

Chapter 4 Monitoring Visibility in Washington’s Mandatory Class I Areas

The Regional Haze Rule (RHR) applies to mandatory Class 1 Areas. In 1979, the Environmental Protection Agency (EPA), in consultation with the Secretary of the Interior, promulgated a list of mandatory Class I Areas. The list contains 156 national parks and wilderness areas where visibility is an important value. Consultation with the Federal Land Managers (FLMs) on visibility values by EPA involved the U.S. Department of the Interior (USDI), U.S. Department of the Interior National Park Service (USDI-NPS), U.S. Department of the Interior Fish and Wildlife Service (USDI-FWS), the U.S. Department of Agriculture (USDA), and U.S. Department of Agriculture Forest Service (USDA-FS).¹

This chapter identifies the mandatory Class I Areas located in the state of Washington, provides background on visibility monitoring for Class I Areas, and identifies the visibility monitoring sites associated with each of Washington’s Class I Areas.

4.1 Washington’s Mandatory Class I Areas

Washington has 8 mandatory Class I Areas: 3 national parks and 5 wilderness areas. Washington’s 8 mandatory Class I Areas are shown in Figure 4-1 along with the locations of the visibility monitoring sites for the Class I Areas.

¹ 40 CFR 81.400

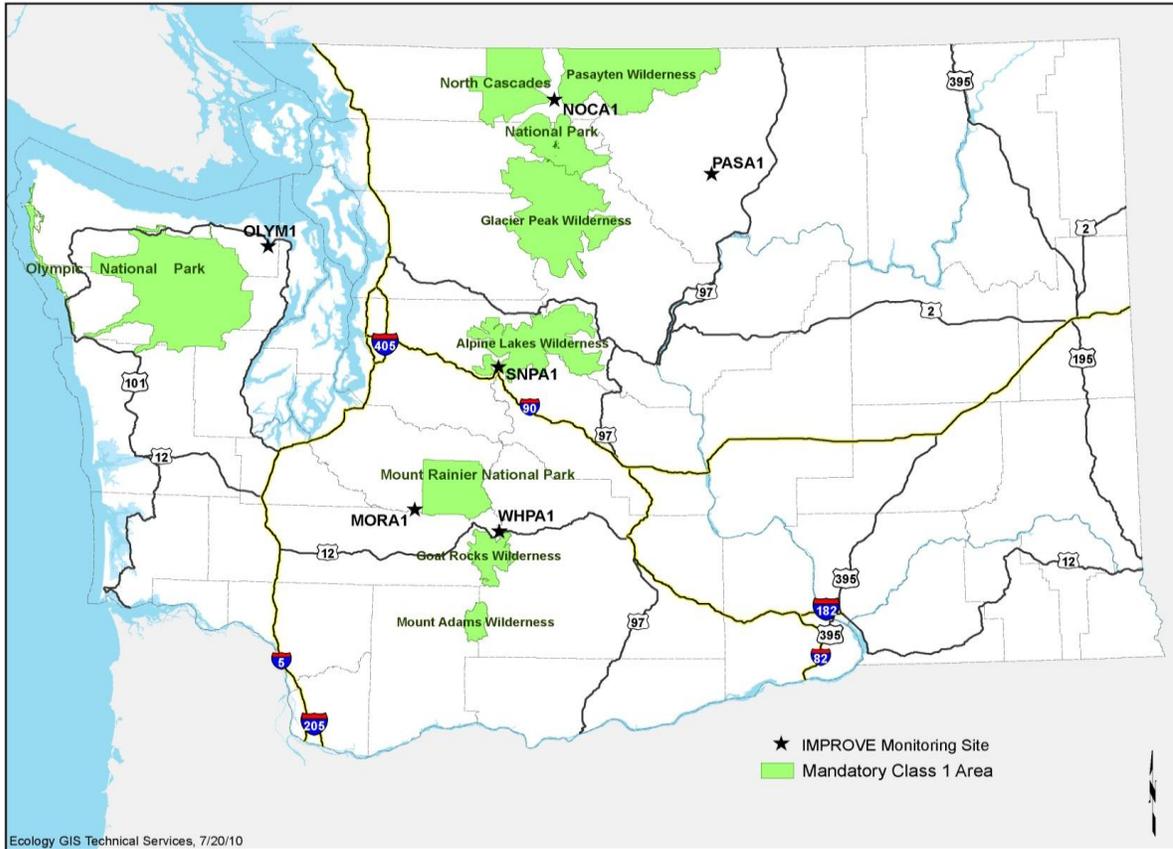


Figure 4-1 Washington’s Mandatory Class I Areas and Visibility Monitoring Sites

Table 4-1 provides information on the size and FLM of each of the mandatory Class I Areas. The acreages may not match the current acreages of the national park or wilderness area for reasons including more accurate surveys or expansion of the area.

Table 4-1 Washington’s Mandatory Class I Areas

| <i>Mandatory Class I Area</i> | <i>Acreage²</i> | <i>Federal Land Manager</i> |
|-------------------------------|----------------------------|-----------------------------|
| Olympic National Park | 892,578 | USDI-NPS |
| North Cascades National Park | 503,277 | USDI-NPS |
| Glacier Peak Wilderness | 464,258 | USDA-FS |
| Alpine Lakes Wilderness | 303,508 | USDA-FS |
| Mt. Rainier National Park | 235,239 | USDI-NPS |
| Goat Rocks Wilderness | 82,680 | USDA-FS |
| Mt. Adams Wilderness | 32,356 | USDA-FS |
| Pasayten Wilderness | 505,524 | USDA-FS |
| Total Acres | 3,019,420 | |

² Acreages listed in 40 CFR 81.434.

Washington's 8 mandatory Class I Areas are briefly described in the sections below; maps of these areas are included later in this chapter. The descriptions start with Olympic National Park followed by the 6 Class I Areas on the west side of the Cascade Range from the Canadian border south and ending with the Pasayten Wilderness which is largely on the east side of the Cascade Range.

4.1.1 Olympic National Park

Olympic National Park comprises a significant portion of the Olympic Peninsula in northwestern Washington. It is divided into two segments: the Olympic Mountains, which form the mountainous core of the Park, and a separate coastal strip, stretching for 90 km (56 mi) along the Pacific coast. The dominant aquatic feature is 13 major rivers flowing from the Olympic Mountains in all directions. Ninety-five percent of the Park is designated wilderness.

Elevations range from sea level along the coast to 2,428 m (7,965 feet) at the crest of Mt. Olympus near the center of the Peninsula. The area has the greatest precipitation gradient in the world for temperate latitudes. Annual precipitation is near 400 cm (150 inches) in the western valleys and 500 cm (200 inches) at the summit of Mt Olympus but as little as 41 cm (16 inches) on the northeast shore of the Peninsula in the rain shadow of the Olympic Mountains.

According to National Park Service statistics, there are approximately 3 million visitors to the Olympic National Park every year.³

4.1.2 North Cascades National Park

North Cascades National Park is set in the rugged mountains and the beautiful scenery of the Cascade Mountain Range in north-central Washington, about 80 km (50 miles) east of Bellingham. The area was set aside to preserve dramatic mountain scenery, alpine areas, and glaciers. Mountain summits rise abruptly 1,800-2,600 m (5,900-8,530 feet) above the valley floor. Approximately 93 percent of the Park is designated wilderness.

North Cascades National Park lies less than 150 km (95 miles) from major metropolitan areas, most notably, Seattle, Washington and Vancouver, British Columbia. According to USDI-NPS statistics, there are approximately 20,000 recreational visitors to the North Cascades National Park every year.⁴

4.1.3 Glacier Peak Wilderness

Glacier Peak Wilderness includes more than 200 lakes, many unnamed and tremendously difficult to access, in various cirques and hidden basins. The Wilderness straddles the northern Cascade Range roughly between Suiattle River on the west and Lake Chelan on the east. North Cascades National Park is adjacent to the northern border.

³ National Park Service Public Use Statistics Office, <http://www.nature.nps.gov/stats/>

⁴ National Park Service Public Use Statistics Office, <http://www.nature.nps.gov/stats/>

The dominant topographic feature is Glacier Peak, a 3,214 m (10,541 foot) high volcanic cone. Other mountain summits are 2,500 m (8,200 feet) or lower in elevation. Most terrain lies below 2,000 m (6,500 feet) elevation.

Glacier Peak Wilderness is drained on the west side of the Cascade crest by the Suiattle and Sauk Rivers, tributaries to the Skagit River, which flows into northern Puget Sound. East of the Cascade crest, streams flow to Lake Chelan and the Columbia River basin. The lowest elevations where streams exit the Wilderness on the west side are around 400 m (1,300 feet). The lowest elevations east of the Cascade crest are 350 to 400 m (1,200 to 1,300 feet), close to the 335 m (1,099 foot) elevation of Lake Chelan.

4.1.4 Alpine Lakes Wilderness

Alpine Lakes Wilderness was created when Congress passed the 1976 Alpine Lakes Wilderness Act to protect the area in its unique natural state. The name Alpine Lakes takes its origin from the nearly 700 small mountain lakes nestled among the high rock peaks and forested valleys of the region. The Wilderness is jointly administered by the Mt. Baker-Snoqualmie National Forest and the Okanogan-Wenatchee National Forest.

Alpine Lakes Wilderness is located in the rugged central Cascade Range. It is accessed by 47 trailheads and 990 km (615 miles) of trail on both sides of the crest of the Cascade Range between Stevens Pass (US Hwy 2) on the north and Snoqualmie Pass (I-90) on the south.

Its breathtaking beauty and proximity to the Seattle metropolitan area makes the Alpine Lakes one of the most popular natural areas in the Northwest. Over half of Washington State's population lives within a one-hour drive of the Wilderness.

4.1.5 Mount Rainier National Park

Mount Rainier National Park was established as the nation's fifth national park in 1899. The Park was set aside to protect timber, minerals, and other natural resources. One hundred kilometers (62 miles) southeast of Seattle, Mount Rainier is the highest of the chain of volcanoes comprising the Cascade Range. At 4,392 m (14,410 feet), Mount Rainier is the fifth tallest peak in the contiguous 48 states. The massive mountain occupies more than one-fourth of the Park's area. The 27 major glaciers on its slopes form the largest mass of year-round ice in the United States outside Alaska.

Mount Rainier National Park lies within 64 km (40 miles) of Puget Sound. The lowlands along the eastern shore of Puget Sound are the most of the populated and industrialized area of Washington. According to National Park Service statistics, there are more than 1 million recreational visitors to the National Park every year.⁵

4.1.6 Goat Rocks Wilderness

⁵ National Park Service Public Use Statistics Office, <http://www.nature.nps.gov/stats/>

The Goat Rocks Wilderness is a portion of the volcanic Cascade Range in southwestern Washington located between Mount Rainier and Mount Adams. The Goat Rocks are remnants of a large volcano, which has been extinct for some two million years. The cluster of rocks and peaks in this area has become known as Goat Rocks because of the bands of mountain goats that live there. The Wilderness lies in both the Gifford Pinchot National and the Okanogan-Wenatchee National Forests.

Glaciation and erosion have worn away the terrain and left moderate summits east and west of the crest of the Cascades. Elevation in the Goat Rocks range from 900 m (3,000 feet) to 2,450 m (8,201 feet) at Gilbert Peak. The deep east-west drainages below the ridges often open into park-like alpine meadows dotted with small lakes and even smaller ponds.

4.1.7 Mount Adams Wilderness

Congress designated the Mount Adams Wilderness in 1964. The Wilderness lies in the Gifford Pinchot National Forest on the crest of the Cascade Range in southwestern Washington. Second in height only to Mount Rainier statewide, 3,742 m (12,276 feet) Mount Adams looms over at least 10 glaciers and a wilderness of forested slopes and subalpine meadows. The huge volcanic bulk of the mountain takes up a considerable portion of the Wilderness. Since the eruption of Mount St. Helens, Mount Adams has become a popular attraction for mountain climbers.

4.1.8 Pasayten Wilderness

The Pasayten Wilderness stretches across the crest of the Cascade Range in northern Washington. The Wilderness is bordered on the north by 80 km (50 mi) of the Canadian border and on the west by the Ross Lake National Recreation Area. The Pasayten Wilderness is located in both the Okanogan-Wenatchee and the Mount Baker-Snoqualmie National Forests.

The terrain of the western Wilderness area is a series of high ridges that flatten out in the eastern Wilderness area to high plateaus. Almost 150 peaks in the Wilderness have elevations above 2,300 m (7,500 feet). The western part of the wilderness area, west of the Cascade crest, is in the upper Skagit River basin and drains into Ross Lake and the Skagit River and thence into northern Puget Sound. From the eastern part of the Wilderness, streams flow north into British Columbia or southeast into the central Columbia Plateau. The lowest Wilderness elevations are around 1,000 m (3,000 feet) at the western boundary near Ross Lake and the southern boundary near Lost River Gorge.

4.2 Visibility Monitoring of Washington's Mandatory Class I Areas

Washington has 6 Interagency Monitoring of Protected Visual Environments (IMPROVE) sites that monitor the visibility of the state's 8 mandatory Class I Areas. Four of Washington's Class I Areas have been combined into two clusters and one monitor used to represent each cluster. Table 4-2 provides general information on the 6 sites. The sites are shown in Figure 4-2. Each site is discussed briefly below. The sites are discussed in the same order as the mandatory Class I Areas earlier in the chapter where Olympic National Park was followed by the mandatory Class

I Areas on the west side of the Cascade Range from the Canadian Border south and ending with Pasayten Wilderness on the east side of the Cascade Range.

Table 4-2 Washington’s Interagency Monitoring of Protected Visual Environments Monitoring Sites

| <i>Site Name</i> | <i>Site Abbreviation</i> | <i>Site Sponsor</i> | <i>Monitored Mandatory Class I Area</i> |
|------------------|--------------------------|---------------------|--------------------------------------------------------|
| Olympic | OLYM1 | USDI-NPS | Olympic National Park |
| North Cascades | NOCA1 | USDI-NPS | North Cascades National Park & Glacier Peak Wilderness |
| Snoqualmie Pass | SNPA1 | USDA-FS | Alpine Lakes Wilderness |
| Mount Rainier | MORA1 | USDI-NPS | Mount Rainier National Park |
| White Pass | WHPA1 | USDA-FS | Goat Rocks Wilderness & Mt. Adams Wilderness |
| Pasayten | PASA1 | USDA-FS | Pasayten Wilderness |

4.2.1 Olympic Interagency Monitoring of Protected Visual Environments Site: OLYM1

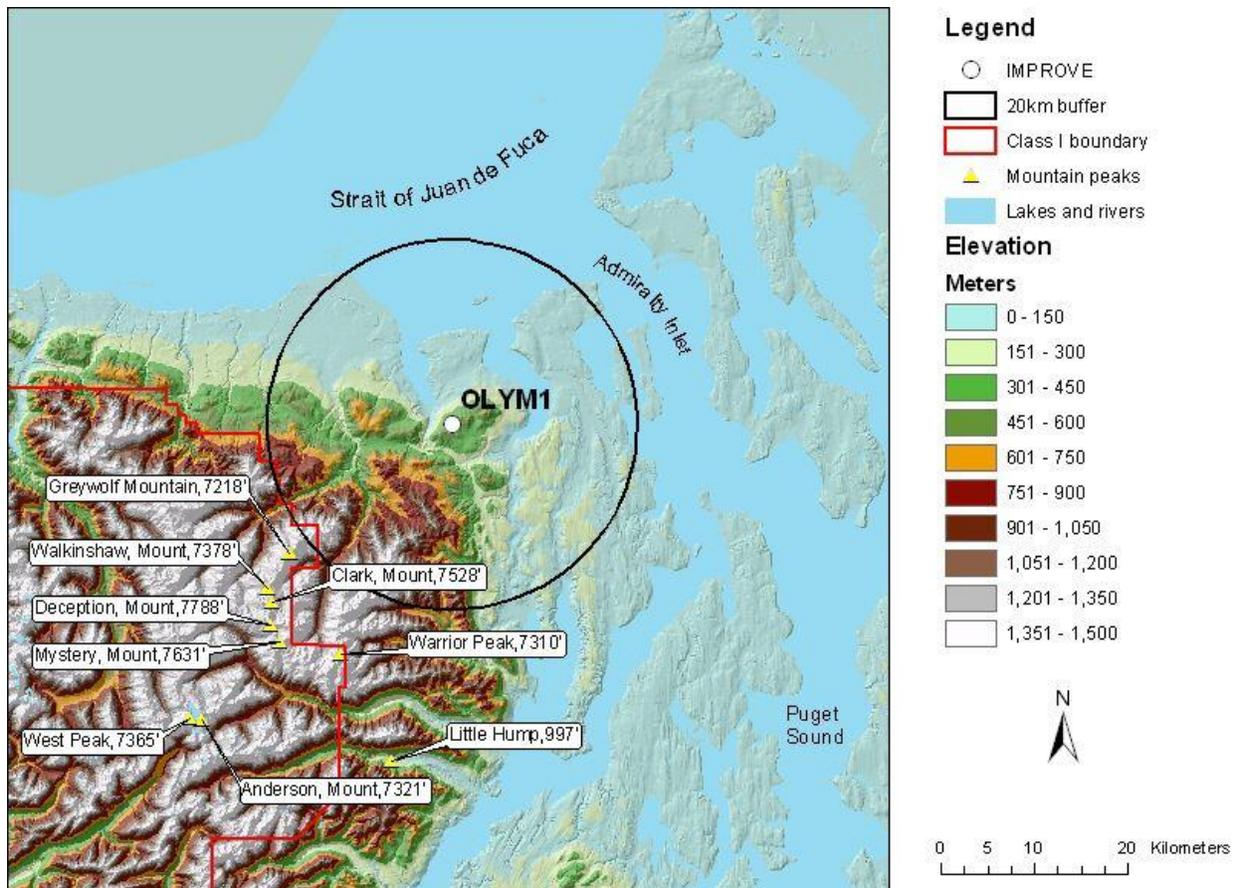


Figure 4-2 Location of OLYM1 Interagency Monitoring of Protected Visual Environments Site

Source: Causes of Haze Assessment Descriptive Maps

The IMPROVE site representing the Olympic National Park is OLYM1, located northeast of the Park boundary on an exposed hilltop (Blyn Lookout) near the northeastern extreme of the Olympic Peninsula at an elevation of 600 m (1,968 feet). See Figure 4-2. Additional information on nearby populations, industrial centers, and wind patterns can be found in Appendix C.

Representativeness

OLYM1 is on the northeast shore of the peninsula near Sequim. Sequim is in the rain shadow of the Olympics, with sea level precipitation less than 50 cm (20 inches) annually. The rain shadow effect may be less severe at the OLYM1 elevation of 600 m. OLYM1 should be representative of eastern National Park areas most of the time, although at this elevation there may be periods when it is above inversion height.

Because of the size of the Park, different areas may be affected by different sources. For the northeastern portion of the Olympic National Park, where the OLYM1 monitoring site is located, nearby industrial and urban emission sources that most immediately affect the area are in Port Angeles. For the western portions of the Olympic National Park including the coastal section, there are no additional large source areas, although there may be timber and shipping related industries.

4.2.2 North Cascades Interagency Monitoring of Protected Visual Environments Site: NOCA1

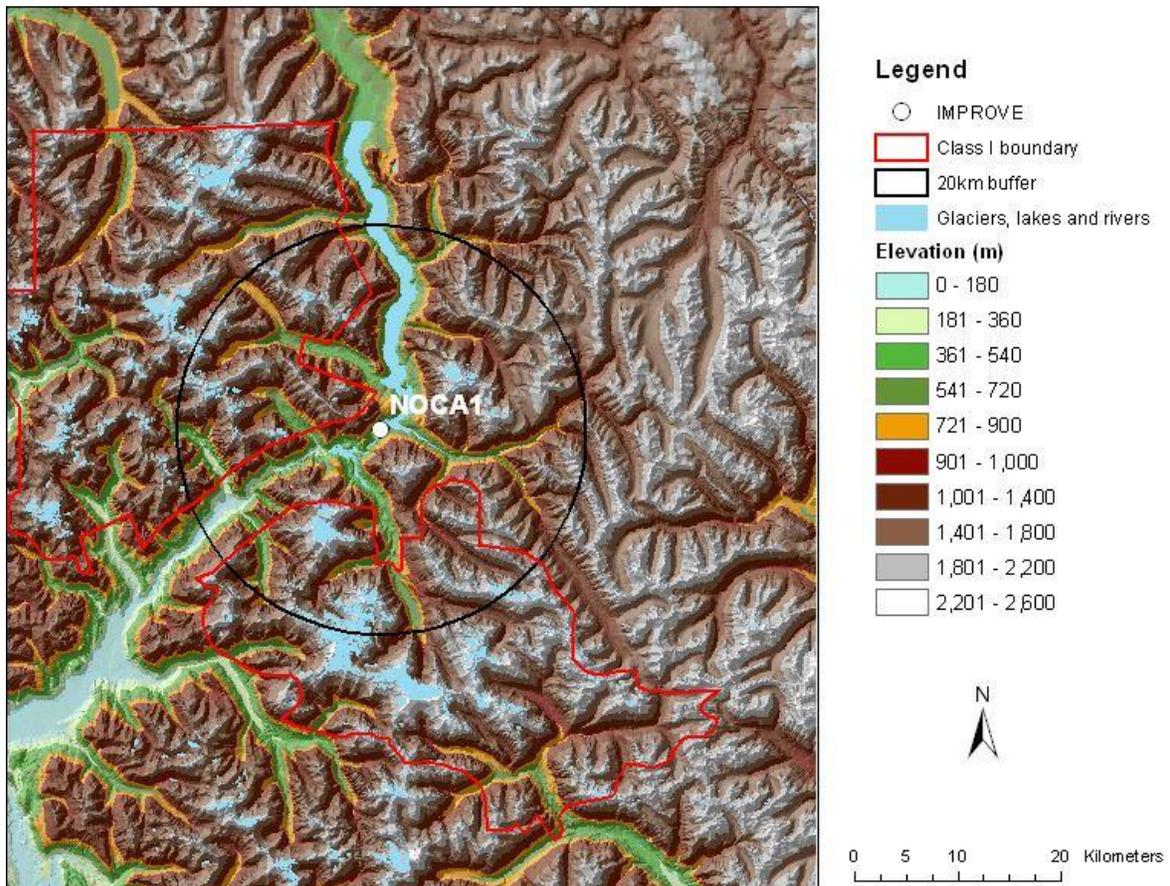


Figure 4-3 Location of NOCA1 Interagency Monitoring of Protected Visual Environments Site

Source: Causes of Haze Assessment Descriptive Maps

The NOCA1 IMPROVE site is the monitoring site for two mandatory Class I Areas, North Cascades National Park and Glacier Peak Wilderness. NOCA1 is located near Ross Lake on the upper reaches of the Skagit River just outside of the eastern boundary of the northern Park section, located north of the Skagit River. See Figure 4-3. The monitor is situated at an elevation of 576 m (1,889 feet) and is 87 m (285 feet) above the level of Ross Lake. Additional information on nearby populations, industrial centers, and wind patterns can be found in Appendix C.

Representativeness

The NOCA1 IMPROVE site is within the Skagit River Valley near Ross Lake, 87 m above lake level and about 200 m (650 feet) below the surrounding ridge tops. The NOCA1 site is in the lower slopes of a valley and may at times be within surface-based valley inversions. In the absence of valley inversions, the monitor should be representative of lower Park elevations at all times.

Similarly for Glacier Peak Wilderness, when NOCA1 is contained within surface-based valley inversions, it would not reflect visibility conditions at higher elevations. In the absence of valley inversions, the monitor should be representative of lower elevations of the Wilderness at all times.

4.2.3 Snoqualmie Pass Interagency Monitoring of Protected Visual Environments Site: SNPA1

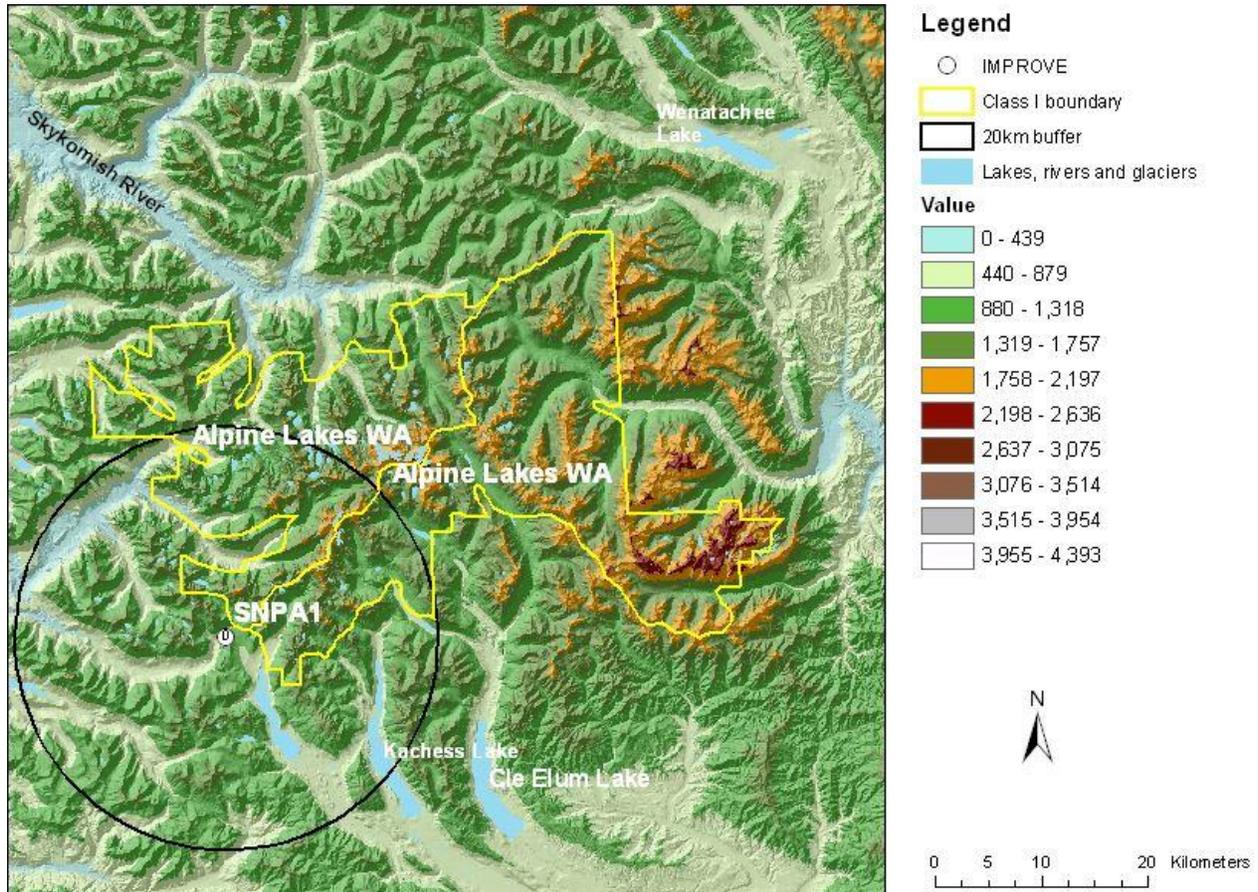


Figure 4-4 Location of SNPA1 Interagency Monitoring of Protected Visual Environments Site

Source: Causes of Haze Assessment Descriptive Maps

SNPA1 is the IMPROVE site representing the Alpine Lakes Wilderness. SNPA1 is located near the southwest boundary of the Wilderness in Snoqualmie Pass, a pass over the Cascade Range. The monitoring site elevation of 1,160 m (3,805 feet) is 239 m (784 feet) above the Snoqualmie Pass elevation of 921 m (3,022 feet). See Figure 4-4 SNPA1 is located near a ski area. Additional information on nearby populations, industrial centers, and wind patterns can be found in Appendix C.

Representativeness

SNPA1 is at a well-exposed ridge crest location and should be very representative of the particulate aerosol concentration and composition at similarly exposed locations in the Alpine Lakes Wilderness. The elevation of SNPA1 is at the lower end of the range of elevations of the Wilderness.

The mountain pass location of SNPA1 is representative of transport flow across the Cascade crest. Due to its location at a ridge crest, SNPA1 is probably above trapping inversions that may develop at valley bottom locations west and east of the Cascade crest.

4.2.4 Mount Rainier Interagency Monitoring of Protected Visual Environments Site: MORA1

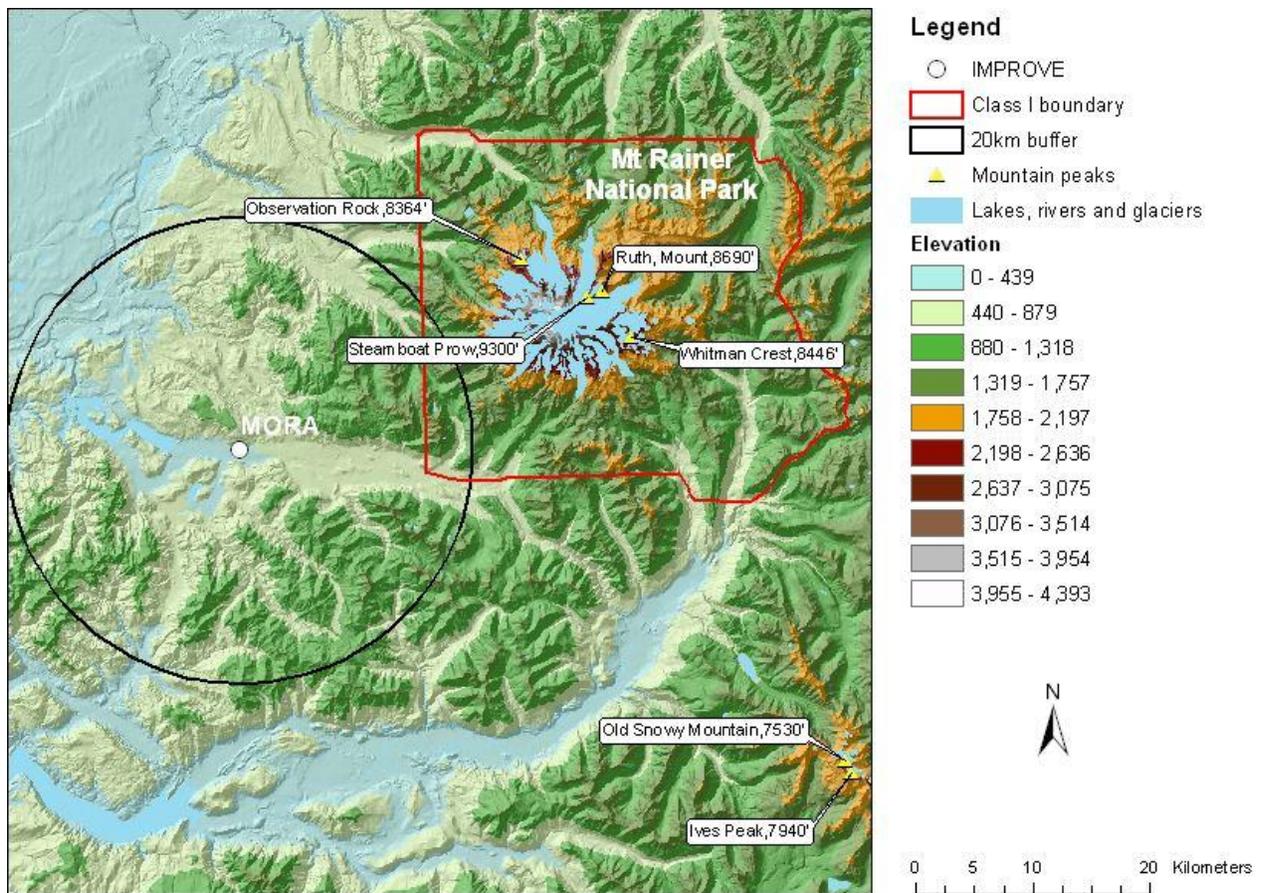


Figure 4-5 Location of MORA1 Interagency Monitoring of Protected Visual Environments Site

Source: Causes of Haze Assessment Descriptive Maps

The IMPROVE site representing Mount Rainier National Park, MORA1, is situated southeast of the Park at the Park headquarters at Tahoma Woods. MORA1 is located within the Nisqually River Valley at an elevation of 439 m (1,440 feet). The monitor is some 30 km (18.5 mi) west-southwest from the summit of Mount Rainier as shown above. See Figure 4-5.

The orientation of the drainage is east to west, with an elevation drop of about 60 ft/mile. Where the Nisqually River empties into Alder Lake reservoir (5 km or 3 miles) west of the site the river elevation is 367 m (1,204 feet).

The valley bottom at the monitoring site is about 1.5 km (0.9 mi) wide. The monitoring site is at the northern edge of the valley bottom. Elevations rise to 450 m (1,475 feet) at a distance of 2 km (1.25 mi) north and 3 km (1.9 mi) south from the monitoring site. Regional ground cover is predominantly fir and pine forest. Additional information on nearby populations, industrial centers, and wind patterns can be found in Appendix C.

Representativeness

The valley where the IMPROVE site is located may be subject to inversion and trapping of pollutants during periods of high pressure and stagnation. In those cases, the monitoring site, located at the bottom of the valley, would be contained within the trapped stable layer and would only be representative of the lower portions of the Park.

Generally, wind directions at MORA1 are channeled to an east/west direction with characteristic mountain/valley circulations of easterly nighttime drainage flow and westerly daytime upslope flow in the valley.

4.2.5 White Pass Interagency Monitoring of Protected Visual Environments Site: WHPA1

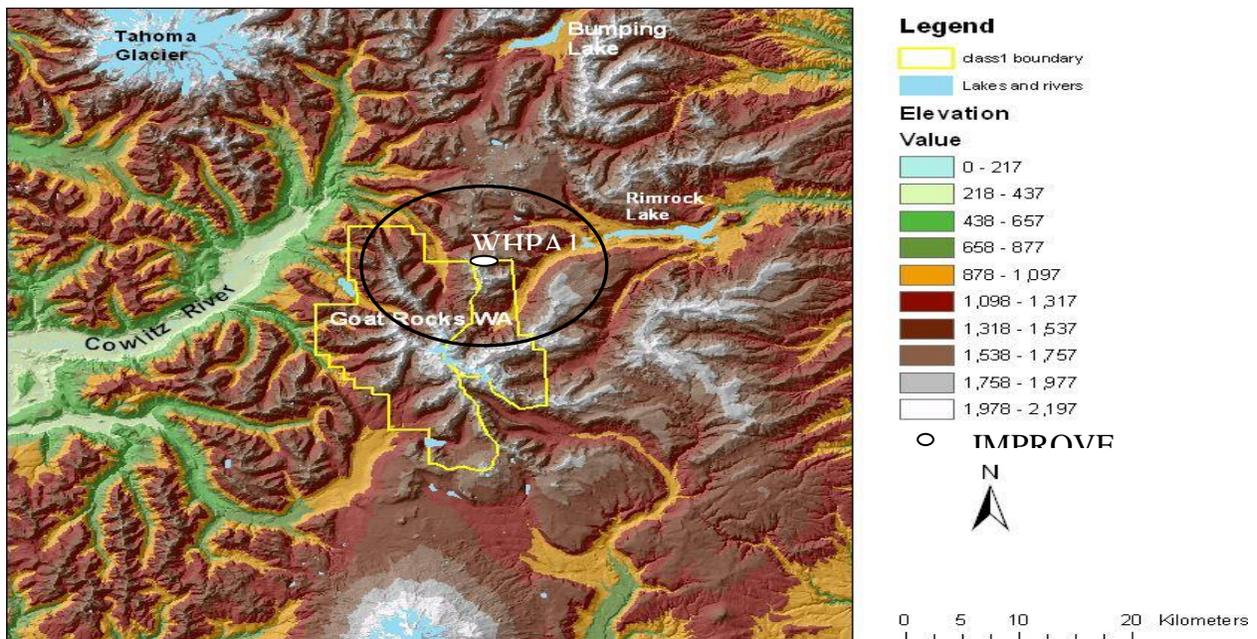


Figure 4-6 Location of WHPA1 Interagency Monitoring of Protected Visual Environments Site

Source: Causes of Haze Assessment Descriptive Maps

The IMPROVE site representing Goat Rocks and Mount Adams Wilderness Areas, WHPA1, is located on the crest of the Cascade Range at the northern Goat Rocks Wilderness boundary at White Pass Ski Resort near White Pass Washington. The monitoring site elevation is 1,830 m (6,002 feet). See Figure 4-6. Additional information on nearby populations, industrial centers, and wind patterns can be found in Appendix C.

Representativeness

WHPA1 is at a ridge crest location well-exposed to upper airflows and to aerosols transported aloft from upwind sources. WHPA1 should be very representative of aerosol concentration and composition at similarly exposed locations in the Goat Rocks and Mount Adams Wilderness Areas. Its elevation and exposure should also make it representative of regional characteristics and transport from distant source regions at pressure heights near 850 mb that are relatively unperturbed by terrain effects.

4.2.6 Pasayten Interagency Monitoring of Protected Visual Environments Site: PASA1

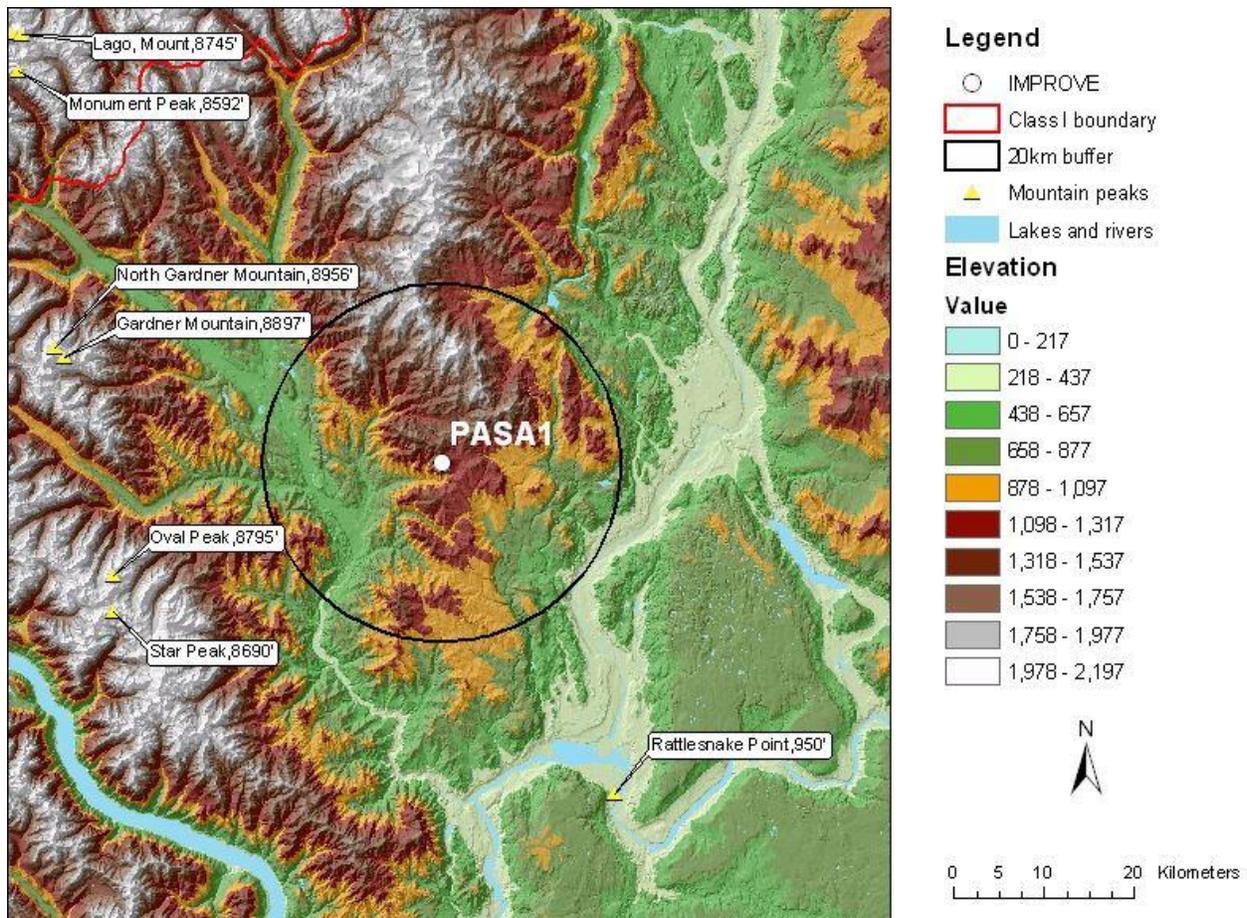


Figure 4-7 Location of PASA1 Interagency Monitoring of Protected Visual Environments Site

Source: Causes of Haze Assessment Descriptive Maps

The IMPROVE site representing Pasayten Wilderness, PASA1, is situated near the crest of Little Buck Mountain, 50 km (30 mi) south and east of the Wilderness boundary. PASA1 is located at an exposed elevation of 1,634 m (5,360 ft). See Figure 4-7. Additional information on nearby populations, industrial centers, and wind patterns can be found in Appendix C.

Representativeness

The PASA1 IMPROVE site is at a well-exposed ridge top location and should be very representative of regional conditions including high elevation locations in the Pasayten Wilderness. It is also representative of upper level (850 mb) aerosol characteristics of the central Columbia Plateau and Basin.

The North Cascades National Park IMPROVE site, NOCA1, may be better representative of low elevations of the Pasayten Wilderness east of the Cascade crest.