State Implementation Plan Revision
Adoption of Regional Haze Strategies in Oregon

Oregon Regional Haze Plan for Implementing Section 308 (40CFR 51.308) of the Regional Haze Rule

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Appendix B: Class I Area Visibility Impairment Supplemental Information
Appendix C: WRAP Technical Support Summary
Appendix D: Supplemental BART Information:

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2. ERG Technical Memorandum #2
3. EPAôs BART Rule Guidelines for BART Determinations
4. Oregon BART Modeling Protocol
5. EPA Guidance on Federally Enforceable Permit Limits (FEPL)
6. DEQ 2010 BART Report for the PGE Boardman Plant
7. DEQ 2010 BART Report addendum

Appendix E: Oregon 2010 BART Rules
Appendix F: Oregon Visibility Protection Plan and Oregon Smoke Management Plan
Appendix G: Oregon Regional Haze SIP Consultation and Coordination
Appendix H: State of Oregon Clean Air Act Implementation Plan

Oregon Regional Haze Plan Reference Materials

Oregon DEQ Information and Documents

Available at the DEQ Regional Haze website:
http://www.deq.state.or.us/aq/haze/index.htm
See other documentation in the Appendices Section of this document

Applicable Western Regional Air Partnership (WRAP) Reports and Documents

Available at the WRAP website:
http://www.wrapair.org/
or at the WRAP TSS website:
http://vista.cira.colostate.edu/tss/

Other Reference

1. EPAôs Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations: Final Rule (64 Federal Register 35714), July 1, 1999.
2. EPAôs Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations: Final Rule (70 Federal Register 39104), July 6, 2005.

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Executive Summary

Regional haze is air pollution that travels long distances and reduces visibility in scenic areas. The haze that affects visibility in Oregon comes from motor vehicles, power plants, industrial and manufacturing processes, forestry, agricultural and other open burning, as well as natural sources such as wildfire and windblown dust. The federal Clean Air Act contains requirements to protect and improve visibility in national parks and wilderness areas in the country. In 1977 Congress designated certain national parks and wilderness areas as "Class 1 areas," where

visibility was identified as an important value. Currently there are 156 Class 1 areas in the country. Oregon has 12 Class 1 areas, including Crater Lake National Park and 11 wilderness areas.

To address the problem of regional haze the Environmental Protection Agency (EPA) adopted the *Regional Haze Rule* in 1999. This rule requires states to adopt regional haze plans to incrementally improve visibility in all Class 1 areas, including Oregon, over the next 60 years. It focuses on improving Class 1 area visibility on the haziest days (the worst 20 percent) and ensuring no degradation on the clearest days (the best 20 percent). The first regional haze plan must include Reasonable Progress Goals (RPGs) for each Class I known as the 2018 URP milestones. RPGs are interim goals that represent incremental visibility improvements, based on a calculation of The uniform first regional haze plan describes the progress anticipated in reaching the 2018 URP milestone for each Class I area, for the 20 percent worst and best days, based on projections of emission reductions and visibility improvements from regional haze control strategies during this first planning period.

Best Available Retrofit Technology (BART) is a key part of the federal Regional Haze Rule, and the central focus of regional haze plans that states are developing. It applies to certain older industrial facilities that began operating before 1977 when federal Prevention of Significant Deterioration (PSD) rules were adopted to protect visibility in Class I areas when permitting new industrial facilities. Under BART, these older facilities must now evaluate their visibility impact in Class I areas, and if found to be significant, conduct an evaluation of new pollution controls, and install them within five years.

This document is Oregonôs Regional Haze Plan plan are as follows:

- History and regulatory background of the Regional Haze Rule, and geographical description of each of Oregonôs 12 Class
- A comprehensive review and technical assessment of visibility conditions in each of Oregonôs Class I areas, showing major pollutants and source categories in Oregon and other states causing haze, and a projdate of 2018. See Chapters 6 through 9.
- DEQôs evaluation of BART eligible and subject to BART sources, and proposes BART requirements controls on the power plant, and reduce emissions at four other facilities to below the visibility impact level considered to be significant. See Chapter 10.
- Reasonable Progress Goals for each Class I area, which show improvements in visibility for the haziest or worst days (but less than the first URP milestone for 2018) and no visibility degradation for the clearest or best days. See Chapter 11.

- A "Long-Term Strategy" th[...] what act[...] DEQ will take to address the major sources of haze over the next 10 years, and commitments for future plan updates and revisions.

- Summary of the efforts by DEQ to consult and coordinate with other States, Tribes, and Federal Land Managers on the regional haze strategies contained in this plan. See Chapter 13.

The major elements of this plan are the BART evaluation, Reasonable Progress Goals, and the Long-Term Strategy.

<u>Best Available Retrofit Technology evaluation</u>

The primary result of the BART evaluation in Chapter 10 was the outcome of the BART determination for the PGE Boardman coal-fired power plant. DEQ evaluated 10 BART-eligible sources, and found that the PGE Boardman plant had by far the greatest visibility impact in Oregon's Class I areas, as well as Washington's Class I [...]. As a result, DEQ adopted BART requirements for the PGE Boardman plant that contain a 2020 closure date for the plant, at the request of PGE. Prior to this date, PGE would install BART controls, and meet emission limits in 2011, 2014, and 2018, that will reduce total emissions by 48%. After 2020, all emissions from the plant, or approximately 25,500 tons per year of primarily sulfur dioxide (SO_2) and nitrogen oxide (NO_x), would be eliminated. Both the emission reductions from the interim BART controls and from plant closure would provide significant visibility benefits to 14 Class I areas impacted by the Boardman plant, including the Columbia Gorge National Scenic Area. In addition, the complete elimination of all emissions after 2020 would greatly contribute to meeting regional haze "reasonable progress" [...]. For a full description of DEQ's BART determination, see Chapter 10.

Also as part of the BART evaluation, DEQ found four other BART-eligible sources that had visibility impacts that we just over the "sig[...] BART sources. DEQ determined these sources could take a federally enforceable permit limit to lower their emissions below the significance level. Sources that take an enforceable permit limit are not subject to further evaluation for BART controls, however as BART-eligible sources, they can be re-evaluated as part of a more comprehensive review of industrial emissions under the reasonable progress requirements for making visibility improvements. This re-evaluation of all BART-eligible sources is part of the Long-Term Strategy described below.

<u>Reasonable Progress Goals</u>

In establishing RPGs for each Class I area, DEQ relied upon emission projections and regional modeling work conducted by the Western Regional Air Partnership (WRAP). The WRAP *Technical Support System* or TSS website provided considerable technical information in determining the RPGs, and is referenced in the Appendices section of the plan. The RPGs described in Chapter 11 represent future vis[...] in 2018, [...] based on the URP calculated for each Class I area (see Chapter 6) that represents a "presumptive goal" for the first regional haze plan. In cases where the RPGs do not meet the

URP goal for 2018, States are required to explain the reasons for the slower progress, additional controls that were considered for this first plan, and what future actions that will be taken to ensure the 60-year objective of the Regional Haze Rule will be met.

While the RPGs for Oregonôs Class I areas me clearest or best days, they do show a slower rate of progress for the haziest or worst visibility days, and do not meet the 2018 URP milestones in most areas. The reasons for this, as described in Chapter 11, are summarized below:

- DEQôs analysis of emissions data, source a supports the finding that the contribution of natural sources, such as wildfire and windblown dust, is the primary reason for slower progress in achieving the 2018 milestone in Oregonôs Class I areas.

- Similar to the contribution of natural sources, DEQ believes marine vessel emissions are also affecting progress in making visibility improvements. These emissions are estimated to be currently half of the statewide SO_2 emissions and one-third the statewide NO_x emissions. This contribution to visibility impairment is significant, especially in Western Oregon Class I areas. Current DEQ authority to regulate offshore shipping emissions is limited. The plan identifies future work that is needed to address this significant source of emissions.

- DEQôs analysis of projected visibility improvements from sulfate and nitrate impacts in Oregon Class I areas shows about a 20 percent reduction in these pollutants by the 2018 milestone. Given the strong association of these pollutant species to anthropogenic sources, DEQ believes this is a more realistic indicator of reasonable progress. If natural sources are excluded, this 20 percent reduction in sulfates and nitrates corresponds to the same percent reduction that is represented by the 2018 milestone.

- Mobile sources (mostly cars and trucks) are the largest anthropogenic source of emissions in Oregon. By 2018 more than half of these emissions are projected to decrease due to numerous federal emission standards that are already ñon the booksò, in Oregon that will reduce these emissions. DEQ believes this major reduction supports the demonstration that RPGs are reasonable based on the considerable progress being made reducing this large source of emissions.

- DEQ conducted a ñFour-Factor Analysisò as required und evaluate other large sources of emissions (non-BART sources) that could be reduced or controlled to improve visibility by 2018. Using this analysis DEQ did not find any controls that were reasonable to pursue at this time. However, as noted above, the BART controls for the PGE Boardman power plant will result in a 48% reduction in emissions prior to 2018, followed by the complete elimination all emissions after 2020. Overall, this represents a total emission reduction of approximately 25,500 tons per year. Although not a direct result of the four-factor analysis, this does rep emission reduction that is significant, and will provide noticeable visibility improvements in 14 different Class I areas. Based on the preliminary information obtained from the

four-factor analysis, DEQ has proposed in the Long-Term Strategy of the plan to further evaluate non-BART industrial sources for possible new controls in the next five years to make additional visibility improvements by 2018.

Long-Term Strategy

Chapter 12 of this plan is the Long-Term Strategy, which describes on-going rules and programs that are expected to provide visibility improvements, and identifies new measures that DEQ has committed to evaluate by the next plan update in 2013. The two primary commitments are to evaluate possible visibility improvements from non-BART industrial sources not included in the BART review, and Class I area smoke impacts from forestry burning. These represent the two greatest areas where potentially significant visibility benefits could be realized.

The evaluation of non-BART sources will include a re-evaluation of the BART-eligible sources. Starting in 2009, DEQ will develop a comprehensive guidance document through a stakeholder process for evaluating visibility impacts from non-BART industrial sources. A DEQ report will be prepared by 2013 that summarizes (1) the development of this guidance; (2) results of applying the guidance to non-BART sources and BART-eligible sources; (3) any potential new controls for sources, (4) proposed rulemaking needed and schedule for adopting new rules, (5) estimated timeline for installing any new controls; and (6) estimate of the expected visibility benefits.

The evaluation of forestry burning will consist of an analysis of smoke impacts from forestry burning on visibility, for the haziest or worst days at each Class I area in Oregon. Where this burning it is found to cause significant visibility impacts, DEQ plans to work with state forestry and federal land managers to identify new smoke management controls to protect visibility.

Other new measures in the Long-Term Strategy included an evaluation of the contribution from residential open burning and rangeland burning, and further assessment on the contribution of marine vessels and possible regulatory actions that could be taken.

Columbia River Gorge National Scenic Area Visibility

The Columbia River Gorge National Scenic Area was created by Congress in 1986. While it was not designated as a Class I area, it will receive significant visibility benefit under the Oregon Regional Haze Plan due to itsô proxim
Wilderness in Oregon. The Gorge was included with other Class I areas in the visibility modeling analysis of BART sources, and the requirement for five-year updates to Oregon Regional Haze Plan will include similar analysis and tracking of visibility improvements for the Gorge.

The National Scenic Area Act of 1986 requires the protection and enhancement of the scenic, natural, cultural, and recreational resources of the Gorge, while at the same time supporting the local economy. The Columbia River Gorge Commission (CRGC) has responsibility to administer the National Scenic Area Act. In 2001, the CRGC determined that in order to

protect air quality in the Gorge, the CRGC would rely on Oregon DEQ and the Washington Southwest Clean Air Agency to develop an air quality strategy for the Scenic Area. The state agencies studied air quality and visibility and the emission sources that contribute to haze in the Gorge. Because many of the same problems that affected haze in the Gorge are the same problems that affect haze across the western region, much of the visibility efforts under the regional haze program will ultimately benefit the Gorge. Therefore, as part of the federally mandated five-year regional haze plan update, DEQ will track visibility conditions in the area and provide a separate follow up with the CRGC to provide a progress report on conditions in the Gorge. See Section 1.6.2 of this plan for more information.

CHAPTER 1: INTRODUCTION

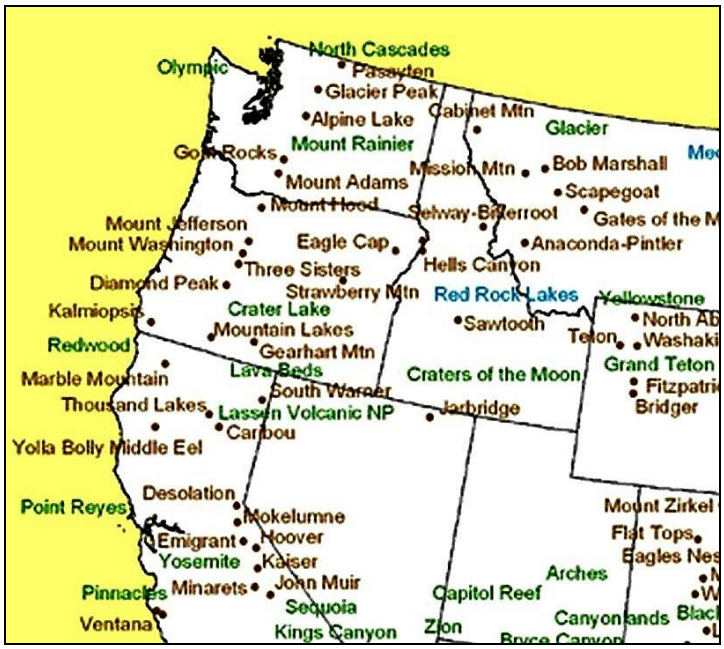
1.1 Overview of Visibility and Regional Haze

Good visibility is essential to the enjoyment of national parks and scenic areas. Visibility impairment occurs as a result of the scattering and absorption of light by particles and gases in the atmosphere. This affects the clarity and color of what we see. Without the effects of air pollution, natural visual range is approximately 140 miles in the West and 90 miles in the East. However, over the years, air pollution in many parts of the United States has significantly reduced the range that people can see. In the West, the current range is 35-90 miles, and in the East, only 15-25 miles.

Regional haze is air pollution that is transported long distances and reduces visibility in national parks and wilderness areas. The pollutants that create this haze are sulfates, nitrates, organic carbon, elemental carbon, and soil dust. Human-caused haze sources include industry, motor vehicles, agricultural and forestry burning, and windblown dust from roads and farming practices.

The federal Regional Raze Rule requires states to improve visibility over the next 60 years in 156 national parks and wilderness areas in the country. In 1977, Congress designated all wilderness areas over 5,000 acres and all national parks over 6,000 acres as ñmandatory federal Class I areasò (or ñClass I areasò for short). These protection under the Clean Air Act. Figure 1.1-1 shows the Class I areas located in Oregon and Northwest.

Figure 1.1-1 Class I Areas in Pacific Northwest



1.2 Oregon Class I Areas

Oregon has 12 specially designated Class I areas, including Crater Lake National Park and 11 wilderness areas. These areas are listed in Table 1.2-1, and are the focus of this Regional Haze Plan. A description of each Class I area is provided in Chapter 3 of this report.

Table 1.2-1 Oregon Class I Areas

Class I Area	Acreage
Mt. Hood Wilderness	47,160
Mt. Jefferson Wilderness	107,008
Mt. Washington Wilderness	52,516
Three Sisters Wilderness	285,202
Diamond Peak Wilderness	52,337
Crater Lake	183,315
Mountain Lakes Wilderness	23,071
Gearhart Mtn. Wilderness	22,809
Kalmiopsis Wilderness	179,700
Strawberry Mtn. Wilderness	69,350
Eagle Cap Wilderness	360,275
Hells Canyon Wilderness	131,133*

* Oregon portion only. Total acreage is 214,944

1.3 Background on the Regional Haze Rule

In 1977, Congress amended the Clean Air Act to include provisions to protect the scenic vistas of the nationôs national parks and wilderness areas. In these amendments, Congress declared as a national visibility goal:

> *The prevention of any future, and the remedying of any existing impairment of visibility in mandatory class I Federal areas which impairment results from man-made air pollution.* (Section 169A)

To address this goal, in 1980 EPA adopted regulations to address visibility impairment caused by one or a small group of man-made sources generally located in close proximity to a specific Class I area. These became known as EPAôs ñPhase Iò visibility rules. At that time, address regional haze, because they lacked the needed scientific information and research needed to understand the long-range transport and formation of regional haze.

In response to EPAôs Phase I visibility rules Protection Plan in October 1986 (see Section 1.5.2). The 1990 amendments to the Clean Air Act established requirements to study regional haze. They gave EPA the authority to establish visibility transport commissions and promulgate regulations to address regional haze. The 1990 amendments also established a visibility transport commission to investigate and report on regional haze visibility impairment in the Grand Canyon National Park and nearby Class I

areas. A summary of the work of the Grand Canyon Visibility Transport Commission is provided in Section 1.5.4.

1.4 Summary of the Regional Haze Rule

To address the problem of long range transport of regional haze and to meet the national goal of reducing man-made visibility impairment in all Class I areas, EPA established regional haze visibility rules in 1999, to be known as the Regional Haze Rules. These rules can be found in 40 Code of Federal Regulations, Volume 64, July 1, 1999, pages 35714-35774.

The objective of the rules was to improve visibility over the next 60 years (by 2064) in all 156 Class I areas in the country. The rules require States to adopt a regional haze State Implementation Plan (SIP) that focuses on improving the haziest days (the worst 20%) and protecting the clearest days (the best 20%). Each SIP will provide a comprehensive analysis of natural and human-caused sources of haze in each Class I area, and contain strategies to control sources and reduce emissions that contribute to haze. The SIP must also address the transport of haze across state boundaries.

The Regional Haze Rule provides two paths for adopting regional haze SIPs. The submittal of this regional haze SIP meets 40 CFR 51.308. The other part of the rule is Section 309 (40 CFR 51.309), and is an option for nine western states - Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, and Wyoming. These states can choose to follow Section 309 and adopt specific regional haze strategies related for the 16 Class I areas of the Colorado Plateau, based on recommendations developed by the Grand Canyon Visibility Transport Commission (see Section 1.5.4 below). Section 309 applies only until 2018, after which Section 308. Since Oregonôs Colorado Plateau Class I areas, Oregon choose not submit a Section 309 plan for this SIP submittal.[1]

Two of the primary components of the Regional Haze Rule are requirements to address Best Available Retrofit Technology (BART) and demonstrate reasonable progress in improving visibility by a 2018 milestone for each Class I area. The BART requirements address certain larger industrial sources that began operation before the adoption of the 1977 Prevention of Significant Deterioration Rules (see Section 1.5.1). Chapter 10 of this Plan describes the BART review and evaluation in detail. The demonstration of reasonable progress requires setting goals for the 20% worst and best days in each Class I area, based on an evaluation of how BART and other regional haze strategies will reduce emissions and improve or protect visibility. Chapter 11 of this Plan describes the Reasonable Progress Demonstration in detail.

[1] In 2003, Oregon did submit to EPA a Section 309 Regional Haze Plan, to primarily address the contribution of Oregon emissions to visibility impacts in the Colorado Plateau. This plan, along with other 4 other state plans submitted under Section 309, were disapproved by EPA due to a lawsuit regarding the BART requirements in Section 309. [For more information see *Center for Energy and Economic Development v. EPA*, no. 03-1222, (D.C. Cir. Feb. 10, 2006)]. The four states chose to resubmit their 309 plans. The Department decided not to resubmit the plan, due to the optional nature of Section 309, the fact that Oregon is only a minor contributor to visibility impacts in the Colorado Plateau, and that a Section 308 plan is required in 2008 regardless under the Regional Haze Rule.

The Regional Haze Rule is in addition to ñPha
The Department developed the Oregon Visibility Protection Plan in 1986, in respon s e to EPAô s
Phase I rules, as described in Section 1.5.2 below.

Additional information on the Regional Haze Rule can be found on the Depa
at http://www.deq.state.or.us/aq/haze/index.htm.

1.5 Other Programs to Address Visibility Impairment

1.5.1 Prevention of Significant Deterioration for New Sources

The 1977 Clean Air Act Amendments established Prevention of Significant Deterioration (PSD) requirements, which protect air quality (and visibility) from air pollution from new major industrial sources, and major modifications of existing sources. Included in the PSD rules were requirements to protect visibility in national parks, national wilderness areas, national monuments and national seashores. The PSD program sets specific increments or limits on the maximum allowable increase in air pollution in certain airsheds, and a preconstruction permit review process for new or modifying major sources that allows for careful consideration of control technology, consultation with FLMs on visibility impacts and public participation in permitting decisions.

1.5.2 Phase I Visibility Rules ïthe Oregon Visibility Protection Plan

In response to EPAô s Phantsadopted thevOregoniVisibilityi t y r u l e s
Protection Plan in October 1986. This visibility plan contains short and long-term strategies for making reasonable progress toward the national goal, related to addressing reasonably attributable im Class I areas through visibility monitoring and control strategies. This plan incorporates PSD requirements for visibility protection from new or modified major stationary sources, and if necessary, applying BART to existing stationary sources if certified as causing reasonably attributable visibility impairment. The plan includes (a) the mitigation of visibility impairment within the Mt. Hood and Central Oregon Cascade wilderness areas through short and long-term control strategies for forest prescribed burning and Willamette Valley agricultural field burning, and (b) mitigation of impairment in the Eagle Cap Wilderness and Central Oregon Cascades resulting from agricultural field burning.

1.5.3 Best Available Retrofit Technology (BART)

Under Section 169A(b)(A) of the Clean Air Act, Congress established Best Available Retrofit Technology (BART) requirements for major stationary sources in operation within a 15-year period before adoption of the 1977 PSD rules. Under EPAô s TñPhase could be required for sources that were certified by the Federal Land Manager as causing reasonably attributable visibility impairment in a Class I area. Under EPAô s ñPhase haze rules, new BART rules were included that automatically triggered a review process for all pre-1977 sources. The review process included criteria for determine BART eligibility, modeling of visibility impacts, and evaluating the need for controls. (The BART review process is described in detail in Chapter 10 of this Plan.) In evaluating controls, the BART rules

require taking into consideration the costs of compliance, the energy and non-air quality environmental impacts of compliance, any existing pollution control technology in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

1.5.4 The Grand Canyon Visibility Transport Commission

The 1990 Clean Air Act Amendments created the Grand Canyon Visibility Transport Commission (GCVTC). The GCVTC was given the charge to assess the currently available scientific information pertaining to adverse impacts on visibility from potential growth in the region, identify clean air corridors, and recommend long-range strategies for addressing regional haze for Class I areas on the Colorado Plateau. The GCVTC completed significant technical analyses and developed recommendations to improve visibility in the 16 Class I areas on the Colorado Plateau. These 16 Class I areas are as follows: Arches National Park, Black Canyon of the Gunnison Wilderness, Bryce Canyon National Park, Canyonlands National Park, Capital Reef National Park, Flat Tops Wilderness, Grand Canyon National Park, Maroon Bells Wilderness, Mesa Verde National Park, Mt. Baldy Wilderness, Petrified Forest National Park, San Pedro Parks Wilderness, Sycamore Canyon Wilderness, Weminuche Wilderness, West Elk Wilderness, Zion National Park.

The GCVTC found that visibility impairment on the Colorado Plateau was caused by a wide variety of sources and pollutants. A comprehensive strategy was needed to address all of the causes of regional haze. The GCVTC submitted these recommendations to EPA in a report dated June 1996 for consideration in rule development. These recommendations were:

Air Pollution Prevention. Air pollution prevention and reduction of per capita pollution was a high priority for the Commission. The Commission recommended policies based on energy conservation, increased energy efficiency and promotion of the use of renewable resources for energy production.

Clean Air Corridors. Clean air corridors are geographic areas that provide a source of clean air to the 16 Class I areas of the Colorado Plateau. For these areas, the Commission primarily recommended careful tracking of emissions growth that may affect air quality in these corridors, and ultimately the 16 Class I areas.

Stationary Sources. For stationary sources, the Commission recommended closely monitoring the impacts of current requirements under the Clean Air Act and ongoing studies. It also recommended regional targets for SO_2 emissions from stationary sources, starting in 2000. If these targets are exceeded, a regional cap and market-based emission trading program should be implemented.

Areas In and Near Parks. The Commission's research and modeling showed that a host of sources adjacent to parks and wilderness areas, including large urban areas, have significant visibility impacts. However, the Commission lacked sufficient data regarding the visibility impacts of emissions from some areas in and near parks and wilderness areas. In general, the models used by the Commission were not readily applicable to such areas. Pending further

studies of these areas, the Commission recommended that local, state, tribal, federal, and private parties cooperatively develop strategies, expand data collection, and improve modeling for reducing or preventing visibility impairment in areas within and adjacent to parks and wilderness areas.

Mobile Sources. The Commission recognized that mobile source emissions are projected to decrease through about 2005 due to improved control technologies. The Commission recommended capping emissions at the lowest level achieved and establishing a regional emissions budget, and also endorsed national strategies aimed at further reducing tailpipe emissions, including the so-called 49-state low emission vehicle, or 49-state LEV.

Road Dust. The Commission's technical assessment indicated that road dust is a large contributor to visibility impairment on the Colorado Plateau. As such, it requires urgent attention. However, due to considerable skepticism regarding the modeled contribution of road dust to visibility impairment, the Commission recommended further study in order to resolve the uncertainties regarding both near-field and distant effects of road dust, prior to taking remedial action. Since this emissions source is potentially such a significant contributor, the Commission felt that it deserved high priority attention and, if warranted, additional emissions management actions.

Emissions from Mexico. Mexican sources are also shown to be significant contributors, particularly of SO_2 emissions. However, data gaps and jurisdictional issues made this a difficult issue for the Commission to address directly. The Commission recommendations called for continued bi-national collaboration to work on this problem, as well as additional efforts to complete emissions inventories and increase monitoring capacities. These matters should receive high priority for regional and national action.

Fire. The Commission recognized that fire plays a significant role in visibility on the Plateau. In fact, land managers propose aggressive prescribed fire programs aimed at correcting the buildup of biomass due to decades of fire suppression. Therefore, prescribed fire and wildfire levels are projected to increase significantly during the studied period. The Commission recommended the implementation of programs to minimize emissions and visibility impacts from prescribed fire, as well as to educate the public.

Future Regional Coordinating Entity. Finally, the Commission believed there was a need for an entity like the Commission to oversee, promote, and support many of the recommendations in their report. To support that entity, the Commission developed a set of recommendations addressing the future administrative, technical and funding needs of the Commission or a new regional entity. The Commission strongly urged the EPA and Congress to provide funding for these vital functions and give them a priority reflective of the national importance of the Class I areas on the Colorado Plateau.

1.5.5 The Western Regional Air Partnership

The GCVTC recognized the need for a long-term organization to address the policy and technical studies needed to address regional haze. The Western Regional Air Partnership

(WRAP) was formed in September 1997 as the successor organization to the GCVTC. The WRAP is made up of western states, tribes and federal agencies. The states are Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. The WRAP is assisting these states by developing the policy and technical work products needed for their regional haze SIPs. The WRAP established stakeholder-based technical and policy oversight committees to assist in managing the development of regional haze work products. See Section 4.1 of this plan for more information on the WRAP. See also WRAP web site at http://www.wrapair.org.

1.6 Purpose of this Document

The Oregon Regional Haze Plan has been prepared to meet the requirements of the Federal Regional Haze Rule, Section 40 CFR, Part 51, Section 308. It contains strategies and elements related to each requirement of this federal rule. The appendices (citation) at the end of this document provide additional information related to the strategies, including citations of new Oregon administrative rules associated with this plan, and the reference material (technical analysis and reports) prepared by the WRAP.

Relation to the WRAPôs Regional Technical Su

The WRAP Technical Support System (TSS) was the source for the majority of key technical information and data used in the Oregon Regional Haze Plan. The WRAP TSS can be found at http://vista.cira.colostate.edu/tss/. See Chapter 12, Section 12.2, for more information on specific WRAP reports and project. Appendix C has additional information on the WRAP TSS.

1.6.1 Mandatory Federal Class I Areas Addressed in this SIP

The Regional Haze Rule under 40 CFR 51.308 requires states to address visibility protection for regional haze in Oregonôs Class I Areas. These areas depicted in Figure 1.2-1.

1.6.2 Columbia River Gorge National Scenic Area

As mentioned earlier, the Regional Haze Rule is applicable to federal Class I areas only. While the Columbia River Gorge National Scenic Area is not a Class I area, it was designated a National Scenic Area by Congress in 1986. The National Scenic Area Act of 1986 requires the protection and enhancement of the scenic, natural, cultural, and recreational resources of the Gorge, while at the same time supporting the local economy.

The Columbia River Gorge Commission (CRGC) has responsibility to administer the National Scenic Area Act. As part of an amendment to the National Scenic Area Management Plan, the CRGC recognized that a Class I designation is not appropriate for the Gorge. However, the CRGC did recognize that air quality degradation can jeopardize those resources, and that in order to protect air quality in the Gorge, the CRGC would rely on state air quality agencies to develop an air quality strategy for the Scenic Area.

Oregon DEQ and the Washington Southwest Clean Air Agency (SWCAA) have been working with the CRGC since 2001 to study air quality and visibility in the Gorge, and the emission sources that contribute to haze in the Gorge. The study also included a projection of future visibility conditions in the Scenic Area. The study results identified that haze in the Gorge was caused by many different sources and haze reduction would need to result from the cumulative effect of numerous emission reduction activities.

Because many of the same problems that affected haze in the Gorge are the same problems that affect haze across the western region, much of the visibility efforts under the regional haze program will ultimately benefit the Gorge. The Columbia River Gorge Scenic Area is situated between two Class I areas (Mt. Hood and Mt. Adams) and the Gorge will benefit from Oregon and Washingtonôs long term regional haze program. The Gorge is a Class II area and will not be expected to be on the same reasonable progress glide path as the Class I areas, visibility in the Gorge can be measured against the nearby Class I areas. This comparison will allow DEQ to track continued visibility improvement progress for

Additionally, as part of the federally mandated five-year regional haze plan update, DEQ will include in these updates a description of visibility benefits to the Gorge, as the result of the effort to make reasonable progress in improving Class I area visibility over the next 60 years. Once this Regional Haze Plan SIP is submitted to EPA, DEQ will follow up with the CRGC to provide a progress report on conditions in the Gorge. DEQ will identify whether Gorge visibility conditions are showing continued improvement, similar to but not on the same glide path as conditions in the Class I areas. If visibility in the Gorge is not improving or showing a downward trend, then DEQ will reassess its Gorge strategy and potentially identify new strategies to ensure continued visibility improvement in the Gorge.

CHAPTER 2: OREGON REGIONAL HAZE SIP DEVELOPMENT AND CONSULTATION PROCESS

The Oregon Regional Haze Plan was developed through a process of consultation with other States, Tribes, state and federal natural resource agencies, EPA, and major stakeholders and the general public. The following is a brief summary of the consultation requirements under the Regional Haze Rule. Chapters 13 and Appendix G contains a full description of the consultation process identified below, in developing the Oregon Regional Haze Plan.

2.1 Federal Land Manager Consultation

The Regional Haze Rule requires consultation between the State and FLMs related to development and implementation of regional haze plans. States need to provide FLMs and opportunity to comment at least 60 days prior to holding a public hearing on a proposed plan or plan revision. This includes assessment of visibility impairment in the State each Class I area, and providing recommendations on the reasonable progress goals and visibility control strategies the State has proposed. States also need to provide the FLM an opportunity to comment on the five-year progress reports and other developing programs that may contribute to Class I visibility impairment.

2.2 State Consultation

Also required under the Regional Haze Rule is state-to-state consultation to develop coordinated regional haze strategies. Regional haze by definition is the long-range transport of air pollution, and as such includes identifying interstate transport issues. This requirement directs States to reasonably anticipated to contribute to visibility impairment in any Class I area in another State or States.

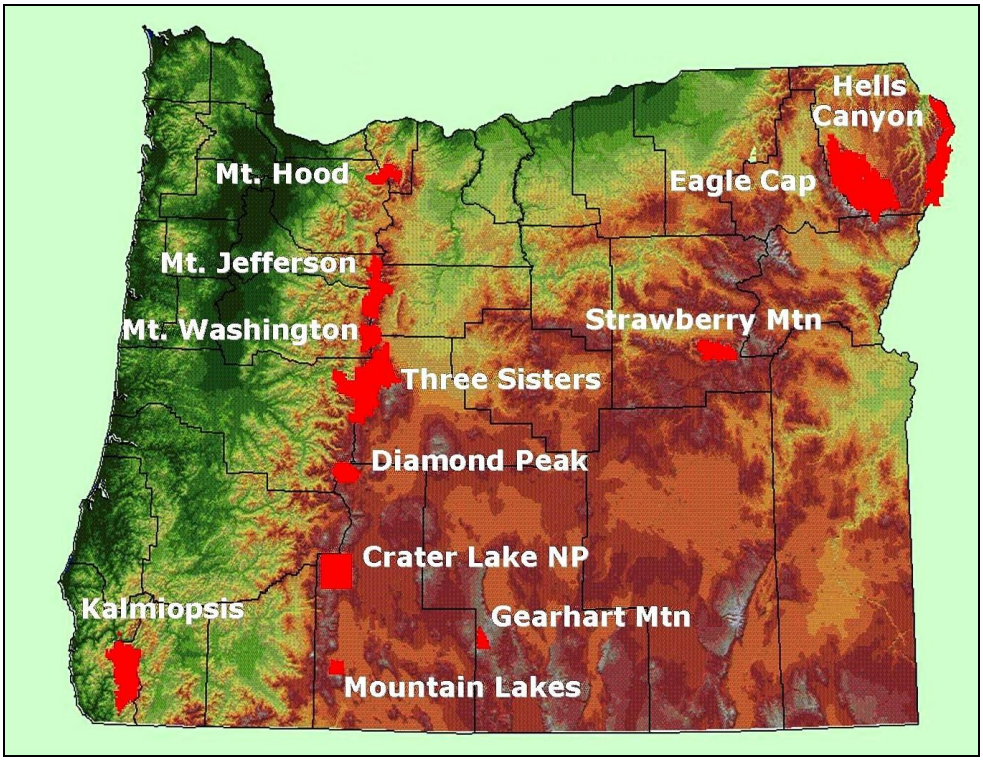
2.3 Tribal Consultation

Although tribal consultation is not required under the Regional Haze Rule, the Department views this as an important part of the consultation process, and actively pursued this during the development of the regional haze plan. Like the State consultation process above, consultation with Tribes involved reviewing major emission sources and regional haze strategies to address visibility issues.

CHAPTER 3: INTRODUCTION TO OREGON CLASS I AREAS

This chapter provides a map and description of the size, elevation, location, and other features of Oregonôs 12 Class I areas.

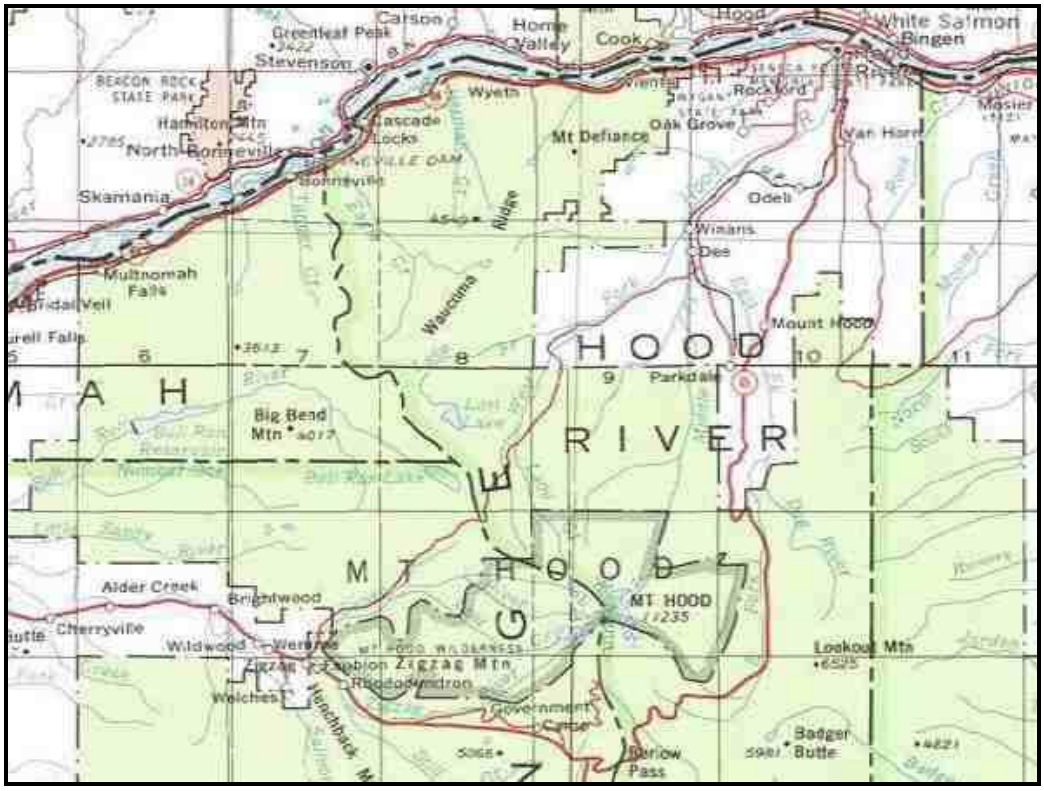
Figure 3-1 Map of Oregon Class I Areas



3.1 Mt. Hood Wilderness Area

Figure 3.1-1 presents a map of the Mt Hood Wilderness, which spans 47,160 acres on the slopes of Mt Hood in the northern Oregon Cascades. Wilderness elevations range from 3,426 m (11,237 ft) on the summit of Mt Hood down to almost 600 m (2,000 ft) at the western boundary. It is almost adjacent to the Portland Oregon metropolitan area; the westernmost boundary is about 20 km east of the Portland Oregon suburb of Sandy and 40 km from the heavily populated metropolitan center, elevation 100 m (300 ft). Visitation to the Mt. Hood Wilderness Area is approximately 50,000 visitors a year, primarily between May and October. Most visitors come from the Portland/Vancouver area that has a population of approximately 2 million.

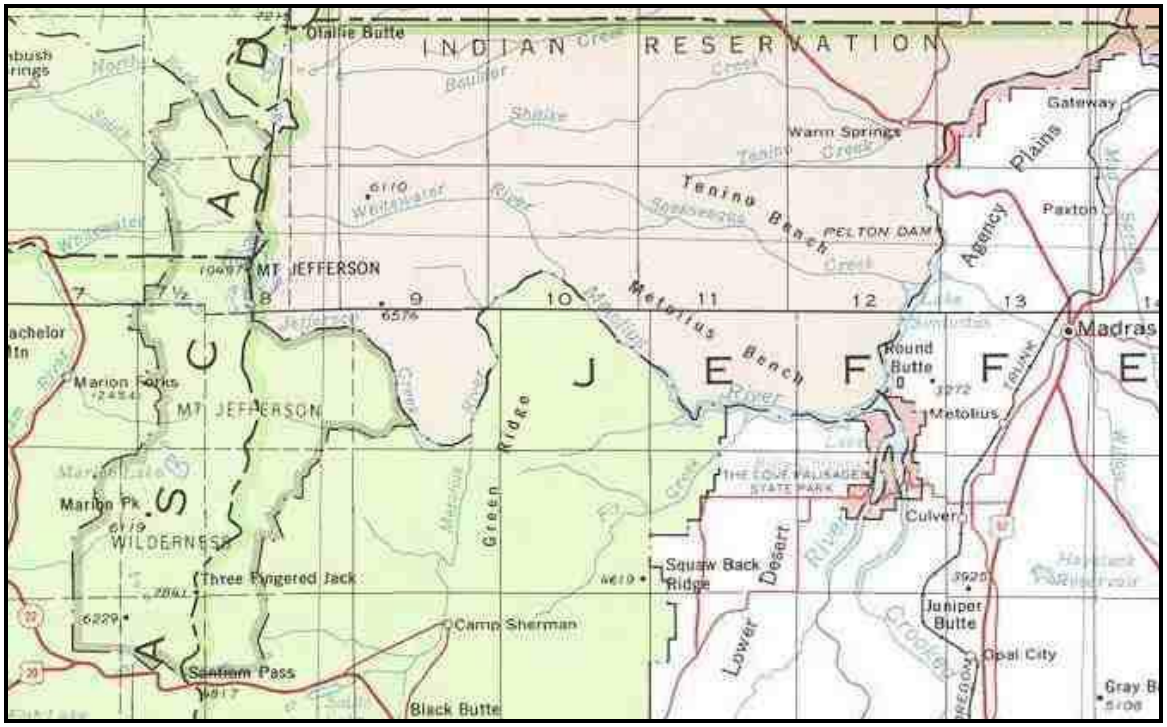
Figure 3.1-1 Map of Mt. Hood Wilderness Area



3.2 Mt. Jefferson Wilderness Area

Figure 3.2-1 presents a map of the Mt. Jefferson Wilderness Area, which occupies 107,008 acres on the crest of the Cascade Range in central Oregon. Its southern boundary is a few km north of the northern boundary of the Mt Washington Wilderness and it extends 40 to 50 km north along the Cascade crest. West of the crest, it consists primarily of the eastern side of the North Santiam River headwaters basin that connects to the Willamette Valley source region near Salem Oregon, 100 km (60 mi) to the west. East of the crest it occupies the western slopes of the Metolius River drainage that connects eastern slopes with Deschutes River in eastern Oregon. The highest Wilderness elevation is 3,200 m (10,497 ft) at the summit of Mt Jefferson in the northern part of the Wilderness. Lowest Wilderness elevations are near 1,000 m (3,000 ft) along the western boundary in the North Santiam headwaters basin and along the eastern boundary in the Metolius River basin.

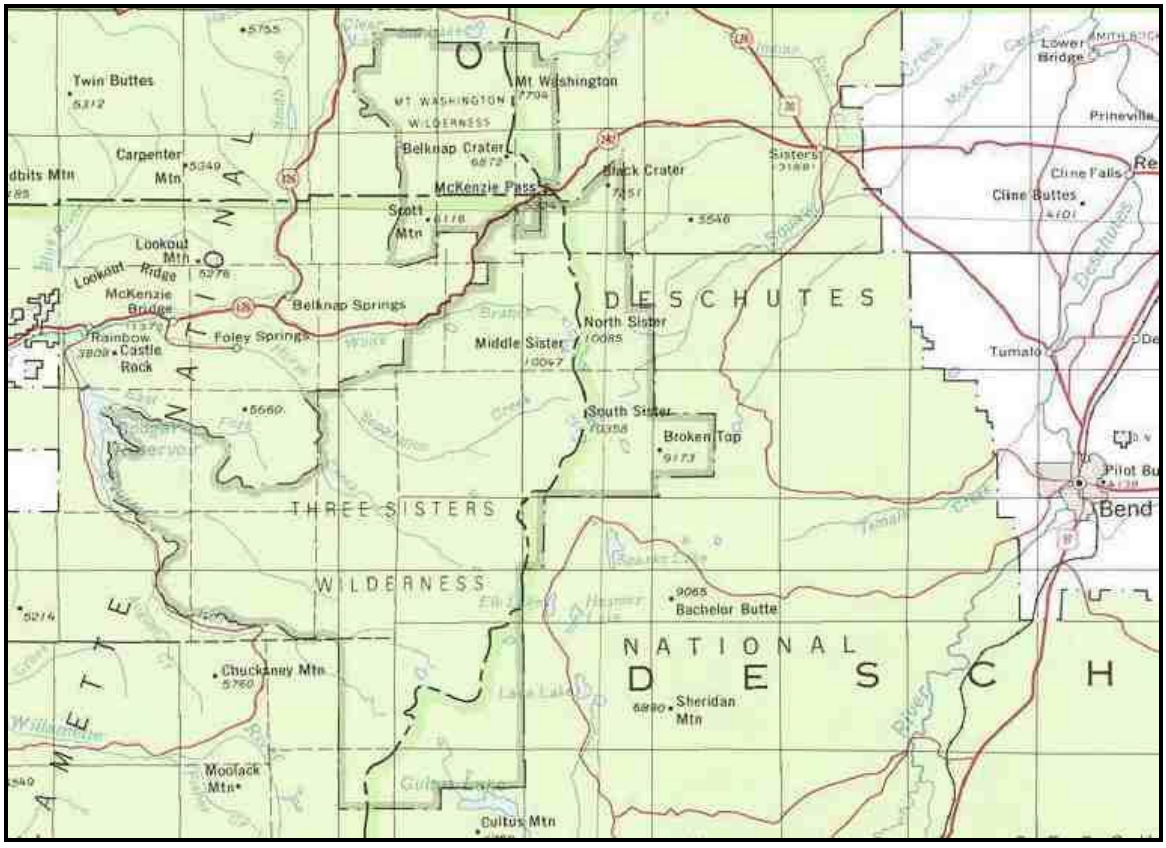
Figure 3.2-1 Map of Mt. Jefferson Wilderness Area



3.3 Mt. Washington Wilderness Area

Figure 3.3-1 presents a map of the Mt. Washington Wilderness Area, which occupies 52,516 acres on the crest of the Cascade Range in central Oregon. Like the Three Sisters Wilderness that it borders to the south, it includes headwaters tributaries of the McKenzie River that flow west into the Willamette Valley near Eugene and connect the Wilderness with that source region. On the east side eastern slopes of the Cascades descend to the Deschutes River near Bend. The highest Wilderness elevation is 2,376 m (7,794 ft) at the summit of Mt Washington. Lowest elevations are near 900 m (3,000 ft) in the upper headwaters basin of the McKenzie River.

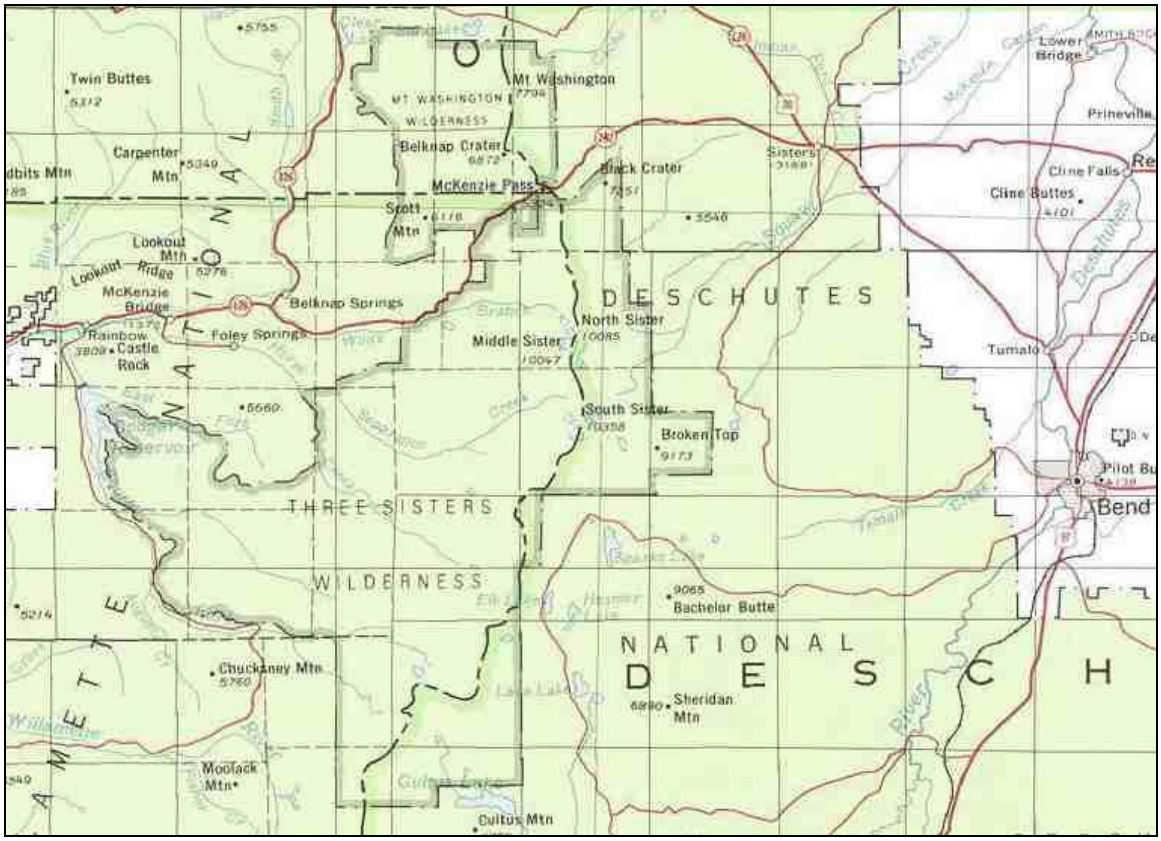
Figure 3.3-1 Map of Mt. Washington Wilderness Area



3.4 Three Sisters Wilderness Area

Figure 3.4-1 presents a map of the Three Sisters Wilderness Area, which consists of 285,202 acres abreast the crest of the Cascade Range in central Oregon. It includes headwaters tributaries of the McKenzie River that flow west into the Willamette Valley near Eugene and connect the Wilderness with that source region. On the east side streams flow east to the Deschutes River near Bend. The highest crest elevation is 3,158 m (10,358 ft) at the summit of the South Sister. Lowest elevations are near 600 m (2,000 ft) where the South Fork of the McKenzie River exits the Wilderness on the west boundary. This is about 500 m (1,600 ft) above the Willamette Valley at Eugene 70 km (40 mi) west.

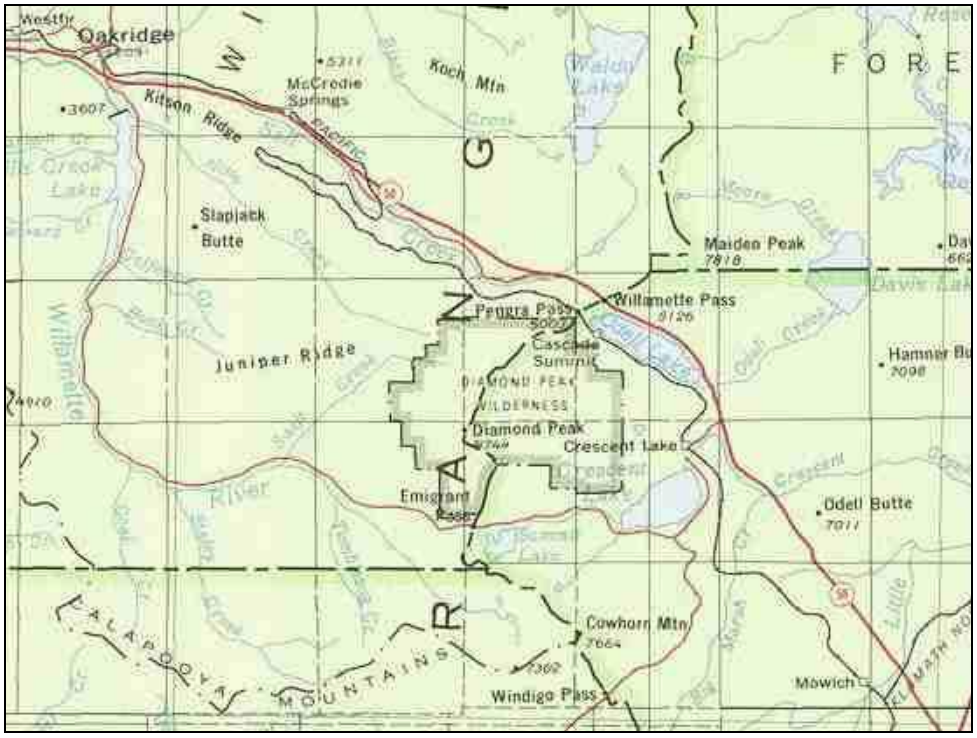
Figure 3.4-1 Map of Three Sisters Wilderness Area



3.5 Diamond Peak Wilderness Area

Figure 3.5-1 presents a map of the 52,337 acre Diamond Peak Wilderness Area, which straddles the Cascade Range 50 km (30 mi) north of Crater Lake National Park. The highest crest elevation in the Wilderness is 2,666 m (8,744 ft) at Diamond Peak, which is also the highest summit in this region of the Cascade Range. Lowest elevations are near 1,450 m (5,000 ft) where streams exit the Wilderness on the west side. On the east side the Wilderness is bordered by mountain lakes with elevations from 1,459 m to 1,693 m (4,786 to 5,553 ft). The area includes headwaters of the Middle Fork of the Willamette River that flows to the Willamette Valley near Eugene, elevation 100 m (300 ft) and 90 km (60 mi) distant. Wilderness elevations are thus some 1,400 m (4,600 ft) above the Willamette Valley floor. East of the Cascade crest, streams flow to the Deschutes River in eastern Oregon.

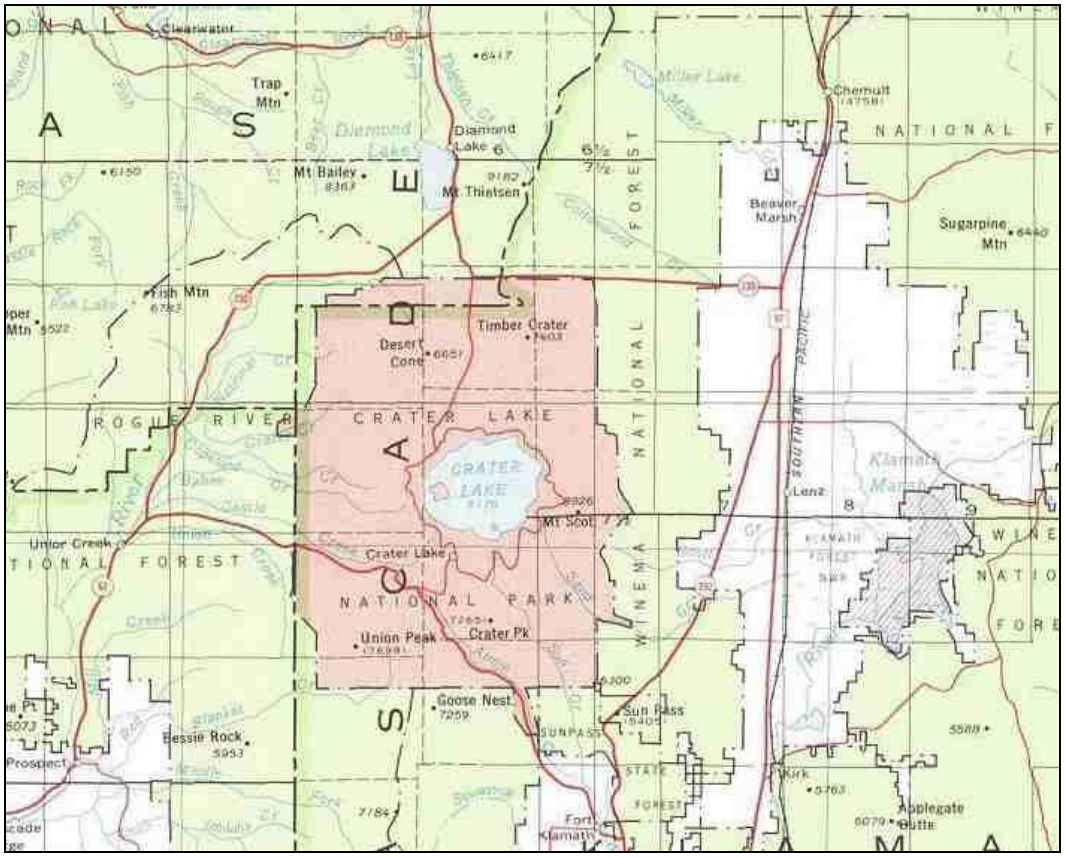
Figure 3.5-1 Map of Diamond Peak Wilderness Area



3.6 Crater Lake National Park

Figure 3.6-1 presents a map of Crater Lake National Park, the only national park in Oregon. The park was established on May 22, 1902, and now consists of 183,315 acres. It is located in southwestern Oregon on the crest of the Cascade Mountain range, 100 miles east of the Pacific Ocean. Rim elevations range from about 900 to 1,873 ft above lake level. The highest park elevation is 8,929 ft at the peak of Mt. Scott, in the eastern Park area. The National Park includes headwaters of the Rogue River that flows southwest towards the Medford/Grants Pass area, and Sun Creek/Wood River that flows southeast to the Klamath Falls area.

Figure 3.6-1 Map of Crater Lake NP



3.7 Mountain Lakes Wilderness Area

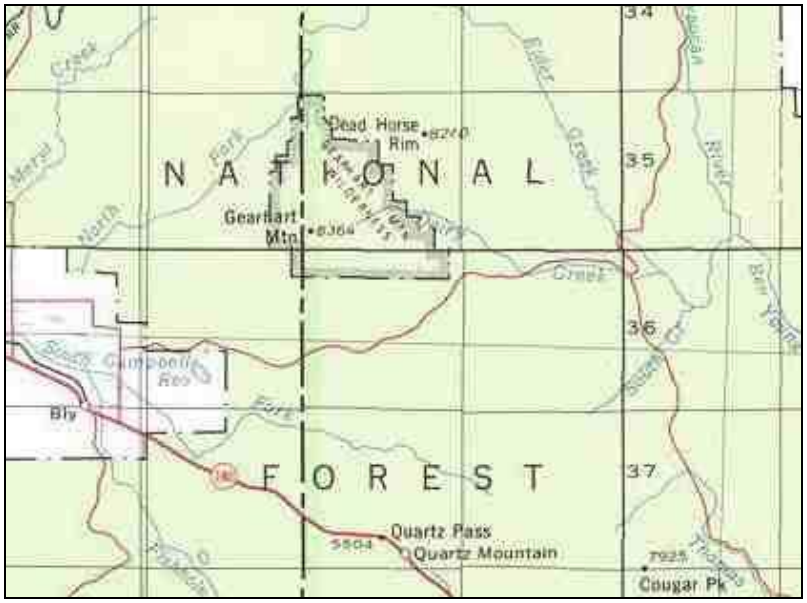
Figure 3.7-1 presents a map of the Mountain Lakes Wilderness Area, which is a relatively small Class 1 Area in southern Oregon of 23,071 acres, 50 km (30 mi) south of Crater Lake National Park. It consists of several peaks with a highest elevation of 2,502 m (8,208 ft) at the crest of Aspen Butte. Lowest elevations are near 1,500 m (5,000 ft). Primary drainages are Varney Creek and Moss Creek that flow into the Upper Klamath Lake, 3 km northeast of the Wilderness boundary.

Figure 3.7-1 Map of Mountain Lakes Wilderness Area

3.8 Gearhart Mountain Wilderness Area

Figure 3.8-1 presents a map of the Gearhart Mountain Wilderness Area, which comprises 22,809 acres on the flanks of Gearhart Mountain in south central Oregon, primarily the northern slope and eastern drainages of Gearhart Mountain, the dominant topographic feature. Elevations range from near 5,900 ft at the North Fork of the Sprague River in the northern Wilderness to 8,364 ft at the summit of Gearhart Mountain.

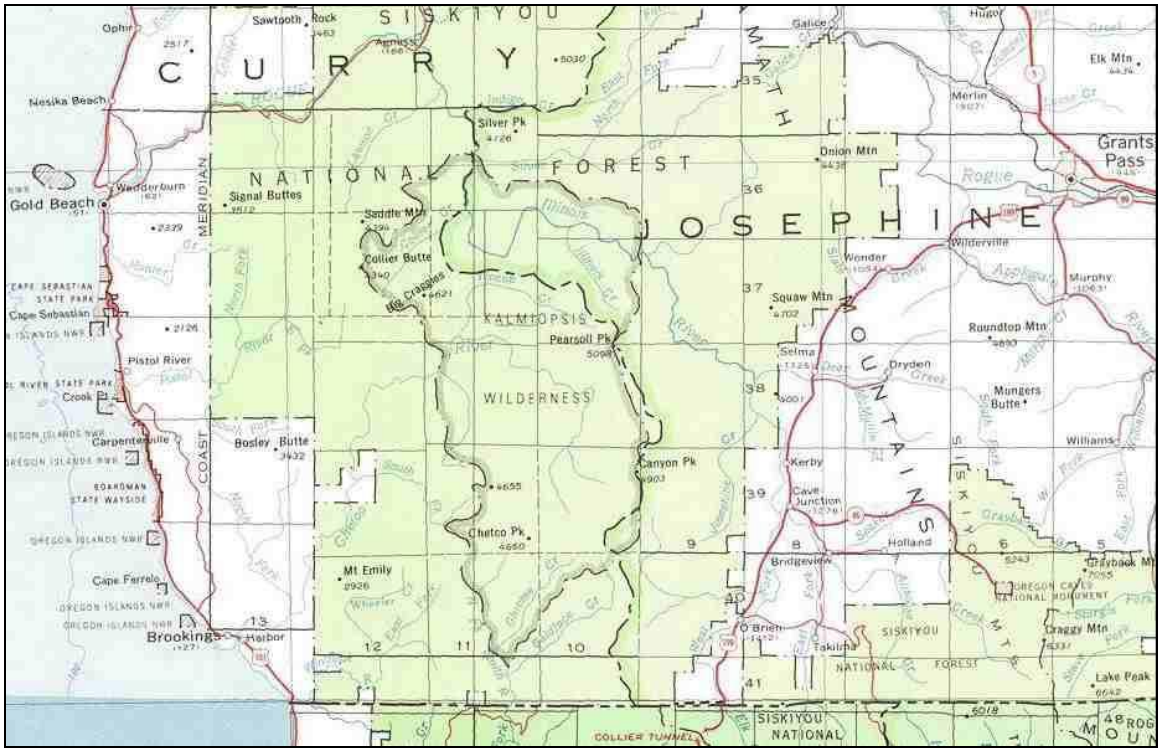
Figure 3.8-1 Map of Gearhart Mountain Wilderness Area



3.9 Kalmiopsis Wilderness Area

Figure 3.9-1 presents a map of the Kalmiopsis Wilderness Area, which currently spans a total of 179,700 acres and is managed by the U.S. Forest Service. The Kalmiopsis Wilderness is located in the Klamath Mountains of southwestern Oregon, part of the coastal temperate rainforest zone that lies between the Pacific Ocean and the east side of the coast ranges in northwestern U.S. and Canada. Its western boundary is 20 to 25 km (12 to 15 mi) from the coast. Its easternmost extent is about 40 km (25 mi) from the coast. Elevations range from about 300 m (900 ft) on the western boundary where the Chetco River exits the Wilderness towards the Pacific Ocean 25 to 30 miles further west, to 1,554 m (5,098 ft) on Pearsoll Peak on the eastern Wilderness boundary. Terrain is steep canyons and long broad ridges. The Wilderness is mostly west of the general crest of the coast range, thus exposed to precipitation caused by lifting of eastward moving maritime air, primarily during the winter. Precipitation ranges from 150 to 350 cm (60 to 140 in) annually, depending on elevation.

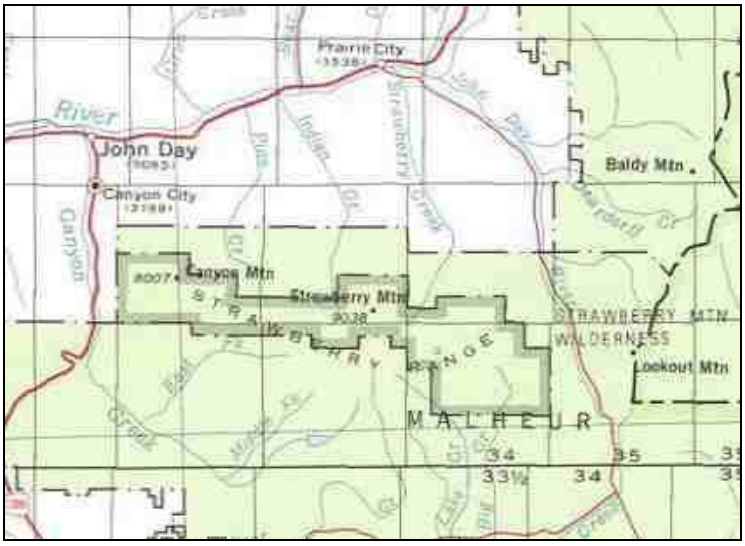
Figure 3.9-1 Map of Kalmiopsis Wilderness Area



3.10 Strawberry Mountain Wilderness Area

Figure 3.10-1 presents a map of the Strawberry Mountain Wilderness Area, which consists of 69,350 acres in eastern Oregon, just east of John Day. The Wilderness comprises most of the Strawberry Mountain Range. Terrain is rugged, with elevations ranging from 1,220 m (4,000 ft) to 2,755 m (9,038 ft) at the summit of Strawberry Mountain. It borders the upper John Day River valley to the north.

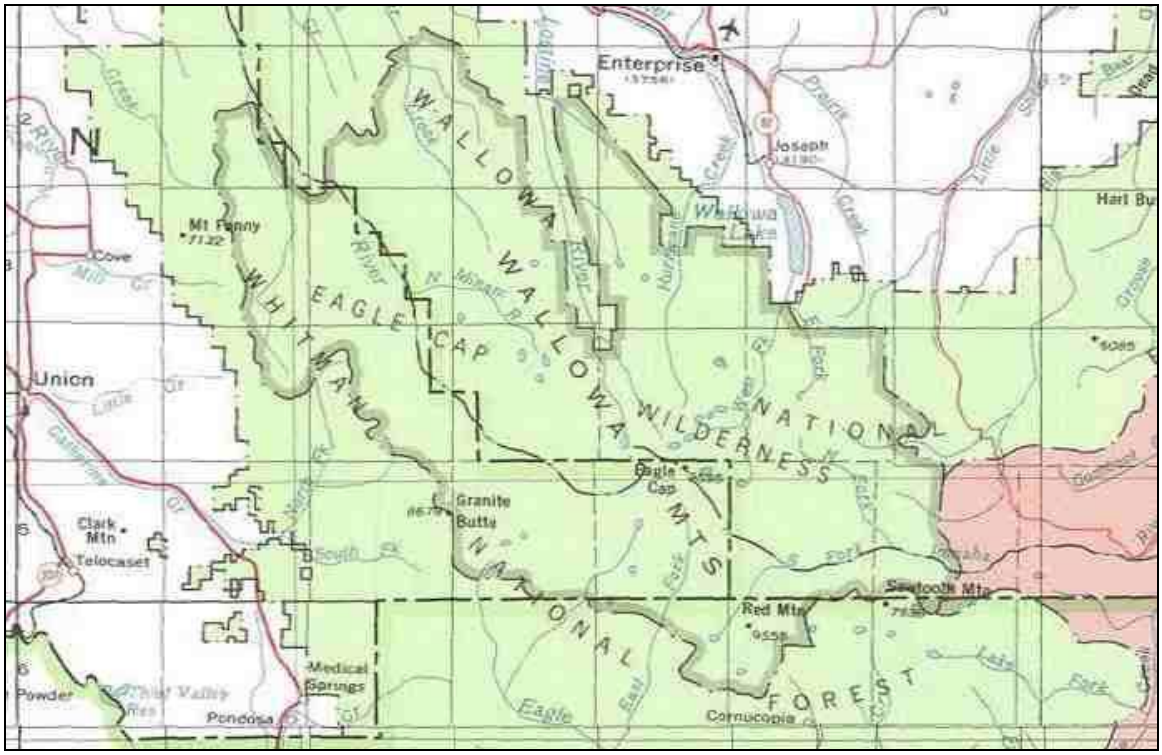
Figure 3.10-1 Map of Strawberry Mountain Wilderness Area



3.11 Eagle Cap Wilderness Area

Figure 3.11-1 presents a map of the Eagle Cap Wilderness Area, which comprises 360,275 acres in northeastern Oregon. Terrain is characterized by bare peaks and ridges and U-shaped glaciated valleys. Elevations range from 5,000 ft in lower valleys to near 10,000 ft at the highest mountain summits. The Lostine and Minam Rivers flow north from the center of the Wilderness towards Pendleton and the Columbia, 130 km northwest.

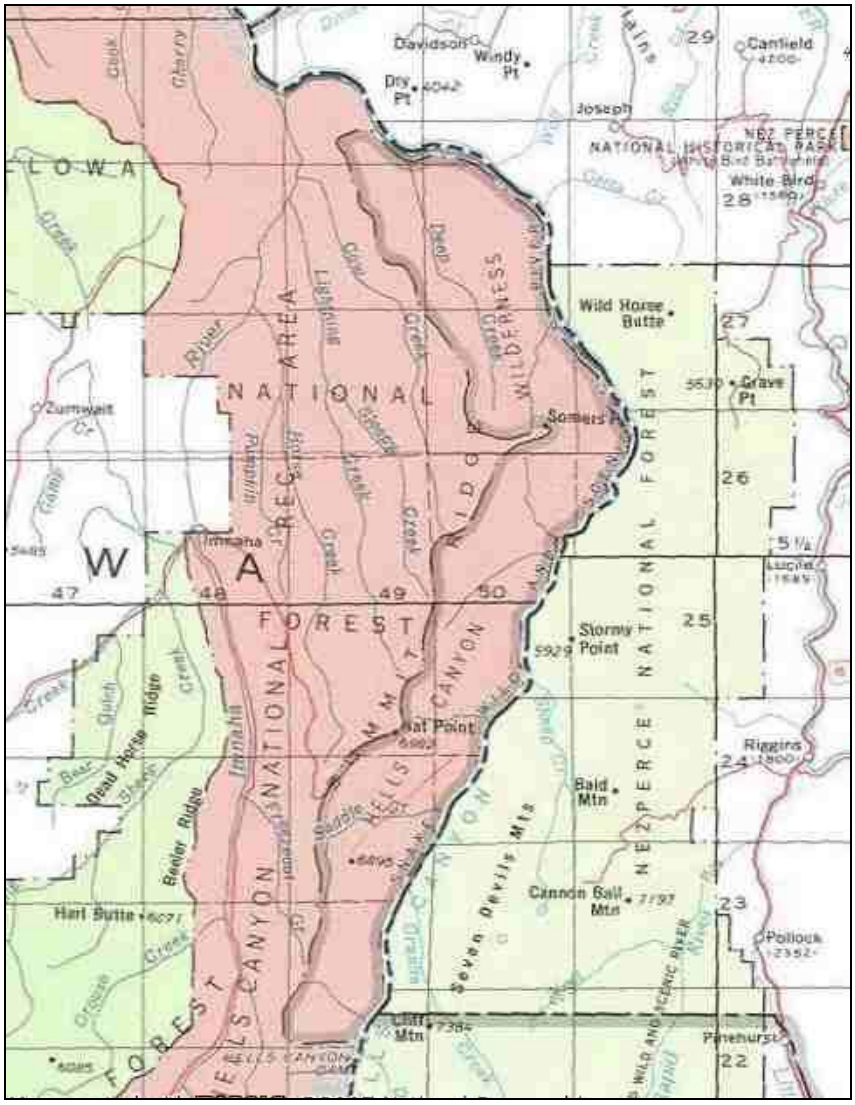
Figure 3.11-1 Map of Eagle Cap Wilderness Area



3.12 Hells Canyon Wilderness Area

Figure 3.12-1 a presents a map of the Hells Canyon Wilderness Area, which consists of 214,944 acres, and is located on the Oregon-Idaho border. The Snake River divides the wilderness, with 131,133 acres in Oregon, and 83,811 acres are in Idaho. It is managed by the Bureau of Land Management and the Forest Service. The Snake River canyon is the deepest river gorge in North America. The higher terrain is located on the Oregon side. Popular Oregon-side viewpoints are McGraw, Hat Point, and Somers Point.

Figure 3.12-1 Map of Hells Canyon Wilderness Area



CHAPTER 4: TECHNICAL INFORMATION AND DATA RELIED UPON IN THIS PLAN

This chapter describes the information relied upon by the Department in developing this regional haze plan. The first part of this chapter describes the Western Air Regional Partnership (WRAP) organization and work products relied upon by the Department. The second part describes the IMPROVE monitoring data and network that is used throughout the country by states in measuring Class I area visibility.

4.1 The WRAP and Technical Support

As described in Section 1.5.5 of this plan, the WRAP is a voluntary organization of western states, tribes and federal agencies. It was formed in 1997 as the successor to the Grand Canyon Visibility Transport Commission. It is a regional planning organization that provides assistance to western states like Oregon in the preparation of regional haze plans. The WRAP is also implementing regional planning processes to improve visibility in all Western Class I areas by providing the technical and policy tools needed by states and tribes to implement the federal regional haze rule. The WRAP is administered jointly by the Western Governors' Association (WGA) and the National Tribal Environmental Council (NTEC).

The WRAP is made up of western states, tribes and federal agencies. The states are Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. Tribal board members include Campo Band of Kumeyaay Indians, Confederated Salish and Kootenai Tribes, Cortina Indian Rancheria, Hopi Tribe, Hualapai Nation of the Grand Canyon, Native Village of Shungnak, Nez Perce Tribe, Northern Cheyenne Tribe, Pueblo of Acoma, Pueblo of San Felipe, and Shoshone-Bannock Tribes of Fort Hall. Representatives of other tribes participate on WRAP forums and committees. Participation is encouraged throughout the Western states and tribes. Federal participants are the Department of the Interior (National Park Service and Fish & Wildlife Service,) the Department of Agriculture (Forest Service), and the Environmental Protection Agency.

4.1.1 WRAP Committeeôs and Workgroups

1. Initiatives Oversight Committee
The Initiatives Oversight Committee is responsible for establishing and overseeing the work of forums that develop policies and programs to improve and protect our air quality. IOC forums are:

The Air Pollution Prevention Forum
The Air Pollution Prevention Forum is tasked with developing energy conservation initiatives and programs to expand the use of renewable energy sources. They are working to find, and encourage use of, energy sources that minimize air pollution.

The Economic Analysis Forum

This Forum assists with studies to evaluate the economic effects of air quality programs being developed by the WRAP to diminish haze throughout the West.

The Forum on Emissions In/Near Class 1 Areas
This Forum is looking at pollution sources in and near federally mandated Class 1 areas to determine their impact on visibility in those areas. The group also will address mitigation and outreach options.

The Mobile Sources Forum
This Forum addresses the impact of motor vehicles and other mobile sources of pollution. For example, the Forum developed a plan presented to the WRAP, suggesting a revision of U.S. Environmental Protection Agency rules regarding the production of low-sulfur fuel by small refineries. The Forum also recommended reforms for off-road emissions and diesel fuel.

2. Technical Oversight Committee
The Technical Oversight Committee manages technical issues and tasks are
establish and oversee the work of forums and work groups that are developing and analyzing, scientific information related to air quality planning in the West. TOC forums and work groups include:

The Air Quality Modeling Forum
This Forum identifies, evaluates the performance of, and applies mathematical air quality models, which can be used to quantify the benefits of various air quality programs for reducing haze in the western United States.

The Ambient Monitoring and Reporting Forum
This Forum oversees the collection, use, and reporting of ambient air quality and meteorological monitoring data as needed to further the WR

The Emissions Forum
This Forum is developing the first comprehensive inventory of haze-causing air emissions in the West, including a comprehensive emissions tracking and forecasting system. The forum also monitors trends in actual emissions and forecasts emissions reductions anticipated from current regulations and alternative control strategies.

Attribution of Haze Work Group
This Work Group is preparing guidance for states and tribes regarding both the types of pollution emitters and the regions in which pollutants contribute to visibility impairment in national parks and other Class 1 wilderness areas. Three state and three tribal representatives form the work group along with all members of the Technical Oversight Committee and one representative each from the Initiatives Oversight Committee, the technical and joint forums and the Tribal Data Development Work Group.

The Tribal Data Development Work Group
This Work Group is identifying gaps in air quality data for tribal lands and working with tribes to collect that data. While some tribes have adequate staff and equipment for such an undertaking, many lack the manpower and technical resources to accomplish the work on their own. This Work Group is providing help by both enhancing collect the necessary data and establishing an organized way to standardize and catalogue the information for subsequent analysis.

3. WRAP Working Committees and Forums

Implementation Work Group
The purpose of this work group is to bring together state and tribal staff involved in the development of regional haze plans, to meet the requirements of the Regional Haze Rule. This work group discusses the major strategies associated with state and tribal regional haze plans, issues associated with plan development and rule interpretation, and coordination and consultation between states, tribes, EPA, and the FLMs on these topics. State representatives on this work group are the primary regional haze plan writers.

Joint Technical and Policy Forums
Joint Forums address both technical issues and policy. Both the TOC and the IOC have oversight.

The Dust Emissions Joint Forum
This Forum is seeking first to improve the methods for estimating dust emissions and their inputs in air quality models. The Forum also is examining the extent of dust impacts and strategies to reduce dust emissions.

The Fire Emissions Joint Forum (FEJF)
The Grand Canyon Commission confirmed that forest fires contribute significantly to visibility problems and that the use of prescribed fire is expected to increase as a forest management tool. The Fire Emissions Joint Forum is developing measures to reduce the effects of prescribed fires and is examining emissions from all kinds of fire, whether ignited naturally or by humans. The Forum is considering public health and nuisance effects as well as visibility impacts. It will develop a tracking system for fire emissions and management techniques to minimize emissions. This Forum is working to coordinate with and gain the full cooperation of federal, tribal, state, and local agencies as well as private landowners, forest managers, and the agriculture community.

The Stationary Sources Joint Forum
The Stationary Sources Joint Forum, formerly the Market Trading Forum, developed the details of an emissions trading program to achieve cost-effective reductions from industrial sources of sulfur dioxide. The Forum first set emission milestones for sulfur dioxide between now and 2018 and then designed a trading program to be triggered if these emission targets are exceeded. The Forum is now examining other industrial source emissions, such as oxides of nitrogen and particulate matter, and is assisting WRAP members in compliance with the stationary source provisions of the regional haze rule.

4.1.2 WRAP TSS

The primary purpose of the TSS is to provide key summary analytical results and methods documentation for the required technical elements of the Regional Haze Rule, to support the preparation, completion, evaluation, and implementation of the regional haze implementation plans to improve visibility in Class I areas. The TSS provides technical results prepared using a regional approach, to include summaries and analysis of the comprehensive datasets used to identify the sources and regions contributing to regional haze in the Western Regional Air Partnership (WRAP) region.

The secondary purpose of the TSS is to be the one-stop-shop for access, visualization, analysis, and retrieval of the technical data and regional analytical results prepared by WRAP Forums and Workgroups in support of regional haze planning in the West. The TSS specifically summarizes results and consolidates information about air quality monitoring, meteorological and receptor modeling data analyses, emissions inventories and models, and gridded air quality/visibility regional modeling simulations. These copious and diverse data are integrated for application to air quality planning purposes by prioritizing and refining key information and results into explanatory tools.

Additional information on the TSS is provided in Appendix C.

4.2 IMPROVE Monitoring

4.2.1 Background on IMPROVE Monitoring

In the mid-1980's, an Interagency Monitoring of PROtected Visual Environments (IMPROVE) program was established to measure visibility impairment in mandatory Class I Federal areas throughout the United States. The monitoring sites are operated and maintained through a formal cooperative relationship between the EPA, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and U.S. Forest Service. In 1991, several additional organizations joined the effort: State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials, Western States Air Resources Council, Mid-Atlantic Regional Air Management Association, and Northeast States for Coordinated Air Use Management.

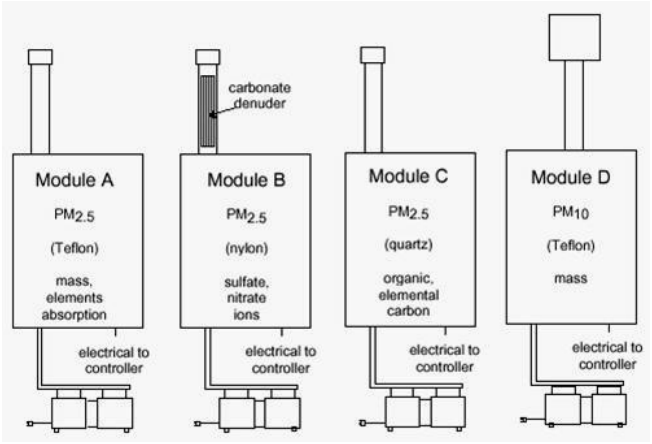
The objectives of the IMPROVE program include establishing the current visibility and aerosol conditions in mandatory Class I federal areas; identifying the chemical species and emission sources responsible for existing human-made visibility impairment; documenting long-term trends for assessing progress towards the national visibility goals; and support the requirements of the Regional Haze Rule by providing regional haze monitoring representing all visibility-protected federal Class I areas where practical.

Figure 4.2.1-1 shows a typical IMPROVE site, and Figure 4.2.1-2 shows the four separate modules used for sampling the different pollutant species.

Figure 4.2.1-1 Picture of an IMPROVE Monitoring Site

The IMPROVE sampler consists of four separate modules for measuring regional haze.

Figure 4.2.1-2 IMPROVE Sampler Modules



The data collected at the IMPROVE monitoring sites are used by land managers, industry planners, scientists, public interest groups, and air quality regulators to better understand and protect the visual air quality resource in Class I areas. Most importantly, the IMPROVE Program scientifically documents the visual air quality of their wilderness areas and national parks.

4.2.2 Formula for Reconstructed Light Extinction

The IMPROVE program has developed methods for estimating light extinction from speciated aerosol and relative humidity data. The three most common metrics used to describe visibility impairment are:

- **Extinction (b_{ext})** ï Extinction is a measure of the fraction of light lost per unit length along a sight path due to scattering and absorption by gases and particles, expressed in inverse Megameters (Mm^{-1}). This metric is useful for representing the contribution of each aerosol species to visibility impairment and can be practically thought of as the units of light lost in a million meter distance.
- **Visual Range (VR)** ï Visual range is the greatest distance a large black object can be seen on the horizon, expressed in kilometers (km) or miles (mi).
- **Deciview (dv)** ï This is the metric used for tracking regional haze in the RHR. The deciview index, was designed to be linear with respect to human perception of visibility. A one deciview change is approximately equivalent to a 10% change in extinction, whether visibility is good or poor. A one deciview change in visibility is generally considered to be the minimum change the average person can detect with the naked eye. See Section 5.3 for additional information.

The IMPROVE network estimates light extinction based upon the measured mass of various contributing aerosol species. EPAôs 2003 guidance for calcul the original protocol defined by the IMPROVE program in 1988. (For further information, see http://vista.cira.colostate.edu/improve/Publications/GuidanceDocs/guidancedocs.htm.) In December 2005, the IMPROVE Steering Committee voted to adopt a revised algorithm for use by IMPROVE as an alternative to the original approach.

The revised algorithm for estimating light extinction is calculated as recommended for use by the IMPROVE steering committee using the following equations:

$$
\begin{aligned}
b_{ext} \approx\ & 2.2 \times f_s(RH) \times [\text{Small Amm. Sulfate}] + 4.8 \times f_L(RH) \times [\text{Large Amm. Sulfate}] \\
& + 2.4 \times f_s(RH) \times [\text{Small Amm. Nitrate}] + 5.1 \times f_L(RH) \times [\text{Large Amm. Nitrate}] \\
& + 2.8 \times [\text{Small POM}] + 6.1 \times [\text{Large POM}] \\
& + 10 \times [EC] \\
& + 1 \times [\text{Soil}] \\
& + 1.7 \times f_{ss}(RH) \times [\text{Sea Salt}] \\
& + 0.6 \times [CM] \\
& + 0.33 \times [NO_2(ppb)] \\
& + \text{Rayleigh Scattering (Site Specific)}
\end{aligned}
$$

The revised algorithm splits ammonium sulfate, ammonium nitrate, and POM concentrations into small and large size fractions as follows:

$$\text{For } [\text{Total}] < 20 \text{ Mm}^{-1}: \begin{cases} [\text{Large}] = \dfrac{[\text{Total}]}{20} \times [\text{Total}] \\ [\text{Small}] = [\text{Total}] - [\text{Large}] \end{cases}$$

$$\text{For } [\text{Total}] \geq 20 \text{ Mm}^{-1}, [\text{Large}] = [\text{Total}]$$

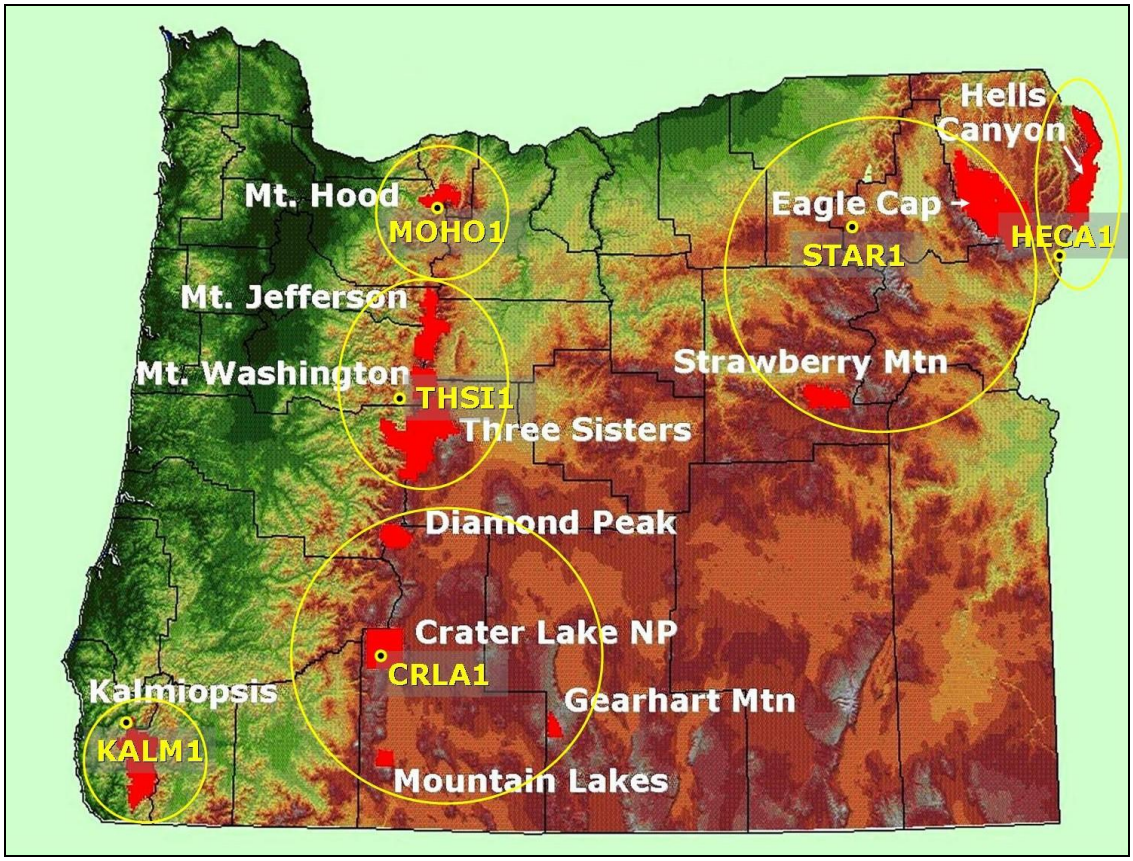
4.3 Oregon IMPROVE Monitoring Network

In Oregon there are six IMPROVE monitors that are listed under the site name in Table 4-3-1. Three are located in the Oregon Cascades, two in Eastern Oregon, and one in the Coast Range. Since there are 12 Class I areas in Oregon, some monitors serve multiple Class I areas. While it is desirable to have one monitor per Class I area, in some cases one monitor can be representative of nearby Class I areas. Figure 4-3-1 shows the location of the IMPROVE monitors and the Class I areas covered by each monitor, as indicated by the yellow circles.

Table 4.3-1 Oregon IMPROVE Monitoring Network

Site Code	Class I Area	Sponsor	Elevation MSL	Start Date
MOHO1	Mt. Hood Wilderness	USFS	1531 m (5022 ft)	3/7/2000
THSI1	Mt. Jefferson Wilderness Mt. Washington Wilderness Three Sisters Wilderness	USFS	885 m (2903 ft)	7/24/1993
CRLA1	Crater Lake National Park; Diamond Peak Wilderness Mountain Lakes Wilderness Gearhart Mountain Wilderness	NPS	1996 m (6548 ft)	3/2/1988
KALM1	Kalmiopsis Wilderness	USFS	80 m (262 ft)	3/7/2000
STAR1	Strawberry Mountain Wilderness Eagle Cap Wilderness	USFS	1259 m (4130 ft)	3/7/2000
HECA1	Hells Canyon Wilderness Area	USFS	655 m (2148 ft)	8/1/2000

Figure 4.3-1 Map of Oregon IMPROVE Sites



4.3.1 MOHO1

The MOHO1 IMPROVE site is the monitor for the Mt. Hood Wilderness Area. It is located just south of the wilderness boundary near Government Camp, at an elevation of 5,022 feet.

4.3.2 THSI1

The THSI1 IMPROVE site is the monitor for the Mt Washington, Three Sisters, and Mt Jefferson Wilderness Areas. It is located 5 miles to the west of Mt Washington, 12 miles southwest of Mt Jefferson, and 10 miles northwest of Three Sisters, at an elevation of 2,903 feet.

4.3.3 CRLA1

The CRLA1 IMPROVE site is the monitor for Crater Lake National Park, and is used as the representative site for Diamond Peak, Mountain Lakes, and Gearhart Mountain Wilderness Areas. It is located at the Park Headquarters in the park, to the south of the crater rim, at an elevation of 6,548 feet. The CRLA1 site is located 40 miles to the south of Diamond Peak, 35 miles to the north of Mountain Lakes, and 70 miles to the northeast of Gearhart Mountain.

4.3.4 KALM1

The KALM1 IMPROVE site is the monitor for the Kalmiopsis Wilderness Area. It is located 6 miles north of the wilderness boundary near where the Illinois River merges with the Rogue River, at an elevation of 262 feet.

4.3.5 STAR1

The STAR1 IMPROVE site is the representative monitoring site for the Strawberry Mountain and Eagle Cap Wilderness Areas. It is located 60 miles north of the Strawberry Mountain Wilderness, and 40 miles west of the Eagle Cap Wilderness, at an elevation of 4,130 feet.

4.3.6 HECA1

The HECA1 IMPROVE site is the monitor for the Hells Canyon Wilderness Area. It is located 10 miles south of the wilderness boundary, at an elevation of 2,148 feet.

4.4 Oregon Regional Haze Monitoring Commitments

Under Section 51.308(d)(4) of the Regional Haze Rule, the State must submit with the implementation plan a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment that is representative of all mandatory Class I Federal areas within the State. This monitoring strategy must be coordinated with the monitoring strategy required in Section 51.305 for reasonably attributable visibility impairment.

The State of Oregon has committed to continue utilizing the IMPROVE monitoring program to track reasonable progress over time. Also, Oregon will continue to develop and update emission inventories sufficient to allow for the tracking of emission increases or decreases attributable to adopted strategies or other factors such as growth, economic downturn, or voluntary or permit related issues. These monitoring and emissions data will be available for electronic processing in future modeling or other emission tracking processes. Information collected from the monitoring system and emission inventory work will be made available to the public on a periodic basis.

Oregon will rely upon WRAP technical support to meet its commitment to conduct the analyses necessary to meet the requirements of Section 51.308(d)(4).

Oregon will rely on the IMPROVE program to collect and report aerosol monitoring data for long-term reasonable progress tracking as specified in the Regional Haze Rule. Since this rule is a long-term tracking program with an implementation period over 60 years, Oregon expects that the IMPROVE program will provide data based on the following goals:

1) Maintain a stable configuration of the individual monitors and sampling sites, and stability in network operations for the purpose of continuity in tracking reasonable progress trends;
2) Assure sufficient data capture at each site of all visibility-impairing species;

3) Comply with EPA quality control and assurance requirements; and
4) Prepare and disseminate periodic reports on IMPROVE program operations.

Oregon is relying on the IMPROVE program to meet these monitoring operation and data collection goals, with the fundamental assumption that network data collection operations will not change, or if changed, will remain directly comparable to those operated by the IMPROVE program during the 2000-04 baseline period. Technical analyses and reasonable progress goals in this implementation plan for Regional Haze are based on data from these sites. As such, Oregon asks that the IMPROVE program identify potential issues affecting regional haze rule implementation trends and notify the State before changes in the IMPROVE program affecting a regional haze tracking site are made.

Further, Oregon notes that the human resources to operate these monitors are provided by Federal Land Management agencies. Beyond that in-kind contribution, resources for operation and sample analysis of a complete and representative monitoring network of these sites by the IMPROVE program in the WRAP region are a collaborative responsibility of members of the WRAP (EPA, states, tribes, and FLMs) and the IMPROVE program steering committee. Oregon will collaborate with the EPA, FLMs, other states, tribes, and the IMPROVE committee to assure adequate and representative data collection and reporting by the IMPROVE program.

Oregon depends on the following IMPROVE program-operated monitors at the following sites for tracking RHR reasonable progress:

Oregon IMPROVE Monitoring Sites: CRLA1, HECA1, KALM1, MOHO1, STAR1, THSI1	
Oregon Class I Areas covered by this network	Crater Lake NP, OR: Diamond Peak W, OR: Gearhart Mountain W, OR: Mountain Lakes W, OR; Class I Area - Hells Canyon W, ID; Class I Area - Kalmiopsis W, OR; Class I Area - Mount Hood W, OR; Class I Areas - Eagle Cap W, OR: Strawberry Mountain W, OR; Class I Areas - Mount Jefferson W, OR: Mount Washington W, OR: Three Sisters W, OR

Oregon will use data reported by the IMPROVE program as part of the regional technical support analysis tools found at the Visibility Information Exchange Web System (VIEWS) and the Technical Support System (TSS), as well as other analysis tools and efforts sponsored by the WRAP. Oregon will participate in the ongoing regional analysis activities of the WRAP to collectively assess and verify the progress toward reasonable progress goals, also supporting interstate consultation as the rule is implemented, and collaborate with WRAP members (EPA, states, tribes, and FLMs) to ensure the continued operation of these technical support analysis tools and systems. Oregon may conduct additional analyses as needed.

Oregon will depend on the routine timely reporting of haze monitoring data by the IMPROVE program for the reasonable progress tracking sites to the EPA air quality data system, VIEWS, and TSS. Oregon will collaborate with WRAP members (EPA, states, tribes, and FLMs) to ensure the continued operation of these technical support analysis tools and systems.

Oregon has prepared a statewide inventory of emissions that can reasonably be expected to cause or contribute to visibility impairment in Federal Class I Areas. Chapter 8, Section 8.1 of this plan summarizes Oregon emissions by pollutant and source category.

Oregon commits to updating statewide emissions periodically. The updates will be used for state tracking of emission changes, trends, and input into the WRAP's evaluation of reasonable progress goals are being achieved and other regional analyses. The inventories will be updated every three years on the same schedule as the every three-year reporting required by EPA's Consolidated Emissions Reporting Rule.

As a member of the WRAP, the state will continue to use the WRAP-sponsored Emissions Data Management System (EDMS) and Fire Emissions Tracking System (FETS) to store and access emission inventory data for the region. Oregon will also depend upon and participate in additional periodic collective emissions inventory efforts by the WRAP. Further, Oregon will continue to depend on and use the capabilities of the WRAP sponsored Regional Modeling Center (RMC) to simulate the air quality impacts of emissions for haze and other related air quality planning purposes. Oregon will collaborate with WRAP members (EPA, states, tribes, and FLMs) to ensure the continued operation of these technical support analysis tools and systems.

Oregon will track data related to regional haze plan implementation for sources for which the state has regulatory authority, and will depend on the IMPROVE program and WRAP-sponsored collection and analysis efforts and data support systems for monitoring and emissions inventory data, respectively. To ensure the availability of data and analyses to report on visibility conditions and progress toward Class I area visibility goals, Oregon will collaborate with WRAP members (EPA, states, tribes, and FLMs) to ensure the continued operation of the IMPROVE program and the WRAP-sponsored technical support analysis tools and systems.

CHAPTER 5: BASIC PLAN ELEMENTS

In order to better understand the information presented in the document, this chapter describes the basic plan elements and key concepts contained in the Oregon Regional Haze Plan.

5.1 Natural Sources of Visibility Impairment

Natural sources of visibility impairment include anything not directly attributed to human-caused emissions of visibility-impairing pollutants. Natural events (e.g. windblown dust, wildfire, volcanic activity, biogenic emissions) also introduce pollutants that contribute to haze in the atmosphere. Specific natural events can lead to high short-term concentrations of visibility-impairing particulate matter and its precursors. Therefore, natural visibility conditions, for the purpose of the Oregon regional haze program, are represented by a long-term average of conditions expected to occur in the absence of emissions normally attributed to human activities. Natural visibility conditions reflect contemporary vegetated landscape, land-use patterns, and meteorological/climatic conditions.

Natural sources, particularly wildfire and windblown dust, can be major contributors to visibility impairment. However, these emissions cannot be realistically controlled or prevented by the states, and therefore the focus of the regional haze strategies in this document are on human-caused (anthropogenic) sources, as described below. While current methods of analysis of monitoring data do not provide a clear distinction between natural and anthropogenic emissions, certain pollutant species, such as sulfur dioxide (SO_2) and nitrogen oxide (NO_x) are more representative of anthropogenic sources, while organic carbon (OC) and coarse particulate matter (PM_{10}) are more representative of natural sources such as wildfire and dust, respectively.

5.2 Human-Caused Sources of Visibility Impairment

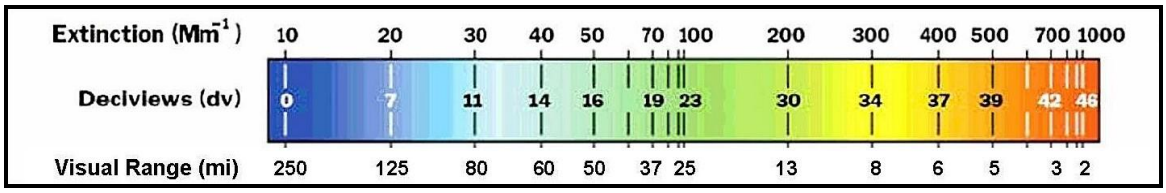
Anthropogenic or human-caused sources of visibility impairment include anything directly attributable to human-caused activities that produce emissions of visibility-impairing pollutants. Some examples include industry, transportation, agriculture activities, home heating, and managed outdoor burning. Anthropogenic sources can be local, regional, or international. Efforts to regulate anthropogenic emissions are mostly limited to inside the United States. Emissions from Mexico & Canada, and off-shore marine shipping emissions in the Pacific Ocean, are examples of anthropogenic sources that contribute to visibility impairment in Oregon, but like natural sources, beyond the scope of this planning document.[2]

5.3 Deciview Measurement

Each IMPROVE monitor collects particulate concentration data which are converted into reconstructed light extinction through a complex calculation using the IMPROVE equation (see Technical Support Documents for any Class I area). Reconstructed light extinction (denoted as

[2] As described in Chapter 9 and elsewhere in this document, international emissions from Canada, as well as offshore marine vessels, are major contributors to regional haze in Oregon.

bext) is expressed in units of inverse megameters (1/Mm or Mm-1). The Regional Haze Rule requires the tracking of visibility conditions in terms of the Haze Index (HI) metric expressed in the deciview (dv) unit (40 CFR 51.308(d)(2)). Generally, a one deciview change in the haze index is considered a humanly perceptible change under ideal conditions, regardless of background visibility conditions. The relationship between extinction (Mm-1), haze index (dv) and visual range (mi) are indicated by the following scale:



5.4 Baseline and Current Conditions

The Regional Haze Rule requires the calculation of baseline conditions for each Class I area. Baseline conditions are defined as the five year average (annual values for 2000 - 2004) of IMPROVE monitoring data (expressed in deciviews) for the most-impaired (20% worst) days and the least-impaired (20% best) days. For this first regional haze plan submittal, the baseline conditions are the reference point against which visibility improvement is tracked. For future plan progress reports and updates, baseline conditions are used to calculate progress from the beginning of the regional haze program. Current conditions for the best and worst days are calculated from a multiyear average, based on the most recent 5-years of monitored data available. This value will be revised at the time of each periodic plan revision, and will be used to illustrate: (1) The amount of progress made since the last plan revision, and (2) the amount of progress made from the baseline period of the program.

5.5 Natural Conditions

The visibility that would exist under natural conditions (absent any man-made impairment) would vary based on the contribution of natural sources and meteorological conditions on a given day. For that reason, natural conditions, as defined in this document, consists of a level of visibility (in deciviews) for both the most-impaired (20% worst) days and the least-impaired (20 % best) days. Since no visibility monitoring data exists from the pre-manmade impairment period, these estimates of natural conditions are based on EPA guidance on how to estimate natural conditions (EPA Document: *Guidance for Estimate Natural Visibility Conditions under the Regional Haze Rule*).

5.6 Reasonable Progress Goals

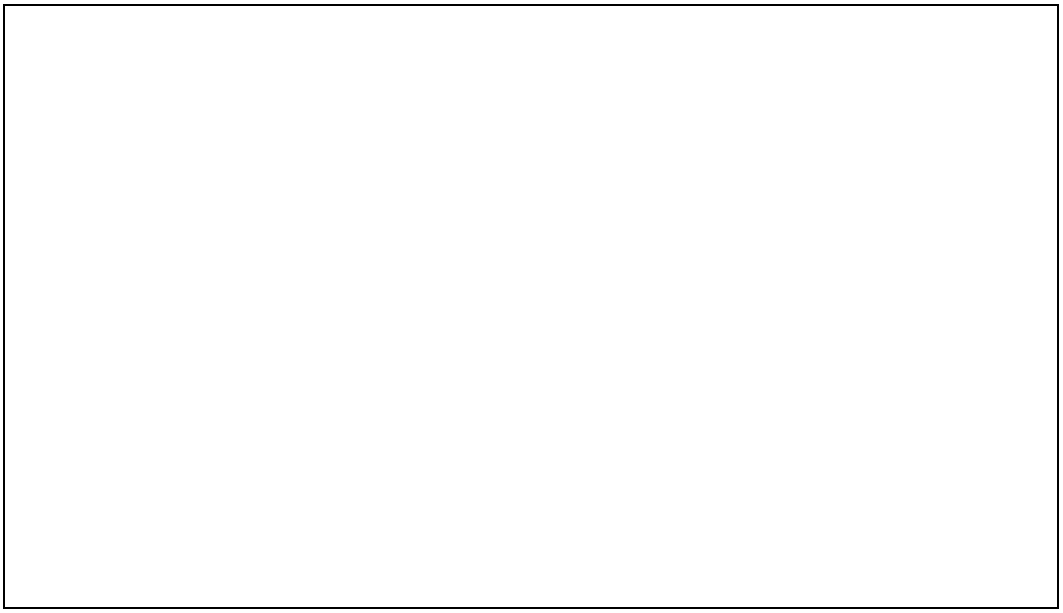
For each Class I area the State must establish goals (measured in deciviews) that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals (RPG) are interim goals that represent incremental visibility improvement over time for the most-impaired (20% worst) days and no degradation in visibility for the least-impaired (20% best) days. The first regional haze plan that States must submit to EPA needs to include RPGs for the year 2018, also known as the ñ2

establishing different RPGs for each Class I area. In establishing the RPG, the State must consider four factors: the costs of compliance; the time necessary for compliance; the energy and non-air quality environmental impacts of compliance; and the remaining useful life of any potentially affected sources. States must demonstrate how these factors were taken into consideration in selecting the goal for each Class I area.

5.7 Uniform Rate of Progress

The uniform rate of progress (URP) is the calculation of the slope of the line between baseline visibility conditions and natural visibility conditions over the 60-year period. For the first regional haze plan, the first benchmark is the deciview level that should be achieved in 2018, as indicated in blue below as the first planning period (Figure 5.7-1). This is 2018 Milestone, and applies to both the 20% worst days and the 20% best days.

Figure 5.7-1 Example of How Uniform Rate of Progress is Determined



- Compare baseline conditions to natural conditions. The difference between these two represents the amount of progress needed to reach natural visibility conditions. In this example, the State has determined that the baseline for the 20 percent worst days for the Class I area is 29 dv and estimated that natural background is 11 dv, a difference of 18 dv.

- Calculate the annual average visibility improvement needed to reach natural conditions by 2064 by dividing the total amount of improvement needed by 60 years (the period between 2004 and 2064). In this example, this value is 0.3 dv/yr.

- Multiply the annual average visibility improvement needed by the number of years in the first planning period (the period from 2004 until 2018). In this example, this value is 4.2 dv. This is the uniform rate of progress that would be needed during the first planning period to attain natural visibility conditions by 2064.