Chapter 9 Reasonable Progress Goals for Washington's Class I Areas

This chapter sets Reasonable Progress Goals first for the Most Impaired Days at all of the state's mandatory Class I Areas and then for the Least Impaired Days. The Reasonable Progress Goals are summarized at the end of the chapter.

9.1 Introduction

The Regional Haze Rule (RHR) requires Washington to establish Reasonable Progress Goals (expressed in deciviews) for the 8 mandatory Class I Areas within the state. The Reasonable Progress Goals are meant to provide for an improvement in visibility on the Most Impaired Days and ensure no degradation in visibility on the Least Impaired Days.

In the establishment of Reasonable Progress Goals, the RHR requires Washington to consider both the uniform rate of progress needed to attain natural conditions by 2064 and the four factors required by the Clean Air Act (CAA) to determine Reasonable Progress. These four statutory factors are costs of compliance, the time necessary for compliance, energy and non-air impacts of compliance, and the remaining useful life of any potentially affected sources.[1]

Ecology's evaluation of Reasonable Progress Goals relies on technical data and analysis developed by the Western Regional Air Partnership (WRAP) and available through the WRAP's Technical Support System (TSS). The source apportionment analyses discussed in Chapter 8 and the Class I Area Summary Table for each mandatory Class I Area were especially helpful. Class I Area Summary Tables for Washington's mandatory Class I Areas are reproduced in Appendix E. The TSS may be accessed through http://vista.cira.colostate.edu/tss/.

9.2 Most Impaired Days

9.2.1 Olympic National Park

Establishing the Reasonable Progress Goal involves the determination of baseline and projected visibility, examination of the progress that has been made in reducing visibility impairing pollutants, and consideration of the four statutory factors.

Baseline and Projected Visibility

Visibility conditions at Olympic National Park are monitored at the Intragency Monitoring of Protected Visual Environments (IMPROVE) site OLYM1. The monitored 2000-2004 baseline conditions at this site on the Most Impaired Days are 16.74 Deciview (dv) and calculated natural conditions are 8.44 dv, a difference of 8.30 dv.

[1] CAA §169A(g)(1)

This foundational State Implementation Plan (SIP) covers the first control period, 2005-2018. WRAP modeling (2018 Preliminary Reasonable Progress a, referred to as "PRP18a") projects 2018 visibility of 16.38 dv, which is a visibility improvement of 0.36 dv. If uniform progress were made on achieving natural conditions by 2064, visibility would be improved 1.93 dv to 14.81 dv by 2018, a 23% improvement in visibility. Because the anticipated rate of progress is slower than the uniform rate of progress, more analysis is required to determine the Reasonable Progress Goal for Olympic National Park.

Progress in Reducing Visibility Impairing Pollutants

As discussed in Chapter 7, WRAP's PRP18a modeling reflects "controls on the books" and visibility improvements from some, but not all, Best Available Retrofit Technology (BART) sources throughout the West.

Controls on the books are existing legally adopted controls that will reduce visibility impairing pollutants during the first control period 2005-2018. Prominent examples are large reductions in Washington's emissions of Sulfur Dioxide (SO_2) (95%) and Nitrogen Oxides (NO_x) (64%) from on-road and off-road mobile sources between the 2000-2004 baseline and the 2018 projection resulting from engine and fuel rules.

WRAP's PRP18a modeling incorporated only limited impacts of BART because states were still working on draft BART determinations when WRAP finalized the PRP18a inventory. The PRP18a inventory includes presumptive SO_2 limits for Electrical Generating Units (EGUs) but uses actual limits where BART is already effective. In 2003 the Environmental Protection Agency (EPA) determined BART for SO_2 and particulate matter for Washington's only coal-fired power plant as part of EPA's approval of the 1999 update to the state's Reasonably Attributable Visibility Impairment (RAVI) SIP. This BART determination is reflected in the PRP18a inventory. The 2000-2004 baseline inventories reflect partial control conditions at the power plant.

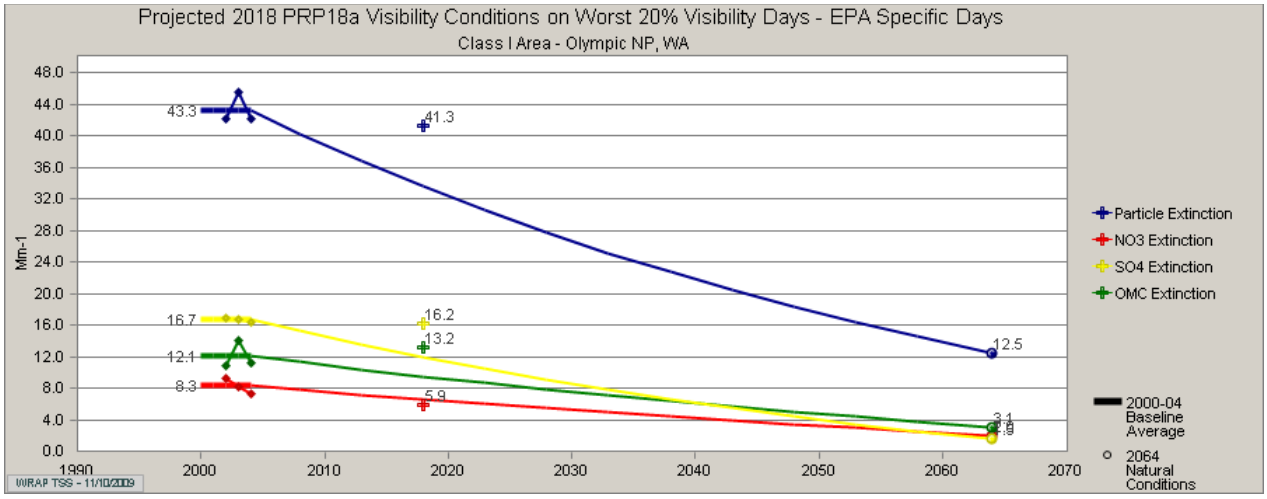

Figure 9-1 Projected 2018 Visibility Conditions on the Most Impaired Days in Olympic National Park

Ecology analyzed projected visibility impacts of sulfate, Organic Mass Carbon (OMC), and nitrate at OLYM1 to characterize progress in reducing visibility impairing pollutants (see Figure 9-1). At OLYM1 these three visibility-impairing pollutants plus Rayleigh scattering were responsible for 88% of the total light extinction for the Most Impaired Days during the 2000-2004 baseline period.

Sulfate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for sulfate from 16.67 to 16.24 Inverse Megameters (Mm^{-1}), a visibility improvement of 0.43 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for sulfate of 11.93 Mm^{-1}.

Statewide emissions of SO_2 are projected to decline almost 40% between the 2000-2004 baseline period and 2018. Basically this decline results from a 29% reduction in point source emissions and a 95% reduction in on-road and off-road mobile source emissions. The mobile source reduction reflects the removal of sulfur from on-road and off-road fuels.

WRAP's Weighted Emissions Potential (WEP) analysis of upwind emissions indicates only a 14% decrease in the upwind direction (see Appendix E for the Olympic National Park Summary Table). While the statewide emissions decrease should be more than sufficient to support the 23% decrease in dv needed to meet the uniform glide path, the upwind emissions decrease is insufficient. This is not surprising as WRAP's Particulate Matter Source Apportionment Technology (PSAT) analysis for 2018 indicates that in order of importance, outside domain, Canada, and Pacific offshore contribute about two-thirds of the sulfate concentrations on the Most Impaired Days at OLYM1. These three regions are outside the control of the state of Washington.

Organic Matter Carbon: WRAP's PRP18a modeling projects an increase in the extinction coefficient for OMC from 12.06 to 13.23 Mm^{-1}, a visibility degradation of 1.17 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for OMC of 9.51 Mm^{-1}.

OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of Volatile Organic Compounds (VOCs). The formation of OMC from VOC**s** depends not only on the total amount of emissions but on the reactivity of individual VOCs and favorable ambient conditions for condensation or photo-oxidation. Washington's VOC emission inventory is much larger than the organic carbon (primary organic aerosol) inventory. Plan02d totals are 1,042,867 and 50,273 tons per year, respectively (see Chapter 6).

The only source apportionment analysis available for OMC is the WEP analysis developed by the WRAP for primary organic aerosols. Statewide emissions of organic carbon presented in section 6.4 are projected to increase by 4% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis projects a much greater increase human-caused weighted emissions of 22% in the upwind direction (see Appendix E for the Olympic National Park Summary Tables).

The WEP analysis indicates the projected increase is primarily from area sources. The increase results from population growth.

Emission inventories presented in section 6.3 indicate that while total VOC emissions are projected to decrease by 1% between the 2000-2004 baseline period and 2018, area sources of VOCs increase by 67%. Area sources are the largest human-generated source category of VOCs in 2018. Area source VOCs are dominated by emissions from solvent utilization and residential wood combustion. These emissions increase due to population growth.

Emissions increases in area sources do not mean that these sources are not controlled. It simply means that that there are more individual sources comprising the area sources as a result of population increase. Briefly the situation is as follows:

- *Solvent utilization:* All types of solvent utilization are regulated through federal and state rules.

- *Residential wood combustion:* Washington has a more stringent woodstove emission standard than EPA. The standard is applicable to all stoves sold in the state. When funding is available, the state and local air agencies have implemented and continue to implement woodstove change-out programs to replace older wood stoves with new, cleaner burning stoves or alternative heating sources.

  Washington law provides for mandatory curtailment of woodstove use when forecast meteorological conditions are predicted to cause the Fine Particulate Matter ($PM_{2.5}$) standard to be exceeded (RCW 70.94.473). The law has been strengthened as Particulate Matter (PM) standards have become more stringent. The latest changes to the woodstove burn-ban program went into effect in 2008.

Nitrate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for nitrate from 8.3 to 5.91 Mm^{-1}, a visibility improvement of 4.39 Mm^{-1}. Adherence to the uniform glide path would result in a higher 2018 extinction coefficient for nitrate of 6.60 Mm^{-1}.

Statewide emissions of nitrate are projected to decrease by 46% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates a similar decrease in weighted emissions of 42% in the upwind direction (see Appendix E for the Olympic National Park Summary Tables). The reductions are due primarily to a projected large decrease in nitrate emissions from on-road and off-road mobile sources. Even with this large reduction of nitrate emissions within Washington, WRAP's PSAT analysis indicates that over half the nitrate impact on OLYM1 comes, in order of importance, from Canada, Pacific offshore, and outside domain.

Summary: Ecology concludes from this analysis that progress is being made in reducing visibility impairing pollutants impacting Olympic National Park. The question still remains, is this progress reasonable? Ecology relied on a four-factor analysis to address this issue.

Four-Factor Analysis

The RHR specifies that a state must consider the four factors specified by the Clean Air Act in determining the Reasonable Progress Goal for a Class I Area. These four statutory factors are

- Costs of compliance
- Time necessary for compliance
- Energy and non-air quality impacts of compliance
- Remaining useful life of any potentially affected sources

Ecology decided to develop a set of Four-Factor Analyses for point sources of SO_2 and NO_x for the 8 mandatory Class I Areas in Washington to meet this requirement. The work done by Ecology on the Four-Factor Analyses is summarized here and described in Appendix F.

The purpose of a Four-Factor Analysis is to evaluate a source or source category for potential controls. Ecology focused its examination of potential sources for Four-Factor Analysis on the PRP18a inventory, which reflects the implementation of controls during the first regional haze planning period.

IMPROVE monitoring shows that Ammonium Sulfate (SO_4) and Ammonium Nitrate (NO_3) are two of the most significant pollutants impairing visibility in Washington's mandatory Class I Areas. The WRAP projects that Washington's share of visibility impairment from each will remain significant in 2018 and largely anthropogenic in origin. SO_4 is attributable largely to point sources with a relatively minor contribution from area and mobile sources. NO_3 is attributable largely to mobile and point sources with a relatively unimportant contribution from area sources. The relative importance of point sources results in part from the significant reduction in NO_x from mobile sources by 2018 due to engine rules. So Ecology decided to turn its focus to NO_x reductions from point sources.

Ecology examined projected 2018 SO_2 and NO_x emissions from specific industries and emission source categories as defined by Standard Classification Codes (SCCs). SO_2 and NO_x are precursors of SO_4 and NO_3, respectively. As a first step, Ecology identified the major category SSCs projected to have the highest 2018 emissions of SO_2 and NO_x. The resulting 3 major source categories are industrial processes, external combustion boilers, and internal combustion engines. Emissions of both SO_2 and NO_x from individual specific industries and emission source categories within these 3 major categories vary greatly.

Ecology decided to consider any specific industry or emissions source category emitting 1,000 tons or more per year of either SO_2 or NO_x as "significant". Ecology deemed some of the resulting 15 specific industries and emission source categories as better prospective opportunities for emission reductions to improve visibility than others. This conclusion was based in part on BART determinations on individual sources subject to BART in some of the specific industries and emission source categories. Ecology decided to focus its four-factor analyses on the resulting set of 10 specific industries and emission source categories. The final list selected for four factor analyses is provided in Table 9-1.

Table 9-1 Specific Industries or Emission Source Categories Selected for a Four-Factor Analysis

Specific Industry or Emission Source Category	Significant Specific SO_2 Industry or Emissions Source Category?	Significant Specific NO_x Industry or Emissions Source Category?
Industrial Processes		
Primary Metal Production		
Aluminum Ore Electro-Reduction	Yes	No
Petroleum Industry		
Process Heaters	Yes	Yes
Catalytic Cracking Units	Yes	Yes
Pulp and Paper and Wood Products		
Sulfate (Kraft) Pulping	Yes	Yes
Sulfite Pulping	No	Yes
Mineral Products		
Cement (Wet Process)	Yes	Yes
Cement (Dry Process)	No	Yes
Glass Manufacture	No	Yes
External Combustion Boilers		
Industrial		
Wood/Bark Waste	Yes	Yes
Residual Oil	Yes	No
Natural Gas	No	Yes

Ecology developed a single set of four-factor analyses for Washington's 8 mandatory Class I Areas. Basically the individual sources in the 11 selected specific industries and emission source categories are located along the Interstate 5 (I-5) corridor in western Washington and are capable of contributing to visibility impairment at more than one mandatory Class I Areas. I-5 runs in an essentially north-south direction between the Canadian and Oregon borders west of the Cascade Mountains in what is sometimes referred to as the Puget Sound trough. Seven of Washington's eight Class I Areas border the Puget Sound trough. The eighth mandatory Class I Area is located largely on the eastern side of the crest of the Cascades Mountains.

Two sources in the set of 11 specific industries and emission source categories lie to the east of the Cascade Mountains in eastern Washington. These are Alcoa Wenatchee Works, an aluminum electro-ore reduction plant, and Boise Inc. Wallula, a pulp and paper plant. A visibility analysis for Alcoa Wenatchee Works (which was BART-eligible) showed that it contributed to visibility impairment essentially at Alpine Lakes Wilderness but did not meet the 0.5 dv significance level that would have made the Alcoa Wenatchee Works subject to BART. Boise Inc. Wallula has the potential to contribute to impairment at more than one mandatory Class I Area.

The set of four-factor analyses indicates there is the potential for SO_2 and NO_x emission reductions from a number of individual sources, principally boilers (oil-, natural gas-, and wood-fired), process heaters, and Fluidized Catalytic Cracking Unit (FCCU)/Carbon Monoxide (CO) boiler systems. This identification sets the stage for future development of SO_2 and NO_x limitations for individual sources. Washington State law requires Ecology to develop new requirements for an existing emission source category through a formal rulemaking action.[2] Ecology can issue a new rule (or revise an existing one) to require the installation of new emission controls.

The process in state law called Reasonably Available Control Technology (RACT) requires a detailed evaluation of the characteristics of each existing source covered by the rule process along with an evaluation of the efficacy of installation of various control equipment. The result of the process is a rule requiring all units of the defined source category to achieve a set of defined emission limitations. The rule will allow the sources a limited time to upgrade the controls to meet the new or revised emission standards. Washington State law does include an economic hardship provision. A company that demonstrates it meets criteria for economic hardship is allowed either an extended time to achieve compliance or an alternate, source-specific emission limitation.

Ecology commits to proceeding with establishing and requiring controls on point sources of SO_2 and NO_x. Because of the process Ecology is required to follow, Ecology concludes that further controls are not reasonable at this time. Development of controls is discussed further as part of Washington's Long-Term Strategy in Chapter 10.

2018 Reasonable Progress Goal for the Most Impaired Days

Ecology concludes that 16.38 dv is the 2018 Reasonable Progress Goal for Olympic National Park in light of controls on the books, implementation of BART, the impact of out-of-state emissions, and the four-factor analysis. At this rate it would take Olympic National Park 323 years from the end of the 2000-2004 baseline period to reach natural visibility conditions. Improving progress toward the natural visibility conditions in the future will require controls on visibility impairing emissions in Washington State and controls on Canadian and Pacific offshore emissions.

9.2.2 North Cascades National Park and Glacier Peak Wilderness

Establishing the Reasonable Progress Goal involves the determination of baseline and projected visibility, examination of the progress that has been made in reducing visibility impairing pollutants, and consideration of the four statutory factors.

Baseline and Projected Visibility

Visibility conditions at North Cascades National Park and Glacier Peak Wilderness are monitored at the IMPROVE site NOCA1. The monitored 2000-2004 baseline conditions at this

[2] §70.94.154 RCW

site on the Most Impaired Days are 16.01 dv and calculated natural conditions are 8.39 dv, a difference of 7.62 dv.

This foundational SIP covers the first control period, 2005-2018. The WRAP's modeling projects 2018 visibility of 17.24 dv, which is a visibility degradation of 1.23 dv. If uniform progress were made on achieving natural conditions by 2064, visibility would instead be improved 1.78 dv to 14.23 dv by 2018, a 24% improvement in visibility.

On May 25, 2010, during the formal consultation on the draft Regional Haze (RH) SIP required by the RHR, the Federal Land Managers (FLMs) informed Ecology that North Cascades National Park and Glacier Peak Wilderness were the only mandatory Class I Areas in the country where visibility impairment is projected to increase in 2018.

Ecology recognized that further analysis of visibility impairment at the 2 mandatory Class I Areas was needed to address the requirements of the RHR. The projected visibility impairment for the 2 mandatory Class I areas is the sum of the projected impairment of the individual visibility-impairing pollutants. It follows that to understand why the WRAP's modeling projected increased visibility impairment; Ecology needs to analyze the projected impacts of individual visibility-impairing pollutants. The results of Ecology's analysis are summarized below in the sulfate and organic matter carbon subsections of Ecology's overview of progress in reducing visibility-impairing pollutants.

Progress in Reducing Visibility Impairing Pollutants

WRAP's PRP18a modeling reflects "controls on the books" and, to some extent, projected implementation of BART. Controls on the books are existing legally adopted controls that will reduce visibility impairing pollutants during the first control period 2005-2018. Prominent examples are large statewide reductions in SO_2 (95%) and NO_x (64%) from on-road and off-road mobile sources between the 2000-2004 baseline and the 2018 projection as a result of engine and fuel rules.

WRAP's PRP18a modeling incorporated only limited impacts of BART because states were still working on draft BART determinations when WRAP finalized the PRP18a inventory. The PRP18a inventory includes presumptive SO_2 limits for EGUs but uses actual limits for SO_2 where BART is already effective. In 2003 the EPA determined BART for SO_2 and particulate matters for Washington's only coal-fired power plant as part of EPA's approval of the 1999 update to the state's RAVI SIP. This BART determination is reflected in the 2018 inventory. The 2000-2004 baseline inventory reflects partial SO_2 control conditions at the power plant because controls were being installed during this period.

Ecology analyzed projected visibility impacts of sulfate, OMC, and nitrate at NOCA1 to characterize progress in reducing visibility impairing pollutants (see Figure 9-2). At NOCA1 these two visibility-impairing pollutants plus Rayleigh scattering were responsible for 91% of the total light extinction for the Most Impaired Days during the 2000-2004 baseline period.

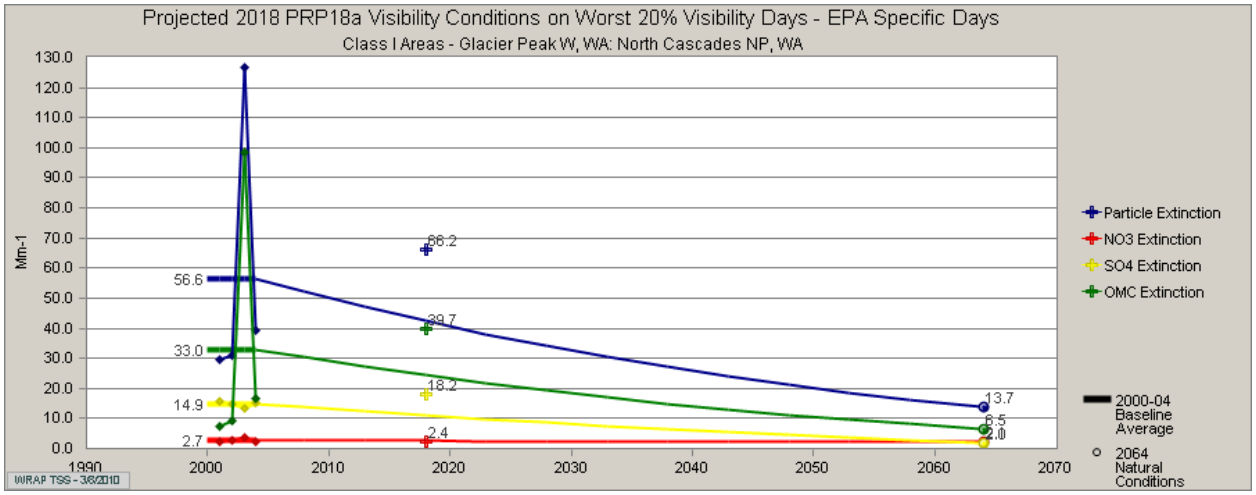

Figure 9-2 Projected 2018 Visibility Conditions on the Most Impaired Days in North Cascades National Park and Glacier Peak Wilderness

Sulfate: The WRAP's PRP18a modeling projects an increase in the extinction coefficient for sulfate from 14.87 to 18.19 Mm^{-1}, a visibility degradation of 3.32 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for sulfate of 10.99 Mm^{-1}.

Statewide emissions of SO_2 are projected to decline almost 40% between the 2000-2004 baseline period and 2018. Basically this decline results from a 29% reduction in point source emissions and a 95% reduction in total on-road and off-road mobile source emissions. The mobile source reduction reflects the removal of sulfur from on-road and off-road fuels.

WRAP's WEP analysis of upwind emissions indicates only a 10% weighted emissions decrease in the upwind direction (see Appendix E for the Glacier Peak Wilderness, North Cascades National Park Summary Table). While the statewide emissions decrease should be more than sufficient to support the 23% decrease in dv needed to meet the uniform glide path, the upwind emissions reduction indicated by the WEP analysis is insufficient. In fact, the 2018 increase in visibility-impairment projected by the WRAP modeling indicates that there is a significant increase in sulfate emissions.

The WRAP's PSAT analysis for 2018 indicates that outside domain, Canada, and Pacific offshore contribute more than two-thirds of the sulfate concentrations monitored at the NOCA1 IMPROVE site on the Most Impaired Days. At 29% overall, Washington's contribution is also significant. Anthropogenic sources constitute 28% of Washington's 29% total contribution. Point sources, the dominant type of anthropogenic sources, contribute 24% of the 28% anthropogenic contribution while area and mobile sources contribute 3% and 1% respectively (see Appendix F, Table 1).

The general identification of the source regions contributing to the NOCA1 IMPROVE monitor on the Most Impaired Days still leaves the basic question of the source area or areas of increased sulfate emissions unanswered.

The commonly used technique for identification of source areas impacting a monitor site is back trajectories. The WRAP developed back trajectories for the WEP Analyses presented in the WRAP's TSS. Back trajectories use meteorological data to estimate the most likely central paths of air parcels to a monitor. The method essentially follows air parcels backwards from the monitor for a specific period of time. Back trajectories account for the impact of wind speed and wind direction but do not account for emissions, chemical transformation, dispersion, and deposition of pollutants.

The WRAP compiled back trajectories into residence time maps. The residence time analysis computed the amount of time that an air parcel was over grid cell on the Most Impaired Days, summed these by 1° latitude and longitude grids, and plotted the results to show the relative time spent by air parcels over geographic areas before reaching the monitor. The resulting residence time maps are indicative of general flow patters but do not necessarily imply an area contributed significantly to the monitor because the methodology does not account for emissions and removal processes.

Ecology consulted with the WRAP staff and Air Resource Specialists, Inc. (ARS), the WRAP contractor which developed the residence time analysis. ARS recompiled the analysis for the NOCA1 IMPROVE monitor on the Most Impaired Days into 0.25° latitude and longitude grids. The results are presented below in Figure 9-3.

The residence time analysis indicates that the NOCA1 IMPROVE monitor is potentially most impacted by relatively nearby sources in Washington's Whatcom and Skagit counties and neighboring southwestern British Columbia. The broader area next most likely to potentially impact the NOCA1 monitor includes a larger area of northwest Washington, the lower British Columbia coast, and the south portion of British Columbia's Vancouver Island. Ecology's examination of emission inventory information in the WRAP's TSS did not indicate large emission increases in these areas.

Ecology came to 2 conclusions about sulfate impacts at the NOCA1 IMPROVE monitor. The less important conclusion concerns the WRAP modeling. The increased visibility impairment projected by the WRAP modeling apparently is the result of the comparatively long residence times of air parcels close to the NOCA1 monitor combined with the presence of large point sources of emission of SO_2, the precursor of sulfate.

Ecology's more important conclusion is that the WRAP's 2018 emission projections (including the PRP18a inventory used in this RH SIP do not include major emission reductions from sulfur reduction projects at 3 oil refineries in Washington's Whatcom and Skagit counties.

Table 9-2 provides a comparison between the WRAP's inventories and projected 2018 360 ton/year decrease in SO_2 emissions and Ecology's analysis that shows a 9,826 ton/year decrease in SO_2 emissions in 2008. The differences between the WRAP's inventories and Ecology's analysis may be attributable in part to Ecology's lack of involvement in the WRAP between 2002 when the Legislature rescinded funding for visibility and the restoration of funding for RH SIP development in 2007.

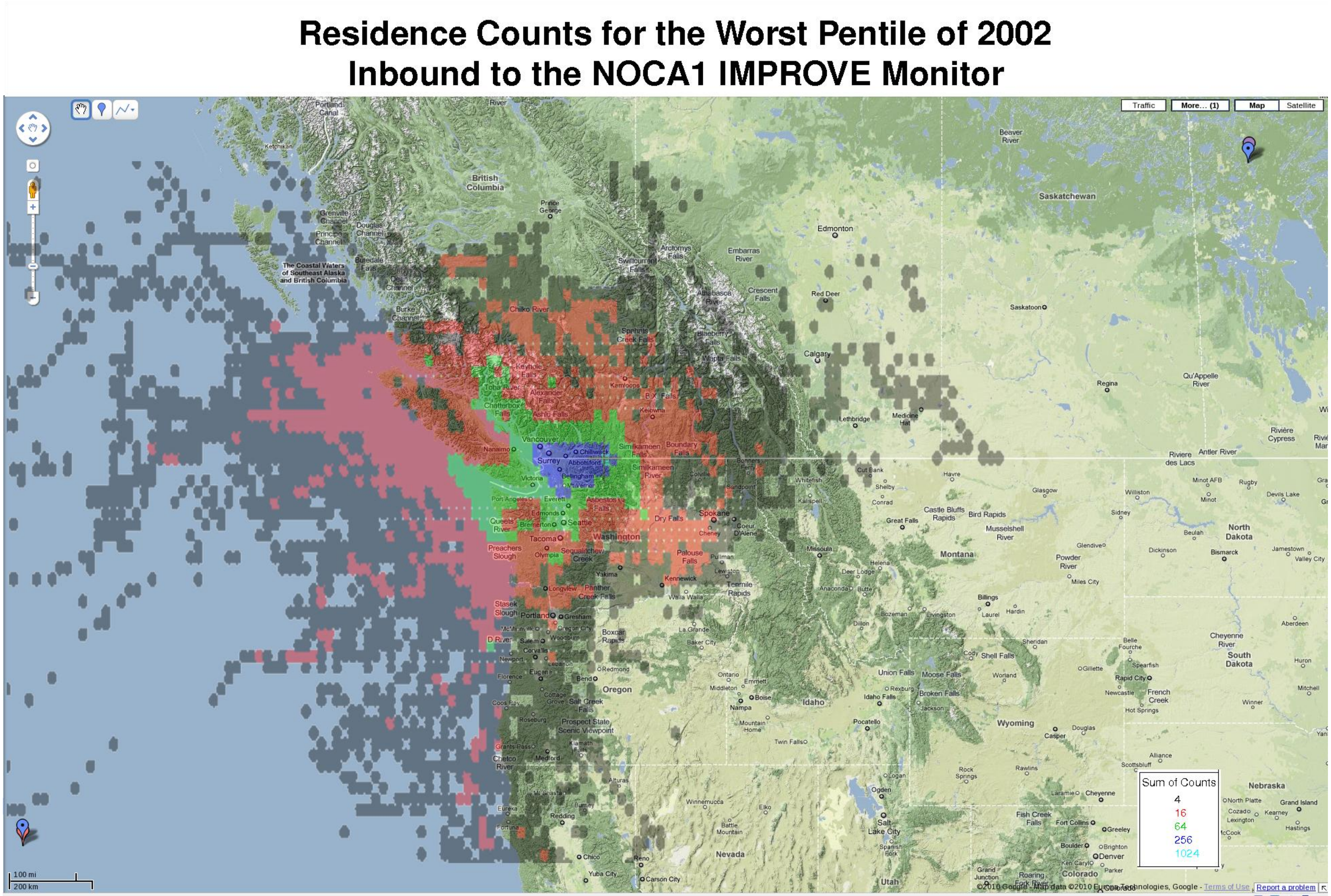

Figure 9-3 Residence Time of Air Parcels to the NOCA1 Interagency Monitoring of Protected Visual Environments Monitor on the Most Impaired Days

Table 9-2 2018 Point Source Sulfur Dioxide Emissions Analysis, Skagit and Whatcom Counties

Oil Refinery (County)	SO_2 (tons/year)					
	The WRAP's Inventories			Ecology's Analysis		
	Plan02d (2000-2004)	PRP18a (2018)	Emission Increase (2005-2018)	Plan02d (2000-2004)	Emission Inventory (2008)	Uncredited Emission Reductions
Conoco-Phillips (Whatcom County)	2,286	2,641	355	2,286	245	(2,041)
				SO_2 Emission Reduction Projects *Wet Gas Scrubber (FCCU-CO Boiler)* *S-Zorb Process Cat Gasoline Desulfurizer* *Sulfur Recovery Unit*		
Shell (Puget Sound Refining) (Skagit County)	3,494	2,444	(1,050)	3,494	449	(3,045)
				SO_2 Emission Reduction Projects *Sulfur Recovery Unit Tail Gas System* *Wet Gas Scrubber (CO Boiler)*		
Tesoro (Skagit County)	5,345	5,680	335	5,345	605	(4,740)
				SO_2 Emission Reduction Projects *Wet Gas Scrubber (CO Boiler)* *Flue Gas Scrubber* *Sulfur Recovery Unit*		
TOTALS	**11,125**	**10,765**	**(360)**	**11,125**	**1,299**	**(9,826)**

Ecology's information comes from the Northwest Clean Air Agency (NWCAA) and is available on-line at http://www.nwcleanair.org/. NWCAA is the Washington local air quality agency with jurisdiction over the oil refineries. NWCAA regulates and permits the refineries except for issuance of Prevention of Significant Deterioration (PSD) permits, which are issued by Ecology. NWCAA also compiles an annual emissions inventory for the major point sources in its jurisdiction. The 2008 inventory is the latest available inventory.

A brief overview of the major sulfur reduction projects at the 3 refineries is as follows:

- Conoco Phillips had 3 major projects associated with a large-scale upgrade of the refinery to make low-sulfur gasoline. First, as part of the replacement of the Catalytic Cracking Unit with a FCCU in 2003, a Wet Gas Scrubber (WGS) was installed to control SO_2 from the FCCU-CO Boiler system. Second, a Cat Gasoline Desulfurizer (CGD) using S-Zorb Sulfur Reduction Technology was constructed in 2003. Finally, a new Sulfur Recovery Unit (SRU) was installed in 2006 for increased reliability and additional sulfur removal capacity.
- Shell (Puget Sound Refining) had 2 major projects. A SRU Tail Gas Unit (TGU) was constructed in 2004 and a WGS was installed on the FCCU in 2006.
- Tesoro had 3 major projects. A WGS was installed on the Catalytic Cracking Unit in 2004, a Flue Gas Scrubber (FGS) was installed on the Catalytic Cracking Unit in 2005, and a SRU was installed in 2006.

Inclusion of the major sulfur reduction projects at the oil refineries in the PRP18a inventory would result in a reduction in total SO_2 of over 50% from the baseline period.

Organic Matter Carbon: The WRAP's PRP18a modeling projects an increase in the extinction coefficient for OMC from 33.02 to 39.74 Mm^{-1}, a visibility degradation of 6.72 Mm^{-1}. The OMC light extinction for 2018 is over half the total projected light extinction of 77.23 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for OMC of 24.39 Mm^{-1}.

OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of VOCs. Washington's VOC emission inventory is much larger than the organic carbon (primary organic aerosol) inventory. Plan02d totals are 1,042,867 and 50,273 tons per year, respectively (see Chapter 6).

The only source apportionment analysis available for OMC is the WEP analysis developed by the WRAP for primary organic aerosols. Statewide emissions of primary organic aerosols are projected to increase by 4% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates a similar total increase in weighted emissions of 6% and a human-generated weighted emissions increase of 12% in the upwind direction (see Appendix E for the Glacier Peak Wilderness, North Cascades National Park Summary Table).

The WEP analysis indicates that the dominant source of primary organic aerosols impacting these two mandatory Class I Areas in the 2000-2004 baseline period is natural fire. Visibility impairment due to natural fire is very variable from year-to-year. Baseline conditions are significantly elevated by very high fire emissions in 2003. In the WRAP's 2018 modeling, natural fire was projected to remain at 2000-2004 baseline levels and locations. Ecology believes this treatment of natural fire results in an overestimate of the visibility impairment caused by natural fire because of the inordinately high impacts from natural fire in 2003.

Emission inventories presented in section 6.3 indicate that while total VOC emissions are projected to decrease by 1% between the 2000-2004 baseline period and 2018, area sources of VOCs increase by 67%. Area sources are the largest human-generated source category of VOCs in 2018. Area source VOCs are dominated by emissions from solvent utilization and residential wood combustion.

The large increase in area source emissions reflects the impact of population growth has on the total amount of emissions despite controls on "individual" areas sources such as a can of paint or a woodstove. Solvent utilization is regulated through federal and state rules. Washington has more stringent woodstove emission standards than EPA and a mandatory curtailment requirement which has been strengthened to require curtailments at lower particulate matter concentrations as particulate matter standards have become more stringent.

The WEP analysis also indicates that North Cascades National Park and Glacier Peak Wilderness are impacted by emissions, primarily area source emissions, from Canada.

Nitrate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for nitrate from 2.69 to 2.11 Mm^{-1}, a visibility improvement of 0.58 Mm^{-1}. Adherence to the uniform glide path would result in a higher 2018 extinction coefficient for nitrate of 2.56 Mm^{-1}.

Statewide emissions of nitrate are projected to decrease by 46% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates a smaller decrease of 37% in total weighted emissions in the upwind direction and 39% in anthropogenic emissions (see Appendix E for the Glacier Peak Wilderness, North Cascades National Park Summary Table). The reductions are due primarily to a projected large decrease in nitrate emissions from on-road and off-road mobile sources. Even with this large reduction of nitrate emissions within Washington, WRAP's PSAT analysis indicates that half the nitrate impact on NOCA1 comes, in order of importance, from Canada, outside domain, and Pacific offshore.

Summary: There is considerable ambiguity with regard to projected 2018 visibility at North Cascades National Park and Glacier Peak Wilderness because of major reductions in SO_2 from oil refineries that are not reflected in the PRP18a emissions inventory, uncertainty about the reasonableness of the projected natural fire emissions, and the influence of areas outside of Washington (outside domain, Canada, and Pacific offshore) on visibility. Ecology concludes from the analysis provided above that overall Washington is making progress albeit limited in reducing visibility impairing pollutants. The question still remains, is this progress reasonable? Ecology relied on a four-factor analysis to address this issue.

Four-Factor Analysis

The RHR specifies that a state must consider the four factors specified by the CAA in determining the Reasonable Progress Goal for a Class I Area. Ecology developed a single set of four-factor analyses for Washington's 8 mandatory Class I Areas. Basically the individual sources in the 10 selected specific industries and emission source categories are located along the I-5 corridor in western Washington and are capable of contributing to visibility impairment at more than one of Washington's mandatory Class I Areas.

The work done by Ecology on the Four-Factor Analyses is summarized in the Four-Factor Analysis subsection of section 9.2.1 Olympic National Park and described in Appendix F.

Ecology commits to proceeding with establishing and requiring controls on point sources of SO_2 and NO_x. Because of the process Ecology is required to follow, Ecology concludes that further controls are not reasonable at this time. Development of controls is discussed further as part of Washington's Long-Term Strategy in Chapter 10.

2018 Reasonable Progress Goal for the Most Impaired Days

Generally, modeled visibility impairment serves as a point of reference for setting the 2018 Reasonable Progress Goal. In the case of North Cascades National Park and Glacier Peak Wilderness, however, the 2018 modeling performed by the WRAP is flawed. The modeling projects a worsening of visibility impairment in 2018, but there are significant issues with the projected SO_2 inventory for 2018. The 2018a inventory[3] does not include major SO_2 reductions at 3 large oil refineries, which in total are 27 times larger than the small reduction indicated by the inventory. The 3 refineries are located in the area indicated by the Residence Time Analysis developed by the WRAP to have the greatest potential for the direct impact on the NOCA1 IMPROVE monitor.

Ecology also has concerns about the treatment of natural fire in 2018 modeling. Natural fire emissions are left unchanged from the baseline period. Yet, 2003 had inordinately high fire emissions impacting the NOCA1 IMPROVE monitor compared to other baseline years. Ecology does not expect natural fire to have so great a influence on visibility impairment in 2018.

Revised modeling to address these issues is not possible for institutional and resource reasons. The PRP18a modeling was done by the Regional Modeling Center (RMC) for the WRAP. Since then, the RMC has ended its relationship with the WRAP. Even if the RMC was still associated with the WRAP, Ecology does not have the resources to have the inventories revised and processed and the modeling re-run either by the RMC, by some other contractor, or in-house.

In lieu of a revised technical demonstration of projected 2018 visibility impairment, the best Ecology can do estimate that lower emissions will result in less visibility impairment than was modeled.

[3] SO_2 reductions at the 3 oil refineries are not in later inventories (2018b and 2018cmv) developed by the WRAP either.

Because it is not possible to project the amount of visibility improvement, Ecology is establishing a Reasonable Progress Goal of "no degradation" of visibility beyond the 2000-2004 baseline period for North Cascades National Park and Glacier Peak Wilderness. The resulting goal is 16.01 dv. This goal takes into account the major emission reductions at the oil refineries that are not included in the PRP18a inventory, controls on the books, the impact of natural fire in the modeling, implementation of BART, the impact of out-of-state emissions, and the four-factor analysis.

9.2.3 Alpine Lakes Wilderness

Establishing the Reasonable Progress Goal involves the determination of baseline and projected visibility, examination of the progress that has been made in reducing visibility impairing pollutants, and consideration of the four statutory factors.

Baseline and Projected Visibility

Visibility conditions at Alpine Lakes Wilderness are monitored at the IMPROVE site SNPA1. The monitored 2000-2004 baseline conditions at this site on the Most Impaired Days are 17.84 dv and calculated natural conditions are 8.43 dv, a difference of 9.41 dv.

This foundational SIP covers the first control period, 2005-2018. WRAP modeling projects 2018 visibility of 16.32 dv, a visibility improvement of 1.52 dv. If uniform progress were made on achieving natural conditions by 2064, visibility would be improved 2.20 dv to 15.64 dv by 2018, a 23% improvement in visibility. Because the anticipated rate of progress is slower than the uniform rate of progress, more analysis is required to determine the Reasonable Progress Goal for Alpine Lakes Wilderness.

Progress in Reducing Visibility Impairing Pollutants

WRAP's PRP18a modeling reflects "controls on the books" and, to some extent, projected implementation of BART. Controls on the books are existing legally adopted controls that will reduce visibility impairing pollutants during the first control period 2005-2018. Prominent examples are large statewide reductions in SO_2 (95%) and NO_x (64%) from on-road and off-road mobile sources between the 2000-2004 baseline and the 2018 projection resulting from engine and fuel rules.

WRAP's PRP18a modeling incorporated only limited impacts of BART because states were still working on draft BART determinations when WRAP finalized the PRP18a inventory. The PRP18a inventory includes presumptive SO_2 limits for EGUs but uses actual limits where BART is already effective. In 2003 the EPA determined BART for SO_2 and particulate matters for Washington's only coal-fired power plant as part of EPA's approval of the 1999 update to the state's RAVI SIP. This BART determination is reflected in the 2018 inventory. The 2000-2004 baseline inventory reflects partial control conditions at the power plant.

Ecology analyzed projected visibility impacts of sulfate, OMC, and nitrate at SNPA1 to characterize progress in reducing visibility impairing pollutants (see Figure 9-4). At SNPA1 these three visibility-impairing pollutants plus Rayleigh scattering were responsible for 89% of the total light extinction for the Most Impaired Days during the 2000-2004 baseline period.

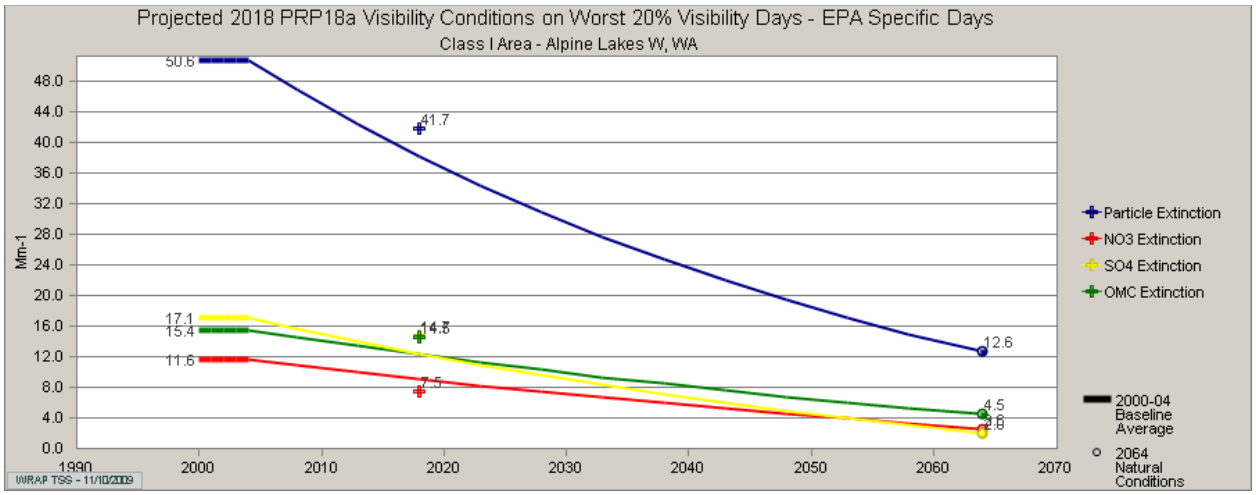

Figure 9-4 Projected 2018 Visibility Conditions on the Most Impaired Days in Alpine Lakes Wilderness

Sulfate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for sulfate from 17.08 to 14.66 inverse Mm^{-1}, a visibility improvement of 2.42 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for sulfate of 12.40 Mm^{-1}.

Statewide emissions of SO_2 are projected to decline almost 40% between the 2000-2004 baseline period and 2018. Basically this decline results from a 29% reduction in point source emissions and a 95% reduction in on-road and off-road mobile source emissions. The mobile source reduction reflects the removal of sulfur from on-road and off-road fuels.

WRAP's WEP analysis of upwind emissions indicates a smaller 32% weighted emissions decrease in the upwind direction (see Appendix E for the Alpine Lakes Wilderness Summary Table). Both the magnitudes of the statewide and the upwind emissions decreases should be sufficient to meet the 23% dv decrease needed to meet the uniform glide path for SO_2. Still, the projected improvement in visibility by 2018 is only a little more than half the improvement needed to meet the uniform glide path.

WRAP's PSAT analysis for 2018 indicates that despite a large decrease in mobile source emissions in Washington, the source areas outside domain, Canada, and Pacific offshore contribute more than two-thirds of sulfate concentrations at SNPA1 on the Most Impaired Days. All of these regions are outside of the control of the state of Washington.

Organic Matter Carbon: WRAP's PRP18a modeling projects a decrease in the extinction coefficient for OMC from 15.41 to 14.52 Mm^{-1}, a visibility improvement of 0.89 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for OMC of 12.27 Mm^{-1}.

OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of VOCs. Washington's VOC emission inventory is much larger than the Organic Carbon (primary organic aerosol) inventory. Plan02d totals are 1,042,867 and 50,273 tons per year, respectively (see Chapter 6).

The only source apportionment analysis available for OMC is the WEP analysis developed by the WRAP for primary organic aerosols. Statewide emissions of primary organic aerosols are projected to increase by 4% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates a small decrease of 4% in human-generated weighted emissions in the upwind direction (see Appendix E for the Alpine Lakes Wilderness Summary Table). The decrease is dominated by reductions in on-road and off-road mobile source emissions in Washington. The decrease also includes significant reductions in anthropogenic fire, point, and area source emissions.

Emission inventories presented in section 6.3 indicate that while total VOC emissions are projected to decrease by 1% between the 2000-2004 baseline period and 2018, area sources of VOCs increase by 67%. Area sources are the largest human-generated source category of VOCs in 2018. Area source VOCs are dominated by emissions from solvent utilization and residential wood combustion.

The large increase in area source emissions reflects the impact of population growth has on the total amount of emissions despite controls on "individual" areas sources such as a woodstove or can of paint. Solvent utilization is regulated through federal and state rules. Washington has more stringent woodstove emission standards than EPA and a mandatory curtailment requirement which has been strengthened to require curtailments at lower particulate matter concentrations as particulate matter standards have become more stringent.

The WEP analysis also indicates that Alpine Lakes Wilderness is impacted by emissions from Canada.

Nitrate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for nitrate from 11.56 to 7.49 Mm^{-1}, a visibility improvement of 4.07 Mm^{-1}. Adherence to the uniform glide path would result in a higher 2018 extinction coefficient for nitrate of 9.03 Mm^{-1}.

Statewide emissions of nitrate are projected to decrease by 46% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates an even larger decrease in human-generated weighted emissions of 51% in the upwind direction (see Appendix E for the Alpine Lakes Wilderness Summary Tables). The reductions are due primarily to a large decrease in nitrate emissions from mobile sources.

Summary: Ecology concludes from this analysis that overall Washington is making progress in reducing visibility impairing pollutants impacting Alpine Lakes Wilderness. The question still

remains, is this progress reasonable? Ecology relied on a four-factor analysis to address this issue.

Four-Factor Analysis

The RHR specifies that a state must consider the four factors specified by the CAA in determining the Reasonable Progress Goal for a Class I Area. Ecology developed a single set of four-factor analyses for Washington's 8 mandatory Class I Areas. Basically the individual sources in the 10 selected specific industries and emission source categories are located along the I-5 corridor in western Washington and are capable of contributing to visibility impairment at more than one mandatory Class I Areas.

The work done by Ecology on the Four-Factor Analyses is summarized in the Four-Factor Analysis subsection of section 9.2.1 Olympic National Park and described in Appendix F.

Ecology commits to proceeding with establishing and requiring controls on point sources of SO_2 and NO_X. Because of the process Ecology is required to follow, Ecology concludes that further controls are not reasonable at this time. Development of controls is discussed further as part of Washington's Long-Term Strategy in Chapter 10.

2018 Reasonable Progress Goal for the Most Impaired Days

Ecology concludes that 16.32 dv is the 2018 Reasonable Progress Goal for Alpine Lakes Wilderness in light of controls on the books, implementation of BART, the impact of out-of-state emissions, and the four-factor analysis. At this rate it would take Alpine Lakes Wilderness 87 years from the 2000-2004 baseline period to reach natural visibility conditions. Improving progress toward the natural visibility conditions in the future will require controls on visibility impairing emissions in Washington State and controls on Canadian and Pacific offshore emissions.

9.2.4 Mount Rainier National Park

Establishing the Reasonable Progress Goal involves the determination of baseline and projected visibility, examination of the progress that has been made in reducing visibility impairing pollutants, and consideration of the four statutory factors.

Baseline and Projected Visibility

Visibility conditions at Mount Rainier National Park are monitored at the IMPROVE site MORA1. The monitored 2000-2004 baseline conditions at this site on the Most Impaired Days are 18.24 dv and calculated natural conditions are 8.54 dv, a difference of 9.70 dv.

This foundational SIP covers the first control period, 2005-2018. WRAP modeling projects 2018 visibility of 16.66 dv, which is a visibility improvement of 1.58 dv. If uniform progress were made on achieving natural conditions by 2064, visibility would be improved 2.26 dv to 15.98 dv by 2018, a 23% improvement in visibility. Because the anticipated rate of progress is

slower than the uniform rate of progress, more analysis is required to determine the Reasonable Progress Goal for Mount Rainier National Park.

Progress in Reducing Visibility Impairing Pollutants

WRAP's PRP18a modeling reflects "controls on the books" and, to some extent, projected implementation of BART. Controls on the books are existing legally adopted controls that will reduce visibility impairing pollutants during the first control period 2005-2018. Prominent examples are large statewide reductions in SO_2 (95%) and NO_x (64%) from on-road and off-road mobile sources between the 2000-2004 baseline and the 2018 projection resulting from engine and fuel rules.

WRAP's PRP18a modeling incorporated only limited impacts of BART because states were still working on draft BART determinations when WRAP finalized the PRP18a inventory. The PRP18a inventory includes presumptive SO_2 limits for EGUs but uses actual limits where BART is already effective. In 2003 the EPA determined BART for SO_2 and particulate matters for Washington's only coal-fired power plant as part of EPA's approval of the 1999 update to the state's RAVI SIP. This BART determination is reflected in the 2018 inventory. The 2000-2004 baseline inventory reflects partial control conditions at the power plant.

Ecology analyzed projected visibility impacts of sulfate, OMC, and nitrate at MORA1 to characterize progress in reducing visibility impairing pollutants (see Figure 9-5). At MORA1 these three visibility-impairing pollutants plus Rayleigh scattering were responsible for 89% of the total light extinction for the Most Impaired Days during the 2000-2004 baseline period.

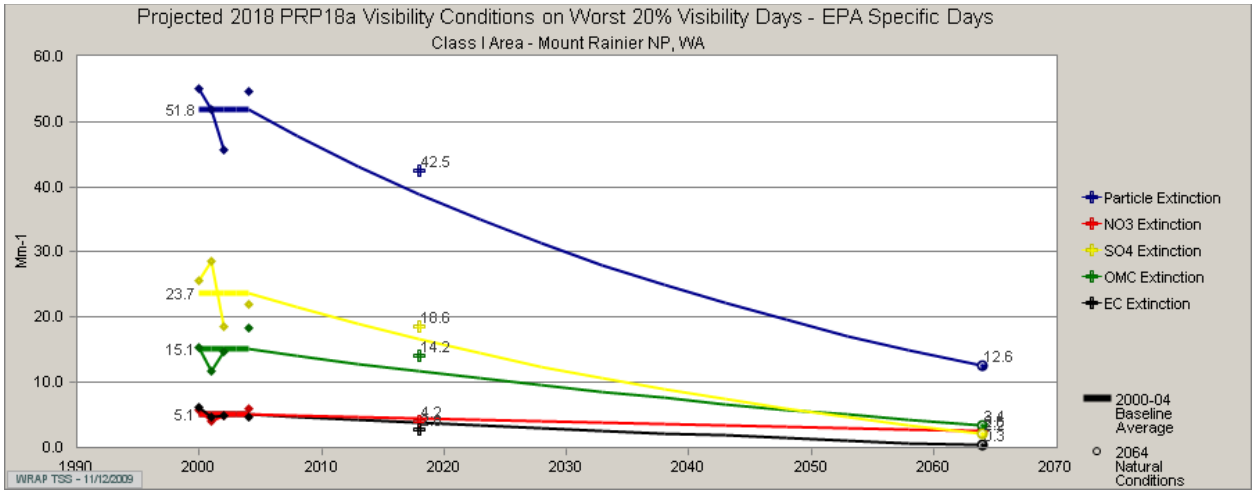

Figure 9-5 Projected 2018 Visibility Conditions on the Most Impaired Days in Mount Rainier National Park

Sulfate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for sulfate from 23.7 to 18.55 Mm^{-1}, a visibility improvement of 5.15 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for sulfate of 16.58 Mm^{-1}.

Statewide emissions of SO_2 are projected to decline almost 40% between the 2000-2004 baseline period and 2018. Basically this decline results from a 29% reduction in point source emissions and a 95% reduction in on-road and off-road mobile source emissions. The mobile source reduction reflects the removal of sulfur from on-road and off-road fuels.

WRAP's WEP analysis of upwind emissions indicates a larger 49%.weighted emissions decrease in the upwind direction (see Appendix E for the Mount Rainier National Park Summary Table). Both the magnitudes of the statewide and the upwind emissions decreases should be sufficient to meet the 23% dv decrease needed to meet the uniform glide path for SO_2. Still, the projected improvement in visibility by 2018 is only about 70% of the improvement needed to meet the uniform glide path.

WRAP's PSAT analysis for 2018 indicates that despite a large decrease in mobile and point source emissions within Washington, the source areas outside domain, Canada, and Pacific offshore contribute over 60% of the sulfate concentrations on the Most Impaired Days at MORA1. Emissions from outside domain, Canada, and Pacific offshore are outside of the control of the state of Washington.

Organic Matter Carbon: WRAP's PRP18a modeling projects a decrease in the extinction coefficient for OMC from 15.06 to 14.18Mm^{-1}, a visibility improvement of 0.88 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for OMC of 11.67 Mm^{-1}.

OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of VOCs. Washington's VOC emission inventory is much larger than the organic carbon (primary organic aerosol) inventory. Plan02d totals are 1,042,867 and 50,273 tons per year, respectively (see Chapter 6).

The only source apportionment analysis available for OMC is the WEP analysis developed by the WRAP for primary organic aerosols. Statewide emissions of primary organic aerosols are projected to increase by 4% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates a decrease in human-generated weighted emissions of 8% in the upwind direction (see Appendix E for the Mount Rainier Summary Tables). This decrease is dominated by reductions in area source emissions.

Emission inventories presented in section 6.3 indicate that while total VOC emissions are projected to decrease by 1% between the 2000-2004 baseline period and 2018, area sources of VOCs increase by 67%. Area sources are the largest human-generated source category of VOCs in 2018. Area source VOCs are dominated by emissions from solvent utilization and residential wood combustion.

The large increase in area source emissions reflects the impact of population growth has on the total amount of emissions despite controls on "individual" areas sources such as a woodstove or can of paint. Solvent utilization is regulated through federal and state rules. Washington has

more stringent woodstove emission standards than EPA and a mandatory curtailment requirement which has been strengthened to require curtailments at lower particulate matter concentrations as particulate matter standards have become more stringent.

Nitrate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for nitrate from 5.14 to 4.15 Mm^{-1}, a visibility improvement of 0.99 Mm^{-1}. Adherence to the uniform glide path would result in a higher 2018 extinction coefficient for nitrate of 4.51 Mm^{-1}.

Statewide emissions of nitrate are projected to decrease by 46% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates an even larger decrease of 51% in human-generated weighted emissions in the upwind direction (see Appendix E for the Mount Rainier Summary Tables). The reductions are due primarily to a large decrease in nitrate emissions from mobile sources.

Summary: Ecology concludes from this analysis that overall Washington is making progress in reducing visibility impairing pollutants impacting Mount Rainier National Park. The question still remains, is this progress reasonable? Ecology relied on a four-factor analysis to address this issue.

Four-Factor Analysis

The RHR specifies that a state must consider the four factors specified by the CAA in determining the Reasonable Progress Goal for a Class I Area. Ecology developed a single set of four-factor analyses for Washington's 8 mandatory Class I Areas. Basically the individual sources in the 10 selected specific industries and emission source categories are located along the I-5 corridor in western Washington and are capable of contributing to visibility impairment at more than one mandatory Class I Areas.

The work done by Ecology on the Four-Factor Analyses is summarized in the Four-Factor Analysis subsection of section 9.2.1 Olympic National Park and described in Appendix F.

Ecology commits to proceeding with establishing and requiring controls on point sources of SO_2 and NO_x. Because of the process Ecology is required to follow, Ecology concludes that further controls are not reasonable at this time. Development of controls is discussed further as part of Washington's Long-Term Strategy in Chapter 10.

2018 Reasonable Progress Goal for the Most Impaired Days

Ecology concludes that 16.66 dv is the 2018 Reasonable Progress Goal for Mount Rainier National Park in light of controls on the books, implementation of BART, the impact of out-of-state emissions, and the four-factor analysis. At this rate it would take Mount Rainier National Park 86 years from the 2000-2004 baseline period to reach natural visibility conditions. Improving progress toward the natural visibility conditions in the future will require controls on visibility impairing emissions in Washington State and controls on Canadian and Pacific offshore emissions.

9.2.5 Goat Rocks Wilderness and Mount Adams Wilderness

Establishing the Reasonable Progress Goal involves the determination of baseline and projected visibility, examination of the progress that has been made in reducing visibility impairing pollutants, and consideration of the four statutory factors.

Baseline and Projected Visibility

Visibility conditions at Goat Rocks Wilderness and Mount Adams Wilderness are monitored at the IMPROVE site WHPA1. The monitored 2000-2004 baseline conditions at this site on the Most Impaired Days are 12.76 dv and calculated natural conditions are 8.35 dv, a difference of 4.41 dv.

This foundational SIP covers the first control period, 2005-2018. WRAP modeling projects 2018 visibility of 11.79 dv, which is a visibility improvement of 0.97 dv. If uniform progress were made on achieving natural conditions by 2064, visibility would be improved 1.03 dv to 11.73 dv by 2018, a 23% improvement in visibility. Because the anticipated rate of progress is slower than the uniform rate of progress, more analysis is required to determine the Reasonable Progress Goal for Goat Rocks Wilderness and Mount Adams Wilderness.

Progress in Reducing Visibility Impairing Pollutants

WRAP's PRP18a modeling reflects "controls on the books" and, to some extent, projected implementation of BART. Controls on the books are existing legally adopted controls that will reduce visibility impairing pollutants during the first control period 2005-2018. Prominent examples are large statewide reductions in SO_2 (95%) and NO_x (64%) from on-road and off-road mobile sources between the 2000-2004 baseline and the 2018 projection resulting from engine and fuel rules.

WRAP's PRP18a modeling incorporates only limited impacts of BART because states were still working on draft BART determinations when WRAP finalized the PRP18a inventory. The PRP18a inventory includes presumptive SO_2 limits for EGUs but uses actual limits where BART is already effective. In 2003 the EPA determined BART for SO_2 and particulate matters for Washington's only coal-fired power plant as part of EPA's approval of the 1999 update to the state's RAVI SIP. This BART determination is reflected in the 2018 inventory. The 2000-2004 baseline inventory reflects partial control conditions at the power plant.

Ecology analyzed projected visibility impacts of sulfate, OMC, and nitrate at WHPA1 to characterize progress in reducing visibility impairing pollutants (see Figure 9-6). At WHPA1 these three visibility-impairing pollutants plus Rayleigh scattering were responsible for 87% of the total light extinction for the Most Impaired Days during the 2000-2004 baseline period.

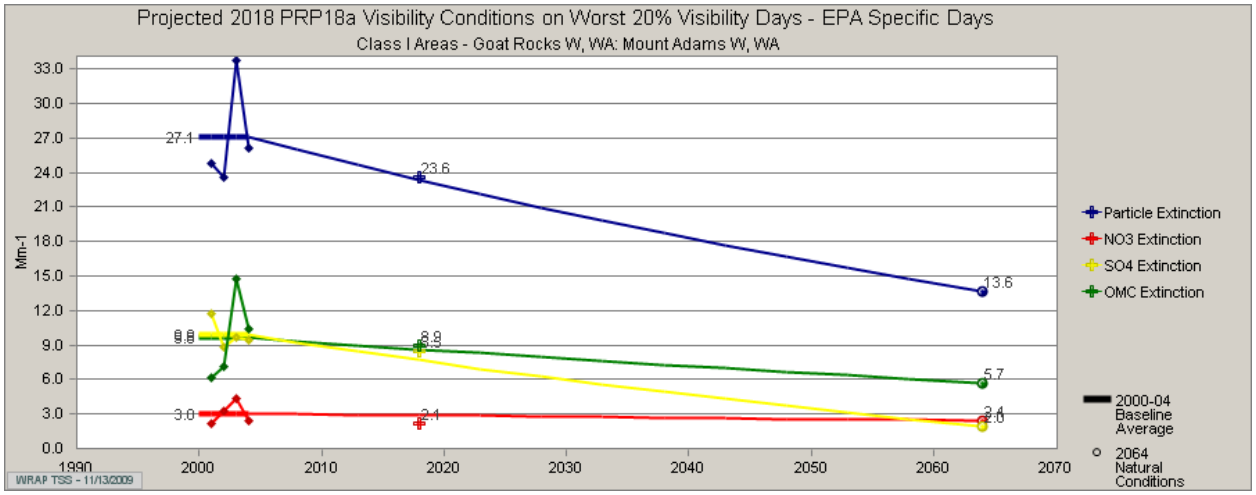

Figure 9-6 Projected 2018 Visibility Conditions on the Most Impaired Days in Goat Rocks Wilderness and Mount Adams Wilderness

Sulfate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for sulfate from 9.92 to 8.52 Mm^{-1}, a visibility improvement of 1.40 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for sulfate of 7.69 Mm^{-1}.

Statewide emissions of SO_2 are projected to decline almost 40% between the 2000-2004 baseline period and 2018. Basically this decline results from a 29% reduction in point source emissions and a 95% reduction in on-road and off-road mobile source emissions. The mobile source reduction reflects the removal of sulfur from on-road and off-road fuels.

WRAP's WEP analysis of upwind emissions indicates a slightly larger 42% weighted emissions decrease in the upwind direction (see Appendix E for the Goat Rocks Wilderness, Mount Adams Wilderness Summary Table). Both the magnitudes of the statewide and the upwind emissions decreases should be sufficient to meet the 23% dv decrease needed to meet the uniform glide path for SO_2. Still, the projected improvement in visibility by 2018 is only 63% of the improvement needed to meet the uniform glide path.

WRAP's PSAT analysis for 2018 indicates that despite a large decrease in mobile and point source emissions within Washington, the source areas outside domain, Canada, and Pacific offshore contribute over 70% of the sulfate concentrations on the Most Impaired Days at WHPA1. Emissions from outside domain, Canada, and Pacific offshore are outside of the control of the state of Washington.

Organic Matter Carbon: WRAP's PRP18a modeling projects a decrease in the extinction coefficient for OMC from 9.63 to 8.93 Mm^{-1}, a visibility improvement of 0.70 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for OMC of 8.63 Mm^{-1}.

OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of VOCs. Washington's VOC emission inventory is much larger than the organic carbon (primary organic

aerosol) inventory. Plan02d totals are 1,042,867 and 50,273 tons per year, respectively (see Chapter 6).

The only source apportionment analysis available for OMC is the WEP analysis developed by the WRAP for primary organic aerosols. Statewide emissions of primary organic aerosols are projected to increase by 4% between the 2000-2004 baseline period and 2018. However, WRAP's WEP analysis of upwind emissions indicates no change in human-generated emissions in the upwind direction (see Appendix E for the Goat Rocks Wilderness and Mount Adams Wilderness). The WEP analysis indicates significant reductions in Washington State emissions from point sources, off-road and on-road mobile sources, and anthropogenic fires. To a large extent these reductions are counterbalanced by a major increase in area source emissions. The 2018 decreases include the permanent closure of Goldendale Aluminum, a BART-eligible source that was determined not to be subject to BART.

Emission inventories presented in section 6.3 indicate that while total VOC emissions are projected to decrease by 1% between the 2000-2004 baseline period and 2018, area sources of VOCs increase by 67%. Area sources are the largest human-generated source category of VOCs in 2018. Area source VOCs are dominated by emissions from solvent utilization and residential wood combustion.

The large increase in area source emissions reflects the impact of population growth has on the total amount of emissions despite controls on "individual" areas sources such as a woodstove or can of paint. Solvent utilization is regulated through federal and state rules. Washington has more stringent woodstove emission standards than EPA and a mandatory curtailment requirement which has been strengthened to require curtailments at lower particulate matter concentrations as particulate matter standards have become more stringent.

The WEP analysis also indicates that the upwind direction includes the Portland, OR metropolitan area. Portland is projected to have increased area source emissions.

Nitrate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for nitrate from 3.05 to 2.14 Mm^{-1}, a visibility improvement of 0.91 Mm^{-1}. Adherence to the uniform glide path would result in a higher 2018 extinction coefficient for nitrate of 2.90 Mm^{-1}.

Statewide emissions of nitrate are projected to decrease by 46% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates an even larger decrease of 49% in human-generated weighted emissions in the upwind direction (see Appendix E for the Goat Rocks Wilderness and Mount Adams Wilderness Summary Tables). The reductions are due primarily to a large decrease in nitrate emissions from mobile sources.

Summary: Ecology concludes from this analysis that overall Washington is making progress in reducing visibility impairing pollutants impacting Goat Rocks Wilderness and Mount Adams Wilderness. The question still remains, is this progress reasonable? Ecology relied on a four-factor analysis to address this issue.

Four-Factor Analysis

The RHR specifies that a state must consider the four factors specified by the CAA in determining the Reasonable Progress Goal for a Class I Area. Ecology developed a single set of four-factor analyses for Washington's 8 mandatory Class I Areas. Basically the individual sources in the 10 selected specific industries and emission source categories are located along the I-5 corridor in western Washington and are capable of contributing to visibility impairment at more than one mandatory Class I Areas.

The work done by Ecology on the Four-Factor Analyses is summarized in the Four-Factor Analysis subsection of section 9.2.1 Olympic National Park and described in Appendix F.

Ecology commits to proceeding with establishing and requiring controls on point sources of SO_2 and NO_X. Because of the process Ecology is required to follow, Ecology concludes that further controls are not reasonable at this time. Development of controls is discussed further as part of Washington's Long-Term Strategy in Chapter 10.

2018 Reasonable Progress Goal for the Most Impaired Days

Ecology concludes that 11.79 dv is the 2018 Reasonable Progress Goal for Goat Rocks Wilderness and Mount Adams Wilderness in light of controls on the books, BART implementation, the impact of out-of-the-state emissions, and the four-factor analysis. At this rate it would take Goat Rocks Wilderness and Mount Adams Wilderness 64 years from the 2000-2004 baseline period to reach natural visibility conditions. Improving progress toward the natural visibility conditions in the future will require controls on visibility impairing emissions in Washington State and controls on Canadian, Pacific offshore, and Oregon emissions.

9.2.6 Pasayten Wilderness

Establishing the Reasonable Progress Goal involves the determination of baseline and projected visibility, examination of the progress that has been made in reducing visibility impairing pollutants, and consideration of the four statutory factors.

Baseline and Projected Visibility

Visibility conditions at Pasayten Wilderness are monitored at the IMPROVE site PASA1. The monitored 2000-2004 baseline conditions at this site on the Most Impaired Days are 15.23 dv and calculated natural conditions are 8.25 dv, a difference of 6.98 dv.

This foundational SIP covers the first control period, 2005-2018. WRAP modeling projects 2018 visibility of 15.09 dv, which is a visibility improvement of 0.14 dv. If uniform progress were made on achieving natural conditions by 2064, visibility would be improved 1.63 dv to 13.60 dv by 2018, a 23% improvement in visibility. Because the anticipated rate of progress is slower than the uniform rate of progress, more analysis is required to determine the Reasonable Progress Goal for Pasayten Wilderness.

Progress in Reducing Visibility Impairing Pollutants

WRAP's PRP18a modeling reflects "controls on the books" and, to some extent, projected implementation of BART. Controls on the books are existing legally adopted controls that will reduce visibility impairing pollutants during the first control period 2005-2018. Prominent examples are large statewide reductions in SO_2 (95%) and NO_x (64%) from on-road and off-road mobile sources between the 2000-2004 baseline and the 2018 projection resulting from engine and fuel rules.

WRAP's PRP18a modeling incorporated only limited impacts of BART because states were still working on draft BART determinations when WRAP finalized the PRP18a inventory. The PRP18a inventory includes presumptive SO_2 limits for EGUs but uses actual limits where BART is already effective. In 2003 the EPA determined BART for SO_2 and particulate matters for Washington's only coal-fired power plant as part of EPA's approval of the 1999 update to the state's RAVI SIP. This BART determination is reflected in the 2018 inventory. The 2000-2004 baseline inventory reflects partial control conditions at the power plant.

Ecology analyzed projected visibility impacts of sulfate, OMC, Elemental Carbon (EC), and nitrate at PASA1 to characterize progress in reducing visibility impairing pollutants (see Figure 9-7). At PASA1 these four visibility-impairing pollutants plus Rayleigh scattering were responsible for 94 % of the total light extinction for the Most Impaired Days during the 2000-2004 baseline period.

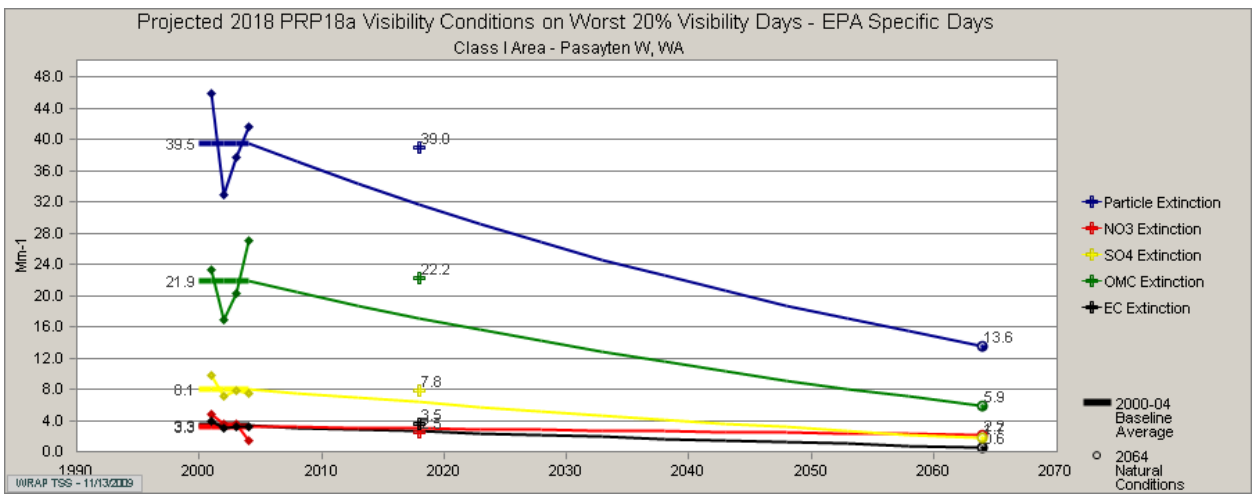

Figure 9-7 Projected 2018 Visibility Conditions on the Most Impaired Days in Pasayten Wilderness

Sulfate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for sulfate from 8.06 to 7.82 Mm^{-1}, a visibility improvement of 0.24 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for sulfate of 6.32 Mm^{-1}.

Statewide emissions of SO_2 are projected to decline almost 40% between the 2000-2004 baseline period and 2018. Basically this decline results from a 29% reduction in point source emissions

and a 95% reduction in on-road and off-road mobile source emissions. The mobile source reduction reflects the removal of sulfur from on-road and off-road fuels.

WRAP's WEP analysis of upwind emissions indicates only an 18% decrease in human-generated weighted emissions in the upwind direction (see Appendix E for the Pasayten Wilderness Summary Table). The reduction is due primarily to a reduction in the sulfur content of fuels for mobile sources.

While the statewide emissions decrease should be more than sufficient to support the 23% decrease in deciviews needed to meet the uniform glide path, the upwind emissions reduction indicated by the WEP analysis is insufficient. Further, WRAP's PSAT analysis for 2018 indicates that Outside Domain and Canada contribute more than three-fourths of the sulfate concentrations at PASA1 on the Most Impaired Days. These source areas are outside of the control of the state of Washington.

Organic Matter Carbon: WRAP's PRP18a modeling projects an increase in the extinction coefficient for OMC from 21.9 to 22.18 Mm^{-1}, an increase in visibility impairment of 0.28 Mm^{-1}. In 2018 the OMC light extinction is 45% of the total projected light extinction of 48.95 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for OMC of 17.12 Mm^{-1}.

OMC measured by IMPROVE monitoring is composed of primary organic aerosols and secondary organic compounds. Primary organic aerosols are directly emitted as particulates. Secondary organic compounds are formed from condensation or photo-oxidization of VOCs. Washington's VOC emission inventory is much larger than the organic carbon (primary organic aerosol) inventory. Plan02d totals are 1,042,867 and 50,273 tons per year, respectively (see Chapter 6).

The only source apportionment analysis available for OMC is the WEP analysis developed by the WRAP for primary organic aerosols. Statewide emissions of primary organic aerosols are projected to increase by 4% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind weighted emissions indicates a similar increase of 3% in overall emissions and an increase of 10% in human-generated weighted emissions (see Appendix E). The WEP analysis projects that much of this increase will come from Puget Sound and the Vancouver, Canada area.

The WEP analysis in TSS indicates natural fire was the dominant source of emissions of primary organic compounds from Washington impacting the Pasayten Wilderness in the 2000-2004 baseline period. The visibility impairment due to natural fire was variable from year-to-year with the largest impacts occurring in 2001 and 2004. In the WRAP's 2018 modeling, natural fire was projected continue at 2000-2004 baseline levels and thus remains the dominant source. The projected human-caused increase in 2018 emissions from Washington State reflects major growth in emissions of area sources.

Emission inventories presented in section 6.3 indicate that while total VOC emissions are projected to decrease by 1% between the 2000-2004 baseline period and 2018, area sources of

VOCs increase by 67%. Area sources are the largest human-generated source category of VOCs in 2018. Area source VOCs are dominated by emissions from solvent utilization and residential wood combustion.

The large increase in area source emissions reflects the impact of population growth has on the total amount of emissions despite controls on "individual' areas sources such as a woodstove or can of paint. Solvent utilization is regulated through federal and state rules. Washington has more stringent woodstove emission standards than EPA and a mandatory curtailment requirement which has been strengthened to require curtailments at lower particulate matter concentrations as particulate matter standards have become more stringent.

The WEP analysis also shows that the Pasayten Wilderness is also impacted by Canadian emissions, primarily area source emissions.

Elemental Carbon: WRAP's PRP18a modeling projects an increase in the extinction coefficient for EC from 3.32 to 3.53 Mm^{-1}, an increase in visibility impairment of 0.21 Mm^{-1}. Adherence to the uniform glide path would result in a 2018 extinction coefficient for EC of 2.61 Mm^{-1}.

Statewide emissions of EC are projected to decrease by 25% between the 2000-2004 baseline period and 2018. However, WRAP's WEP analysis of upwind weighted emissions indicates an overall 14% decrease and much larger decrease in human-generated emissions of 33% (see Appendix E for the Pasayten Wilderness Summary Tables). The WEP analysis in TSS projects most of this increase will come from Puget Sound and the Vancouver, Canada area.

The WEP analysis indicates natural fire was the dominant source of EC impacting the Pasayten Wilderness in the 2000-2004 baseline period. In the WRAP's 2018 modeling, natural fire was projected to remain at 2000-2004 baseline levels and thus remains the dominant source.

The WEP analysis indicates on-road and off-road mobile sources and area sources were responsible for most of the remainder of the EC in the 2000-2004 baseline period. The projected 2018 decrease of 33% in human-caused weighted emissions basically reflects the major reduction in mobile sources emissions resulting from federal rules that is somewhat offset by significant growth in emissions of area sources.

The WEP analysis indicates significant area source emissions from Canada. Though weighted Canadian emissions decrease slightly between the 2000-2005 baseline period and 2018, Canada continues to contribute elemental carbon emissions, particularly from off-road mobile source and area source emissions, to the Pasayten Wilderness and is apparently responsible for the projected increase in visibility impairment in 2018 due to elemental carbon.

Nitrate: WRAP's PRP18a modeling projects a reduction in the extinction coefficient for nitrate from 3.28 to 2.45 Mm^{-1}, a visibility improvement of 0.83 Mm^{-1}. Adherence to the uniform glide path would result in a higher 2018 extinction coefficient for nitrate of 3.02 Mm^{-1}.

Statewide emissions of nitrate are projected to decrease by 46% between the 2000-2004 baseline period and 2018. WRAP's WEP analysis of upwind emissions indicates a decrease in human-caused emissions of 41% in the upwind direction (see Appendix E for the Pasayten Wilderness Summary Tables). The reductions are due primarily to large decrease in nitrate emissions from mobile sources.

Summary: Ecology concludes from the analysis provided above that overall Washington is making progress in reducing visibility impairing pollutants impacting Pasayten Wilderness. At the same time Ecology acknowledges some ambiguity exists with regard to projected 2018 visibility at Pasayten Wilderness because of uncertainty about the reasonableness of the projected natural fire emissions. The question still remains, is this progress reasonable? Ecology relied on a four-factor analysis to address this issue.

Four-Factor Analysis

The RHR specifies that a state must consider the four factors specified by the CAA in determining the Reasonable Progress Goal for a Class I Area. Ecology developed a single set of four-factor analyses for Washington's 8 mandatory Class I Areas. Basically the individual sources in the 10 selected specific industries and emission source categories are located along the I-5 corridor in western Washington and are capable of contributing to visibility impairment at more than one mandatory Class I Areas.

The work done by Ecology on the Four-Factor Analyses is summarized in the Four-Factor Analysis subsection of section 9.2.1 Olympic National Park and described in Appendix F.

Ecology commits to proceeding with establishing and requiring controls on point sources of SO_2 and NO_X. Because of the process Ecology is required to follow, Ecology concludes that further controls are not reasonable at this time. Development of controls is discussed further as part of Washington's Long-Term Strategy in Chapter 10.

2018 Reasonable Progress Goal for the Most Impaired Days

Ecology concludes that 15.09 dv is the 2018 Reasonable Progress Goal for Pasayten Wilderness in light of controls on the books, BART implementation, the impact of out-of-state emissions, and the four-factor analysis. At this rate it would take Pasayten Wilderness 698 years from the 2000-2004 baseline period to reach natural visibility conditions. Improving progress toward the natural visibility conditions in the future will require controls on visibility impairing emissions in Washington State and controls on Canadian emissions.

9.3 Least Impaired Days

9.3.1 Olympic National Park

Baseline and Projected Visibility

Visibility conditions at Olympic National Park are monitored at the IMPROVE site OLYM1. The monitored 2000-2004 baseline conditions at this site on the Least Impaired Days are 6.02 dv and calculated natural visibility conditions are 2.7 dv, a difference of 3.32 dv.

This foundational SIP covers the first control period, 2005-2018. PRP18a WRAP modeling projects 2018 visibility of 5.82 dv (Figure 9-8).

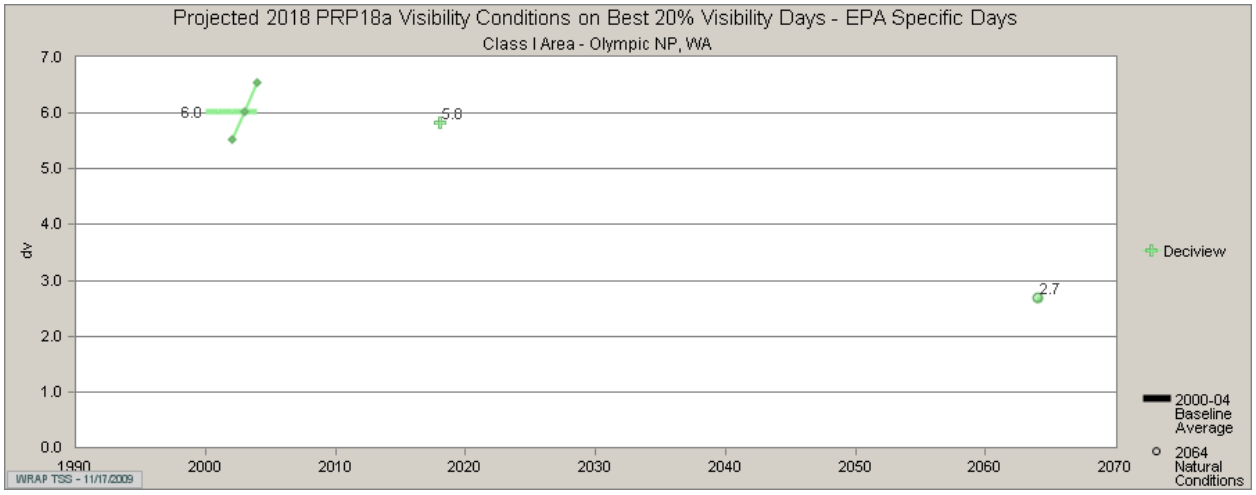

Figure 9-8 Projected Visibility Conditions on the Least Impaired Days in Olympic National Park

2018 Reasonable Progress Goal for the Least Impaired Days

The RHR requires the state to establish a Reasonable Progress Goal that ensures no degradation of visibility on the Least Impaired Days. This requirement may be satisfied by maintaining the baseline visibility of 6.02 dv. WRAP modeling indicates that this is achievable.

Ecology establishes 6.02 dv as the 2018 Reasonable Progress Goal for Olympic National Park for the Least Impaired Days.

9.3.2 North Cascades National Park and Glacier Peak Wilderness

Baseline and Projected Visibility

Visibility conditions at North Cascades National Park and Glacier Peak Wilderness are monitored at the IMPROVE site NOCA1. The monitored 2000-2004 baseline conditions at this site on the Least Impaired Days are 3.37 dv and calculated natural visibility conditions are 1.93 dv, a difference of 1.44 dv.

This foundational SIP covers the first control period, 2005-2018. PRP18a WRAP modeling projects 2018 visibility of 3.24 dv (Figure 9-9).

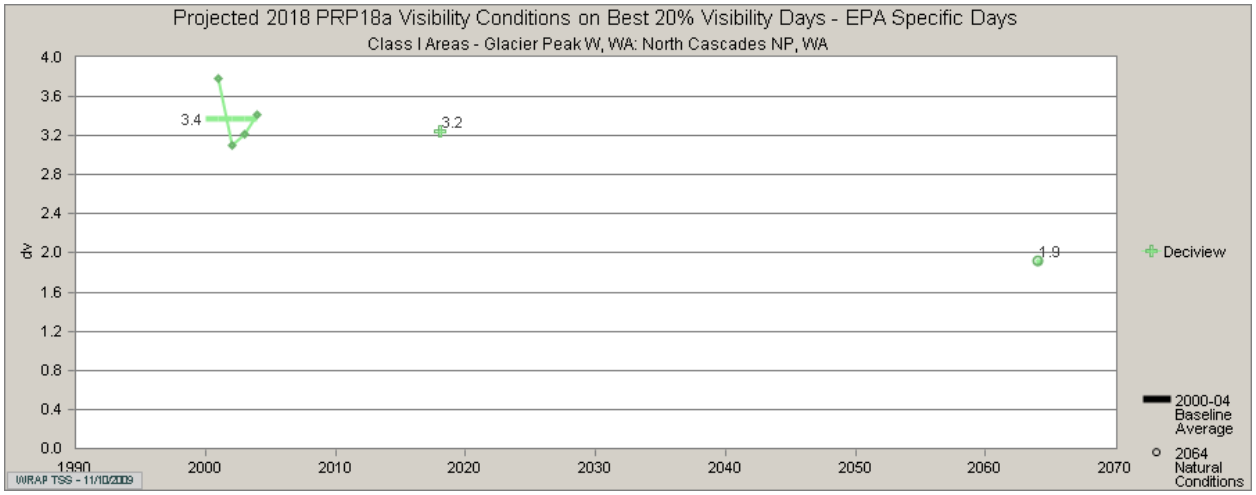

Figure 9-9 Projected Visibility Conditions on the Least Impaired Days in North Cascades National Park and Glacier Peak Wilderness

2018 Reasonable Progress Goal for the Least Impaired Days

The RHR requires the state to establish a Reasonable Progress Goal that ensures no degradation of visibility on the Least Impaired Days. This requirement may be satisfied by maintaining the baseline visibility of 3.37 dv. WRAP modeling indicates that this is achievable.

Ecology establishes 3.37 dv as the 2018 Reasonable Progress Goal for North Cascades National Park and Glacier Peak Wilderness for the Least Impaired Days.

9.3.3 Alpine Lakes Wilderness

Baseline and Projected Visibility

Visibility conditions at Alpine Lakes Wilderness are monitored at the IMPROVE site SNPA1. The monitored 2000-2004 baseline conditions at this site on the Least Impaired Days are 5.5 dv and calculated natural visibility conditions are 2.33 dv, a difference of 3.17 dv.

This foundational SIP covers the first control period, 2005-2018. PRP18a WRAP modeling projects 2018 visibility of 4.86 dv (Figure 9-10).

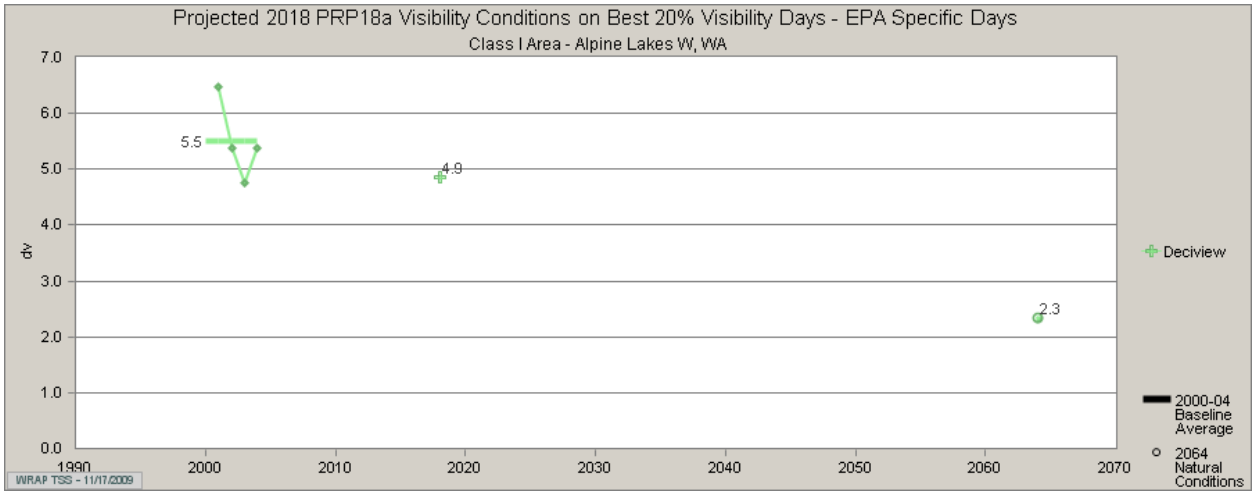

Figure 9-10 Projected Visibility Conditions on the Least Impaired Days in Alpine Lakes Wilderness

2018 Reasonable Progress Goal for the Least Impaired Days

The RHR requires the state to establish a Reasonable Progress Goal that ensures no degradation of visibility on the Least Impaired Days. This requirement may be satisfied by maintaining the baseline visibility of 5.5 dv. WRAP modeling indicates that this is achievable.

Ecology establishes 5.5 dv as the 2018 Reasonable Progress Goal for Alpine Lakes Wilderness for the Least Impaired Days.

9.3.4 Mount Rainier National Park

Baseline and Projected Visibility

Visibility conditions at Mount Rainier National Park are monitored at IMPROVE site MORA1. The monitored 2000-2004 baseline conditions at this site on the Least Impaired Days are 5.47 dv and calculated natural visibility conditions are 2.56 dv, a difference of 2.91 dv.

This foundational SIP covers the first control period, 2005-2018. PRP18a WRAP modeling projects 2018 visibility of 4.83 dv (Figure 9-11).

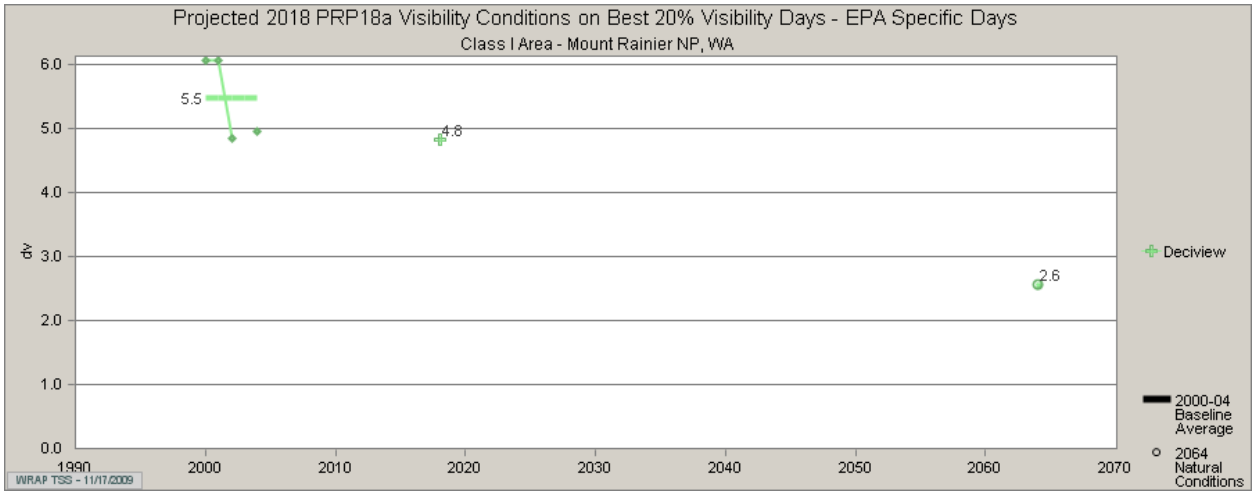

Figure 9-11 Projected Visibility Conditions on the Least Impaired Days in Mount Rainier National Park

2018 Reasonable Progress Goal for the Least Impaired Days

The RHR requires the state to establish a Reasonable Progress Goal that ensures no degradation of visibility on the Least Impaired Days. This requirement may be satisfied by maintaining the baseline visibility of 5.47 dv. WRAP modeling indicates that this is achievable.

Ecology establishes 5.47 dv as the 2018 Reasonable Progress Goal for Mount Rainier National Park for the Least Impaired Days.

9.3.5 Goat Rocks Wilderness and Mount Adams Wilderness

Baseline and Projected Visibility

Visibility conditions at Goat Rocks Wilderness and Mount Adams Wilderness are monitored at IMPROVE site WHPA1. The monitored 2000-2004 baseline conditions at this site on the Least Impaired Days are 1.66 dv and calculated natural visibility conditions are 0.82 dv, a difference of 0.84 dv.

This foundational SIP covers the first control period, 2005-2018. PRP18a WRAP modeling projects 2018 visibility of 1.47 dv (Figure 9-12).

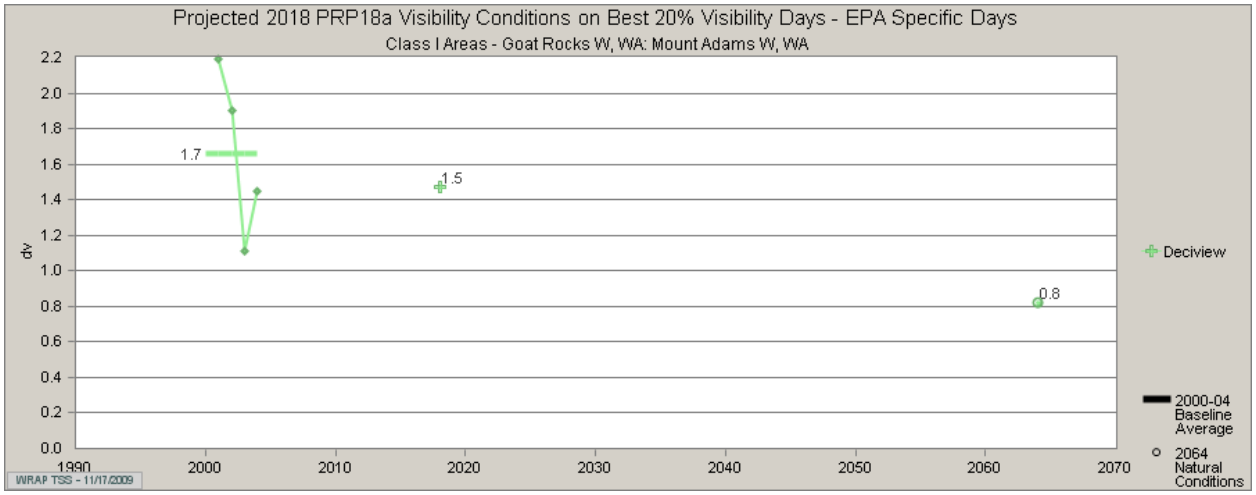

Figure 9-12 Projected Visibility Conditions on the Least Impaired Days in Goat Rocks Wilderness and Mount Adams Wilderness

2018 Reasonable Progress Goal for the Least Impaired Days

The RHR requires the state to establish a Reasonable Progress Goal that ensures no degradation of visibility on the Least Impaired Days. This requirement may be satisfied by maintaining the baseline visibility of 1.66 dv. WRAP modeling indicates that this is achievable.

Ecology establishes 1.66 dv as the 2018 Reasonable Progress Goal for Goat Rocks Wilderness and Mount Adams Wilderness for the Least Impaired Days.

9.3.6 Pasayten Wilderness

Baseline and Projected Visibility

Visibility conditions at Pasayten Wilderness are monitored at the IMPROVE site PASA1. The monitored 2000-2004 baseline conditions at this site on the Least Impaired Days are 2.73 dv and calculated natural visibility conditions are 1.16 dv, a difference of 1.57 dv.

This foundational SIP covers the first control period, 2005-2018. PRP18a WRAP modeling projects 2018 visibility of 1.89 dv (Figure 9-13).

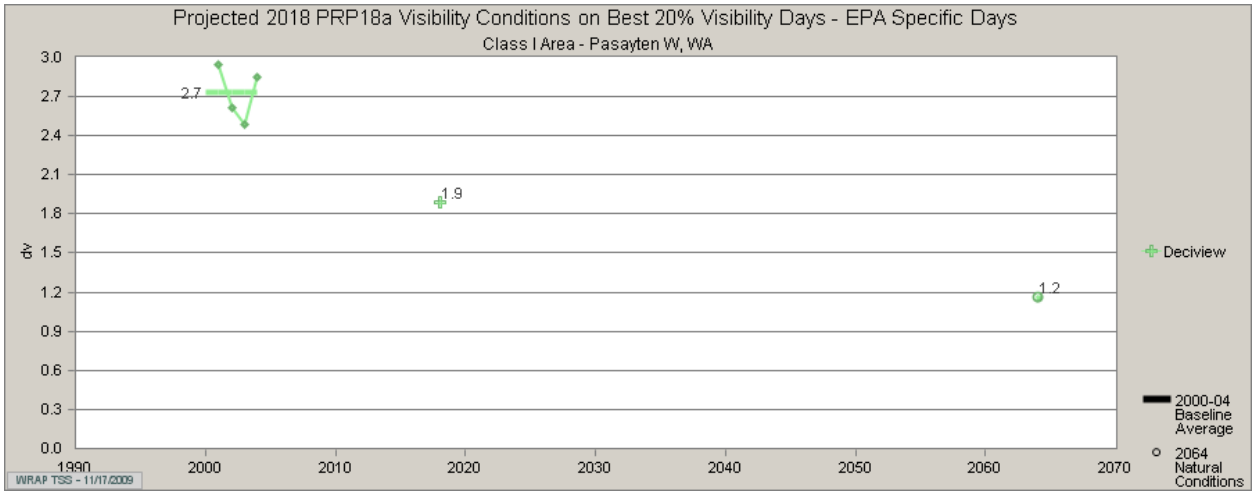

Figure 9-13 Projected Visibility Conditions on the Least Impaired Days in Pasayten Wilderness

2018 Reasonable Progress Goal for the Least Impaired Days

The RHR requires the state to establish a Reasonable Progress Goal that ensures no degradation of visibility on the Least Impaired Days. This requirement may be satisfied by maintaining the baseline visibility of 2.73 dv. WRAP modeling indicates that this is achievable.

Ecology establishes 2.73 dv as the 2018 Reasonable Progress Goal for Pasayten Wilderness for the Least Impaired Days.

9.4 Summary

Ecology established Reasonable Progress Goals for the Most Impaired Days and the Least Impaired Days as required by the RHR. These are summarized in Table 9-3.

Table 9-3 2018 Reasonable Progress Goals for Washington's Class I Areas

Mandatory Class I Areas	Most Impaired Days				Least Impaired Days	
	2000-2004 Baseline Conditions (dv)	Uniform Glide Path 2018 Target (dv)	2018 Reasonable Progress Goal (dv)	Years from Baseline to Attain Natural Conditions at Reasonable Progress	2000-2004 Baseline Conditions (dv)	2018 Reasonable Progress Goal (dv)
Olympic National Park	16.74	14.81	16.38	323	6.02	6.02
North Cascades National Park & Glacier Peak Wilderness	16.01	14.23	16.01	n/a[1]	3.37	3.37
Alpine Lakes Wilderness	17.84	15.64	16.32	87	5.5	5.5
Mount Rainier National Park	18.24	15.98	16.66	86	5.47	5.47
Goat Rocks Wilderness & Mount Adams Wilderness	12.76	11.73	11.79	64	1.66	1.66
Pasayten Wilderness	15.23	13.60	15.09	698	2.73	2.73

[1] Because it is not possible to estimate visibility improvement, the years needed to attain natural conditions cannot be determined.

In establishing Reasonable Progress Goals for the Most Impaired Days, Ecology considered controls on the books, implementation of BART, the impact of out-of-state emissions, and a four-factor analysis of significant source categories in the state of Washington.

Ecology also considered major SO_2 reduction projects at 3 oil refineries that were not included in the PRP18a emission inventory and the disproportionately high fire impacts of 2003 in setting a "no degradation" goal for the Most Impaired Days at North Cascades National Park and Glacier Peak Wilderness. Because revised modeling is not possible, the best Ecology can do is estimate that lower emissions will result in less visibility impairment than the increased impairment modeled from the faulty inventory.

The analysis determined that emissions from Canada play a significant role in all of Washington's mandatory Class I Areas. Likewise, Pacific offshore emissions play a significant role in all mandatory Class I Areas except Pasayten Wilderness. Washington's mandatory Class I Areas will not be able to attain natural conditions without controls on Canadian and Pacific offshore emissions. Lack of controls will continue to hamper our ability to achieve the uniform

glide path in the future and lengthen the time needed to reach natural conditions. Canadian and Pacific offshore controls are discussed further in the Long-Term Strategy.

Three mandatory Class I Areas — North Cascades National Park, Glacier Peak Wilderness, and Pasayten Wilderness — are significantly impacted by natural fire. WRAP's analysis projected baseline period fire emissions to 2018 without any change. If these projections are assumed to be reasonable estimates of the impacts of fire in 2018, the magnitude of fire impacts is so great that unless actual fire impacts decrease significantly in the future or natural conditions are reinterpreted sometime to allow for increased smoke impacts, the 3 mandatory Class I Areas will not be able to achieve natural conditions.

Under the RHR, Reasonable Progress Goals for the Least Impaired Days are required to ensure no degradation of visibility. Ecology set the Reasonable Progress Goals at baseline visibility conditions. The WRAP's modeling analysis indicates these goals will be met.