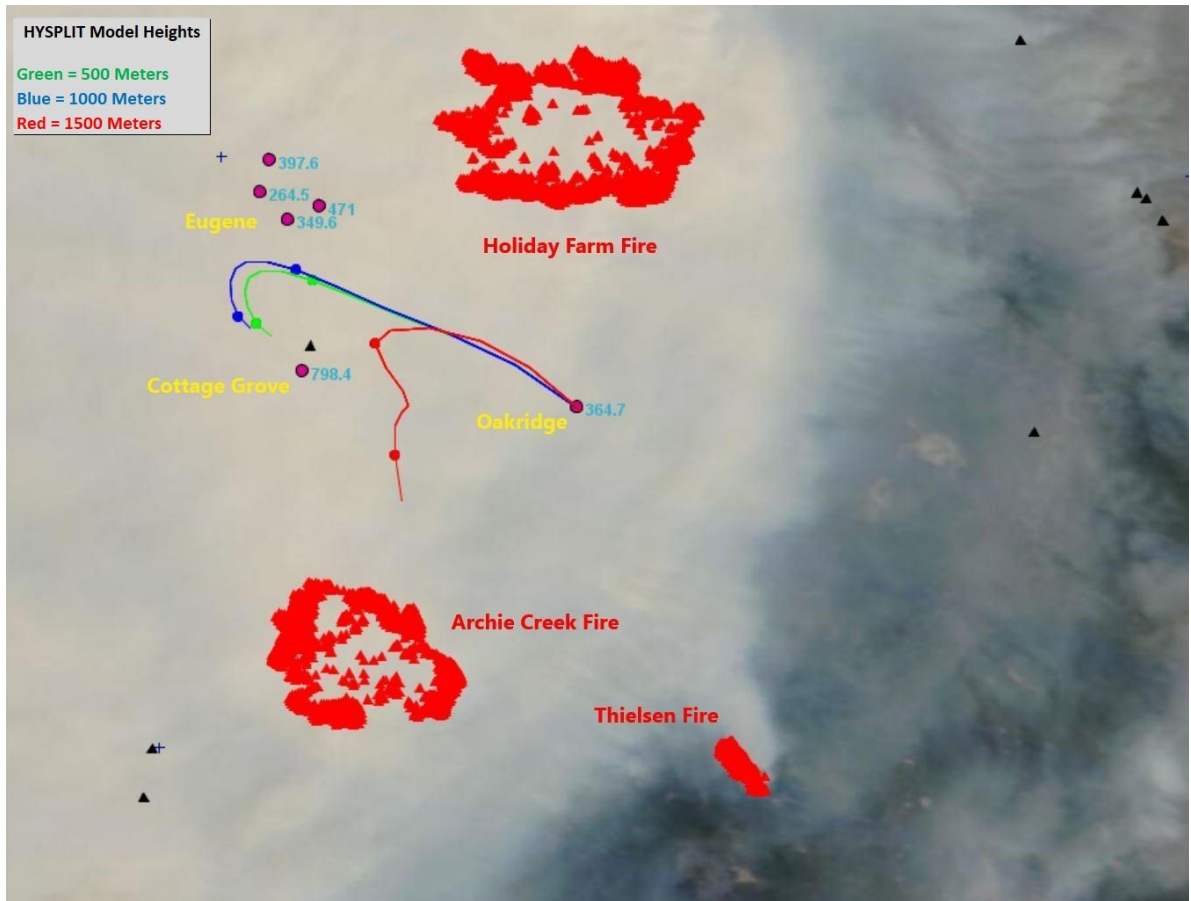


Figure 12. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/10/2020



**Figure 13. Time Series, 9/11/2020**

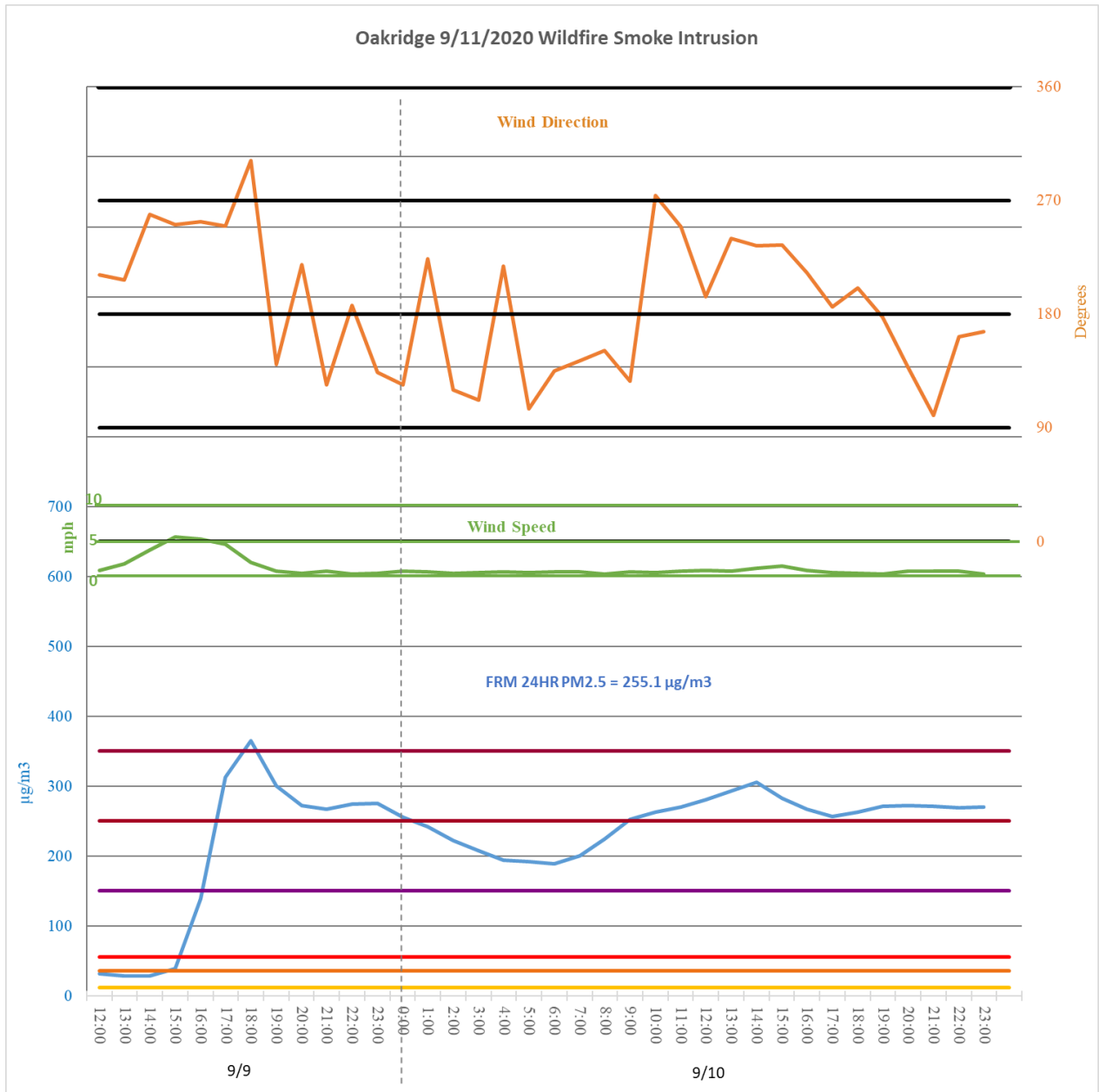
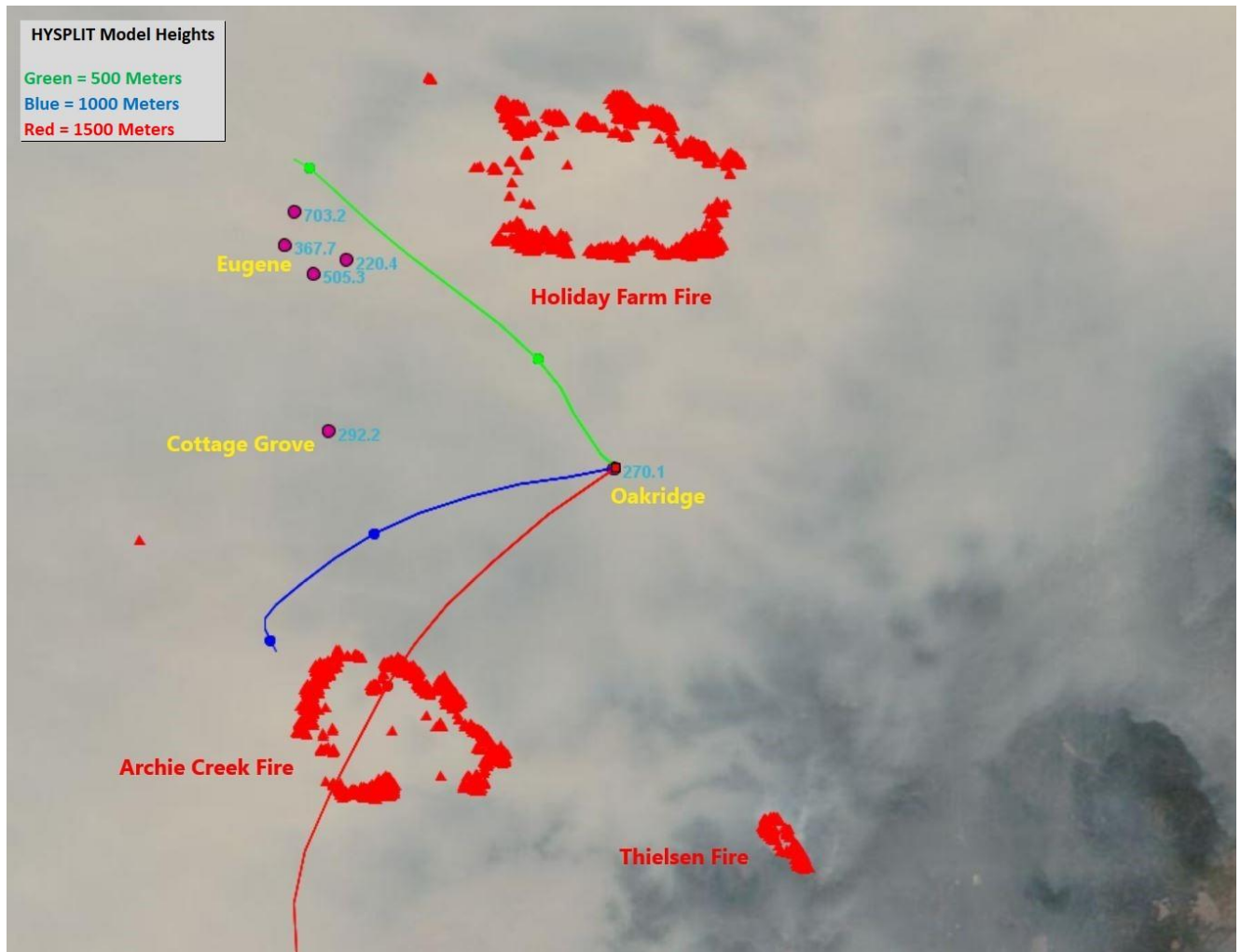




Figure 14. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/11/2020



**Figure 15. Time Series, 9/12/2020**

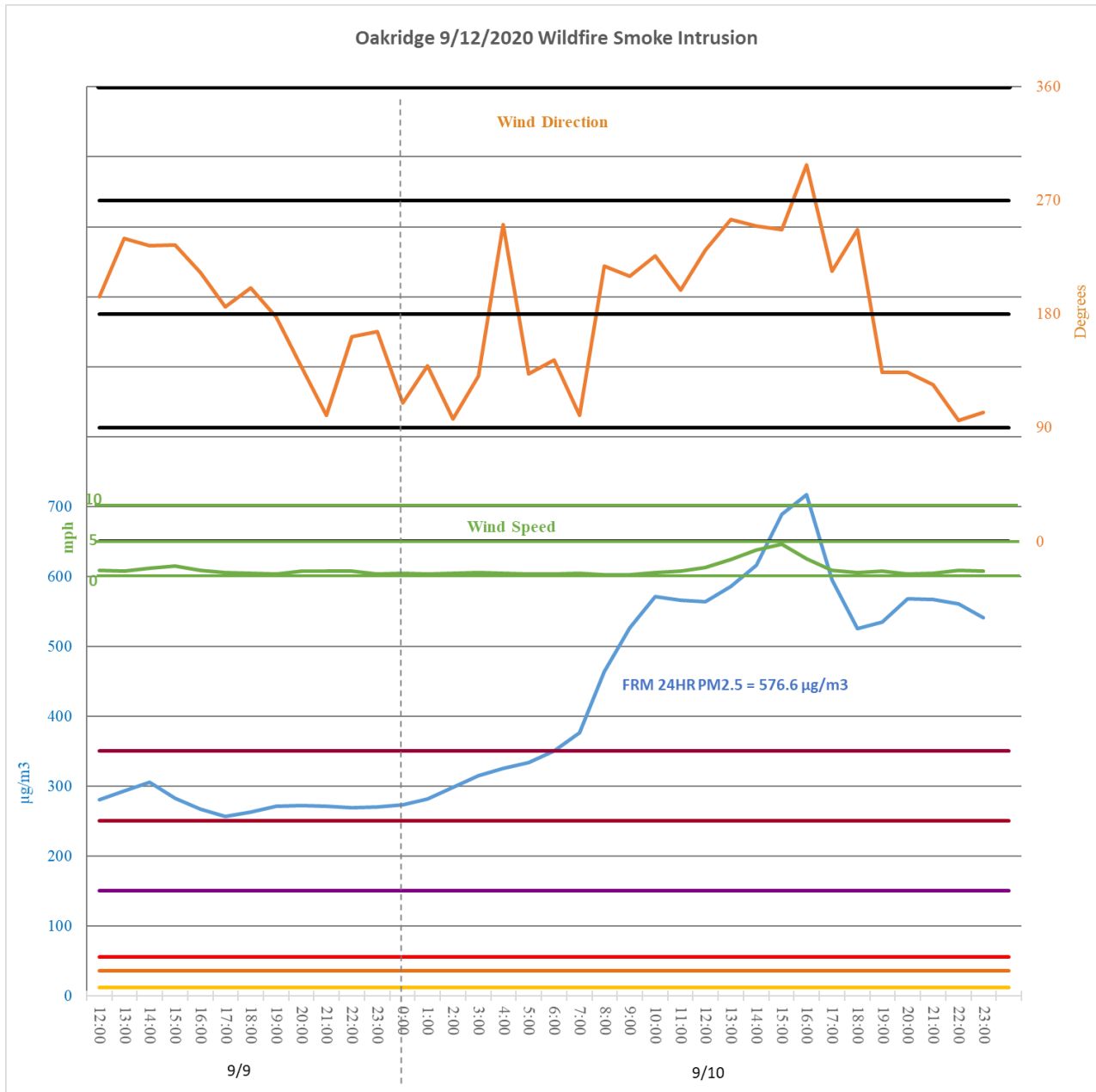
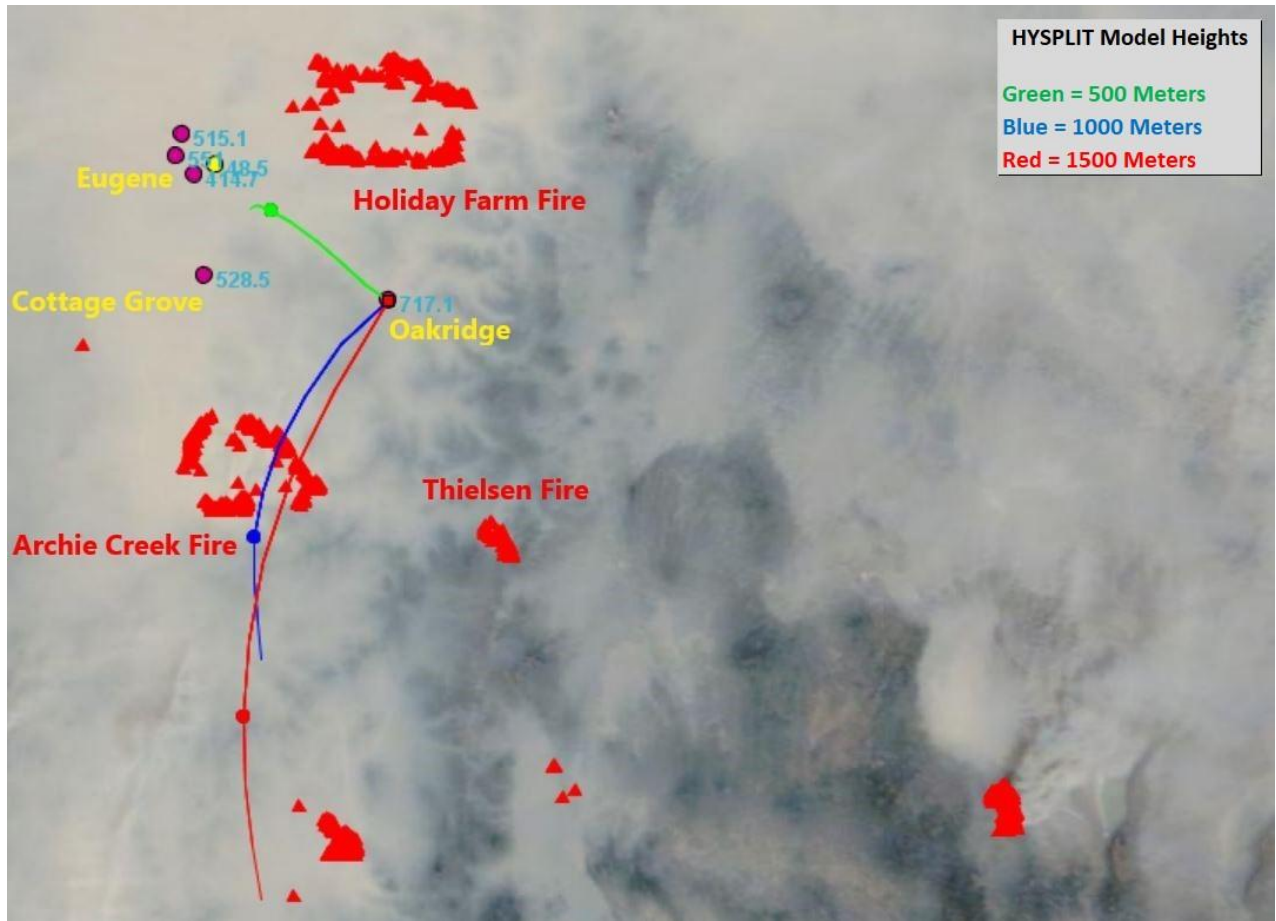


Figure 16. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/12/2020



**Figure 17. Time Series, 9/13/2020**

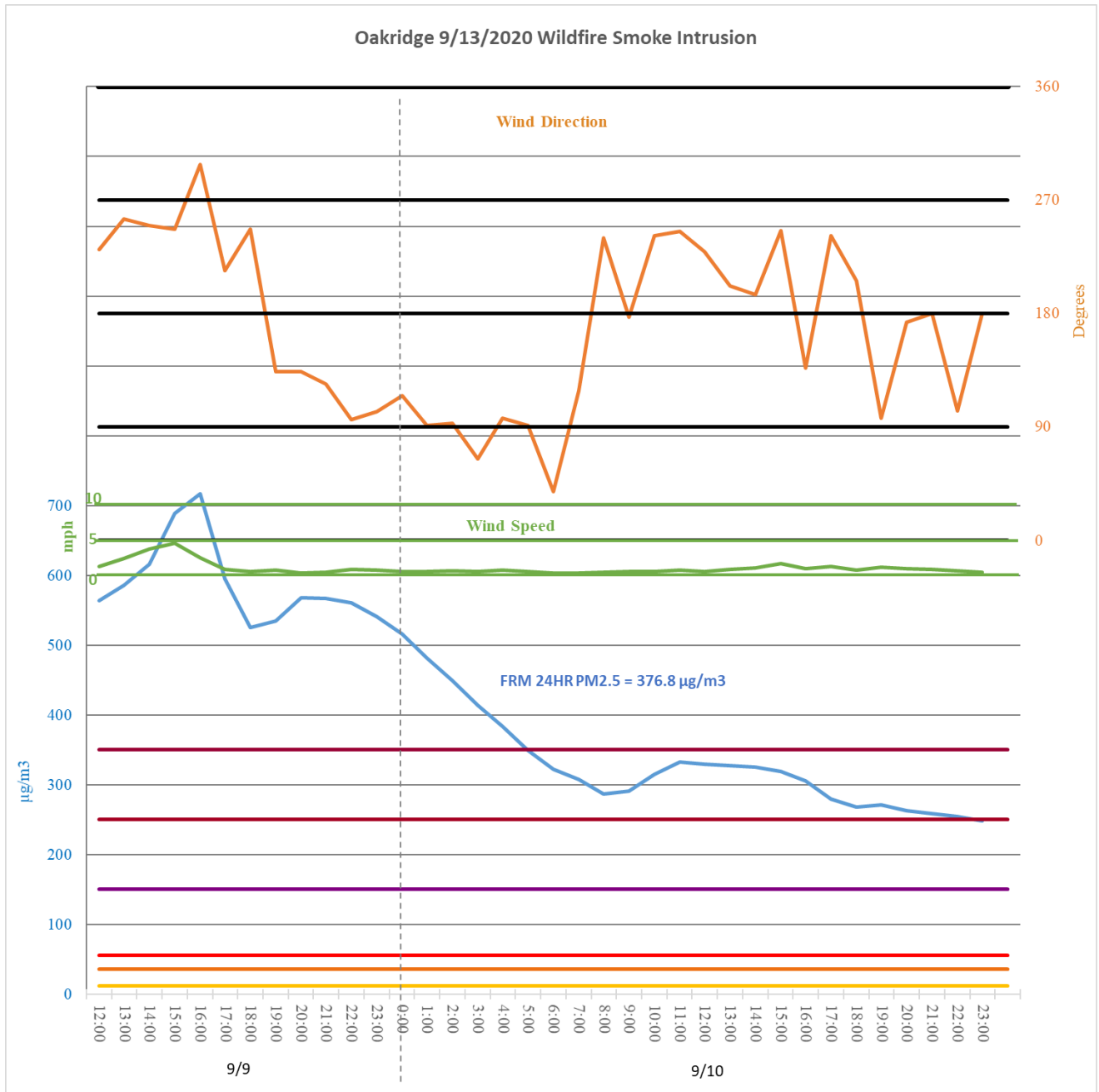
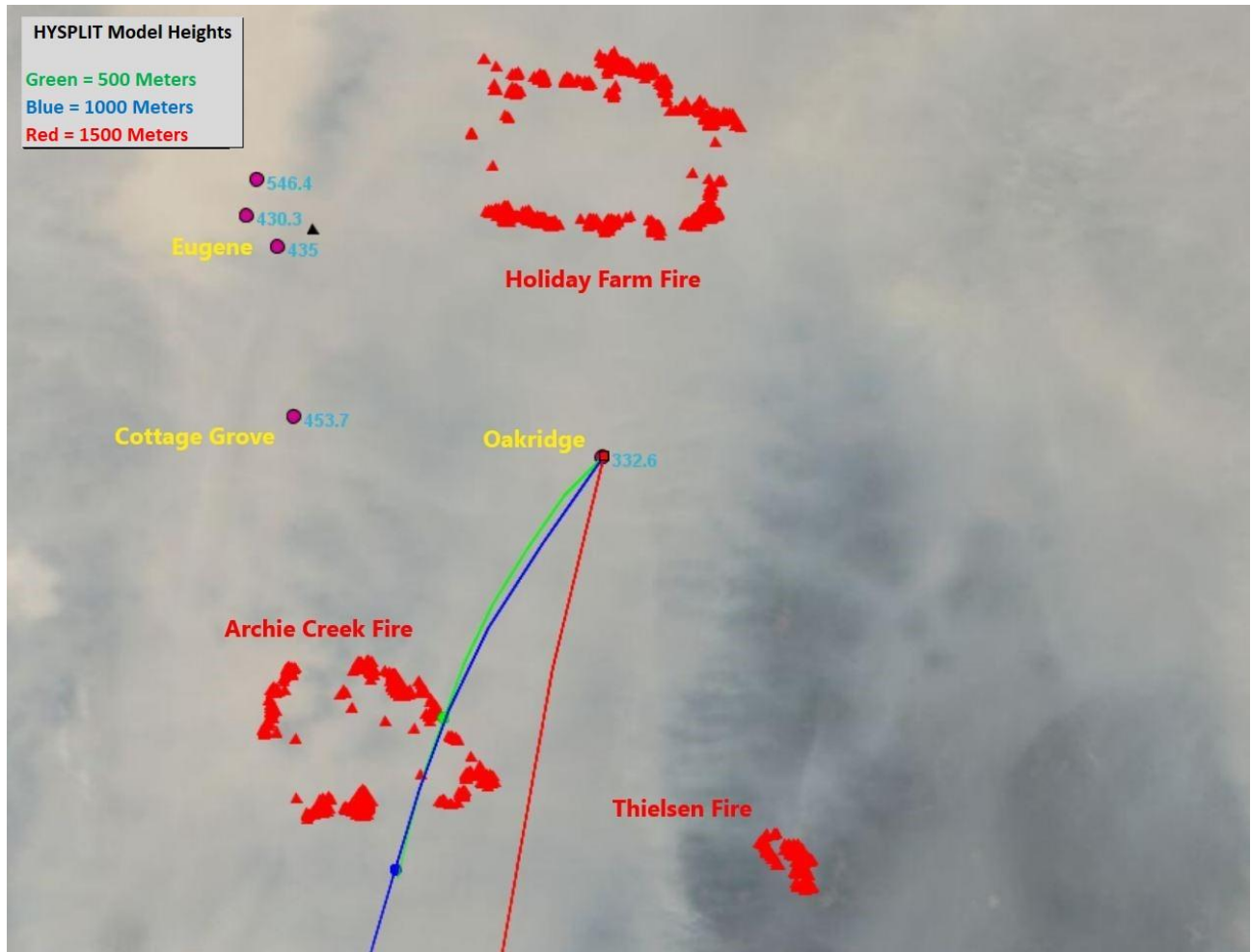


Figure 18. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/13/2020



**Figure 19. Time Series, 9/14/2020**

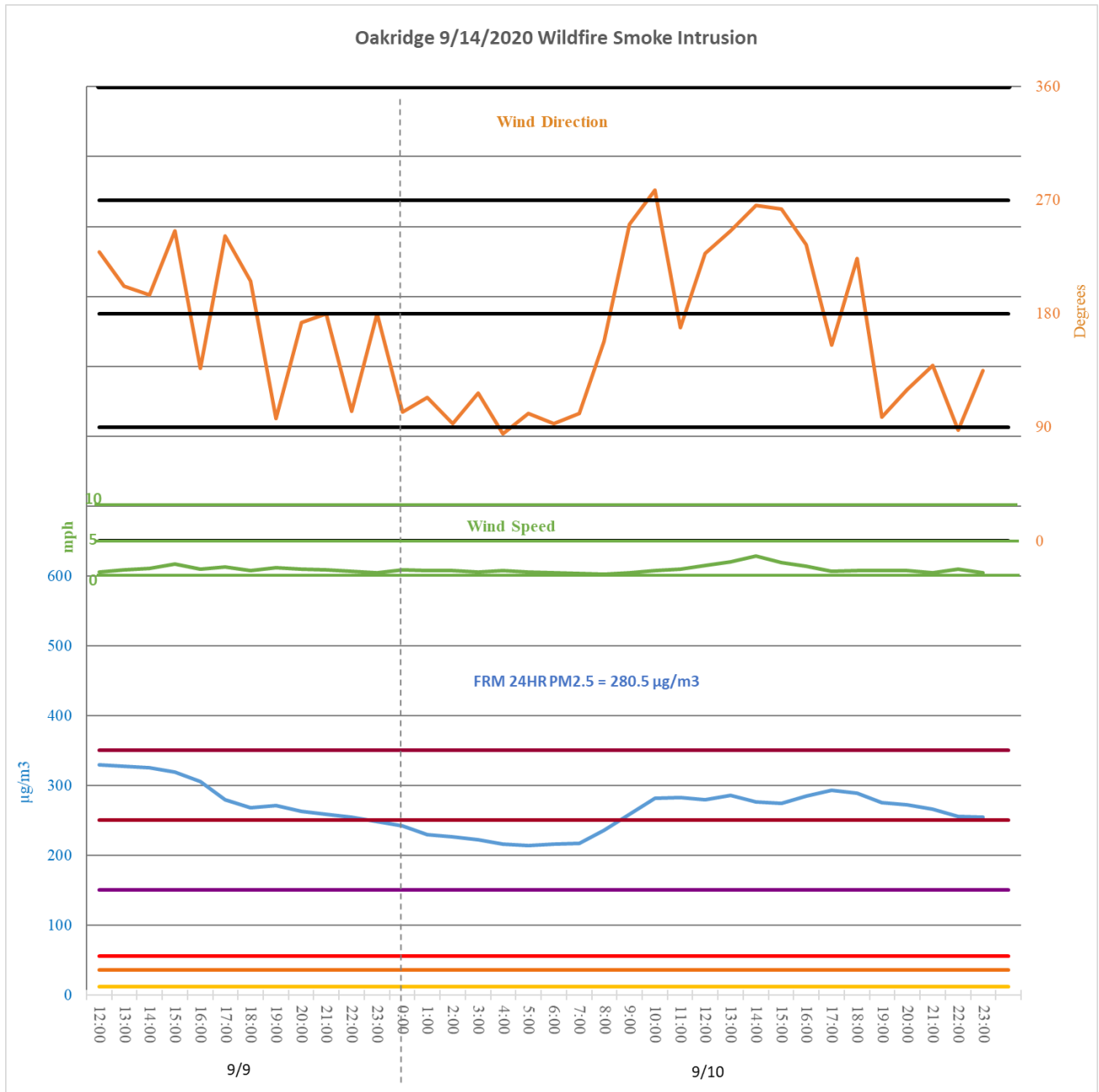
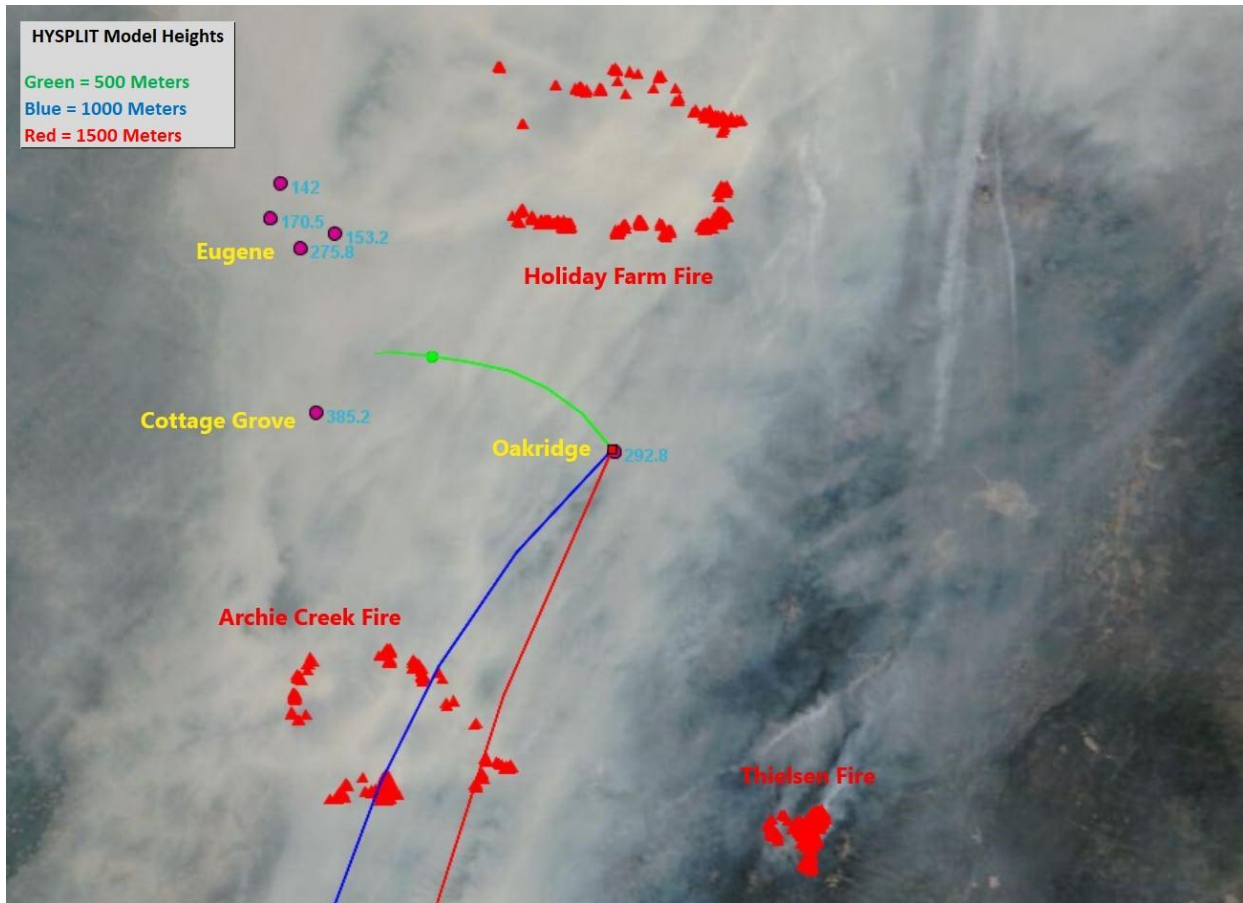
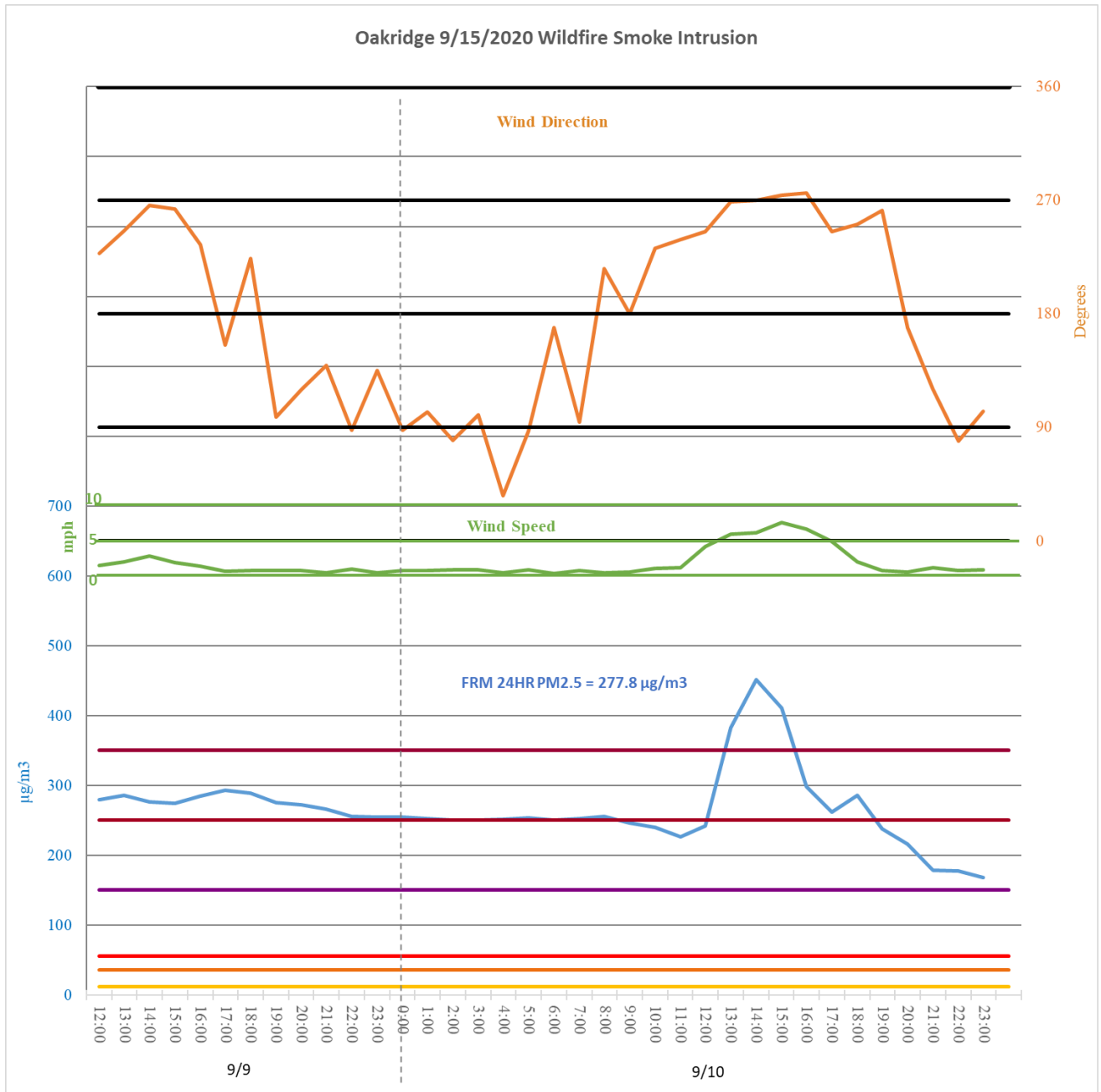


Figure 20. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/14/2020

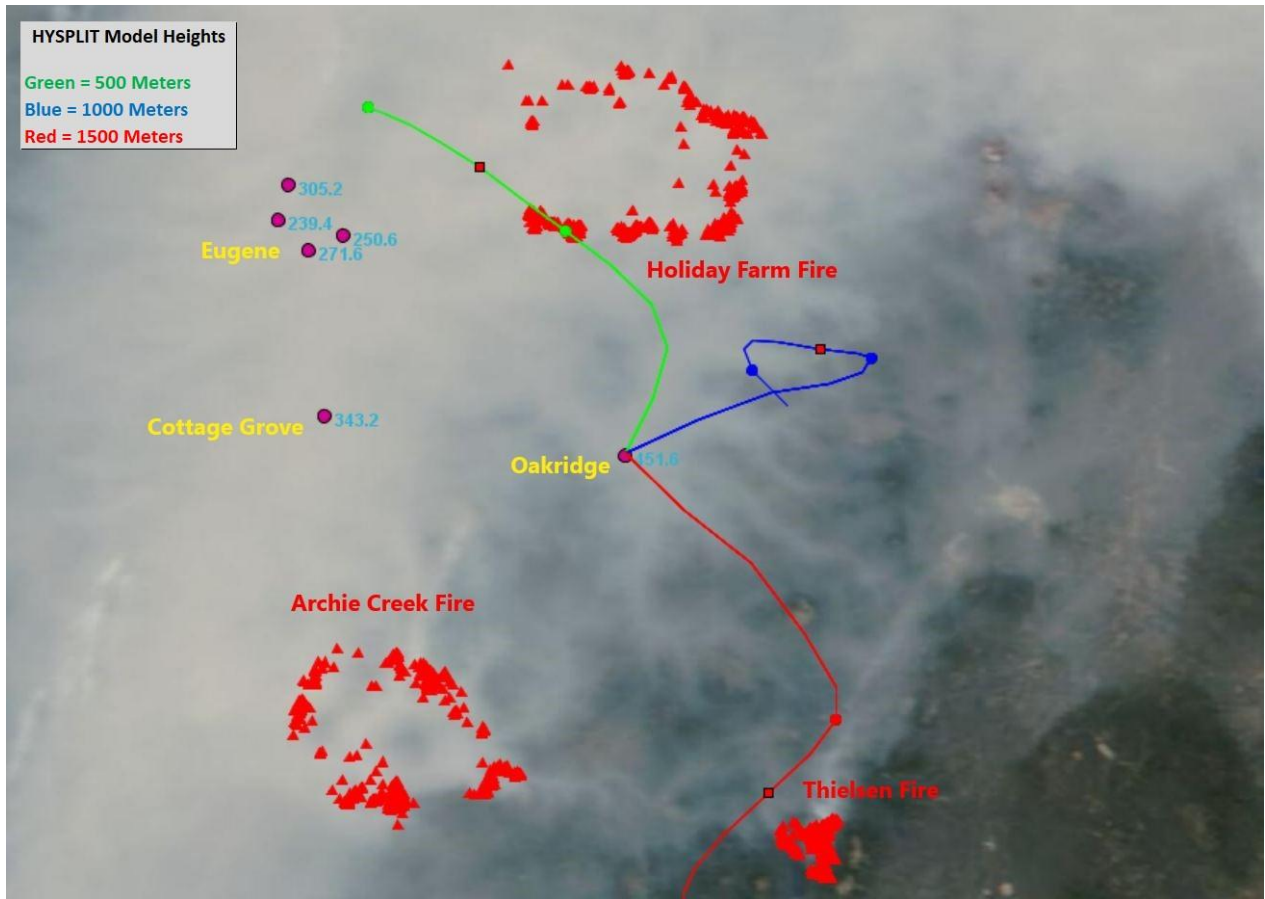


**Figure 21. Time Series, 9/15/2020**





**Figure 22. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/15/2020**



**Figure 23. Time Series, 9/16/2020**

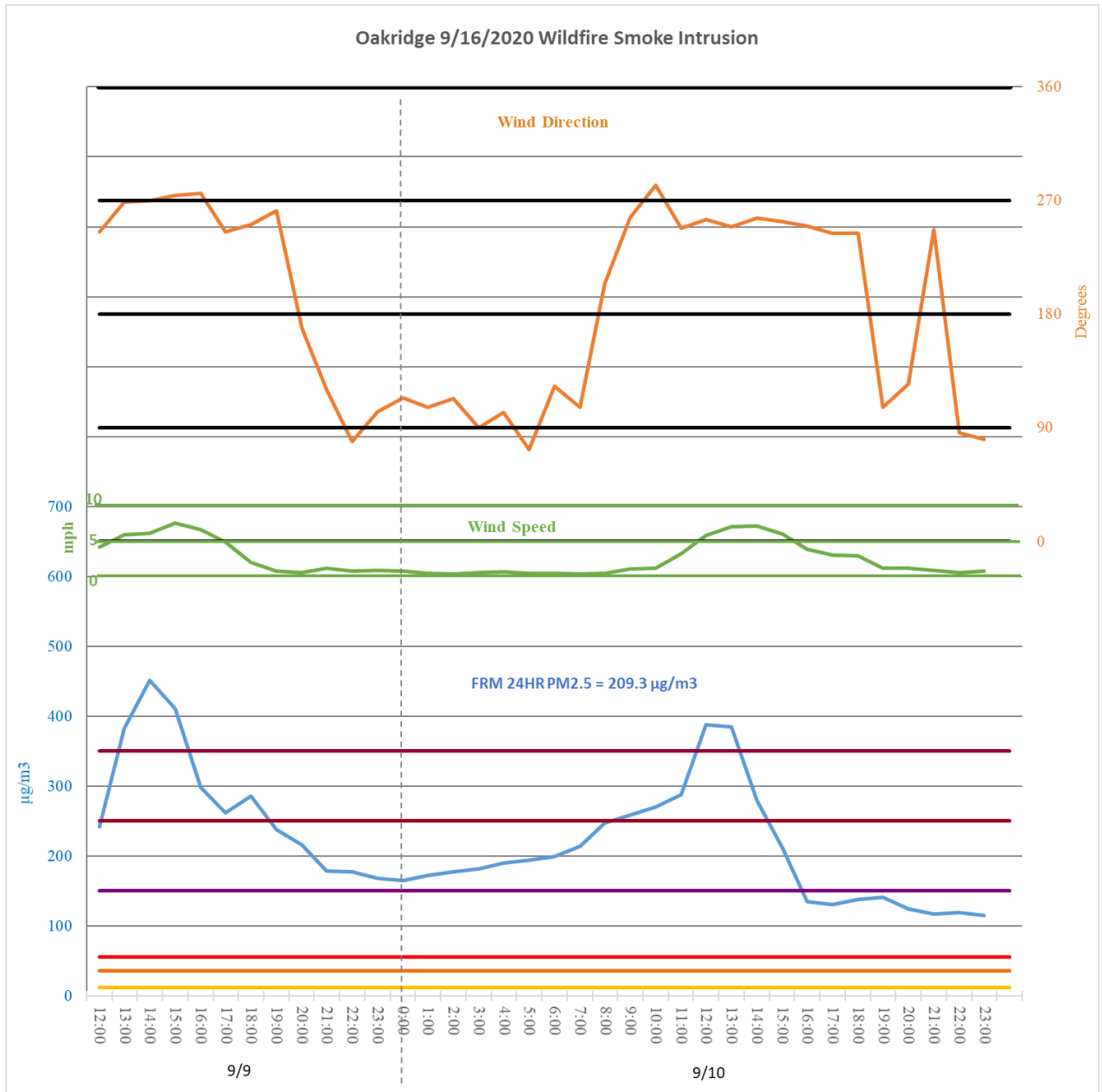
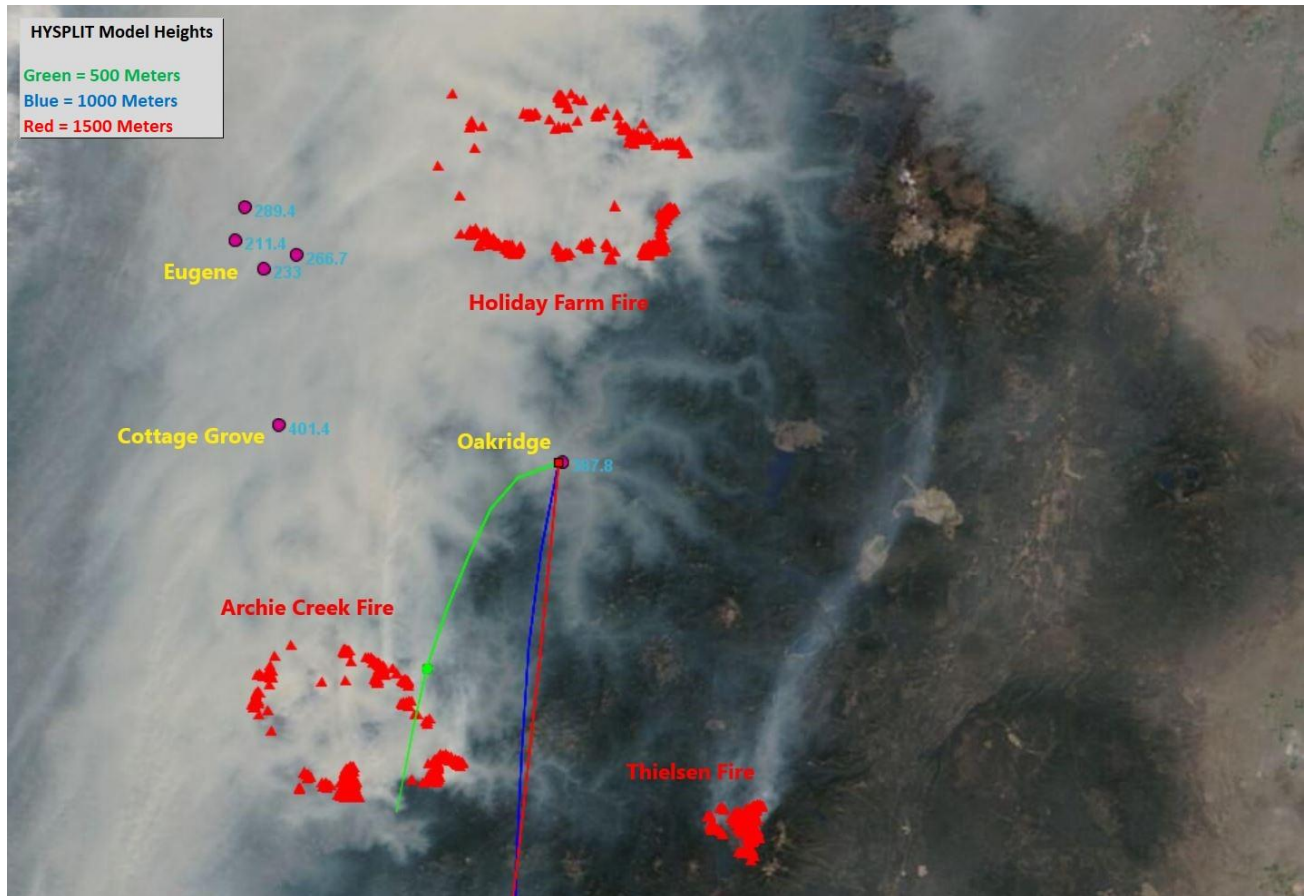


Figure 24. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/16/2020



**Figure 25. Time Series, 9/17/2020**

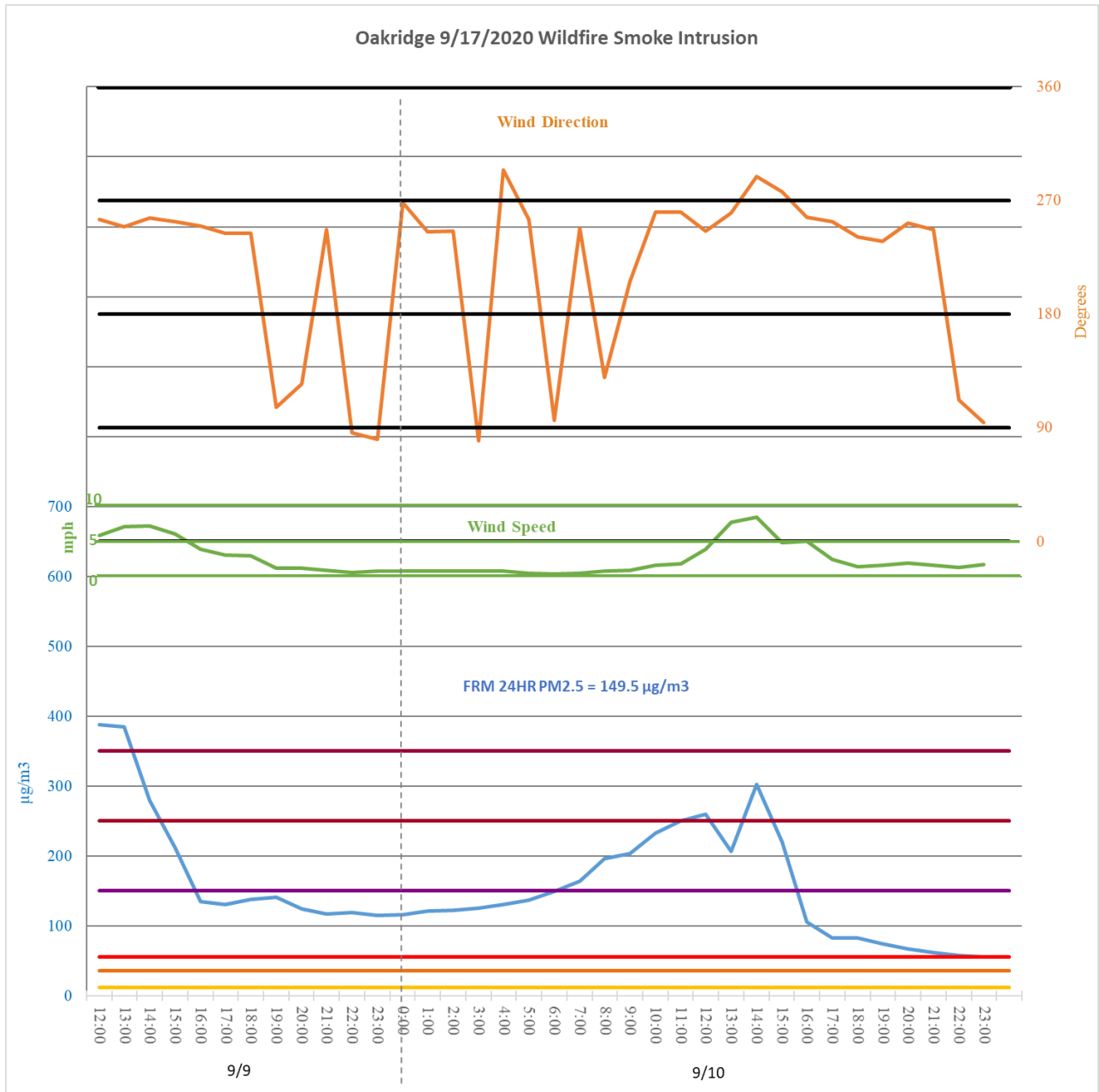


Figure 26. Satellite Smoke and back trajectory HYSPLIT Model Image, 9/17/2020

