Vehicle Inspection Program

Cost Effectiveness Analysis

Oregon DEQ
700 NE Multnomah St.
Suite 600
Portland, OR 97232
Phone: 503-229-5696

www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

State of Oregon
Department of Environmental Quality

This report prepared by:

Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232
1-800-452-4011
www.oregon.gov/deq

Contact:
Matthew Davis, Senior Legislative Analyst
503-229-5687
Davis.matthew@deq.state.or.us

Ali Mirzakhalili, Air Quality Division Administrator
503-229-5041
Mirzakhalili.ali@deq.state.or.us

Michael Skorupka, Vehicle Inspection Program Manager
971-673-1638
Skorupka.michael@deq.state.or.us

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Executive Summary

The Vehicle Inspection Program (VIP), which began in the Portland area in 1975 and in the Medford area in 1986, is Oregon's cornerstone strategy for reducing emissions from the number one source of air pollution: cars and trucks. While today's vehicles are *manufactured* to burn less fuel and burn that fuel cleaner, those improvements rely on the regular maintenance of engines and onboard emissions control systems. As vehicles age, maintenance becomes more and more important. Ensuring that regular maintenance is the primary purpose of VIP.

The program, which is entirely fee-funded, operates seven Clean Air Stations; one in Medford and six in the Portland-metro area. In addition to visiting a Clean Air Station, motorists and fleet-operators can use innovative test methods such as Mobile/Fleet testing or DEQ Too™, a new public-private partnership that allows motorists to test their vehicle at convenient locations such as gas stations or service repair shops.

The program benefits Oregon in several important ways:

- Reducing pollution from vehicles helps keep Oregonians healthy, especially children and people with respiratory problems. High concentrations of pollution from vehicles are associated with health problems including asthma attacks, increased risk of heart attacks and premature death.
- Reducing vehicle emissions is a core part of Oregon's State Implementation Plan (SIP). The SIP is Oregon's federally approved strategy for meeting Clean Air Act requirements and federal air quality standards. If Oregon had no VIP, it would need to impose more stringent standards on other sources of pollution, including industrial sources.
- Reducing vehicle emissions ensures that Oregon remains in compliance with the federal air quality standard for ozone, one of six pollutants called "criteria" pollutants. Preventing violations of federal air quality standards is essential to maintaining the health and economic vitality of communities. Failure to meet the federal air quality standards triggers mandatory sanctions including the loss of federal highway funds.

In advance of proposing a fee increase to the Environmental Quality Commission, DEQ has completed a compressive review of the program, its impact, its current staffing levels and budget, and an analysis of alternative program delivery options. The review found that VIP remains both a <u>cost-effective</u> and <u>efficient</u> approach to reducing emissions from motor vehicles. Specific findings include:

- Approximately 1 in 4 cars (25%) are being serviced in the three months between receiving their registration renewal notice and visiting a Clean Air Station. This indicates that the program is effective at capturing and resolving maintenance problems that might otherwise not get resolved or addressed in a timely way.
- In the Portland-area, VIP is responsible for a 10-20% reduction in on-road emissions of criteria and hazardous air pollutants.
- Over 80,000 customer surveys indicate a positive experience with VIP visits 97% of the time.
- The program has not adjusted fees in over 20 years. While a series of innovations has allowed the program to maintain and improve the staff-to-test ratio, a failure to restore 8 recently eliminated positions will seriously jeopardize the effectiveness and quality of the program.
- An analysis of alternative service delivery models, including decentralization (i.e. privatization) found that customers receiving testing services from privatized test programs pay on average triple the fees paid by their centralized (public) station counterparts. This is despite the fact that privatized programs do not experience the same labor constraints in the form of pay for inspectors, as do public entities.

- Oregon's fee, including the proposed increase, remains among the lowest in the nation, particularly given the unique features of Oregon's program (entirely fee-funded, free re-testing, innovative test options and on-site DMV renewal registration).

For these reasons, DEQ recommends that, in accordance with ORS 468A.370 and ORS 468A.400, the Environmental Quality Commission find that the Vehicle Inspection program, including the proposed 2020 fee increase, is the most cost effective program consistent with Clean Air Act requirements.

Introduction

When Oregon began implementing requirements of the federal Clean Air Act, in the 1970s and 1980s, air quality in the Portland and Medford areas of the state did not meet federal standards for ozone and carbon monoxide. In response to the poor air quality, the Department of Environmental Quality (DEQ) was required to develop plans to reduce these pollutants. Once the areas were attaining standards, DEQ had to submit plans to US Environmental Protection Agency (EPA) that described how Oregon's pollution control strategies would ensure that the Portland and Medford areas would stay in compliance with air quality standards.

Some of the same air quality challenges persist today. Concentrations of ground-level ozone are on the rise. Both the Portland-metro and Rogue Valley areas have experienced unhealthy levels of ozone for the past three summers. Emissions from cars are responsible for the majority of the pollution that causes ozone in Oregon.

To address the leading cause of pollution, Oregon operates a biennial vehicle emissions testing program in the Portland and Medford areas. Vehicles registered within the two testing boundaries must pass an emissions test in order to be (re)registered with the Oregon Department of Transportation, Driver and Motor Vehicle Services (DMV). Vehicles 1995 and older receive a tailpipe emissions test, while cars 1996 and newer are tested through their On-Board Diagnostics (OBD) system.

This report describes the Vehicle Inspection Program (VIP) operation and service delivery model, inventories past and current efforts to improve efficiency and customer experience, provides the budget justification and rationale for a proposed fee increase, and summarizes the results of four recent analyses:

1. A review of all test types and trending that has occurred since 2007, and projected forward;
2. An inventory of past and current efforts to improve the efficiency of Oregon VIP;
3. A comprehensive analysis of the air quality benefits attributable to VIP; and
4. An assessment of alternative service delivery models.

Collectively, this information forms the basis for a cost-effectiveness determination required to be made by the Environmental Quality Commission pursuant to ORS 468A.370 and ORS 468A.400.

Vehicle Inspection Program Operations and Service Delivery

VIP operates seven Clean Air Stations, one in Medford and six in the Portland-metro area. The program tests nearly one third (1.3 million vehicles) of all registered vehicles in the state of Oregon. Vehicles 4 years old or newer are exempt from testing in both areas. In the Portland-metro area, vehicles 1975 and newer are required to test. In Medford, vehicles 20 years old or less are required to test. A more expansive test window is required in the Portland-metro area to achieve the necessary emission reductions.

In addition to the Clean Air Stations, the program maintains an administrative office in the Portland-metro area that houses maintenance staff, information technology staff, business operations staff, administrative support staff, as well as the program manager. These staff not only ensure the entire program has what it needs to operate on a day-to-day basis; they also ensure improvements are implemented and maintain working relationships with DEQ's headquarters, DMV and other operations partners.

Recent program operational statistics for calendar year 2018 are included in Figure 1 below. As noted, the VIP performs more than 680,000 annual inspections at its seven testing stations, resulting in the issuance of over 570,000 certificates of compliance after vehicles secure passing test results. Additionally, because of the VIP's innovative partnership with the DMV, more than 365,000 annual customers also receive their registration stickers directly from staff at a VIP test station.

Figure 1 – 2018 VIP Station Operations and Staffing

VIP 2018 Station Operations & Staffing						
	Tests	**Certs**	**Basic**	**OBD**	**SS-OBD**	**Staff (2019)**
Sunset	143,877	125,692	13,859	74,284	55,396	14
Clackamas	128,958	110,735	17,221	91,897	19,600	14
Gresham	108,466	89,417	13,856	58,613	35,738	13
NE and Scappoose	111,334	95,008	13,950	56,201	40,655	12
Sherwood	95,597	84,896	9,261	65,812	20,396	11
Medford	59,207	50,915	2,290	56,845		6
T/C Admin.	441	441	14	427		20
DEQ Too	26,328	15,685				N/A*
Mobile	7,452	5,706		7,442		N/A**
Totals	681,660	578,495	70,451	411,521	171,785	90

(*) Staff for DEQ Too included in T/C Admin.

(**) Staff for Mobile included in Gresham Station

The VIP, as a large volume, customer-facing operation, continually adjusts to meet increasing vehicle-testing demands and evolving customer preferences. Figure 1 includes statistics, by station or other test type, for the following ways in which the program conducts its vehicle testing:

- *Basic Tests:* These tests, also referred to as "tailpipe" tests, are used for older vehicles, generally those manufactured before 1996, that do not have Onboard Diagnostic Systems.

- *OBD Tests*: OBD tests, used for newer vehicles, involves the review of data from vehicle computers and an assessment of the effective functioning of vehicle emissions control equipment.
- *Self-Service (SS) OBD Tests:* VIP stations provide for Self-Service tests, with customers primarily completing information screens and with inspection agents assisting in the testing process, as needed. The Self-Service option is limited to vehicles that are eligible for an OBD test.
- *Technical Center (T/C) Administratively Issued Tests:* These tests typically involve Oregon residents temporarily living out of state and submitting test results conducted through a companion program.
- *Mobile Tests:* These tests meet the needs of automobile retailers, which own multiple vehicles and are performed on-site, using the VIP mobile testing van.
- *DEQ Too:* An OBD test remotely administered from a host site. The test results are transmitted to DEQ for review and approval.

In relation to these test types, Appendix 1 depicts the trending of the VIP's primary test types over the last several biennia.

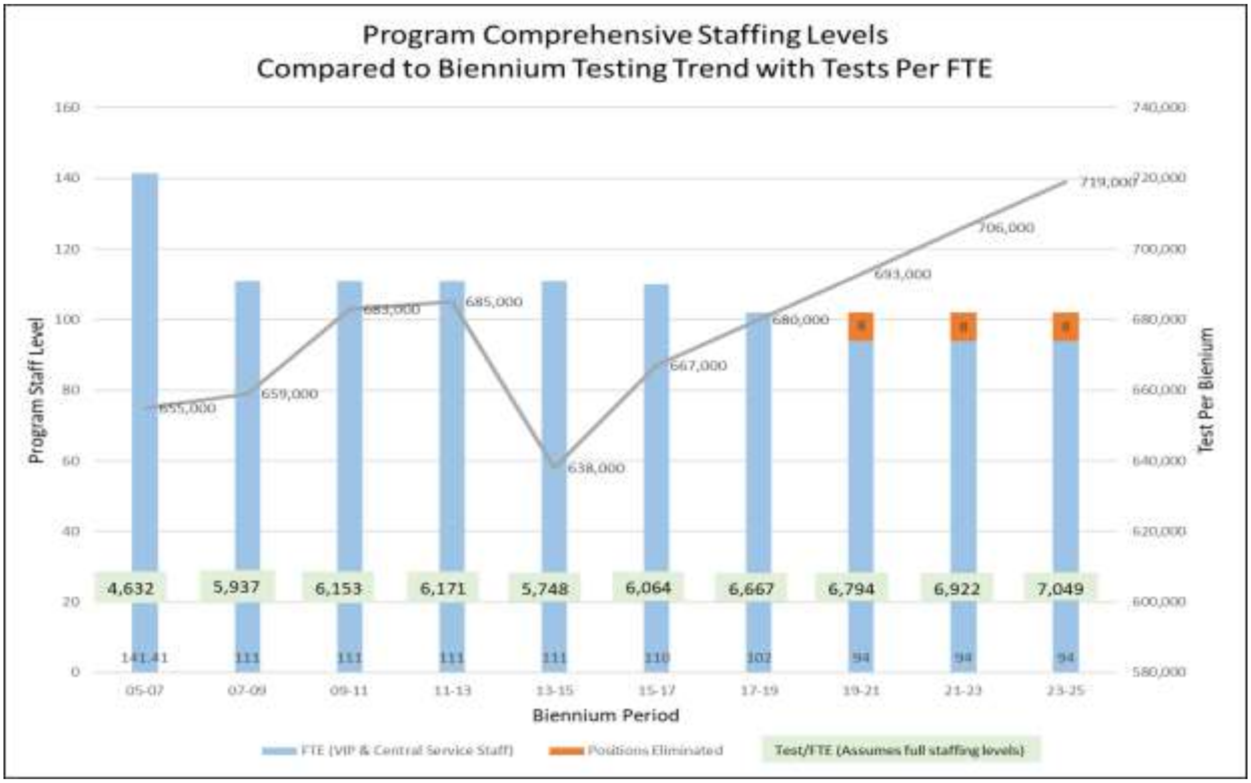
The program overall testing demands are increasing at a rate of approximately 2 percent per year. Several aspects of the program's design and operations, however, enable it to meet these increasing demands, within its existing station footprint and at 2017-2019 resourcing levels. First, as vehicles continue to modernize, the more efficient testing via the OBD systems continues to replace the somewhat more time-intensive tailpipe or basic vehicle tests. Program projections indicate that OBD tests will represent 91-96 percent of the program's test volume over the next three biennia, with basic tests diminishing to less than 4 percent of annual tests.

The VIP uses several additional approaches to assist in the management of its increasing, primarily OBD-based, test volume. These approaches enhance customer choice and present opportunities to most efficiently secure vehicle test certificates. Notably, the VIP is the only program in the U.S. offering remote testing through its partnership with private sector businesses, using a testing approach referred to as "DEQ Too". These tests are achieved through the VIP's network of nearly 200 service providers, and currently represents 4 percent of the program's test volume. Although it is difficult to accurately project the extent to which customers will select this testing option over the next several years, it is expected that DEQ Too tests could represent as much as 10 percent of VIP's test volume by 2025.

The VIP also continues to allow customers to participate more directly in the testing process via each of the stations' 10 self-service lanes. Customer preferences and operational limitations currently restrict the capacity of the self-service testing approach to approximately 25 percent of all test volume. Constraints on further expansion include the ability to use this technology for limited vehicles, and the limited extent to which customers choose to fully participate in the testing process. Collectively, the prevalence of OBD-based testing, the partnership with the private sector through DEQ Too, and the continued use of self-service lane technology, positions the VIP to address continued test volume increases within the current program design, structure and 2017-2019 staffing levels.

While the VIP's operations will remain flexible and its efficiency gains are expected to continue, a foundational level of staffing is required across its seven stations. Figure 2 depicts the total program FTE supporting all station operations over time, relative to the consistently increasing total test volume. The figure also includes the program test volume per FTE ratios for each biennium.

Figure 2 – Program Comprehensive Staffing Levels Compared to Biennium Testing Trend with Tests Per FTE



As reflected, while program staffing levels are expected to remain relatively static over the next three biennia, a modest but continued increase in testing demands is expected. More significantly, it is important to note that the program is currently operating at its highest-ever test volume to FTE ratio of 6794 tests per FTE per biennium. This ratio, a primary indicator of continually improving program efficiencies, is projected to continue to increase over the next three biennia, potentially reaching a ratio of over 7000 tests per FTE per biennium. Therefore, even with continued efficiency gains assumed, the restored staffing levels are required to meet the needs of the current and future test volume.

A failure to restore staffing to 2017-19 levels will hinder the ability of the program to operate stations at full capacity and will directly contribute to longer wait times, among other customer service issues. This reality is no different at the station level. VIP allocates its limited staff to the stations it operates as reflected in Figure 1. Already today, the program is in the position of making daily decisions regarding the deployment of staff resources. In response to unexpected leave, for example, employees are forced to drive to alternate work locations to ensure a minimum staffing level is achieved. Similarly, if one station receives an atypical uptick in customers seeking tests, inspectors need to be shifted from one base station to another. For this reason, the high test to staff ratios occur both in the aggregate, and at each of the VIP test stations. An elimination of 8 positions would represent up to a 15% decrease in inspector positions, reducing the program's FTE base beyond what is workable in the near or long term.

A failure to restore the 8 positions will also hinder the program's ability to fully implement DEQ Too, expand the availability of self-service lanes and explore additional innovations in testing. Resourcing for these program elements is necessary to maintain current service levels and to keep pace with increasing test volumes.

The eight positions highlighted in the 2017-2019 biennia were recently eliminated from the VIPs budget. But, current VIP inspector vacancies, including these positions, remain filled through a combination of limited duration and temporary staff positions. Therefore, Figure 2 denotes current and future tests per FTE assuming that the 8 positions at issue are *not* eliminated. It remains particularly important to keep these positions in place going forward for the reasons described above. It follows then that these staff can remain in place only if fees increase.

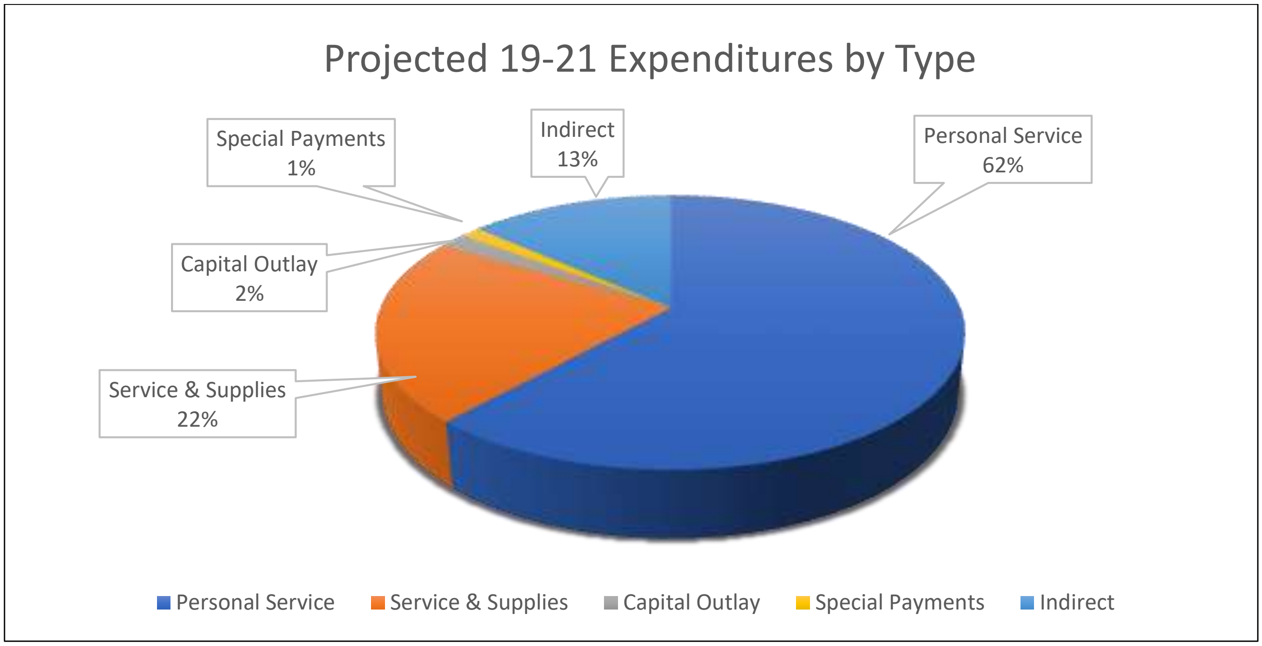
Program Budget

Program funding is entirely 'Other Funds,' i.e. the fees collected for the issuance of certificates of compliance. The program charges a fee (currently $21 in Portland and $10 in Medford) for the issuance of certificates of compliance. The program does not charge a fee for the test. In other words, motorists are only charged when their vehicle passes the test and a certificate is issued. If the program charged on a per-test basis, the weighted average fee following the increase would be closer to $20. Fees were last updated in 1997.

The fee disparity between Portland and Medford is attributable to a period in the late 1990s and early 2000s when the program employed an enhanced (and consequently more expensive) test method in the Portland area. That test method required additional staff resources. Since that time both areas have transitioned to OBD testing.

Figure 3 illustrates the current program biennial expenses of $27,841,888. Biennial expenditures include $17,168,679 in Personal Service expenses, $6,100,448 in Services and Supplies, $3,725,603 in Indirect Expenses and a small amount of expense attributable to Special Payments and Capital Outlay. The primary cost drivers for the VIP are personnel expenses and, to a lesser extent, the costs associated with the maintenance of seven testing stations. On a biennia over biennia basis, Personal Service costs increase due to factors beyond the control of VIP. These factors include adjustments to the agency's indirect rate and inflation in the costs of public employee benefits.

Figure 3 – Projected 2019 – 2021 Expenditures by Type



The primary reason the program has sustained for over twenty years without a fee increase is due to a culture of innovation and continuous improvement. In addition to leading the nation in adoption of OBD testing, the program has developed a remote fleet testing program and a public-private partnership known as DEQ Too. Appendix 2 provides a comprehensive inventory of past and current efforts to increase efficiency and the quality of the customer experience.

DEQ proposes an increase in fees as follows:

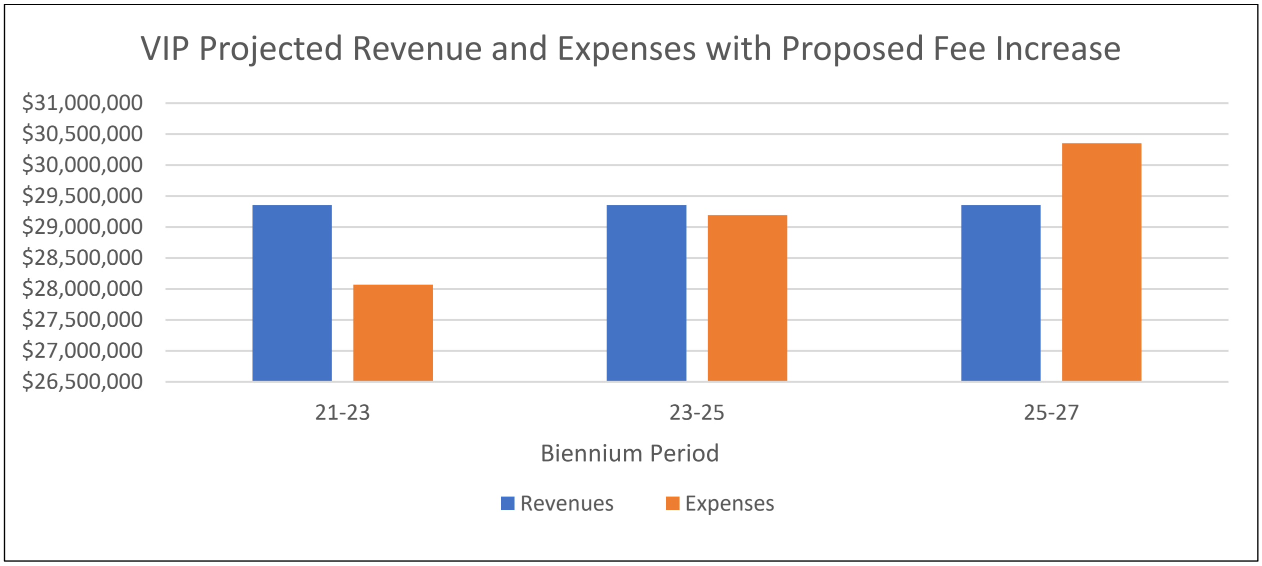
Portland-area	Effective no earlier than April 1 2020, the $21 fee would be adjusted upward to $25
Rogue Valley (Medford)	• Effective no earlier than April 1 2020, the $10 fee would be adjusted upward to $15 • Effective July 1 2021, the $15 fee would be adjusted upward to $20.

Additionally, the mobile fleet testing fee is proposed to increase from $26 to $30. Medford station fees are proposed to freeze at $20 in the near term to maintain an appropriate differential between Portland area and Medford area station fees. This differential aligns with the varying cost structures between the two areas of the state and an interest in phasing in the Medford fee increase at a steady and predictable pace.

The proposed fee increase is necessary to provide sufficient revenue to restore the 8 eliminated positions and balance the budget for the subsequent three biennia. As illustrated in Figure 4, over the next three biennia, the projected net revenues are positive in the first two biennia, turning negative in the 2025-2027 biennia, as projected expenses outpace the modest fee increase (See below). The projected net revenue surplus, while largely limited to the approximate $1.2M surplus in the 2021-2023 biennium and existing fund balance, is projected to carry the program through the projected deficit in the 2025-2027 biennium.

Therefore, the additional revenues derived from the projected fee increase should adequately support the program over the next three biennia.

Figure 4 – VIP Projected Revenue and Expenses with Proposed Fee Increase



It will be important in the future, however, for the program to make adjustments to fees commensurate with inflation, as is more typical for a fee-funded program of this type. Here, the VIP in partnership with stakeholders and the legislature, will explore approaches that provide for future fee adjustments.

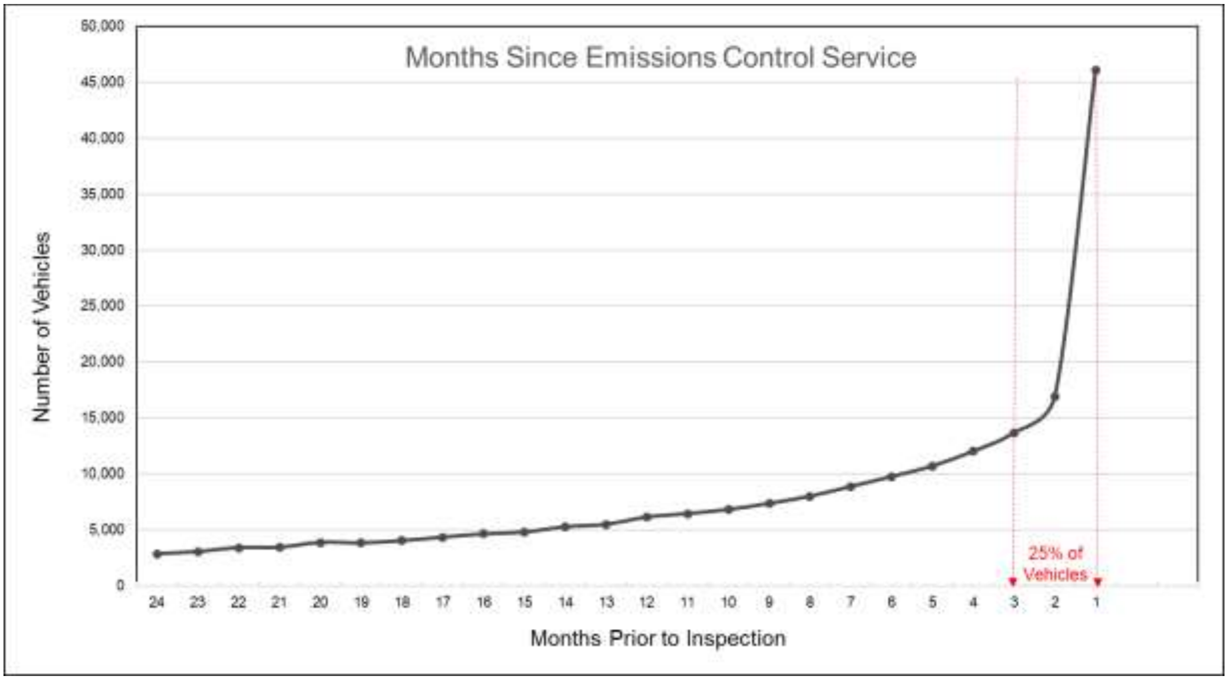
Air Quality Benefits

DEQ recently completed a comprehensive analysis of the air pollution prevented by operating VIP in the Portland and Medford airsheds. This analysis (Appendix 3) demonstrates that the program continues to be an effective strategy at reducing vehicle emissions and associated pollutants.

DEQ inspections find that overall, at the time of inspection approximately 6% of vehicles do not have a properly functioning emission control systems. Also, the more miles a vehicle has driven, the more likely it is to have problems with its emission control equipment.

That being said, the primary purpose, and benefit, of the program is not in identifying vehicles that fail the test. Rather the program is focused on ensuring regular maintenance of vehicles *before* they are tested. To measure this outcome, DEQ reviews data on when a vehicle's OBD codes were most recently cleared. The clearing of OBD codes is an indication the vehicle was serviced. Figure 5 shows that 1 in 4 (25%) of vehicles have codes cleared (i.e. repaired) in the three months between receiving their registration renewal notice and visiting a clean air station.

Figure 5 – Months Since Emissions Control Service



An additional finding of the analysis is that on-road emissions of pollutants would increase 7 to 20% if the vehicle inspection program were not operating in Portland, and 5 to 8% if the program were not operating in Medford. The increases in Medford are proportionately less given the fleet we test in Medford is younger, with fewer miles on the emission control systems. Reducing emissions, particularly precursors to ozone formation, is critical to *preventing* violations of federal clean air standards and a subsequent nonattainment designation. This holds particularly true in recent years as we have routinely experienced exceedances of federal standards in both Portland and Medford.

In addition to preventing violations of federal air quality standards, reducing emissions from passenger vehicles also results in fewer emissions of toxic air contaminants. These pollutants, which all form as a result of incomplete combustion, are associated with a variety of health impacts, including:

- Cardiovascular disease (1, 3-Butadiene)
- Increased risk of cancer (1, 3-Butadiene, 15-PAH, Acetaldehyde and Benzene)
- Upper respiratory system irritation (Acrolein and Formaldehyde)
- Adverse developmental and reproductive effects (Benzene)
- Anemia (Benzene and Naphthalene)

Long Term Program Issues

The proposed fee increase can sustain program operations over approximately the next three biennia. During that time, the VIP will continue to evaluate opportunities to evolve and, if needed, modify its service delivery lines. There are several issues the agency will pay close attention to in the coming years.

Bringing DEQ Too to Scale
In 2016 DEQ officially launched DEQ Too, a new approach to service delivery that allows customers to have their vehicle tested at a participating host site. Host sites include auto repair shops, gas stations, and

automobile dealerships, among other business types. The primary goal of the program is to enhance convenience by offering testing locations with business hours that extend beyond the Clean Air Stations. Host sites do not review or approve test results; they transmit vehicle test data remotely to DEQ. Motorists login to the DEQ webpage to review their test results and pay the certificate of compliance fee when appropriate. Host site participation is free of cost from the agency, however host sites are allowed, and often do charge a convenience fee to motorists for the business of administering the test. Those fees are paid to the host sites and are separate from the fee charged by the agency for the review of test results and issuance of certificate of compliance.

Although a state inspector does not administer tests conducted under DEQ Too, the resources needed to develop and now implement this nascent program are significant. They include:

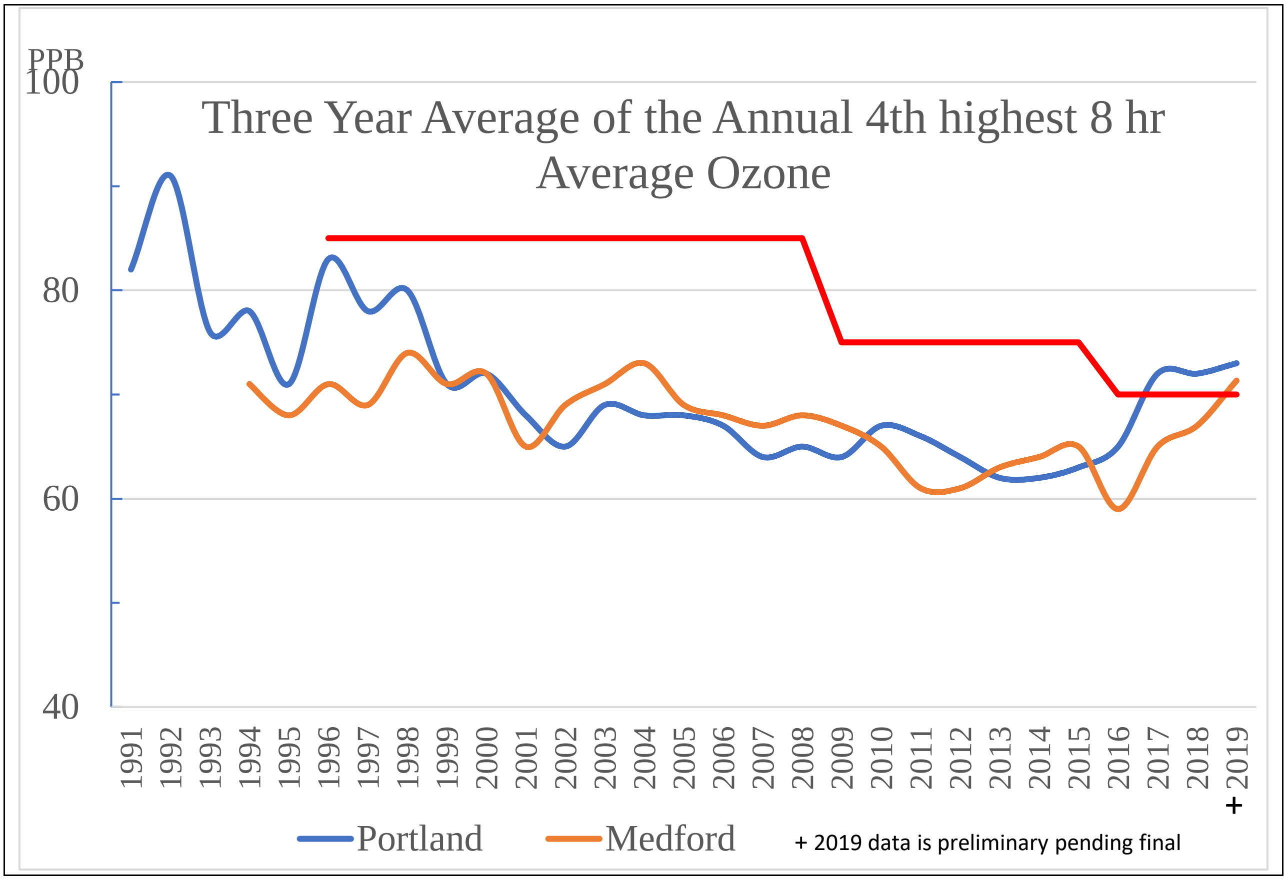
- Information Technology. IT solutions development, vendor selection and oversight, system testing and maintenance, data management, data security and server upgrades.
- Telematics Devices. Development of device specifications, development of telematics provider agreements, and device testing and certification.
- DEQ Too Host Sites. Host site recruitment, development and implementation of host terms and conditions agreements, providing host site technical assistance and ensuring host site oversight and auditing.
- Communications. Developing, implementing and updating DEQ Too communication strategies and tools (webpage, signage agreements, satisfaction surveying and marketing).
- Evaluation and reporting. Annual reporting to the Environmental Protection Agency as required by the federal Clean Air Act, continuous improvement efforts to expand DEQ Too and reconciliation of accounting and other records.

The VIP continues to invest in this unique partnership with the private sector as a critical strategy for enhancing the program cost effectiveness. Long term, VIP intends to evaluate the cost-structure of DEQ Too in hopes of developing a fee structure that aligns with the associated work. In the near term, the annual expenses associated with DEQ Too exceed the associated fee revenue. For this reason, the proposed fee increase maintains that DEQ Too customers pay a fee equal to those who test at a Clean Air Station, with the fee amount being tied to the relevant boundary area.

Air Quality Trends

Most importantly, the DEQ will continue to closely measure ozone concentrations within the Portland and Medford airsheds to ensure the program achieves the required emission reductions. The current federal standard for ozone levels in ambient air is 70 parts per billion. That standard will be evaluated by the US Environmental Protection Agency in 2020 and may be lowered. As reflected in Figure 6, below, the standard is routinely being exceeded in the Portland and Medford areas in recent years. Evidence suggests the level will also exceed the standard in 2019.

Figure 6 – Portland Metro and Medford Area Ozone Trends



These heightened ozone levels have even required the issuance of air quality advisories to protect the health of sensitive groups, including children, the elderly, pregnant women and people with medical conditions. On August 28, 2019, Portland residents were encouraged to take steps to help reduce these levels, including increasing the use of public transportation, avoiding engine idling and other actions involving the use of motor vehicles.

While these incidents do not represent violations of the federal Clean Air Act, each serves as an important reminder that Oregon must remain vigilant in reducing vehicle emissions to avoid a violation of the federal ozone standard in the future. Such a violation could have significant negative impacts on Oregonians if the state was found to be in non-attainment for ozone. A nonattainment designation has the potential to be highly consequential in the following ways:

- Public health impacts. Nonattainment indicates unhealthy levels of pollution, increasing the chances of negative health effects in the community.
- Economic impacts. A nonattainment designation means additional regulation for industry, which can limit the availability of economic development/expansion or new industry investments. The stigma of nonattainment can also dampen interest in economic development in a region.
- Regulatory burdens. A nonattainment designation requires decades of planning and reporting obligations with the Environmental Protection Agency.

- Potential Sanctions. Failure to prepare and submit plans that reduce emissions and bring non-attaining areas back into attainment can trigger mandatory sanctions including loss of federal highway funds.

Evaluation of Alternative Service Models

Appendix 4 details the process and results of a comprehensive analysis of operational models for delivering vehicle inspection services. Oregon currently operates a ‘centralized’ program, meaning it operates a small number of facilities dedicated exclusively to the testing of automobile emissions. However, the addition of DEQ Too means Oregon VIP is effectively a hybrid – the only of its kind in the country.

In order to provide the information necessary for the Environmental Quality Commission to make a cost-effectiveness finding the agency evaluated programs of all types. Key findings from this analysis include:

- The decentralized model (i.e. privatized programs) are charging higher fees in the aggregate. Customers receiving testing services from decentralized test stations pay, on average, triple the fees paid by their centralized station counterparts. This is despite the fact that privatized programs do not experience the same labor or wage constraints as public entities.
- Among centralized programs, Oregon’s VIP’s costs remain competitive relative to like-programs. This holds true even when accounting for the proposed fee increase. Additionally, the $24.59[1] weighted average Oregon post-increase fee overstates the fee relative to like-programs. When the fee is also adjusted to account for the free re-tests performed at Oregon stations, the average fee is reduced to $20.18[2]. The analysis also found that many centralized programs are supplemented with general funds or other funds. This is not the case in Oregon.
- Oregon’s program is the only program in the nation that is offering both self-service testing and a public-private telematic OBD partnership.

In addition to cost, the analysis includes the consideration of efficiency and quality. While DEQ cannot objectively evaluate the quality of other programs, nor can the agency forecast the quality-impact of decentralizing Oregon’s program, we find that the current program is delivering an outstanding and efficient experience for our customers.

VIP offers every customer, no matter when a test is performed, the opportunity to report on their experience via a 10-question comment card. DEQ VIP receives thousands of customer responses annually from this approach. The results reveal that greater than 97% of customers rank DEQ VIP as “good” to “excellent”. The program uses this information to gauge its overall effectiveness, and to identify ongoing opportunities for improvement. Comment cards and results are routinely shared with station managers and staff, and any items of concern or opportunities for improvement are promptly addressed by the program.

In addition to customer satisfaction, the agency monitors wait-time at the stations by scanning vehicles as they enter the station; measuring the time upon completion of the process. Motorists experience an

[1] The weighted average $24.59 fee is based on a $30 mobile fleet testing fee, a $25 Portland fee, and a $20 Medford fee.
[2] This is a result of dividing the total certificate fee revenue by the total number of tests conducted in 2018. Oregon only charges for a certificate and does not charge for a test.

average wait time of approximately 10 minutes and have the benefit of receiving their license plate stickers upon passage – saving a separate trip to a DMV office.

Conclusion

The Vehicle Inspection Program remains a critically important strategy for reducing and preventing pollution from cars and trucks in Oregon. While demand for testing continues to increase, the program has managed to do more with less because of a culture of innovation and continuous improvement. Fees for the issuance of certificates of compliance have not been adjusted in over twenty years. A transition to OBD testing, development of self-service testing lanes and the development of a public-private partnership model allow the program to operate in an extremely efficient manner. While revenue shortfalls have resulted in position eliminations, these changes in the service delivery model have allowed wait times to remain low and customer satisfaction to remain stellar.

However, the program is at a tipping point. Test to staff ratios are now nearing 7,000 tests per biennium and forecasted to increase with the demand on testing. The program requires a minimum level of staffing to provide an efficient and safe testing environment. Without the restoration of 8 positions recently eliminated, the program cannot operate its seven stations at the capacity for which they were designed. This will lead to longer wait times, reducing the cost-effectiveness of the program.

In developing a fee increase proposal that would stabilize the programs finances and allow for the restoration of 8 positions, DEQ evaluated alternative models of service delivery. Through that work, the fees paid by VIP customers, including the proposed increase, were shown to be roughly one-third of the fees paid by customers of the fully privatized programs. Even among the less expensive centralized programs, the Oregon VIP's fees are among the lowest in the nation and its wide range of service offerings is unmatched.

For these reasons, DEQ recommends that in accordance with ORS 468A.370 and ORS 468A.400 the Environmental Quality Commission find that the Vehicle Inspection program, including the proposed 2020 fee increase, is the most cost effective program consistent with Clean Air Act requirements.

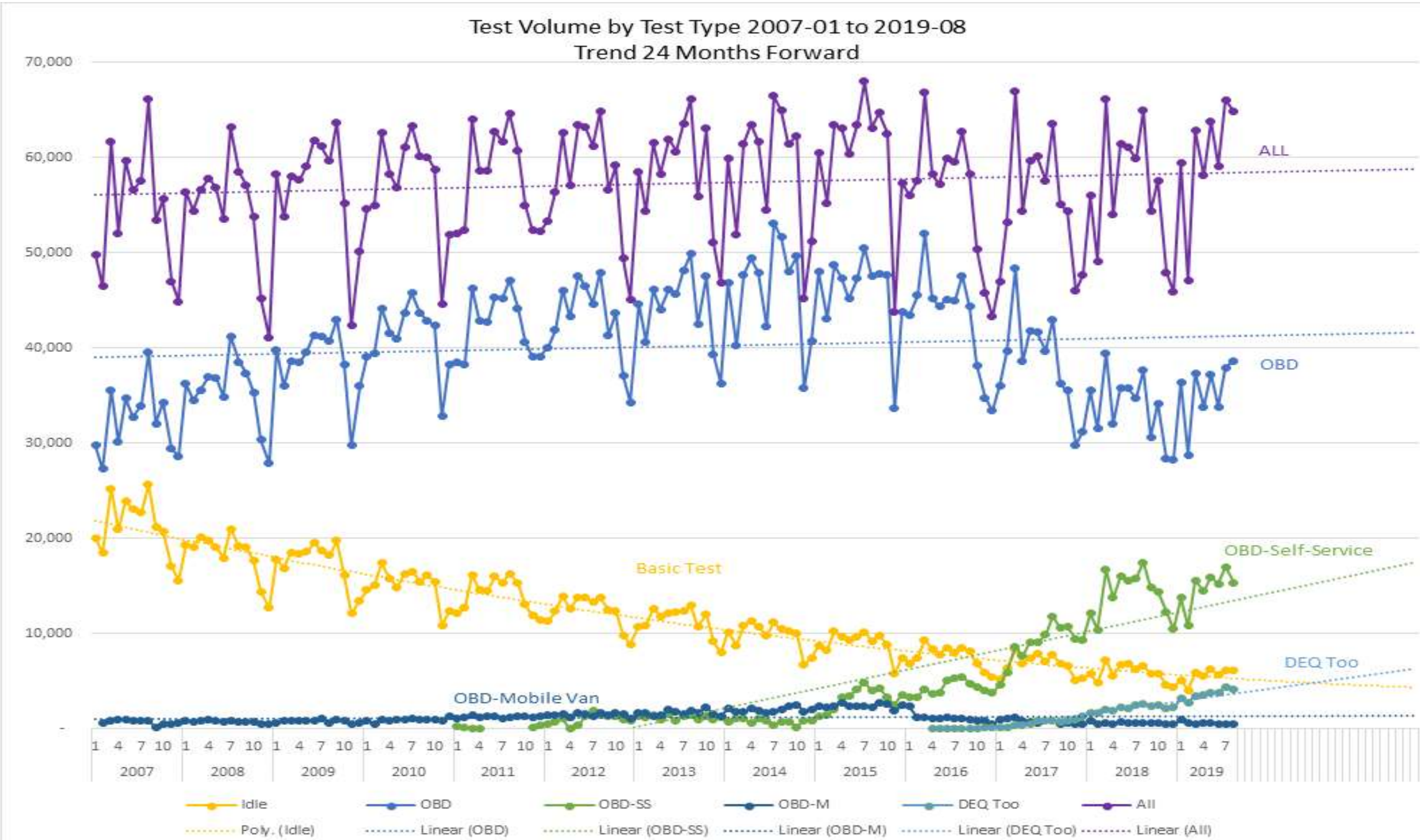
Appendix 1 – Test Volume by Type Graphs

Appendix 2 – Efforts to Increase Efficiency

Appendix 3 – Emissions Inventory Analysis

Appendix 4 – Evaluation of Alternative Service Models

Appendix 1 – Test Volume by Type Graphs



Appendix 2 - Efforts to Improve Efficiency and Customer Experience

VIP has a long history of implementing measures to improve the efficiency and customer experience of the program. These improvements include:

Modernizing test methods: Changes to generally accepted test methods have contributed to vehicle testing industry-wide efficiency gains. Most significantly, the 1990 amendments to the Clean Air Act established the requirement that passenger vehicles be equipped with an OBD system. A vehicle's OBD is designed to trigger a dashboard "check engine" or Malfunction Indicator Light (MIL). This light alerts the driver to a malfunctioning pollution control device. OBD-based testing systems assess whether a vehicle's emission control systems are working as designed. If a vehicle fails an OBD test, repairs to the equipment causing the failure will enable the vehicle to return to compliance, and pass a subsequent test.

Oregon was a national leader in beginning to deploy the OBD testing approach in January 2000. This test is currently available for all vehicles that are 1996 model year and newer, with older model vehicles receiving the prior "basic" or "tailpipe" test. The industry transition to the use of OBD tests is a primary reason that Oregon has been able to maintain its fee structure since 1996. Although testing demands and certain expenses increased during this period, much of the increase was offset through OBD-based efficiencies. For example, staff-deployed OBD tests are generally performed by a single testing agent, or inspector. Prior enhanced tests required the work of two to three inspectors. Therefore, the use of OBD tests has reduced the costs of a typical vehicle inspection, and contributed significantly to overall program cost effectiveness since 2000. The use of OBD tests has, at the same time, improved emission reductions within the VIP program. OBD tests, unlike tailpipe tests, directly address the root cause of a pollution problem[1], with sustained emissions reduction benefits.

Self-service lanes: The nationwide transition to OBD testing also set the stage for Oregon's more recent use of self-service lanes. With many vehicle-testing hazards associated with the prior tailpipe tests now removed, and with other technologies available, Oregon was among the first in the nation to develop self-service lanes. VIP began using its first self-serve lane in 2011. Ten self-service lanes are currently available at five of the program's Portland area stations. At these stations, customers directly participate in the testing process by confirming vehicle information and entering vehicle owner insurance and odometer information at a computer terminal located at each station. Customers who are familiar with the OBD testing port location in their vehicle may also connect their OBD testing equipment. The inspector assigned to the lane provides needed assistance to the customer, confirms the pass or fail results, and completes

[1] The root cause of a pollution problem is a failing system or component which leads to the symptom of elevated emissions.

the transaction. With the benefit of assistance from the customer, one inspector can oversee two self-service stations, giving rise to efficiency gains.

The use of self-service lanes within VIP's service array is in its relative infancy, but shows significant promise. VIP staff and customers are becoming more accustomed to the use of this shared service approach to vehicle testing. Over time, and with the benefit of additional technologies, VIP anticipates that a more fully customer-driven test will be possible. Among the current challenges that VIP is addressing are those related to payment processing technologies and requirements. VIP continues to explore technology and process options and to integrate operational improvements into this and other processes. In the meantime, Oregon VIP stands ahead of many other providers in the industry by realizing efficiency gains through its use of self-service testing.

DEQ Too™: In July 2016 Oregon launched the use of its remote-telematics device program—DEQ Too™—at certain private business locations. The DEQ Too™ program enables testing information to be sent to VIP from customer vehicles located at remote locations, outside of a VIP test station. Test information is currently sent to VIP through devices referred to as "S-type" or "shared telematics" devices. S-type devices are used for brief periods to collect emission data, and are attached to vehicles at a private business. For example, customers may use an S-type device to relay OBD information while receiving an oil change at an approved service provider. The remote test is completed when VIP receives the test information telematically, confirms whether the vehicle passed or failed the test, and the customer completes an on-line transaction to purchase their certificate of compliance and registration tags[2].

Since VIP's initiation of this program in 2016, the program has seen a continued increase in its utilization. VIP has authorized the use of DEQ Too™ technologies at more than 166 business locations, performing 27,658 tests in 2018. Authorized providers include businesses such as auto repair shops and oil change service centers. All DEQ Too™ hosts and other providers must abide by the terms of an Agreement with VIP. The Agreement includes program obligations addressing approved devices, testing protocol, communications with customers, performance of repairs and a variety of measures to ensure the relay of accurate test information.

As with VIP's use of self-service lanes, this newer program has produced early testing successes and continues to be evaluated. Currently, tests performed under the DEQ Too™ program represent only 4.5% of total annual tests performed by VIP. Although this market space appears to hold significant near-term opportunity for growth, the program continues to evaluate additional opportunities for individuals to remotely test their vehicles.

[2] Registration tags are currently sold separately through DMV's online portal, but motorists are directed there through the DEQ Too™ online service.

Mobile/Fleet Testing: VIP continually strives to meet the unique test needs of all vehicle owners, including businesses and automobile retailers who possess large vehicle fleets. As with privately owned personal vehicles, corporate fleets are required to undergo testing following the current four-year initial exemption period, and consistent with the DMV's two-year renewal cycle. Retailers of used automobiles must similarly undergo testing. Given the large number of vehicles held by these entities, VIP offers mobile testing services at the business owner's location. Tests are performed by VIP personnel using a program cargo van outfitted with the needed OBD test equipment. VIP performs approximately 7,500 annual tests using this approach. VIP is also reaching out to fleets and dealers to promote the use of DEQ Too™ as a means of reducing the business burden of complying with the emission test requirement. CarMax, for example, performed almost 4,000 tests in 2018 using DEQ Too™.

Clean Air Partners (CAP) Program: Unlike some state vehicle inspection programs, VIP does not exempt failing vehicles when a minimum amount is spent on repairs. These "repair exemptions," while relatively common in other states, produce lower levels of compliance by leaving more failing and polluting vehicles on the road. VIP recognizes, however, that the absence of such an exemption could negatively impact low-income vehicle owners. For reasons including this, since 2003, VIP has offered subsidized and usually free repair services to low income customers through the CAPs program. VIP collects voluntary donations at its testing locations, and through the United Way and a participating repair facility, the funds cover repair costs for qualified, low-income applicants. The program currently serves more than 100 annual applicants, with funds sufficient to meet the repair needs of qualified applicants.

DMV Service Delivery Partnership: Finally, while efficiency and effectiveness in vehicle emission testing remains VIP's operational focus, the program also plays a critical role in the state's vehicle registration process. In most states, a visit to a state vehicle inspection station must be followed by a visit, in person or on-line, to a state DMV office. In Oregon, however, a partnership between VIP and the DMV enables the registration renewal process to be completed, in most cases, at any of the VIP stations. VIP customers leave the test stations with documentation of their passing emission test, and with license plate registration tags in hand. No fewer than 365,757, or 63% of motorists who received testing services, also renewed their registrations at DEQ VIP in 2018.

Portland-Medford
SIP-VIP Updates Project

Emission Inventory Demonstration
for Air Toxics and Ozone Precursors

Air Quality Division
700 NE Multnomah
Portland, OR 97232
Phone: 503-229-5696
800-452-4011
Fax: 503-229-6124
Contact: Jeffrey Stocum
www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

State of Oregon
Department of Environmental Quality

EXECUTIVE SUMMARY

This report presents results from DEQ's evaluation of several emission control strategies implemented in the Portland and Medford Air Quality Maintenance Areas. DEQ's analysis focused on Portland and Medford because DEQ operates a vehicle inspection and maintenance program in these AQMAs. DEQ analyzed emissions of nationally regulated pollutants, called criteria pollutants, as well as air toxics from multiple sources. DEQ analyzed pollutants from onroad vehicles and nonroad equipment, nonpoint sources, biogenic sources (such as vegetation), events (such as wildfires and prescribed burning) and permitted point sources. The report describes the technical analysis and emission inventory demonstration that DEQ completed to compare current and modified emissions control strategies.

DEQ staff generated the onroad portion of the emission inventory using the EPA Motor Vehicle Emissions Simulator model, called MOVES. For the MOVES runs, Metro Regional Government provided Portland area activity data as Vehicle Miles Traveled and ODOT provided VMT for the Medford area, both for base year 2015. DEQ staff generated 2014 emissions data for gasoline dispensing facilities, residential wood combustion and perchloroethylene dry cleaners. EPA's 2014 National Emissions Inventory (NEI) v.2 was the source of all other inventory data. DEQ staff allocated all emissions to the AQMA boundaries using Geographic Information Systems (GIS).

The emission inventory shows that onroad sources may contribute more than 50 percent of criteria and air toxics pollutant emissions to the Portland and Medford AQMAs. Onroad sources predominantly contribute the criteria emissions, nitrogen oxides (NO_X), carbon monoxide (CO) and volatile organic compounds (VOC). Air toxics prevalent in onroad emissions are ethylbenzene, benzene, 1,3-butadiene and acetaldehyde. Other toxics emitted by onroad sources include 15-PAH, naphthalene, formaldehyde, acrolein and the metals arsenic and hexavalent chromium. Onroad source contribution to total emissions varies by pollutant and ranges from 57 percent and 80 percent of ethylbenzene emitted in the Portland and Medford AQMAs, respectively, to 1 percent of emitted hexavalent chromium in each airshed.

Figures A and B show the contribution by source type to anthropogenic criteria pollutant emissions for the Portland and Medford AQMAs. Figures C and D show results for anthropogenic air toxic emissions. All of the figures are sorted from left to right by highest to lowest onroad contribution to the AQMA.

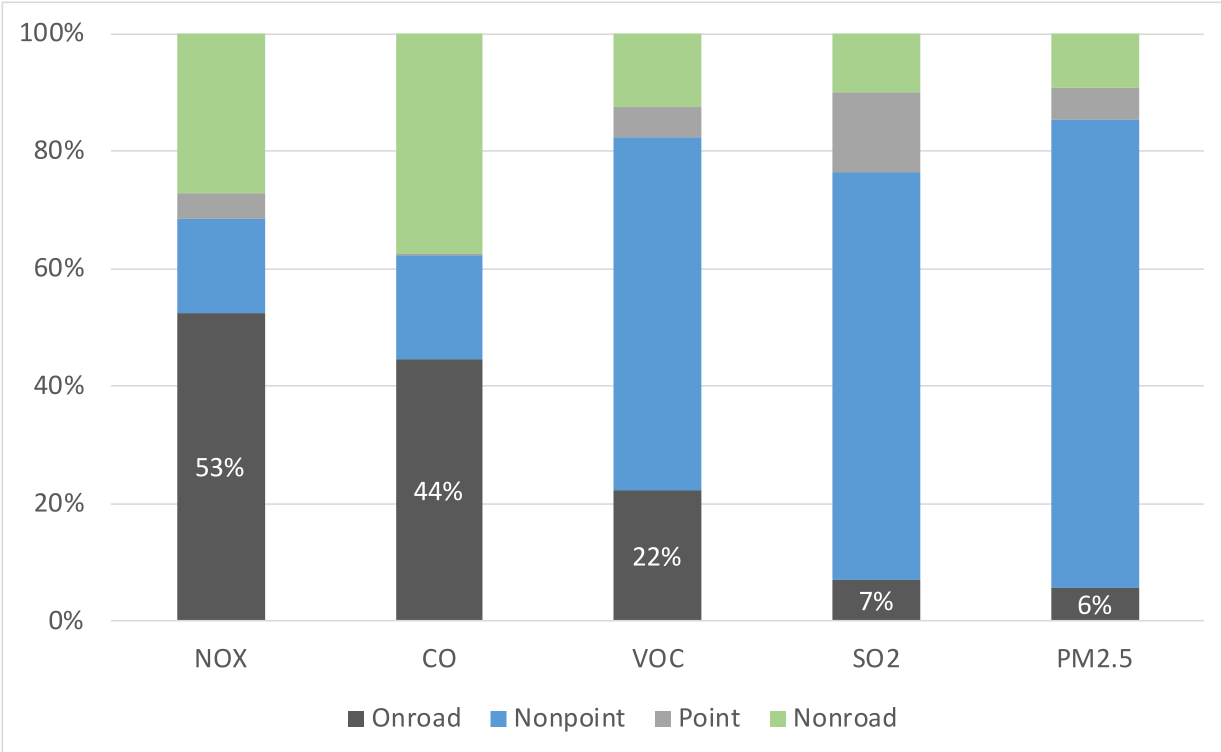


Figure A. Anthropogenic criteria pollutant emissions sources: Portland AQMA

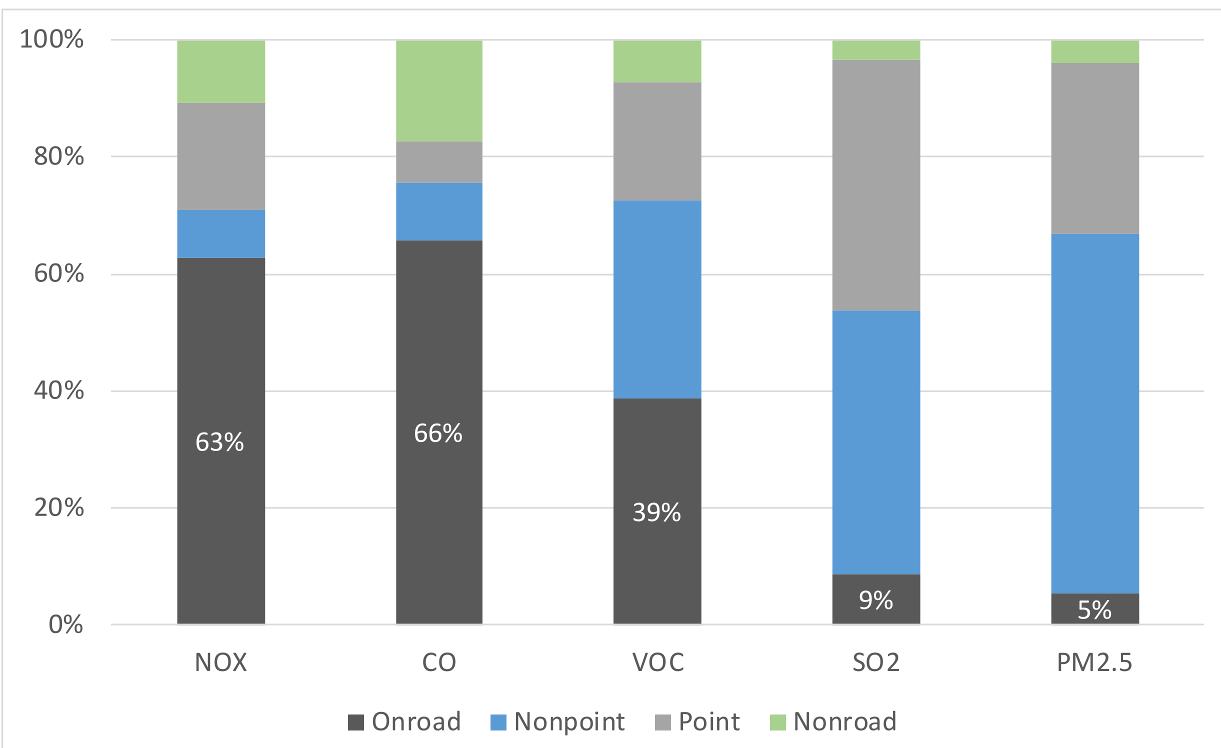


Figure B. Anthropogenic criteria pollutant emission sources: Medford AQMA

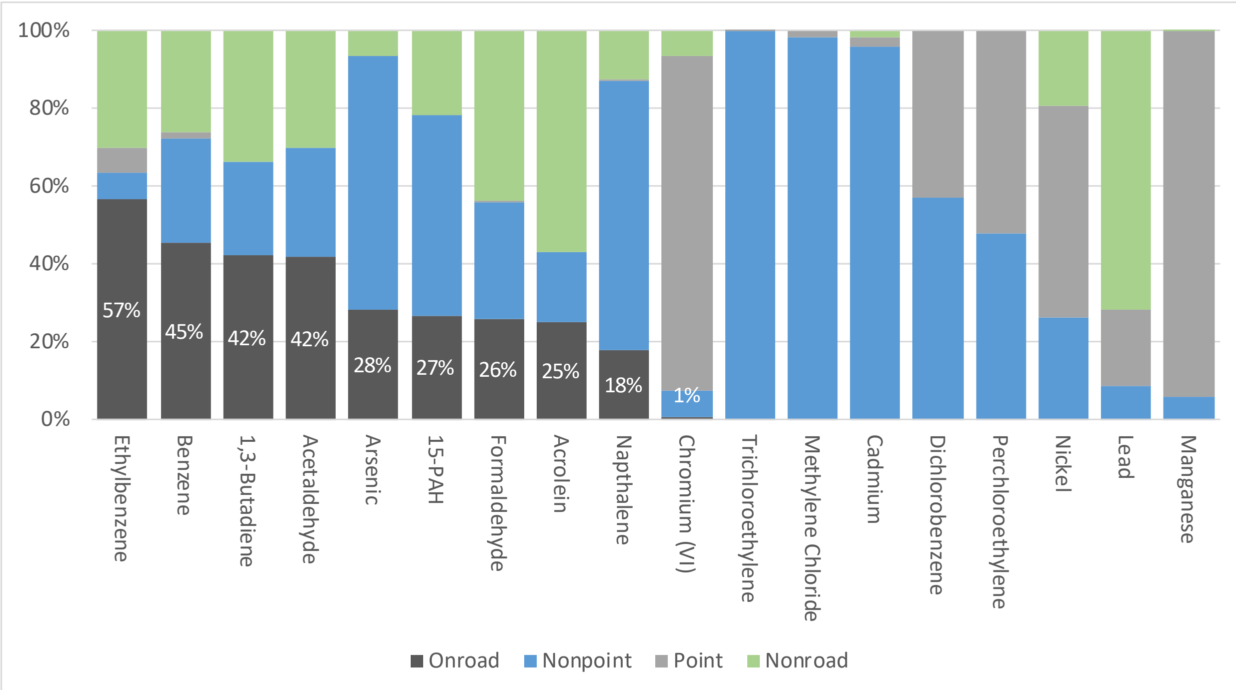


Figure C. Anthropogenic air-toxic pollutant emission sources: Portland AQMA

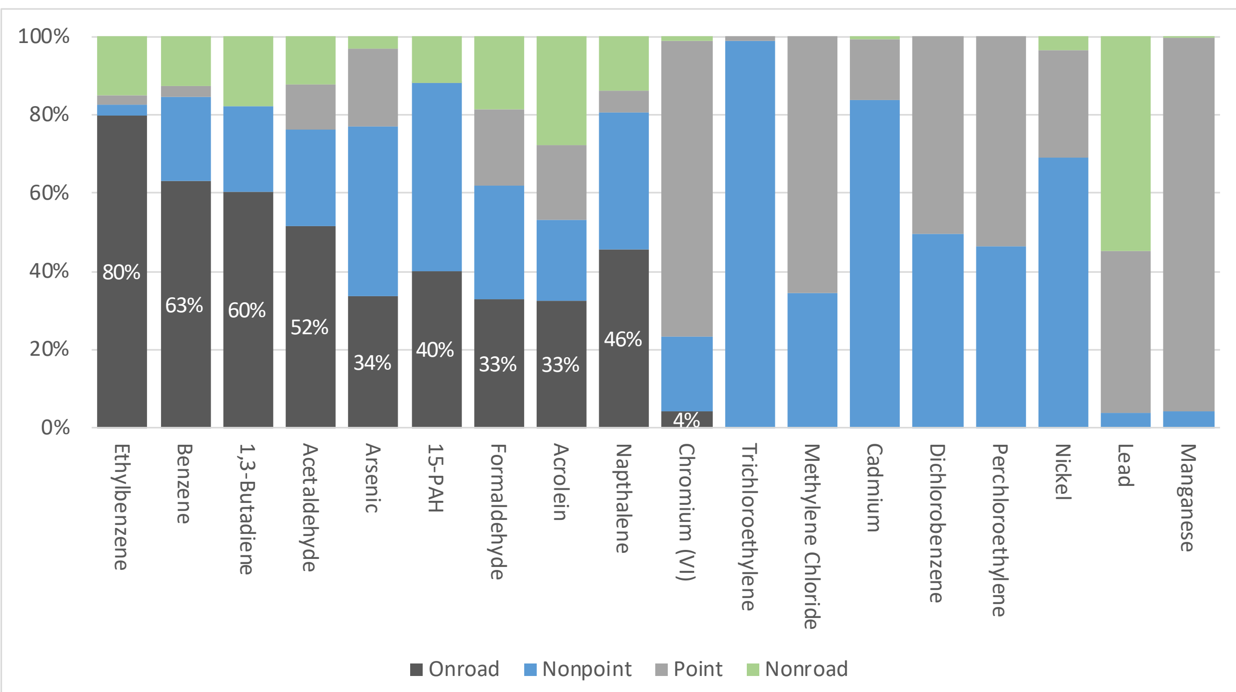


Figure D. Anthropogenic air-toxic pollutant emission sources: Medford AQMA

The purpose of this project was to compare criteria and toxics pollution reduction achievable from each of several control strategies in the Portland and Medford area Ozone and Carbon Monoxide maintenance plans, including a vehicle inspection program, employee commute options, barge loading controls and vapor recovery systems at gasoline dispensing facilities. The ECO Program requires large employers in the Portland area with more than 100 employees reporting to a work site to provide commute options to encourage employees to reduce auto trips to the work site. Vapor recovery, required in the Portland metropolitan area, captures fugitive emissions from gasoline as it is pumped into onroad vehicles. Barge loading controls capture fugitive emissions from gasoline as it is pumped from tank farms in the Portland area into barges for transport up the Columbia River to eastern Oregon.

For the evaluation of pollution reduction from VIP, DEQ analyzed four scenarios:

- Current VIP with 4-year new model exemption
- No VIP
- VIP with 5-year new model exemption
- VIP with 6-year new model exemption

DEQ's analysis shows that the vehicle inspection and maintenance program prevents hundreds of tons per year of pollutant emissions into the Portland and Medford areas. Criteria and air toxics emissions from onroad sources would increase by the percentages shown in Tables A and B if DEQ did not operate a Vehicle Inspection Program. Pollutants listed in both tables are those that onroad sources predominantly emit.

Table A. Percent increase to onroad emissions without VIP program: Portland AQMA

		2015 (tpy)	2015 No VIP (tpy)	Emissions Increase (a)
Air Toxic	1,3-Butadiene	30.14	35.71	18%
	Benzene	213.3	255.3	20%
	Ethylbenzene	128.0	148.5	16%
	Acetaldehyde	90.3	103.9	15%
	Napthalene	15.18	17.31	14%
	15-PAH	5.454	6.162	13%
	Formaldehyde	106.51	119.35	12%
	Acrolein	7.286	8.043	10%
Criteria	NOX	13,760	14,698	7%
	CO	74,894	85,748	14%
	VOC	7,783	9,260	19%

(a) % increase = ((2015 tpy no VIP) - (2015 tpy)) / (2015 tpy)

Table B. Percent increase to onroad emissions without VIP program: Medford AQMA

		2015 (tpy)	2015 No VIP (tpy)	Emissions Increase (a)
Air Toxic	1,3-Butadiene	8.04	8.73	8%
	Benzene	62.8	67.7	8%
	Ethylbenzene	43.1	45.7	6%
	Acetaldehyde	22.3	24.0	8%
	Napthalene	3.77	4.04	7%
	15-PAH	1.463	1.551	6%
	Formaldehyde	25.03	26.64	6%
	Acrolein	1.458	1.550	6%
Criteria	NOX	2,597	2,767	7%
	CO	21,703	22,920	6%
	VOC	2,515	2,647	5%

(a) % increase = ((2015 tpy no VIP) - (2015 tpy)) / (2015 tpy)

DEQ represents the effectiveness of all the control strategies by calculating the increase in total anthropogenic emissions if these strategies were not in place. Anthropogenic emissions come directly from human activities like driving, industrial operations and energy use. Emissions from natural sources, like wildfires, volcanic eruptions and vegetation, are not included in anthropogenic emissions. Table C compares anthropogenic emissions increase from removing each of the controls, VIP, ECO, VRS and barge loading. The analysis shows that among the strategies modeled, removing the vehicle inspection and maintenance program would result in the greatest emission increases.

Table C. Percent increase to anthropogenic emissions from removal of pollution control strategies

		Anthropogenic Emissions Increase (a) ------ Scenario: Control or Program Removed ------				
		Portland VIP	Medford VIP	Portland ECO	Portland GDF VRS	Portland Barge Loading
Air Toxic	1,3-Butadiene	7.8%	5.1%	0.5%	0%	0%
	Acetaldehyde	6.3%	4.0%	0.4%	0%	0%
	Acrolein	2.6%	2.1%	0.2%	0%	0%
	Benzene	8.9%	4.9%	0.5%	1.0%	2.0%
	Dichlorobenzene	0%	0%	0%	0%	0%
	Ethylbenzene	9.1%	4.6%	0.5%	1.7%	3.4%
	Formaldehyde	3.1%	2.1%	0.1%	0%	0%
	Methylene Chloride	0%	0%	0%	0%	0%
	Napthalene	2.5%	3.2%	0.1%	0%	0%
	Perchloroethylene	0%	0%	0%	0%	0%
	Trichloroethylene	0%	0%	0%	0%	0%
Air Toxic: 15-PAH	15-PAH	3.5%	2.4%	0.2%	0%	0%
Air Toxic: Metals	Arsenic	0%	0%	1.5%	0%	0%
	Cadmium	0%	0%	0%	0%	0%
	Chromium (VI)	0%	0%	0.04%	0%	0%
	Manganese	0%	0%	0%	0%	0%
	Nickel	0%	0%	0%	0%	0%
Criteria Pollutant	CO	6.4%	3.7%	0.8%	0%	0%
	Lead	0%	0%	0%	0%	0%
	NOX	3.6%	4.1%	0.4%	0%	0%
	PM10	0%	0%	0.03%	0%	0%
	PM2.5	0%	0%	0.05%	0%	0%
	SO2	0%	0%	0.3%	0%	0%
	VOC	4.2%	2.0%	0.2%	1.7%	3.3%

(a) % increase = [Emissions (control removed) – Emissions (control in place)]/Emissions (control in place)

Shaded indicates no impact

DEQ also analyzed the percent of total emissions from each anthropogenic sector and from natural sources, displayed in Figures D and E. DEQ illustrates the percent of total air toxics and criteria pollutant emissions, by EPA Tier 1 sector description, including non-anthropogenic sources: biogenic (vegetation) and miscellaneous (includes fires).

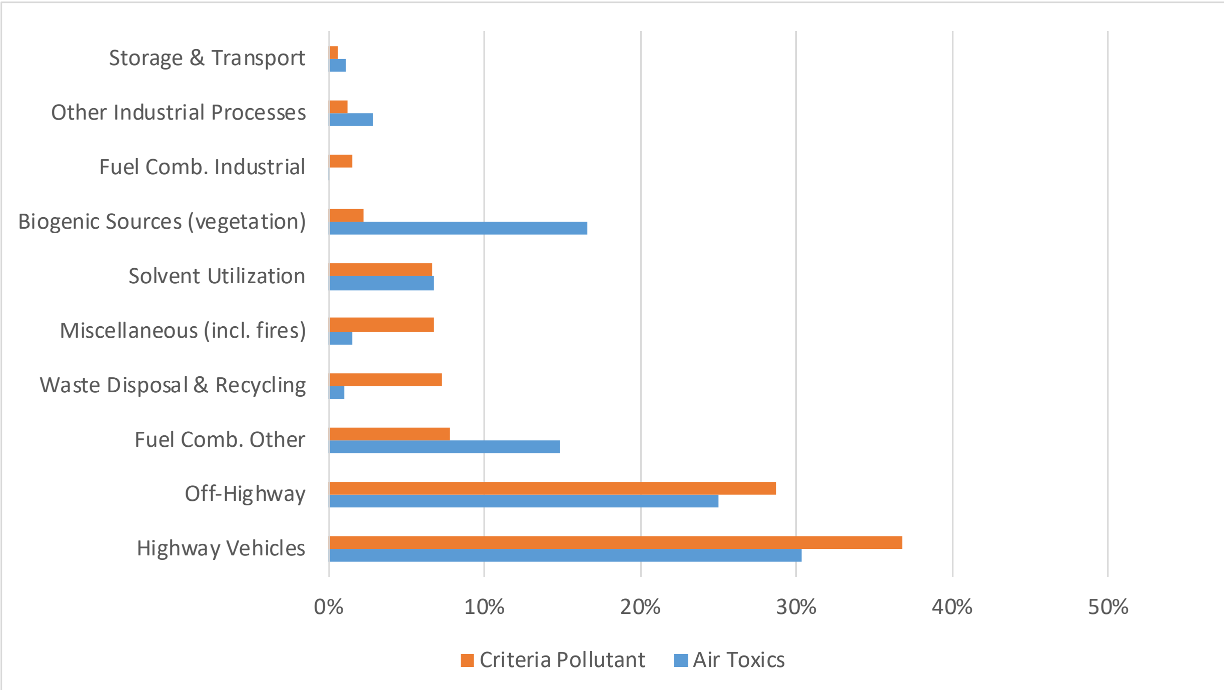


Figure D. Contribution to emissions, all sources: Portland AQMA. Biogenic and miscellaneous sources are non-anthropogenic.

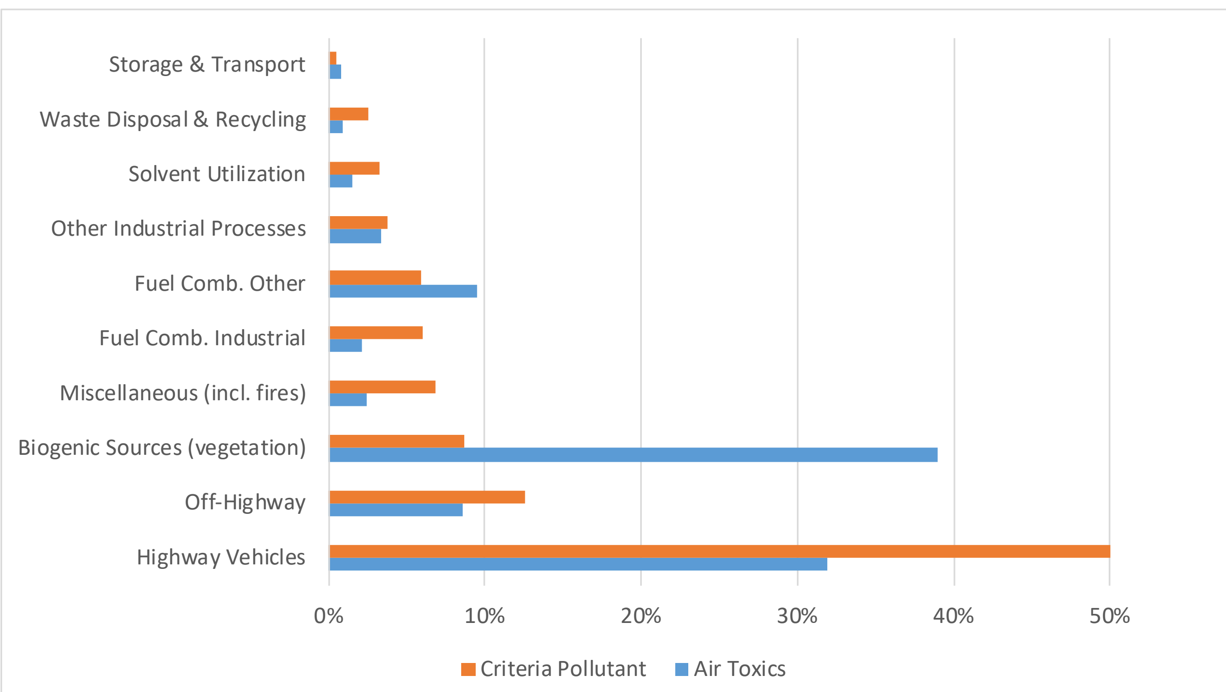


Figure E. Contribution to emissions, all sources: Medford AQMA. Biogenic and miscellaneous sources are non-anthropogenic.

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1 INTRODUCTION

1.1 Background

Since the 1990s, Oregon has fulfilled Clean Air Act requirements to maintain air pollution control strategies that assure compliance with National Ambient Air Quality Standards. EPA bases NAAQS on health criteria and these nationally regulated pollutants are called criteria pollutants. They are:

- Ozone
- Nitrogen oxides
- Carbon monoxide
- Particulate matter
- Sulfur dioxide
- Lead

Once Oregon had demonstrated approximately 20 years of maintenance with the NAAQS, the Oregon Department of Environmental Quality's air quality planning section asked how effective several air pollution control strategies were, with particular focus on air toxics and on-road sources. This report provides a technical basis for future decision-making by analyzing how DEQ's Vehicle Inspection Program and other strategies reduce criteria pollutant and air toxics emissions. The analysis encompasses the Portland and Medford-Ashland (Medford) Air Quality Maintenance Area boundaries. Within those AQMAs, DEQ analyzed data from an emission inventory of biogenic (for example, vegetation), event (for example, wildfires and prescribed burning), nonpoint (also called area), nonroad, permitted point and onroad sources.

Portland is classified as "in attainment" for ozone. In 2007, DEQ submitted to EPA an ozone maintenance plan that relied on strategies focusing on emission reductions from vehicles, industry, paints and household products. A subset of the ozone control strategies also control carbon monoxide, and are federally approved elements of the Portland CO Plan. Since Portland complies with the revised, more protective 2015 federal ozone standard, DEQ does not have to update or submit a new maintenance plan. Neither do conditions in Medford require maintenance plan updates, as EPA classifies Medford as maintaining the CO standard and attaining with ozone standard. However, population growth, increasing vehicle miles traveled and increasing hot weather periods will pose challenges for communities to maintain ozone concentrations below the standard.

DEQ used this analysis to better characterize the benefits of ozone control measures that also decrease air toxics, particulates and greenhouse gases. This report covers the project technical analysis, which consisted of an emission inventory demonstration and application to particular geographic areas. DEQ will use analytical results as an effectiveness measure of current and modified emissions control strategies and operating scenarios. The emissions inventory is broken down into two geographic areas:

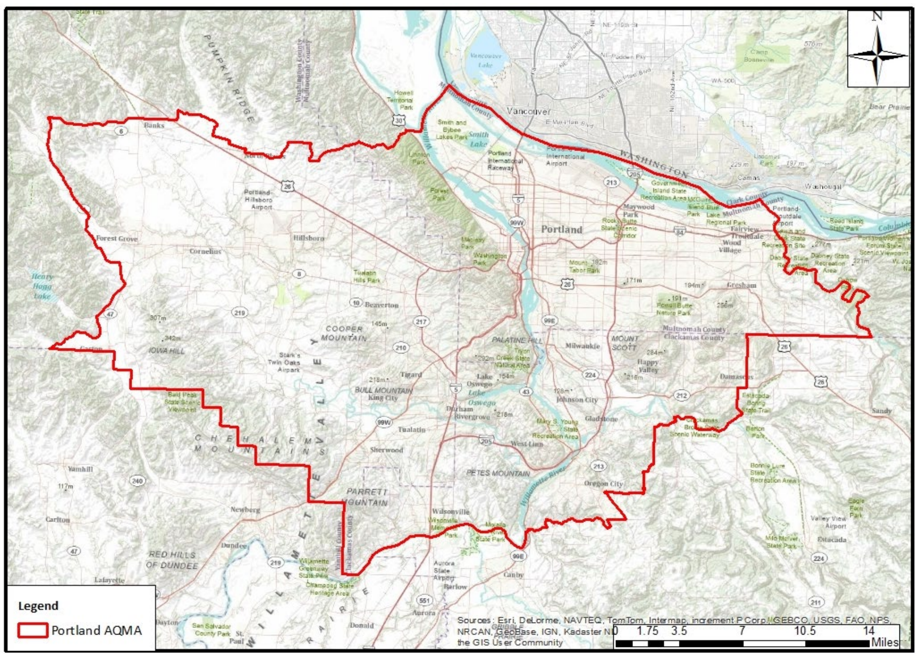
- Portland: analysis of VOC control strategies, including the Vehicle Inspection Program (VIP), for effectiveness in controlling ozone and reducing air toxics risk. This includes various model year exemption scenarios.
- Medford: initial analysis of VIP for effectiveness in controlling ozone and reducing air toxics risk.

1.2 Purpose

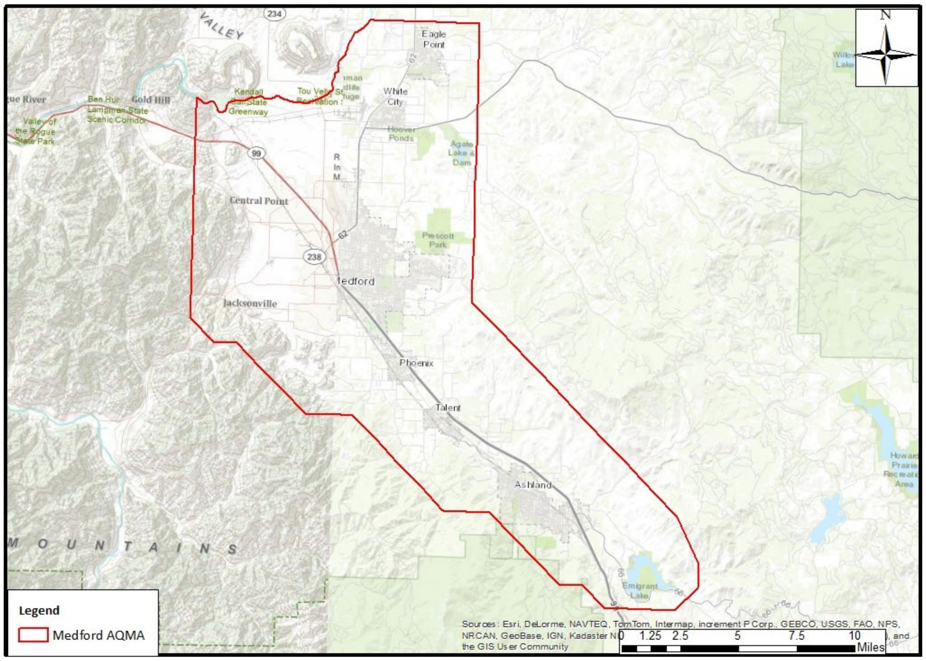
This report documents DEQ's analysis of control strategies for air toxics and ozone precursor pollutants in the Portland and Medford areas.

1.3 Description of Inventory and Area Covered

The emission inventory boundaries are the Portland and Medford AQMAs, as shown in Figure 1. Boundary legal descriptions, which coincide with the VIP implementation boundaries, are in Oregon Administrative Rules 340-204-0010 (14) and OAR 340-204-0010 (10).



A: Portland



B: Medford

Figure 1. Emission inventory analysis boundaries

1.4 Report Contents

The Report is divided into the following parts:

Part 1: Introduction to the Report
Part 2: Base Year Emission Inventory
Part 3: Strategy Evaluation
Part 4: Conclusions
Part 5: Quality Control
Part 6: References
Part 7: Appendices

Part 1 provides an introduction to this Report and its purpose.

Part 2 describes in detail DEQ's methodologies and approaches to estimate emissions in the Portland and Medford AQMA boundaries for the base year inventory. Part 2 is divided into sections describing the inventory process and the types of emission sources that are addressed in the inventory, as follows:

> Section 2.1 provides maps of the Portland and Medford areas, with written descriptions of each area. This section also details the pollutants of concern and describes the inventory base year.

Section 2.2 contains summary tables for all sectors of emissions sources in the Portland AQMA and Medford AQMA.

Section 2.3 describes the stationary point source emission category methodology and emissions estimate approach. Tables summarizing point source emissions estimates follow the discussion.

Section 2.4 addresses area, nonroad, event and biogenic sources, and describes the approaches used to estimate emissions. Tables summarizing the emissions estimates from stationary area sources follow the discussion.

Section 2.5 describes the approach and methodology used to evaluate emissions from on-road mobile sources. Tables summarizing the emissions estimate from on-road mobile sources follow the discussion.

Part 3 provides emission inventory data for strategy evaluation.

Part 4 presents conclusions based on inventory results.

Part 5 describes the Quality Control procedures utilized in preparing the base year inventory.

Part 6 contains the list of references cited in this document.

Part 7 includes appendices with supplemental data used to estimate emissions, as well as detailed methodology descriptions for some source categories.

1.4.1 Overview of Inventory Sources

DEQ's Technical Services Section staff has assembled the inventory. DEQ staff calculated onroad mobile, residential wood combustion, gasoline dispensing facility and drycleaner emissions estimates. DEQ staff also calculated strategy and scenario estimates. DEQ staff obtained the remaining emissions estimates from the EPA 2014 National Emissions Inventory Version 2. DEQ staff double-checked permitted point source criteria pollutant emissions for accuracy using the DEQ Tracking Reporting and Administration of Air Contaminant Sources database. DEQ uses TRAACS to track compliance with plant site emission limits and report compliance status to EPA.

1.4.2 Sources Not Inventoried

DEQ considered all source categories contained in the EPA 2014 NEI for inclusion in the emission inventory. DEQ derived location data for all sources if that data was not known. After analysis and placement of emissions, DEQ excluded sources for one or both of the following reasons:

- sources did not emit pollutants of concern for this analysis
- source location was not within analysis boundaries of interest (Portland and Medford AQMAs)

1.4.3 Guidance Documents

For DEQ estimates, DEQ used current and applicable EPA procedure and guidance documents to compose the inventory. DEQ cites information sources in the text and includes references as end notes.

1.4.4 Personnel for the Inventory

An abbreviated list of those conducting or assisting with the emission inventory demonstration is shown below:

Oregon Department of Environmental Quality
Air Quality Division
  Ali Mirzakhalili, Division Administrator
  Jeffrey Stocum, Air Quality Technical Services Manager
    Christopher Swab, Sr. Emission Inventory Analyst
    Brandy Albertson, Emission Inventory Analyst
    Wesley Risher, Emission Inventory Analyst
  Michael Orman, Air Quality Planning Manager
    Karen Font Williams, Air Quality Planner
MOVES Output Storage and Transformation (MOST) development
  Brian Fields, DEQ Development Database Administrator
  Gary Beyer, DEQ Environmental Engineer 2

2 EMISSION INVENTORY

2.1 Boundaries, Pollutants and Base Year

Maps of the emission inventory analysis boundaries (Portland and Medford AQMAs) are shown in the previous Figure 1.

2.1.1 Boundary Legal Descriptions

Oregon Administrative Rule 340-200-0020 defines "maintenance area" as any area that was formerly nonattainment for a criteria pollutant but has since met the ambient air quality standard, and EPA has approved a maintenance plan to comply with the standards under 40 CFR 51.110. The Oregon Environmental Quality Commission designates maintenance areas according to Division 204.

Oregon Administrative Rules 340-204-0010 (14) and OAR 340-204-0010 (10) provide the legal descriptions of the Portland and Medford boundary areas.

2.1.2 Pollutants

The pollutants DEQ analyzed are precursors to ozone formation and some air toxics from on-road sources, suggested by a review of the Portland Air Toxics Solutions Project (http://www.deq.state.or.us/aq/factsheets/12aq035patsReport.pdf). DEQ analyzed strategies that control both criteria pollutants and air toxics. Table 1 lists the pollutants included in this analysis.

Table 1. Toxics pollutants known from on-road sources.

Air Toxic	Air Toxic - 15-PAH	Criteria - Ozone Precursor
1,3-Butadiene	Acenaphthene	Carbon Monoxide
Acetaldehyde	Acenaphthylene	Nitrogen Oxides
Acrolein	Anthracene	Volatile Organic Compounds
Benzene	Benz(a)anthracene	*Criteria - Other*
Dichlorobenzene	Benzo(a)pyrene	Lead and Lead Compounds
Ethylbenzene	Benzo(b)fluoranthene	PM10
Formaldehyde	Benzo(g,h,i)perylene	PM2.5
Methylene Chloride	Benzo(k)fluoranthene	Sulfur Dioxide
Napthalene	Chrysene	
Perchloroethylene	Dibenzo(a,h)anthracene	
Trichloroethylene	Fluoranthene	
Air Toxic - Metals	Fluorene	
Arsenic & Arsenic Compounds	Indeno(1,2,3,c,d)pyrene	
Cadmium & Cadmium Compounds	Phenanthrene	
Chromium (VI)	Pyrene	
Manganese and Manganese Compounds		
Nickel and Nickel Compounds		

2.1.3 Base Year

With the exception of on-road emissions estimates, the project inventory represents 2014 annual emissions. The on-road emission inventory base year is 2015 and derives from the activity data (vehicle miles traveled or VMT) that Metro and ODOT provided to DEQ.

2.2 Summary of Emissions Data

Tables 2 and 3 include summary emissions estimates from all source categories. Figures 2 and 3 show the emissions contribution from anthropogenic sources (nonroad, onroad, point and nonpoint sources). The Portland chart (Fig. 2) is sorted in order of the decreasing contribution from onroad sources by pollutant. The Medford chart (Fig. 3) follows the same pollutant order as the Portland chart. The percent contribution from each category (onroad, nonroad point, nonpoint) varies between Portland and Medford because of different types and quantities of sources, including commercial marine (not present in Medford), locomotives (higher percentage in Portland) and point sources (fewer in Medford).

Table 2. Base Year Summary of Emissions by Source Type, tons per year: Portland AQMA

		Biogenic	Event	Nonpoint	Nonroad	Onroad	Point	**Total**
Air Toxic	1,3-Butadiene		1.4	17.3	24.2	30.1		**73.0**
	Acetaldehyde	138.1	6.4	61.1	65.1	90.3		**361.0**
	Acrolein		2.3	5.2	16.4	7.3		**31.1**
	Benzene		2.1	126.3	122.7	213.3	7.1	**471.5**
	Dichlorobenzene			0.0057			0.0043	**0.0100**
	Ethylbenzene			15.4	67.7	128.0	14.8	**225.9**
	Formaldehyde	188.3	13.0	124.2	180.5	106.5	1.1	**613.6**
	Methylene Chloride			9.0			0.2	**9.2**
	Napthalene		1.9	58.2	10.6	15.2	0.1	**86.1**
	Perchloroethylene			15.1			16.41	**31.53**
	Trichloroethylene			42.8			0.05	**42.87**
Air Toxic: 15-PAH	15-PAH		0.2	10.5	4.4	5.5	0.00002	**20.49**
Air Toxic: Metals	Arsenic			0.057	0.0055	0.025	0.0002	**0.087**
	Cadmium			0.038	0.0		0.001	**0.039**
	Chromium (VI)			0.0011	0.001049	0.00013	0.0144	**0.0167**
	Manganese			0.08	0.0031		1.3	**1.4**
	Nickel			0.10	0.0770		0.219	**0.400**
Criteria Pollutant	CO	1,319.8	615.6	29,868.8	63,347.9	74,893.5	414.5	**170,460.2**
	Lead			0.13	1.1		0.3	**1.5**
	NOX	66.2	14.3	4,167.7	7,100.4	13,759.9	1,156.2	**26,264.7**
	PM10		67.9	19,125.1	627.7	728.7	401.2	**20,950.6**
	PM2.5		57.5	5,101.9	594.1	367.0	349.0	**6,469.5**
	SO2		6.4	955.0	140.0	97.0	186.9	**1,385.3**
	VOC	4,415.8	146.9	21,141.4	4,374.3	7,782.8	1,775.6	**39,636.7**

Table 3. Base Year Summary of emissions by source type, tons per year: Medford AQMA

		Biogenic	Event	Nonpoint	Nonroad	Onroad	Point	**Med Total**
Air Toxic	1,3-Butadiene		0.4	2.9	2.4	8.0		**13.7**
	Acetaldehyde	86.8	2.5	10.6	5.3	22.26	5.0	**132.4**
	Acrolein		0.8	0.9	1.2	1.46	0.9	**5.3**
	Benzene		0.9	21.4	12.6	62.76	2.9	**100.5**
	Dichlorobenzene			0.0005			0.0005	**0.0009**
	Ethylbenzene			1.5	8.0	43.1	1.5	**54.1**
	Formaldehyde	118.3	4.6	22.5	14.3	25.03	14.7	**199.5**
	Methylene Chloride			0.7			1.4	**2.1**
	Napthalene		0.8	2.9	1.1	3.77	0.5	**9.1**
	Perchloroethylene			1.2			1.34	**2.49**
	Trichloroethylene			3.3			0.03	**3.31**
Air Toxic: 15-PAH	15-PAH		0.1	1.7	0.4	1.46	0.00	**3.71**
Air Toxic: Metals	Arsenic			0.004	0.0003	0.003	0.002	**0.010**
	Cadmium			0.003	0.0		0.001	**0.003**
	Chromium (VI)			0.0001	0.000005	0.00002	0.0003	**0.0004**
	Manganese			0.01	0.0002		0.1	**0.1**
	Nickel			0.01	0.0004		0.003	**0.012**
Criteria Pollutant	CO	828.7	246.2	3,185.8	5,731.8	21,703.2	2,345.9	**34,041.5**
	Lead			0.01	0.1		0.1	**0.3**
	NOX	21.8	4.5	341.9	448.7	2,596.6	747.2	**4,160.8**
	PM10		26.1	3,366.3	51.2	119.6	401.8	**3,964.9**
	PM2.5		22.1	744.0	48.0	65.4	351.1	**1,230.6**
	SO2		2.2	68.5	5.3	13.3	65.3	**154.6**
	VOC	3,853.4	58.4	2,188.5	474.6	2,514.8	1,311.7	**10,401.3**

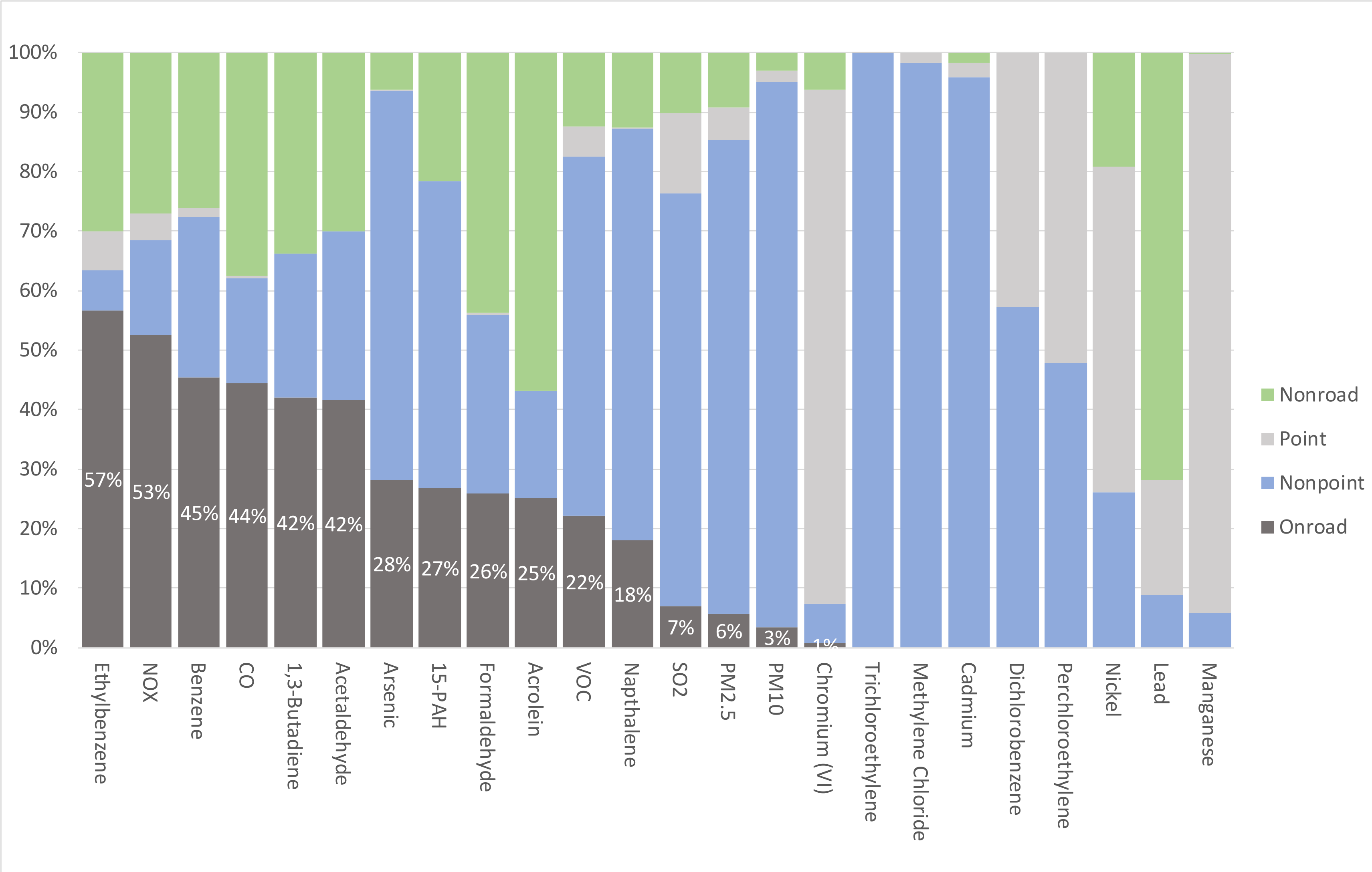


Figure 2. Percent anthropogenic emissions contributed to the total by source category, Portland AQMA

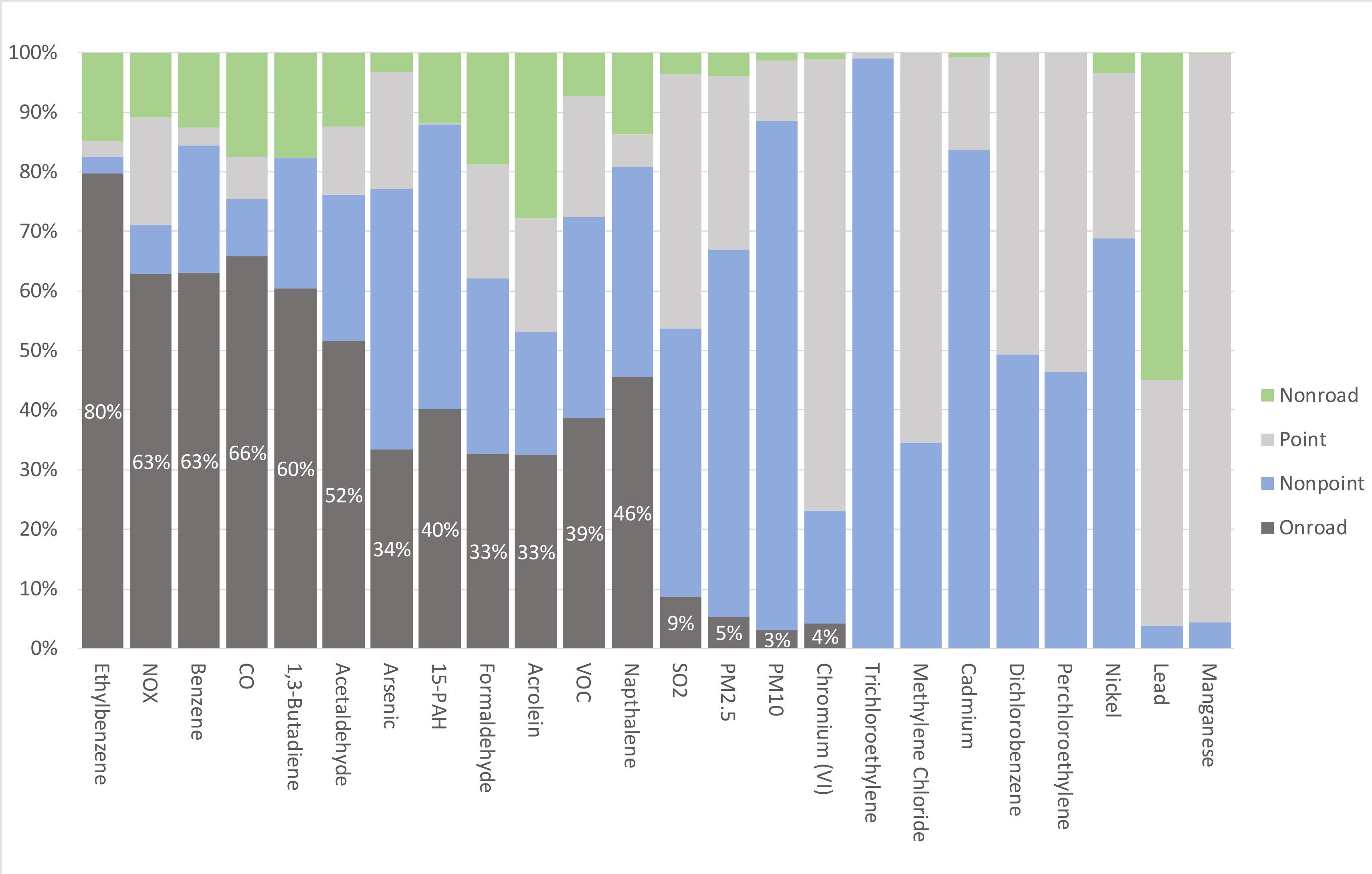


Figure 3. Percent anthropogenic emissions contributed to the total by source category, Medford AQMA

2.3 Stationary Permitted Point Sources

2.3.1 Data sources

DEQ obtained permitted point source emissions data from the EPA 2014 National Emission Inventory Version 2. The NEI compiles point source emissions data for Oregon that DEQ has submitted to EPA, as well as emissions information from the EPA Toxics Release Inventory. Through the TRI program, facilities in different industry sectors must report air toxics emission quantities to EPA annually. EPA permitted and non-permitted point source emissions data is categorized under the "Facility" sector. In Section 2.4 and Figure 4 of this report, DEQ describes and illustrates source data used in this analysis, including Facility data.

2.3.2 DEQ methodology – reporting to EPA

2.3.2.1 Activity

DEQ collected activity data from 2014 annual reports for all permitted facilities. Facilities must fulfill permit conditions for annual reporting by submitting emission estimates for criteria and/or some hazardous air pollutant emissions. DEQ used the activity data to verify existing 2014 emissions estimates from the reports, as well as to calculate emissions not typically reported by the facilities themselves.

2.3.2.2 Emission Factors

Emission factors used for the point source emission inventory submitted to EPA were developed through DEQ source testing, or EPA approved emissions factors from documentation such as AP-42(8) or the National Council for Air and Stream Improvement. (360)

2.3.2.3 Annual Emissions Calculations

Data used in the annual emissions estimates includes emission factors, annual throughput or process rate from source submitted annual reports, and operation schedules. DEQ used the emission factors, together with the annual production levels, to estimate annual emissions.

2.3.2.4 Control Efficiency, Rule Effectiveness, and Rule Penetration

DEQ considered permitted point source emission factors to include the efficiency of control devices.

2.3.3 Source location and mapping

DEQ used ArcGIS mapping to determine the locations of sources emitting pollutants of concern within AQMA boundaries. Plant-site coordinates were mapped and only those sources falling within the AQMA boundaries were included. Appendix A, Figures A-1 through A-4 show the locations of the stationary point sources included in this project's inventory.

2.3.4 Gasoline dispensing facilities

DEQ obtained 2014 permitted Gasoline Dispensing Facilities annual throughput, tank size, location (lat/long), and controls data from DEQ permitting staff.(968,969) DEQ mapped GDFs and reviewed facility control data(849) as a quality control check.

DEQ used 2014 Oregon vehicle registration data from ODOT Driver and Motor Vehicle Services to estimate the vehicle population with Onboard Refueling Vapor Recovery. ORVR interferes with specific types of gasoline pump vapor recovery controls, potentially increasing volatile emissions. DEQ grouped and summed the number of registered gasoline vehicles for each county by vehicle year, type (car and truck), and class (light, medium, and heavy duty). DEQ then used ORVR phase-in estimates, specific to the Pacific Northwest and based on vehicle class and type,[(848)] to estimate ORVR fleet penetration.

DEQ calculated VOC emission factors, which are temperature dependent, for each county using 2014 NOAA temperature data. DEQ calculated VOC emission factors for six processes: Underground Storage Tank breathing/emptying, controlled and uncontrolled Stage I vapor recovery UST filling, and controlled and uncontrolled Stage II vapor recovery pump dispensing. DEQ then used ORVR fleet penetration to estimate ORVR's effects on specific controls.

DEQ mapped GDFs using location-specific coordinates from the DEQ TRAACS database. DEQ did not include GDFs, and their associated emissions, if they fell outside the AQMA boundaries were not included in this project's emission inventory. DEQ describes its GDF emission inventory methodology in Reference 987.

2.3.5 Perchloroethylene dry cleaners

DEQ estimated emissions from perchloroethylene dry cleaners through facility 2015 annual reports, and calculated emission factors for each reporting facility using information that DEQ land quality program staff compile. The method used to calculate emission factors is mass balance: the amount of solvent evaporated from a facility equals the amount of solvent purchased minus the amount of solvent contained in still bottoms sent for reclamation. The base year EI for perchloroethylene drycleaners is 2015, the first year the EI method was used to estimate emissions.

DEQ mapped perchloroethylene drycleaners from coordinates stored in the TRAACS database. DEQ did not include drycleaners, and their associated emissions, that fell outside the AQMA boundaries in the inventory. DEQ provides additional explanation of the perchloroethylene dry cleaner emission inventory methodology in Reference 988.

2.3.6 Summary of Stationary Permitted Point Source Emissions Estimates

Tables 4 through 7 summarize point source emissions by facility and industry for the Portland and Medford AQMAs. Facilities represented are those for which data was available in the NEI, including sources that DEQ inventoried and those sources that reported toxics emissions data to the EPA TRI.

Table 4. Portland base year (2014) AQMA point source emissions in tons by facility

EIS Facility ID NUMBER	Facility Name	DEQ Source Number	15-PAH	Acetaldehyde	Acrolein	Arsenic	Benzene	Cadmium	Chromium (VI)	Ethylbenzene	Formaldehyde	Manganese	Methylene Chloride	Napthalene	Nickel	Perchloroethylene	Trichloroethylene	CO	Lead	NOX	PM10	PM2.5	SO2	VOC
789411	Oregon Cutting Systems								2.9E-04										1.6E-05					
790211	Oeco L L C																		1.4E-05					
891311	Owens Corning Roofing and Asphalt, LLC	26-3067	9.9E-07			7.1E-06	1.5E-04	3.9E-05	2.0E-06	0.0E+00	5.4E-03	1.4E-05		4.4E-05	7.5E-05	0.0E+00		5.4E+01		1.6E+01	3.6E+00	3.6E+00	5.2E+01	3.8E+00
910311	Cascade Corp	26-3038										7.3E-02												
910511	Columbia Steel Casting Co Inc	26-1869							3.2E-04			3.4E-01			1.4E-02				3.0E-03					
910711	Rodda Paint Co									4.3E-01														
910811	PCC STRUCTURALS INC LARGE PARTS CAMPUS	26-1867							2.9E-03						8.0E-02									
911211	ESCO Corp								1.8E-04			3.2E-02			2.2E-02				1.1E-02					
911511	Sapa Inc Coatings Div								6.1E-03	6.5E-01									7.0E-07					
911611	Aviation Exteriors Portland Inc													8.5E-03										
911711	Tarr Inc									1.7E-02				7.2E-03										
912011	Glacier Northwest Inc Troutdale Ready-Mix Plant																		3.5E-05					
912311	Glacier Northwest Inc Front Ave Ready-Mix Plant																		4.0E-05					
3774611	Fiskars Brands/Gerber Legendary Blades Div								3.4E-06															
3774911	Glacier Northwest Inc Tualatin Ready-Mix Plant																		3.0E-05					
3775211	Valmont Coatings Pacific States Galvanizing	34-0005																	2.0E-03					
4695411	Glacier Northwest Inc Hillsboro Ready-Mix Plant																		2.0E-05					
4695511	Quality Production Ltd																		3.8E-04					
7393511	Shaw s Fiberglass and Plastics, Inc.	03-0017																			1.0E+00	1.0E+00		6.4E+00
7394211	Northwest Pipe Company	26-2492																		1.7E+00	3.9E+00	1.9E+00		6.6E+00
7394311	Graphic Packaging International, Inc	26-2777																2.3E+00		6.8E+00	7.4E+00	6.2E+00	1.2E+00	2.1E+01
8055511	Miles Fiberglass & Plastics, Inc.	03-2777																						1.0E+01
8055611	Miles Fiberglass & Composites	03-2778																						8.3E+00
8140711	Western Star Truck Plant Portland	26-2197	3.4E-06			2.5E-05	1.4E-04	1.4E-04	6.9E-06		5.1E-03	4.7E-05		5.0E-04	2.6E-04			2.1E+00		2.3E+01	8.2E+00	6.8E+00	1.1E+00	2.2E+02
8140811	Boeing Company (The)	26-2204							2.9E-03						2.0E-03	6.0E+00			5.6E-03					
8203911	Ash Grove Cement Company																		2.5E-04					
8204011	Willbridge Asphalt Refinery	26-2025	8.7E-07			6.2E-06	1.3E-04	3.4E-05	1.7E-06		4.7E-03	1.2E-05		3.8E-05	6.6E-05			5.2E+00	1.6E-05	6.2E+00	1.6E-01	1.6E-01	1.1E-01	5.1E+01
8219311	Tosco Portland Terminal						4.9E-01			1.1E-01				6.6E-02										
8219411	Chevron Products Company	26-2027				1.3E-05	1.6E-01	7.4E-05	3.8E-06	5.9E-02		2.5E-05		1.4E-02	1.4E-04			1.2E+00	1.0E-04	1.2E+00	3.4E-01	3.4E-01	3.3E-02	9.2E+01
8219511	Willbridge Terminal	26-2028																0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.0E+01
8220311	Nustar	26-2029																4.4E-02		2.6E-02	4.0E-03	4.0E-03	3.2E-04	3.0E+01
8220411	BP West Coast Products, LLC	26-2030					1.8E-01			6.0E-02				1.5E-02				9.9E+00		3.9E+00	5.9E-01	5.9E-01	5.9E-01	3.4E+01
8220511	Oregon Health Sciences University	26-2050	3.8E-06			2.8E-05	5.5E-04	1.5E-04	7.7E-06		2.0E-02	5.2E-05		1.6E-04	2.9E-04			1.9E+00	3.2E-06	1.0E+01	1.7E+00	1.7E+00	1.5E+00	2.5E+00
8220611	ESCO Corporation	26-2068							6.5E-04			2.2E-01			2.1E-02			1.5E+02	4.3E-02	3.2E+01	5.2E+01	5.2E+01	3.7E+00	3.4E+01
8401111	Gunderson LLC	26-2944										6.2E-01								3.1E+00	3.7E+01	3.0E+01		1.1E+02
8405111	Tektronix Inc																		3.7E-05					
8405211	DMH, Inc.	34-2756																			1.6E+00	1.6E+00		4.2E+01
8417511	West Linn Paper Company	03-2145	1.0E-05			7.6E-05	4.1E-04	4.2E-04	2.1E-05		1.5E-02	1.4E-04		1.2E-04	7.9E-04			3.6E+01	1.5E-03	4.2E+02	1.7E+01	1.0E+01	3.1E+00	7.6E+01
8418211	Portland Operations	26-3009	1.1E-06			7.7E-06		4.2E-05	2.2E-06		1.0E+00	1.5E-05			8.1E-05			1.7E+01	1.9E-05	3.0E+01	1.2E+00	1.2E+00	1.2E+00	1.1E+01
8418411	Vigor Industrial, LLC	26-3224	5.3E-07			3.8E-06		2.1E-05	1.1E-06	8.4E+00		7.2E-06			4.0E-05			1.3E+00	1.2E-03	5.4E+00	1.0E+01	4.9E+00	9.9E-02	1.2E+02
8505611	PCC Structurals Inc Small Structurals Business Operation	03-2674							6.8E-04						5.2E-02									
8520811	Owens-Brockway Glass Container Inc.	26-1876	1.9E-07			1.4E-06	1.5E-05	7.7E-06	3.9E-07		5.3E-04	2.7E-06		4.3E-06	1.5E-05			1.0E+01	1.2E-01	4.1E+02	1.1E+02	9.1E+01	1.2E+02	2.3E+00
8521611	EVRAZ Inc, NA	26-1865																1.3E+02	9.6E-02	1.8E+02	1.4E+02	1.3E+02	3.8E+00	1.3E+02
9235511	Utility Vault																		5.0E-07					
9248411	U.S. Air Force Portland ANG AFB OR													2.5E-03										
9248811	CERTAINTEED CORP																		4.5E-05					
16725411	PCC STRUCTURALS INC DEER CREEK ANNEX	03-0020							3.4E-04						2.7E-02									
17018111	Owens Corning-Gresham Plant	26-9537																5.3E-01		2.0E-01	7.9E+00	5.3E+00		1.0E+00
Various	Percholorethylene Dry Cleaners															1.0E+01								
Various	Gasoline Dispensing Facilities						4.2E+00			3.4E+00														5.2E+02

Table 5. Medford AQMA base year (2014) point source emissions in tons by facility

EIS Facility ID NUMBER	Facility Name	DEQ Source Number	15-PAH	Acetaldehyde	Acrolein	Arsenic	Benzene	Cadmium	Chromium (VI)	Ethylbenzene	Formaldehyde	Manganese	Methylene Chloride	Napthalene	Nickel	Perchloroethylene	Trichloroethylene	CO	Lead	NOX	PM10	PM2.5	SO2	VOC
8054611	Rogue Valley	15-0020	4.4E-07			3.2E-06	6.1E-05	1.8E-05	9.0E-07		2.2E-03	6.1E-06		1.8E-05	3.4E-05			2.6E+00	8.0E-06	3.0E+00	4.4E+00	1.4E+00	4.8E-02	6.3E+00
8054711	Timber Products Co.	15-0025	2.6E-06	1.1E+00		1.8E-05	2.0E-04	1.0E-04	5.2E-06		7.0E-03	3.5E-05		5.7E-05	1.9E-04			2.4E+01	1.1E-02	9.6E+01	5.4E+01	5.1E+01	2.7E+00	2.5E+02
8054811	Carestream Health, Inc.	15-0029	1.6E-06			1.1E-05	4.7E-02	6.2E-05	3.2E-06		1.7E+00	2.2E-05		1.4E-02	1.2E-04			1.3E+01	2.8E-05	1.5E+01	3.1E-01	3.1E-01	7.9E-01	1.6E+02
8056111	Medford MDF	15-0073	3.7E-04	5.1E-01	5.0E-03	3.1E-04	2.6E-01	5.8E-05	5.0E-05	1.9E-02	9.5E+00	2.3E-02	1.8E-01	5.9E-02	4.7E-04	2.3E-02	1.8E-02	2.8E+01	3.1E-02	1.3E+02	1.8E+02	1.6E+02	3.9E+00	5.1E+02
8056211	Biomass One, L.P.	15-0159	5.5E-04	1.8E-01	8.5E-01	4.7E-04	8.9E-01	8.7E-05	7.4E-05	6.6E-03	9.4E-01	3.4E-02	6.2E-02	2.1E-02	7.0E-04	8.1E-03	6.4E-03	4.8E+02	6.0E-02	3.6E+02	2.2E+01	1.2E+01	2.2E+01	1.4E+01
8418111	Medford	15-0004	1.3E-03	3.2E+00		1.1E-03		2.1E-04	1.8E-04	1.2E-01	2.6E+00	8.1E-02	1.1E+00	3.7E-01	1.7E-03			1.6E+03	3.8E-03	1.2E+02	1.3E+02	1.2E+02	1.6E+01	1.4E+02
Various	Percholorethylene Dry Cleaners															1.3E+00								
Various	Gasoline Dispensing Facilities						1.7E+00			1.3E+00														2.0E+02

Table 6. Portland base year (2014) AQMA point source emissions in tons by industry

NAICS description	15-PAH	Acetaldehyde	Acrolein	Arsenic	Benzene	Cadmium	Chromium (VI)	Ethylbenzene	Formaldehyde	Manganese	Methylene Chloride	Napthalene	Nickel	Perchloroethylene	Trichloroethylene	CO	Lead	NOX	PM10	PM2.5	SO2	VOC
Aircraft Manufacturing												8.5E-03										
All Other Miscellaneous Nonmetallic Mineral P																	5.0E-07					
All Other Plastics Product Manufacturing																			1.0E+00	1.0E+00		6.4E+00
Asphalt Paving Mixture and Block Manufacturin	9.9E-07			7.1E-06	1.5E-04	3.9E-05	2.0E-06	0.0E+00	5.4E-03	1.4E-05		4.4E-05	7.5E-05	0.0E+00		5.4E+01		1.6E+01	3.6E+00	3.6E+00	5.2E+01	3.8E+00
Asphalt Shingle and Coating Materials Manufac																	4.5E-05					
Bare Printed Circuit Board Manufacturing																	3.8E-04					
Colleges, Universities, and Professional Scho	3.8E-06			2.8E-05	5.5E-04	1.5E-04	7.7E-06		2.0E-02	5.2E-05		1.6E-04	2.9E-04			1.9E+00	3.2E-06	1.0E+01	1.7E+00	1.7E+00	1.5E+00	2.5E+00
Commercial Gravure Printing																2.3E+00		6.8E+00	7.4E+00	6.2E+00	1.2E+00	2.1E+01
Custom Compounding of Purchased Resins																						1.8E+01
Cutlery and Handtool Manufacturing							3.4E-06															
Electroplating, Plating, Polishing, Anodizing							2.9E-04										1.6E-05					
Fuel Dealers								1.7E-02				7.2E-03										
Glass Container Manufacturing	1.9E-07			1.4E-06	1.5E-05	7.7E-06	3.9E-07		5.3E-04	2.7E-06		4.3E-06	1.5E-05			1.0E+01	1.2E-01	4.1E+02	1.1E+02	9.1E+01	1.2E+02	2.3E+00
Heavy Duty Truck Manufacturing	3.4E-06			2.5E-05	1.4E-04	1.4E-04	6.9E-06		5.1E-03	4.7E-05		5.0E-04	2.6E-04			2.1E+00		2.3E+01	8.2E+00	6.8E+00	1.1E+00	2.2E+02
Industrial Truck, Tractor, Trailer, and Stack										7.3E-02												
Instrument Manufacturing for Measuring and Te																	3.7E-05					
Iron and Steel Pipe and Tube Manufacturing fr																		1.7E+00	3.9E+00	1.9E+00		6.6E+00
Lime Manufacturing																	2.5E-04					
Metal Coating, Engraving (except Jewelry and							6.1E-03	6.5E-01									2.0E-03					
Metal Heat Treating																1.3E+02	9.6E-02	1.8E+02	1.4E+02	1.3E+02	3.8E+00	1.3E+02
National Security												2.5E-03										
Nonferrous Metal Foundries							3.4E-04						2.7E-02									
Other Aircraft Parts and Auxiliary Equipment							2.9E-03						2.0E-03	6.0E+00			5.6E-03					
Other Nonferrous Metal Foundries (except Die-							3.6E-03						1.3E-01									
Paint and Coating Manufacturing								4.3E-01														
Paper (except Newsprint) Mills	1.0E-05			7.6E-05	4.1E-04	4.2E-04	2.1E-05		1.5E-02	1.4E-04		1.2E-04	7.9E-04			3.6E+01	1.5E-03	4.2E+02	1.7E+01	1.0E+01	3.1E+00	7.6E+01
Petroleum and Petroleum Products Merchant Who					4.9E-01			1.1E-01				6.6E-02										
Petroleum Bulk Stations and Terminals				1.3E-05	3.4E-01	7.4E-05	3.8E-06	1.2E-01		2.5E-05		2.9E-02	1.4E-04			1.1E+01	1.0E-04	5.1E+00	9.3E-01	9.3E-01	6.3E-01	1.3E+02
Petroleum Refineries	8.7E-07			6.2E-06	1.3E-04	3.4E-05	1.7E-06		4.7E-03	1.2E-05		3.8E-05	6.6E-05			5.2E+00	1.6E-05	6.2E+00	1.6E-01	1.6E-01	1.1E-01	5.1E+01
Polystyrene Foam Product Manufacturing																5.3E-01		2.0E-01	7.9E+00	5.3E+00		1.0E+00
Power, Distribution, and Specialty Transforme																	1.4E-05					
Pump and Pumping Equipment Manufacturing										6.2E-01								3.1E+00	3.7E+01	3.0E+01		1.1E+02
Ready-Mix Concrete Manufacturing																	1.3E-04					
Ship Building and Repairing	5.3E-07			3.8E-06		2.1E-05	1.1E-06	8.4E+00		7.2E-06			4.0E-05			1.3E+00	1.2E-03	5.4E+00	1.0E+01	4.9E+00	9.9E-02	1.2E+02
Steam and Air-Conditioning Supply	1.1E-06			7.7E-06		4.2E-05	2.2E-06		1.0E+00	1.5E-05			8.1E-05			1.7E+01	1.9E-05	3.0E+01	1.2E+00	1.2E+00	1.2E+00	1.1E+02
Steel Foundries (except Investment)							1.1E-03			5.9E-01			5.6E-02			1.5E+02	5.7E-02	3.2E+01	5.2E+01	5.2E+01	3.7E+00	3.4E+01
Wood Window and Door Manufacturing																			1.6E+00	1.6E+00		4.2E+01
Perchlorethylene Dry Cleaners														1.0E+01								
Gasoline Dispensing Facilities					4.2E+00			3.4E+00														5.2E+02

Table 7. Medford AQMA base year (2014) point source emissions in tons by industry

NAICS description	15-PAH	Acetaldehyde	Acrolein	Arsenic	Benzene	Cadmium	Chromium (VI)	Ethylbenzene	Formaldehyde	Manganese	Methylene Chloride	Napthalene	Nickel	Perchloroethylene	Trichloroethylene	CO	Lead	NOX	PM10	PM2.5	SO2	VOC
Hardwood Veneer and Plywood Manufacturing	4.4E-07			3.2E-06	6.1E-05	1.8E-05	9.0E-07		2.2E-03	6.1E-06		1.8E-05	3.4E-05			2.6E+00	8.0E-06	3.0E+00	4.4E+00	1.4E+00	4.8E-02	6.3E+00
Reconstituted Wood Product Manufacturing	3.7E-04	5.1E-01	5.0E-03	3.1E-04	2.6E-01	5.8E-05	5.0E-05	1.9E-02	9.5E+00	2.3E-02	1.8E-01	5.9E-02	4.7E-04	2.3E-02	1.8E-02	2.8E+01	3.1E-02	1.3E+02	1.8E+02	1.6E+02	3.9E+00	5.1E+02
Softwood Veneer and Plywood Manufacturing	1.3E-03	3.2E+00		1.1E-03		2.1E-04	1.8E-04	1.2E-01	2.6E+00	8.1E-02	1.1E+00	3.7E-01	1.7E-03			1.6E+03	3.8E-03	1.2E+02	1.3E+02	1.2E+02	1.6E+01	1.4E+02
Steam and Air-Conditioning Supply	5.6E-04	1.8E-01	8.5E-01	4.8E-04	9.4E-01	1.5E-04	7.7E-05	6.6E-03	2.6E+00	3.4E-02	6.2E-02	3.4E-02	8.2E-04	8.1E-03	6.4E-03	4.9E+02	6.0E-02	3.8E+02	2.2E+01	1.2E+01	2.2E+01	1.7E+02
Veneer, Plywood, and Engineered Wood Product	2.6E-06	1.1E+00		1.8E-05	2.0E-04	1.0E-04	5.2E-06		7.0E-03	3.5E-05		5.7E-05	1.9E-04			2.4E+01	1.1E-02	9.6E+01	5.4E+01	5.1E+01	2.7E+00	2.5E+02
Perchlorethylene Dry Cleaners														1.3E+00								
Gasoline Dispensing Facilities					1.7E+00			1.3E+00														2.0E+02

2.4 Nonpoint (area), Nonroad, Event and Biogenic Sources

2.4.1 Introduction and Scope

This section describes the development of the emissions inventory for area, nonroad and biogenic sources in the Portland and Medford AQMAs for the 2014 Base Year. Included are the following broad categories of emissions sources:

Nonpoint (area) sources:

- Non-permitted industrial, commercial/institutional, and residential fossil fuel combustion
- Commercial agricultural pesticide and fertilizer application
- Agricultural burning and residential open burning
- Structure fires
- Residential charcoal grilling, and restaurants (emissions from cooking meat)
- Gasoline distribution, including tanker trucks and portable gas cans
- Solvent use, including graphic arts, and non-permitted industrial and commercial/consumer cleaning, degreasing and coating, and asphalt production and application
- Publicly owned treatment works (POTWs)
- Residential Wood Combustion (RWC)
- Fugitive dust from construction, agricultural and livestock activity
- Fugitive dust from paved and unpaved roads
- Miscellaneous industrial processes not covered in Section 2.3

Nonroad sources

- Aircraft, locomotives and marine vessels (commercial and recreational)
- Recreational, construction, lawn & garden, agricultural, commercial, logging, light industrial, railway maintenance, and airport ground support vehicles and equipment

Biogenic sources: Emissions from vegetation

Events: Wildfires and prescribed burning

2.4.2 Methodology and Approach

2.4.2.1 Data Sources

2.4.2.1.1 EPA 2014 NEI v.2

With the exception of residential wood combustion, DEQ downloaded county-wide 2014 annual emissions data for area, nonroad and biogenic sources from the EPA 2014 NEI version 2 website[1]. Data report format was EPA source classification code, encompassing a total of 448 SCCs. The county-wide NEI data is the basis for emissions estimates that are specific to the Portland and Medford AQMA boundaries.

[1] https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data

2.4.2.1.2 Residential Wood Combustion

DEQ staff estimated residential wood combustion emissions, excluding emissions from outdoor wood burning and wood-fired central furnaces, from the 2014 Portland Residential Wood Combustion Survey.[939]

2.4.2.1.3 Prevention of Double-Counting

DEQ avoided double counting between permitted and non-permitted solvent and fuel use by using two EPA emissions estimation tools, provided to states specifically to remove double-counting in the NEI:

- Solvent Emissions Tool v.1.5, released December 2015.
- Industrial, Commercial and Institutional (ICI) Fuel Combustion Tool v. 1.4, released December 2015

These tools generated non-permitted emissions from fuel and solvent use after DEQ staff removed permitted point source activity levels from EPA-estimated Oregon total fuel and solvent use.

2.4.2.2 Allocation of County-Wide Emissions Data to AQMA

County-wide emissions data were allocated to AQMA using the following equation:

*AQMA emissions = (county-wide emissions) * (AQMA spatial surrogate)*

For sectors in which DEQ did not have precise geographic coordinates of county-wide emissions, DEQ developed spatial surrogates specific to emission source type through a process called "clipping" in ArcGIS desktop. For each county, DEQ clipped county-wide GIS data (zoning, land-cover, track length, etc.) associated with the source of the emissions to the AQMA boundary. The value (area or length) of the clipped data was then divided by the county total, resulting in the spatial surrogate value.

For sectors where emissions location was specific to coordinates, DEQ created spatial surrogates by mapping source location relative to the AQMA boundary. Examples of coordinate-specific source types include gas stations (permitted by DEQ), and wildfires and prescribed burning (where location is provided as part of the NEI release). Other coordinate-specific source types include airports (ground support equipment, aircraft to 3000 feet), commercial marine (in-transit and port), and recreational marine boat launch location combined with boat use days from the OSMB Triennial Boating Survey.[967]

2.4.2.3 Residential Wood Combustion Spatial Allocation

For residential wood combustion, DEQ allocated emissions to U.S. Census block-group level by correlating survey results and Census housing data. DEQ then summed results by census block-group to the AQMA boundary. [986]

2.4.2.4 Relational Databases

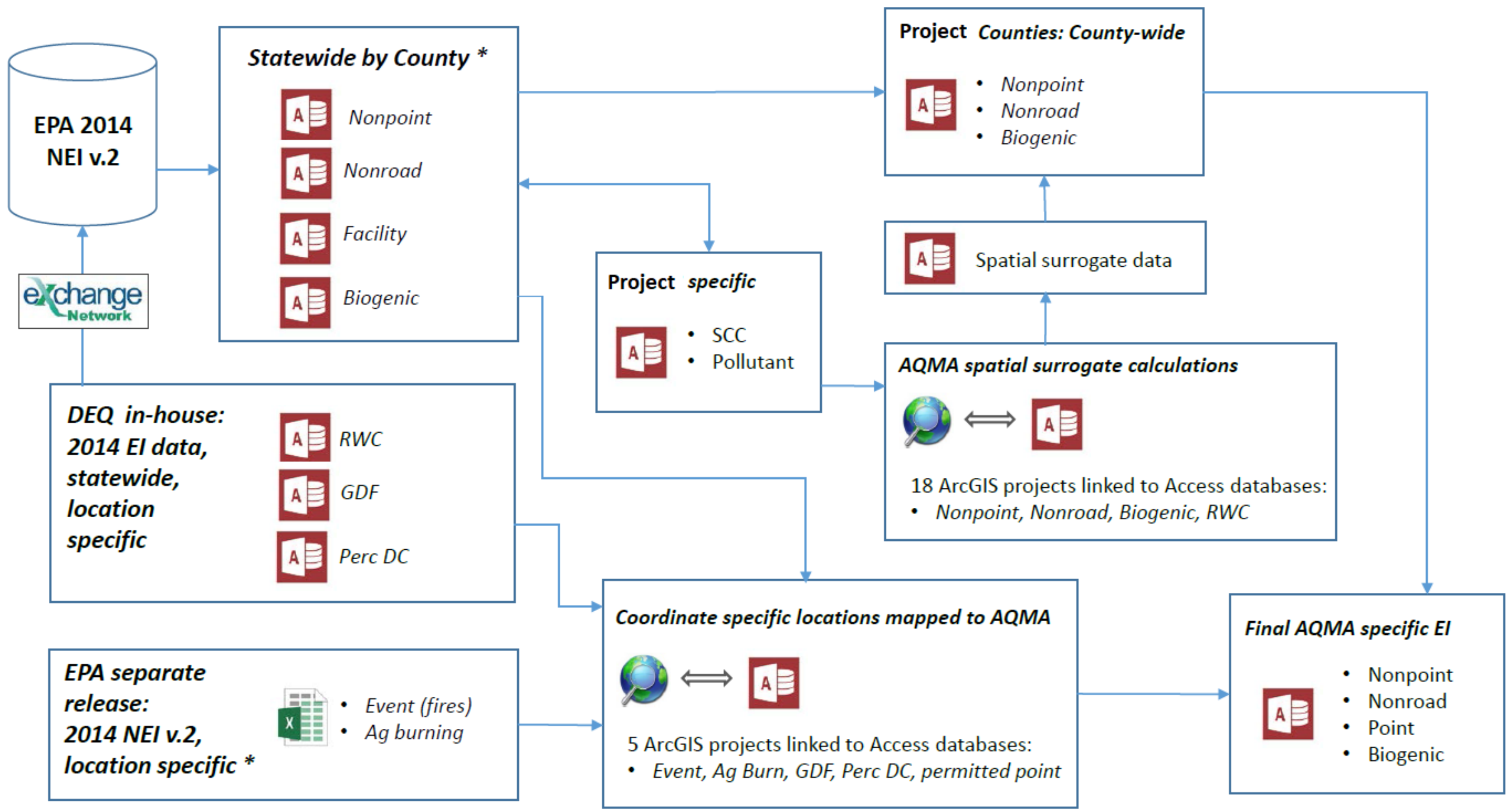
DEQ used linked MS Access databases to estimate final emissions. DEQ gave an ID number to spatial surrogates, specific to county and general source type. DEQ assigned each EPA SCC in the inventory an SSID according to its general source type. For example, DEQ assigned SCCs pertaining to construction equipment and vehicles in Washington County a specific construction SSID (4106711), and estimated via GIS clipping of building and roadway data in Washington County, the portion of the Portland AQMA within Washington County.

Figure 4 shows the EI source data and data flow for the nonroad portion of the project, and includes the GIS component of the EI preparation.

2.4.3 Summary of Nonpoint, Nonroad, Event and Biogenic Source Emissions

Emissions summary data for nonpoint (area), nonroad, event and biogenic sources are detailed by source category in Tables 8 and 9 for the major area source categories. Appendix B contains spatial surrogate data and maps for nonpoint, nonroad, event, biogenic and stationary non-permitted facility (aircraft and railyard) sources.

Source data and data flow diagram



* EPA statewide NEI data downloaded and stored on DEQ EI_FILES share-drive

Figure 4. Data flow and GIS components of non-onroad EI preparation

Table 8. Portland base year (2014) AQMA nonpoint, nonroad, biogenic and event source emissions in tons.

Data Category	Sector	1,3-Butadiene	15-PAH	Acetaldehyde	Acrolein	Arsenic	Benzene	Cadmium	Chromium (VI)	Dichlorobenzene	Ethylbenzene	Formaldehyde	Manganese	Methylene Chloride	Napthalene	Nickel	Perchloroethylene	Trichloroethylene	CO	Lead	NOX	PM10	PM2.5	SO2	VOC
Biogenic	Biogenics - Vegetation and Soil			1.4E+02								1.9E+02							1,320		66				4,416
Event	Fires - Prescribed Fires	1.4E+00	1.7E-01	6.4E+00	2.3E+00		2.1E+00					1.3E+01			1.9E+00				616		14	68	58	6	147
Nonpoint	Agriculture - Crops & Livestock Dust																					597	119		
Nonpoint	Av Gas Stations						1.2E+00				1.4E-01				6.9E-02					8.6E-04					137
Nonpoint	Commercial Cooking		3.5E-01	8.4E+00			9.7E+00				7.2E-01	9.2E+00			5.0E-01				258			132	101		85
Nonpoint	Dust - Construction Dust																					8,566	857		
Nonpoint	Dust - Paved Road Dust																					1,365	340		
Nonpoint	Dust - Unpaved Road Dust																					4,512	450		
Nonpoint	Fires - Agricultural Field Burning	3.4E-02	2.9E-02	1.4E-01			5.4E-01					2.5E+00							138		3	24	18	1	8
Nonpoint	Fuel Comb - Comm/Institutional - Biomass	3.9E-02	1.6E-02	5.6E-01	2.1E-02		1.3E-01				7.6E-03	3.9E-01			7.5E-02				160		59	138	119	7	5
Nonpoint	Fuel Comb - Comm/Institutional - Natural Gas		1.7E-04	8.1E-05			1.2E-02					4.7E-01			3.8E-03				498	3.0E-03	593	3	3	4	33
Nonpoint	Fuel Comb - Comm/Institutional - Oil	4.2E-04	9.0E-04	8.8E-03	9.9E-04	9.8E-04	1.0E-02	7.2E-04	1.3E-04			1.8E-02	1.5E-03		1.1E-03	2.7E-03			11	1.7E-04	51	4	4	9	3
Nonpoint	Fuel Comb - Comm/Institutional - Other		6.7E-06	3.1E-06			4.8E-04					1.8E-02			1.5E-04				21	1.1E-04	37	0.1	0.1	0.2	1
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Coal		1.1E-04			7.9E-03		9.9E-04	6.0E-04			4.6E-03			2.5E-04				97	8.1E-03	213	253	47	368	1
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Natural Gas		3.3E-04	1.6E-04			2.4E-02					9.0E-01			7.3E-03				957	5.7E-03	1,139	6	5	7	63
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Oil	2.0E-03	4.4E-03	4.7E-02	4.8E-03	4.6E-02	4.9E-02	3.4E-02	1.2E-04			1.1E-01	7.0E-02		6.0E-03	1.0E-01			56	1.1E-01	290	34	27	246	16
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Other																		33		59	0.2	0.2	0.3	2
Nonpoint	Fuel Comb - Residential - Natural Gas		3.0E-04	1.4E-04			2.3E-02					8.1E-01			6.6E-03				410		964	5	4	6	56
Nonpoint	Fuel Comb - Residential - Oil		1.9E-04	1.5E-02		1.8E-03	6.6E-04	1.3E-03	2.4E-04			1.1E-01	2.6E-03		3.6E-03	1.3E-03			16	4.0E-03	56	7	7	133	2
Nonpoint	Fuel Comb - Residential - Other		9.5E-06	4.5E-06			7.2E-04					2.6E-02			2.1E-04				13		46	0.2	0.1	0.2	2
Nonpoint	Fuel Comb - Residential - Wood	1.7E+01	9.8E+00	4.7E+01	5.0E+00		9.5E+01	7.6E-04				1.0E+02	5.7E-03		1.1E+01	5.6E-04			11,269		177	1,687	1,686	28	1,983
Nonpoint	Industrial Processes - Mining																					134	17		
Nonpoint	Industrial Processes - Storage and Transfer						3.5E-01				4.4E-02				2.2E-04										83
Nonpoint	Miscellaneous Non-Industrial NEC		3.9E-02	2.2E+00			1.0E+01				2.7E+00	3.2E+00			2.2E-01				1,074		23	75	60		372
Nonpoint	Solvent - Consumer & Commercial Solvent Use						7.0E-01				1.8E+00				4.5E+01										8,824
Nonpoint	Solvent - Degreasing						2.0E+00							8.7E+00	6.1E-02		1.5E+01	4.3E+01							1,417
Nonpoint	Solvent - Graphic Arts																								3,670
Nonpoint	Solvent - Industrial Surface Coating & Solvent Use																								1,499
Nonpoint	Solvent - Non-Industrial Surface Coating			1.8E-01							4.5E+00	3.7E-02			8.4E-01										1,832
Nonpoint	Waste Disposal	6.4E-04	2.3E-01	2.8E+00	1.8E-01		6.6E+00			5.7E-03	5.5E+00	2.9E+00		3.3E-01	1.0E-01		9.3E-02	7.8E-03	14,857		456	1,583	1,238	147	1,046
Nonroad	Mobile - Aircraft	4.3E+00	2.2E-01	1.1E+01	6.1E+00		4.7E+00				6.2E-01	3.1E+01			2.9E+00				2,204	1.1E+00	1,093	54	48	123	277
Nonroad	Mobile - Commercial Marine Vessels		2.2E-04	1.7E-02	7.3E-04	1.9E-03	4.3E-03	4.4E-05	9.7E-04		4.2E-04	4.1E-02	3.0E-04		6.5E-04	7.2E-02			18	3.3E-04	154	6	5		6
Nonroad	Mobile - Locomotives	1.1E-01	3.5E-02	6.5E-01	1.1E-01	8.4E-06	8.9E-02	6.6E-04	4.9E-05		9.3E-02	1.5E+00	4.8E-05		6.0E-02	1.5E-04			117	2.0E-03	815	23	22	0.2	46
Nonroad	Mobile - Non-Road Equipment - Diesel	7.4E-01	1.7E+00	3.7E+01	8.7E+00	1.0E-03	1.4E+01		1.9E-05		2.6E+00	1.1E+02	1.7E-03		2.4E+00	2.9E-03			2,453		3,974	330	320	8	443
Nonroad	Mobile - Non-Road Equipment - Gasoline	1.9E+01	2.4E+00	1.5E+01	1.1E+00	1.8E-03	1.0E+02		6.3E-06		6.4E+01	2.8E+01	7.8E-04		5.2E+00	8.7E-04			56,201		669	202	185	5	3,514
Nonroad	Mobile - Non-Road Equipment - Other	5.5E-02	3.1E-03	1.1E+00	4.0E-01	7.3E-04	6.5E-02		7.7E-06		7.3E-03	1.4E+01	3.1E-04		9.6E-03	1.1E-03			2,354		395	13	13	4	87

Table 9. Medford base year AQMA nonpoint, nonroad, biogenic and event source emissions in tons.

Data Category	Sector	1,3-Butadiene	15-PAH	Acetaldehyde	Acrolein	Arsenic	Benzene	Cadmium	Chromium (VI)	Dichlorobenzene	Ethylbenzene	Formaldehyde	Manganese	Methylene Chloride	Napthalene	Nickel	Perchloroethylene	Trichloroethylene	CO	Lead	NOX	PM10	PM2.5	SO2	VOC
Biogenic	Biogenics - Vegetation and Soil			8.7E+01								1.2E+02							829		22				3,853
Event	Fires - Prescribed Fires	3.3E-01	3.8E-02	1.6E+00	5.4E-01		5.3E-01					3.0E+00			5.0E-01				181		3	19	16	1	43
Event	Fires - Wildfires	1.2E-01	1.9E-02	9.4E-01	2.8E-01		3.6E-01					1.6E+00			2.8E-01				65		2	7	6	1	16
Nonpoint	Agriculture - Crops & Livestock Dust																					113	23		
Nonpoint	Av Gas Stations						1.9E-01				2.1E-02				1.1E-02					1.3E-04					21
Nonpoint	Commercial Cooking		4.4E-02	9.8E-01			1.1E+00				7.5E-02	1.1E+00			5.2E-02				30			16	12		10
Nonpoint	Dust - Construction Dust																					346	35		
Nonpoint	Dust - Paved Road Dust																					59	14		
Nonpoint	Dust - Unpaved Road Dust																					2,330	232		
Nonpoint	Fires - Agricultural Field Burning		2.3E-02				4.4E-01					2.1E+00							112		3	19	14	0	7
Nonpoint	Fuel Comb - Comm/Institutional - Biomass	3.9E-03	1.6E-03	5.6E-02	2.1E-03		1.3E-02				7.6E-04	3.9E-02			7.5E-03				16		6	14	12	1	0
Nonpoint	Fuel Comb - Comm/Institutional - Natural Gas		2.0E-05	9.2E-06			1.4E-03					5.3E-02			4.3E-04				57	3.4E-04	68	0.4	0.3	0.4	4
Nonpoint	Fuel Comb - Comm/Institutional - Oil	4.2E-05	9.0E-05	8.9E-04	9.9E-05	9.8E-05	1.0E-03	7.2E-05	1.3E-05			1.8E-03	1.5E-04		1.1E-04	2.7E-04			1	1.8E-05	5	0.4	0.4	1	0.3
Nonpoint	Fuel Comb - Comm/Institutional - Other		6.7E-07	3.1E-07			4.8E-05					1.8E-03			1.5E-05				2	1.1E-05	4	0.01	0.01	0.02	0.1
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Coal		8.6E-06			6.0E-04		7.4E-05	4.5E-05			3.5E-04			1.9E-05				7	6.1E-04	16	19	4	28	0.1
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Natural Gas		1.6E-05	7.6E-06			1.2E-03					4.4E-02			3.6E-04				47	2.8E-04	56	0.3	0.2	0.3	3
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Oil	1.5E-04	3.3E-04	3.5E-03	3.6E-04	3.5E-03	3.7E-03	2.6E-03	9.1E-06			8.6E-03	5.2E-03		4.5E-04	7.5E-03			4	8.0E-03	22	3	2	18	1
Nonpoint	Fuel Comb - Industrial Boilers, ICEs - Other																		3		4	0.02	0.01	0.02	0.16
Nonpoint	Fuel Comb - Residential - Natural Gas		2.7E-05	1.2E-05			2.0E-03					7.2E-02			5.8E-04				36		85	0.5	0.4	1	5
Nonpoint	Fuel Comb - Residential - Oil		8.1E-06	6.7E-04		7.7E-05	2.9E-05	5.8E-05	1.0E-05			4.6E-03	1.2E-04		1.6E-04	5.8E-05			1	1.7E-04	2	0.3	0.3	6	0.1
Nonpoint	Fuel Comb - Residential - Other		1.5E-06	6.9E-07			1.1E-04					4.0E-03			3.2E-05				2		7	0.03	0.02	0.03	0.3
Nonpoint	Fuel Comb - Residential - Wood	2.9E+00	1.6E+00	8.3E+00	8.6E-01		1.6E+01	1.1E-04				1.8E+01	8.6E-04		2.0E+00	8.5E-05			1,903		31	290	290	5	328
Nonpoint	Industrial Processes - Mining																					34	4		
Nonpoint	Industrial Processes - Storage and Transfer						4.2E-03				2.0E-04				1.0E-06										0.4
Nonpoint	Miscellaneous Non-Industrial NEC		5.2E-03	2.9E-01			1.1E+00				2.7E-01	4.2E-01			2.7E-02				142		3	10	8		38
Nonpoint	Solvent - Consumer & Commercial Solvent Use						1.0E-02				2.6E-02				6.6E-01										837
Nonpoint	Solvent - Degreasing						1.6E-01							6.7E-01	4.7E-03		1.1E+00	3.3E+00							108
Nonpoint	Solvent - Graphic Arts																								364
Nonpoint	Solvent - Industrial Surface Coating & Solvent Use																								210
Nonpoint	Solvent - Non-Industrial Surface Coating			1.9E-02							4.7E-01	3.8E-03			8.8E-02										191
Nonpoint	Waste Disposal	4.6E-05	7.6E-02	9.3E-01	5.8E-02		2.1E+00			4.6E-04	6.1E-01	9.7E-01		5.4E-02	2.7E-02		5.5E-03	5.7E-04	822		30	112	93	8	60
Nonroad	Mobile - Aircraft	3.3E-01	3.1E-02	8.0E-01	4.4E-01		3.8E-01				5.7E-02	2.4E+00			3.3E-01				223	1.4E-01	26	5	4	4	20
Nonroad	Mobile - Locomotives	4.3E-03	1.3E-03	2.5E-02	4.1E-03	3.2E-07	3.4E-03	2.5E-05	1.9E-06		2.8E-03	5.7E-02	1.8E-06		2.3E-03	5.9E-06			4	7.5E-05	36	1	1		1
Nonroad	Mobile - Non-Road Equipment - Diesel	5.4E-02	1.3E-01	2.7E+00	6.3E-01	7.6E-05	1.0E+00		1.4E-06		1.9E-01	7.7E+00	1.2E-04		1.7E-01	2.1E-04			172		293	24	23	1	32
Nonroad	Mobile - Non-Road Equipment - Gasoline	2.0E+00	2.7E-01	1.7E+00	1.3E-01	1.7E-04	1.1E+01		5.9E-07		7.8E+00	3.0E+00	7.3E-05		6.3E-01	8.2E-05			5,132		61	20	18	0.4	414
Nonroad	Mobile - Non-Road Equipment - Other	3.4E-03	2.7E-04	8.8E-02	3.2E-02	6.3E-05	4.0E-03		6.7E-07		4.0E-04	1.2E+00	2.7E-05		4.1E-04	9.3E-05			202		32	1	1	0.1	7

2.5 On-Road Mobile Sources

2.5.1 Introduction and Scope

DEQ followed EPA emission inventory preparatory guidelines for state implementation plans and transportation conformity when completing the on-road portion of the project emission inventory.[989] DEQ completed the emission inventory by incorporating several key elements and contributions from Metro for the Portland AQMA, and ODOT for the Medford-Ashland AQMA. Appendix C provides supplemental, technical detail related to the development of the 2015 on-road motor vehicle emission inventory.

The on-road mobile category consists of emissions from all types of highway vehicles, including light and heavy duty diesel and gasoline vehicles, and motorcycles. Light duty includes vehicles up to 8,500 lbs. Heavy duty vehicles are those vehicles with a gross vehicle weight ratings heavier than 8,500 lbs. to vehicles weighing up to 105,000 lbs. Fuel types include gasoline, diesel, and electric. The inventory encompasses exhaust, brake, evaporation and tire emissions.

2.5.2 Methodology: Exhaust, Brake & Tire

The following Figure 5 provides an overview of the methodology for the on-road mobile exhaust, brake, and tire emission estimates. As shown in the figure, the two main steps in developing the vehicle exhaust, brake and tire inventory were (1) the generation of link-based activity estimates using the transportation network travel demand model (TDM), and (2) the modeling of fleet pollutant emission factors using EPA's MOVES2014a emissions model.

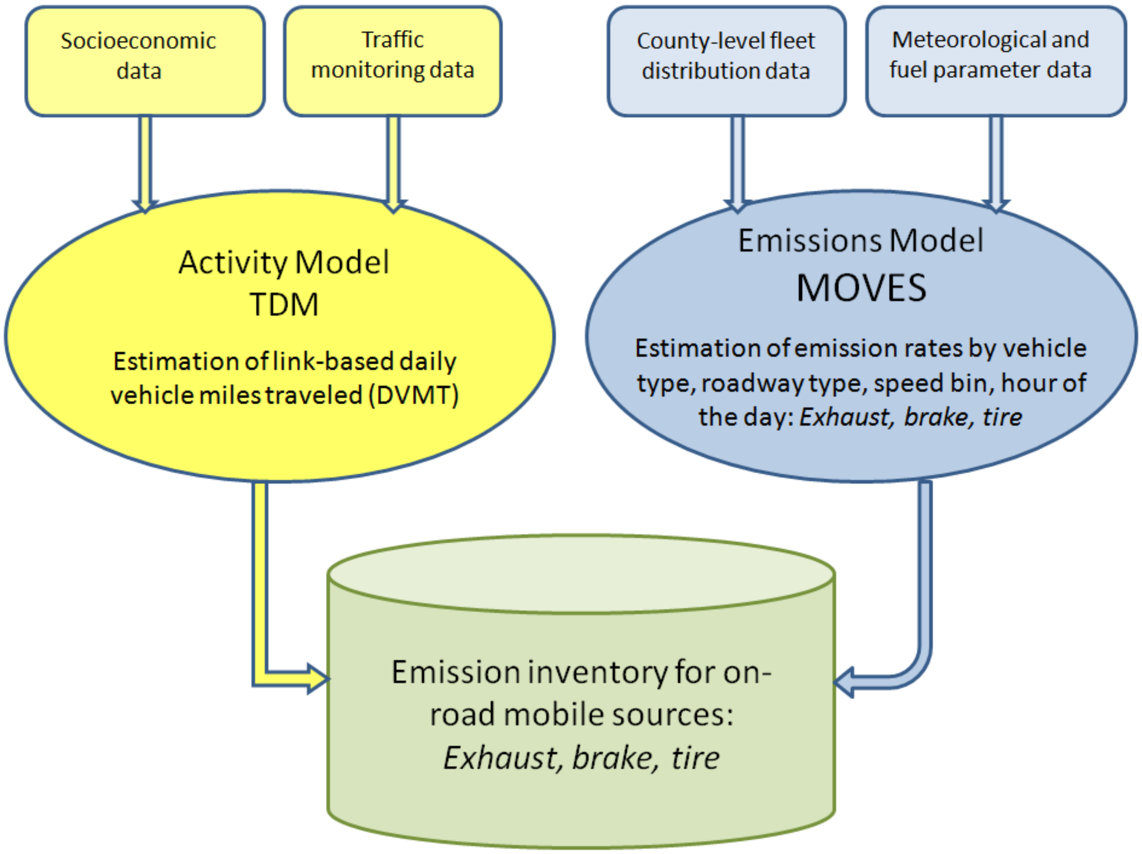


Figure 5. Main processing steps and software: on-road mobile exhaust, brake, and tire EI.

2.5.3 Re-Entrained Road Dust

Re-entrained road dust is the dust resulting from the pulverization and abrasion of the roadway surface by application of mechanical force through vehicle wheels. The source of emissions data for re-entrained road dust was the EPA 2014 NEI version 2 website.[966] Re-entrained road dust data is included in calculations described in Section 2.4 of this document (nonpoint sources).

2.5.4 Vehicle Activity Data

2.5.4.1 Portland AQMA

2.5.4.1.1 Metro Methodology

Metro provided their MOVES2014a RunSpec input files from the 2018 Regional Transportation Plan. The base year for the travel demand model activity was 2015. From the Metro MOVES2014a RunSpec inputs, DEQ prepared emission inventory model runs for the four onroad mobile scenarios being reviewed, representing the same onroad mobile activity and Vehicle Inspection and Maintenance Program settings.

2.5.4.1.2 Metro DVMT Apportionment to Source Type

Metro Daily VMT was apportioned to MOVES vehicle type using estimated fleet percentages, developed by ODOT HPMS coordinator staff local knowledge of DMV registration data. The ODOT DVMT apportionment to MOVES vehicle type is detailed in Table 10.

2.5.4.1.3 Metro DVMT Temporal Allocation – Hour VMT Fraction

Metro provided 2015 DVMT from their 2018 RTP, and a MOVES roadway type was assigned to each link, based on Metro speed bin and link location. The Metro DVMT data was also assigned a MOVES speed bin ID. Metro DVMT values were then adjusted to hourly VMT using MOVES default data, specifically the MOVES default hourly VMT Excel database input table "HourVMTFraction." The input table breaks down daily activity into hourly activity fractions by MOVES roadway and source types.

2.5.4.1.4 MOVES2014a: 2015 Inputs and Scenarios – Portland AQMA

Onroad mobile source emissions were modeled using EPA's MOVES2014a model version. Four MOVES model scenario runs were conducted for the Portland AQMA:

- No Vehicle Inspection and Maintenance (VIP) program
- Current VIP program which includes a 4-yr grace period testing exemption for the newest model year vehicles
- Current VIP program with a 5-yr grace period testing exemption for the newest model year vehicles
- Current VIP program with a 6-yr grace period testing exemption for the newest model year vehicles

2.5.4.2 Medford-Ashland AQMA

2.5.4.2.1 ODOT Methodology: Estimating Daily VMT by Link

ODOT provided DEQ 2015 DVMT by link. Appendix C includes an ODOT Memo[971] that details the Medford Travel Demand Model and describes the generation of link-based daily VMT. DEQ apportioned ODOT DVMT to the AQMA using ODOT supplied DVMT by links within Travel Analysis Zones. The total area for DVMT supplied was slightly larger than the AQMA. DEQ used ArcGIS10 to clip the ODOT data down to the AQMA. Link distance was re-calculated, and VMT re-estimated for the clipped links and TAZs using a ratio of distances or areas.

2.5.4.2.2 ODOT DVMT Apportionment to Source Type

ODOT DVMT was apportioned to MOVES vehicle type using estimated fleet percentages developed by ODOT staff local knowledge of DMV registration data. Table 10 shows the ODOT DVMT apportionment to MOVES vehicle type.

2.5.4.2.3 ODOT DVMT Temporal Allocation – Hour VMT Fraction

DEQ mapped the ODOT DVMT with ArcGIS10, and assigned a MOVES roadway type to each link based on ODOT speed bin and link location. DEQ also assigned the ODOT DVMT data a MOVES speed bin ID, which aligned with ODOT speed bins. ODOT daily VMT values were then adjusted to hourly VMT using MOVES default data, specifically the MOVES default hourly VMT Excel database input table "HourVMTFraction." The input table breaks down daily activity into hourly activity fractions by MOVES roadway and source types.

2.5.4.2.4 MOVES2014a: 2015 Inputs and Scenarios

DEQ modeled onroad mobile source emissions with EPA's MOVES2014a model version.
DEQ completed four MOVES model scenario runs for each AQMA:

- No Vehicle Inspection and Maintenance (VIP) program
- Current VIP which includes a 4-yr grace period testing exemption for the newest model year vehicles
- Current VIP program with a 5-yr grace period testing exemption for the newest model year vehicles
- Current VIP program with a 6-yr grace period testing exemption for the newest model year vehicles

The MOVES model was run in emission inventory mode to output emissions for each road type, fuel type, day type, hour, speed bin, and process. The MOVES2014a modeling Run Specification(s) are detailed in Appendix C: MOVES2014a Mobile Emissions Estimate Steps.

2.5.5 Base Year Summary of Onroad Emissions by Source Type

Tables 11 and 12 display a summary of onroad emissions by source type in tons per year for the Portland and Medford-Ashland AQMAs. DEQ ran the MOVES model with the current VIP pollutant control strategy in place.

Table 10. Fleet percentage breakdown for Portland and Medford VMT estimates.

ID	sourcetypename	Fuel Type	Fleet Percentage	SCC	scc level one	scc level two	scc level three	scc level four
11	Motorcycle	Gasoline	100%	2201080000	Mobile Sources	Highway Vehicles - Gasoline	Motorcycles (MC)	Total: All Road Types
21	Passenger Car	Gasoline	98.5%	2201001000	Mobile Sources	Highway Vehicles - Gasoline	Light Duty Gasoline Vehicles (LDGV)	Total: All Road Types
31	Passenger Truck	Gasoline	88.5%	2201020000 & 2201040000	Mobile Sources	Highway Vehicles - Gasoline	Light Duty Gasoline Trucks 1 through 4 (M6)	Total: All Road Types
32	Light Commercial Truck	Gasoline	50%	2201070000	Mobile Sources	Highway Vehicles - Gasoline	Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV)	Total: All Road Types
41	Intercity Bus	Gasoline	20%	2201070000	Mobile Sources	Highway Vehicles - Gasoline	Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV)	Total: All Road Types
42	Transit Bus	Gasoline	20%	2201070000	Mobile Sources	Highway Vehicles - Gasoline	Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV)	Total: All Road Types
43	School Bus	Gasoline	20%	2201070000	Mobile Sources	Highway Vehicles - Gasoline	Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV)	Total: All Road Types
54	Motor Home	Gasoline	85.5%	2201070000	Mobile Sources	Highway Vehicles - Gasoline	Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV)	Total: All Road Types
21	Passenger Car	Diesel	1.5%	2230001000	Mobile Sources	Highway Vehicles - Diesel	Light Duty Diesel Vehicles (LDDV)	Total: All Road Types
31	Passenger Truck	Diesel	11.5%	2230060000	Mobile Sources	Highway Vehicles - Diesel	Light Duty Diesel Trucks 1 thru 4 (M6) (LDDT)	Total: All Road Types
32	Light Commercial Truck	Diesel	50%	2230060000	Mobile Sources	Highway Vehicles - Diesel	Light Duty Diesel Trucks 1 thru 4 (M6) (LDDT)	Total: All Road Types
41	Intercity Bus	Diesel	80%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
42	Transit Bus	Diesel	80%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
43	School Bus	Diesel	80%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
51	Refuse Truck	Diesel	100%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
52	Single Unit Short-haul Truck	Diesel	100%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
53	Single Unit Long-haul Truck	Diesel	100%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
54	Motor Home	Diesel	14.5%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
61	Combination Short-haul Truck	Diesel	100%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types
62	Combination Long-haul Truck	Diesel	100%	2230070000	Mobile Sources	Highway Vehicles - Diesel	All HDDV including Buses (use subdivisions -071 thru -075 if possible)	Total: All Road Types

Table 11. Base Year Summary of Onroad Emissions by Source Type, tons per year: Portland AQMA.

		Motorcycles (MC)	Light Duty Gasoline Vehicles (LDGV)	Light Duty Gasoline Trucks (LDGT)	Heavy Duty Gasoline Vehicles (HDGV)	Light Duty Diesel Vehicles (LDDV)	Light Duty Diesel Trucks (LDDT)	Heavy Duty Diesel Vehicles (HDDV)	**Total**
Air Toxic	1,3-Butadiene	0.1	11.2	11.3	2.3	0.2	3.7	1.4	**30.1**
	Acetaldehyde	0.5	27.5	29.1	6.3	0.4	10.1	16.4	**90.3**
	Acrolein	0.0	1.6	1.8	0.45	2.4E-02	0.7	2.7	**7.3**
	Benzene	2.4	78.4	81.6	16.1	1.2	26.7	6.8	**213.3**
	Dichlorobenzene	--	--	--	--	--	--	--	**--**
	Ethylbenzene	3.1	49.1	46.6	9.3	0.7	15.3	3.8	**128.0**
	Formaldehyde	0.6	21.6	27.5	6.8	0.3	10.4	39.3	**106.5**
	Methylene Chloride	--	--	--	--	--	--	--	**--**
	Napthalene	0.1	3.9	4.5	1.0	0.1	1.6	4.0	**15.2**
	Perchloroethylene	--	--	--	--	--	--	--	**--**
	Trichloroethylene	--	--	--	--	--	--	--	**--**
Air Toxic: 15-PAH	15-PAH	0.0	1.5	1.7	0.4	0.02	0.6	1.2	**5.5**
Air Toxic: Metals	Arsenic	1.0E-04	1.1E-02	7.8E-03	1.5E-03	1.7E-04	2.6E-03	1.4E-03	**0.025**
	Cadmium	--	--	--	--	--	--	--	**--**
	Chromium (VI)	5.3E-07	5.7E-05	4.1E-05	8.0E-06	8.7E-07	1.3E-05	6.5E-06	**0.00013**
	Manganese	--	--	--	--	--	--	--	**--**
	Nickel	--	--	--	--	--	--	--	**--**
Criteria Pollutant	CO	690.1	23,619.1	28,476.6	7,005.4	359.7	10,705.7	4,036.9	**74,893.5**
	Lead	--	--	--	--	--	--	--	**--**
	NOX	38.2	2,892.2	3,898.6	728.8	44.0	1,235.4	4,922.7	**13,759.9**
	PM10	2.0	208.3	173.4	37.1	3.2	59.7	245.0	**728.7**
	PM2.5	1.3	77.4	71.0	16.6	1.2	25.8	173.7	**367.0**
	SO2	0.4	35.8	34.3	6.4	0.5	10.8	8.7	**97.0**
	VOC	182.7	2,917.2	2,679.6	543.6	44.4	891.8	523.4	**7,782.8**

Table 12. Base Year Summary of Onroad Emissions by Source Type, tons per year: Medford AQMA.

		Motorcycles (MC)	Light Duty Gasoline Vehicles (LDGV)	Light Duty Gasoline Trucks (LDGT)	Heavy Duty Gasoline Vehicles (HDGV)	Light Duty Diesel Vehicles (LDDV)	Light Duty Diesel Trucks (LDDT)	Heavy Duty Diesel Vehicles (HDDV)	**Total**
Air Toxic	1,3-Butadiene	0.3	2.1	4.5	0.2	0.03	0.7	0.2	**8.0**
	Acetaldehyde	1.5	5.3	11.5	0.5	0.1	1.9	1.4	**22.3**
	Acrolein	0.1	0.3	0.7	0.04	4.5E-03	0.1	0.2	**1.5**
	Benzene	7.4	15.1	32.5	1.3	0.2	5.4	0.9	**62.8**
	Dichlorobenzene	--	--	--	--	--	--	--	**--**
	Ethylbenzene	5.7	11.1	21.3	0.9	0.2	3.5	0.5	**43.1**
	Formaldehyde	2.5	5.0	11.9	0.6	0.1	2.0	3.0	**25.0**
	Methylene Chloride	--	--	--	--	--	--	--	**--**
	Napthalene	0.3	0.8	1.9	0.1	0.01	0.3	0.3	**3.8**
	Perchloroethylene	--	--	--	--	--	--	--	**--**
	Trichloroethylene	--	--	--	--	--	--	--	**--**
Air Toxic: 15-PAH	15-PAH	0.1	0.3	0.7	0.036	0.005	0.1	0.2	**1.5**
Air Toxic: Metals	Arsenic	3.4E-04	1.1E-03	1.4E-03	6.3E-05	1.7E-05	2.4E-04	1.2E-04	**0.003**
	Cadmium	--	--	--	--	--	--	--	**--**
	Chromium (VI)	1.79E-06	5.83E-06	7.14E-06	3.33E-07	8.88E-08	1.23E-06	6.30E-07	**0.00002**
	Manganese	--	--	--	--	--	--	--	**--**
	Nickel	--	--	--	--	--	--	--	**--**
Criteria Pollutant	CO	2,572.2	4,494.8	11,561.0	552.9	68.4	1,941.3	512.5	**21,703.2**
	Lead	--	--	--	--	--	--	--	**--**
	NOX	128.1	540.0	1,328.6	66.5	8.2	221.8	303.4	**2,596.6**
	PM10	7.6	31.7	44.5	2.9	0.5	7.7	24.7	**119.6**
	PM2.5	4.6	15.7	23.1	1.7	0.2	4.0	16.1	**65.4**
	SO2	1.1	3.9	6.2	0.3	0.1	1.1	0.6	**13.3**
	VOC	336.8	652.5	1,206.6	52.3	9.9	199.0	57.5	**2,514.8**

2.5.6 Estimated Emissions Benefit of VIP Control Strategy

To represent the pollutant emissions prevented by having a vehicle inspection and maintenance program, DEQ ran the MOVES model without including VIP as a pollutant control strategy. Tables 13 and 14 represent the emission increase in on-road emissions if an inspection and maintenance program were not in place in the Portland and Medford-Ashland AQMAs.

Table 13. : Percent increase to onroad emissions from removal of VIP program: Portland AQMA.

		2015 (tpy)	2015 No VIP (tpy)	Emissions Increase (a)
Air Toxic	1,3-Butadiene	30.14	35.71	18%
	Benzene	213.3	255.3	20%
	Ethylbenzene	128.0	148.5	16%
	Acetaldehyde	90.3	103.9	15%
	Napthalene	15.18	17.31	14%
	15-PAH	5.454	6.162	13%
	Formaldehyde	106.51	119.35	12%
	Acrolein	7.286	8.043	10%
Criteria	NOX	13,760	14,698	7%
	CO	74,894	85,748	14%
	VOC	7,783	9,260	19%

(a) % increase = ((2015 tpy no VIP) - (2015 tpy)) / (2015 tpy)

Table 14. Percent increase to onroad emissions from removal of VIP program: Medford AQMA.

		2015 (tpy)	2015 No VIP (tpy)	Emissions Increase (a)
Air Toxic	1,3-Butadiene	8.04	8.73	8%
	Benzene	62.8	67.7	8%
	Ethylbenzene	43.1	45.7	6%
	Acetaldehyde	22.3	24.0	8%
	Napthalene	3.77	4.04	7%
	15-PAH	1.463	1.551	6%
	Formaldehyde	25.03	26.64	6%
	Acrolein	1.458	1.550	6%
Criteria	NOX	2,597	2,767	7%
	CO	21,703	22,920	6%
	VOC	2,515	2,647	5%

(a) % increase = ((2015 tpy no VIP) - (2015 tpy)) / (2015 tpy)

3 STRATEGY and SCENARIO EVALUATION

This section presents modeled effects of existing and modified strategies. DEQ represents the effectiveness of these strategies by showing how much total anthropogenic emissions would increase if these strategies were removed. This project analyzed the effects of only four strategies but analysts could use similar methodology to calculate emissions reductions from other strategies such as parking ratio rules, industrial growth allowance, industrial New Source Review, rules applicable to non-permitted autobody shops or spray paints, and nonroad diesel controls.

3.1 Strategies and Scenarios Evaluated

Strategies and scenarios evaluated for the Portland-Medford SIP-VIP Updates Project include:

- MOVES run with No Vehicle Inspection and Maintenance Program included
- Current VIP (4 year grace period for new vehicles)
- VIP with a 5 year grace period for new vehicles
- VIP with a 6 year grace period for new vehicles
- Employee Commute Options program
- Gasoline Dispensing Facility Stage II VRS controls
- Marine Loading (barge) controls

3.1.1 Onroad mobile: VIP scenarios

VIP ensures that motorists maintain emission control systems to keep pollution levels within EPA's allowable standards over the life of a vehicle. The current program requires a vehicle emissions test before DMV registration in the Portland-Metro and Medford-Ashland areas every two years. Vehicles 4-years and newer are exempted from testing.

To demonstrate existing VIP control strategy effectiveness, DEQ changed base year MOVES input settings to "uncheck" the inspection and maintenance (I/M) program. MOVES model results show how much onroad emissions would increase under this scenario. DEQ then input MOVES results into the emissions inventory and geographic analysis of total anthropogenic emissions. DEQ also modeled how much total anthropogenic emissions would increase from expanding the current exemption (4-year grace period) to a 5- or 6-year exemption. All other settings were unchanged from the base year run.

Tables 15 and 16 show the increase in total anthropogenic emissions under the differing grace period years and No VIP scenarios. The tables include only those pollutants that increase with changes to VIP implementation. The emissions shown are for nonpoint, nonroad, point and onroad emissions totals for each AQMA. Event (e.g. wildfires and prescribed burning) and biogenic (e.g. vegetation) emissions are not included in the totals.

Table 15. Emissions growth from VIP scenarios: Portland AQMA.

	Anthropogenic emissions, tpy				(a)	(b)	(c)
	VIP in effect				Emissions Increase		
	Base Year: 4 yr grace	5 yr grace	6 yr grace	No VIP	5 yr grace	6 yr grace	No VIP
1,3-Butadiene	71.61	71.65	71.69	77.18	0.06%	0.12%	8%
Benzene	469.4	469.7	470.0	511.4	0.07%	0.14%	9%
Ethylbenzene	225.9	226.0	226.2	246.3	0.06%	0.13%	9%
Acetaldehyde	216.5	216.6	216.7	230.2	0.05%	0.10%	6%
Napthalene	84.12	84.14	84.15	86.25	0.02%	0.03%	3%
15-PAH	20.318	20.323	20.328	21.027	0.02%	0.05%	3%
Formaldehyde	412.27	412.33	412.40	425.11	0.02%	0.03%	3%
Acrolein	28.86	28.87	28.88	29.62	0.02%	0.05%	3%
NOX	26,184	26,198	26,212	27,122	0.05%	0.11%	4%
CO	168,525	168,722	168,928	179,380	0.12%	0.24%	6%
VOC	35,074	35,082	35,091	36,551	0.02%	0.05%	4%

(a) % increase = ((5 yr grace VIP) - (base year)) / (base year)

(b) % increase = ((6 yr grace) - (base year)) / (base year)

(c) % increase = ((no VIP) - (base year)) / (base year)

Table 16. Emissions growth from VIP scenarios: Medford AQMA.

	Anthropogenic emissions, tpy				(a)	(b)	(c)
	VIP in effect				Emissions Increase		
	Base Year: 4 yr grace	5 yr grace	6 yr grace	No VIP	5 yr grace	6 yr grace	No VIP
1,3-Butadiene	13.299	13.302	13.304	13.982	0.02%	0.04%	5%
Benzene	99.63	99.66	99.68	104.55	0.02%	0.04%	5%
Ethylbenzene	54.11	54.12	54.13	56.62	0.02%	0.04%	5%
Acetaldehyde	43.11	43.12	43.13	44.82	0.02%	0.03%	4%
Napthalene	8.280	8.281	8.282	8.544	0.01%	0.02%	3%
15-PAH	3.6491	3.6494	3.6497	3.7371	0.01%	0.02%	2%
Formaldehyde	76.582	76.586	76.591	78.193	0.01%	0.01%	2%
Acrolein	4.4841	4.4846	4.4850	4.5763	0.01%	0.02%	2%
NOX	4,134	4,135	4,136	4,305	0.03%	0.05%	4%
CO	32,967	32,982	32,996	34,183	0.05%	0.09%	4%
VOC	6,490	6,490	6,491	6,622	0.01%	0.02%	2%

(a) % increase = ((5 yr grace VIP) - (base year)) / (base year)

(b) % increase = ((6 yr grace) - (base year)) / (base year)

(c) % increase = ((no VIP) - (base year)) / (base year)

3.1.2 Onroad mobile: Employee Commute Options (ECO)

The Employee Commute Options or "ECO" Program requires large employers in the Portland area with more than 100 employees reporting to a work site to provide commute options to encourage employees to reduce auto trips to the work site. ECO is part of a federally required plan to reduce smog levels. ECO is one of several strategies included in the Ozone Maintenance Plan for the Portland Air Quality Maintenance Area.

DEQ requires employers to survey to determine current commute methods, prepare a plan to meet the target reduction and submit the plan to DEQ for approval, and perform follow-up surveys every two years to measure progress toward the 10% trip reduction goal. The plan needs to include commute option plan incentives. The incentives must have the potential to reduce commute trips to work site by 10% from an established baseline. Common commute option incentives include: Transit and vanpool subsidies, allowing employees to purchase transit passes with pre-tax dollars, carpool matching and preferential parking for carpools, compressed work weeks, telecommuting, bike/walk incentives, emergency ride home program.

The main goal of ECO is to protect public health by reducing air pollution from motor vehicles. Car exhaust is one of our region’s largest single sources of air pollution. ECO also helps offset transportation congestion caused by the use of single passenger vehicles.

ECO also helps reduce traffic congestion. Car exhaust is a main ingredient in ground-level ozone, also called smog. Breathing even low levels of smog can decrease lung function and aggravate asthma. Smog hurts everyone but is especially harmful to children, older adults and people with heart disease and breathing problems like asthma. According to the Oregon Health Authority, approximately 10.2 percent of adults and 9.5 percent of children in Oregon have asthma. This is higher than the national average. More than a quarter of adults with asthma report missing at least one day of work per year due to their condition. Car exhaust is a primary source of carbon dioxide, a global warming gas. Car exhaust also is a major source of air toxics - chemicals known or suspected to cause cancer and other serious health effects. A recent DEQ study shows unhealthy levels of benzene and other air toxics in Portland’s air.

Table 17 outlines the emissions growth from ECO removal on the base year nonpoint, nonroad, point and onroad emissions totals.

Table 17. Anthropogenic emissions growth from removal of ECO program: Portland AQMA.

		---- Nonpoint, Nonroad, Point and Onroad Totals (TPY) ---- - Base Year: VIP in effect, 4 yr grace - With ECO	 Without ECO	Emissions Increase Without ECO (a)
Air Toxic	1,3-Butadiene	71.6	72.0	0.5%
	Acetaldehyde	216.5	217.4	0.4%
	Acrolein	28.86	28.92	0.2%
	Benzene	469.4	471.7	0.5%
	Dichlorobenzene	1.0E-02	1.0E-02	0%
	Ethylbenzene	225.9	227.1	0.5%
	Formaldehyde	412.3	412.8	0.1%
	Methylene Chloride	9.2	9.2	0%
	Napthalene	84.1	84.2	0.1%
	Perchloroethylene	31.5	31.5	0%
	Trichloroethylene	42.9	42.9	0%
Air Toxic: 15-PAH	15-PAH	20.3	20.4	0.2%
Air Toxic: Metals	Arsenic	8.7E-02	8.8E-02	1.5%
	Cadmium	0.04	0.04	0%
	Chromium (VI)	1.6698E-02	1.6705E-02	0.04%
	Manganese	1.4	1.4	0%
	Nickel	0.4	0.4	0%
Criteria Pollutant	CO	168,525	169,865	0.8%
	Lead	1.5	1.5	0%
	NOX	26,184	26,287	0.4%
	PM10	20,883	20,888	0.03%
	PM2.5	6,412	6,415	0.05%
	SO2	1,379	1,383	0.3%
	VOC	35,074	35,127	0.2%
	Shaded rows indicate no impact			

(a) % increase = ((Without ECO) - (base year)) / (base year)

3.2 Point sources: Gasoline Dispensing Facility Stage II Controls

DEQ permits GDFs, resulting in location, activity and controls data specific to each station. In addition to total annual throughput data from facility annual reporting to DEQ, facility-specific inspection data includes control types for storage tanks and pumps at each GDF. This data allows for emissions estimates with and without Stage II Vapor Recovery System controls at the gasoline dispensing pump. Table 18 outlines the emissions growth from VRS removal on the base year (2014) nonpoint, nonroad, point and onroad emissions totals.

Table 18. Anthropogenic emissions growth from VRS removal: Portland AQMA.

	Nonpoint, Nonroad, Point and Onroad Totals (TPY) Base Year: VRS	 Base Year: No VRS	Emissions Increase (a)
Benzene	469.4	474.2	1.0%
Ethylbenzene	225.9	229.7	1.7%
VOC	35,074.0	35,654.5	1.7%

(a) % increase = ((no VRS) - (base year)) / (base year)

3.3 Point sources: Marine loading (barge) controls

Oregon rule OAR 340-232-0110 is applicable to loading gasoline into marine tank vessels, including marine loading racks. In Oregon, gasoline is loaded into barges at Portland ports for transport to eastern areas of the state. Control consists of a vapor collection system. Part 4 of the rule specifies "*Vapors that are displaced and collected during marine tank vessel loading events must be reduced from the uncontrolled condition by at least 95 percent by weight…*" Uncontrolled emissions estimates from barge loading were estimated using the formula

Uncontrolled emissions, tpy = (Controlled emissions, tpy) / (1-0.95)

Table 19 details uncontrolled emissions estimates for barge loading. Table 20 outlines the emissions growth from removal of barge loading controls on the base year (2014) nonpoint, nonroad, point and onroad emissions totals.

Table 19. Controlled vs. uncontrolled emissions details: Barge loading.

Source Number	Source Name	Emission Description	(1) Controlled VOC (tpy)	(2) Controlled Benzene (tpy)	(2) Controlled Ethylbenzene (tpy)	(3) Uncontrolled VOC (tpy)	(2) Uncontrolled Benzene (tpy)	(2) Uncontrolled Ethylbenzene (tpy)
26-2027	Chevron U.S.A. Inc.	Marine loading racks	59.00	0.48	0.39	1,180.00	9.68	7.79
26-2028	Kinder Morgan Liquids Terminals LLC	Marine loading racks	0.67	0.01	4.E-03	13.40	0.11	0.09
26-2029	Shore Terminals LLC	Marine loading racks	0.01	8.E-05	7.E-05	0.20	2.E-03	1.E-03
26-2030	Seaport Midstream Partners, LLC	Marine loading racks	0.80	0.01	0.01	16.00	0.13	0.11
			-------	-------	-------	-------	-------	-------
	Total		60.48	0.50	0.40	1,209.60	9.93	7.98

Notes

(1) DEQ TRAACS data

(2) HAP emissions = (VOC tpy) * (VOC Weight Percent)

CAS	NAME	Weight Percent
71-43-2	Benzene	0.82% (a)
100-41-4	Ethylbenzene	0.66% (b)

(a) Benzene wt% from EPA PADD 5 Vol % data: EPA-420-R-10-029, Table 16, p.14 (AQ-TS ref. 973)

(b) Ethylbenzene from EPA Speciate 4.5: Profile 2455 (Composite Gasoline Vapor from Seattle (5 brands, 3 grades) - 1997)

(3) Barge loading controls estimated to be 95% effective (OAR 340-232-0110).

Uncontrolled emissions = (Controlled emissions, tpy) / (1-0.95)

Table 20. Anthropogenic emissions growth from removal of barge loading controls: Portland AQMA.

	Nonpoint, Nonroad, Point and Onroad Totals (TPY)		
	Base Year: Loading controls	Base Year: No loading controls	Emissions Increase (a)
Benzene	469.4	478.8	2.0%
Ethylbenzene	225.9	233.5	3.4%
VOC	35,074.0	36,223.7	3.3%

(a) % increase = ((no barge loading controls) - (base year)) / (base year)

4 Conclusions

In this emission inventory demonstration and analysis, DEQ evaluated several emission control strategies in the Portland and Medford areas, including different scenarios of the vehicle inspection and maintenance program. Other strategies analyzed were the employee commute options program, barge loading controls, and vapor recovery systems at gasoline dispensing facilities. DEQ analyzed strategies' effects on absolute emissions of criteria and toxics pollutants, and compared pollutant contributions among various sources: onroad vehicles and nonroad equipment, nonpoint sources, biogenic sources, events, and permitted point sources.

The emission inventory shows that onroad sources may contribute from 20% to more than 50% of criteria and air toxics pollutant emissions to the Portland and Medford AQMAs, predominantly NO_X, CO, VOCs, and the air toxics ethylbenzene, benzene, 1,3-butadiene, and acetaldehyde. DEQ's analysis shows that the vehicle inspection and maintenance program prevents hundreds of tons per year of pollutant emissions into the Portland and Medford areas. Criteria and air toxics emissions from onroad sources would increase by 5% to 20% if DEQ did not operate a Vehicle Inspection Program in the Portland and Medford areas.

DEQ's emission inventory and analysis demonstrate that each of the non-VIP controls (ECO, GDF vapor recovery, barge loading) achieve overall pollutant reductions between < 1% and 3.3%. The currently operated VIP achieves reduction to overall anthropogenic emissions, ranging from 2% to 9%.

5 QUALITY CONTROL

5.1 Introduction

The purpose of this section of the document is to describe the quality control procedures utilized in preparing the emission inventory demonstration. QC is an internal system of routine technical activities implemented by inventory development personnel to measure and control the quality of the inventory as it is developed, as well as actually checking the data generated.

The bulk of the nonpoint, point, nonroad, biogenic and event data was limited to a single source of information, the EPA 2014 NEI v.2. Therefore, many of the standard QA/QC procedures DEQ staff typically use for SIP emissions inventories were not applicable. Instead, DEQ relies upon EPA QA/QC procedures for any data generated by EPA, and on EPA QC procedures for any data submitted to EPA by DEQ. The following sections present QC procedures for the DEQ-generated parts of the project inventory.

5.2 Organization and Personnel

Christopher Swab, Wes Risher and Brandy Albertson performed QC procedures on DEQ generated emissions inventory data. Gary Beyer from the DEQ Vehicle Inspection Program performed extensive QC on the MOVES emissions inventory output and conversions.

5.3 Data collection and analysis

To ensure the comprehensive nature of the emission inventory, EPA Emission Inventory Improvement Program (EIIP) QA/QC guidance was used, specifically the guidance found in EIIP Volume VI, Chapter 3.[(321)] The inventoried sources are marked under the appropriate pollutant category. Only those sources that have been determined to operate in the inventoried areas were included.

As detailed in Section 2.4, area, nonroad and biogenic source emissions estimates were based on three sources of data:

- EPA 2014 NEI Data
- DEQ Permitted Point data submittals and DEQ emissions estimates for GDF and perc drycleaners
- Emissions estimates from residential wood combustion survey results

As part of the NEI submittal process for those data not generated by EPA, DEQ performs QA/QC steps according to EPA requirements. Examples include reconciliation of point and area source fuel and solvent use, and QC procedures embedded in the submittal process for permitted point source emissions estimates. The statewide residential wood combustion survey that served as a basis for estimating RWC emissions for this inventory was conducted in 2014 by the Portland State University Survey Research Lab (SRL). [(939)] Analysis and QC of the survey data was conducted by the SRL, and occurred at the database level. GDF emissions data were submitted to peer review as part of the DEQ Cleaner Air Oregon project.

On-road emissions data, generated by the newly developed DEQ MOST application, were subjected to rigorous QC through range-checks against on-road emissions generated for previous projects, specifically those projects utilizing the MOVES model. Additionally, peer review of MOST code on a step-by-step process occurred during application development via meetings of DEQ HQ and VIP staff.

5.4 QC Components

The QC components of the emissions inventory included results evaluation, location review, data handling, and peer review. Table 21 below details the processes and description for each

QC component. These QC components were applied to all emissions data allocated to AQMA boundaries.

Table 21. Quality Control components.

QC component	Process	Description
Results Evaluation	Range Check	Comparison of project EI data against NEI
	Ranking Check	Does the comparison of results by source and EI categories look reasonable?
	Outlier Analysis	What do the outliers signify?
Location review	GIS analysis	Are spatial surrogates accurate?
Reference data verification	DEQ reference database	Thorough documentation of all references and sources of data.
Data Handling	MS Access databases	Value and structure errors:
Peer review	Peer review	GDF emissions reviewed by DEQ modeling and toxicology staff.

6 REFERENCES

Numbers are DEQ Air Quality Technical Services Section internal reference numbers.

8. *Compilation of Air Pollutant Emission Factors*, Fifth Edition and Supplements, AP-42, U.S. EPA, Research Triangle Park, NC. January 1995.

321. Emission Inventory Improvement Program (EIIP), EPA, Office of Air Quality Planning and Standards, Emission Factor and Inventory Group, Research Triangle Park, NC. Volume I – X.

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(VOC) Emissions Estimates and GDF Vapor Recovery System (VRS) Impact Evaluation." June 14, 2018. Oregon Department of Environmental Quality.

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989. MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity. EPA-420-B-15-093. November 2015.

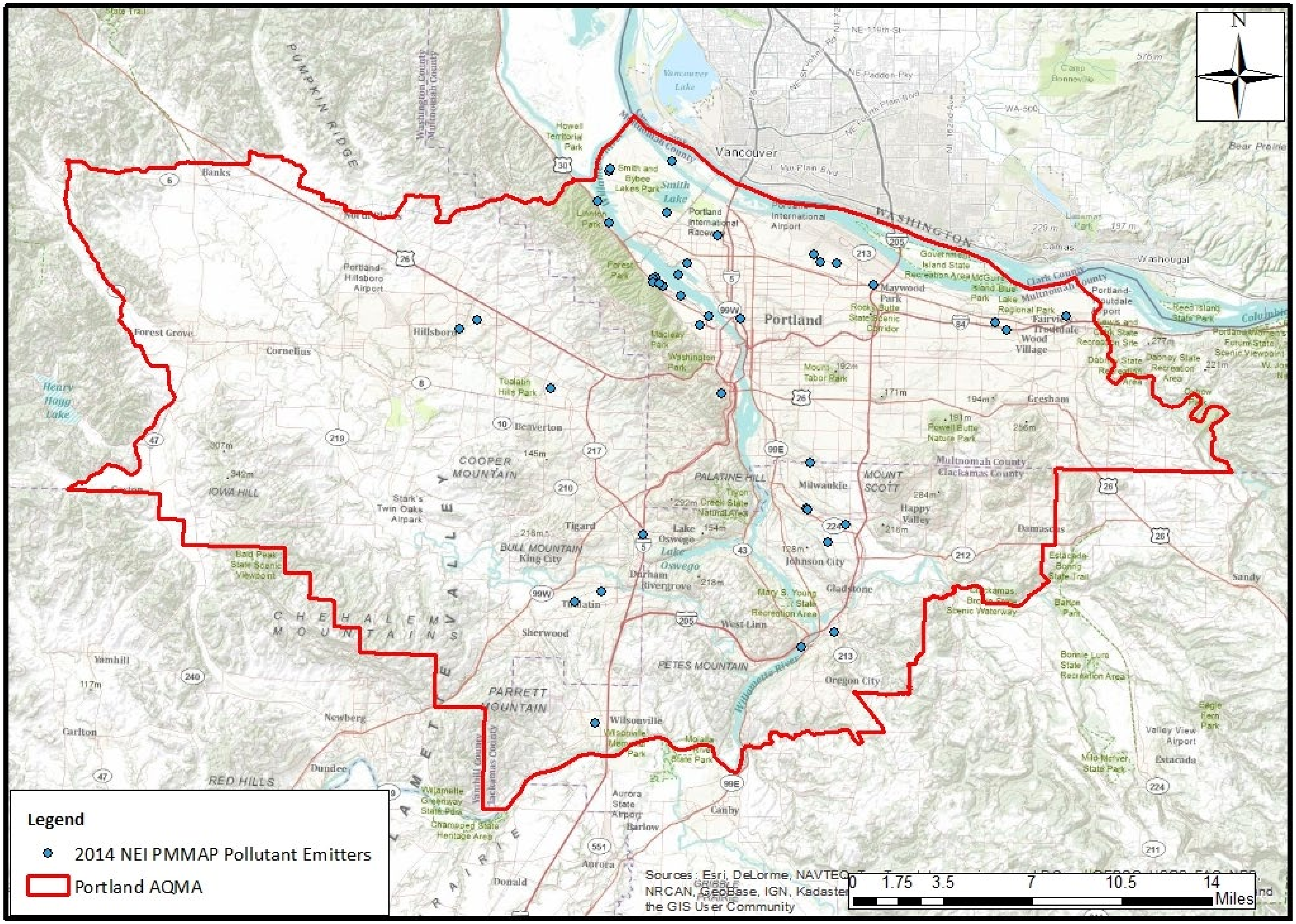
7 APPENDICES

APPENDIX A: STATIONARY POINT LOCATIONS

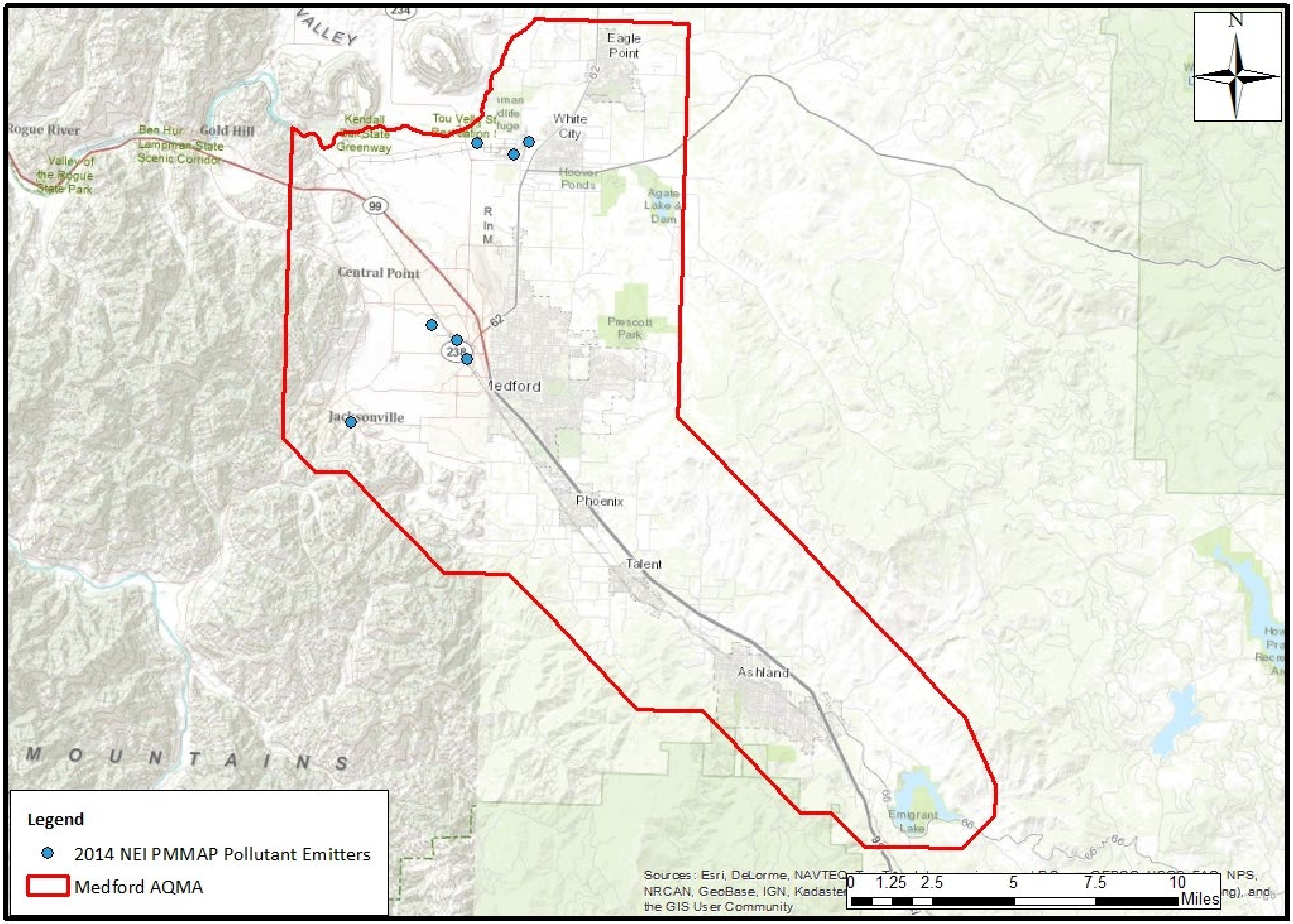
APPENDIX B: SPATIAL SURROGATE DATA AND MAPS

APPENDIX C: ONROAD

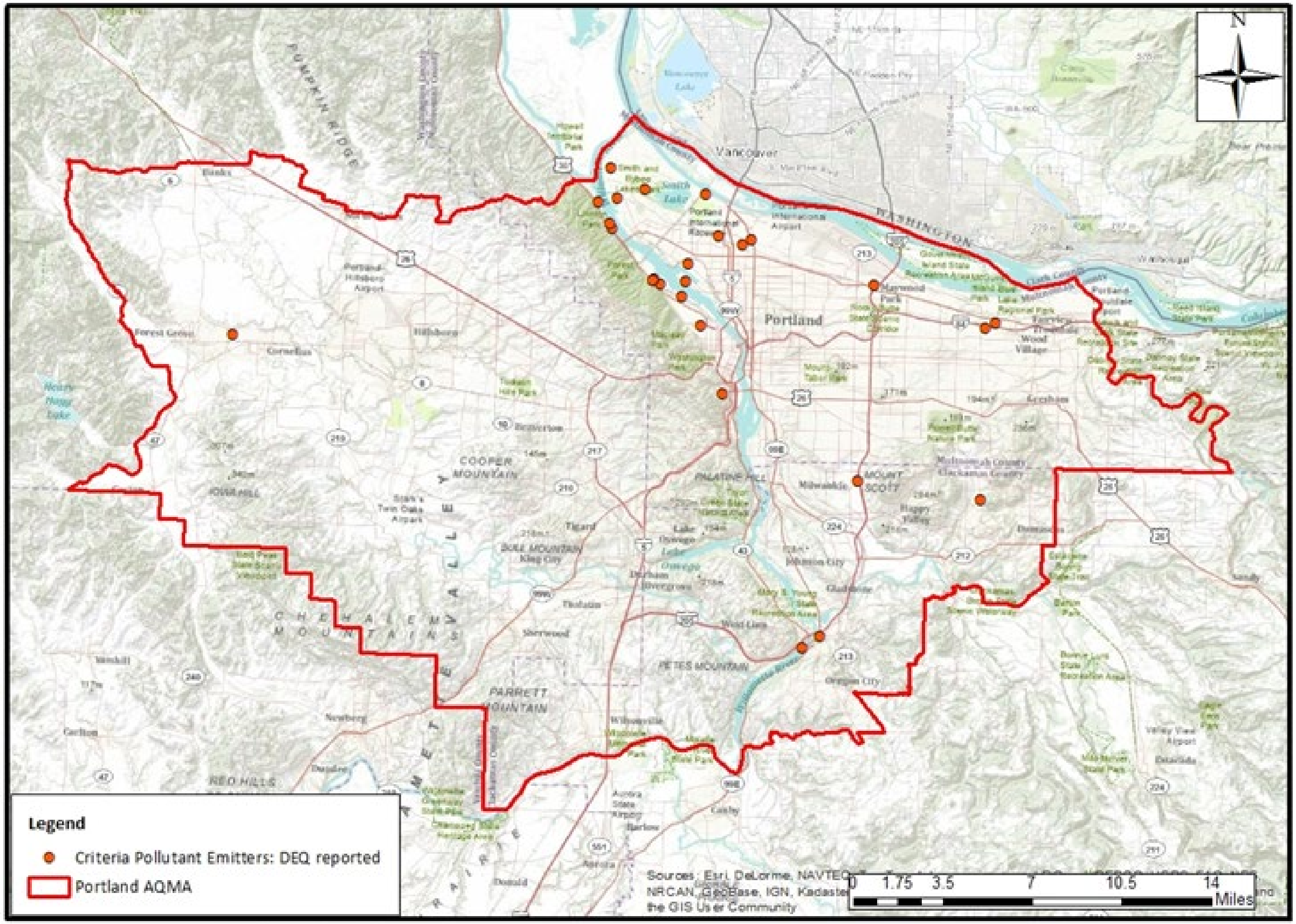
APPENDIX A: STATIONARY POINT LOCATIONS



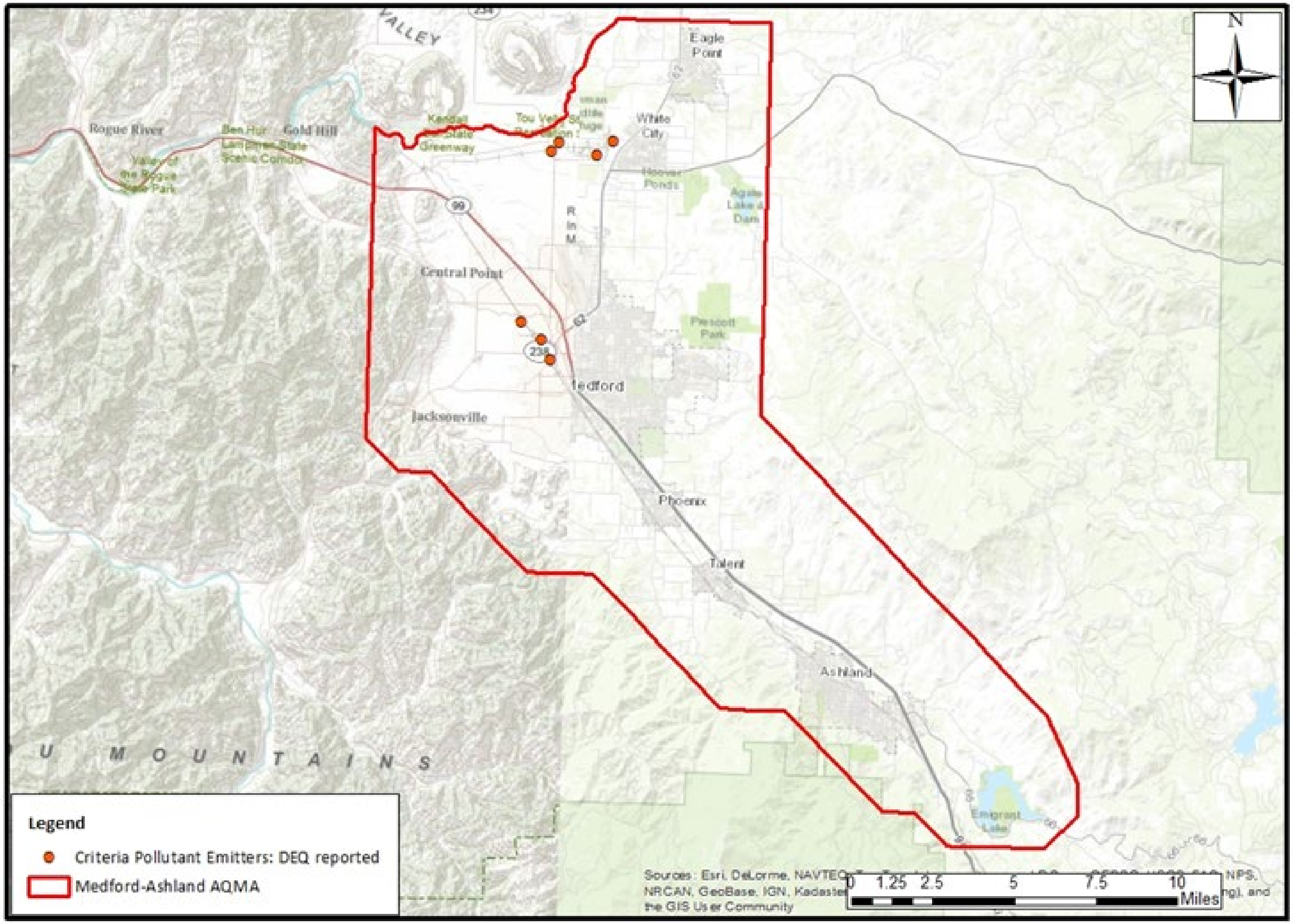
Appendix A, Figure A- 1. Portland point source locations, air toxics



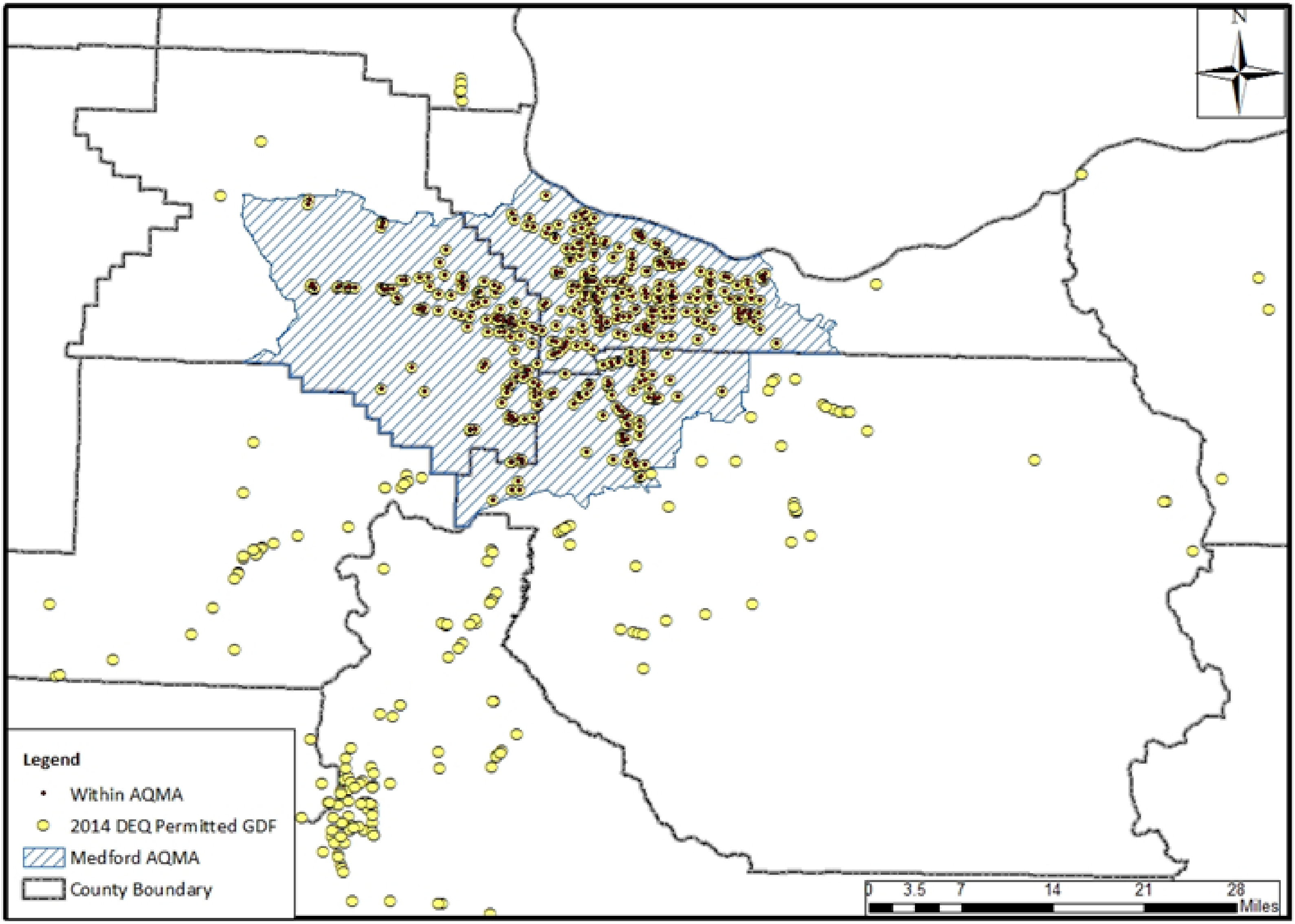
Appendix A, Figure A- 2. Medford-Ashland point source locations, air toxics



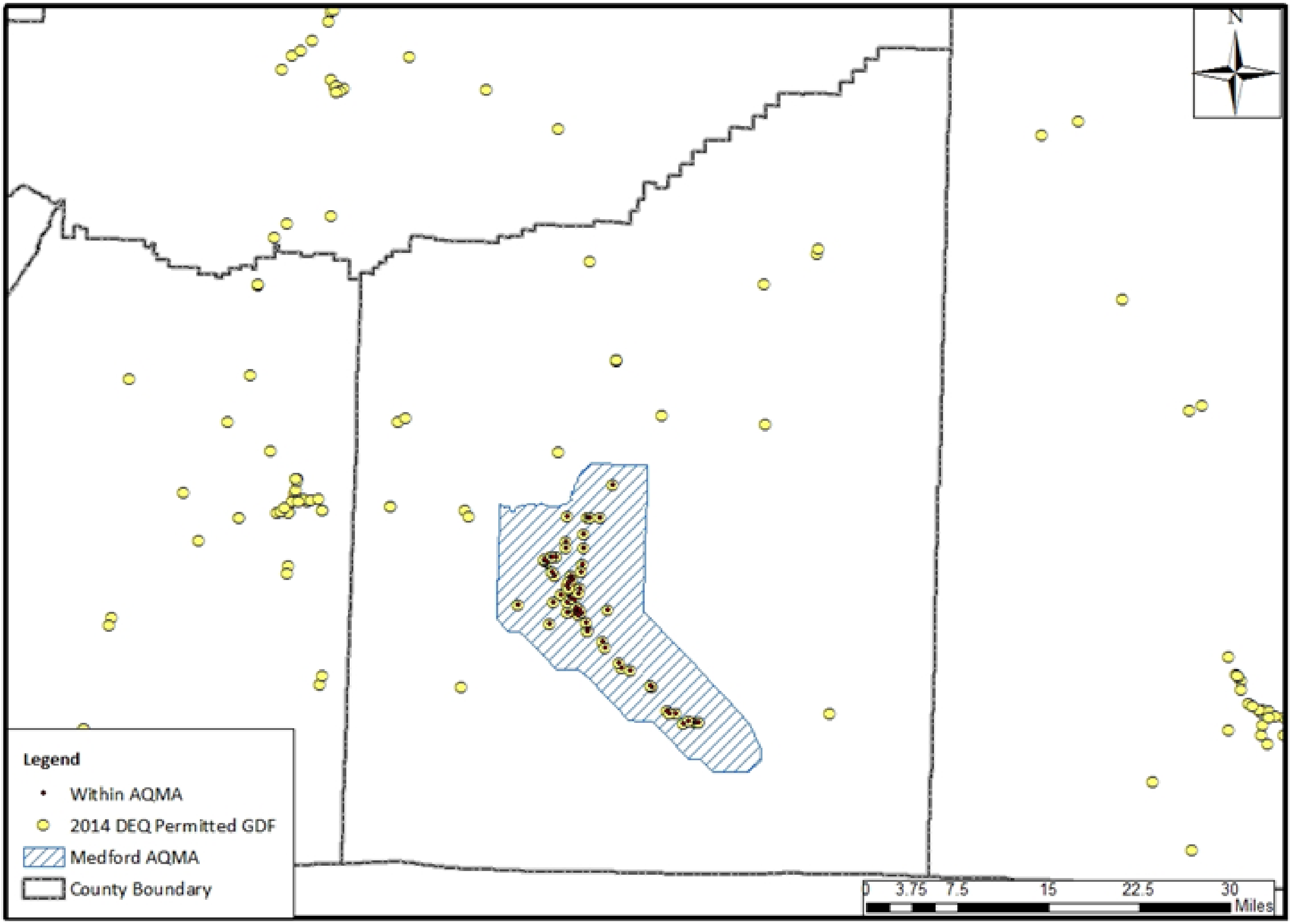
Appendix A, Figure A- 3. Portland point source locations, criteria pollutants



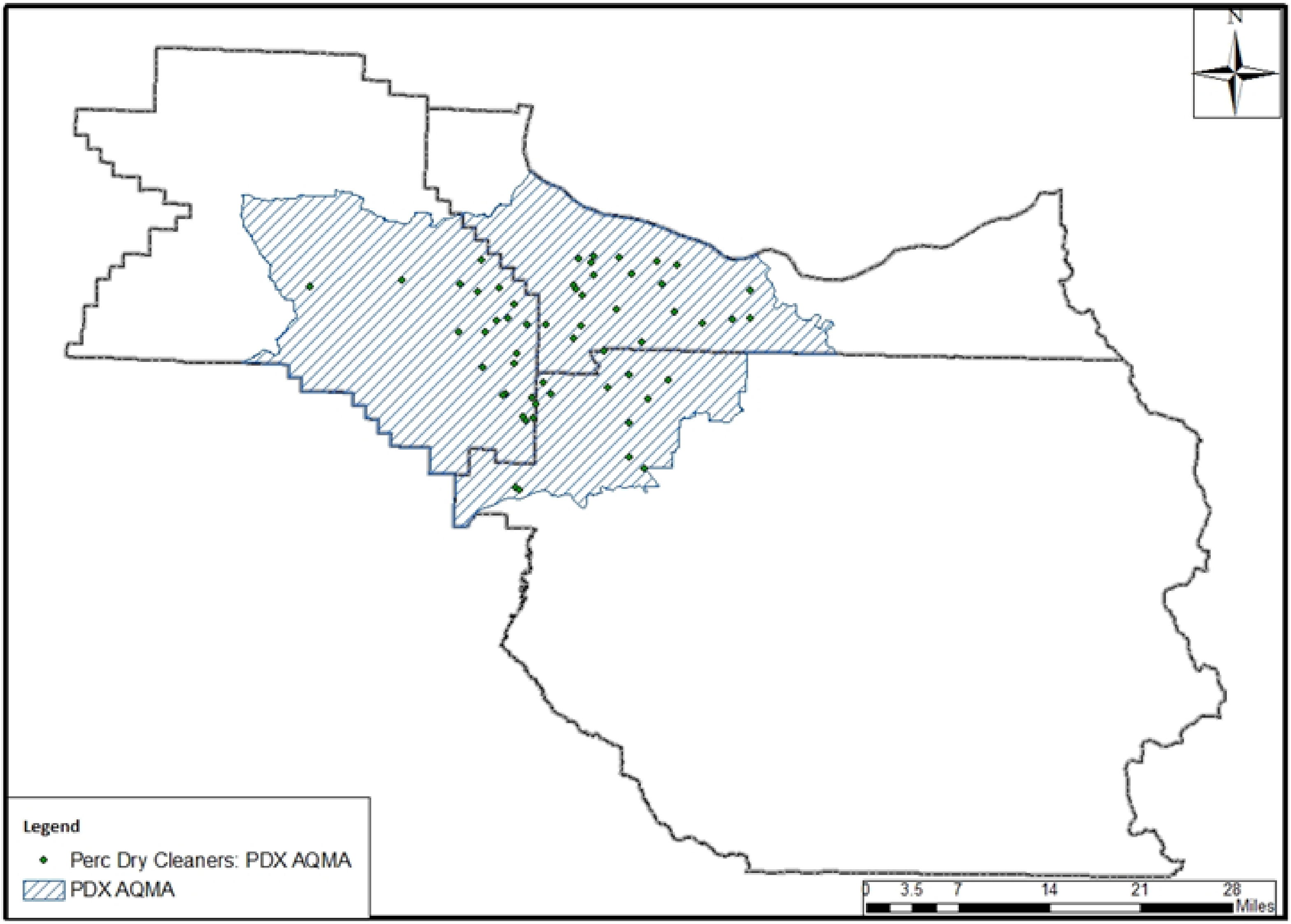
Appendix A, Figure A- 4. Medford point source locations, criteria pollutants



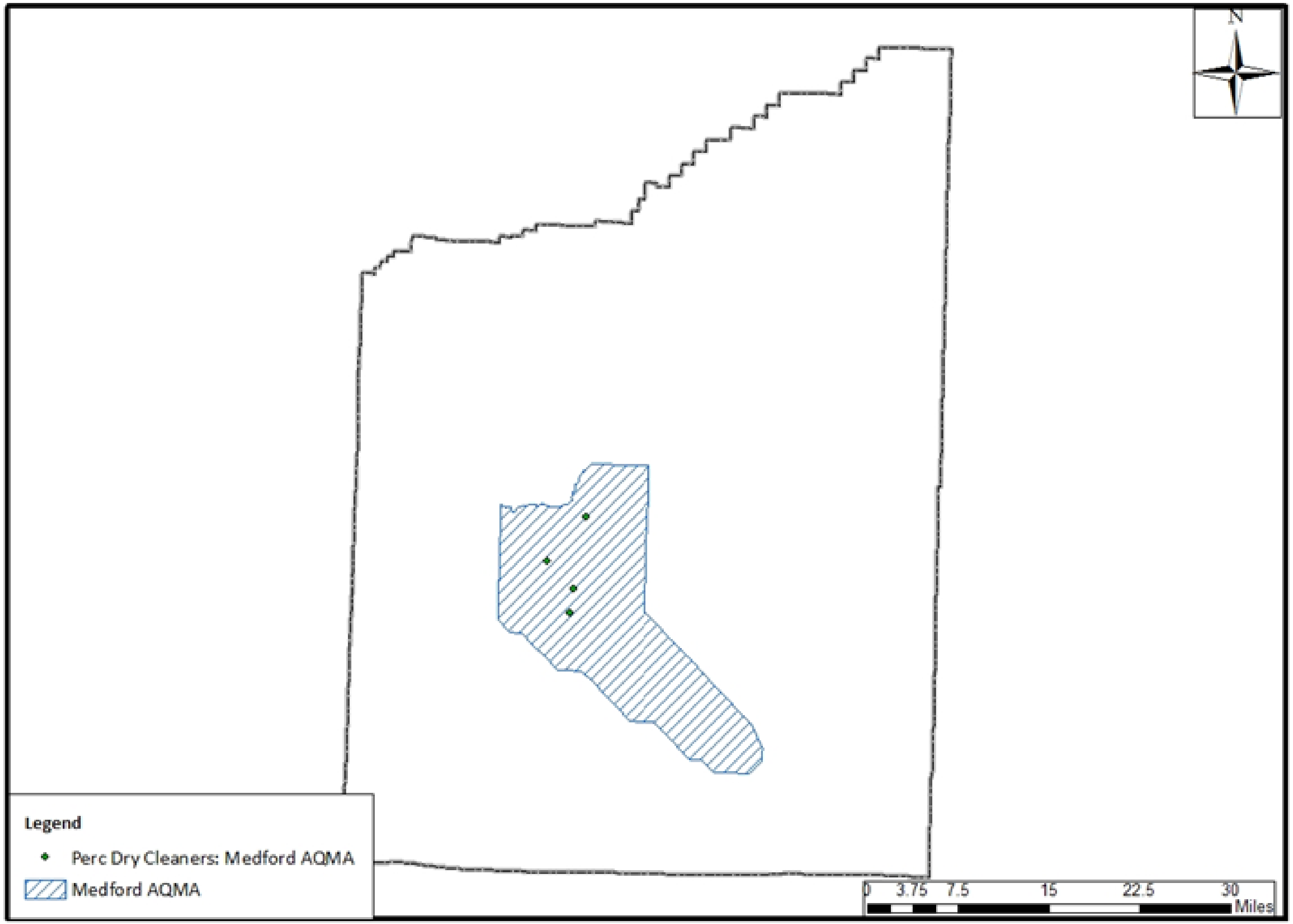
Appendix A, Figure A-5. Gasoline dispensing facility locations in relation to the Portland AQMA



Appendix A, Figure A-6. Gasoline dispensing facility locations in relation to the Medford AQMA



Appendix A, Figure A-7. Portland AQMA perchloroethylene dry cleaner locations



Appendix A, Figure A-8. Medford AQMA perchloroethylene dry cleaner locations

APPENDIX B: SPATIAL SURROGATE DATA AND MAPS

Appendix B contains spatial surrogate data for nonpoint (area), nonroad, biogenic, event (wildfire and prescribed burning) and stationary non-permitted facility (airports and railyards) emissions sources.

- Appendix B Tables
  - B-i. Spatial surrogates by EI category and sector
  - B-ii. Spatial Surrogate ID (SSID), value, description, basis and Appendix references
  - B-iii. Description of location-specific source types
  - B-1. Multnomah County & AQMA nonpoint spatial surrogates
  - B-2. Washington County & AQMA nonpoint spatial surrogates
  - B-3. Clackamas County & AQMA nonpoint spatial surrogates
  - B-4. Jackson County & AQMA nonpoint spatial surrogates
  - B-5. Ethyl benzene emissions by airport (facility) and process.
  - B-6. Biogenic spatial surrogates, estimated using land cover raster cell counts
  - B-7. Additional spatial surrogate references and appendix figures of relevant maps

- Appendix B Figures
  - B-1. Portland Metro zoning
  - B-2. Multnomah County building footprint
  - B-3a. Tri-County roadway
  - B-3b. Tri-County unpaved roadway
  - B-4. Tri-County airport locations
  - B-5. Tri-County railway
  - B-6a. DOGAMI oil and gas permit locations, northern Willamette Valley
  - B-6b. DOGAMI surface mining permit locations, northern Willamette Valley
  - B-7. Tri-County boat launch locations
  - B-8. Washington County building footprint
  - B-9. Clackamas County building footprint
  - B-10. Jackson County zoning
  - B-11. Jackson County building footprint
  - B-12. Jackson County roadway
  - B-13. Jackson County census block groups
  - B-14. Jackson County airport locations
  - B-15a. DOGAMI oil and gas permit locations, Jackson County
  - B-15b. DOGAMI surface mining permit locations, Jackson Count
  - B-16. Tri-County 2014 agricultural and prescribed burning locations
  - B-17. Jackson County 2014 agricultural and prescribed burning locations
  - B-18. Jackson County boat launch locations
  - B-19. Tri-County land cover
  - B-20. Jackson County land cover

Appendix B, Table B-i. Spatial surrogates by EI category and sector (SSID = Yes indicates that the EI sector has been spatially allocated to AQMA using a spatial surrogate).

EI Category	EI Sector	Spatial Surrogate	SSID?	Comment
Nonpoint	Commercial Cooking	Zone	Yes	
Nonpoint	Dust - Agriculture - Crops & Livestock	Zone	Yes	
Nonpoint	Dust - Building Construction	Zone	Yes	
Nonpoint	Dust - Mining & Quarrying	DOGAMI permit location	Yes	
Nonpoint	Dust - Paved Roads	Roadway	Yes	
Nonpoint	Dust - Road Construction	Roadway	Yes	
Nonpoint	Dust - Unpaved Roads	Roadway	Yes	
Nonpoint	Fires - Agricultural Field Burning	Zone and Point (location specific)	Varies	
Nonpoint	Fires - Open Burning, Land Clearing Debris	Building Footprint & Roadway	Yes	
Nonpoint	Fires - Prescribed burning and Wildfires	Location Specific - Point	No	Location mapped in GIS
Nonpoint	Fires - Residential Open Burning	Zone	Yes	
Nonpoint	Fuel Combustion - Non-Permitted Industrial, Commercial, Institutional	Zone	Yes	
Nonpoint	Fuel Combustion - Residential - Wood: DEQ Surveyed categories	US Census block group	No	
Nonpoint	Fuel Combustion - Residential - Wood: non DEQ surveyed categories	Population & Zone	Yes	Survey results allocated
Nonpoint	Fuel Combustion - Residential Fossil Fuel	Population & Zone	Yes	
Nonpoint	Fuel Distribution - Aircraft Fuel Dispensing	Location Specific - Point	Yes	
Nonpoint	Fuel Distribution - Fugitive leaks from fuel pipelines	GIS - Location proprietary	N/A	
Nonpoint	Fuel Distribution - Gasoline Dispensing Facilities, all processes	DEQ Permit - Location Specific	No	Location mapped in GIS
Nonpoint	Fuel Distribution - Portable Gas Cans - Filling	Location Specific - Point (DEQ permit)	Yes	
Nonpoint	Fuel Distribution - Portable Gas Cans - Transportation	Roadway	Yes	
Nonpoint	Fuel Distribution - Truck Transport	Roadway	Yes	
Nonpoint	Publicly Owned Treatment Works (sewage treatment)	Zone	Yes	
Nonpoint	Residential - Charcoal grilling, gas can storage	Population & Zone	Yes	
Nonpoint	Solvent Use - Architectural Surface Coating	Building Footprint	Yes	
Nonpoint	Solvent Use - Asphalt production & application	Roadway	Yes	
Nonpoint	Solvent Use - Consumer & Commercial	Population, Census Blocks, Zone	Yes	
Nonpoint	Solvent Use - Degreasing	Zone	Yes	
Nonpoint	Solvent Use - Graphic Arts	Zone	Yes	
Nonpoint	Solvent Use - Perc Dry Cleaners	DEQ Permit - Location Specific	No	Location mapped in GIS
Nonpoint	Solvent Use - Surface Coating	Zone	Yes	
Nonpoint	Solvent Use - Traffic Markings	Roadway	Yes	
Biogenic	Biogenic Emissions	Raster (pixels)	Yes	
Nonroad	Aircraft (to 3000 feet) and Airport Ground Support Equipment	Location Specific - Point	No	Location mapped in GIS
Nonroad	Locomotives - Line-Haul	Rail Line	Yes	EPA shapefile fraction
Nonroad	Locomotives - Yard	Location Specific - Polygon	No	Location mapped in GIS
Nonroad	Marine - Commercial	Location Specific - Polygon	No	EPA shapefile fraction
Nonroad	Marine - Recreational	Launch Location - Boating Use Days	Yes	
Nonroad	Vehicles & Equipment: Agricultural, Recreational, Light Industrial, Lawn & Garden, Logging,	Zone	Yes	
Nonroad	Vehicles & Equipment: Construction	Building Footprint & Roadway	Yes	
Nonroad	Vehicles & Equipment: Onshore Oil and Gas Production	DOGAMI permit location	Yes	

Appendix B, Table B-ii. Spatial Surrogate ID (SSID), value, description, basis and Appendix references, ordered descending by spatial surrogate ID (SS_ID). Table B-ii continues on pages B-4 through B-6.

FIPS	**SS_ID**	**SS_Value**	**SS_Description**	**Spatial Surrogate Basis**	**Appendix Table**	**Appendix Ref. Table**	**Appendix Figure**
41005	**4100501**	0.02620	Exclusive Farm and Forest	Zone	B-3	--	Fig. B-1
41005	**4100502**	0.55772	Commercial	Zone	B-3	--	Fig. B-1
41005	**4100503**	0.64824	Building Footprint and Paved Roadway	Building Footprint & Roadway	B-3	--	Fig. B-10 & B-3a
41005	**4100504**	0.72477	Industrial	Zone	B-3	--	Fig. B-1
41005	**4100505**	0.02755	Farm or Forest + Parks and Open Space	Zone	B-3	--	Fig. B-1
41005	**4100506**	0.51170	Residential Lawn & Garden	Zone	B-3	--	Fig. B-1
41005	**4100507**	0.51867	Residential	Zone	B-3	--	Fig. B-1
41005	**4100508**	0.68595	Commercial & Industrial	Zone	B-3	--	Fig. B-1
41005	**4100509**	0.73432	Building Footprint	Building Footprint	B-3	--	Fig. B-9
41005	**4100510**	0.43016	Paved Road	Roadway	B-3	--	Fig. B-3a
41005	**4100511**	0.67503	Publicly Owned	Zone	B-3	--	Fig. B-1
41005	**4100512**	0.01769	Airport Location - Avgas Storage	Airport Location	B-3	B-5	Fig. B-4
41005	**4100513**	0.64690	Active Rail Line	Rail Line	B-3	--	Fig. B-5
41005	**4100514**	0.62309	Boat Launch Location - Boating Use Days	Launch Location - Boating Use Days	B-3	--	Fig. B-7
41005	**4100515**	0.33333	On-Shore Oil and Gas Permit location	DOGAMI permit location	B-3	--	Fig. B-6a
41005	**4100516**	0.12589	Biogenic: Vegetation landcover	Raster	B-6	--	Fig. B-19
41005	**4100517**	0.72385	Pipeline transmission of gasoline	GIS - Location proprietary	Location proprietary	--	Location proprietary
41005	**4100518**	0.73350	GDF permit location	DEQ Permit - Location Specific	B-3	--	Fig A-5
41005	**4100519**	0.71913	Population	US Census blocks	B-3	--	Fig. B-28
41005	**4100520**	0.00010	Unpaved Roadway Miles	Unpaved Roadway	B-3	--	Fig. B-3b
41005	**4100521**	0.17424	Surface Mining & Quarrying Permit Location	DOGAMI permit location	B-3	--	Fig. B-6b
41029	**4102901**	0.30185	Agricultural	Zone	B-4	--	Fig. B-10
41029	**4102902**	0.91518	Commercial	Zone	B-4	--	Fig. B-10
41029	**4102903**	0.43814	Building Footprint and Streets	Building Footprint & Roadway	B-4	--	Fig. B-11 & B-12
41029	**4102904**	0.97233	Industrial	Zone	B-4	--	Fig. B-10
41029	**4102905**	0.01955	Forest Land	Zone	B-4	--	Fig. B-10
41029	**4102906**	0.32437	Farm/Rural and Low-Density Residential Zoning Mix	Zone	B-4	--	Fig. B-10
41029	**4102907**	0.91518	Commercial Lawn & Garden	Zone	B-4	--	Fig. B-10
41029	**4102908**	0.69248	Residential Lawn & Garden	Zone	B-4	--	Fig. B-10
41029	**4102909**	0.94969	Commercial & Industrial	Zone	B-4	--	Fig. B-10
41029	**4102910**	0.82776	Population	Population	B-4	--	Fig_B-13

Table B-ii Continued

FIPS	SS_ID	SS_Value	SS_Description	Spatial Surrogate Basis	Appendix Table	Appendix Ref. Table	Appendix Figure
41029	**4102911**	0.78652	Building Footprint	Building Footprint	B-4	--	Fig_B-11
41029	**4102912**	0.16231	Streets	Roadway	B-4	--	Fig_B-12
41029	**4102913**	0.54897	Public	Zone	B-4	--	Fig. B-10
41029	**4102914**	1.00000	Airport location - Jet Naphtha Storage	Airport Location	B-4	B-5	Fig. B-14
41029	**4102915**	0.94040	Airport Location - Avgas Storage	Airport Location	B-4	B-5	Fig. B-14
41029	**4102916**	1.00000	On-Shore Oil and Gas Permit location	DOGAMI permit location	B-4	--	Fig. B-15a
41029	**4102917**	0.14704	Boat Launch Location - Boating Use Days	Launch Location - Boating Use Days	B-4	--	Fig. B-18
41029	**4102918**	0.07082	Biogenic: Vegetation landcover	Raster	B-6	--	Fig. B-20
41029	**4102919**	0.00000	Pipeline transmission of gasoline	GIS - Location proprietary	Location proprietary	--	Location proprietary
41029	**4102920**	0.69923	Active Rail Line	Rail Line	B-4	--	Fig B-24
41029	**4102921**	0.88416	GDF permit location	DEQ Permit - Location Specific	B-4	--	Fig A-6
41029	**4102922**	0.61780	Residential	Zone	B-4	--	Fig. B-10
41029	**4102923**	0.13694	Unpaved Roadway Miles	Roadway	B-4	--	Fig. B-12
41029	**4102924**	0.37143	Surface Mining & Quarrying Permit Location	DOGAMI permit location	B-4	--	Fig. B-15b
41051	**4105101**	0.11664	Exclusive Farm and Forest	Zone	B-1	--	Fig. B-1
41051	**4105102**	0.89234	Commercial	Zone	B-1	--	Fig. B-1
41051	**4105103**	0.96649	Building Footprint and Paved Roadway	Building Footprint & Roadway	B-1	--	Fig. B-2 & B-3a
41051	**4105104**	0.99834	Industrial	Zone	B-1	--	Fig. B-1
41051	**4105105**	0.20210	Farm or Forest + Parks and Open Space	Zone	B-1	--	Fig. B-1
41051	**4105106**	0.97068	Residential Lawn & Garden	Zone	B-1	--	Fig. B-1
41051	**4105107**	0.97392	Residential	Zone	B-1	--	Fig. B-1
41051	**4105108**	0.57940	Shipping Lanes	Shipping Lanes	B-1	--	Fig. B-21
41051	**4105109**	0.98108	Building Footprint	Building Footprint	B-1	--	Fig. B-2
41051	**4105110**	0.90346	Paved Road	Roadway	B-1	--	Fig. B-3a
41051	**4105111**	0.99360	Publicly Owned	Zone	B-1	--	Fig. B-1
41051	**4105112**	1.00000	Airport location - Jet Naphtha Storage	Airport Location	B-1	B-5	Fig. B-4
41051	**4105113**	0.99912	Airport Location - Avgas Storage	Airport Location	B-1	B-5	Fig. B-4
41051	**4105114**	0.82440	Active Rail Line	Rail Line	B-1	--	Fig. B-5
41051	**4105115**	0.41423	Boat Launch Location - Boating Use Days	Launch Location - Boating Use Days	B-1	--	Fig. B-7
41051	**4105116**	0.98910	Commercial & Industrial	Zone	B-1	--	Fig. B-1
41051	**4105117**	0.12589	Biogenic: Vegetation landcover	Raster	B-6	--	Fig. B-19

Table B-ii continued

FIPS	SS_ID	SS_Value	SS_Description	Spatial Surrogate Basis	Appendix Table	Appendix Ref. Table	Appendix Figure
41051	**4105118**	0.89897	Pipeline transmission of gasoline	GIS - Location proprietary	Location proprietary	--	Location proprietary
41051	**4105119**	0.99960	GDF permit location	DEQ Permit - Location Specific	B-1	--	Fig A-5
41051	**4105120**	0.50000	On-Shore Oil and Gas Permit location	DOGAMI permit location	B-1	--	Fig. B-6a
41051	**4105121**	0.99067	Population	US Census blocks	B-1	--	Fig. B-28
41051	**4105122**	0.29322	Unpaved Roadway Miles	Unpaved Roadway	B-1	--	Fig. B-3b
41051	**4105123**	0.74510	Surface Mining & Quarrying Permit Location	DOGAMI permit location	B-1	--	Fig. B-6b
41067	**4106701**	0.79547	Agricultural	Zone	B-2	--	Fig. B-1
41067	**4106702**	0.99643	Commercial	Zone	B-2	--	Fig. B-1
41067	**4106703**	0.98807	Building Footprint	Building Footprint	B-2	--	Fig. B-8
41067	**4106704**	0.95263	Industrial	Zone	B-2	--	Fig. B-1
41067	**4106705**	0.01043	Forest Land: Excusive Forest Use	Zone	B-2	--	Fig. B-1
41067	**4106706**	0.99900	Publicly owned	Zone	B-2	--	Fig. B-1
41067	**4106707**	1.00000	Recreational	Zone	B-2	--	Fig. B-1
41067	**4106708**	0.99745	Commercial Lawn & Garden	Zone	B-2	--	Fig. B-1
41067	**4106709**	0.98108	Residential and Residential Lawn & Garden	Zone	B-2	--	Fig. B-1
41067	**4106710**	0.01706	Boat Launch Location - Boating Use Days	Launch Location - Boating Use Days	B-2	--	Fig. B-7
41067	**4106711**	0.97254	Building Footprint and Paved Roadway	Building Footprint & Roadway	B-2	--	Fig. B-8 & B-3a
41067	**4106712**	0.90119	Paved Road	Roadway	B-2	--	Fig. B-3a
41067	**4106713**	0.99704	Commercial & Institutional	Zone	B-2	--	Fig. B-1
41067	**4106714**	1.00000	On-Shore Oil and Gas Permit location	DOGAMI permit location	B-2	--	Fig. B-6a
41067	**4106715**	0.72873	Active Rail Line	Rail Line	B-2	--	Fig. B-5
41067	**4106716**	0.00000	Airport location - Jet Naphtha Storage	Airport Location	B-2	B-5	Fig. B-4
41067	**4106717**	0.99621	Airport Location - Avgas Storage	Airport Location	B-2	B-5	Fig. B-4
41067	**4106718**	0.97369	Commercial, Institutional and Industrial	Zone	B-2	--	Fig. B-1
41067	**4106719**	0.12589	Biogenic: Vegetation landcover	Raster	B-6	--	Fig. B-19
41067	**4106720**	1.00000	Pipeline transmission of gasoline	GIS - Location proprietary	Location proprietary	--	Location proprietary
41067	**4106721**	0.99590	GDF permit location	DEQ Permit - Location Specific	B-2	--	Fig A-5
41067	**4106722**	0.98767	Population	US Census blocks	B-2	--	Fig. B-28
41067	**4106723**	0.25804	Unpaved Roadway Miles	Unpaved Roadway	B-2	--	Fig. B-3b
41067	**4106724**	0.55556	Surface Mining & Quarrying Permit Location	DOGAMI permit location	B-2	--	Fig. B-6b

Appendix B, Table B-iii. Description of location-specific source types.

Source Type	Surrogate Source	Unit	Figures
Perc Dry Cleaners	DEQ Coordinates	Location	A-7 & A-8
Gasoline Dispensing Facilities	DEQ Coordinates	Location	A-5 & A-6
Commercial Marine Vessels: In-Transit	EPA shapefile	Acres	B-22
Commercial Marine Vessels: In-Port	EPA shapefile	Acres	B-23
Line-Haul Locomotives	EPA shapefile	Length	B-5 & B-24
RailYards	EPA coordinates	Location	B-25
Airports	EPA coordinates	Location	B-4 & B-14
Rx, Ag burning and Wildfires	EPA coordinates	Location	B-17 & B-18
Residential Wood Combustion	Census Block Group	Location	B-26 & B-27

Appendix B, Table B-1. Multnomah County & AQMA nonpoint spatial surrogate values.

County Zoning File (1)	(1,2)	(1,2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(9)	(3)	(3)	(3)	(3)	(5)	(5)	(6)	(7)	(8)	(10)	(3)	(11)	(12)
	Total	AQMA	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*
General Class Description	Acres	Acres	4105101	4105102	4105103	4105104	4105105	4105106	4105107	4105108	4105109	4105110	4105111	4105120	4105112	4105113	4105114	4105115	4105116	4105119	4105121	4105122	4105123
Commercial	2,190.6	1,954.8		X															X				
Farm or Forest	167,378.0	19,523.3	X				X																
Industrial	22,954.2	22,916.0				X													X				
Mixed-Use Residential	12,102.9	12,052.2						X	X														
Multi-Family Residential	9,673.4	9,642.2							X														
Parks and Open Space	18,072.2	17,956.5					X						X										
Residential	3,895.1	2,118.2						X	X														
Single Family	52,236.2	52,063.1						X	X														
Building Footprint	14,986.2	14,702.7			X						X												
Other Spatial Surrogate Data																							
Paved Road (miles)	3,469.7	3,134.8			X							X											
Oil and Gas Permits	2	1												X									
Railway Miles	188.0	155.0															X						
Jet Naphtha storage	1	1													X								
AVGas storage	1	0.999														X							
Recreational Marine	286,985	118,879																X					
Shipping Lanes (acres)	15,116	8,758							X														
GDF Throughput (1000 gal)	227,070	226,979																		X			
Population	751,125	744,120																			X		
Unpaved Roadway (miles)	242.8	71.2																				X	
Mining/Quarrying (permits)	51	38																					X
			----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Multnomah County Total			167,378.0	2,190.6	18,456.0	22,954.2	185,450.2	68,234.2	77,907.7	15,115.8	14,986.2	3,469.7	18,072.2	2	1	1.0	188.0	286,985	25,145	227,070	751,125	242.8	51
AQMA Boundary Total			19,523.3	1,954.8	17,837.4	22,916.0	37,479.8	66,233.6	75,875.8	8,758.0	14,702.7	3,134.8	17,956.5	1	1	0.9991	155.0	118,879	24,871	226,979	744,120	71.2	38
AQMA Spatial Surrogate (13)			0.1166	0.8923	0.9665	0.9983	0.2021	0.9707	0.9739	0.5794	0.9811	0.9035	0.9936	0.5	1	0.9991	0.8244	0.4142	0.9891	0.9996	0.9907	0.2932	0.7451

Notes for Table B-1 are found on page B-9

Notes for Table B-1:
(1) Multnomah County Zoning shapefile from DEQ internal files.
Appendix B, Figure B-1 illustrates zoning in Multnomah County
(2) The GIS projects used to calculate acreages, and other units via clipping from DEQ internal files.
(3) IDs are as follows: An "X" indicates value used to estimate AQMA spatial surrogate factors
Spatial Surrogate ID descriptions
4105101 = EFU: Exclusive farm and forest use
4105102 = Commercially Zoned
4105103 = Building footprint + paved road
Appendix B, Figures B-2 and B-3 illustrate building footprint and roadway.
4105104 = Industrially Zoned
4105105 = Farm or Forest + Parks and Open Space
4105106 = Residential - Mixed use, single family, residential
4105107 = Residential (all types)
4105109 = Building Footprint
4105110 = Paved Road (Appendix B, Figure 3a)
4105111 = Publicly Owned
4105120 = On-shore oil and gas production: Locations from DOGAMI website, see Appendix B, Figure B-6a
4105121 = Population (from 2010 US census by census block)
(5) IDs 4105112 & 4105113: Aircraft fuel storage based on 2011 NEI data of aircraft emissions of
ethylbenzene by airport location and aircraft type. Appendix B, Table B-5 details aircraft fuel storage spatial surrogate estimates.
Appendix B, Figure B-4 shows the location of airports / heliports within the tri-county area.
(6) 4105114 = Active Rail Line. Appendix B, Figure B-5 shows active rail line (note: the rail line shapefile used is from the EPA 2014 NEI)
(7) 4105115 = Recreational Marine= Boating Use Days. Boating use days taken from Oregon State Marine Board 2010 survey data.
GIS clipping used to determine use days for launches/ramps located with the AQMA. Appendix B, Figure B-7 shows location of launch/ramp sites. ArcGIS desktop application used to clip data located here:
(8) 4105116 = Commercial and Industrial: Commercial Roofing Asphalt Production and specific fugitive dust
(9) 4105108 = Marine transport of petrol and petrol products: Based on GIS clipping of the EPA 2014 NEI shipping lane shapefile:
GIS clipping used to determine area of shipping lanes for Multnomah County and AQMA. Appendix B, Figure B-21 shows location of shipping lanes.
(10) 4105119: DEQ permitting data used to calculate Gasoline Dispensing Facility (GDF) throughput - please see Appendix A, Figure A-5
(11) 4105122 = Unpaved Roadway estimated using Metro RLIS roadway GIS files (roadway type = 9000 or 2000)
See Appendix B, Figure B-3b
(12) 4105123 = Surface Mining & Quarrying: DOGAMI data downloaded from
http://www.oregongeology.org/mlrr/permitviewer.htm
Active and closed permit data included. see Appendix B, Figure B-6b
(13) AQMA spatial surrogate = (AQMA Boundary Total) / (County Total)

Appendix B, Table B-2. Washington County & AQMA nonpoint spatial surrogate values.

(1)	(1,2)	(1,2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(5)	(6)	(7)	(3)	(3)	(8)	(8)	(9)	(10)	(3)	(11)	(12)
	Total	AQMA	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*
City and County Zone Description	Acres	Acres	4106701	4106702	4106703	4106704	4106705	4106706	4106707	4106708	4106709	4106710	4106711	4106712	4106713	4106714	4106715	4106716	4106717	4106718	4106721	4106722	4106723	4106724
	Acres	Acres																						
Agriculture and Forest	58,988	43,466	X																					
Agriculture: Exclusive Farm Use	96,217	79,995	X																					
Commercial / Residential	4,791	4,791		X											X					X				
Commercial: Central	445	445		X											X					X				
Commercial: Community Business District	236	236		X											X					X				
Commercial: General	2,079	2,079		X						X					X					X				
Commercial: Neighborhood	254	254		X						X					X					X				
Commercial: Office	181	181		X						X					X					X				
Commercial: Rural	62	32		X											X					X				
Commercial: Transit Oriented	374	374		X											X					X				
Exclusive Forest and Conservation	220,785	2,302					X																	
Industrial	452	447				X														X				
Industrial: Heavy	2,287	2,286				X														X				
Industrial: Light	8,817	8,741				X														X				
Industrial: Rural	713	213				X														X				
Institutional	1,607	1,605						X							X					X				
Parks and Open Space	569	569							X															
Public / Government / Institutional	1,034	1,033						X							X					X				
Residential: Multi-Family	20,127	20,069								X														
Residential: Rural	530	430									X													
Residential: Single Family	22,554	22,526									X													
Residential: Transit Oriented	513	513									X													
Other Spatial Surrogate Data																								
Recreational Marine (Boating Use Days)	39,146	668										X												
Paved Roadway (miles)	2,445	2,203											X	X										
Oil and Gas Permits	4	4														X								
Railway Miles	135.2	98.5															X							
Jet Naphtha storage	1	0																X						
AVGas storage	1	0.996																	X					
Building Footprint Acreage	11,787	11,638			X								X											
GDF Throughput (1000 gal)	208,377	207,522																			X			
Population	536,653	530,038																				X		
Unpaved Roadway (miles)	220.3	56.9																					X	
Mining/Quarrying (permits)	54	30																						X
			-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Washington County Total			155,205	8,422	67,055	12,268	220,785	2,641	569	22,641	23,597	39,146	14,232	2,445	11,063	4	135	1	1	23,331	208,377	536,653	220.3	54
AQMA Boundary Total			123,460	8,392	66,255	11,687	2,302	2,638	569	22,583	23,469	668	13,841	2,203	11,030	4	99	0	0.996	22,717	207,522	530,038	56.9	30
AQMA Spatial Surrogate (13)			0.7955	0.9964	0.9881	0.9526	0.0104	0.9990	1	0.9974	0.9946	0.0171	0.9725	0.9012	0.9970	1	0.7287	0	0.9962	0.9737	0.9959	0.9877	0.2580	0.5556

Notes for Table B-2 found on page B-11

Notes for Table B-2

(1) The Washington County Zoning shapefile, provided to DEQ by the Washington County Department of Land Use & Transportation from DEQ internal files.
Appendix B, Figure B-1 illustrates zoning in Washington County

(2) The GIS projects used to calculate acreages, and other units via clipping from DEQ internal files.

(3) An "x" indicates value used to estimate AQMA spatial surrogate factors

Spatial Surrogate ID descriptions

4106701 = Agricultural
4106702 = Commercial
4106703 = Building Footprint (architecture): Structure fires, architectural surface coating. See Appendix B, Figure B-8
4106704 = Industrial
4106705 = Forest Land: Excusive Forest Use: Logging
4106706 = Institutional
4106707 = Recreational
4106708 = Commercial Lawn & Garden
4106709 = Residential and Residential Lawn & Garden
4106714 = On-shore oil and gas production: Locations from DOGAMI website, see Appendix B, Figure B-6a
4106715 = Active Rail Line. Appendix B, Figure B-5 shows active rail line (note: the rail line shapefile used is from the EPA 2014 NEI)
4106722 = Population (from 2010 US census by census block)

(4) 4106710 = Recreational Marine= Boating Use Days. Boating use days taken from Oregon State Marine Board 2010 survey data.
GIS clipping used to determine use days for launches/ramps located with the AQMA. Appendix B, Figure B-7 shows location of launch/ramp sites.

(5) 4106711 = Building footprint and Paved Roadway Miles = Construction & Mining
Appendix B, Figures B-8 and B-3 illustrate building footprint and roadway.

(6) 4106712 = Paved Roadway Miles. Appendix B, Figure B-3a illustrates roadway.

(7) 4106713 = Commercial / Institutional

(8) 4106716 & 4106717: Aircraft fuel storage based on 2011 NEI data of aircraft emissions of
ethylbenzene by airport location and aircraft type. Appendix B, Table B-5 details aircraft fuel storage spatial surrogate estimates.
Appendix B, Figure B-4 shows the location of airports / heliports within the tri-county area.

(9) 4106718 = Commercial, Institutional and Industrial zoned = Commercial Roofing Asphalt production/application & specific fugitive dust

(10) 4106721: DEQ permitting data used to calculate Gasoline Dispensing Facility (GDF) throughput - please see Appendix A, Figure A-5

(11) 4106723 = Unpaved Roadway estimated using Washington County roadway GIS files (see note 1)
See Appendix B, Figure B-3b

(12) 4106724 = Surface Mining & Quarrying: DOGAMI data downloaded from: http://www.oregongeology.org/mlrr/permitviewer.htm
Active and closed permit data included. see Appendix B, Figure B-6b

(13) AQMA spatial surrogate = (AQMA Boundary Total) / (County Total)

Appendix B, Table B-3. Clackamas County & AQMA nonpoint spatial surrogate values.

County Zoning File (1)	(1,2)	(1,2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(3)	(4)	(3)	(5)	(6)	(7)	(8)	(9)	(3)	(10)	(11)
	Total	AQMA	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*
General Class Description	Acres	Acres	4100501	4100502	4100503	4100504	4100505	4100506	4100507	4100508	4100509	4100510	4100511	4100512	4100513	4100514	4100515	4100518	4100519	4100520	4100521
Commercial	2,458.6	1,371.2		X						X											
Farm or Forest	1,073,738.8	28,130.4	X				X														
Industrial	8,123.0	5,887.3				X				X											
Mixed-Use Residential	3,911.5	3,822.6						X	X												
Multi-Family Residential	3,124.6	2,369.1							X												
Parks and Open Space	2,248.3	1,517.6					X						X								
Public Facilities	1,175.3	1,169.3																			
Residential	67,917.3	20,569.2						X	X												
Single Family	35,513.5	30,535.1						X	X												
Building Footprint	9,311.5	6,837.6			X						X										
Other Spatial Surrogate Data																					
Paved Road	3,675.9	1,581.2			X							X									
Oil and Gas Permits	3	1															X				
Railway Miles	69.0	44.6													X						
AVGas storage	1.0	0.018												X							
Recreational Marine	221,615	138,086														X					
GDF Throughput (1000 gal)	163,820	120,162																X			
Population	385,502	277,227																	X		
Unpaved Roadway (miles)	1,269	0.13																		X	
Mining/Quarrying (permits)	132	23																			X
			----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Clackamas County Total			1,073,738.8	2,458.6	12,987.4	8,123.0	1,075,987.1	107,342.3	110,467.0	10,581.6	9,311.5	3,675.9	2,248.3	1.0	69.0	221,615	3	163,820	385,502	1,269	132
AQMA Boundary Total			28,130.4	1,371.2	8,418.9	5,887.3	29,648.0	54,926.9	57,296.0	7,258.5	6,837.6	1,581.2	1,517.6	0.0177	44.6	138,086	1	120,162	277,227	0.13	23
AQMA Spatial Surrogate (12)			0.0262	0.5577	0.6482	0.7248	0.0276	0.5117	0.5187	0.6860	0.7343	0.4302	0.6750	0.0177	0.6469	0.6231	0.3333	0.7335	0.7191	0.0001	0.1742

Notes for Table B-3 found on page B-13

Notes for Table B-3

(1) Clackamas County Zoning shapefile from DEQ internal files.
Appendix B, Figure B-1 illustrates zoning in Clackamas County

(2) The GIS projects used to calculate acreages, and other units via clipping from DEQ internal files.

(3) IDs are as follows: An "X" indicates value used to estimate AQMA spatial surrogate factors

Spatial Surrogate ID descriptions

4100501 = EFU: Exclusive farm and forest use
4100502 = Commercially Zoned: Commercial and Commercial Lawn and Garden
4100503 = Construction & Mining: Aggregate removal, building footprint and street mix:
Appendix B, Figures B-9 and B-3 illustrate building footprint and roadway.
4100504 = industrially zoned
4100505 = Recreational: Farm or Forest + Parks and Open Space
4100506 = Residential Lawn & Garden
4100507 = Residential
4100509 = Building Footprint, see Appendix B, Figure B-9
4100510 = Streets
4100511 = Publicly Owned
4100519 = Population (from 2010 US census by census block)

(4) 4100508 = Commercial and Industrial zoned = Commercial Roofing Asphalt production/application

(5) 4100512: Aircraft fuel storage based on 2011 NEI data of aircraft emissions of
ethylbenzene by airport location and aircraft type. Appendix B, Table B-5 details aircraft fuel storage spatial surrogate estimates.
Appendix B, Figure B-4 shows the location of airports / heliports within the tri-county area.

(6) 4100513 = Active Rail Line. Appendix B, Figure B-5 shows active rail line (note: the rail line shapefile used is from the EPA 2014 NEI)

(7) 4100514 = Recreational Marine= Boating Use Days. Boating use days taken from Oregon State Marine Board 2010 survey data.
GIS clipping used to determine use days for launches/ramps located with the AQMA. Appendix B, Figure B-7 shows location of
launch/ramp sites. ArcGIS desktop application used to clip data located in DEQ internal files.

(8) 4100515 = On-shore oil and gas production: Locations from DOGAMI website, see Appendix B, Figure B-6a

(9) 4100518: DEQ permitting data used to calculate Gasoline Dispensing Facility (GDF) throughput - please see Appendix A, Figure A-5

(10) 4100520 = Unpaved Roadway estimated using Metro RLIS roadway GIS files (roadway type = 9000 or 2000)
Please see Appendix B, Figure B-3b

(11) 410521 = Surface Mining & Quarrying: DOGAMI data downloaded from http://www.oregongeology.org/mlrr/permitviewer.htm
Active and closed permit data included. see Appendix B, Figure B-6b

(12) AQMA spatial surrogate = (AQMA Boundary Total) / (County Total)

Appendix B, Table B-4. Jackson County & AQMA nonpoint spatial surrogates (note – this table is continued on page B-14).

County Zoning File (1)	(1)	(1)	(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(3)	(3)	(3)	(5)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			Total	AQMA	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*
ZON_GEN	COMP_PLAN	ZON_DESC	Acres	Acres	4102901	4102902	4102903	4102904	4102905	4102906	4102907	4102908	4102909	4102910	4102911	4102912	4102913	4102914	4102915	4102916	4102917	4102920	4102921	4102922	4102923	4102924
aggregate	Aggregate Removal Land	Aggregate Removal (AR)	6,371.9	2,340.1			X																			
commercial	Commercial Land	Applegate Rural Service Commercial	16.7			X					X		X													
commercial	Commercial Land	General Commercial (GC)	586.7	585.4		X					X		X													
commercial	Commercial Land	Interchange Commercial (IC)	112.2	38.5		X					X		X													
commercial	Commercial Land	Neighborhood Commercial (NC)	1.4	1.4		X					X		X													
commercial	Commercial Land	Ruch Rural Service Commercial	41.4			X					X		X													
commercial	Commercial Land	Rural Service Commercial (RS)	151.3	34.3		X					X		X													
commercial	Commercial Land	Sams Valley Rural Service Commercial	24.8			X					X		X													
efu and ar	CITY	CITY OF CENTRAL POINT	53.1	53.1		X		X			X		X													
farm	Aggregate Removal Land	Exclusive Farm Use (EFU)	20.1	20.1	X																					
farm	Agricultural Land	Exclusive Farm Use (EFU)	249,802.1	75,073.2	X					X																
farm	Rural Residential Land	Rural Residential - 5 (RR-5)	7.7		X					X																
farm, cmrcl, industr	CITY OF MEDFORD	CITY	152.2	152.2		X					X		X													
forest	Forestry / Open Space Land	Forest Resource (FR)	1,244,847.4	4,795.5					X																	
forest	Forestry / Open Space Land	Open Space Reserve (OSR)	37,983.7	12,115.0					X																	
forest	Forestry / Open Space Land	Woodland Resource (WR)	171,302.4	11,432.0					X																	
forest	Industrial Land	Open Space Reserve (OSR)	85.1	85.1					X																	
industrial	Industrial Land	General Industrial (GI)	3,291.4	3,291.4				X					X													
industrial	Industrial Land	Light Industrial (LI)	772.7	769.6				X					X													
industrial	Industrial Land	Rural Light Industrial (RLI)	22.7	10.3				X					X													
limited	Limited Use Land	Limited Use (LU)	239.9	219.9																						
rural	Commercial Land	Rural Residential - 5 (RR-5)	1.3	1.3		X					X		X													
rural	Industrial Land	Rural Residential - 5 (RR-5)	1.5	1.5																						
rural	Rural Residential Land	Applegate Rural Residential - 5	141.0							X		X												X		
rural	Rural Residential Land	Rural Residential - 00 (RR-00)	5,418.3	2,350.7						X		X												X		
rural	Rural Residential Land	Rural Residential - 10 (RR-10)	891.2	568.4						X		X												X		
rural	Rural Residential Land	Rural Residential - 5 (RR-5)	29,716.0	14,069.8						X		X												X		
suburban	CITY OF MEDFORD	CITY	4.8	4.8		X		X			X	X	X											X		
suburban	Limited Use Land	Rural Residential - 2.5 (RR-2.5)	7.6									X												X		
suburban	Rural Residential Land	Rural Residential - 2.5 (RR-2.5)	6,470.7	2,909.5								X												X		
suburban	Urban Residential Land	Urban Residential (UR-1)	2,527.9	1,481.2								X												X		
urban	Urban Residential Land	Urban Residential - 10 (UR-10)	134.3	134.3								X														
urban	Urban Residential Land	Urban Residential - 30 (UR-30)	30.2	30.2								X														
urban	Urban Residential Land	Urban Residential - 8 (UR-8)	25.0	25.0								X														
White City Urban Resident	Urban Residential Land	White City Urban Residential - 10	97.6	97.6								X														
White City Urban Resident	Urban Residential Land	White City Urban Residential - 30	87.0	87.0								X														
White City Urban Resident	Urban Residential Land	White City Urban Residential - 4	150.0	150.0								X														
White City Urban Resident	Urban Residential Land	White City Urban Residential - 6	410.3	410.3								X														
White City Urban Resident	Urban Residential Land	White City Urban Residential - 8	296.6	296.6								X														

Appendix B, Table B-4. Jackson County & AQMA nonpoint spatial surrogates (continued).

City Zoning File (1)	(1)	(1)	(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(3)	(3)	(3)	(5)	(5)	(6)	(7)	(8)	(9)			
			Total	AQMA	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*
GENZONE	ZONE	DETZONE	Acres	Acres	4102901	4102902	4102903	4102904	4102905	4102906	4102907	4102908	4102909	4102910	4102911	4102912	4102913	4102914	4102915	4102916	4102917	4102920	4102921	4102922	4102923	4102924
NULL	AD-MU	unknown - assume ind-comm-inst-res	232.3	232.3		X					X		X													
NULL	I5	assume industrial	102.6	102.6				X					X													
NULL	I5OUT	assume industrial	34.0	34.0				X					X													
NULL	LMR	Low Mix Residential (TOD)	146.5	146.5						X		X												X		
NULL	MMR	Medium Mix Residential (TOD)	66.7	66.7								X												X		
NULL	ODOT	assume roadway	11.2	11.2																						
Agriculture	--	--	568.8	489.1	X					X																
Business Park	--	--	28.3	28.3		X					X		X													
Civic	--	--	90.1	90.1																						
Commercial	--	--	3,526.1	3,382.8		X					X		X													
Industrial	--	--	3,232.8	3,093.4				X					X													
Light Industrial	--	--	1.5	1.5				X					X													
MF Residential	--	--	1,180.4	1,054.9								X												X		
Mixed Use	--	--	0.2	0.2																						
Not In City	--	--	0.2	0.2																						
Open Space	--	--	727.5	507.1						X																
Other	--	--	550.7	550.7																						
Park	--	--	33.6	33.6																						
Public	--	--	155.2	85.2																						
Residential	--	--	3,366.4	3,358.8								X												X		
Residential Farm	--	--	142.3	142.3								X												X		
Rural	--	--	37.2	37.2						X																
SF Residential	--	--	15,438.1	14,323.2								X												X		
Other Spatial Surrogate Data (1)			(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(3)	(3)	(3)	(5)	(5)	(6)	(7)	(8)	(9)			
					SSID	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*	*SSID*
			Total	AQMA	4102901	4102902	4102903	4102904	4102905	4102906	4102907	4102908	4102909	4102910	4102911	4102912	4102913	4102914	4102915	4102916	4102917	4102920	4102921	4102922	4102923	4102924
Population (4)			181,269	150,047										X												
Streets, miles (1)			6,910.5	1,121.6			X									X	X									
Building Footprint, Acres (1)			6,767.8	5,323.0			X						X		X											
Jet Naphtha storage			1	0														X								
AVGas storage			1	0.940															X							
On-Shore Oil and Gas Production			1	1																X						
Recreational Marine			294,035	43,235																	X					
Railway Miles			133.6	93.4																		X				
GDF Throughput (1000 gal)			76,941	68,029																			X			
Rural and Suburban Residential			65,518	40,477																						
Unpaved Roadway (miles)			11,621.5	1,591.4																					X	
Mining/Quarrying (permits)			210	78																						X
					4102901	4102902	4102903	4102904	4102905	4102906	4102907	4102908	4102909	4102910	4102911	4102912	4102913	4102914	4102915	4102916	4102917	4102920	4102921	4102922	4102923	4102924
					---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
				Jackson County Total	250,398.8	4,932.8	20,050.2	7,515.7	1,454,218.6	287,456.4	4,932.8	66,749.3	12,448.4	181,269.0	6,767.8	6,910.5	155.2	1.0	1.0	1.0	294,035	133.6	76,941	65,518	11,622	210
				AQMA Total	75,582.4	4,514.4	8,784.8	7,307.7	28,427.6	93,242.1	4,514.4	46,222.5	11,822.1	150,047.0	5,323.0	1,121.6	85.2	1.0	0.94	1.0	43,235	93.4	68,029	40,477	1,591	78
				AQMA % of County Total (13)	0.3018	0.9152	0.4381	0.9723	0.0195	0.3244	0.9152	0.6925	0.9497	0.8278	0.7865	0.1623	0.5490	1	0.9404	1	0.1470	0.6992	0.8842	0.6178	0.1369	0.3714

Notes for Table B-4 found on page B-16:

Notes for Table B-4

(1) Jackson County Zoning Shapefiles downloaded from http://gis.jacksoncounty.org/Portal/gis-data.aspx
Appendix B, Figure B-10 illustrates zoning in Jackson County

(2) The GIS project used to calculate acreages & miles in DEQ internal files.

(3) An "X" indicates value used to estimate AQMA spatial surrogate factors

Spatial Surrogate ID descriptions

4102901 = Agriculturally Zoned
4102902 = Commercially Zoned
4102903 = Construction & Mining: Aggregate removal, building footprint and street mix: Appendix B Figures B-11 and B-12 illustrate building footprint and roadway.
4102904 = Industrially Zoned
4102905 = Forest Land
4102906 = Recreational Vehicles & Equipment: Farm/Rural and Low-Density Residential Zoning Mix
4102907 = Commercial Lawn & Garden
4102908 = Residential Lawn & Garden
4102909 = Commercial and Industrial zoned = Commercial Roofing Asphalt production/application & specific fugitive dust
4102911 = Architecture: See Appendix B, Figure B-11 for Jackson County building footprint illustration
4102912 = Streets: See Appendix B, Figure B-12 for Jackson County roadway illustration

(4) 4102910 = Population, DEQ GIS files, 2010 US Census. Population based on US Census blockgroup data. GIS project used to calculate population is same as in note (2).
Appendix B, Figure B-13 illustrates Jackson County census blockgroups.

(5) 4102914 & 4102915: Aircraft fuel storage based on 2011 NEI data of aircraft emissions of ethylbenzene by airport location and aircraft type. Appendix B, Table B-5 details aircraft fuel storage spatial surrogate estimates. Appendix B, Figure B-14 shows the location of airports / heliports within the tri-county area.

(6) 4102916= On-shore oil and gas production: Locations from DOGAMI website, see Appendix B, Figure B-15a

(7) 4102917 = Recreational Marine= Boating Use Days. Boating use days taken from Oregon State Marine Board 2010 survey data. GIS clipping used to determine use days for launches/ramps located with the AQMA. Appendix B, Figure B-18 shows location of launch/ramp sites.

(8) 4102920 = Active Rail Line. Appendix B, Figure B-24 shows Jackson Co. active rail line (note: the rail line shapefile used is from the EPA 2014 NEI)

(9) 4102921: DEQ permitting data used to calculate Gasoline Dispensing Facility (GDF) throughput - please see Appendix A, Figure A-6

(10) 4102922 = Rural and Suburban Residential - (residential open burning, fire pits, chimneys)

(11) 4102923 = Unpaved Roadway estimated using …Reference X (email from Matthew Bell, Kittelson & Associates, Inc.)

(12) 4102924 = Surface Mining & Quarrying: DOGAMI data downloaded from http://www.oregongeology.org/mlrr/permitviewer.htm
Active and closed permit data included. Appendix B, Figure B-15b

(13) AQMA spatial surrogate = (TSD: AQMA Boundary Total) / (County Total)

Appendix B, Table B-5. Ethyl benzene emissions by airport (facility) and process.

county_name	facility_site_name	eis_facility_site_id	LAT_DD	LONG_DD	Air Taxi	Aircraft Auxiliary Power Units	Commercial Aircraft	General Aviation	Military Aircraft	Jet Naptha	Aviation Gasoline	Within AQMA
Clackamas	AEROACRES	12204011	45.3165	-122.6054				0.3121		0	0.0043	Yes
Clackamas	AUBERGE DES FLEURS	11919711	45.4498	-122.2543				0.3492		0	0.0048	No
Clackamas	BEAVER OAKS	12218111	45.3040	-122.3609				0.4235		0	0.0058	No
Clackamas	BONNEY ACRES	11715811	45.3243	-122.4720				0.2749		0	0.0038	No
Clackamas	BRUCES	11508211	45.4218	-122.6204				0.2749		0	0.0038	Yes
Clackamas	COMPTON	11150411	45.2223	-122.7268				0.3121		0	0.0043	No
Clackamas	COUNTRY SQUIRE AIRPARK	12083711	45.3544	-122.2681				2.3840		0	0.0328	No
Clackamas	DIETZ AIRPARK	12202111	45.2557	-122.6509				1.1851		0	0.0163	No
Clackamas	EAGLE NEST RANCH	12218011	45.3548	-122.3459				0.6464		0	0.0089	No
Clackamas	FAIRWAYS	12203311	45.3207	-122.5512				12.4130		0	0.1709	No
Clackamas	FLYING K BAR J RANCH	12201711	45.4426	-122.3206				0.2749		0	0.0038	No
Clackamas	HAPPY VALLEY	12183711	45.4482	-122.4995				0.2894		0	0.0040	Yes
Clackamas	HELITRADEWINDS	11742511	45.1412	-122.6215				0.0914		0	0.0013	No
Clackamas	KRUEGER	12218711	45.4421	-122.3231				0.2935		0	0.0040	No
Clackamas	LENHARDT AIRPARK	11731411	45.1804	-122.7434				7.1518		0	0.0985	No
Clackamas	MC KINNON AIRPARK	12203911	45.4307	-122.2420				0.3307		0	0.0046	No
Clackamas	MERIDIAN PARK HOSPITAL	11238311	45.3779	-122.7404				0.0914		0	0.0013	Yes
Clackamas	NIELSEN	11955011	45.3443	-122.5179				0.3307		0	0.0046	No
Clackamas	Portland-Mulino	9238211	45.2163	-122.5901				25.5565		0	0.3518	No
Clackamas	PYNN	11671111	45.3365	-122.6648				0.0914		0	0.0013	Yes
Clackamas	SANDY RIVER	10945811	45.4018	-122.2287				13.7076		0	0.1887	No
Clackamas	SCHMIDT	11743011	45.4529	-122.3211				0.3121		0	0.0043	No
Clackamas	SKYDIVE OREGON	12183911	45.1462	-122.6176				0.4341		0	0.0060	No
Clackamas	SKYHILL	11906311	45.2879	-122.4561				0.2749		0	0.0038	No
Clackamas	VALLEY VIEW	11759311	45.3082	-122.3187				3.5342		0	0.0487	No
Clackamas	WARNERS	11497311	45.3250	-122.4242				0.3121		0	0.0043	No
Clackamas	WILEYS	11943511	45.4310	-122.6495				0.1345		0	0.0019	Yes
Clackamas	WILLAMETTE FALLS COMMUNITY HOSPITAL	11906511	45.3576	-122.5859				0.0914		0	0.0013	Yes
Clackamas	WORKMAN AIRPARK	12202211	45.2076	-122.6693				0.7579		0	0.0104	No

Continued on page B-17

Table B-5 continued

county_name	facility_site_name	eis_facility_site_id	LAT_DD	LONG_DD	Air Taxi	Aircraft Auxiliary Power Units	Commercial Aircraft	General Aviation	Military Aircraft	Jet Naptha	Aviation Gasoline	Within AQMA
Jackson	Ashland Muni-Sumner Par	9226211	42.1903	-122.6606	1.4911			29.1170	0.0623	0.0056	0.3220	Yes
Jackson	BEAGLE SKY RANCH	12222411	42.5390	-122.9039				0.6106		0	0.0064	No
Jackson	BURRILL	12222511	42.4387	-122.8637				0.4806		0	0.0051	Yes
Jackson	CROMAN	12043711	42.4292	-122.8756				0.0914		0	0.0010	Yes
Jackson	EAST OREGON CATTLE CO	11536511	42.5035	-122.8548				0.2577		0	0.0027	No
Jackson	ERICKSON AIR-CRANE ADMIN OFFICES	12206211	42.4300	-122.9049				0.0914		0	0.0010	Yes
Jackson	ERICKSON AIR-CRANE WHETSTONE	11072611	42.4300	-122.9049				0.0914		0	0.0010	Yes
Jackson	FIREFLY RANCH AIRFIELD	12203711	42.5112	-122.9242				0.3691		0	0.0039	No
Jackson	FLY BY NIGHT	12202911	42.2461	-123.0700				0.0028		0	0.0000	No
Jackson	LIGHT VALLEY TREE FARM	11196511	42.3593	-122.5111				0.0914		0	0.0010	No
Jackson	MUCKY FLAT	11272711	42.5979	-122.7125				0.2577		0	0.0027	No
Jackson	OAKRIDGE RANCH	16139111	42.4632	-122.7340				0.2763		0	0.0029	No
Jackson	PINEHURST STATE	11063611	42.1102	-122.3832				0.7003		0	0.0074	No
Jackson	PROSPECT STATE	11221611	42.7432	-122.4881	0.1988			1.2028		0	0.0147	No
Jackson	PROVIDENCE HOSPITAL	11536411	42.3387	-122.8623				0.0914		0	0.0010	Yes
Jackson	Rogue Valley Internatio	9226311	42.3796	-122.8802	27.2276	0.4230	10.2355	30.1947	0.7460	0.9944	0.6085	Yes
Jackson	ROGUE VALLEY MEDICAL CENTER	12222711	42.3179	-122.8306				0.0914		0	0.0010	No
Jackson	SHADY COVE AIRPARK	12204111	42.6082	-122.8262	0.0119			0.7473		0	0.0080	No
Jackson	SNIDER CREEK	12199811	42.5390	-122.9229				0.2948		0	0.0031	No
Jackson	SPRINGBROOK	11172511	42.5551	-123.2045				0.2577		0	0.0027	No
Jackson	SUTTON ON ROGUE	11536611	42.4848	-122.8662				0.2948		0	0.0031	No
Jackson	TIMBERLAND SHOP	11223011	42.2054	-122.6336				0.0914		0	0.0010	Yes

Table B-5 continued on page B-19

Table B-5 continued

county_name	facility_site_name	eis_facility_site_id	LAT_DD	LONG_DD	Air Taxi	Aircraft Auxiliary Power Units	Commercial Aircraft	General Aviation	Military Aircraft	Jet Naptha	Aviation Gasoline	Within AQMA
Multnomah	EMANUEL HOSPITAL	11715511	45.5432	-122.6701				0.0914		0	0.0003	Yes
Multnomah	HESSEL TRACTOR	11991511	45.5887	-122.6540				0.0914		0	0.0003	Yes
Multnomah	KATU	11933911	45.5271	-122.6440				0.0914		0	0.0003	Yes
Multnomah	LEHMAN FIELD	12216911	45.4857	-122.2340				0.0028		0	0.0000	No
Multnomah	MOUNT HOOD MEDICAL CENTER	11188211	45.5169	-122.4067				0.0914		0	0.0003	Yes
Multnomah	OREGON HEALTH SCIENCES UNIVERSITY EMERG	11573711	45.4957	-122.6873				0.0914		0	0.0003	Yes
Multnomah	PARRETT MOUNTAIN	11076511	45.4790	-122.2343				0.2473		0	0.0009	No
Multnomah	PGE SERVICE CENTER	11991311	45.4960	-122.6479				0.0914		0	0.0003	Yes
Multnomah	PORTLAND ADVENTIST MEDICAL CENTER	11573611	45.5133	-122.5569				0.0914		0	0.0003	Yes
Multnomah	Portland Downtown	9250711	45.5253	-122.6709	1.7853			2.6971	0.1245	0.0003	0.0158	Yes
Multnomah	Portland Intl	9246511	45.5916	-122.6142	166.0988	6.4038	420.7232	30.0659	4.4683	0.9973	0.7119	Yes
Multnomah	Portland-Troutdale	9246411	45.5494	-122.4013	1.3151		0.0433	75.0210	0.9826	0.0024	0.2683	Yes
Multnomah	PROVIDENCE MEDICAL CENTER	11883611	45.5280	-122.6121				0.0914		0	0.0003	Yes
Multnomah	ROSE GARDEN	12202811	45.5328	-122.6661				0.0914		0	0.0003	Yes
Multnomah	WORLD TRADE CENTER	11955311	45.5171	-122.6737				0.0914		0	0.0003	Yes

Table B-5 continued on page B-20

Table B-5 continued

county_name	facility_site_name	eis_facility_site_id	LAT_DD	LONG_DD	Air Taxi	Aircraft Auxiliary Power Units	Commercial Aircraft	General Aviation	Military Aircraft	Jet Naptha	Aviation Gasoline	Within AQMA
Washington	AMBER GLEN BUSINESS CENTER HP	11569911	45.5304	-122.8832				0.0914		0	0.0003	Yes
Washington	APPLE VALLEY	12217811	45.6784	-123.1862				0.4946		0	0.0017	No
Washington	CHADWICK	12201211	45.6332	-123.1679				0.2902		0	0.0010	No
Washington	CHEHALEM MOUNTAIN	11905911	45.3554	-122.9462				0.0914		0	0.0003	Yes
Washington	FISHBACK	11573811	45.6039	-123.0786				0.0914		0	0.0003	Yes
Washington	FLYING K RANCH	12199211	45.4345	-122.8800				0.3460		0	0.0012	Yes
Washington	GILBERT	12206411	45.6489	-123.0394				0.2902		0	0.0010	No
Washington	HARVEYS ACRES	12201311	45.4415	-122.8929				0.2902		0	0.0010	Yes
Washington	LINCOLN TOWER	12201811	45.4451	-122.7737				0.0914		0	0.0003	Yes
Washington	MEYER RIVERSIDE AIRPARK	12204311	45.3998	-122.8290				0.3460		0	0.0012	Yes
Washington	NORTH PLAINS	11906111	45.6040	-123.0248				0.5318		0	0.0019	Yes
Washington	OLINGER AIRPARK	12221611	45.5598	-123.0196				0.5318		0	0.0019	Yes
Washington	Portland-Hillsboro	9238011	45.5404	-122.9498	6.2010	0.0002	0.0216	243.8267	0.5131	1.0000	0.8819	Yes
Washington	RIEBEN	12188411	45.6103	-123.0800				0.2902		0	0.0010	Yes
Washington	SKYPORT	11931811	45.5826	-123.0529				2.3469		0	0.0083	Yes
Washington	ST VINCENT HOSPITAL	11996611	45.5101	-122.7734				0.0914		0	0.0003	Yes
Washington	STARKS TWIN OAKS AIRPARK	11731111	45.4285	-122.9422				26.4557		0	0.0933	Yes
Washington	SUNSET AIR STRIP	11906011	45.5915	-123.0096				0.5503		0	0.0019	Yes
Washington	TEUFEL	16139711	45.5308	-123.0856				0.0914		0	0.0003	Yes
Washington	TEUFELS	16139811	45.5314	-123.0845				0.0914		0	0.0003	Yes
Washington	TUALITY HOSPITAL	12205411	45.5279	-122.9798				0.0914		0	0.0003	Yes

Notes for Table B-5:

Source: EPA NEI

Appendix B, Table B-6. Biogenic spatial surrogates, estimated using land cover raster cell counts.

(1)	(1)	(1), (2)	(1), (2)	(3)	(1), (2)	(1), (2)	(3)
		-- Jackson County: Medford AQMA --			-- Tri-County Area: PDX AQMA --		
		Cell COUNT		Spatial Surrogate	Cell COUNT		Spatial Surrogate
VALUE	LAND_COVER	County	AQMA	AQMA / County	County	AQMA	AQMA / County
41	Deciduous Forest	24,853	510		83,197	28,276	
42	Evergreen Forest	4,451,319	46,609		4,191,712	139,489	
43	Mixed Forest	151,547	10,790		447,363	104,107	
52	Shrub/Scrub	2,092,835	148,543		938,694	28,855	
71	Herbaceuous	403,522	68,547		307,094	33,134	
81	Hay/Pasture	352,011	186,863		676,865	240,109	
82	Cultivated Crops	125,109	69,057		646,387	299,579	
90	Woody Wetlands	29,020	8,075		100,339	45,231	
95	Emergent Herbaceuous Wetlands	11,980	2,191		31,165	15,687	
		-------	-------		-------	-------	
	Vegetation Land Cover	7,642,196	541,185	7.08%	7,422,816	934,467	12.59%

Notes:

(1) The GIS project used to generate raster cell counts for landcover is located in DEQ internal files.

Source data: 2011 National Land Cover Database (NLCD) raster file from DEQ GIS Library.

(2) Please see Appendix B, Figures B-19 (PDX area) and B-20 (Medford) for landcover maps.

(3) Spatial Surrogate = Vegetation Land Cover (County total count / AQMA total count)

Appendix B, Table B-7. Additional spatial surrogate references and appendix figures of relevant maps.

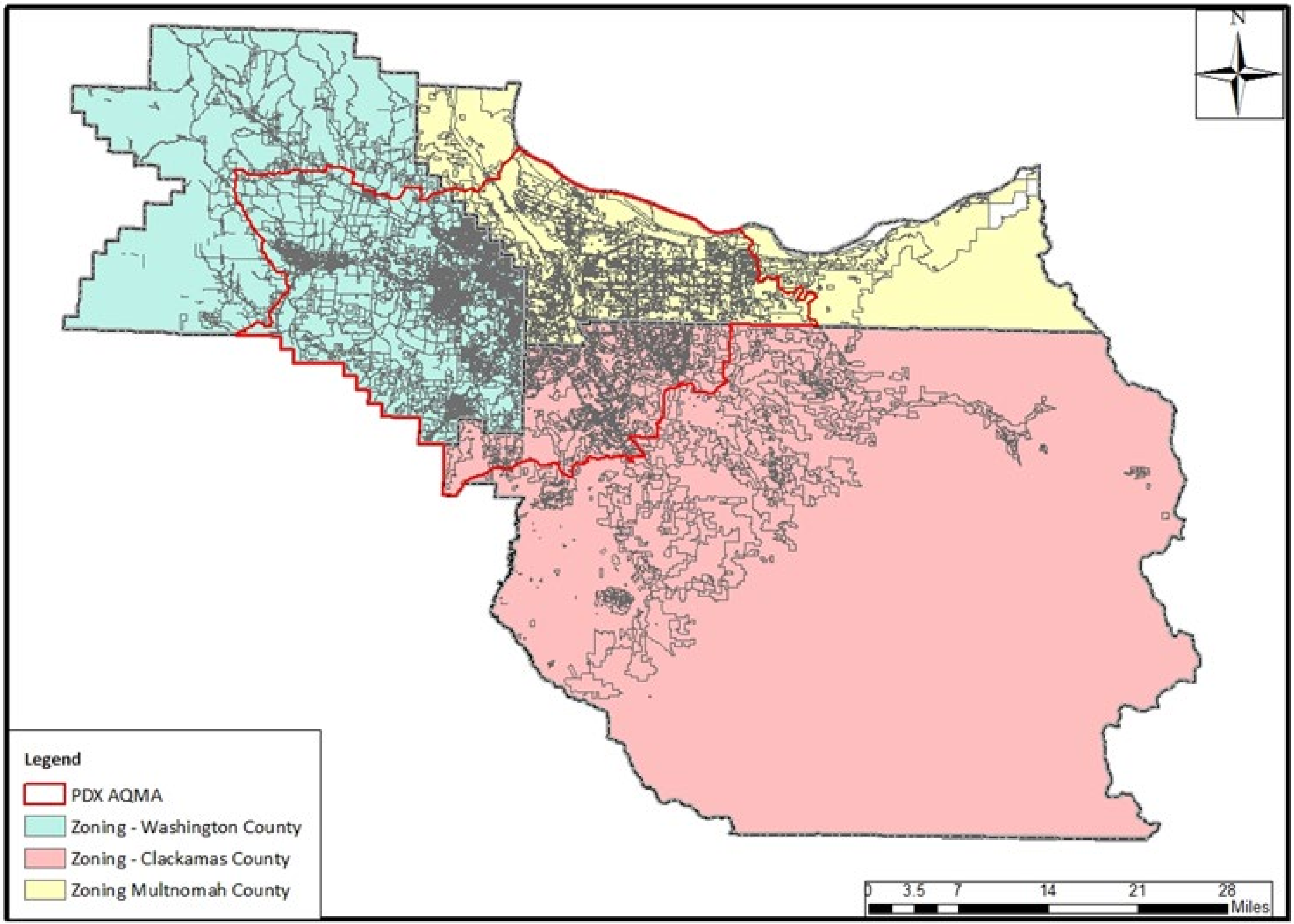
Source Type	Surrogate Source	Unit	Figures
Commercial Marine Vessels: In-Transit	EPA shapefile	Acres	B-22
Commercial Marine Vessels: In-Port	EPA shapefile	Acres	B-23
Line-Haul Locomotives	EPA shapefile	Length	B-5 & B-24
Rail Yards	EPA coordinates	Location	B-25
Airports	EPA coordinates	Location	B-24 & B-14
Rx, Ag burning and Wildfires	EPA coordinates	Location	B-16 & B-17
Residential Wood Combustion	Census Block Group	Location	B-26 & B-27

Permitted point: Location specific

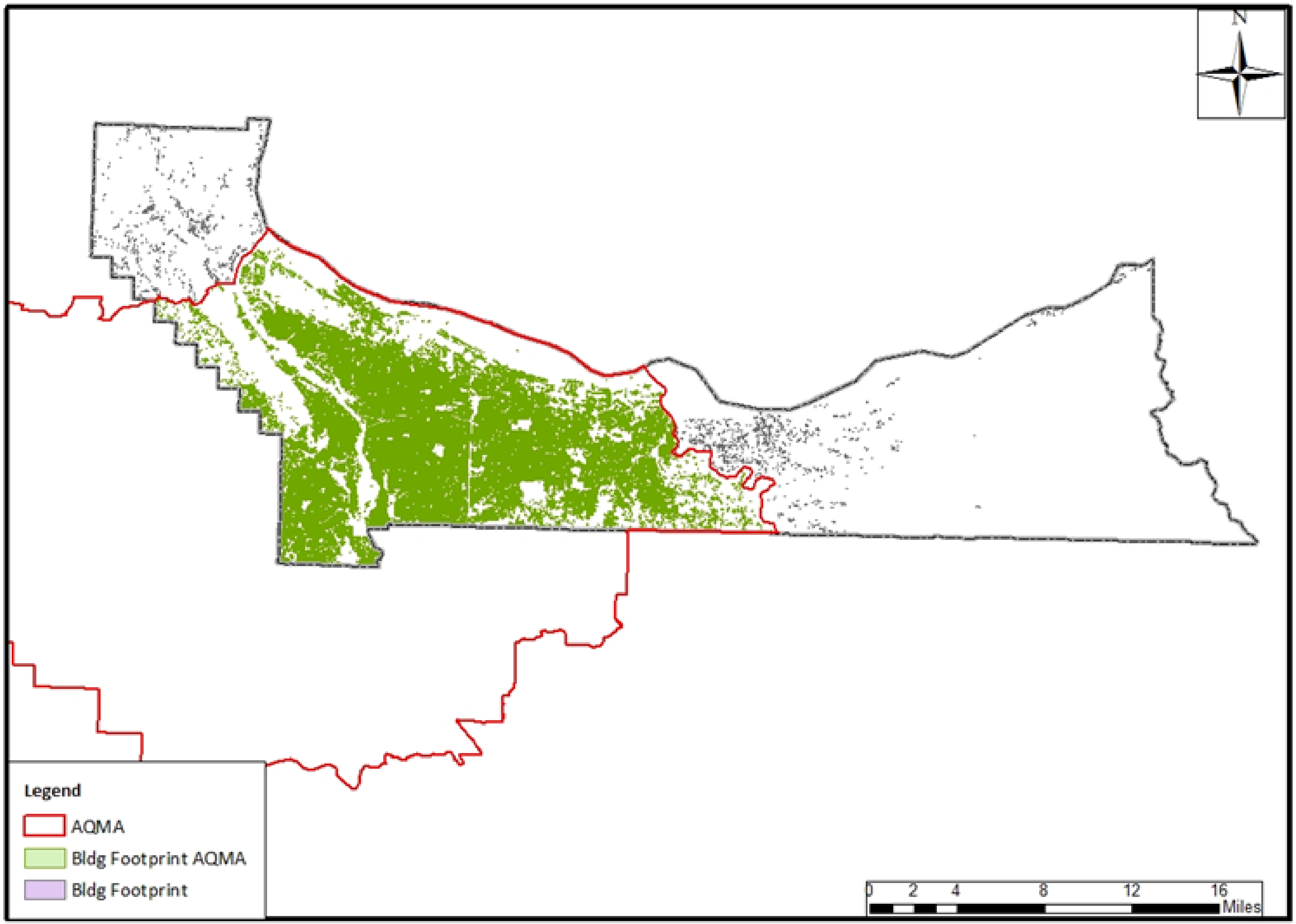
Point (2014 NEI v.2)	EPA coordinates	Location	Appendix A: A-1 through A-4
Gasoline Dispensing Facilities	DEQ coordinates	Location	Appendix A: A-5 and A-6
Perc Dry Cleaners	DEQ coordinates	Location	Appendix A: A-7 and A-8

Notes for Table B-7

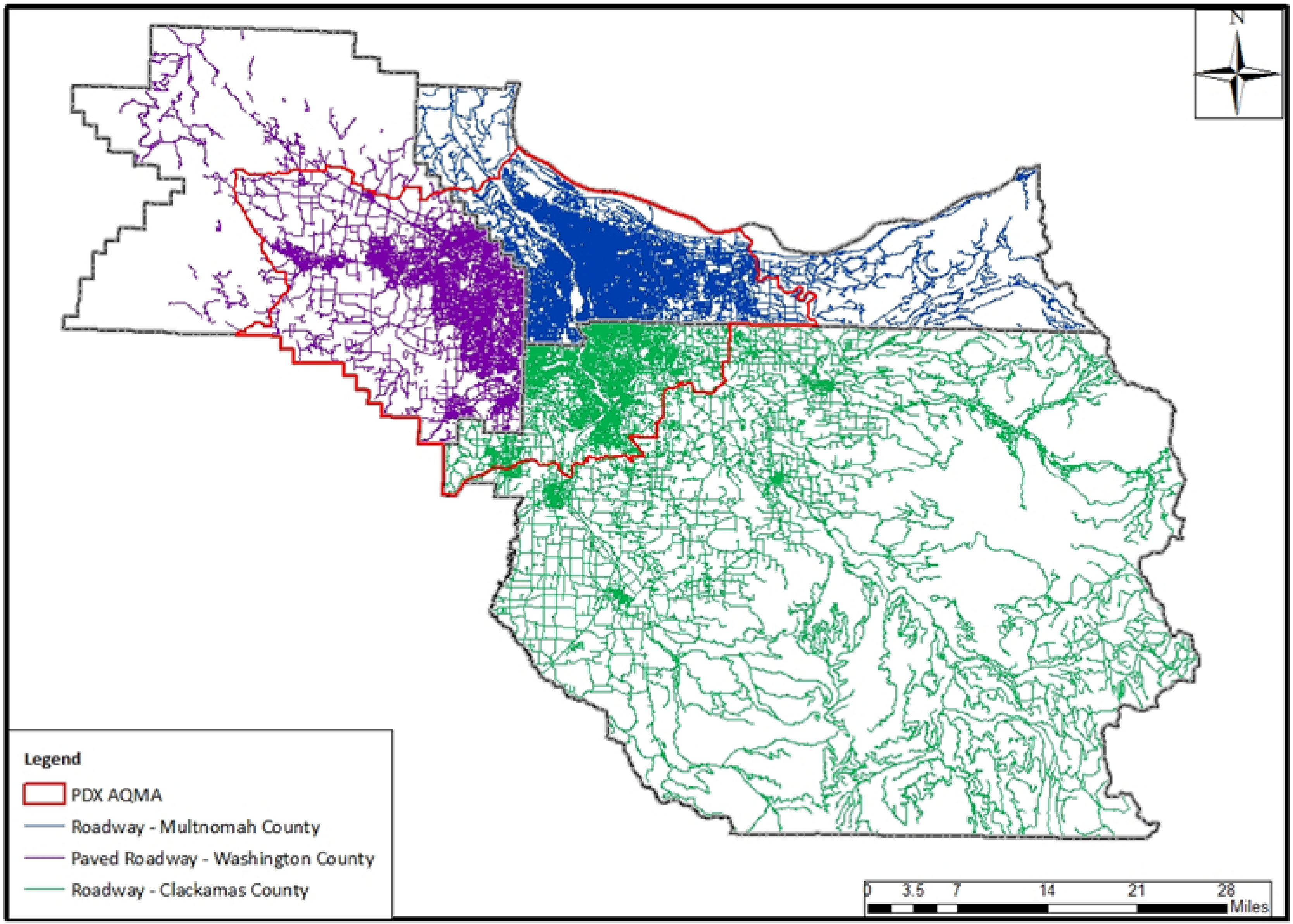
GIS projects for SS estimates in DEQ internal files.



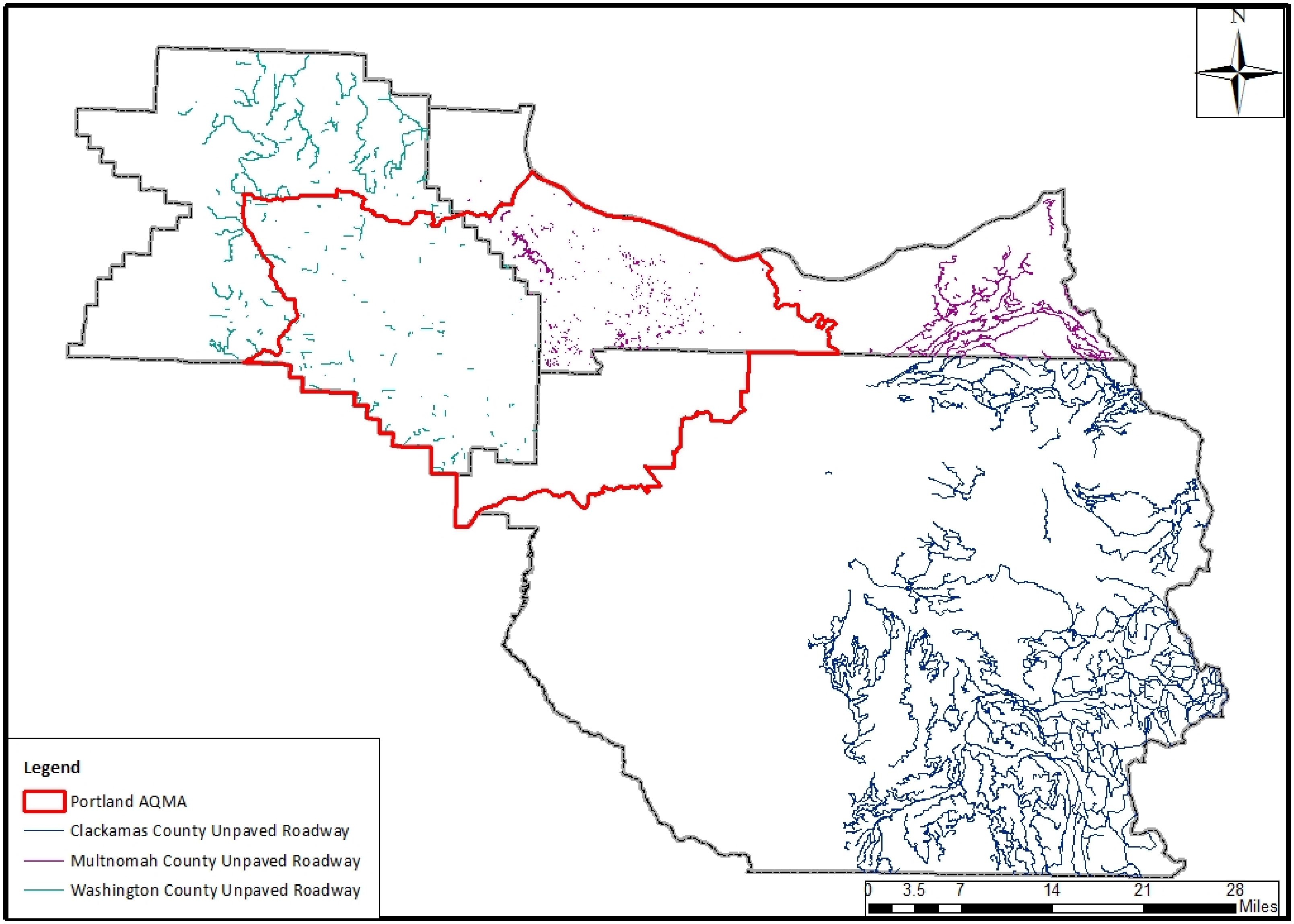
Appendix B, Figure B-1. Tri-county zoning



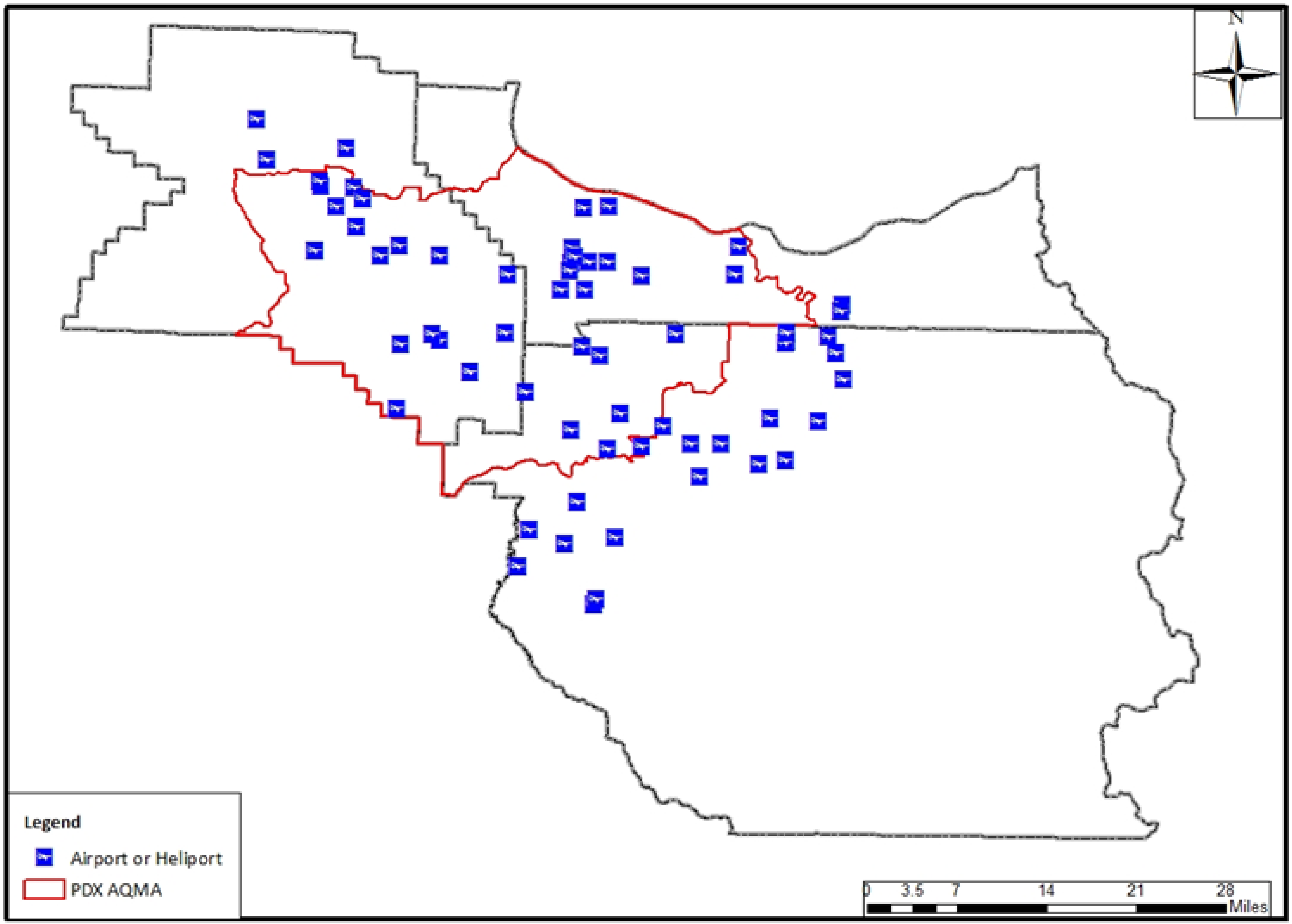
Appendix B, Figure B-2. Multnomah County building footprint



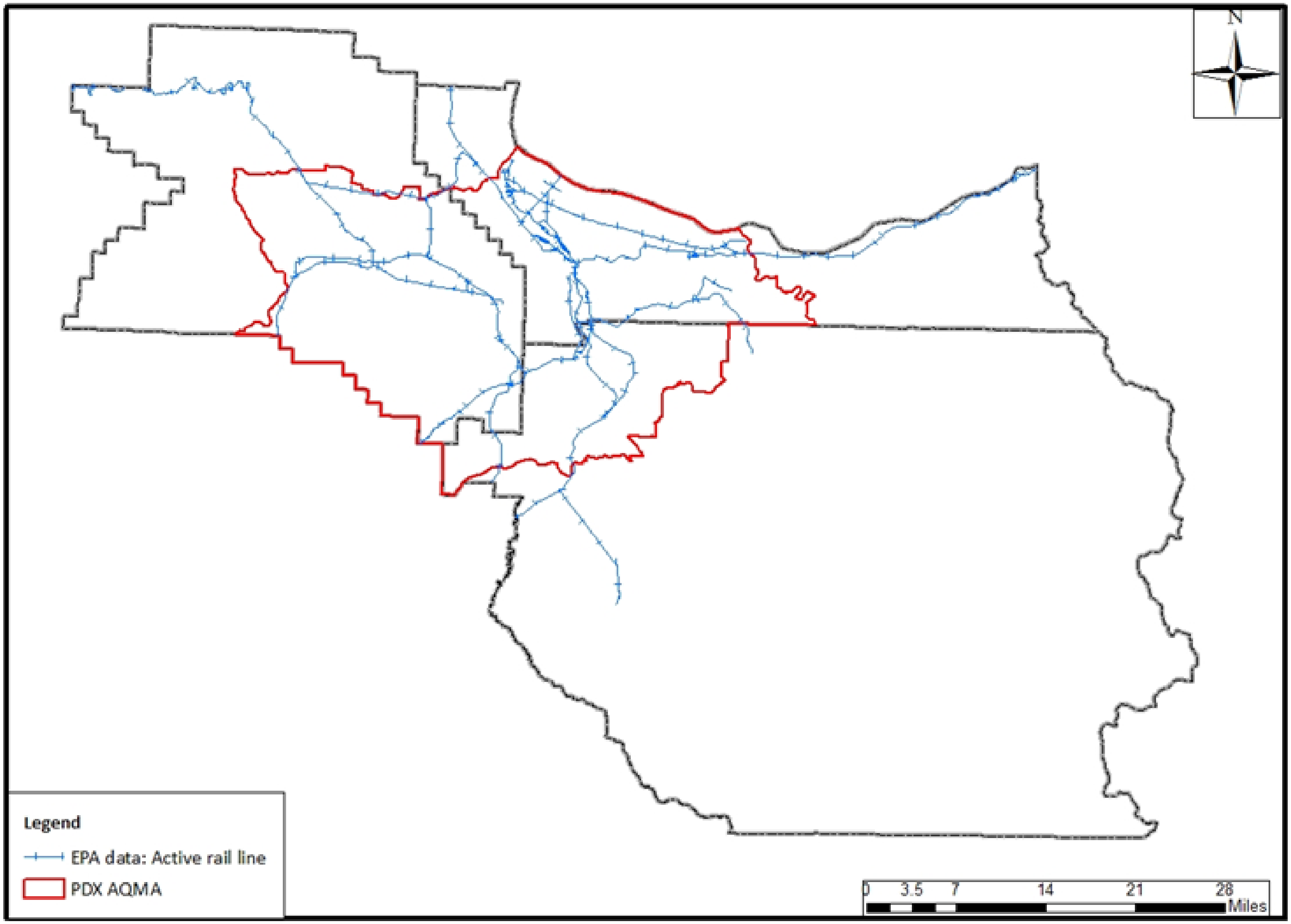
Appendix B, Figure B-3a. Tri-county roadway



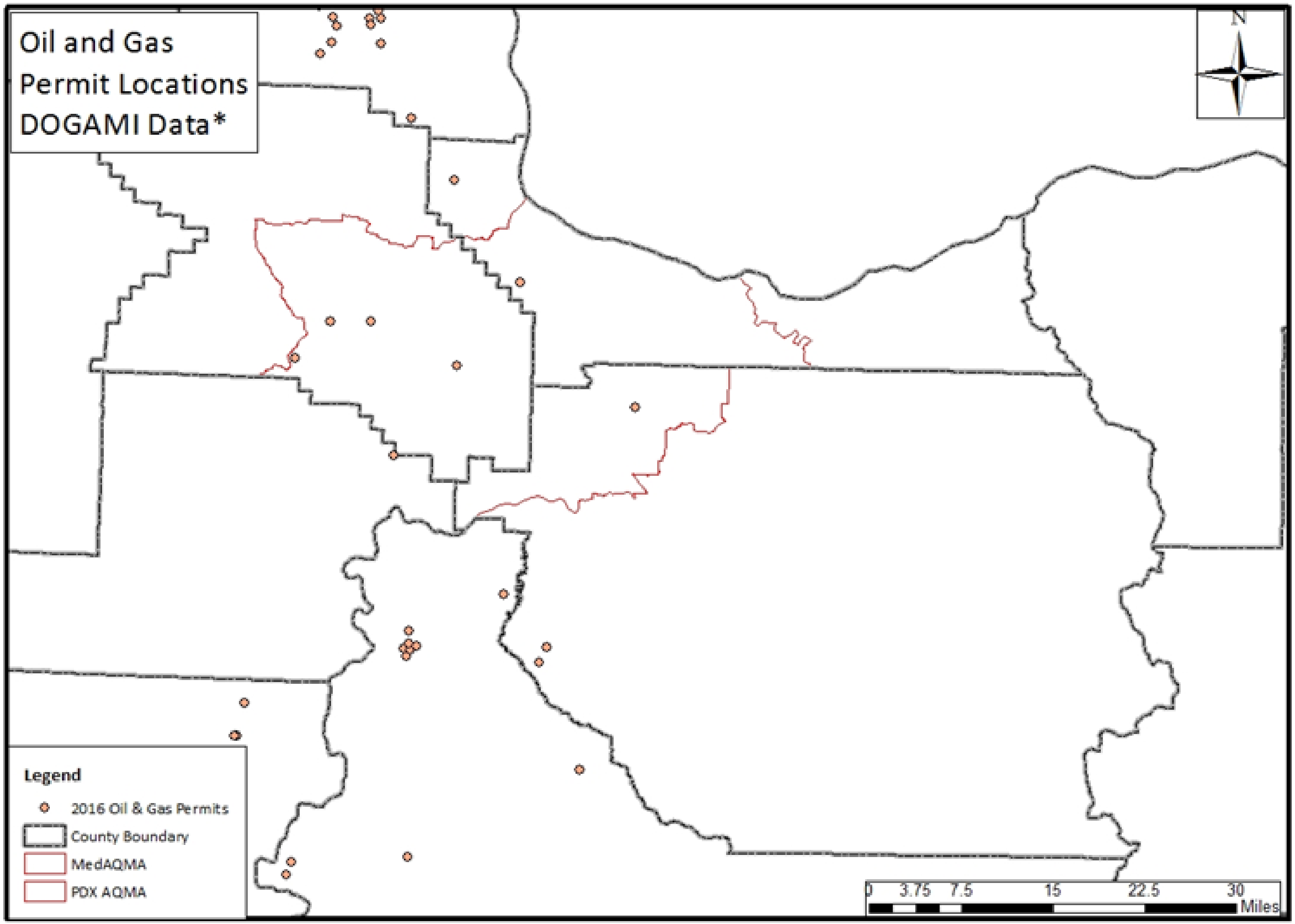
Appendix B, Figure B+3b. Tri-county unpaved roadway



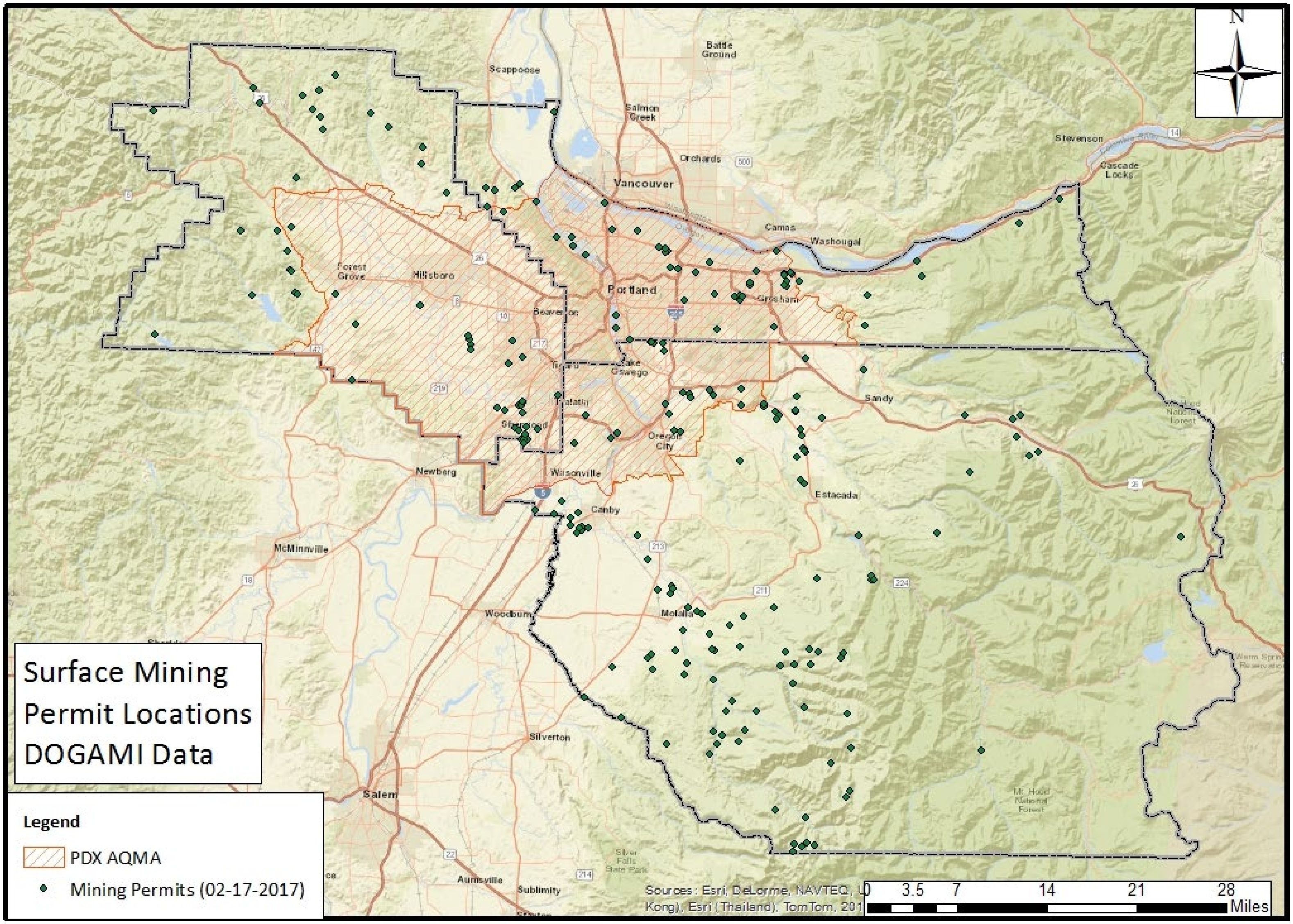
Appendix B, Figure B-4. Tri-County airport locations



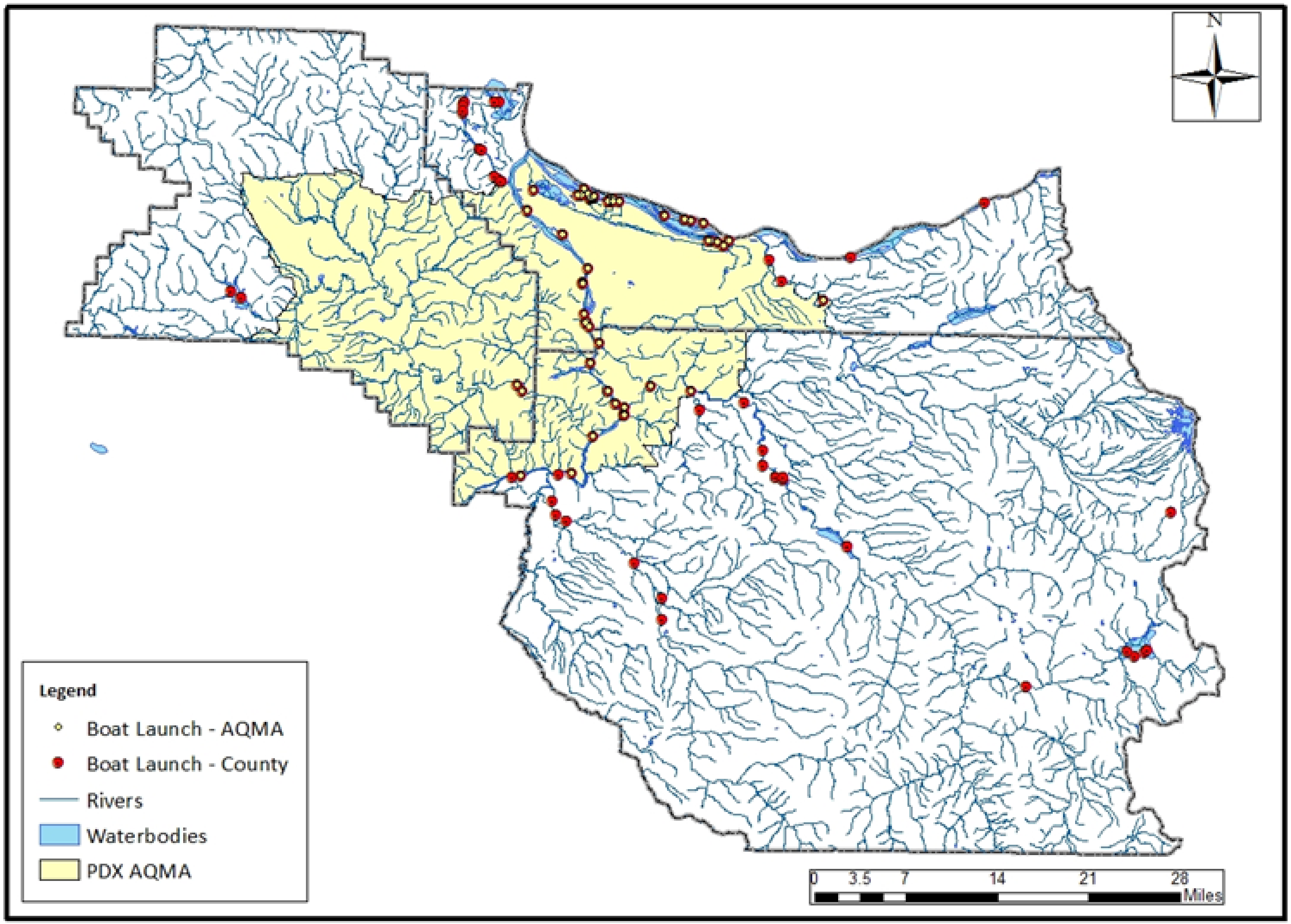
Appendix B, Figure B-5. Tri-County railway



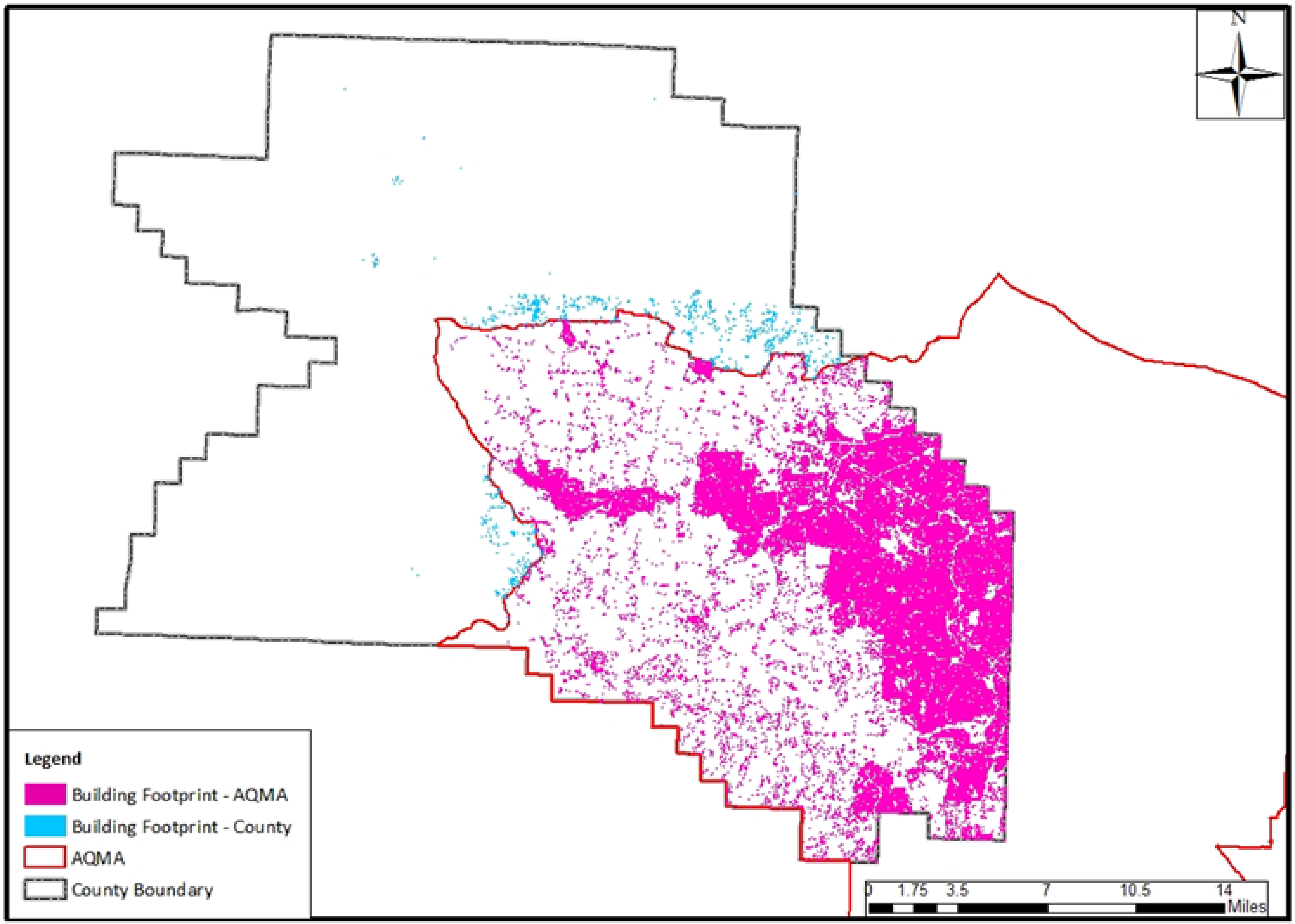
Appendix B, Figure B-6a. DOGAMI oil and gas permit locations, northern Willamette Valley



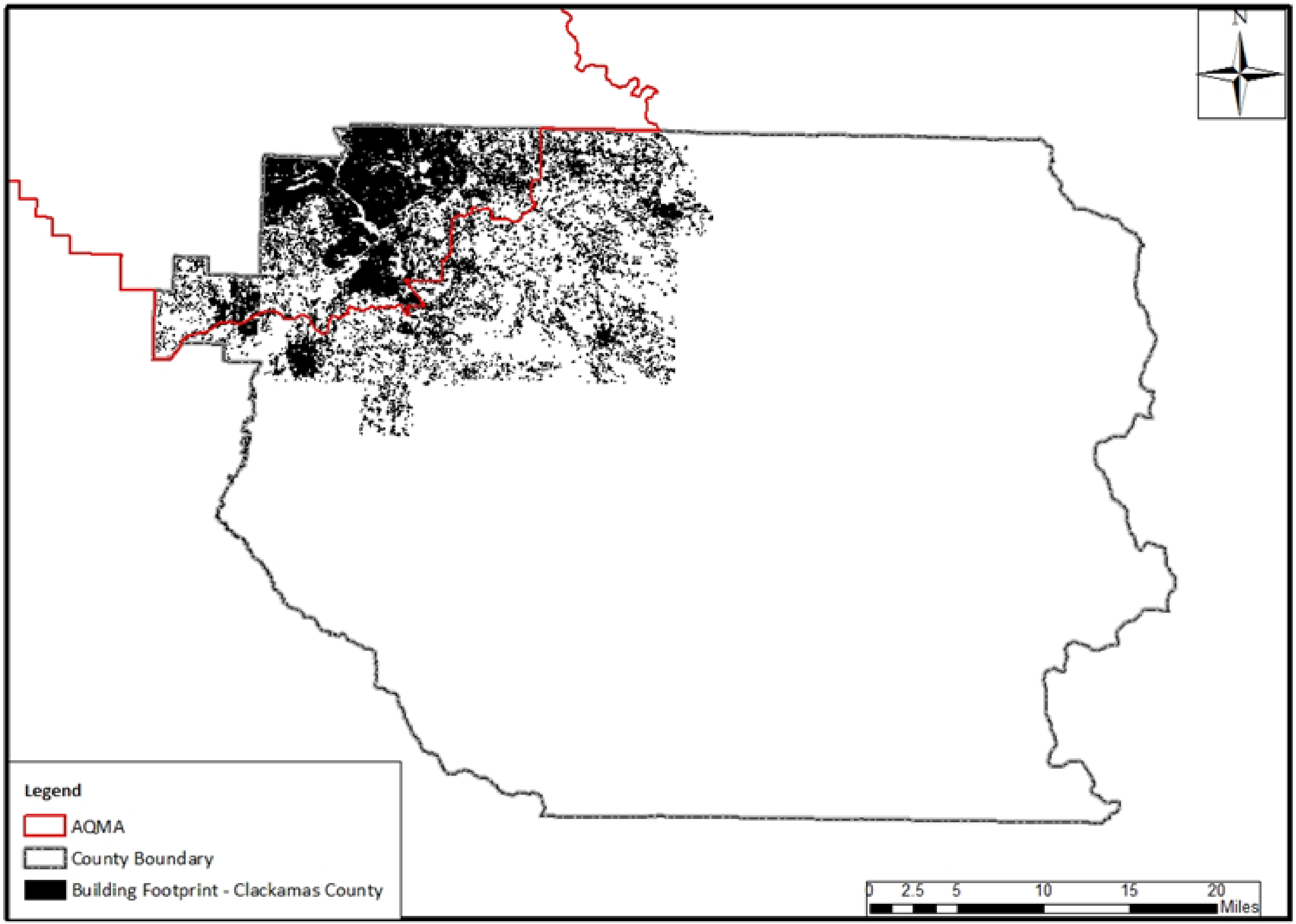
Appendix B, Figure B-6b. DOGAMI surface mining locations, northern Willamette Valley



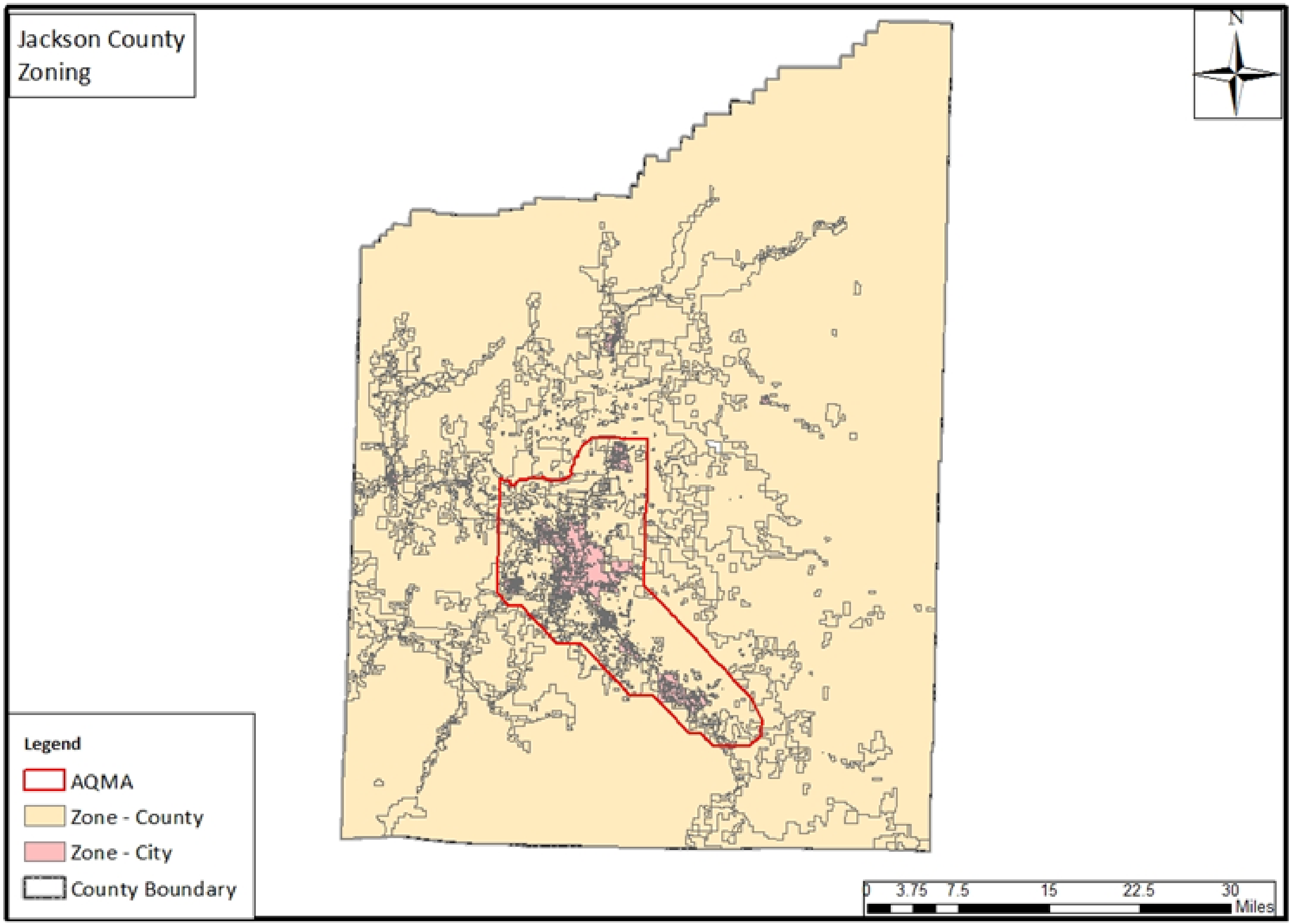
Appendix B, Figure B-7. Tri-County boat launch locations



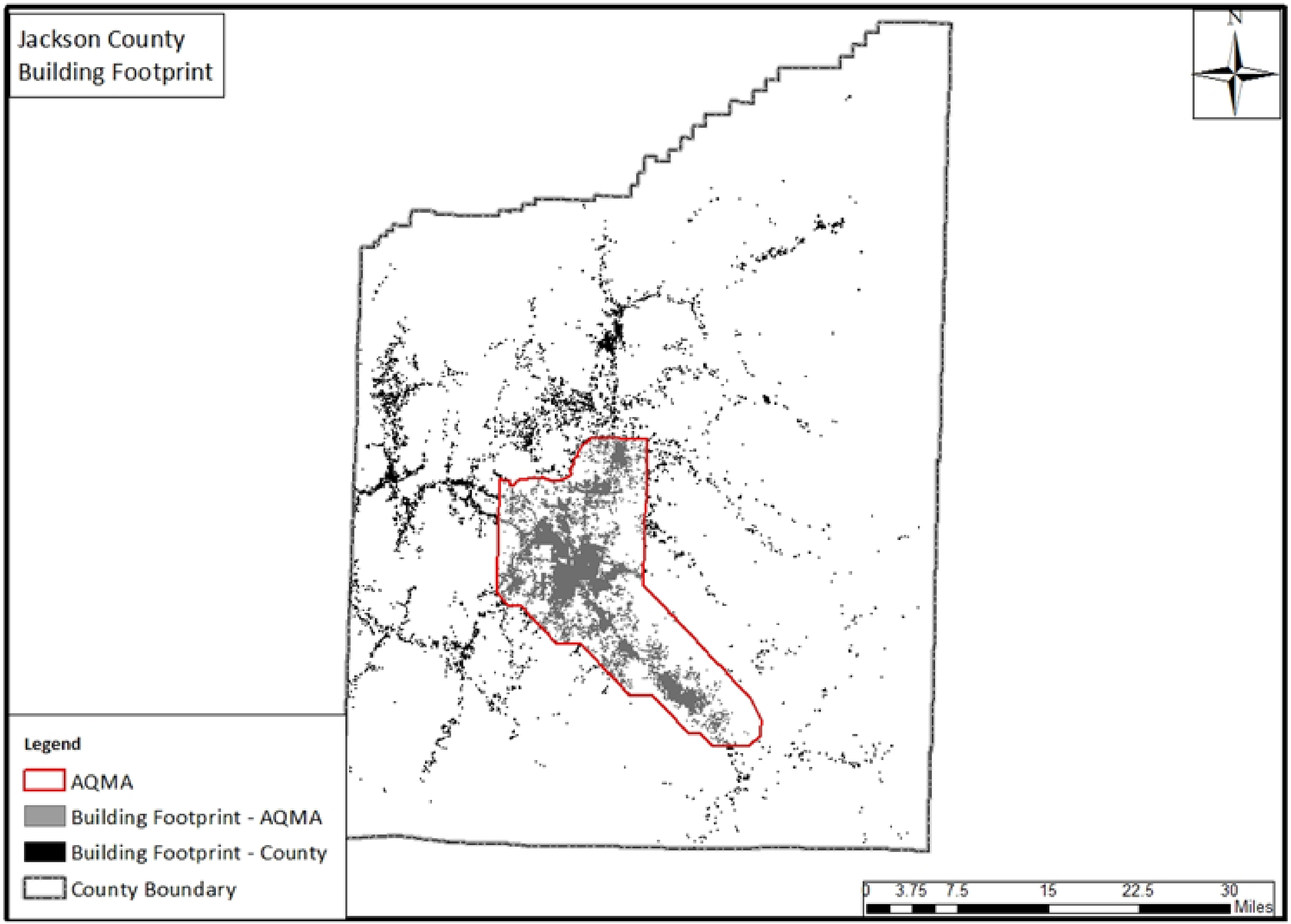
Appendix B, Figure B-8. Washington County building footprint



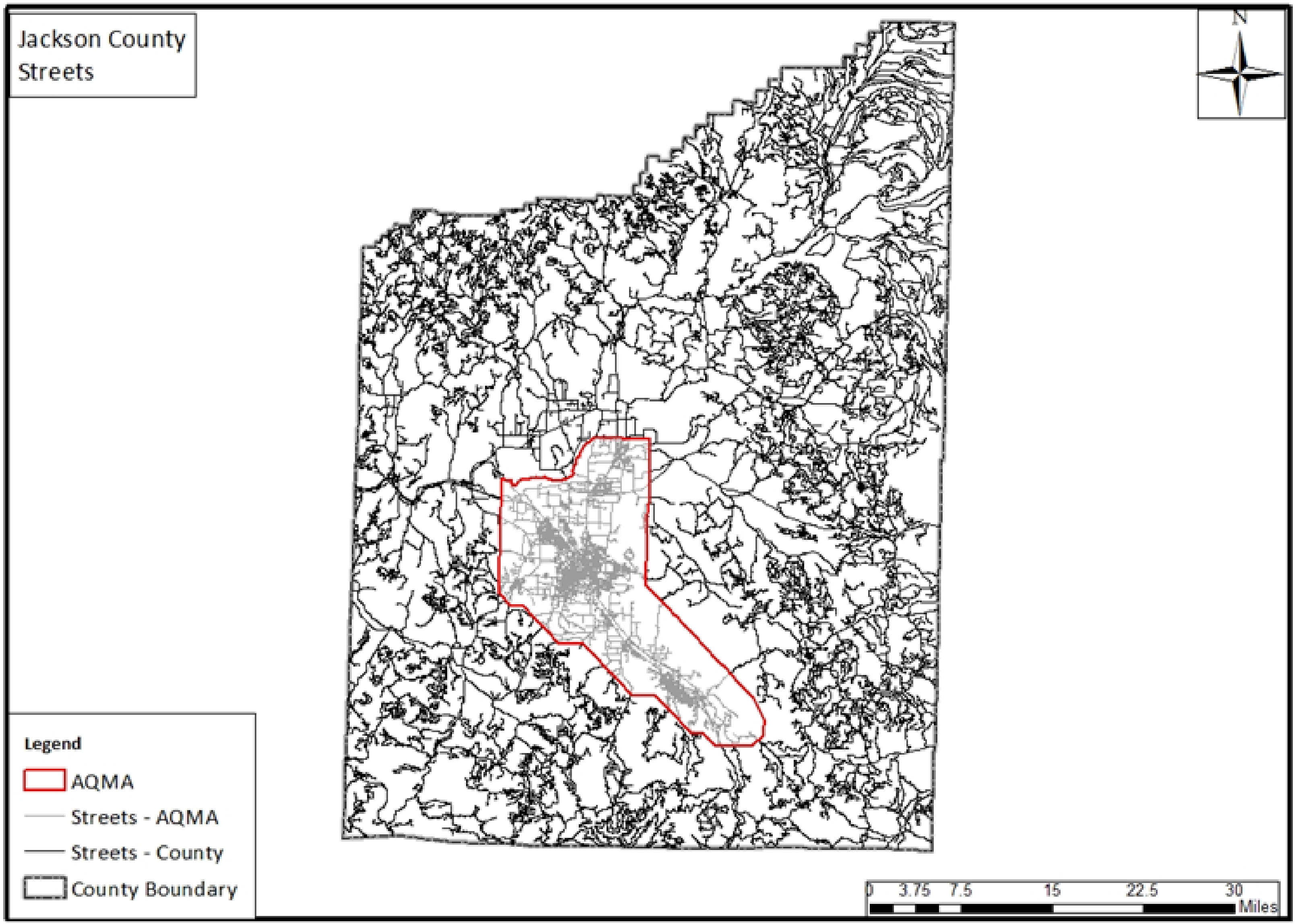
Appendix B, Figure B-9. Clackamas County building footprint



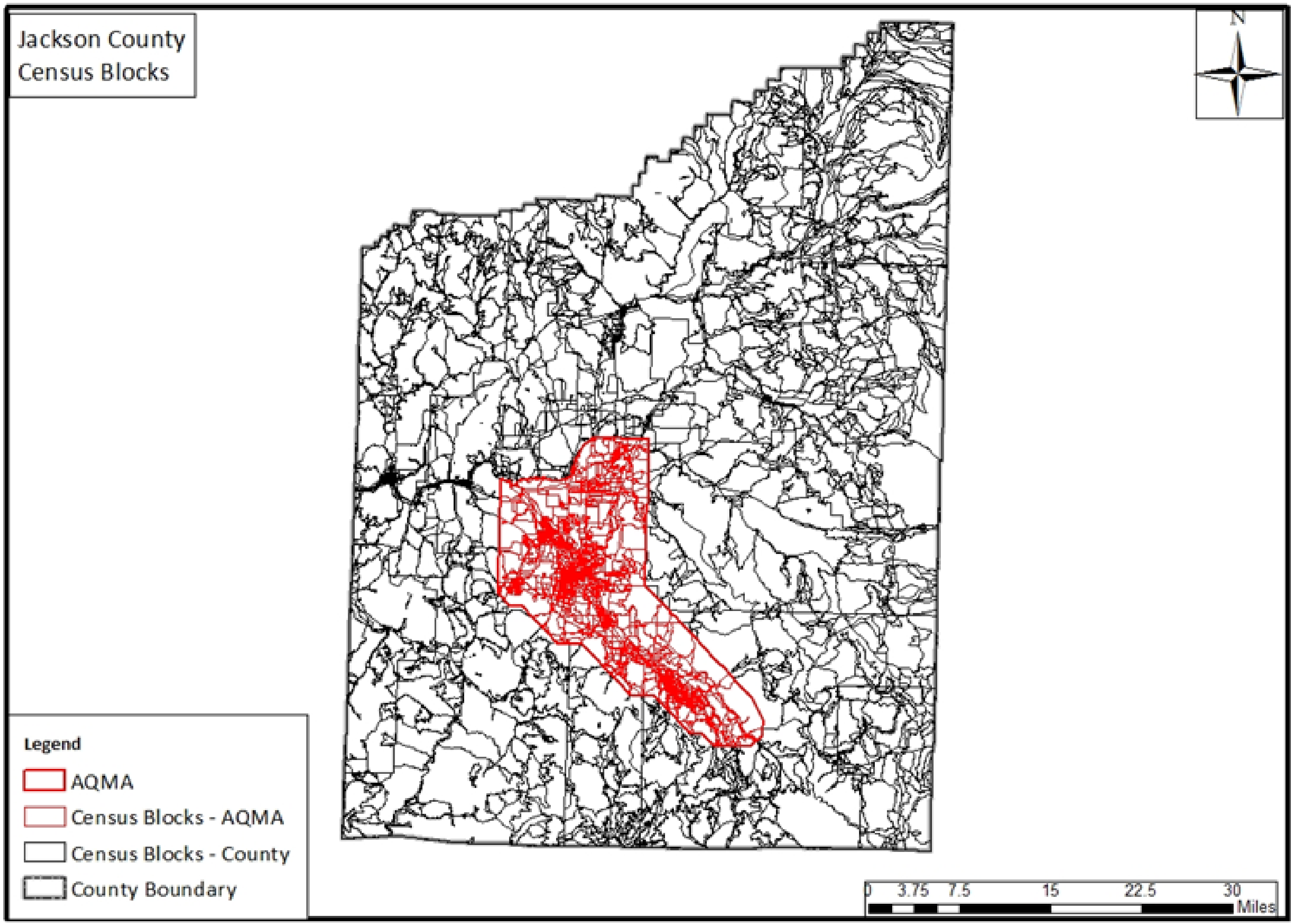
Appendix B, Figure B-10. Jackson County zoning



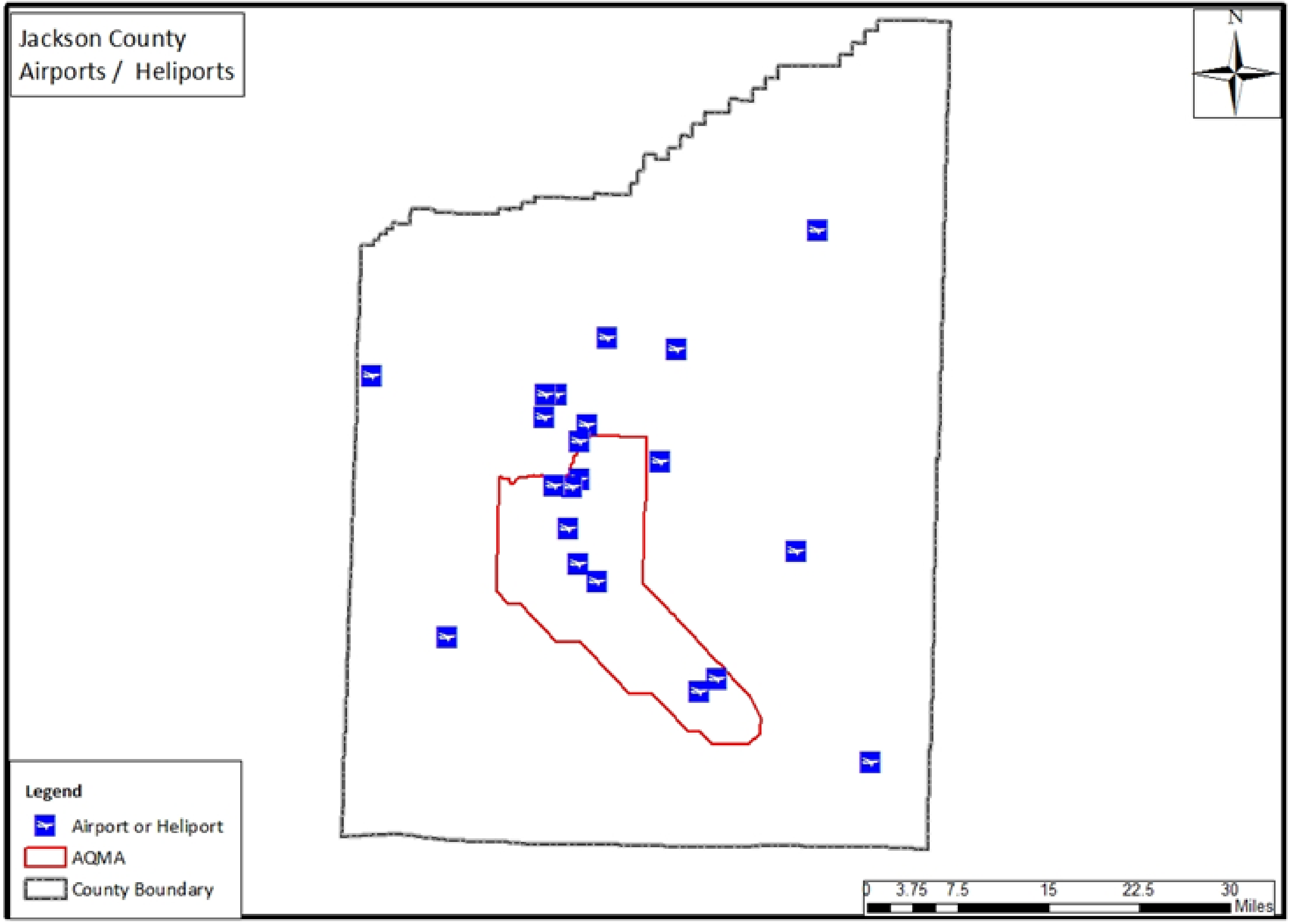
Appendix B, Figure B-11. Jackson County building footprint



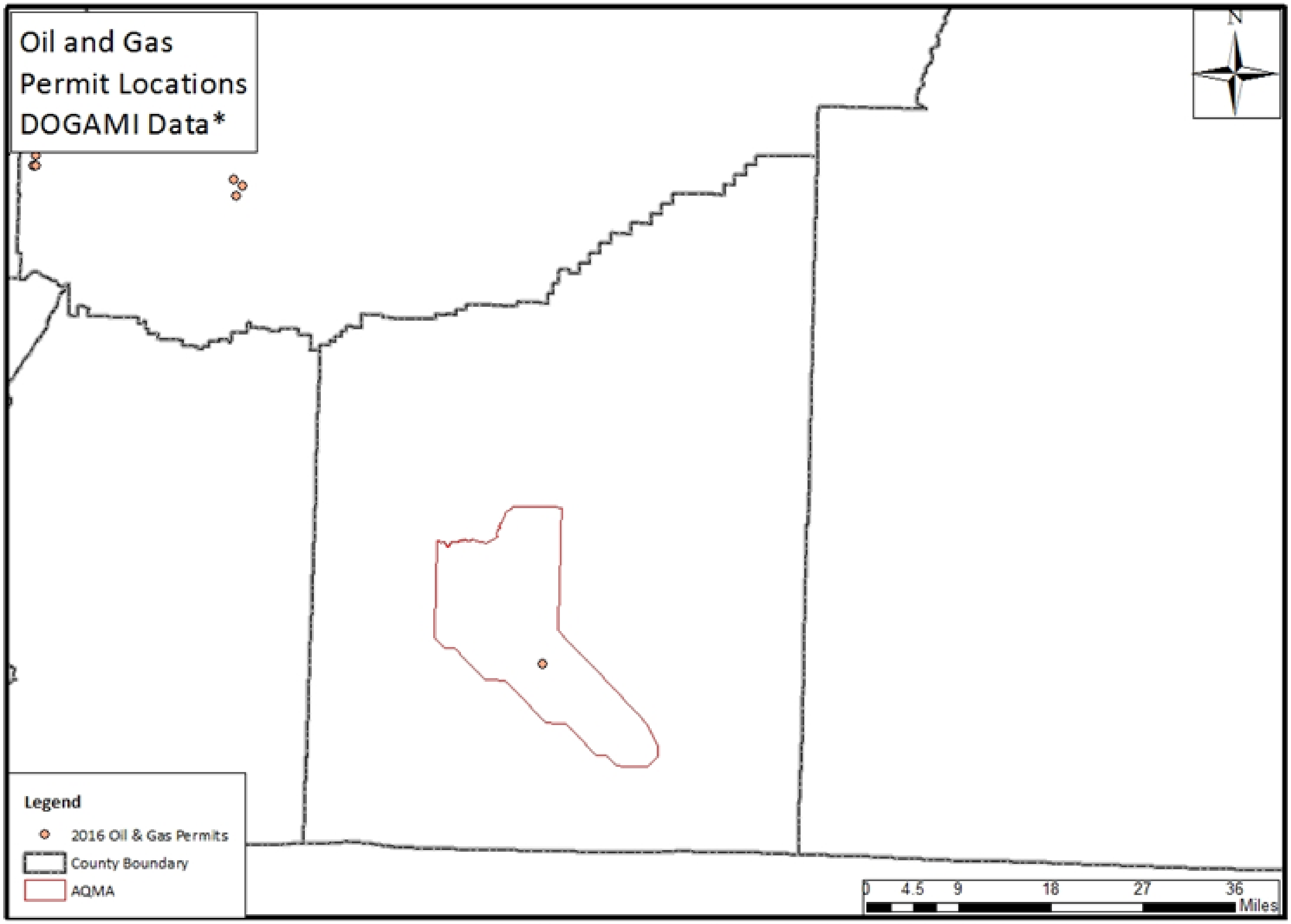
Appendix B, Figure B-12. Jackson County roadway



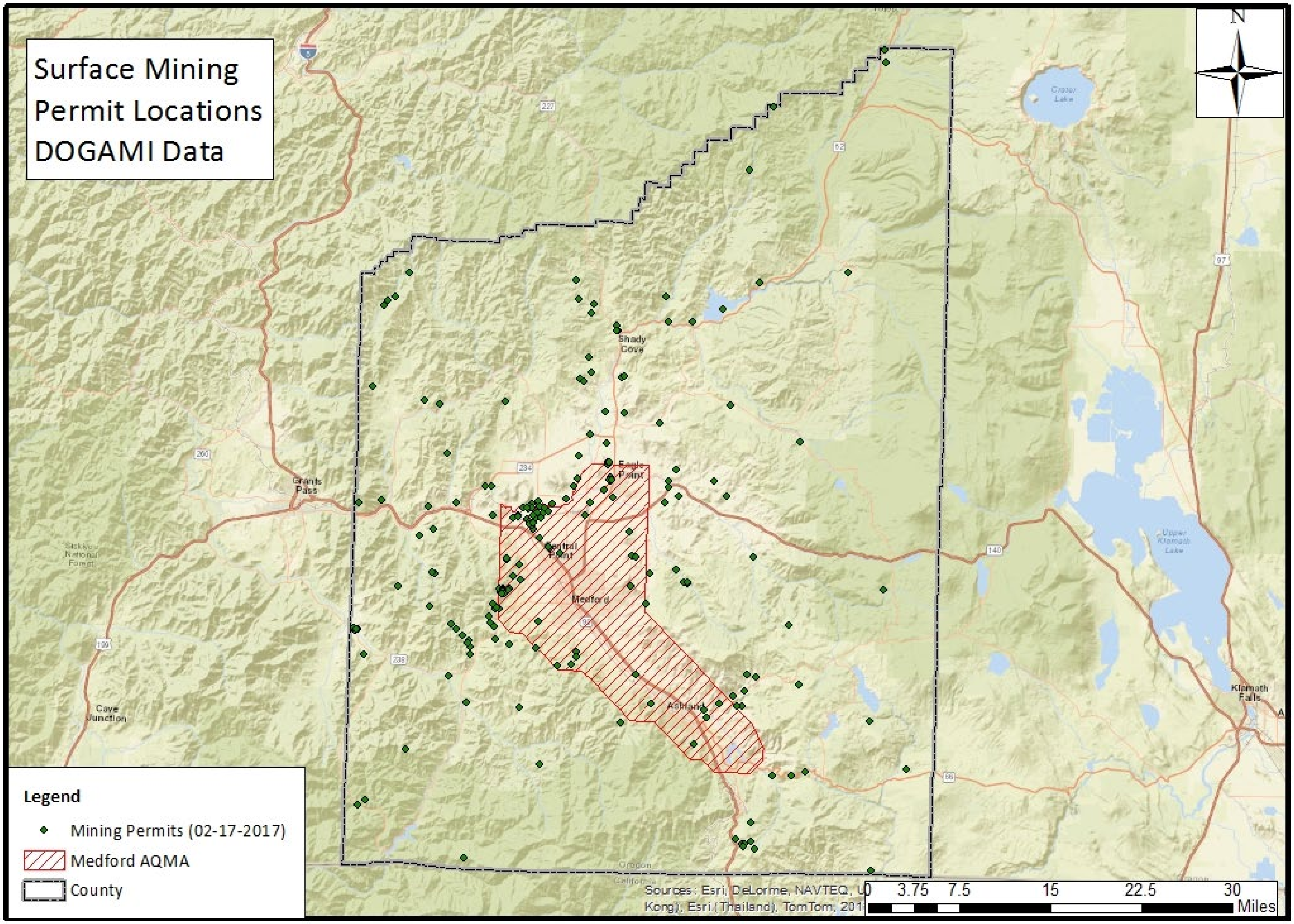
Appendix B, Figure B-13. Jackson County census block groups



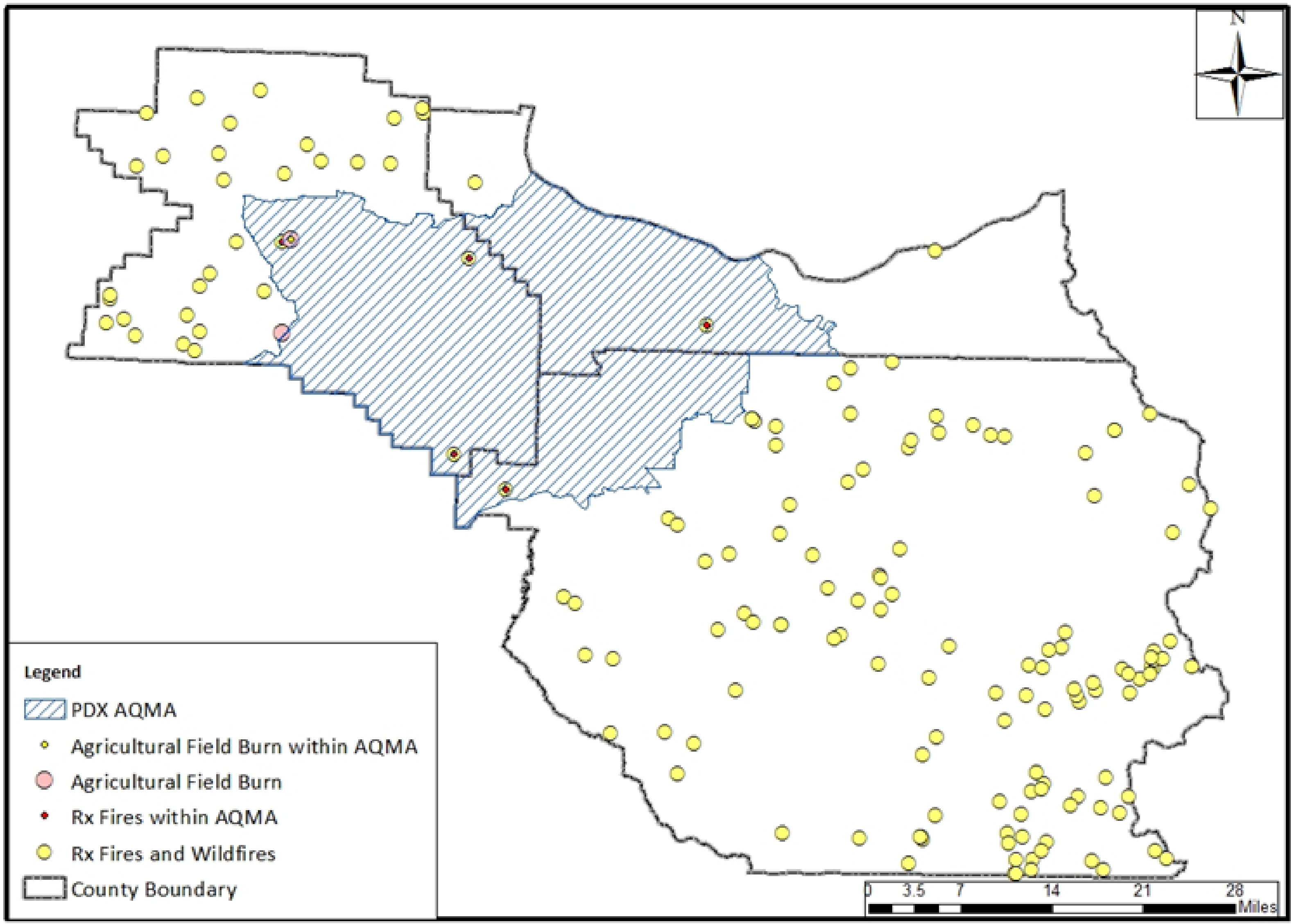
Appendix B, Figure B-14. Jackson County airport locations



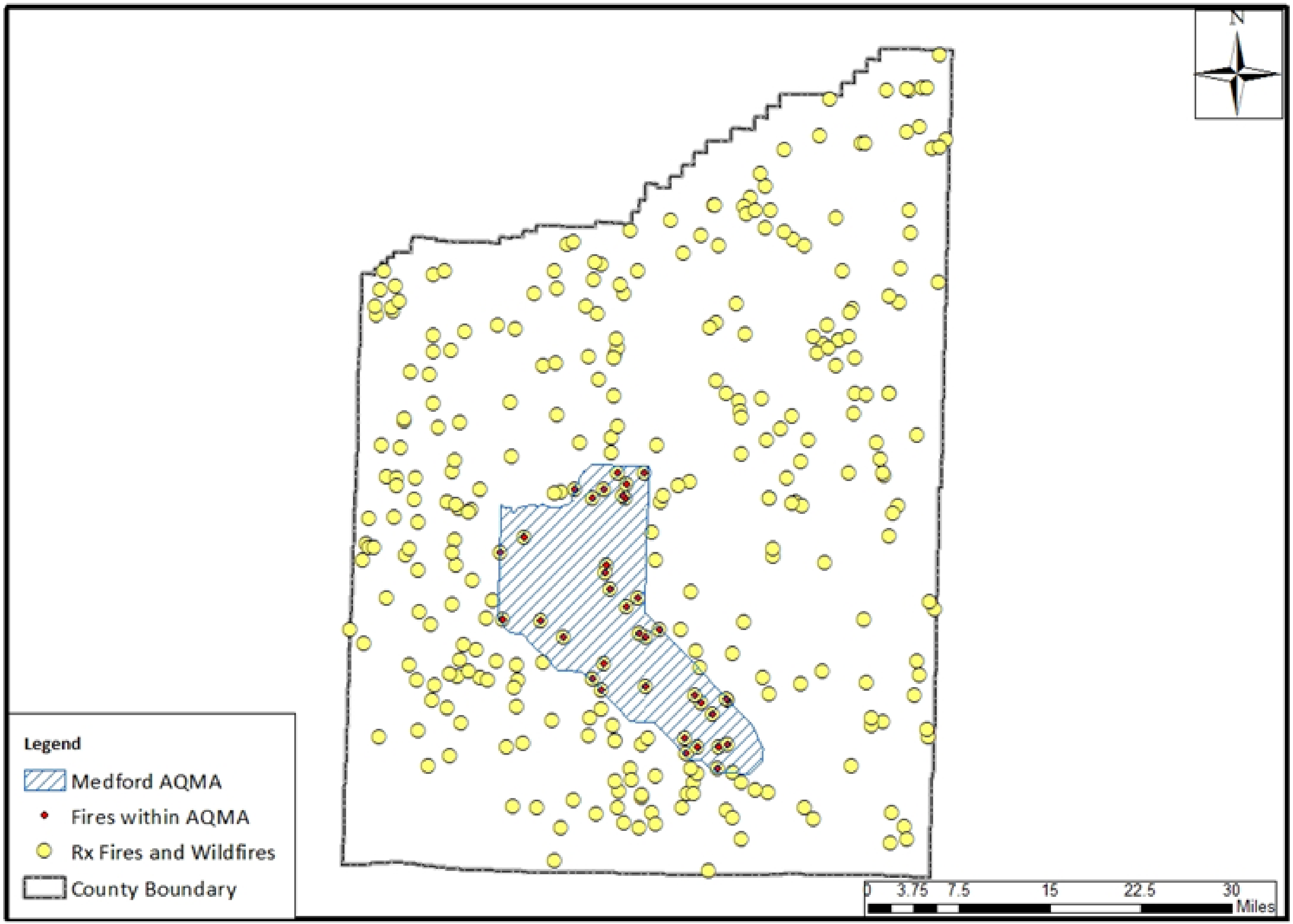
Appendix B, Figure B-15a. DOGAMI oil and gas permit locations, Jackson County



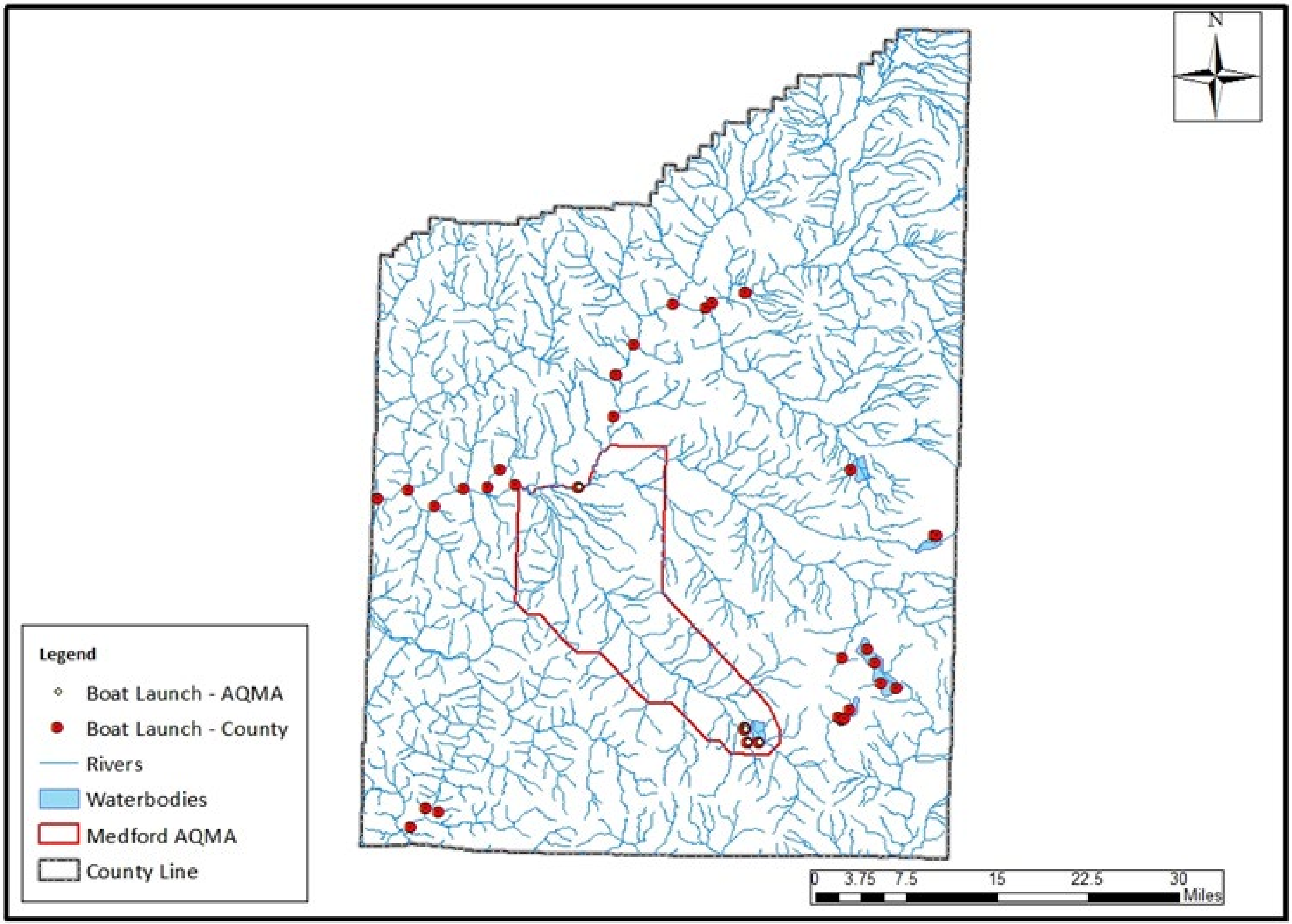
Appendix B, Figure B-15b. DOGAMI surface mining locations, Jackson County



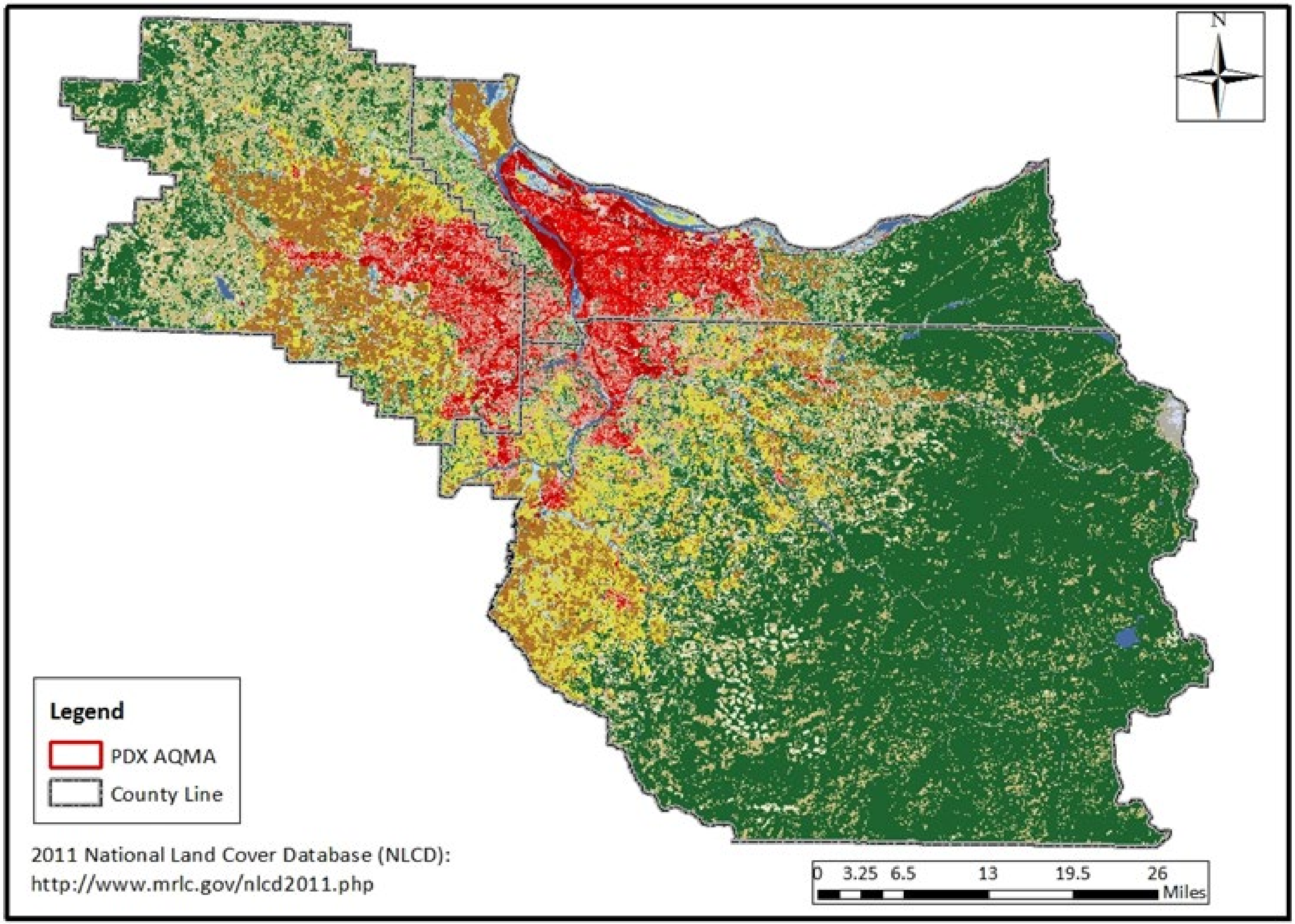
Appendix B, Figure B-16. Tri-County 2014 agricultural and prescribed burning locations



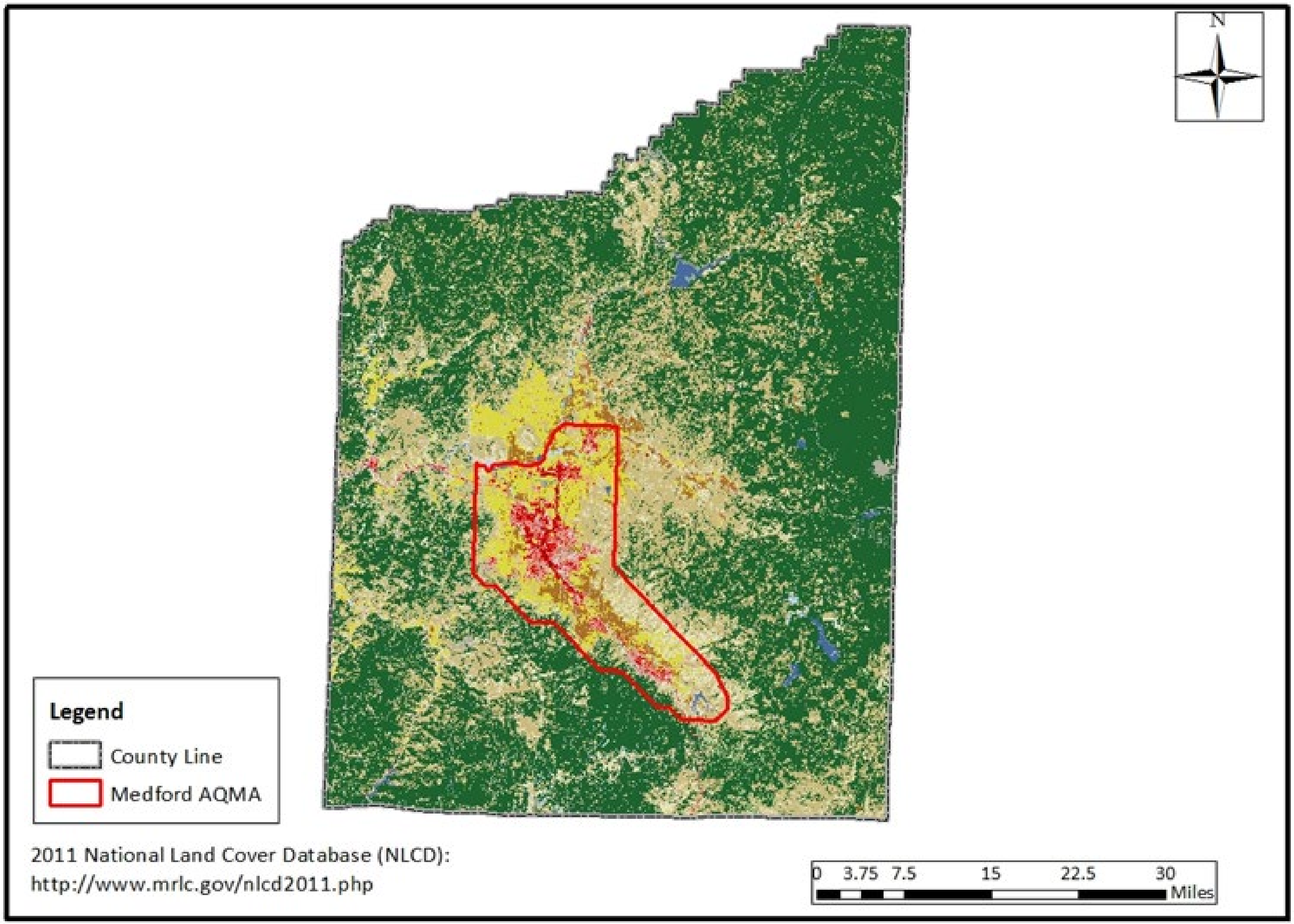
Appendix B, Figure B-17. Jackson County 2014 agricultural and prescribed burning locations



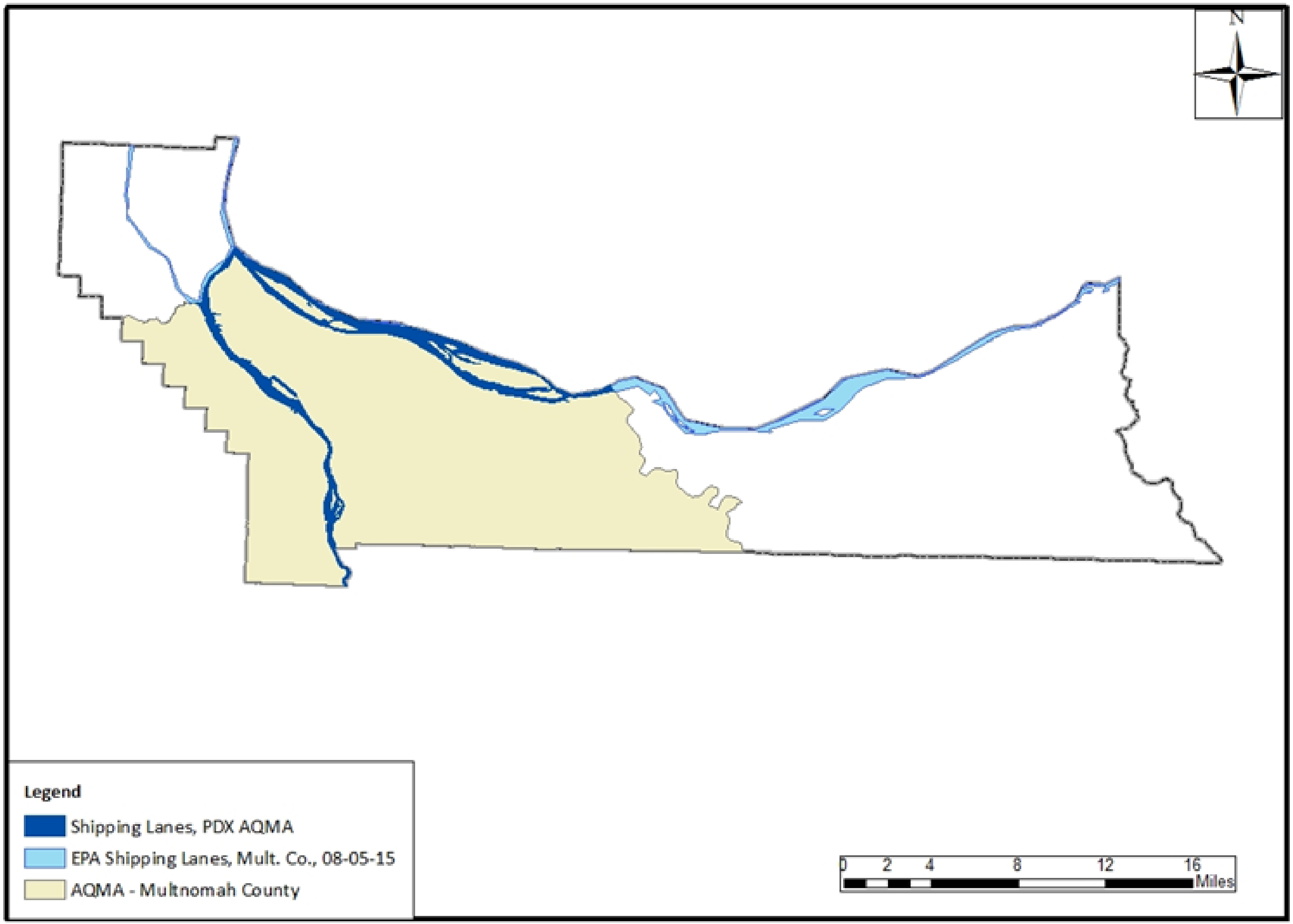
Appendix B, Figure B-18. Jackson County boat launch locations



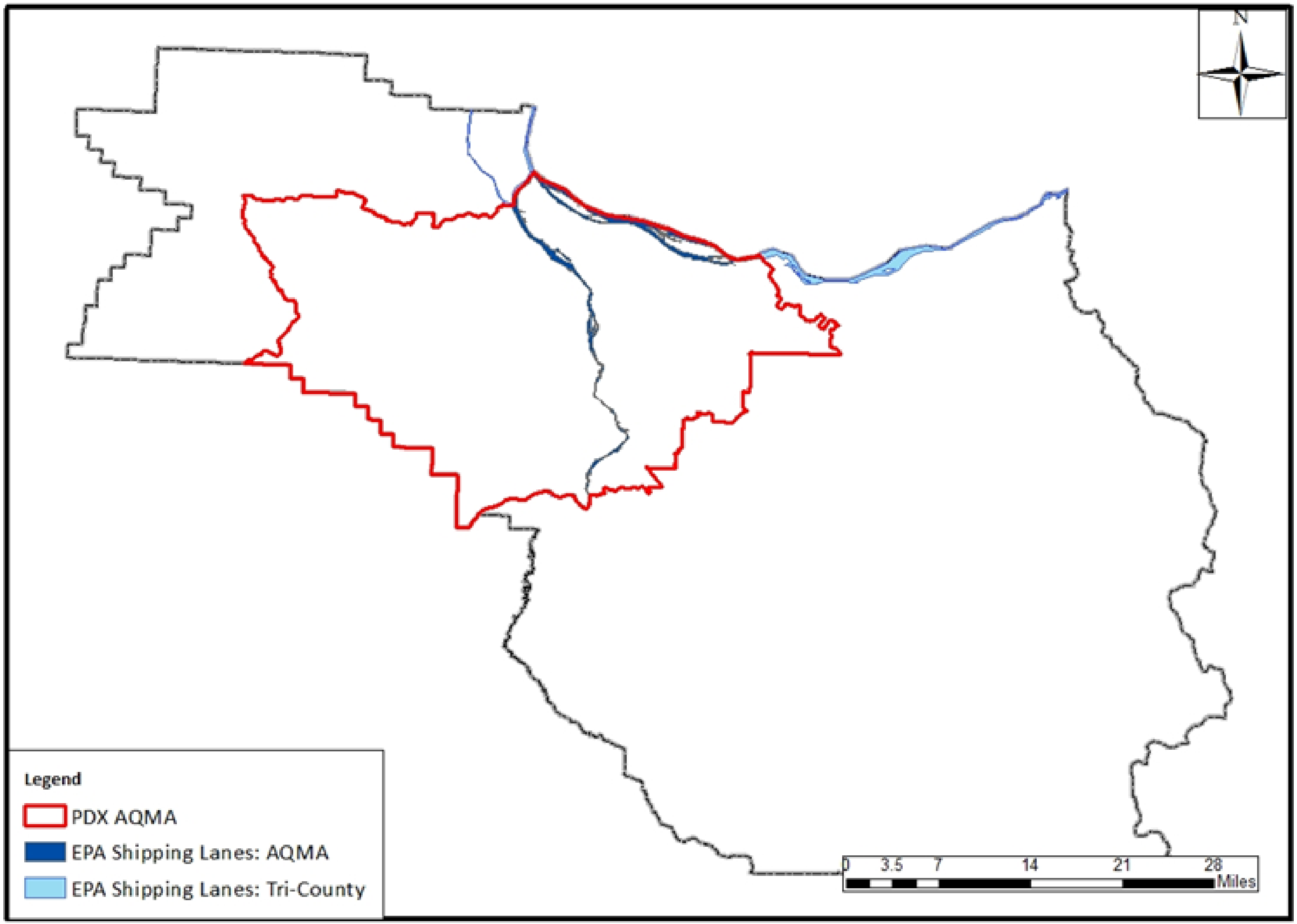
Appendix B, Figure B-19. Tri-County land cover – Raster data used for biogenic spatial allocation



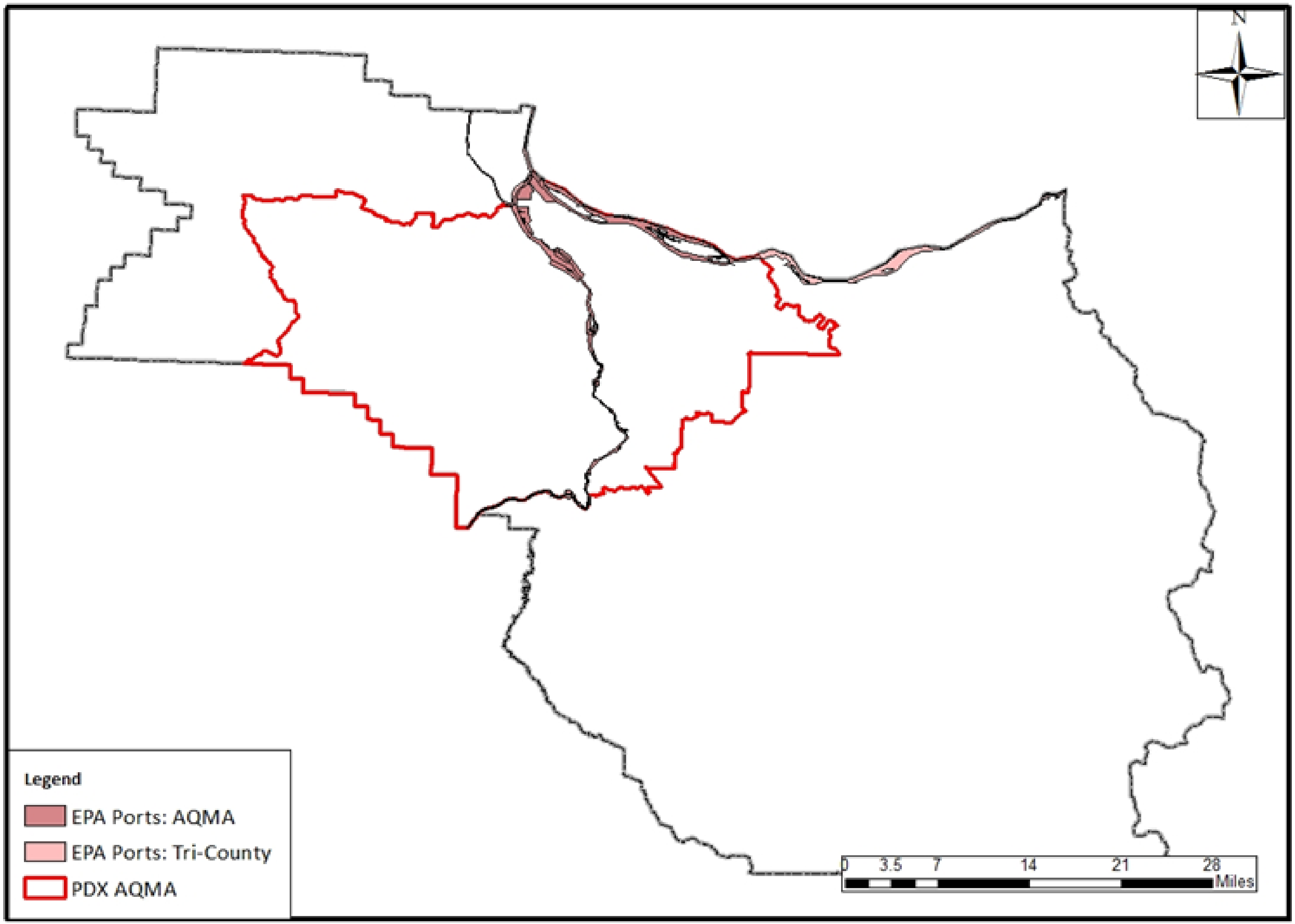
Appendix B, Figure B-20. Jackson County land cover – Raster data used for biogenic spatial allocation



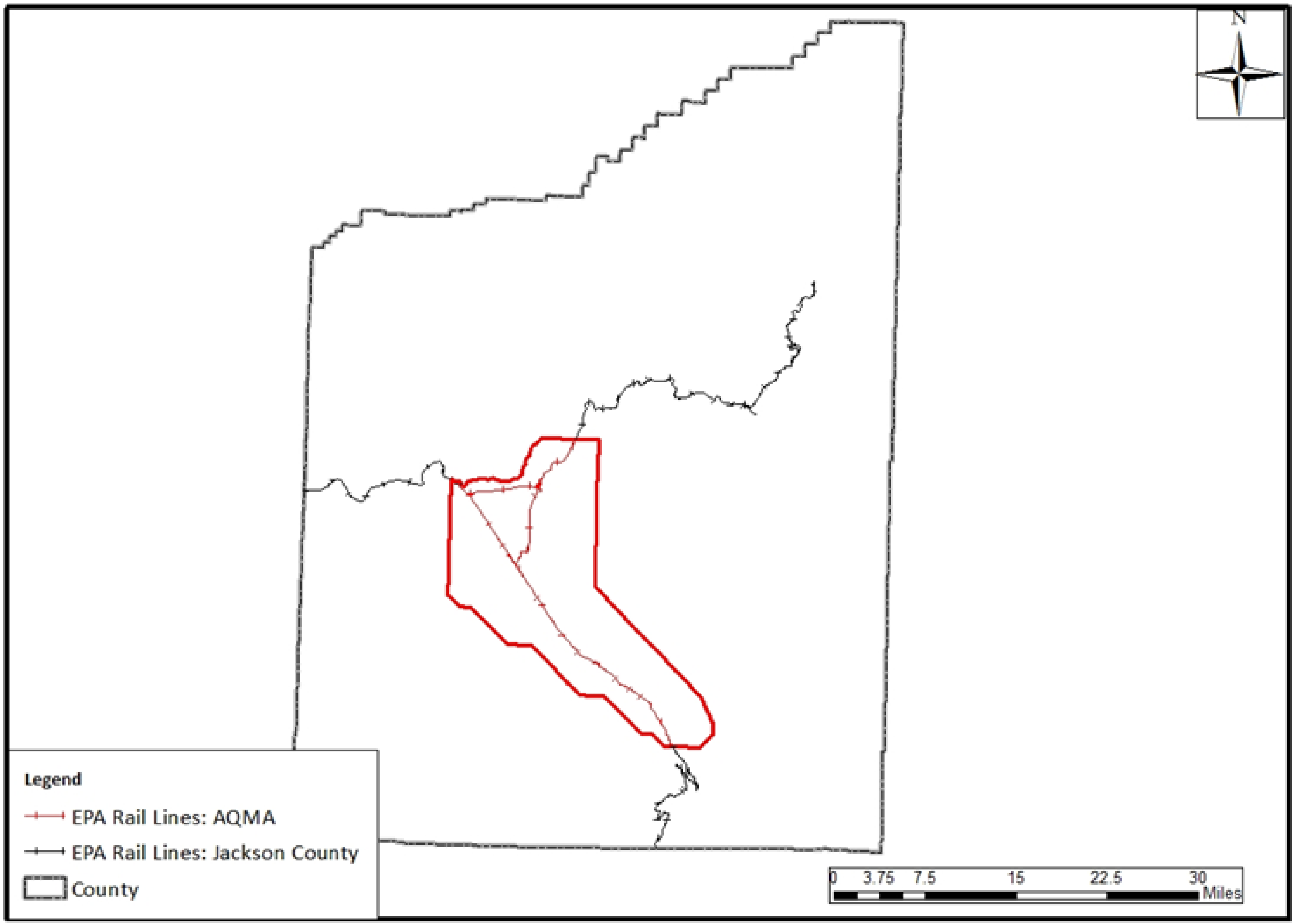
Appendix B, Figure B-21. Multnomah County shipping lanes



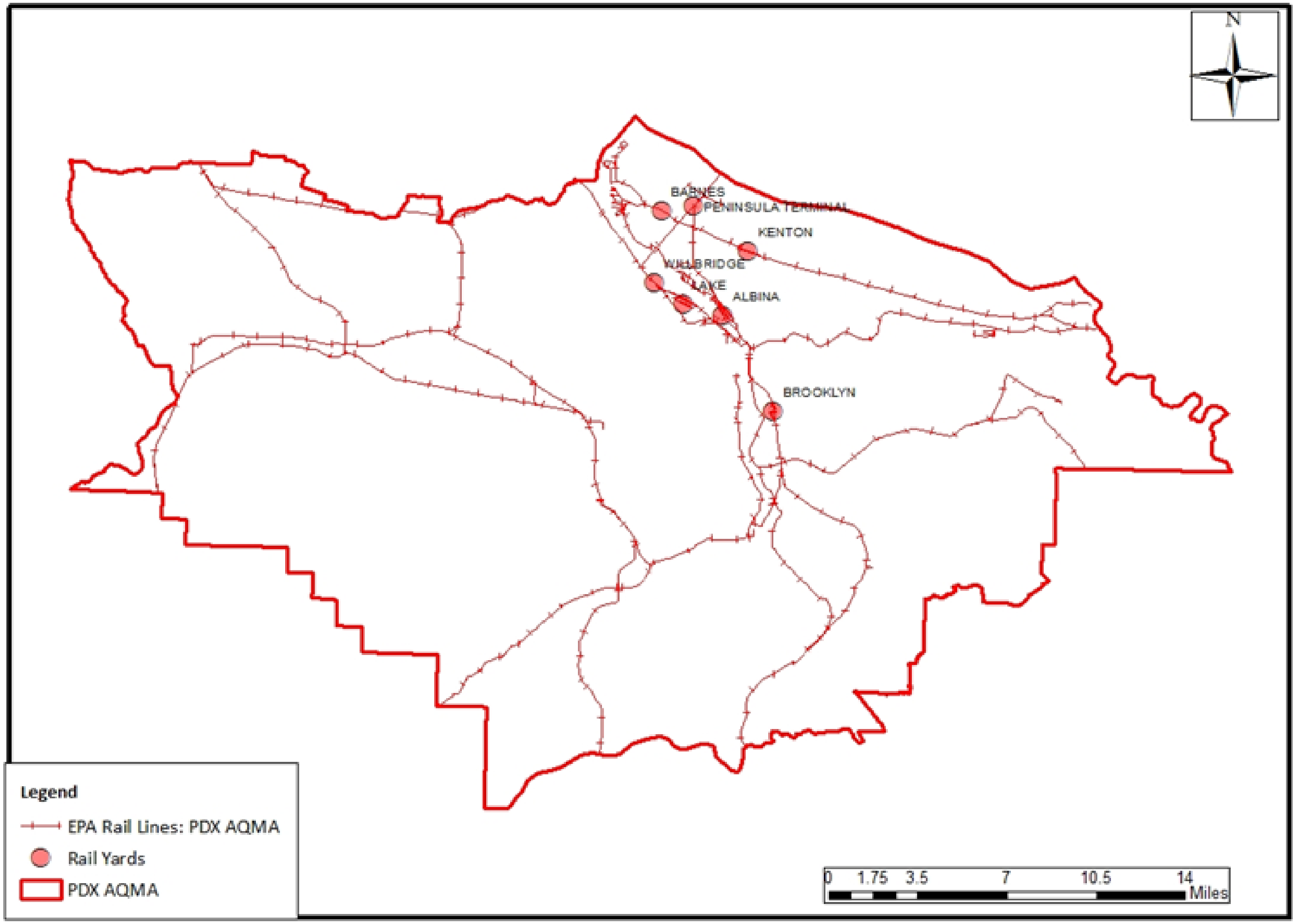
Appendix B, Figure B-22. Tri-County commercial marine vessel shipping lanes



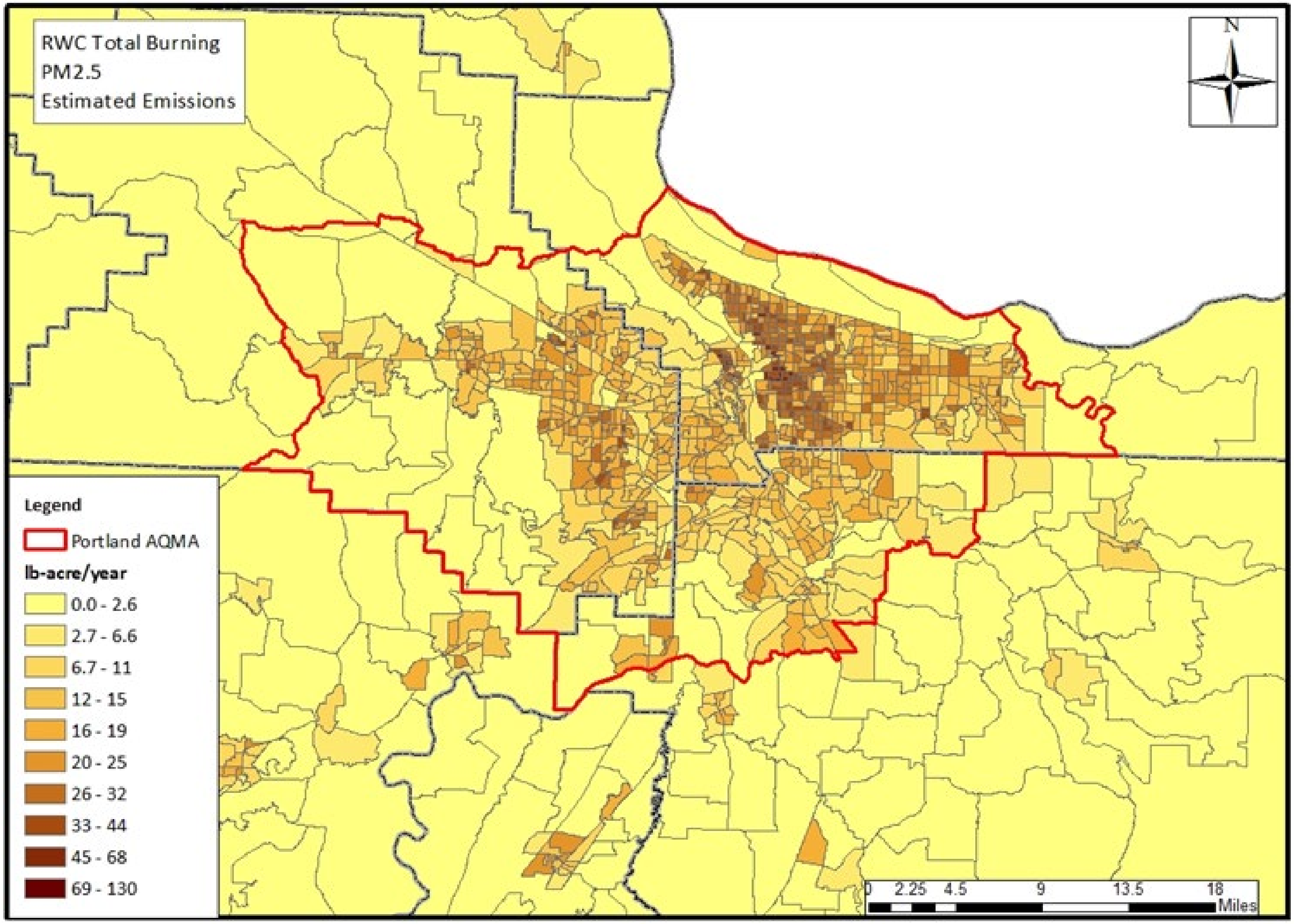
Appendix B, Figure B-23. Tri-County commercial marine vessel port locations



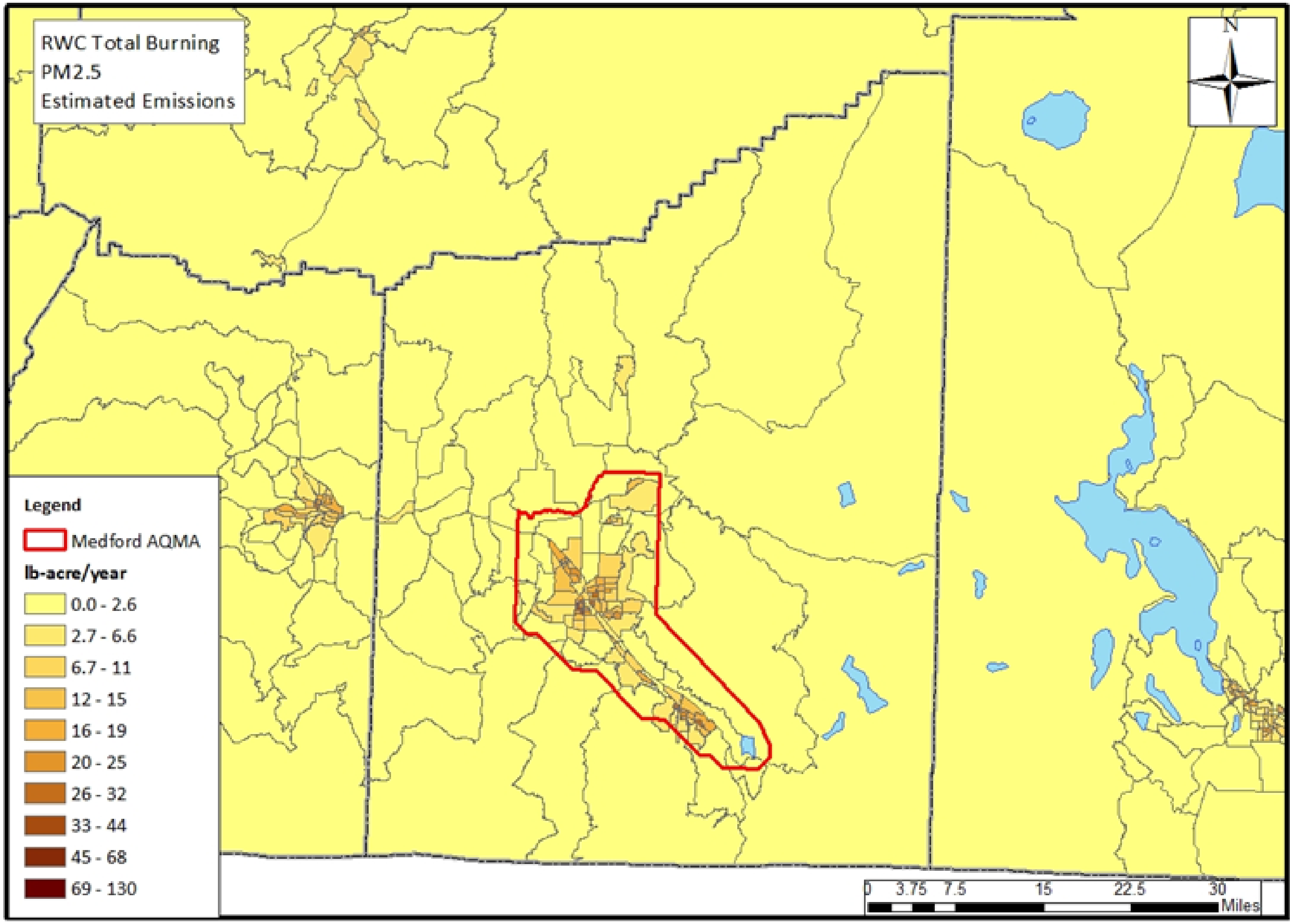
Appendix B, Figure B-24. Jackson County line-haul locomotive track location



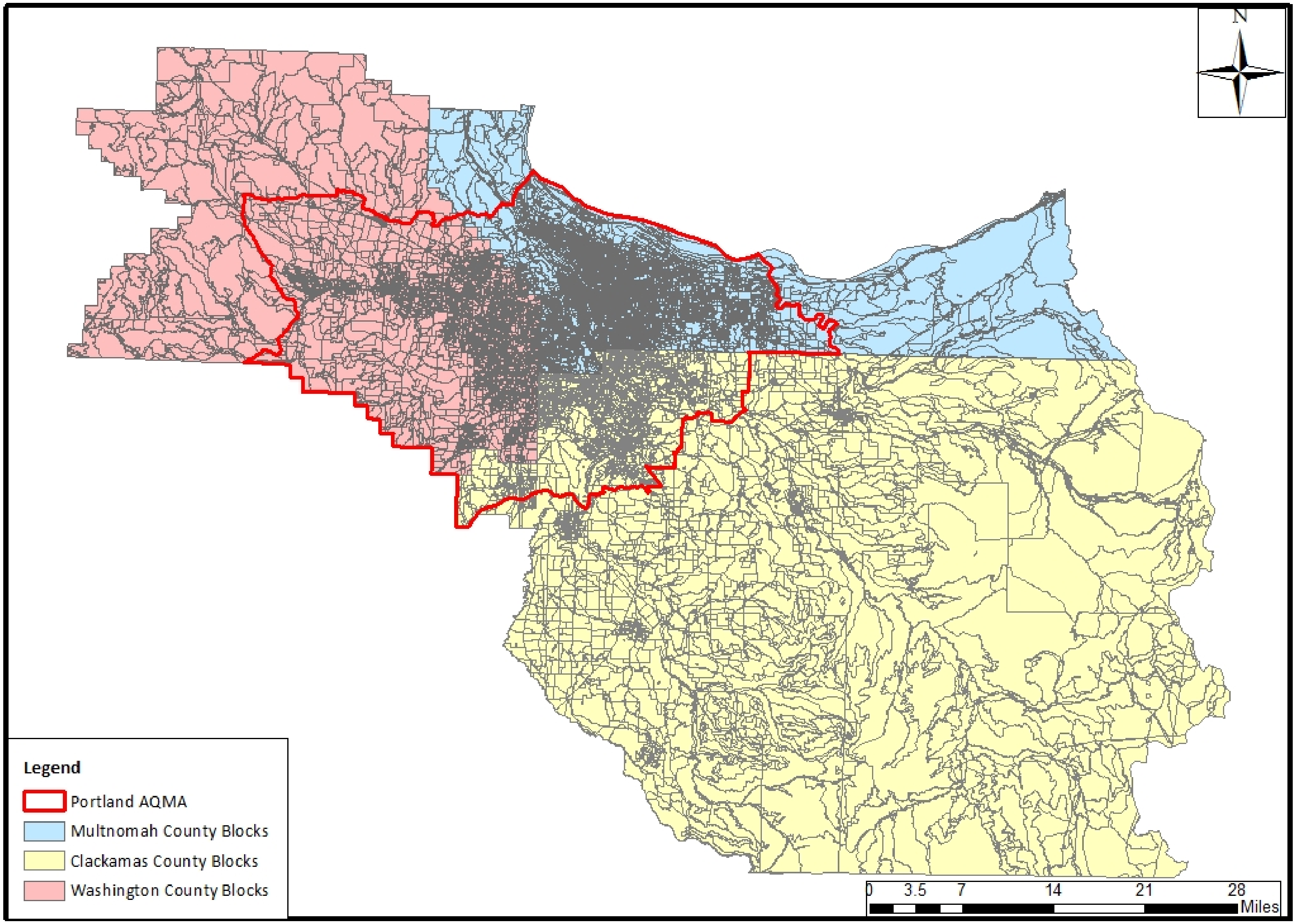
Appendix B, Figure B-25. Rail yards within the Portland AQMA



Appendix B, Figure B-26. Portland area residential wood combustion PM2.5 emissions by block group



Appendix B, Figure B-27. Medford area residential wood combustion PM2.5 emissions by block group



Appendix B, Figure B-28. Tri-county US Census block groups

APPENDIX C: ONROAD

Oregon
Kate Brown, Governor

Department of Transportation
Transportation Development Division
Transportation Planning Analysis Unit (TPAU)
Mill Creek Office Park
555 13th Street NE Suite 2
Salem, Oregon, 97301-4178
Phone: (503) 986-4120
Fax: (503) 986-4174

Date: January 22, 2016

To: Wesley Risher, Oregon Department of Environmental Quality

From: Jin Ren, P.E., Senior Transportation Modeler/Analyst
ODOT Transportation Planning Analysis Unit (TPAU)

Cc: Brian Dunn, P.E., Transportation Planning Analysis Manager, ODOT TPAU
Dan Moore, AICP, Planning Program Manager, RVMPO
Peter Schuytema, P.E., Senior Transportation Engineer, ODOT TPAU
Ian Horlacher, MPO Senior Planner, ODOT Regional 3, District 8

RE: Medford Multipollutant Analysis Project
– Potential Multipollutant Emission Effects/Benefits of Various On-road Emission Control Scenarios

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Brief Description

A model request was submitted by Oregon Department of Environmental Quality (DEQ) to utilize the RVMPO Travel Demand Models (TDM)[2] to forecast the base year 2014 and future year 2024 scenario daily link vehicle miles traveled (VMT).

[2] *Note that travel models provide only generalized travel forecasts because they are based on generalized land use patterns and transportation networks. Since models do not represent individual land uses, driveways or neighborhood-scale streets, the forecasts produced are not sensitive to these specific land use and transportation characteristics.*

It is inappropriate to use raw model outputs as the basis for transportation and land use decisions that require consideration of detailed transportation and land use characteristics. Therefore, post-processing of model outputs to account for the influence of specific transportation and land use characteristics is mandatory. Methods used for post-processing must conform to specifications provided within the ODOT Analysis Procedures Manual (http://www.oregon.gov/ODOT/TD/TP/pages/APM.aspx).

The purpose of the request is for DEQ to post process the travel demand model outputs with MOVES2014a emission rates to estimate base year 2014 and future year 2024 on-road pollutant emissions for the Medford-Ashland Air Quality Management Area (AQMA).

Land Use & Network Assumptions

The decision was made to use the RVMPO-Version 3.0 models for base year 2015 scenario and future year 2028 scenario as they were previously used for the RVMPO air quality studies. DEQ will use their interpolation method to estimate 2014 base year and 2024 future year daily and annual VMT in the RVMPO selected study areas, such as: Medford and Ashland.

Both base year 2015 scenario and future year 2028 scenario land use/network forecasting assumptions were kept the same as in the respective 2015 and 2028 RVMPO-v3.0 models. In other words, no land use or network changes were made to the original base year 2015 scenario or future year 2028 scenario RVMPO-v3.0 models. Note that the RVMPO-v3.0 models do not include all local or neighborhood streets; therefore, usually daily VMT for model centroid connectors and local streets should be combined to roughly represent no more than 10% of local street VMT in the respective study areas.

Modeling Methods and Assumptions

Since there were no changes to land use or network assumptions, based on the previous model runs the daily model link VMT attributes were calculated by multiplying the daily link vehicle volumes with the link lengths for both base year 2015 scenario and future year 2028 scenario.

Other requested TDM link attributes were directly output from the daily scenario models and made into GIS shape files. The 2015 base year scenario and 2028 future scenario land use data attributes were tabulated by TAZ and made into respective TAZ shape files as requested.

Requested Output

After clarifying with DEQ staff, TPAU staff received the “following TDM request specifics;

- Shapefile data
- Rogue Valley MPO area
- On each link
    - Posted speed
    - Functional classifications
    - Link length
    - VMT
- 2015 and 2028 years
- TAZ data
    - Include population (& household) by TAZ
    - We don’t need employment data”

The attached zipped file “Ashland_Medford_DEQ_ES_AQ.zip” includes a tech memo (in MS-Word and PDF formats) and the model output GIS shapefiles (as shown below).

<u>Tech Memo response files to this model request:</u>

1. Tech_Memo_Request066.doc
2. Tech_Memo_Request066.pdf

<u>For Base year 2015 RVMPO-v3.0 Model Outputs:</u>

1. Links_2015_Daily_With_VMT_AutoOnly.dbf
2. Links_2015_Daily_With_VMT_AutoOnly.prj
3. Links_2015_Daily_With_VMT_AutoOnly.sbn
4. Links_2015_Daily_With_VMT_AutoOnly.sbx
5. Links_2015_Daily_With_VMT_AutoOnly.shp
6. Links_2015_Daily_With_VMT_AutoOnly.shx

<u>For Future year 2028 Scenario RVMPO-v3.0 Model Outputs:</u>

1. Links_2028_Daily_With_VMT_AutoOnly.dbf
2. Links_2028_Daily_With_VMT_AutoOnly.prj
3. Links_2028_Daily_With_VMT_AutoOnly.sbn
4. Links_2028_Daily_With_VMT_AutoOnly.sbx
5. Links_2028_Daily_With_VMT_AutoOnly.shp
6. Links_2028_Daily_With_VMT_AutoOnly.shx

<u>TAZ Households and Population for Base year 2015 Scenario and Future year 2028 Scenario:</u>

1. TAZv3_PopHH.dbf
2. TAZv3_PopHH.prj
3. TAZv3_PopHH.sbn
4. TAZv3_PopHH.sbx
5. TAZv3_PopHH.shp
6. TAZv3_PopHH.shx

Descriptions about a list of model output attribute:

1. Posted speed: "DATA1" in miles per hour
2. Functional classifications: "TYPE"
   Type 1 = freeway
   Type 2 = major arterial
   Type 3 = minor arterial
   Type 4 = collector
   Type 5 = local street
   Type 30 = freeway ramp, and
   Type 99 = centroid connector.
3. Link length: "LENGTH" in miles
4. VMT: "@DYVMT" in miles
5. Daily Vehicle Volumes: "@od24"
6. Base year 2015 households by TAZ: "HHBASE15"
7. Base year 2015 population by TAZ: "POPBASE15"
8. Base year 2028 households by TAZ: "HHBASE28"
9. Base year 2028 population by TAZ: "POPBASE28"

Please feel free to contact Jin Ren at 503-986-4120 Jinxiang.ren@odot.state.or.us if you have any questions or comments.

Medford-Ashland AQMA and the Portland AQMA MOVES2014a Mobile Emissions Estimate Steps

Medford-Ashland AQMA - 2015

2015 Medford-Ashland Base Year RunSpec
Jackson County
4 Month (January, April, July, October)
Weekday (5) and Weekend (2)
24hrs

Ran in INVENTORY Calculation Type.

- **Edit the MyLEVs database** to reflect Oregon adoption of the LEV and ZEV program in 2009 forward, run script and reference edited database within RunSpec.

- **Road Type Distribution** – work with Chris Swab to determine what the VMT fraction is upon the various road types present in the Medford-Ashland area by the various source types

- **Source Type Population**, use DMV Jackson county vehicle registration file to get the population count

- **Age Distribution** - Jackson county 30 year fleet ages mix for Source Type 25.

- **Vehicle Type VMT** – determine from the provided TDM VMT from RVCOG/ODOT what input VMT to allocate to the various source types or to the HPMS vehicle type on the road network, one of the more difficult MOVES inputs to estimate as VMT is not usually recorded by source type. Export the MOVES default hourly VMT fraction rates from MOVES2014a for Jackson County for Chris Swab's use to adjust ODOT TDM daily VMT by link to hourly.

DEQ Vehicle Inspection and Maintenance (IM) program scenarios Medford-Ashland AQMA: Each I/M scenario will require a separate MOVES Run Spec to generate different emissions outputs that can be compared to other scenarios to determine the benefit of the I/M program.

- Current I/M scenario with **4 year grace period** for new vehicles, rolling 20 year fleet exemption for older vehicles
- I/M with **5 year grace period** for new vehicles, rolling 20 year fleet exemption for older vehicles
- I/M with **6 year grace period** for new vehicles, rolling 20 year fleet exemption for older vehicles
- **No I/M**

I/M program scenario settings confirmed with Gary Beyer at the VIP Tech Center.

Pollutants selected for inventory output from MOVES2014a RunSpec for each scenario:

✓	Total Gaseous Hydrocarbons	
✓	Non-Methane Hydrocarbons	
✓	Non-Methane Organic Gases	
✓	Volatile Organic Compounds	
✓	Methane (CH_4)	
✓	Carbon Monoxide (CO)	
✓	Oxides of Nitrogen (NO_x)	
✓	Ammonia (NH_3)	
✓	Nitrous Oxide (N_2O)	
✓	Primary Exhaust PM2.5 - Total	
✓	(+) Primary Exhaust PM2.5 - Species	
	✓	Composite - NonECPM
	✓	Elemental Carbon
	✓	H_2O (aerosol)
	✓	Organic Carbon
	✓	Sulfate Particulate
✓	Primary PM2.5 - Brakewear Particulate	
✓	Primary PM2.5 - Tirewear Particulate	
✓	Primary Exhaust PM10 - Total	
✓	Primary PM10 - Brakewear Particulate	
✓	Primary PM10 - Tirewear Particulate	
✓	Sulfur Dioxide (SO_2)	
✓	Total Energy Consumption	
✓	Atmospheric CO_2	
✓	CO_2 Equivalent	
✓	Benzene	
✓	Ethanol	
✓	MTBE	
✓	1,3-Butadiene	
✓	Formaldehyde	
✓	Acetaldehyde	
✓	Acrolein	
✓	(+) Additional Air Toxics	
	✓	2,2,4-Trimethylpentane
	✓	Ethyl Benzene
	✓	Hexane
	✓	Propionaldehyde
	✓	Styrene
	✓	Toluene

	✓	Xylene
✓	(+) Polycyclic Aromatic Hydrocarbons (PAH)	
	✓	Acenaphthene gas
	✓	Acenaphthene particle
	✓	Acenaphthylene gas
	✓	Acenaphthylene particle
	✓	Anthracene gas
	✓	Anthracene particle
	✓	Benz(a)anthracene gas
	✓	Benz(a)anthracene particle
	✓	Benzo(a)pyrene gas
	✓	Benzo(a)pyrene particle
	✓	Benzo(b)fluoranthene gas
	✓	Benzo(b)fluoranthene particle
	✓	Benzo(g,h,i)perylene gas
	✓	Benzo(g,h,i)perylene particle
	✓	Benzo(k)fluoranthene gas
	✓	Benzo(k)fluoranthene particle
	✓	Chrysene gas
	✓	Chrysene particle
	✓	Dibenzo(a,h)anthracene gas
	✓	Dibenzo(a,h)anthracene particle
	✓	Fluoranthene gas
	✓	Fluoranthene particle
	✓	Fluorene gas
	✓	Fluorene particle
	✓	Indeno(1,2,3,c,d)pyrene gas
	✓	Indeno(1,2,3,c,d)pyrene particle
	✓	Naphthalene gas
	✓	Naphthalene particle
	✓	Phenanthrene gas
	✓	Phenanthrene particle
	✓	Pyrene gas
	✓	Pyrene particle
✓	(+) Metals	
	✓	Arsenic Compounds
	✓	Chromium 6+

Portland AQMA – 2015

2015 Portland Metro Base Year RunSpec
Multnomah County as representative county for area
4 Month (January, April, July, October)
Weekday (5) and Weekend (2)
24hrs

Ran in INVENTORY Calculation Type.

- Edit the **MyLEVs database** to reflect Oregon adoption of the LEV and ZEV program in 2009 forward, run script and reference edited database within RunSpec.

- **Road Type Distribution** – work with Chris Swab to determine what the VMT fraction is upon the various road types present in the Metro provided TDM area by the various source types

- **Source Type Population**, use DMV Multnomah county vehicle registration file to get the population count. There are problems with the 2014 database whereby we will be using the Dec. 2016 DMV vehicle registration file as a surrogate for 2015 fleet mix.

- **Age Distribution -** Multnomah county 30 year fleet ages mix for Source Type 25.

- **Vehicle Type VMT** – determine from the provided TDM VMT from Metro what input VMT to allocate to the various source types or to the HPMS vehicle type on the road network, one of the more difficult MOVES inputs to estimate as VMT is not usually recorded by source type. Export the MOVES default hourly VMT fraction rates from MOVES2014a for Multnomah County for Chris Swab's use to adjust Metro TDM daily VMT by link to hourly.

DEQ Vehicle Inspection and Maintenance (IM) program scenarios- Portland AQMA:
Each I/M scenario will require a separate MOVES Run Spec to generate different emission rate outputs that can be compared to other scenarios to determine the benefit of the I/M program.

- Current I/M scenario with newest **4 year grace period** for new vehicles, no rolling 20 year fleet exemption for older vehicles, 1975 and newer subject to the I/M program
- I/M with **5 year grace period** for new vehicles, no rolling 20 year fleet exemption for older vehicles, 1975 and newer subject to the I/M program
- I/M with **6 year grace period** for new vehicles, no rolling 20 year fleet exemption for older vehicles, 1975 and newer subject to the I/M program
- **No I/M**

I/M program scenario settings confirmed by Gary Beyer at the VIP Tech Center.

Pollutants selected for inventory output from MOVES2014a RunSpec for each scenario:

✓	Total Gaseous Hydrocarbons	
✓	Non-Methane Hydrocarbons	
✓	Non-Methane Organic Gases	
✓	Volatile Organic Compounds	
✓	Methane (CH4)	
✓	Carbon Monoxide (CO)	
✓	Oxides of Nitrogen (NOx)	
✓	Ammonia (NH3)	
✓	Nitrous Oxide (N2O)	
✓	Primary Exhaust PM2.5 - Total	
✓	(+) Primary Exhaust PM2.5 - Species	
	✓	Composite - NonECPM
	✓	Elemental Carbon
	✓	H2O (aerosol)
	✓	Organic Carbon
	✓	Sulfate Particulate
✓	Primary PM2.5 - Brakewear Particulate	
✓	Primary PM2.5 - Tirewear Particulate	
✓	Primary Exhaust PM10 - Total	
✓	Primary PM10 - Brakewear Particulate	
✓	Primary PM10 - Tirewear Particulate	
✓	Sulfur Dioxide (SO2)	
✓	Total Energy Consumption	
✓	Atmospheric CO2	
✓	CO2 Equivalent	
✓	Benzene	
✓	Ethanol	
✓	MTBE	
✓	1,3-Butadiene	
✓	Formaldehyde	
✓	Acetaldehyde	
✓	Acrolein	
✓	(+) Additional Air Toxics	
	✓	2,2,4-Trimethylpentane
	✓	Ethyl Benzene
	✓	Hexane
	✓	Propionaldehyde
	✓	Styrene
	✓	Toluene
	✓	Xylene

✓	(+) Polycyclic Aromatic Hydrocarbons (PAH)	
	✓	Acenaphthene gas
	✓	Acenaphthene particle
	✓	Acenaphthylene gas
	✓	Acenaphthylene particle
	✓	Anthracene gas
	✓	Anthracene particle
	✓	Benz(a)anthracene gas
	✓	Benz(a)anthracene particle
	✓	Benzo(a)pyrene gas
	✓	Benzo(a)pyrene particle
	✓	Benzo(b)fluoranthene gas
	✓	Benzo(b)fluoranthene particle
	✓	Benzo(g,h,i)perylene gas
	✓	Benzo(g,h,i)perylene particle
	✓	Benzo(k)fluoranthene gas
	✓	Benzo(k)fluoranthene particle
	✓	Chrysene gas
	✓	Chrysene particle
	✓	Dibenzo(a,h)anthracene gas
	✓	Dibenzo(a,h)anthracene particle
	✓	Fluoranthene gas
	✓	Fluoranthene particle
	✓	Fluorene gas
	✓	Fluorene particle
	✓	Indeno(1,2,3,c,d)pyrene gas
	✓	Indeno(1,2,3,c,d)pyrene particle
	✓	Naphthalene gas
	✓	Naphthalene particle
	✓	Phenanthrene gas
	✓	Phenanthrene particle
	✓	Pyrene gas
	✓	Pyrene particle
✓	(+) Metals	
	✓	Arsenic Compounds
	✓	Chromium 6+

Appendix 4 - Evaluation of Program Models

VIP monitors opportunities to modify its service delivery through ongoing communications with industry leaders, and assessments of performance of other programs. In connection with the recent update of the program's fee structure, and pursuant to ORS 468A.370 and 468A.400, VIP performed a comprehensive assessment of the program, relative to other U.S. vehicle testing programs.

A core element of this analysis was a review of data collected by the National OBD Clearinghouse established by the National Center for Automotive Science and Technology at Weber State University and funded through a U.S. Environmental Protection Agency (EPA) grant. More specifically, DEQ VIP evaluated all state programs by considering program characteristics and performance information such as program type, annual tests performed, test fees and testing frequency.

In an effort to secure more detailed information, in 2018 DEQ VIP also conducted a survey of like programs through the national IM Solutions Forum. A 12 question survey was distributed to program leaders with 20 programs supplying additional requested data and information. The survey results supplemented the data that had been assembled, adding important program specifics including whether re-tests are free, and if programs are supported by any non-fee revenues. This information, along with other data assembled, produced the dataset reflected in Table 1.[1]

With key data assembled, VIP analyzed the cost effectiveness of its current state operating model by comparing that model to the 38 other programs included in Table 1. More specifically, VIP first assessed the pros and cons, and operating successes of the centralized design relative to other program designs. Next, VIP compared its program to the other centralized programs, to ensure that the analysis included a like kind comparison, and a focus on the most relevant programs. The evaluation of all programs was performed through the lens of cost effectiveness, with adjusted biennial fee per test being the central unit of measurement. Given the somewhat varying designs and unique aspects of all programs, the analysis proceeded beyond a comparison of fees assessed, considering the other indicators of program success and overall cost effectiveness.

DEQ VIP's analysis included 38 programs, including all state programs. In some cases, multiple programs within one state are represented in Table 1 because some state programs are operated by separate smaller regulatory jurisdictions such as counties or cities, largely independent local air pollution authorities, charging different fees. Within the universe of programs, DEQ VIP considered the three primary models used in delivering vehicle testing services: the Centralized--Public Model, the Centralized--Private Model, and the Decentralized or Fully Private Model. The key features of each are as follows:

- **Centralized-Public Model:** The primary characteristic of a centralized testing program is its few, larger sized stations that are dedicated to addressing emissions through vehicle testing. The stations do not perform repairs on vehicles, with those services provided by privately

[1] DEQ VIP completed its data compilation of information in 2019, with some data previously relayed by programs prior to that date.

operated businesses. The facilities housing the stations are usually leased and operated by a single agency or contractor. The fee charged for testing services is a set fee, consistent throughout the program. The primary advantages of this model include standard fees, consistent test procedures, efficiencies associated with large test volume capacity, and the ability to offer DMV tags, or other registration services, with the testing activity.

Within the centralized model, services may be delivered publically or privately. The primary distinguishing characteristic is whether the front line testing services, or inspections, are provided by public or private employees. Program administrative services, such as those staff dedicated to technology and compliance management, and other core services common to multiple stations, are typically retained by the public entity.

- **Centralized-Private Model**: As noted above, the Centralized—Private Model differs primarily by the outsourcing of station specific testing services to the private sector. In selecting between the public or private delivery of these services, centralized programs generally balance wage and other cost considerations against compliance considerations. Most centralized programs, including Oregon, operate within the public model to avoid the additional costs and risks associated with the needed monitoring and oversight.

- **Decentralized/Fully Private Model:** Decentralized, or more fully private, testing programs have multiple small locations that are typically repair garages. The testing and repair garages are owned and operated by disparate entities, charging independently selected and varying prices for services. An advantage of a decentralized program is the ability to transfer equipment, supply and operating costs to the private sector. A decentralized environment relies on the competitive nature of garages located throughout the state.

  As the decentralized programs operate through facilities that perform both testing and repairs, however, the unavoidable conflict between test and repair is a significant drawback. These programs typically direct relatively more public staffing resources to the management and oversight of the activities performed at the garages. This work is often needed to ensure that test results remain accurate, and that repair services are appropriate and necessary to address the specific malfunction issues associated with a failing test.

As reflected by the data in Table 1, the majority of states currently operate under a Decentralized model. Only 11 of the 38 programs evaluated in Oregon VIP's recent analysis use a Centralized program model. See Tables 2 and 3 for lists of decentralized and centralized programs, respectively. Many states currently using the decentralized model transitioned to that model following the transition to OBD-based testing following the implementation of the 1990 amendments to the Clean Air Act. Since approximately 2005, most differences between states that have elected the centralized or decentralized model have remained largely static.

The recent evaluation of fees charged by centralized vehicle testing programs versus the decentralized vehicle testing programs indicates that the centralized programs charge customers lower fees. In comparing fees across the different programs, VIP used a weighted average approach to representing inspection fees when different fee rates are used by a program. Oregon's fee of $24.59 used in this analysis, for example, represents an average fee assessed when considering the number of inspections performed at $20 in Medford[2], $25 in the Portland areas, and $26 for mobile testing. This weighted average biennial fee of $24.59 is roughly one-third of the $59.34 weighted average fee assessed by the service providers in decentralized programs. As reflected in bar chart in Figure 1, whether the fees charged within the different programs are compared by weighted average or straight average, the pattern of centralized program fees representing one-third of decentralized program fees remains consistent.

The $24.59[3] weighted average Oregon fee overstates the fee to a limited extent. The true fee impact to an Oregon VIP program customer is actually somewhat less than this amount. If the fee is also adjusted to account for the free re-tests performed at Oregon stations, the average fee is reduced to $20.18[4]. This is relevant as half of the states surveyed charge customers for re-tests if customers exceed a re-test threshold. See Table 3.

Oregon's rate is also effectively lower than the value used in the analysis when considering that no other financial support is provided. Although details in this areas are difficult to secure, it is known that other state programs often receive some elements of general fund support. As Oregon's VIP is fee-driven, and does not receive general fund support[5], its effective rate charged is, again, lower, than those charged by other centralized programs. See Figure 2.

Therefore, under the first prong of the analysis, the centralized model used by Oregon is more cost effective than the decentralized model. The recent analysis indicates that the decentralized model is producing higher fees in the aggregate, without any identifiable benefits in the form of improved services or enhanced environmental protection.

Under the second prong of the analysis, in further comparing the fee charged by Oregon to those charged by other centralized programs, the Oregon fee remains among the lowest of the fees set within this centralized, lower fee tier. See Table 3 and Figure 2. This is also the case when considering some of the modestly reduced fees within the Centralized-Private subgroup. See Table 3. While several programs initially appear to have lower fees under this type of Centralized program, most of these programs receive non-fee financial support. If these amounts were known and accounted for, these fees would be higher. Also, any difference from privatization does not appear significant when considering the effect of unlimited retests for Oregon consumers. Finally, the Centralized private programs are to be negatively distinguished from the other centralized programs when considering the nature of services provided. None of the Centralized-private programs in the analysis offer remote testing services.[6] Also, each of these programs included a repair waiver, with the associated negative impact to emission reductions.

The range of service offerings available to Oregon customers is of direct benefit to those customers, and separates it from other service providers. The Oregon VIP program is the only

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[2] The current $10 fee in Medford is anticipated to be increased over time to $20, supporting more alignment with fees assessed at the Portland stations. The lower fee is a legacy of the more expensive BAR-31 test which was not implemented in Medford. Portland and Medford are both using OBD as the enhanced test method today.
[3] The weighted average $24.59 fee is based on the $30 mobile fleet testing fee, the $25 Portland fee, and the eventual $20 Medford fee.
[4] This is a result of dividing the total certificate fee revenue by the total number of tests conducted in 2018. Oregon only charges for a certificate and does not charge for a test.
[5] Although Oregon participates in limited cost-sharing through its partnership with the Oregon DMV, any limited net revenues made available through the partnership have an insignificant impact on this analysis.
[6] This sub-group does not offer either remote testing either for emissions or OBD.

program in the country that is currently offering both self-service lanes and remote testing via the DEQ Too™ program. This supports program effectiveness both in the additional elements of choice available to Oregon customers, and in the ability to continually adjust to changing operating realities.

The importance of Oregon's dynamic programmatic design, including traditional lane testing, double-lane testing, self-service testing, mobile fleet testing, and now even remote testing through independent service providers, cannot be overstated. The broader array of services available within the Oregon model ideally positions the program for inevitable future technological change, and for continued evolution as a program. If a particular mode of testing is later found to be more cost effective relative to other testing approaches, additional resources may be directed to that approach.

Finally, DEQ VIP also recognizes that the recipient of services is best positioned to evaluate the success of the program. For this reason, DEQ VIP offers every customer, no matter when a test is performed, the opportunity to report on their experience via a 10-question comment card. DEQ VIP receives thousands of customer responses annually from this approach. The results reveal that greater than 97% of customers rank DEQ VIP as "good" to "excellent". The program uses this information to not only gauge its overall effectiveness, but to also identify ongoing opportunities for improvement. Comment cards and results are routinely shared with station managers and staff, and any items of concern or opportunities for improvement are promptly addressed by the program. This reliance on customer feedback, as with the dynamic design of the program, helps to ensure the program's long term cost effectiveness.

Table 1 – All Programs

Program	Program Type	Annual Tests	Fee-Adj[1] (Biennial)	Fee Revenue	Freq[2]	Total Vehicles	Free Retests	Non-Fee[3] Revenue	Remote Sensing	Remote OBD	Repair Waiver
Arizona, Phoenix	Centralized	600,000	$ 20.35	$12,210,000	B	1,200,000		No	No	No	Yes
Arizona, Tucson	Centralized	800,000	$ 12.25	$9,800,000	B	1,600,000		No	No	No	Yes
California	Decentralized	13,081,788	$ 59.33	$776,142,452	B	26,163,575		Yes	No	Pilot	Yes
Colorado	Centralized	1,200,000	$ 25.00	$30,000,000	B	2,400,000	Limited	Yes	Yes	No	Yes
Connecticut	Decentralized	1,032,784	$ 30.00	$30,983,520	B	2,065,568			Yes	No	Yes
Delaware	Centralized	460,000	$ -	$0	B	920,000	Yes		No	No	Yes
District of Columbia	Centralized	120,000	$ 35.00	$4,200,000	B	240,000			No	No	Yes
Georgia	Decentralized	3,100,000	$ 50.00	$155,000,000	A	3,100,000		No	Yes	No	Yes
Idaho	Decentralized	125,000	$ 20.00	$2,500,000	B	250,000	Limited		No	No	Yes
Illinois	Centralized	2,100,000	$ -	$0	B	4,200,000	Yes		No	No	Yes
Indiana	Centralized	195,000	$ 23.83	$4,646,850	B	390,000			No	No	Yes
Louisiana	Decentralized	425,000	$ 36.00	$15,300,000	A	425,000		No	No	No	No
Maine	Decentralized	137,500	$ 37.00	$5,087,500	A	137,500		Yes	No	No	No
Maryland	Centralized	1,750,000	$ 14.00	$24,500,000	B	3,500,000	Limited		No	No	Yes
Massachusetts	Decentralized	4,800,000	$ 70.00	$336,000,000	A	4,800,000	Limited		No	No	Yes
Missouri	Decentralized	812,531	$ 26.50	$21,532,072	B	1,625,062	Limited	No	No	No	Yes
Nevada	Decentralized	1,856,507	$ 96.00	$178,224,672	A	1,856,507		No	No	No	Yes
New Hampshire	Decentralized	1,053,884	$ 70.00	$73,771,880	A	1,053,884			No	No	No
New Jersey	Decentralized	3,250,000	$ 70.00	$227,500,000	B	6,500,000	Varies	Yes	No	No	No
New Mexico	Decentralized	250,000	$ 20.00	$5,000,000	B	500,000			No	No	Yes
New York	Decentralized	11,000,000	$ 74.00	$814,000,000	A	11,000,000		No	No	No	Yes
North Carolina	Decentralized	5,000,000	$ 60.00	$300,000,000	A	5,000,000	Yes		No	No	Yes
Ohio	Decentralized	840,000	$ -	$0	B	1,680,000	Yes	Yes	Yes	No	Yes
Ontario, Canada	Decentralized	2,000,000	$ 33.90	$67,800,000	B	4,000,000			Pilot	Pilot	Yes
Oregon – Phase 2	Centralized	600,000	$ 24.59[4]	$12,024,000	B	1,200,000	Yes	No	No	Yes[5]	No
Pennsylvania	Decentralized	3,500,000	$ 70.00	$245,000,000	A	3,500,000			No	No	Yes
Rhode Island	Decentralized	347,000	$ 55.00	$19,085,000	B	694,000	Limited	No	Yes	No	Yes
Tennessee	Centralized	1,400,000	$ 18.00	$25,200,000	A	1,400,000	Limited		No	No	Yes
Texas	Decentralized	9,854,000	$ 37.00	$364,598,000	A	9,854,000	Limited	No	Yes	No	Yes
Utah, Davis	Decentralized	276,745	$ 82.50	$22,831,463	A	276,745		Yes	No	No	Yes
Utah, Weber	Decentralized	152,000	$ 60.00	$9,120,000	A	152,000	Limited		No	No	Yes
Utah, Utah Co.	Decentralized	290,111	$ 74.00	$21,468,214	A	290,111			No	No	Yes
Utah, Salt Lake	Decentralized	1,000,000	$ 73.20	$73,200,000	A	1,000,000			No	No	Yes
Utah, Cache County	Decentralized	50,600	$ 15.00	$759,000	B	101,200		Yes	No	No	Yes
Vermont	Decentralized	573,000	$ 100.00	$57,300,000	A	573,000	Varies	No	No	No	TBD
Virginia	Decentralized	895,322	$ 30.00	$26,859,660	B	1,790,644	Limited	No	Yes	No	Yes
Washington[6]	Centralized	747,727	$ 15.00	$11,215,905	B	1,495,454		Yes	No	No	Yes
Wisconsin	Decentralized	650,000	$ -	$0	B	1,300,000			No	No	Yes
Total Tests		**72,276,499**[7]	**$ 55.14**[8]	**$3,982,860,187**		**108,234,250**					

Table 2
Decentralized Programs

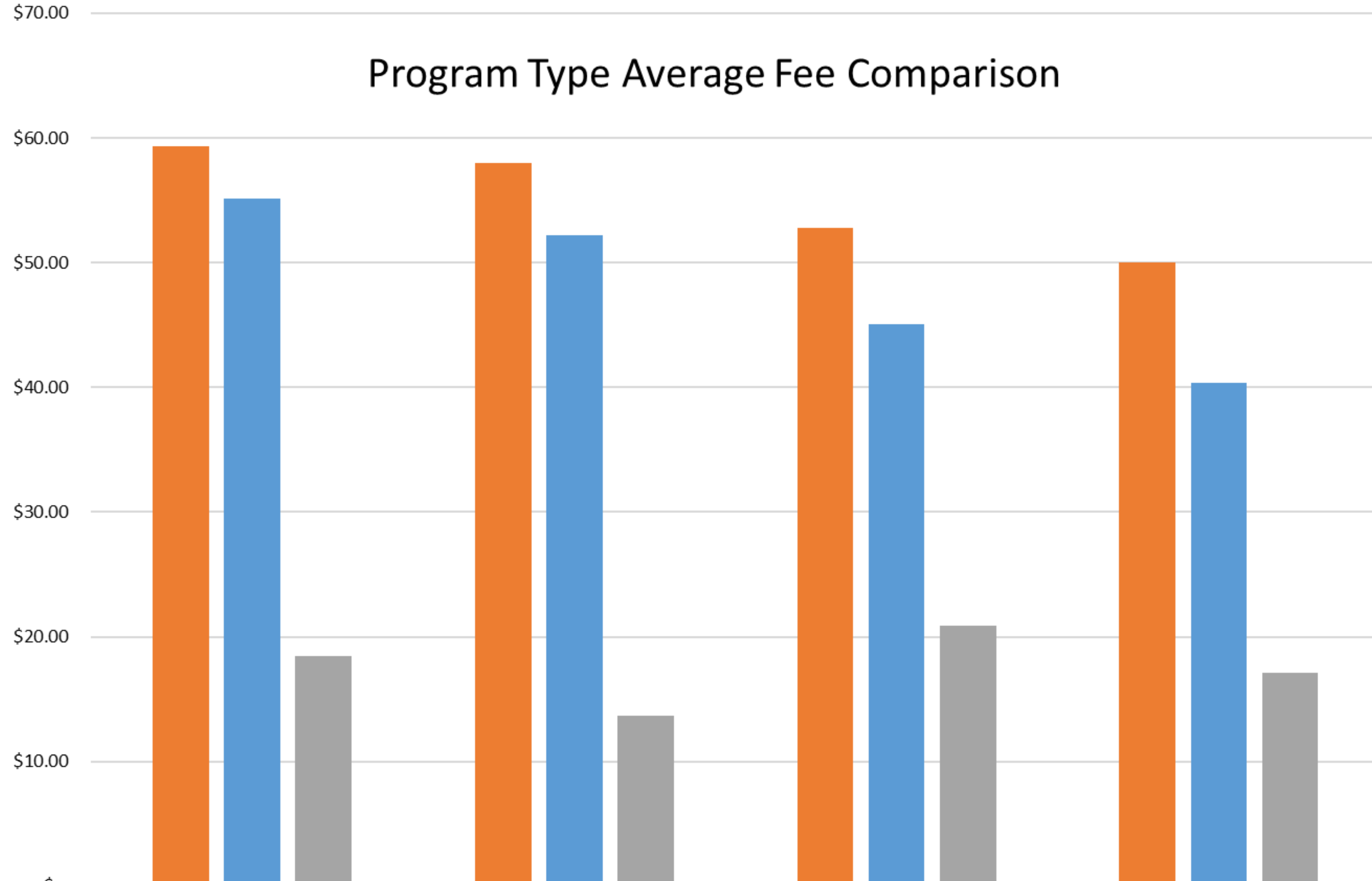
Program	Program Type	Annual Tests	Fee-Adj (Biennial)	Fee Revenue	Freq	Total Vehicles	Free Retests	Non-Fee Revenue	Remote Sensing	Remote OBD	Repair Waiver
California	Decentralized	13,081,788	$ 59.33	$776,142,452	B	26,163,575		Yes	No	Pilot	Yes
Connecticut	Decentralized	1,032,784	$ 30.00	$30,983,520	B	2,065,568			Yes	No	Yes
Georgia	Decentralized	3,100,000	$ 50.00	$155,000,000	A	3,100,000		No	Yes	No	Yes
Idaho	Decentralized	125,000	$ 20.00	$2,500,000	B	250,000	Limited		No	No	Yes
Louisiana	Decentralized	425,000	$ 36.00	$15,300,000	A	425,000		No	No	No	No
Maine	Decentralized	137,500	$ 37.00	$5,087,500	A	137,500		Yes	No	No	No
Massachusetts	Decentralized	4,800,000	$ 70.00	$336,000,000	A	4,800,000	Limited		No	No	Yes
Missouri	Decentralized	812,531	$ 26.50	$21,532,072	B	1,625,062	Limited	No	No	No	Yes
Nevada	Decentralized	1,856,507	$ 96.00	$178,224,672	A	1,856,507		No	No	No	Yes
New Hampshire	Decentralized	1,053,884	$ 70.00	$73,771,880	A	1,053,884			No	No	No
New Jersey	Decentralized	3,250,000	$ 70.00	$227,500,000	B	6,500,000	Varies	Yes	No	No	No
New Mexico	Decentralized	250,000	$ 20.00	$5,000,000	B	500,000			No	No	Yes
New York	Decentralized	11,000,000	$ 74.00	$814,000,000	A	11,000,000		No	No	No	Yes
North Carolina	Decentralized	5,000,000	$ 60.00	$300,000,000	A	5,000,000	Yes		No	No	Yes
Ohio	Decentralized	840,000	$ -	$0	B	1,680,000	Yes	Yes	Yes	No	Yes
Ontario, Canada	Decentralized	2,000,000	$ 33.90	$67,800,000	B	4,000,000			Pilot	Pilot	Yes
Pennsylvania	Decentralized	3,500,000	$ 70.00	$245,000,000	A	3,500,000			No	No	Yes
Rhode Island	Decentralized	347,000	$ 55.00	$19,085,000	B	694,000	Limited	No	Yes	No	Yes
Texas	Decentralized	9,854,000	$ 37.00	$364,598,000	A	9,854,000	Limited	No	Yes	No	Yes
Utah, Davis	Decentralized	276,745	$ 82.50	$22,831,463	A	276,745		Yes	No	No	Yes
Utah, Weber	Decentralized	152,000	$ 60.00	$9,120,000	A	152,000	Limited		No	No	Yes
Utah, Utah Co.	Decentralized	290,111	$ 74.00	$21,468,214	A	290,111			No	No	Yes
Utah, Salt Lake	Decentralized	1,000,000	$ 73.20	$73,200,000	A	1,000,000			No	No	Yes
Utah, Cache County	Decentralized	50,600	$ 15.00	$759,000	B	101,200		Yes	No	No	Yes
Vermont	Decentralized	573,000	$ 100.00	$57,300,000	A	573,000	Varies	No	No	No	TBD
Virginia	Decentralized	895,322	$ 30.00	$26,859,660	B	1,790,644	Limited	No	Yes	No	Yes
Wisconsin	Decentralized	650,000	$ -	$0	B	1,300,000			No	No	Yes
Total Tests		**64,863,772**	**$ 59.34**	**$3,849,063,432**		**89,688,796**					

Table 3
Centralized Programs

Program	Program Type	Operated	Annual Tests	Fee-Adj (Biennial)	Fee Revenue	Freq	Total Vehicles	Free Retests	Non-Fee Revenue	Remote Sensing	Remote OBD	Repair Waiver
Arizona, Phoenix	Centralized	Privately	600,000	$ 20.35	$12,210,000	B	1,200,000	Limited	No	No	No	Yes
Arizona, Tucson	Centralized	Privately	800,000	$ 12.25	$9,800,000	B	1,600,000	Limited	No	No	No	Yes
Colorado	Centralized	Publicly	1,200,000	$ 25.00	$30,000,000	B	2,400,000	Limited	Yes	Yes	No	Yes
Delaware	Centralized	Publicly	460,000	$ -	$0	B	920,000	Yes	Yes	No	No	Yes
District of Columbia	Centralized	Publicly	120,000	$ 35.00	$4,200,000	B	240,000		No	No	No	Yes
Illinois	Centralized	Privately	2,100,000	$ -	$0	B	4,200,000	Yes	Yes	No	No	Yes
Indiana	Centralized		195,000	$ 23.83	$4,646,850	B	390,000			No	No	Yes
Maryland	Centralized	Privately	1,750,000	$ 14.00	$24,500,000	B	3,500,000	Limited	No	No	No	Yes
Oregon - Current	Centralized	Publicly	600,000	$ 20.04	$12,024,000	B	1,200,000	Yes	No	No	Yes	No
Oregon - Phase 1	Centralized	Publicly	600,000	$24.13	$14,478,000	B	1,200,000	Yes	No	No	Yes	No
Oregon - Phase 2	Centralized	Publicly	600,000	$24.59	$14,754,000	B	1,200,000	Yes	No	No	Yes	No
Tennessee	Centralized	Privately	1,400,000	$ 18.00	$25,200,000	A	1,400,000	Limited	Yes	No	No	Yes
Washington	Centralized	Privately	747,727	$ 15.00	$11,215,905	B	1,495,454		Yes	No	No	Yes
Total Tests			**7,412,727**	**$ 18.42**[7]	**$133,796,755**		**18,545,454**					

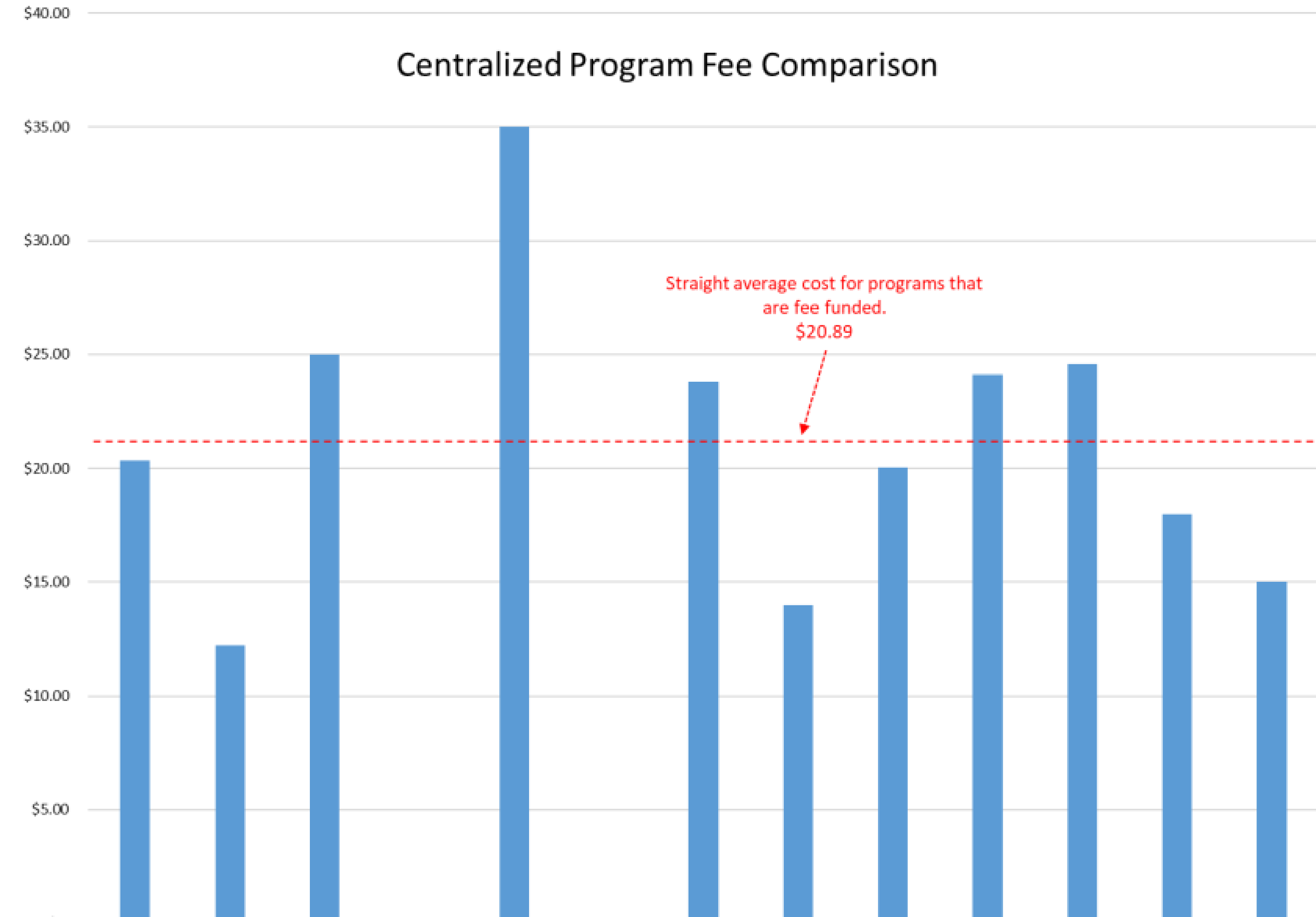
[7] This program average uses Oregon's Phase 2 fee structure and ignores the other Oregon fee structures.

Figure 1



	Weighted average price per motorist for programs that are fee funded.	Weighted average price per motorist for all programs including those with no fee.	Straight average price for all programs that are fee funded.	Straight average price for all programs including those with no fee.
Decentralized	$59.34	$58.01	$52.79	$49.98
All	$55.14	$52.22	$45.09	$40.34
Centralized	$18.42	$13.69	$20.89	$17.09

Figure 2



	Arizona, Phoenix	Arizona, Tucson	Colorado	Delaware	District of Columbia	Illinois	Indiana	Maryland	Oregon - Current	Oregon - Phase 1	Oregon - Phase 2	Tennessee	Washington
Fee-Adj (Biennial)	$20.35	$12.25	$25.00	$-	$35.00	$-	$23.83	$14.00	$20.04	$24.13	$24.59	$18.00	$15.00

Notes:

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[1] Fee adjusted to biennial form to match Oregon.

[2] Frequency of testing. Annual testing is represented with an ‘A’ while Biennial testing is represented with a ‘B.’

[3] Indicates if jurisdiction receives funding beyond the test fee. These fees would include such sources as: a CAA renewal fee, the state motor fuel tax, the state general fund, an Air Pollution Control Fee, state Transportation and Petroleum Environmental Cleanup Fund Act (PECFA). If additional funding is unknown, this column is left blank.

[4] This is the weighted average cost between Portland, Medford, and the Mobile Service.

[5] Oregon is the only program that currently offers Remote OBD to motorists. (DEQ Too™)

[6] Program expires in 2020 unless EPA rejects Washington’s latest SIP submittal.

[7] Total annual tests for programs that have a fee.

[8] This represents the weighted average motorist cost for all programs that have a fee.