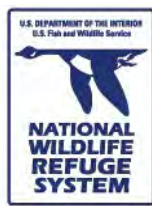


U.S. Fish & Wildlife Service

**Draft Comprehensive River Management
Plan and Environment Assessment**

Nowitna Wild and Scenic River



Nowitna National Wildlife Refuge

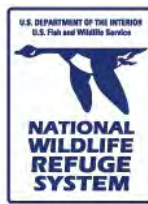
PO Box 287

Galena, Alaska 99741

October 2024

MISSION STATEMENTS

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.



The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

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Photo: Reflection of the sky over the Nowitna National Wildlife Refuge, Alaska

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Chapter I. Introduction

I.1 BACKGROUND

The Nowitna River flows through the Nowitna National Wildlife Refuge (NWR) which was established under the Alaska National Interest Lands Conservation Act of 1980 (ANILCA). National wildlife refuges are guided by the mission and goals of the National Wildlife Refuge System, the purposes of an individual refuge, U.S. Fish and Wildlife Service (Service) policy, and laws and international treaties. Additional guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997; the Refuge Act of 1962; and selected portions of the Code of Federal Regulations (CFR) and Service manuals. The Wild and Scenic Rivers Act of 1968 (WSRA) established the National Wild and Scenic Rivers System (NWSRS). ANILCA added the Nowitna Wild and Scenic River (WSR) to the NWSRS and classified it as “wild”.

ANILCA sets out specific purposes for each refuge in Alaska; the purposes of the Nowitna NWR are set forth in Section 302 of ANILCA. The purposes identify some of the reasons why Congress established the Nowitna NWR and set the management priorities for the refuge. The purposes are as follows:

- “(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, trumpeter swans, greater white-fronted geese, canvasbacks and other waterfowl and migratory birds, moose, caribou, martens, wolverines and other furbearers, salmon, sheefish, and northern pike;
- (ii) to fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats;
- (iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and
- (iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.”

Title VI of ANILCA added river segments to the National Wild and Scenic Rivers System. Part B of Title VI designates selected rivers within the National Wildlife Refuge System, including the Nowitna WSR as follows:

602. DESIGNATION.—Section 3(a) of the Wild and Scenic Rivers Act, as amended (16 USC [United States Code] 1274(a)), is further amended by adding the following new paragraphs:
...(40) NOWITNA, ALASKA.—That portion from the point where the river crosses the west limit of township 18 south, range 22 east, Kateel River meridian, to its confluence with the Yukon River within the boundaries of the Nowitna National Wildlife Refuge; to be administered by the Secretary of the Interior.

I.2 PROPOSED ACTION

The Nowitna WSR is a part of the National Wild and Scenic River System. The Service is proposing to establish and implement a comprehensive river management plan (CRMP) for the Nowitna WSR in the Nowitna NWR in accordance with the Revised Comprehensive Conservation Plan for the Koyukuk,

Northern Unit Innoko, and Nowitna NWRs (Revised CCP [USFWS 2009]). The primary goal of a CRMP is to provide management direction for protecting and enhancing the river values (the water quality, free-flowing condition, and outstandingly remarkable values [ORVs]). The proposed action would also include minor revisions to the Revised CCP (USFWS 2009). Minor revisions to a CCP constitute changes to the CCP's objectives or strategies, or both, that do not significantly change the management direction of the NWR. The Service prepares step-down management plans when required by policy or when the plans may be necessary to provide more detailed objectives, strategies, and/or implementation schedules for meeting the management direction identified in CCPs.

The Service prepared this environmental assessment (EA) to analyze and disclose the effects of adopting the proposed CRMP. By preparing this EA, the Service fulfills agency policy and direction to comply with the National Environmental Policy Act (NEPA) and other relevant federal laws and regulations. This EA has been written in accordance with the Council on Environmental Quality (CEQ) final rule, National Environmental Policy Act (NEPA) Implementing Regulations Revisions published April 20, 2022, including to address amendments to NEPA made by the Fiscal Responsibility Act of 2023. The CEQ final rule, National Environmental Policy Act (NEPA) Implementing Regulations Revisions Phase 2 (CEQ Phase 2 NEPA regulations) published May 1, 2024, is not applied since the EA was initiated before July 1, 2024.

I.3 PURPOSE AND NEED

I.3.1 Purpose

The purpose of this proposal is to develop a CRMP pursuant to the WSRA, as amended by ANILCA, to protect and enhance the river values for which the Nowitna WSR was designated. Also, the purpose is to identify data gaps and monitoring opportunities to protect these river values within the Nowitna WSR corridor.

The ORVs for the Nowitna WSR are ecology, fish, cultural, and scenery. In addition, the Nowitna WSR is classified as a "wild" river because it is free of impoundments, is generally inaccessible except by trail, has essentially primitive watersheds or shorelines, and has unpolluted waters.

In accordance with the WSRA, the CRMP will protect and enhance the river values of the designated Nowitna WSR for the benefit and enjoyment of present and future generations. Based on the baseline conditions (at the time of designation) and existing management direction, the CRMP will do the following:

- Clearly identify and describe the river's ORVs.
- Describe existing resource conditions with a focus on the river values.
- Identify threats to ORVs and strategies to protect them.
- Define goals with desired future conditions and objectives that are specific, measurable, achievable, results oriented, time fixed, and spatially explicit.
- Identify potential development of lands and facilities consistent with the wild classification.
- Identify user capacities compatible with the desired conditions and other management directions.
- Identify water quality concerns and instream flow requirements.
- Develop management strategies, actions, and practices to support river values.

- Establish collaborative roles between the Service, the State of Alaska, Tribes, and members of the public.
- Establish corridor boundaries consistent with Section 3(b) of the WSRA. The corridor boundary will adhere to ANILCA, which stipulates that boundaries shall include an average of not more than 640 acres per mile on both sides of the river, and mineral withdrawals shall be situated within one-half mile of each bank of the river.
- Identify regulatory authorities to assist in the protection of river values.
- Develop a monitoring strategy to document current and future conditions and/or effectiveness of management actions.

1.3.2 Need

The underlying need for the CRMP is to address the requirements in the WSRA for federal agencies to prepare a CRMP that protects the river values for each designated river segment. The CRMP will amend the Revised CCP (USFWS 2009) to augment the administration and stewardship of the Nowitna WSR. The need for the CRMP is also driven by the changing environment including increasing average annual air temperatures, permafrost thaw, and changes in seasonal weather patterns and hydrology. Current river management does not include a strategy for monitoring and responding to these changes being observed in interior Alaska.

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Chapter 2. Involvement, Consultation, and Coordination

2.1 PUBLIC INVOLVEMENT

Scoping occurs early in the NEPA process. The scoping process provides an opportunity for interested parties to provide input on the range of issues to be addressed. Although scoping for an EA is not required (40 CFR 1501.9 and 43 CFR 46.235, 305), the Service felt scoping was important for this CRMP. Prior to preparing the CRMP, the Service requested input from interested parties during scoping to guide the development of the CRMP. The Service deemed the involvement vital to understanding existing conditions, issues of concern, and where quality watershed conditions should continue to be supported. The Service distributed scoping letters and created a project website to inform interested parties about the CRMP's development. The Service invited interested parties to share their thoughts and perspectives about what is important to consider in the CRMP planning process.

The Service CRMP project website announced a scoping period from July 11 to August 10, 2023. The announcement was accompanied by a scoping newsletter that was included on the website. The Service advertised the scoping period and newsletter over public radio and in a local newspaper. The announcement was run in the *Fairbanks Daily News-Miner* on July 11, 2023. The Service posted the announcement on the Yukon Wireless (on K1YU Public Radio) on July 11, 2023, and the announcement ran during the entire scoping period.

The Service collected preliminary information and identified issues that should be analyzed in the CRMP and EA. During the 30-day scoping period, interested parties could provide input via the project website, email, mail, hand delivery, fax, or a recorded voicemail at:

- Email: Nowitna_CRMP@fws.gov
- Project website: <https://www.fws.gov/refuge/nowitna>
- Mail:
 - Attention: Nowitna WSR CRMP/EA
 - PO Box 287
 - Galena, AK 99741
- Hand delivery:
 - Attention: Nowitna WSR CRMP/EA
 - 101 Front Street
 - Galena, AK 99741-0287
- Telephone voicemail: (907) 656-1231
- Fax: (907) 656-1708

The Service received three unique written submissions during the public scoping period; the number of substantive comments extracted from these submissions varied between all submissions. The Service

categorized all submissions received by the commenter’s affiliation. The unique submissions by affiliation are as follows:

- **Government (federal, state, tribal, and local)**—Three commenters:
 - State of Alaska
 - Bureau of Indian Affairs
 - Bureau of Land Management

While scoping comments regarding Alaska Native interests were not received from Tribes or Alaska Native corporations (ANCs),¹ the Bureau of Indian Affairs and State of Alaska identified the following concerns regarding Alaska Native interests during the scoping process:

- The Service should ensure continued access for tribal subsistence users.
- The Service should incorporate Secretarial Order 3403 (Joint Secretarial Order on Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters) in the CRMP development process.
- The CRMP should include a discussion of special access provisions for traditional activities under ANILCA and how ANILCA will apply to the Nowitna WSR corridor.
- The Service should incorporate Section 1110(a) of ANILCA (43 CFR 36).
- The CRMP should consider how ORVs may conflict with each other in the context of subsistence and cultural resources.
- The Service should utilize the established State of Alaska Board of Game and Board of Fisheries and the Federal Subsistence Board.

Table 2-1, below, shows the number of substantive comments received by issue category. The 48 substantive comments were categorized into 20 issue categories.

Table 2-1. Number of Substantive Comments by Issue Category

Issue Category	Number of Substantive Comments
Access	1
ANILCA	2
Best available information	2
Climate change	1
Coordination	3
Designation	4
Ecology	2
Fire	1
Fisheries	4
Instream flow requirements	1
Management	1
Mapping	1
Monitoring	6

¹ Alaska Native Claims Settlement Act (ANCSA) established 13 regional corporations and 195 village corporations. ANCs manage the lands and resources for the benefit of Alaska Native shareholders.

Issue Category	Number of Substantive Comments
Navigable waters	2
Purpose and need	3
Recreation	3
Subsistence and cultural resources	6
User capacity	2
Water quality	2
Wilderness	1
Total	48

The scoping summary report for the Nowitna WSR CRMP and EA (USFWS 2024a) provides additional details about the method of comment collection and analysis and a summary of public comments.

2.2 COOPERATING AGENCIES

A cooperating agency is any federal, tribal, state, or local government agency that enters into formal agreement with the lead federal agency to help develop an environmental analysis. The Service held a meeting with potentially interested Tribes, ANCs, and agencies on March 15, 2023, to provide information about what a CRMP is, the timeline for developing the CRMP, and the various roles and responsibilities of Tribes, ANCs, and agencies. Letters were sent to the following entities to attend the meeting:

- Tozitna, Limited
- Doyon, Limited
- Dineega Corporation
- Gana-A'Yoo, Limited
- Bureau of Land Management
- Bureau of Indian Affairs
- State of Alaska Department of Natural Resources
- Ruby City Council
- Galena City Council
- Tanana City Council
- Louden Tribal Council
- Tanana Tribal Council
- Ruby Tribal Council

After the meeting, entities that intended to participate as a cooperating agency were provided a memorandum of understanding to be signed and returned to the Service. The Bureau of Indian Affairs and State of Alaska signed memoranda of understanding.

The Service held workshops on October 3 and 4, 2023, in Fairbanks, Alaska, to gather input on the development of the CRMP and EA from cooperating agencies and subject matter experts. In addition to Service staff, the workshops were also attended by staff from the following entities:

- Alaska Department of Environmental Conservation
- Alaska Department of Fish and Game (ADFG)
- Alaska Department of Natural Resources
- Bureau of Land Management
- Louden Tribe

Workshop discussions focused on issues affecting the Nowitna WSR that were identified during internal scoping and external scoping as well as river values, current management, and proposed management. As a result of the October workshops, additional follow-up workshops on November 16 and 17, 2023 focused on cultural resources, fish, and water quality. In addition to Service staff, the workshops were attended by staff from the following entities:

- Cultural resources workshop – ADFG, Alaska Department of Natural Resources, and the State Historic Preservation Office²
- Fish workshop – ADFG, Alaska Department of Natural Resources, and Bureau of Land Management
- Water quality workshop – Alaska Department of Environmental Conservation and Alaska Department of Natural Resources

Workshop discussions involved an overview of information about each resource, sources of additional information, gaps in information, and what is needed to understand conditions long term. Also discussed were a need to preserve cultural components for current and future generations (during the cultural resources workshop), species to be included in the fish ORV (during the fish workshop), and the reliability of current data (during the water quality workshop).

2.3 TRIBAL CONSULTATION

The Service conducts government-to-government consultation with federally recognized Tribes in accordance with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments; the President's memorandum of April 29, 1994, Government-to-Government Relations with Native American Tribal Governments; the Department of the Interior's Alaska Policy on Government-to-Government Relations with Alaska Native Tribes, dated January 18, 2001; the Service's Native American Policy (510 FW 1); and the Service's Alaska Native Relations Policy (510 FW 2).³

² The Service determined that consultation with the State Historic Preservation Office on the CRMP and EA was not required under 36 CFR 800.4, but the State Historic Preservation Office participated in the cultural resources workshop to provide technical assistance during the planning process.

³ The Service's Draft Alaska Native Relations Policy (510 FW 2 or Chapter 2) supplements the Service's Native American Policy (510 FW 1).

The Service also coordinates and engages with Tribes, Alaska Native organizations,⁴ and ANCs in accordance with the following statutes, presidential memoranda, secretarial orders, and federal boards:

- Native Townsite Act of 1926 (44 Statute 629), repealed as part of the Federal Land Policy and Management Act of 1976 (Public Law 94-579, formerly codified at 43 USC 733–736)
- Alaska Native Veterans Allotment Act of October 21, 1998 (Public Law 105-276, 112 Statute 2516, 43 USC 1629g)
- Federally Recognized Indian Tribe List Act of 1994 (Public Law 103-454, 108 Statute 4791, 25 USC 479a)
- Presidential Memorandum: Tribal Consultations and Strengthening Nation-to-Nation Relationships; January 26, 2021
- Secretarial Order 3342, Identifying Opportunities for Cooperative and Collaborative Partnerships with Federally Recognized Indian Tribes in the Management of Federal Lands and Resources; October 21, 2016
- Joint Secretarial Order 3403, Joint Secretarial Order on Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters; November 15, 2021
- Secretarial Order 3342, Identifying Opportunities for Cooperative and Collaborative Partnerships with Federally Recognized Indian Tribes in the Management of Federal Lands and Resources; November 2021
- Federal Subsistence Board Government-to-Government Tribal Consultation Policy
- Federal Subsistence Board Policy on Consultation with ANCs

Under Executive Order 13175, the federal government also consults with ANCs on the same basis as Tribes. As a matter of practice, the Service coordinates with all tribal governments, associated Native communities, Native organizations, and tribal individuals whose interests might be directly and substantially affected by activities on public lands.

Section 106 of the National Historic Preservation Act requires federal agencies to consult with Tribal Nations for undertakings on tribal lands and for historic properties of significance to the Tribes that may be affected by an undertaking (36 CFR 800.2(c)(2)). Executive Order 13175 stipulates that during the NEPA process, federal agencies must consult with Tribes identified as being directly and substantially affected. Tribes, ANCs, and agencies work with the Service by sharing knowledge and resources to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks.

In February 2023, the Service mailed letters regarding this EA effort to interested Tribes, ANCs, and potential cooperating agencies. The Service reached out to village councils (Tanana, Loudon, and Ruby), city councils (Tanana, Galena, and Ruby), and the following ANCs: Dineega Corporation; Gana-A'Yoo Corporation; Tozitna, Limited; and Doyon, Limited. Government-to-government consultation was extended to the village councils and ANCs. None of the Tribes elected to participate as cooperating agencies.

⁴ Alaska Native organizations are tribally controlled nonprofit organizations that act on behalf and for the benefit of their member Tribes.

The Service conducted a meeting in Ruby on November 3, 2023, at the Tribal Office. One-on-one conversations with village residents also occurred in Tanana on October 18 and 19, 2023, and in Ruby on November 2 through 4, 2023. A summary of the discussions involving river values is as follows:

- Tanana:
 - Upstream users of the Nowitna River create water quality problems.
 - Water testing of the Nowitna River is wanted.
 - Wildfires should be put out everywhere.
 - More research should be allowed.
 - There should be more documentation of historic and prehistoric history of the area.
 - Temporary camps along the Nowitna River should not become permanent.
 - There should be mandatory moose hunter check stations in the villages.
 - Agates are collected from the Nowitna River.
 - Moose population decline is a threat to food security.
- Ruby:
 - All the wildlife species should be included in the ORVs.
 - It makes sense to keep fish as a separate ORV because of their uniqueness and importance, especially with tributaries going outside the refuge.
 - Fishing opportunities should be maintained.
 - Agates should be included in the scenery ORV.
 - Spruce bark beetles should be addressed in the CRMP. A lot of spruce are dying between Ruby and Galena.
 - There are concerns about people coming from other parts of the state and bringing drugs (particularly in the context of the state's plan to open a road between Ruby and McGrath).
 - Traditional ecological knowledge was mentioned with respect to the cultural ORV.

Chapter 3. Alternatives

3.1 DECISION FRAMEWORK

The Alaska Region Refuge Chief must decide which management actions to include in the CRMP (as required by the WSR). To help inform that decision, this EA analyzes the effects of a reasonable range of alternatives on the river values within the area. The CRMP will be the result of the Nowitna NWR manager's coordination with communities, staff, and subject matter experts. Although the Nowitna WSR is only a 220-mile portion of the Nowitna River, CRMP management direction is only for areas within the Nowitna WSR corridor that are administered by the Service.

3.2 COMPARISON OF ALTERNATIVES

3.2.1 Planning Issues and Opportunities

Planning issues define opportunities, conflicts, or problems regarding the use or management of the Nowitna WSR. The CRMP focuses on protecting and enhancing river values, including the free-flowing condition, water quality, and ORVs. The ORVs for the Nowitna WSR are ecology, fish, cultural, and scenery.

Planning issues were identified by the public; Service staff; local, state, and federal agencies; and organizations during scoping (internally and externally). **Chapter 2**, Involvement, Consultation, and Coordination, identifies coordination that the Service conducted with the public and with subject matter experts to identify issues. The Water Resources Inventory and Assessment for Koyukuk, Nowitna, and Innoko National Wildlife Refuges (Burkart et al. 2023) was also reviewed to identify potential conservation issues related to the Nowitna WSR.

The alternatives address issues that may adversely affect river values (the water quality, free-flowing condition, and ORVs), including uncertain ecological transformations due to climate change or other anthropogenic changes. Further, the alternatives address the lack of resource data (see Alternative B for data collection). In addition to identifying management strategies for protecting and enhancing river values, the CRMP also presents decisions about recreational and other public uses and associated user capacity for the river corridor. There are no anticipated impacts or issues related to the free-flowing condition of the Nowitna WSR. Planning issues relevant to the Nowitna WSR are summarized below.

Water Quality

- Climate change is an overarching issue relating to all river values. Impacts that could affect water quality include:
 - Permafrost thaw could change flow regimes and water chemistry, which would affect water quality. Changing weather patterns can cause increased water temperatures.
 - Drought that decreases streamflow could result in changes to water chemistry that would affect water quality. Extreme precipitation events can impact water chemistry and flood frequency.
 - Increased fire frequency and intensity may result in increased erosion, which in turn could cause higher sediment loading, increased turbidity, and debris in river systems.

- Increased fire suppression efforts could result in a chemical influx from fire suppression materials (aerially applied fire retardant).
- Improperly mitigated and unpermitted mining may impact water quality within the Nowitna WSR and downstream communities.
- Building and maintenance of access roads near the Nowitna WSR or its tributaries could result in a loss or alteration of vegetation and floodplain habitat along the Nowitna WSR and changes in water quality.

Ecology ORV

- Climate change is an overarching issue relating to all river values. Impacts that could affect ecology include:
 - Permafrost thaw could change flow regimes and water chemistry, which would affect water quality. This could result in an impact on plant communities or species, or both.
 - Changes in weather patterns (air and water temperature, rain and snow regimes, and seasonal phenology) could affect the quality of habitats and species found in the Nowitna WSR.
 - Drought could decrease streamflow, change habitat suitability, and impact plant and wildlife species in the Nowitna WSR.
 - Increased fire frequency and intensity could result in direct impacts on vegetation (via high-severity fires) and increased erosion. This could cause higher sediment loading, increased turbidity, and debris in river systems, which could impact riparian vegetation and instream habitat for aquatic species.
 - Fire suppression efforts (mechanical vegetation removal and aerially applied fire retardant) could affect instream habitat and/or directly impact terrestrial habitat through vegetation disturbance and the introduction of invasive species.
- The community diversity and assemblage of wildlife found in the Nowitna WSR is very dynamic; the community is supported by a diversity of habitats. Wildlife species associated with the Nowitna River seasonally use areas outside the Nowitna WSR. These populations are potentially affected by issues impacting essential habitat outside the management area.
- Incomplete understanding of the natural variability of high-quality habitats and species found within the Nowitna WSR, including larch and old-growth white spruce forest, reduces management capabilities.
- Improperly mitigated and unpermitted mining may cause direct impacts on the habitat and species found in the Nowitna River.
- Invasive species, pest, and pathogen introduction and spread could result in habitat loss and alteration or direct impacts on wildlife populations.
- Recreation or visitation patterns may change and cause impacts on the habitat and species found within the Nowitna WSR.
- Building and maintenance of access roads near the Nowitna WSR or its tributaries could result in a loss or alteration of vegetation and floodplain habitat along the Nowitna WSR and changes in water quality.

Fish ORV

- Climate change is an overarching issue relating to all river values. Impacts that could affect the fish community include:
 - Permafrost thaw could change flow regimes and water chemistry, which would affect water quality. This could impact instream habitat conditions for aquatic species.
 - Changes in the snow regime could impact seasonal flow dynamics and instream habitat conditions for aquatic species.
 - Increasing air and water temperatures could decrease habitat quality and/or result in fish mortality and susceptibility to disease.
 - Drought could result in decreased streamflow and decreased habitat suitability; drought could result in fish stranding and mortality.
 - Increased fire frequency and intensity could result in increased erosion, which in turn could cause higher sediment loading, increased turbidity, and debris in river systems. These could impact instream habitat for aquatic species. Extreme events could result in a reduction of oxygen in the river and fish mortality.
- The lack of understanding and quantification of the natural range of flows and water quality found in the Nowitna WSR could hamper fish conservation efforts.
- The fish community uses areas within and outside the Nowitna WSR, depending on the life cycle stages. Therefore, issues affecting the fish community could derive from both inside and outside the Nowitna WSR.
- Improperly mitigated and unpermitted mining may cause direct impacts on the fish community and habitats.
- Introduction of invasive species could result in habitat loss and alteration (by invasive plants) or changes in ecosystem dynamics (caused by invasive aquatic organisms).
- Recreation or visitation patterns may change and cause impacts on the habitat and fish community.
- Building and maintenance of access roads near the Nowitna WSR or its tributaries could result in the loss or alteration of vegetation and floodplain habitat along the Nowitna WSR and changes in water quality.

Cultural ORV

- Climate change is an overarching issue relating to all river values. Impacts that could affect the cultural resources include:
 - Permafrost thaw could change flow regimes and water chemistry, which would affect water quality. This could impact instream habitat conditions for aquatic species and human activities along the Nowitna WSR.
 - Changes in the snow regime could impact instream habitat conditions for aquatic species and human activities along the Nowitna WSR.
 - Increasing air and water temperatures could decrease habitat quality or result in fish mortality, or both, which could impact human activities along the Nowitna WSR.

- Drought could result in decreased streamflow and decreased habitat suitability. Drought could result in fish stranding and mortality, and impact human activities along the Nowitna WSR.
- Increased fire frequency and intensity could result in increased erosion, which in turn could cause higher sediment loading, increased turbidity, and debris in river systems. These could impact instream habitat for aquatic species and impact human activities along the Nowitna WSR.
- Extreme events could result in a reduction of oxygen in the river and fish mortality. These could impact human activities along the Nowitna WSR. Increased erosion could also expose additional archaeological sites along the river.
- A lack of documentation of archaeological and paleontological resources, historic place-names, community practices, and traditional skills can limit efforts to preserve or protect these cultural elements.
- Recreation or visitation patterns may change and cause direct impacts on cultural resources and visitor experiences.

Scenery ORV

- Climate change is an overarching issue relating to all river values. Impacts that could affect scenery include:
 - Permafrost thaw could change flow regimes and water chemistry, which would affect water quality and clarity. Permafrost thaw could also impact plant communities.
 - Changes in the snow regime could impact the quality and extent of habitats and species found in the Nowitna WSR.
 - Drought could decrease streamflow and the stream's visual quality.
 - Increased fire frequency and intensity could result in direct impacts on vegetation (via high-severity fires) and increased erosion. Erosion could cause higher sediment loading, increased turbidity, and debris in river systems, which could impact riparian vegetation and instream habitat for aquatic species.
 - Fire suppression efforts (mechanical vegetation removal) could directly impact vegetation and habitat through vegetation removal and the introduction of invasive species.
- Improperly mitigated and unpermitted mining may cause direct impacts on the scenic quality of the Nowitna WSR.
- Invasive species' introductions could result in habitat loss and alteration, and impact the scenic quality of the Nowitna WSR.
- Recreation or visitation patterns may change and cause direct impacts on the visitor experience of the river's scenic quality.
- The presence of stream-gaging and fish-tracking equipment could cause impacts on the Nowitna WSR's scenic quality.
- Maintenance of existing roads outside the corridor but in the watershed could result in the loss or alteration of vegetation and the Nowitna WSR's scenic quality.

3.2.2 Description of Alternatives

Alternative A—No Action Alternative

Alternative A is the No Action Alternative and would continue existing management direction. “No action” does not mean that no actions would be taken; rather, it is a continuation of what is currently happening or not happening in the Nowitna WSR corridor. The No Action Alternative is the benchmark used to compare effects of an action alternative. Management of the Nowitna WSR corridor is currently guided by the Revised CCP (USFWS 2009). Existing management from the Revised CCP (USFWS 2009) that is relevant to the Nowitna WSR corridor is consolidated in Attachment B of **Appendix A**.

Alternative A would include the Nowitna WSR corridor being larger than what is allowed under ANILCA. ANILCA Section 606(a) states the boundary shall include an average of not more than 640 acres per mile on both sides of the river (measured from the ordinary high-water mark). The corridor boundary of the Nowitna WSR was first described in the Nowitna National Wildlife Refuge Final Comprehensive Conservation Plan (Nowitna CCP [USFWS 1987]). The Nowitna CCP (USFWS 1987) description of the Nowitna WSR corridor is 18,044 acres larger than the maximum allowed by ANILCA Section 606(a) (**Figure 3-1**). See the *CCP Minor Revision* discussion below for more information.

Alternative B—Proposed Action Alternative

Alternative B is the proposed action alternative (a CRMP). All existing management for the Nowitna NWR from the Revised CCP (USFWS 2009) would continue under this alternative. Further, Alternative B would implement (not replace) existing management direction contained in the Revised CCP (USFWS 2009). **Appendix A** contains the additional step-down management direction, actions, and monitoring that would be implemented to protect and enhance the river values. River values, which are the core of the CRMP, refer to the free-flowing condition, water quality, and ORVs. Specifically, the CRMP (1) more clearly documents the river corridor boundary with enhanced mapping; (2) clearly identifies and describes the river’s ORVs; (3) describes existing resource conditions, with a focus on the river values; (4) identifies threats and defines goals and desired conditions for protecting river values; (5) addresses development of lands and facilities; (6) addresses user capacities; (7) addresses water quality and sets the stage for determining flow requirements for the river values; (8) reflects a collaborative approach with stakeholders; (9) identifies regulatory authorities of other governmental agencies that assist in protecting river values; and (10) includes a monitoring and adaptive management strategy to maintain or make progress toward desired conditions.

Revised CCP Minor Revision

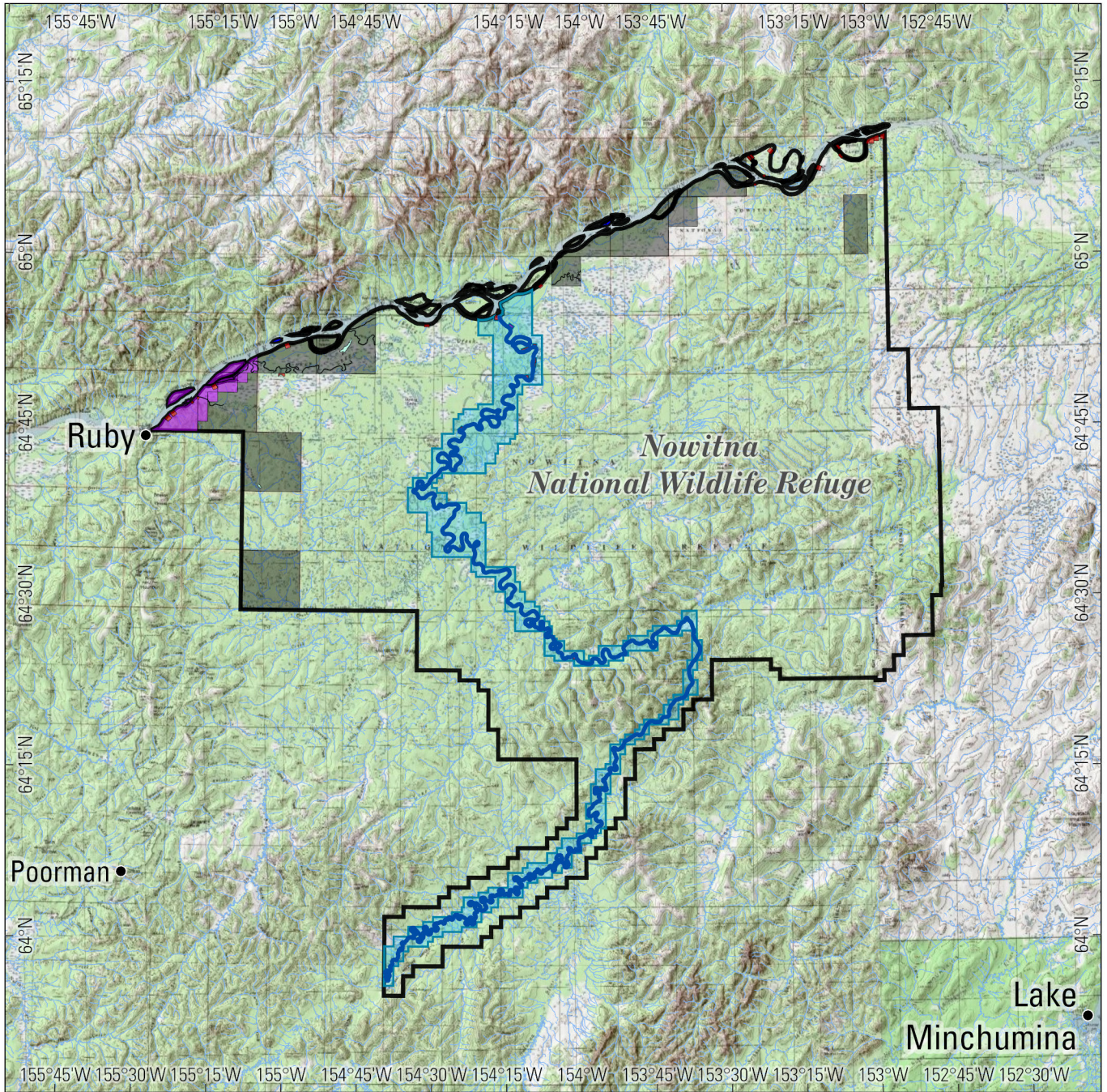
Service Manual Part 602 FW Chapters 1–4 outline policy and procedures for revising CCPs and step-down management plans. In compliance with the Service’s minor revisions to CCPs process, the Revised CCP (USFWS 2009) would be modified to update the Nowitna WSR corridor to conform with ANILCA requirements. Other updates include changing the “Nowitna Wild River” to the “Nowitna Wild and Scenic River” and updating the ORVs to those identified in the CRMP. These and other updates are explained in the minor CCP amendment memo (**Appendix B**).

Figure 3-1: Nowitna WSR Overview - Alternative A









U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



0 5 10 15 miles

0 5 10 15 km

-  Nowitna NWR boundary
-  Nowitna WSR segment
-  Nowitna WSR corridor
-  Patented native allotment
-  Patented ANCSA village corporation
-  Patented ANCSA regional corporation



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Corridor Boundary

The WSRA requires that each federally administered river in the National Wild and Scenic Rivers System has a legally established boundary. Establishing a WSR boundary that includes identified river-related values is essential as a basis from which to provide necessary protection. ANILCA Section 606(a) states the boundary shall include an average of not more than 640 acres per mile on both sides of the river (measured from the ordinary high-water mark). The boundary shall not include any lands owned by the State or a political subdivision of the State, nor shall such boundary extend around any private lands adjoining the river in such manner as to surround or effectively surround such private lands. This CRMP amends the river corridor using current mapping capabilities that were not available when the Nowitna WSR was designated or at the time of the CCPs (USFWS 1987, 2009).

Corridor Boundary Delineation

The corridor boundary of the Nowitna WSR was first described in the Nowitna CCP (USFWS 1987). This description was based on the Public Land Survey System, whereby sections (1 square mile) and townships (aggregation of 36 sections) provide a foundation for legal descriptions of public and private lands. The Nowitna WSR corridor was described in terms of townships, sections, and aliquot parts (subdivisions of a section). Consequently, the corridor boundary was represented as a “stair-step” polygon comprised of a series of straight lines oriented in north–south and east–west directions (**Figure 3-1**). This corridor was roughly centered on the centerline of the Nowitna River and was of variable width with respect to the centerline. Some portions of the corridor boundary were a mile or more away from the centerline, and other portions of the corridor boundary were less than one-half mile from the centerline. As such, the Nowitna CCP description of the Nowitna WSR corridor is 18,044 acres larger than the maximum allowed by ANILCA Section 606(a).

To rectify the over-maximum acreage of the 1987 Nowitna WSR corridor, the Service used geographic information system (GIS) software to create a digital representation of the corridor that adhered to the requirements of ANILCA Section 606(a). The multistage process is detailed in Attachment A of **Appendix A** and outlined in the steps below:

1. Create a polygon that follows the ordinary high-water mark of the extreme left and right banks of the Nowitna River.
2. From the polygon created in Step 1, generate a line that represents the centerline of the main channel of the Nowitna River.
3. From the polygon created in Step 1, generate buffer zones extending one-half mile outward from the extreme left and right banks of the Nowitna River. These one-half-mile buffer zones represent an area of 320 acres per linear river mile on each bank of the river, for an aggregate of 640 acres per linear river mile.
4. From the buffer zones created in Step 3, remove privately owned land and any land necessary to prevent privately owned land from being effectively surrounded.
5. Use the polygon created in Step 1 to remove the river from the polygon created in Step 4 and islands that lie between the ordinary high-water mark of the extreme left and right banks of the Nowitna River.

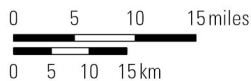
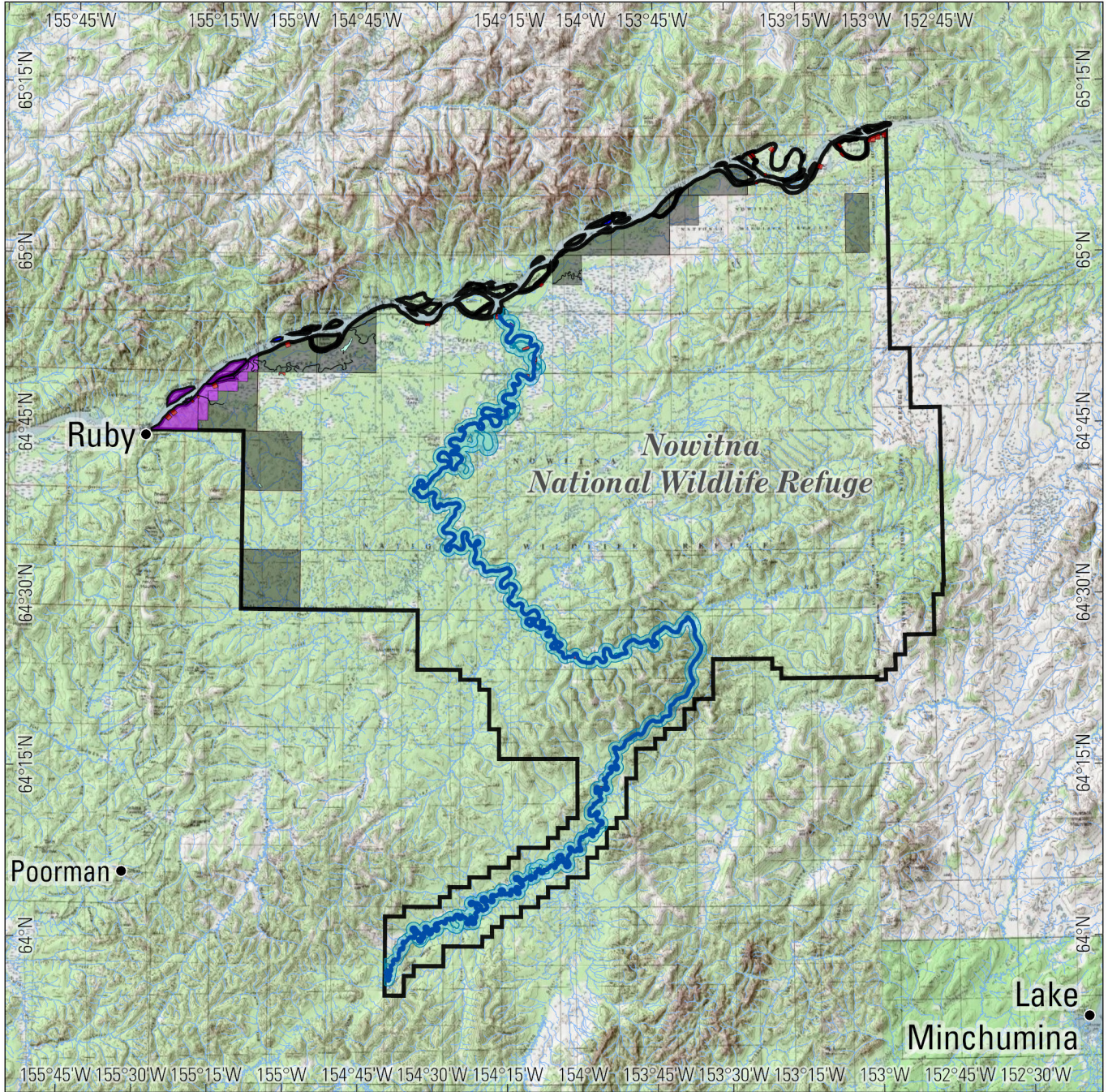
The resulting polygon (**Figure 3-2**) represents a one-half-mile wide corridor extending outward from the ordinary high-water mark of the extreme left and right banks of the Nowitna River and excludes private land parcels and the area of the river itself (IWSRCC 2017). The final polygon encompasses 122,330 acres; given the length of the centerline of the main channel of 220 miles, the final polygon is 18,776 acres less than the maximum allowed area of 141,106 acres. This acreage deficit is due to the meandering course of the Nowitna River, which results in areas where the one-half-mile wide buffer zones overlap, thus reducing the overall acreage. The proposed corridor under Alternative B encompasses all river-related values, to the extent possible, while adhering to the acreage limit stipulated by ANILCA Section 606(a).







Figure 3-2: Nowitna WSR Overview - Alternative B



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Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



-  Nowitna NWR boundary
-  Nowitna WSR segment
-  Nowitna WSR corridor
-  Patented native allotment
-  Patented ANCSA village corporation
-  Patented ANCSA regional corporation



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Chapter 4. Affected Environment and Environmental Consequences

4.1 INTRODUCTION

This chapter describes the environment of the designated Nowitna WSR corridor. The intent is not to provide an exhaustive description of resources and other relevant factors, but to provide sufficient detail to reasonably assess and compare the effects of implementing the management alternatives described in **Chapter 3**, Alternatives. Topics were selected based on federal laws, Service expertise, and the concerns expressed by other agencies or members of the public during scoping. Information provided in this affected environment establishes the conditions for analyzing impacts (direct, indirect, and cumulative), which are also presented in this chapter. Unless described differently, the analysis area for identifying direct and indirect impacts is the Nowitna WSR corridor.

The year a WSR is designated represents the baseline condition against which subsequent conditions of river values are assessed (IWSRCC 2018). The baseline condition serves as the basis on which the degree or intensity of any existing impacts can be measured, and future impacts assessed, should they occur. All future activities are to be measured from this baseline to ensure continued high-quality conditions and, with respect to river values, to eliminate adverse effects (protect) or improve conditions (enhance) within the river corridor.

The remote and often inaccessible nature of the areas being studied during the 1970s presented challenges. Limited information was available about many resource values in these remote regions, making it difficult to provide detailed descriptions of the baseline conditions. Often, existing conditions are relied on to represent the condition against which subsequent conditions of river values are assessed. This chapter describes baseline conditions, if known, and existing conditions for river values and other relevant resources.

NEPA (40 CFR 1500–1508) mandates that an EA disclose the environmental impacts of proposed federal actions. In this case, the proposed federal action is implementation of the Nowitna WSR CRMP analyzed in this EA. Consistent with the provisions of NEPA, Service managers would determine whether more detailed planning, environmental compliance, or other documentation (for example, Section 7 evaluations) is required before undertaking specific actions that may arise from implementation of the approved plan.

4.2 METHODOLOGY AND ASSUMPTIONS

To assess current conditions and potential impacts, the Service gathered site-specific information from GIS data sets, historical data, and recent planning documents. Data on visitor use patterns and visitor preferences were gathered from historical records, moose hunter check station reports, and conversations with communities. The Service used this background information to communicate its analysis of resource impacts. The planning team based the impact analyses in this chapter on professional judgment, research of existing studies and literature, opinions from experts within the Service and other agencies, and the study of other projects that had similar effects.

For this analysis, the Service assumes the action alternative would not substantially increase the frequency or intensity of visitor use. This assumption is based on the remote location, rugged terrain, and lack of accessibility within the Nowitna WSR corridor.

Cumulative effects are addressed for those resources directly or indirectly impacted by an alternative. If an alternative has no direct or indirect impacts, then there would be no contribution to cumulative impacts discussed. Similarly, if there are no reasonably foreseeable future actions that would contribute to similar direct or indirect impacts for a resource, then there would be no cumulative impacts. The effects of past and present actions on specific resources are described in the affected environment discussions, and they are considered in the environmental consequences discussions. For example, these actions would include actions inside the corridor and actions in the watershed (such as improperly mitigated and unpermitted mining) that affect the Nowitna WSR corridor.

Cumulative Effects Analysis

The CEQ, which regulates NEPA, defines cumulative impacts as the impacts on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from minor, but collectively significant, actions taking place over time (40 CFR 1508.7).

Both the temporal and geographic scope of the cumulative impact analysis could vary according to the resource under consideration. Generally, the appropriate time frame for the cumulative impacts analysis spans from the 1990s through the life of the CRMP. Climate change may require a larger temporal scale to see measurable changes. The geographic scope generally encompasses the Nowitna River watershed but could extend beyond for some resources (for example, air resources).

Past, Present, and Reasonably Foreseeable Future Actions

The cumulative analysis must consider past, present, and reasonably foreseeable future actions in the analysis. Relevant past and present actions are those that have influenced the condition of the resource. Past actions were identified using agency documentation, NEPA analyses, reports and resource studies, peer-reviewed literature, and best professional judgment.

Most regulations that refer to “reasonably foreseeable” do not define the meaning of the words; they do, however, provide guidance on the term. Typically, reasonably foreseeable future actions are based on such documents as plans, permit applications, and fiscal appropriations. Reasonably foreseeable future actions considered in the cumulative effects analysis consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, to occur over the life of the CRMP. Recent environmental reports, surveys, research plans, NEPA compliance documents, and other source documents were evaluated to identify these actions. **Table 4-1**, below, summarizes the projects and activities considered in the cumulative effects analysis.

Reasonably foreseeable future actions were assessed to determine whether they were speculative and would occur within the CRMP’s analytical time frame. Any actions that fall outside the past, present, or reasonably foreseeable categories are speculative and are not evaluated as part of the cumulative impacts analysis.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions Considered in the Cumulative Effects Analysis

Resource	Action Description
Vegetation	Brush and tree clearing are implemented to ensure the Nowitna administrative cabin complies with FireWise requirements. The coordinates are N 64°40'27", W 154°30'52", World Geodetic System 84. Work is expected this year and repeated every 5 years, depending on funding.
Cultural resources	In 2024, a cultural resource survey at the confluence with the Yukon River area is continuing in accordance with the National Historic Preservation Act Section 110, including using metal detectors and subsurface testing, if warranted, over a 1-week period to identify any remains of a former historic village site. 2025–2030: Additional annual reconnaissance cultural and paleontological resource surveys will be conducted upstream in high-probability areas as they become identified, and funding allows.
Recreation, subsistence	An annual moose hunter check station is operated from approximately late August to October 1. This voluntary check-in has occurred annually since 1988 and documents the number of hunters, the residence of hunters, and harvest reports for moose, bears, and wolves. The coordinates are N 64°54'35.07", W 154°16'48.22", World Geodetic System 84.
Water resources, fisheries	The Bureau of Land Management is updating the Central Yukon Resource Management Plan, which is anticipated to be finalized in December 2024. This plan covers actions for mining and other upstream activities in the upper Nowitna River watershed that may affect downstream conditions, including Nowitna WSR river values.

4.3 LAND USE

4.3.1 Affected Environment

The region of influence, or geographic scope, for this land use analysis is the Nowitna WSR corridor (**Figure 4-1.1** through **Figure 4-1.8**). The Nowitna WSR is in a remote and undeveloped area of Alaska. Landownership within the Nowitna WSR corridor is almost entirely federal. However, portions of the existing corridor include private inholdings.

All uses of an NWR over which the Service has jurisdiction must be determined to be appropriate uses under the Appropriate Refuge Uses Policy (USFWS 2006). Land uses that were found appropriate for the Nowitna NWR, including the Nowitna WSR, in the Revised CCP (USFWS 2009) are the following:

- ADFG management and Bureau of Wildlife enforcement activities
- Commercial big game hunting guide services
- Subsistence and trapping cabins
- Commercial recreational fishing guide services
- Fishing (general and other)
- Helicopter landings to support authorized activities by other federal, tribal, state, and local governments; universities; etc.
- Subsistence harvest of house logs
- Recreational hunting
- Non-wildlife-dependent recreation

- Wildlife observation and photography and environmental education and interpretation
- Reburial of archaeological human remains per State and federal guidelines
- Commercial recreational guide services
- Research and surveys
- Subsistence activities
- Native allotment surveys
- Commercial transporter services
- Trapping

These types of land uses in the Nowitna WSR corridor occur at various times.

4.3.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, land uses would continue as authorized and outlined in the Revised CCP (USFWS 2009). New land use authorizations would continue to be approved, provided they are consistent with the management direction, goals, and objectives in the Revised CCP (USFWS 2009). There would be no new impacts on land uses and designations. Landownership within the Nowitna WSR corridor would continue to be almost entirely federal (**Figure 4-1.1** through **Figure 4-1.8** and **Table 4-2**).

Table 4-2. Landownership within the Nowitna WSR Corridor—Alternative A

Landownership	Area (acres)
Service	159,150
Patented Native allotments ⁵	780
Patented village corporation	80

Source: USFWS 2024d

Under Alternative A, the Service would continue to rely on the Revised CCP (USFWS 2009) to manage the Nowitna WSR corridor. The Service would not develop a CRMP. Federal agencies charged with the administration of the National Wild and Scenic Rivers System are required to prepare a CRMP for designated river segments (WSRA, Section 3(d)(1)). Therefore, Alternative A would not comply with the WSRA's requirement to prepare a CRMP.

A corridor boundary of the Nowitna WSR was first described in the Nowitna CCP (USFWS 1987). This corridor was roughly centered on the centerline of the Nowitna River and was of variable width with respect to the centerline; some portions of the corridor boundary were a mile or more away from the centerline, and other portions of the corridor boundary were less than one-half mile from the centerline. As such, the 1987 Nowitna CCP description of the Nowitna WSR corridor is 18,044 acres larger than the maximum allowed by ANILCA Section 606(a). Under Alternative A, the Nowitna WSR corridor would remain larger than what is allowed under ANILCA.

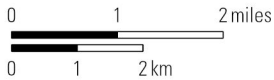
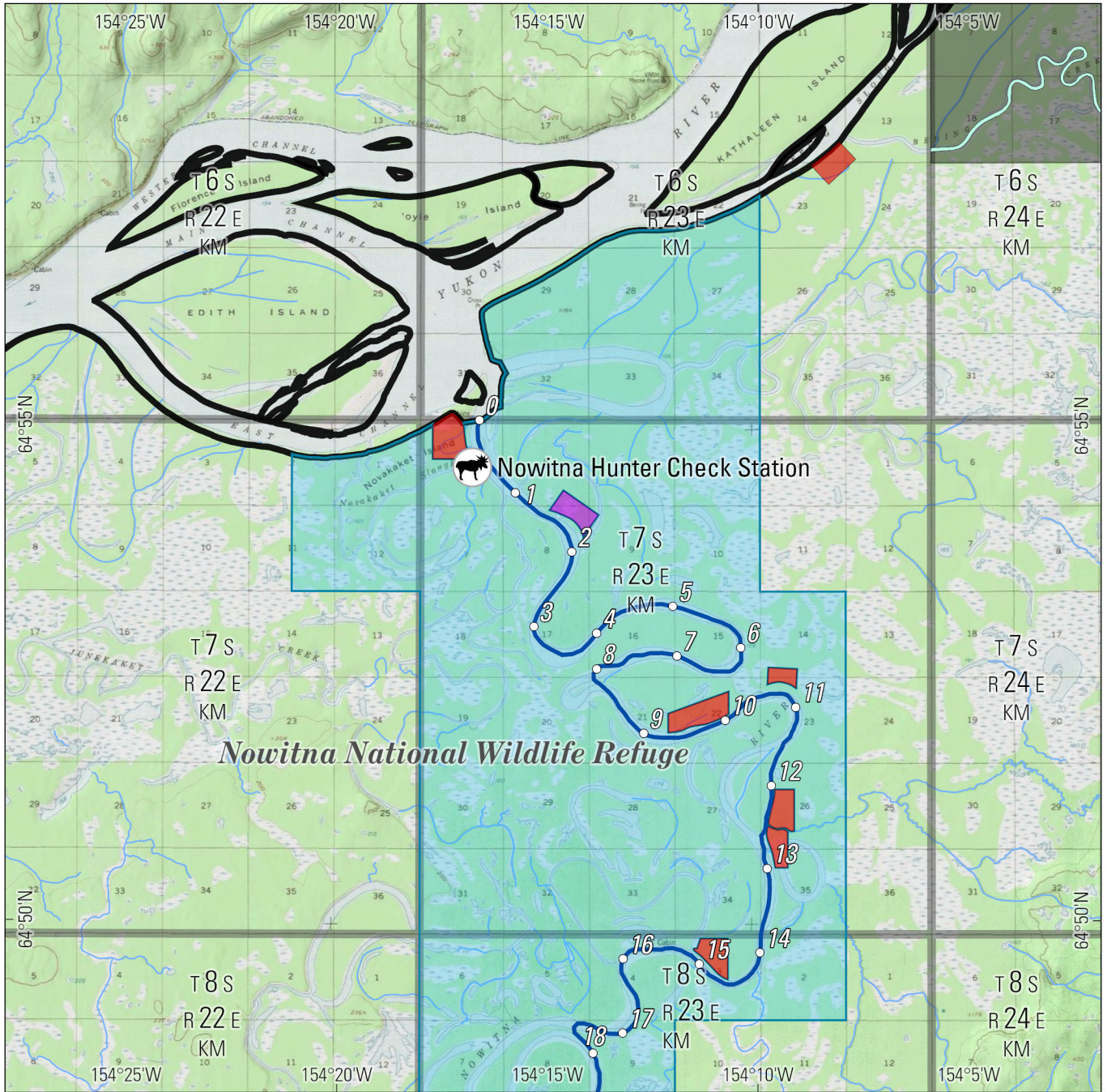
⁵ Alaska Native allotment is defined as a parcel or parcels of land totaling up to 160 acres, conveyed by restricted deed to an Alaska Native under the terms and conditions of the Alaska Native Allotment Act of 1906 (and 1956 amendment) and the Alaska Native Veteran Allotment Act of 1998 (43 USC 357, 357a, and 357b).

Figure 4-1.1: Nowitna WSR Series - Alternative A (1 of 8)

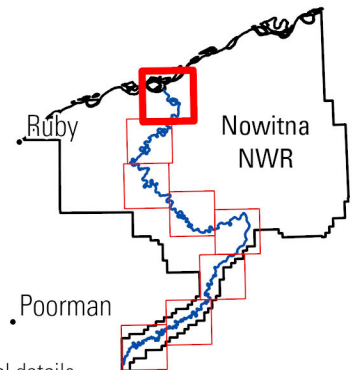


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Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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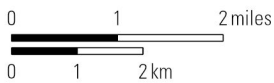
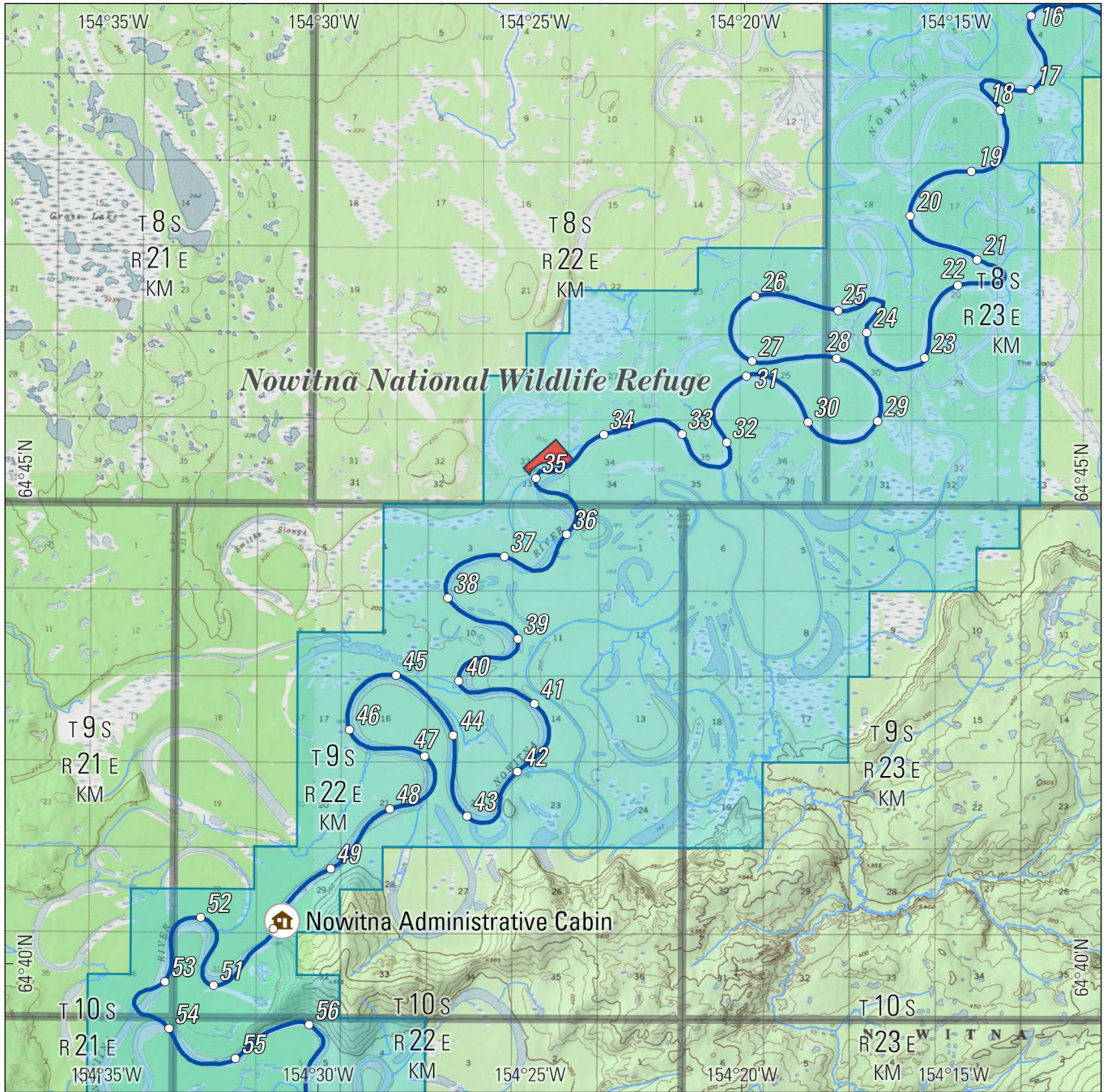
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Figure 4-1.2: Nowitna WSR Series - Alternative A (2 of 8)

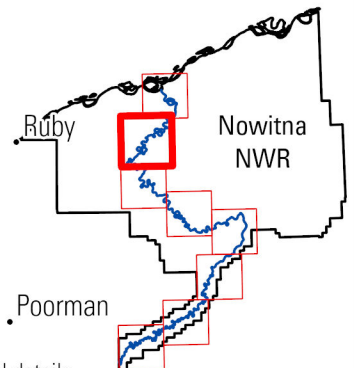


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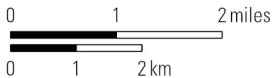
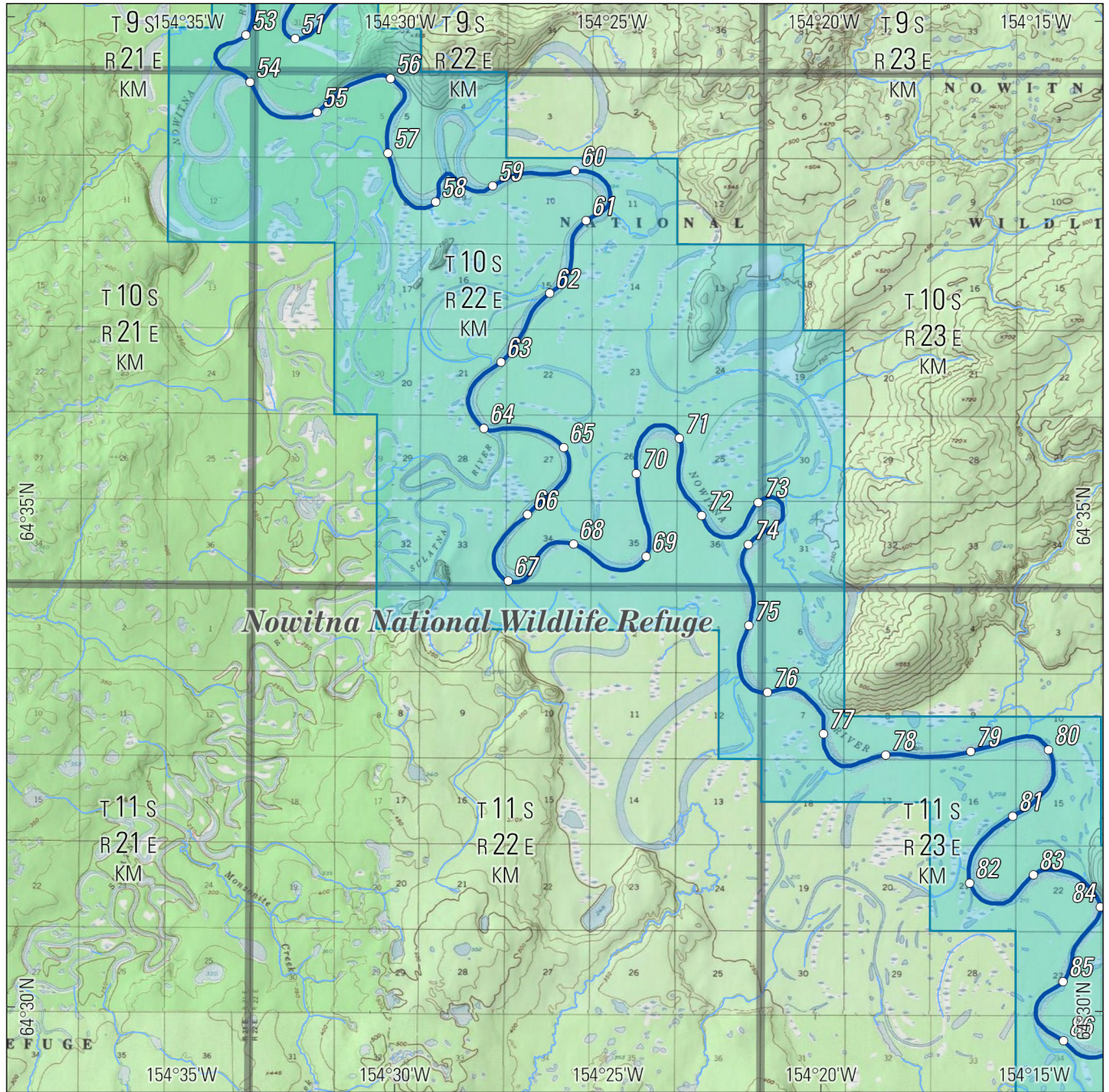
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Figure 4-1.3: Nowitna WSR Series - Alternative A (3 of 8)

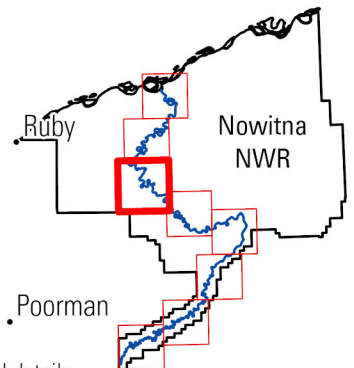


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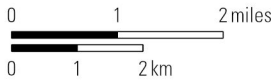
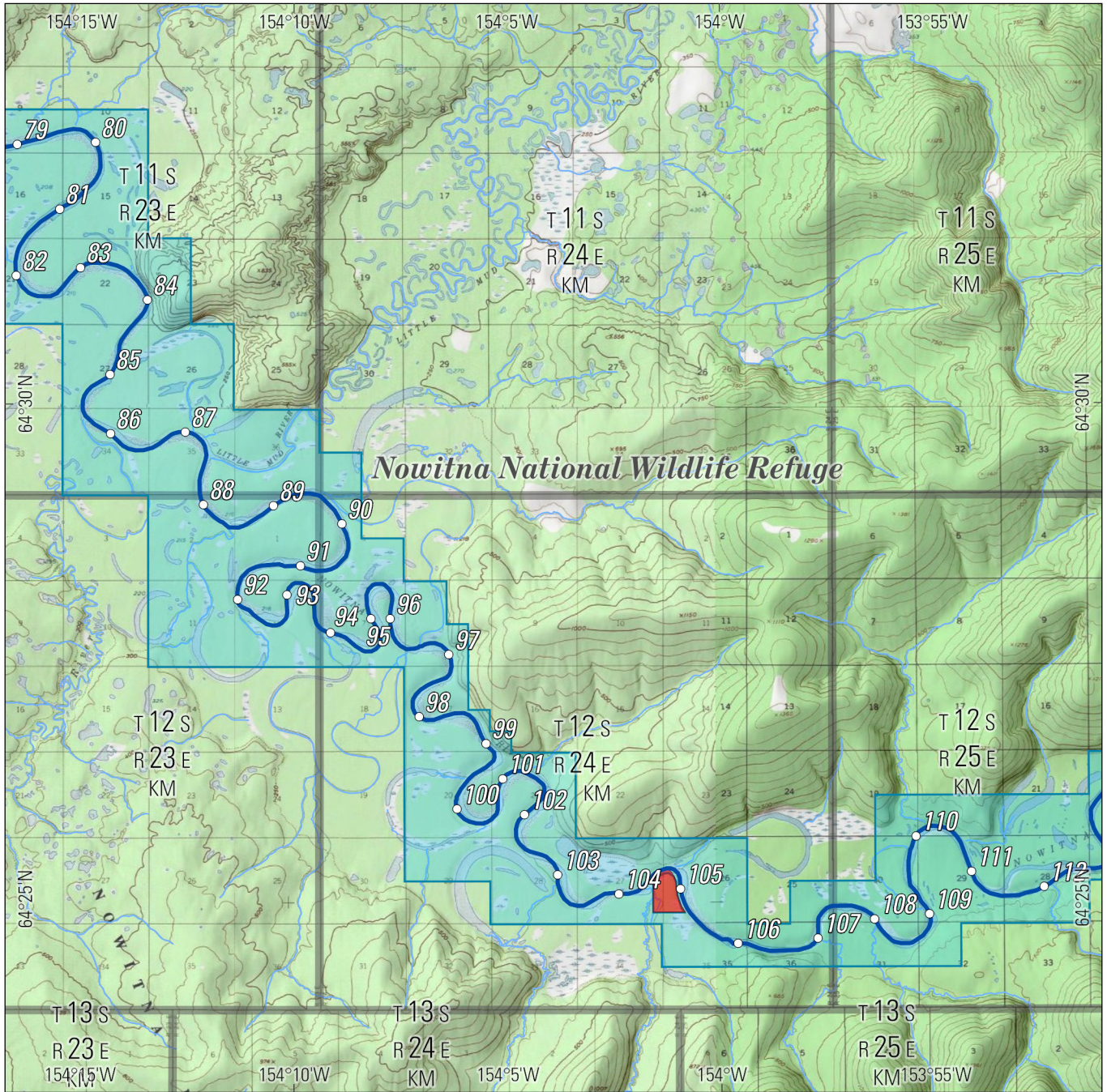
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Figure 4-1.4: Nowitna WSR Series - Alternative A (4 of 8)

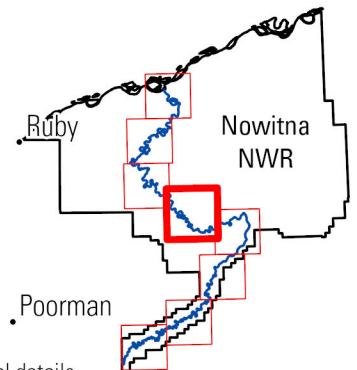


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Nowitna Wild & Scenic River



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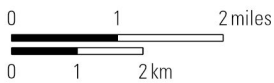
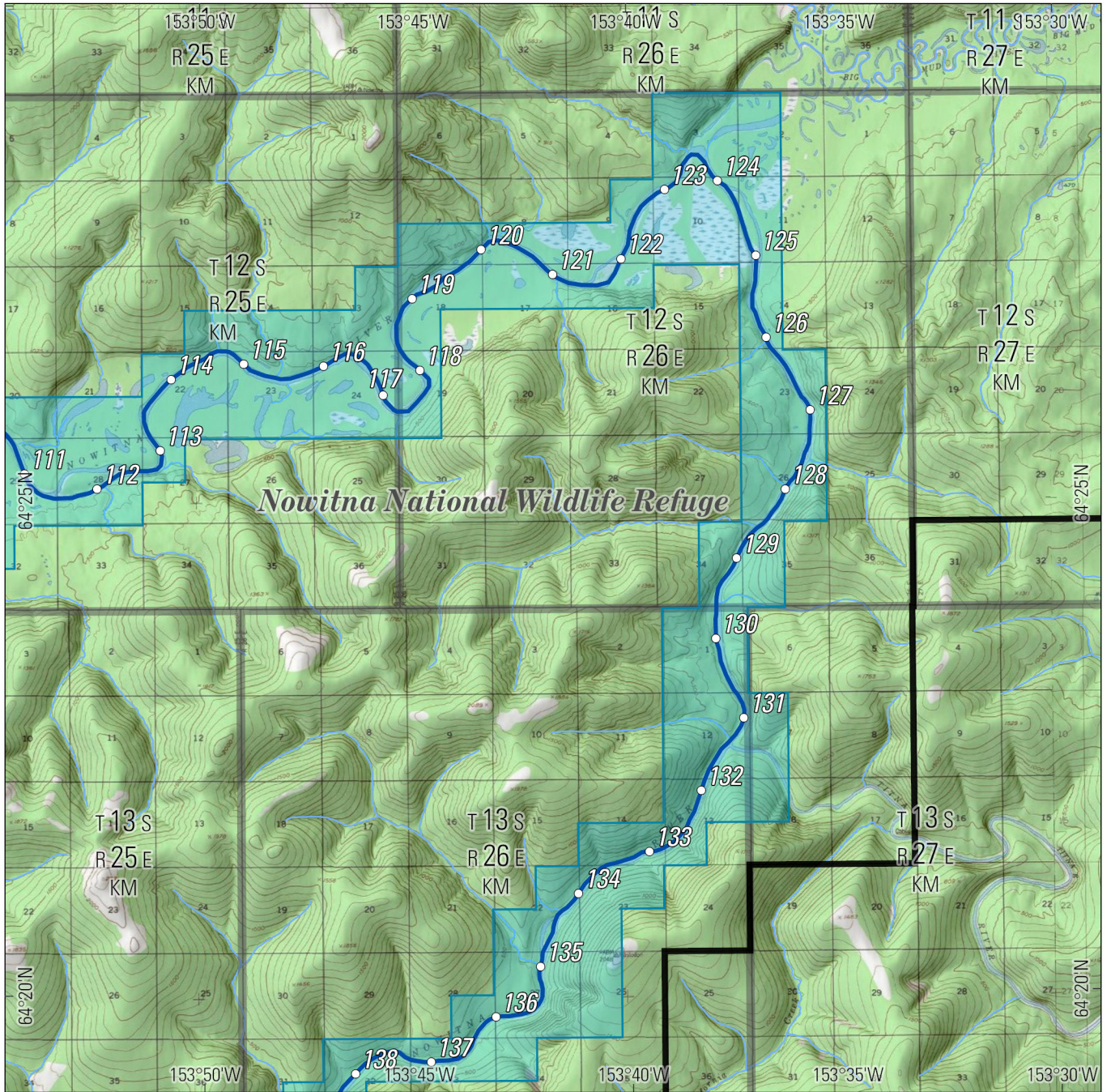
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Figure 4-1.5: Nowitna WSR Series - Alternative A (5 of 8)

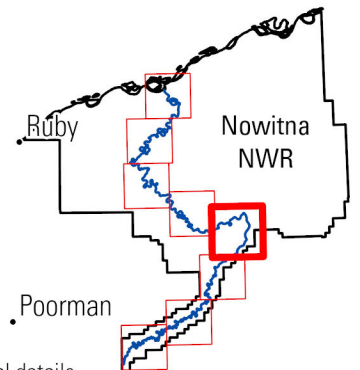


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Nowitna Wild & Scenic River



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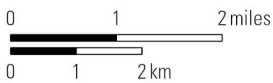
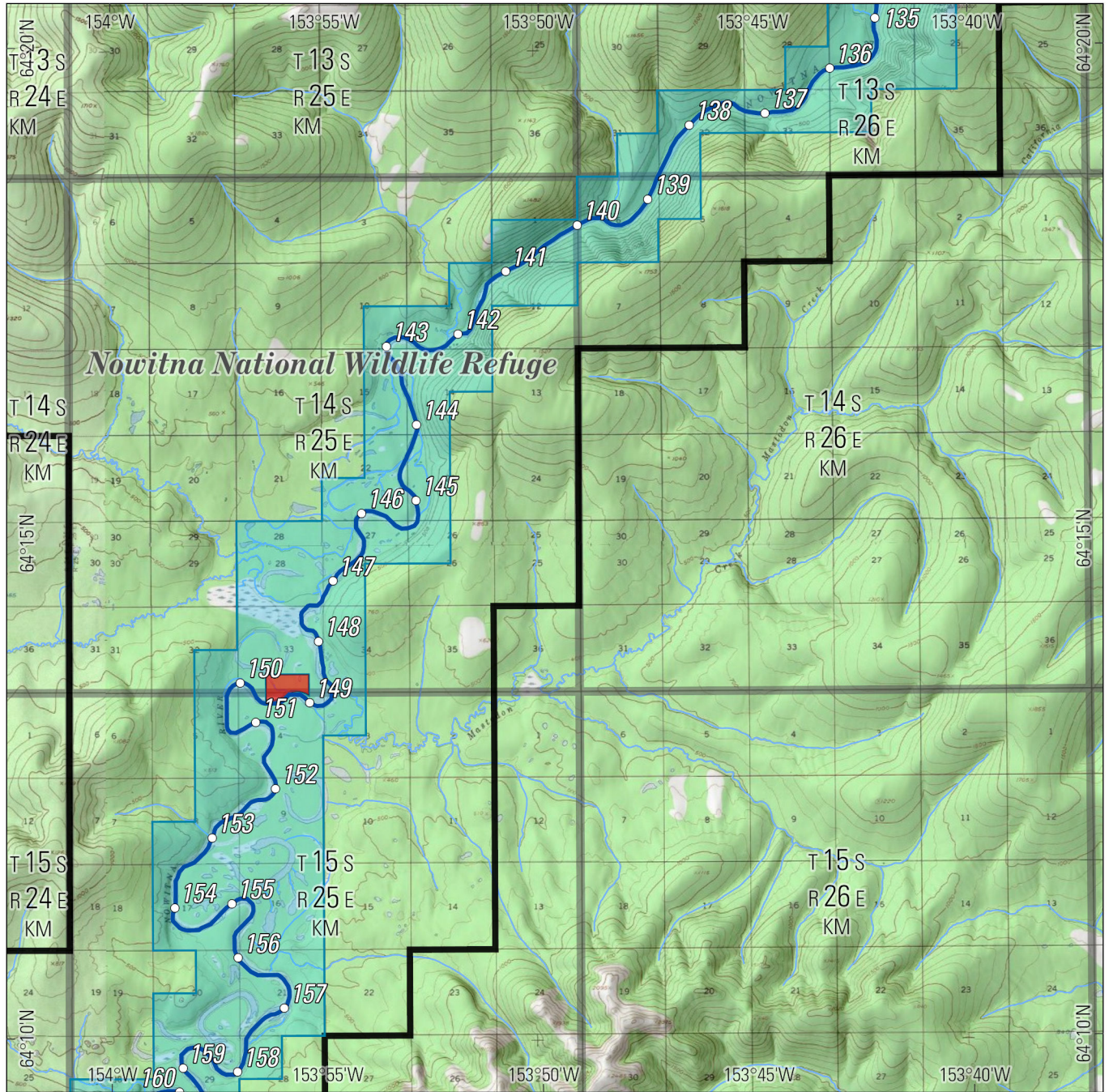
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Figure 4-1.6: Nowitna WSR Series - Alternative A (6 of 8)

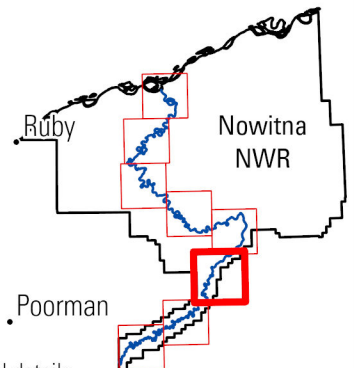


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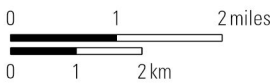
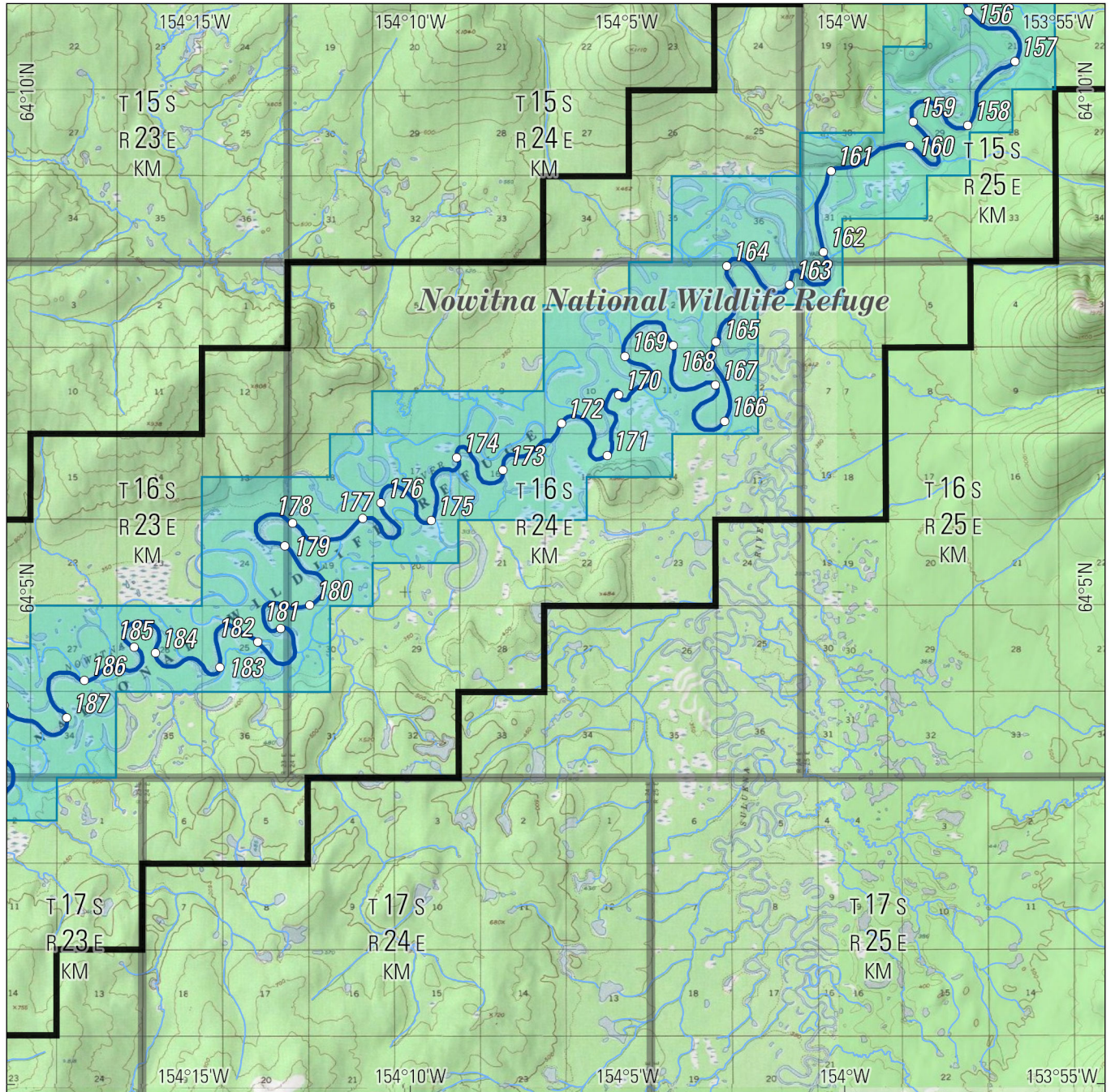
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-1.7: Nowitna WSR Series - Alternative A (7 of 8)

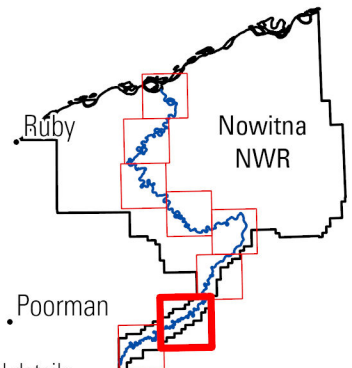


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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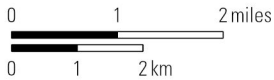
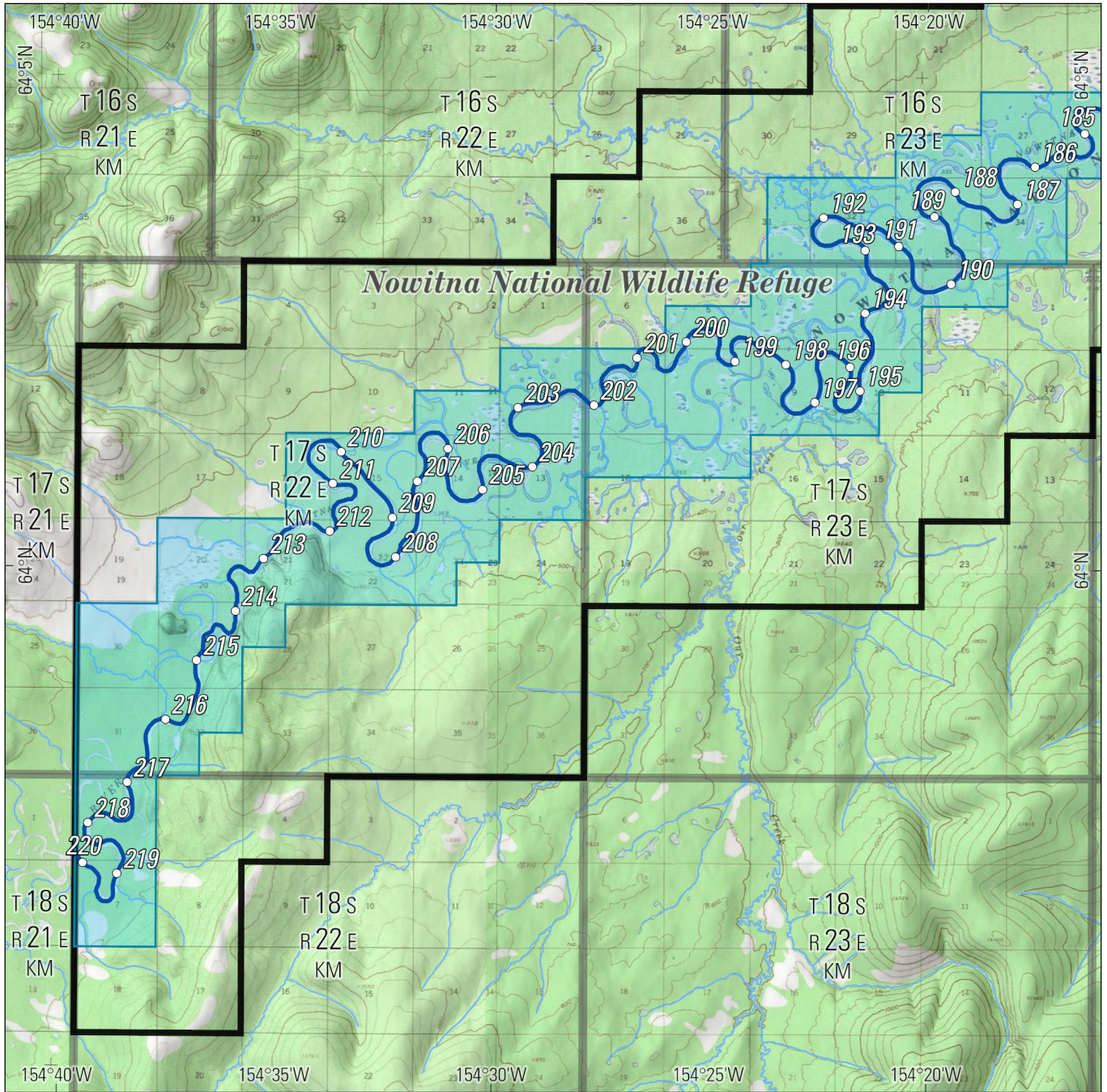
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-I.8: Nowitna WSR Series - Alternative A (8 of 8)

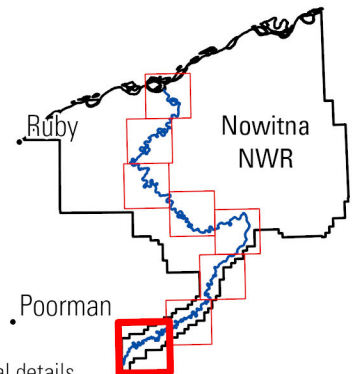


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
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Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, land uses would generally be similar to uses under Alternative A to protect the ORVs and achieve the goals and objectives outlined in **Chapter 3**, Alternatives. Landownership within the Nowitna WSR corridor would continue to be almost entirely federal (**Figure 4-2.1** through **Figure 4-2.8** and **Table 4-3**).

Table 4-3. Landownership within the Nowitna WSR Corridor—Alternative B

Landownership	Area (acres)
Service	122,330
Patented Native allotments	780
Patented village corporation	80

Source: USFWS 2024d

In addition to the implementation of the CRMP, a minor revision to the Revised CCP (USFWS 2009) would occur under Alternative B. The Service is required to prepare step-down management plans typically when more detailed objectives, strategies, and/or implementation are needed to meet the management direction set forth in CCPs. In this case, the CRMP would be a step-down management plan that expands on CCP Goal 8 and Objective I. The number of total acres in the minimal and wild and scenic river management categories in the CCP would be updated for those occurring within the WSR, since the boundary would be amended through the CRMP.

Under Alternative B, the Service would reduce the size of the WSR corridor from 159,150 acres to 122,330 acres. The maximum allowed area by ANILCA for the corridor given the current length of the Nowitna WSR is 141,106 acres. Therefore, Alternative B would comply with the corridor acreage requirements stipulated by ANILCA Section 606(a).

The additional collection of environmental data would be conducted in a manner that complies with land uses and designations. This would not impact land uses and designations.

Scoping revealed concerns about trespassing on allotments in the area. Trespassing on allotments in the area would likely continue to be a concern.

Alternative B would comply with the WSRA by developing a CRMP for the Nowitna WSR and meet the purpose and need.

Cumulative Effects

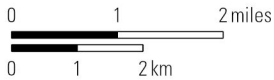
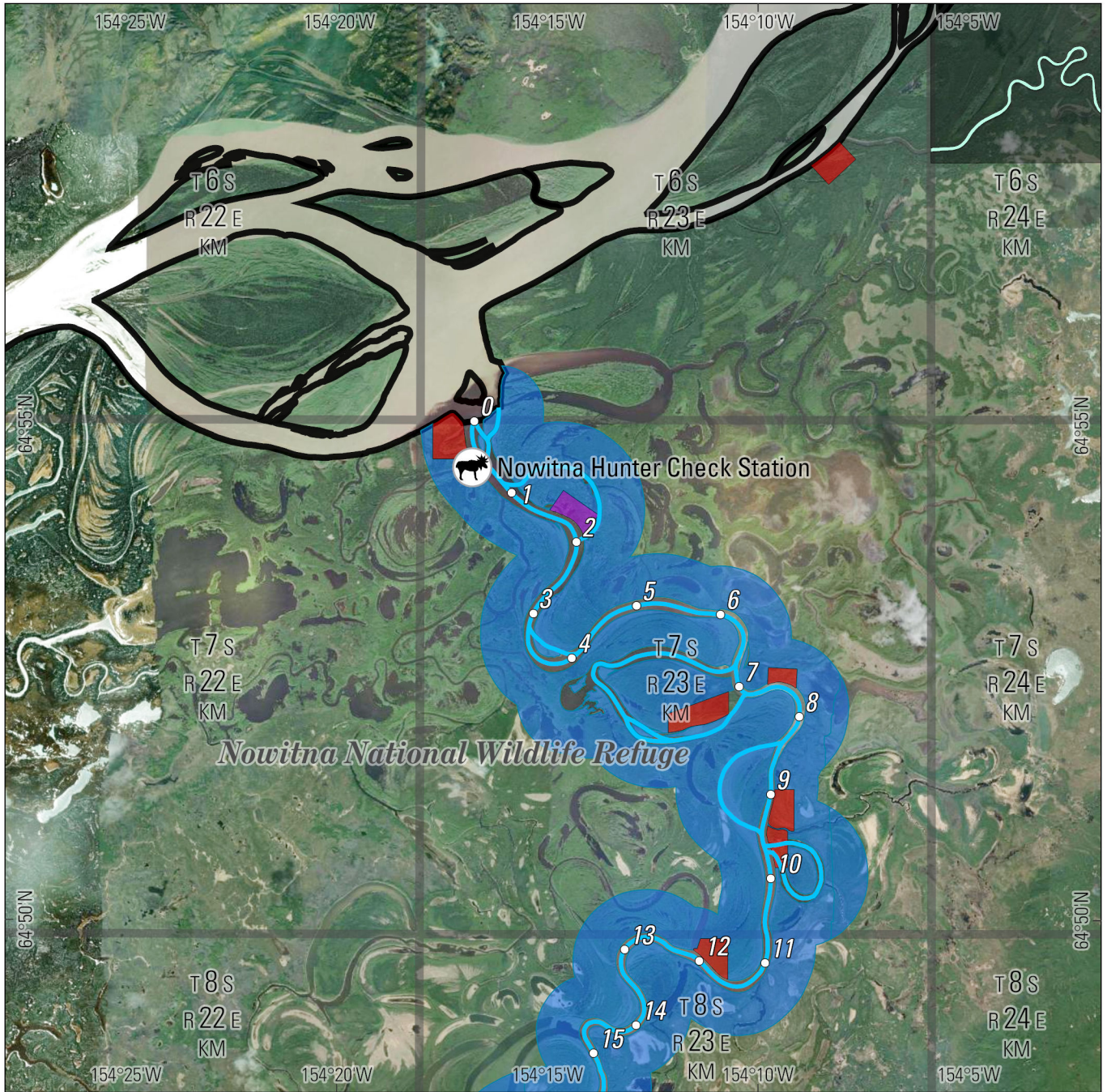
Because there would be no new direct or indirect impacts, there would be no new cumulative impacts.

Figure 4-2.1: Nowitna WSR Series - Alternative B (1 of 8)

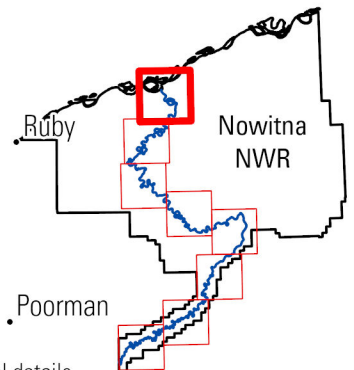


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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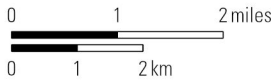
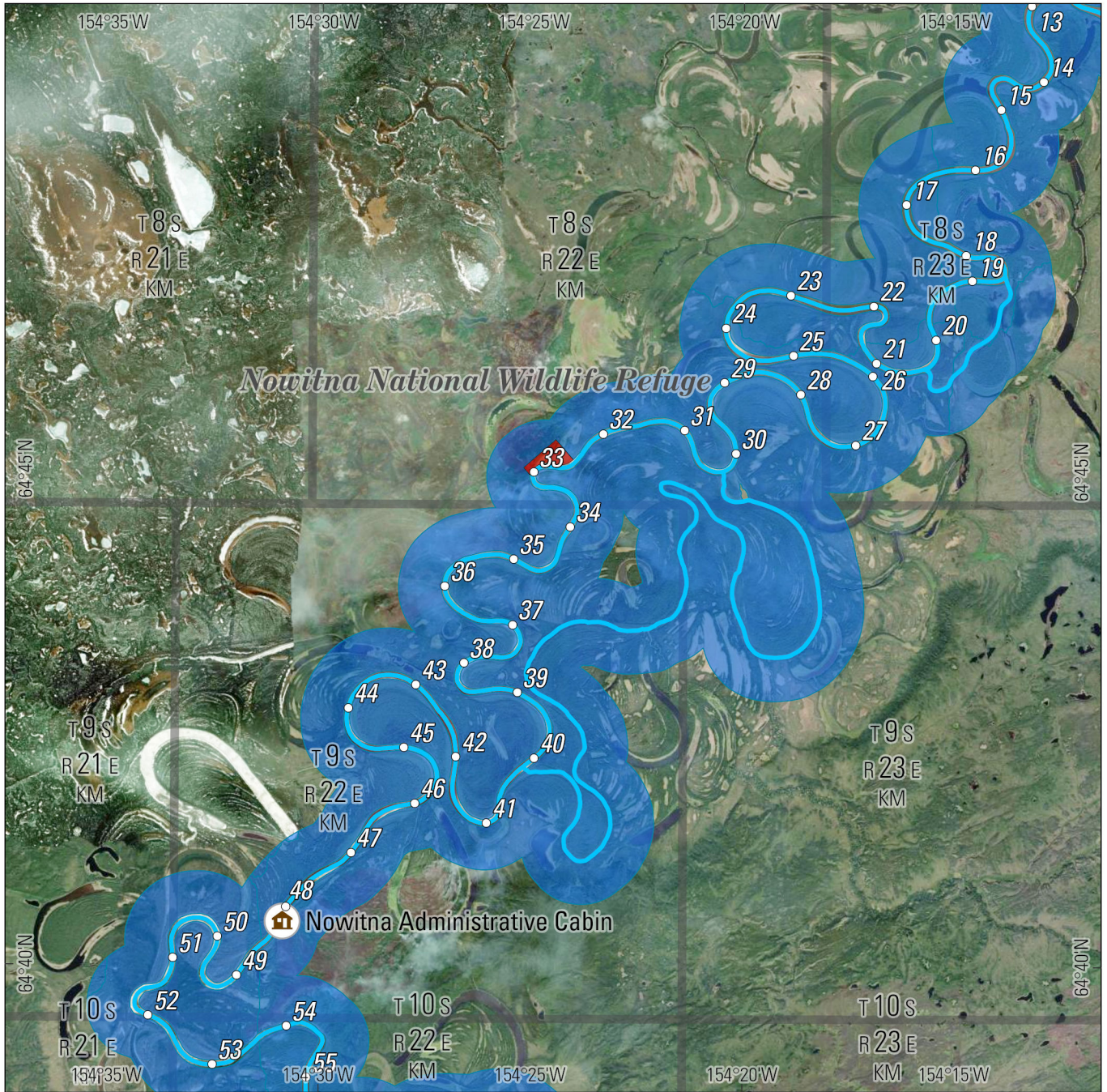
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.2: Nowitna WSR Series - Alternative B (2 of 8)

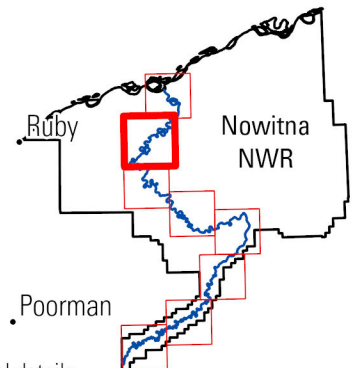


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
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- Patented ANCSA regional corporation



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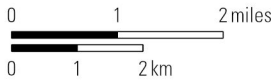
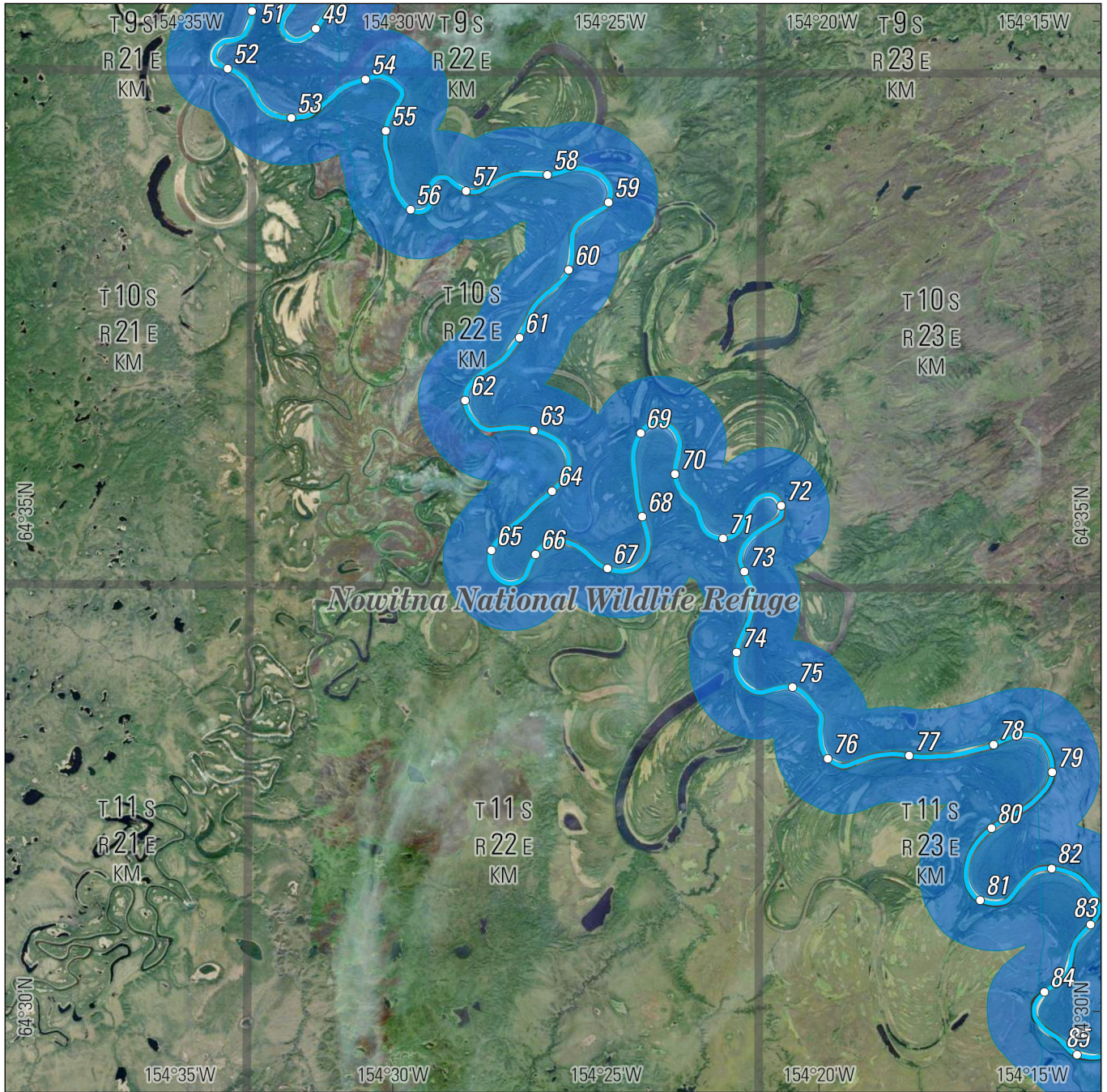
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.3: Nowitna WSR Series - Alternative B (3 of 8)

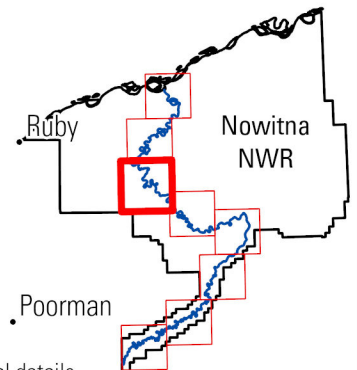


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
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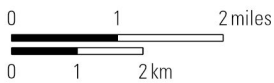
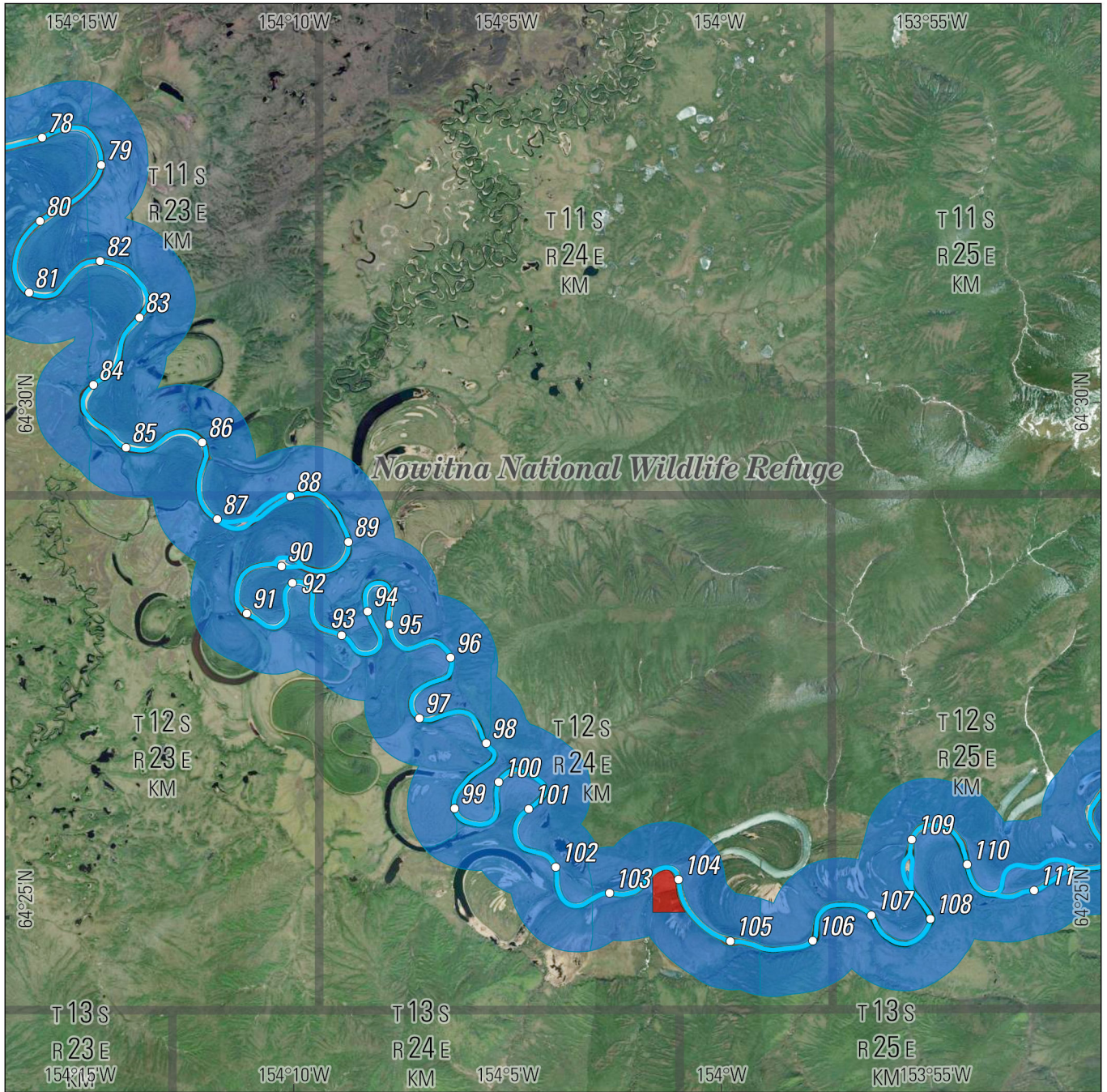
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.4: Nowitna WSR Series - Alternative B (4 of 8)

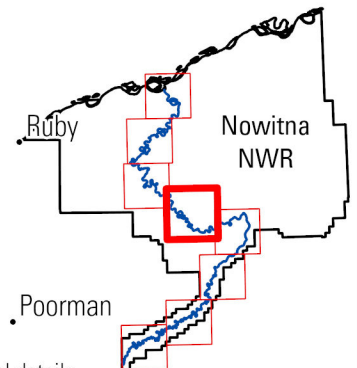


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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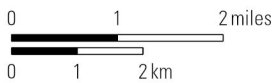
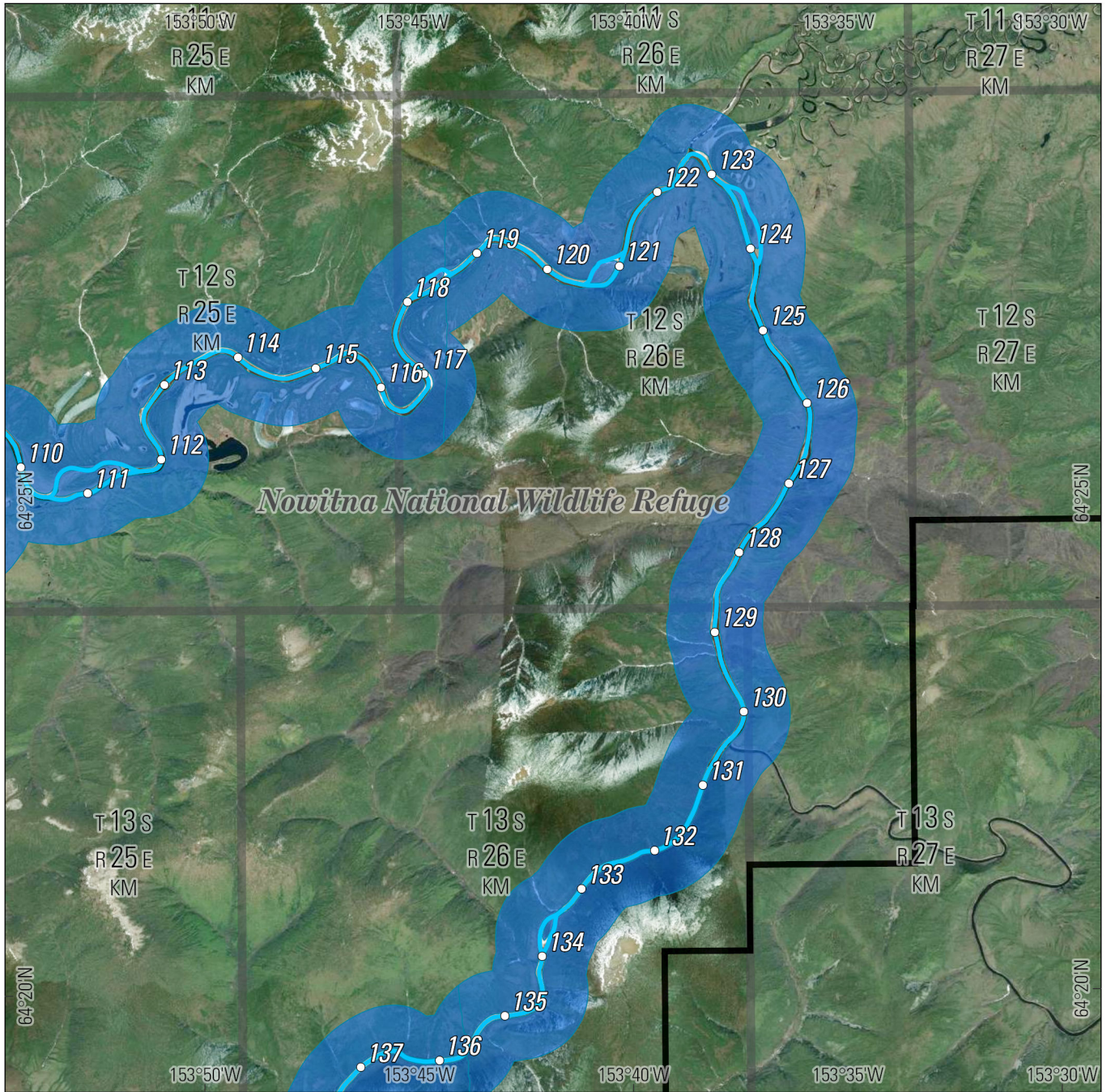
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.5: Nowitna WSR Series - Alternative B (5 of 8)

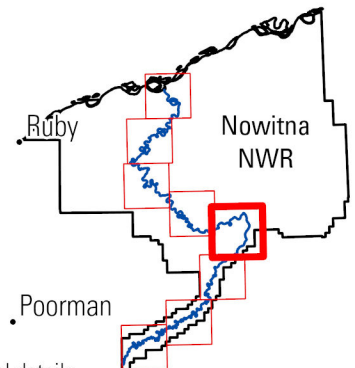


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
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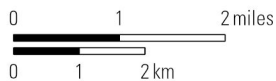
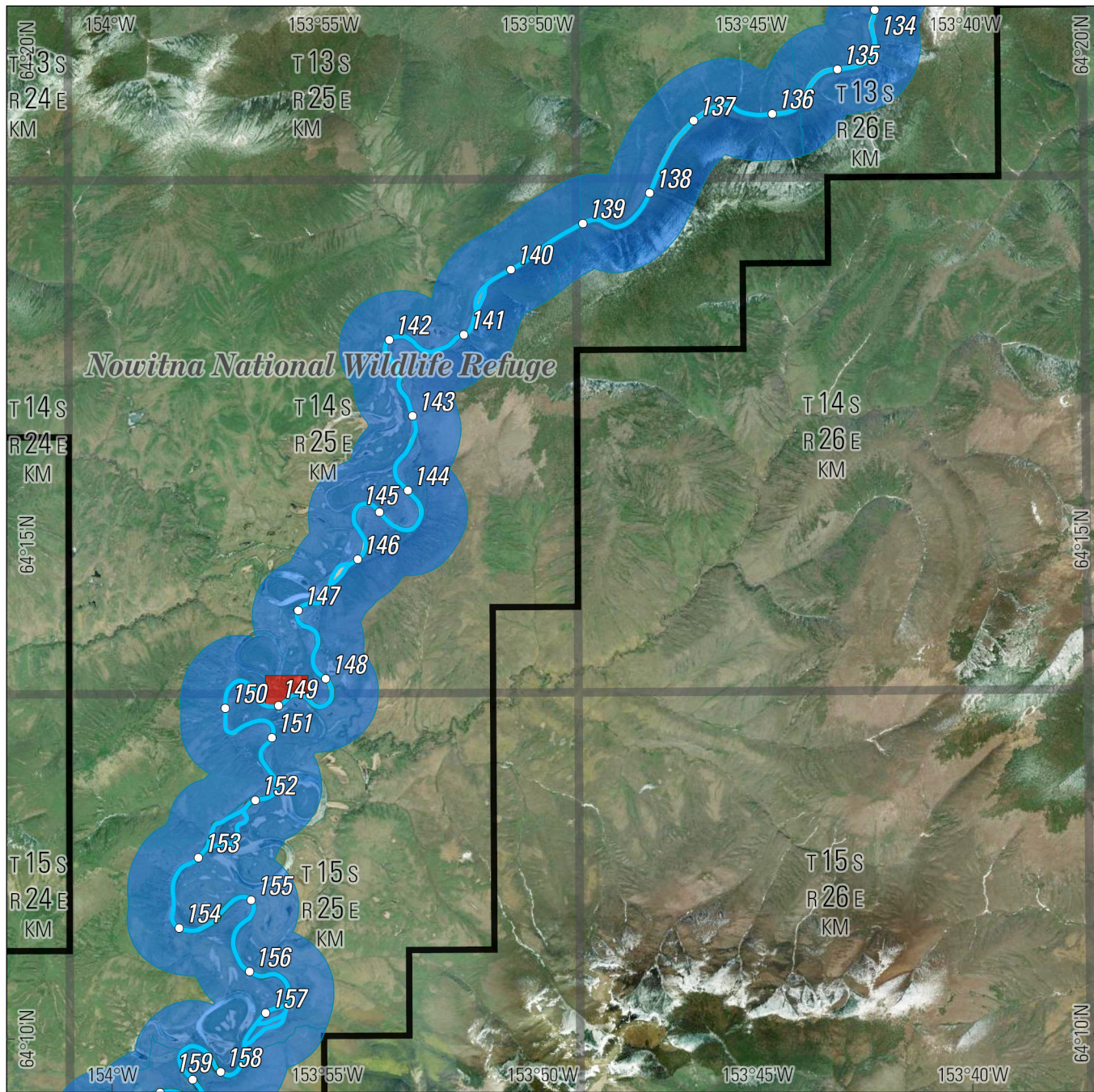
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.6: Nowitna WSR Series - Alternative B (6 of 8)

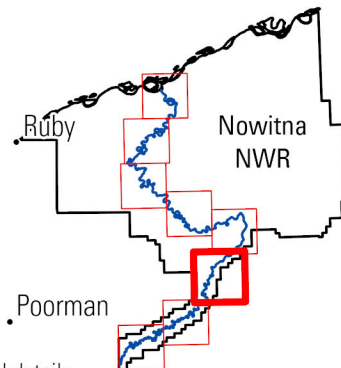


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
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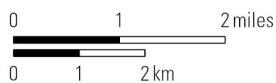
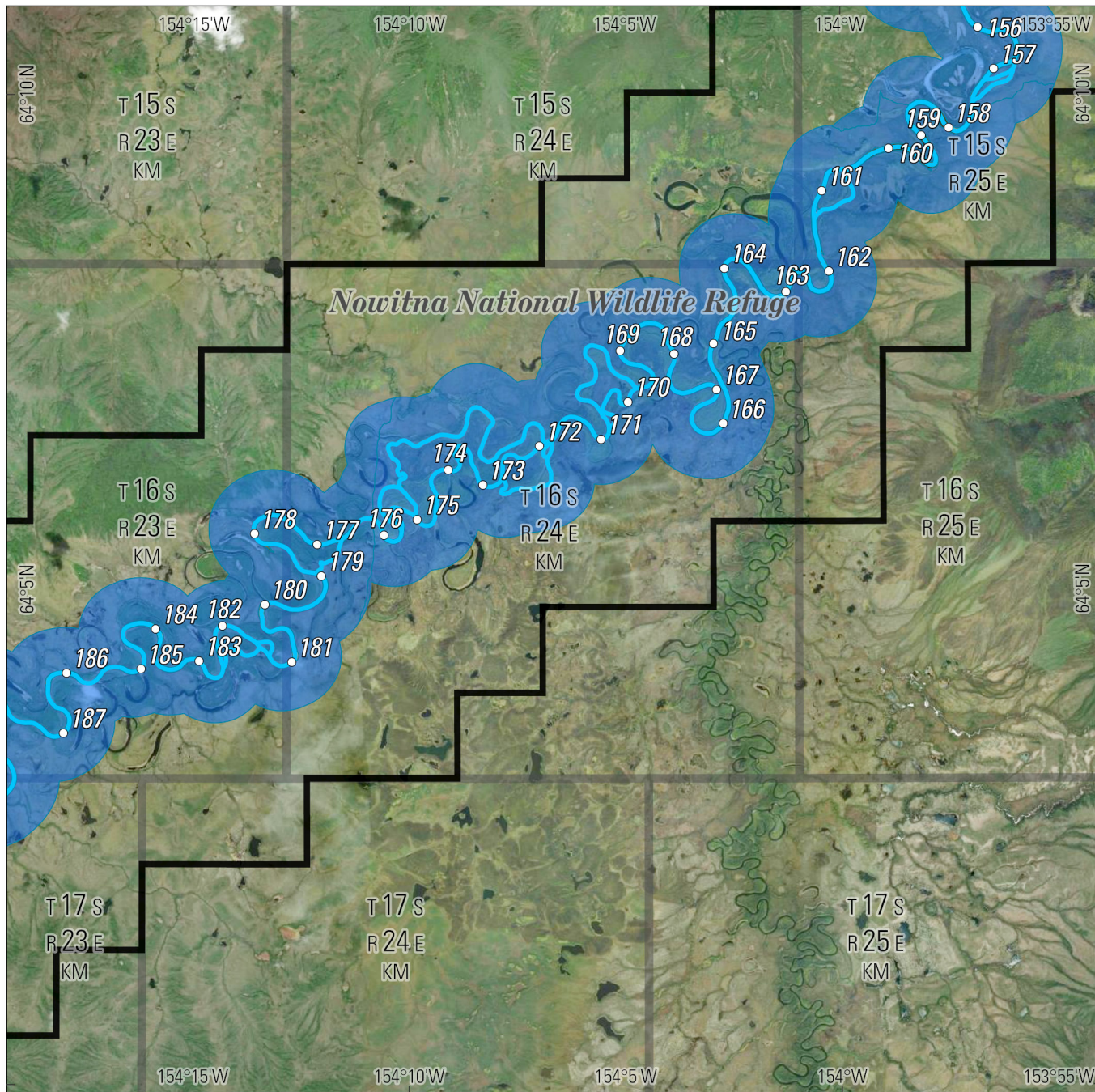
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.7: Nowitna WSR Series - Alternative B (7 of 8)

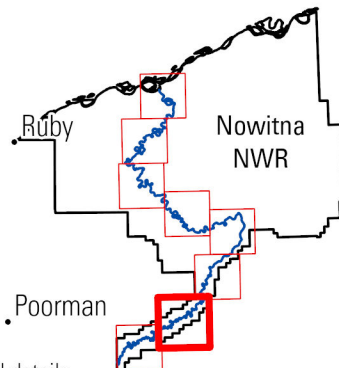


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
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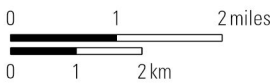
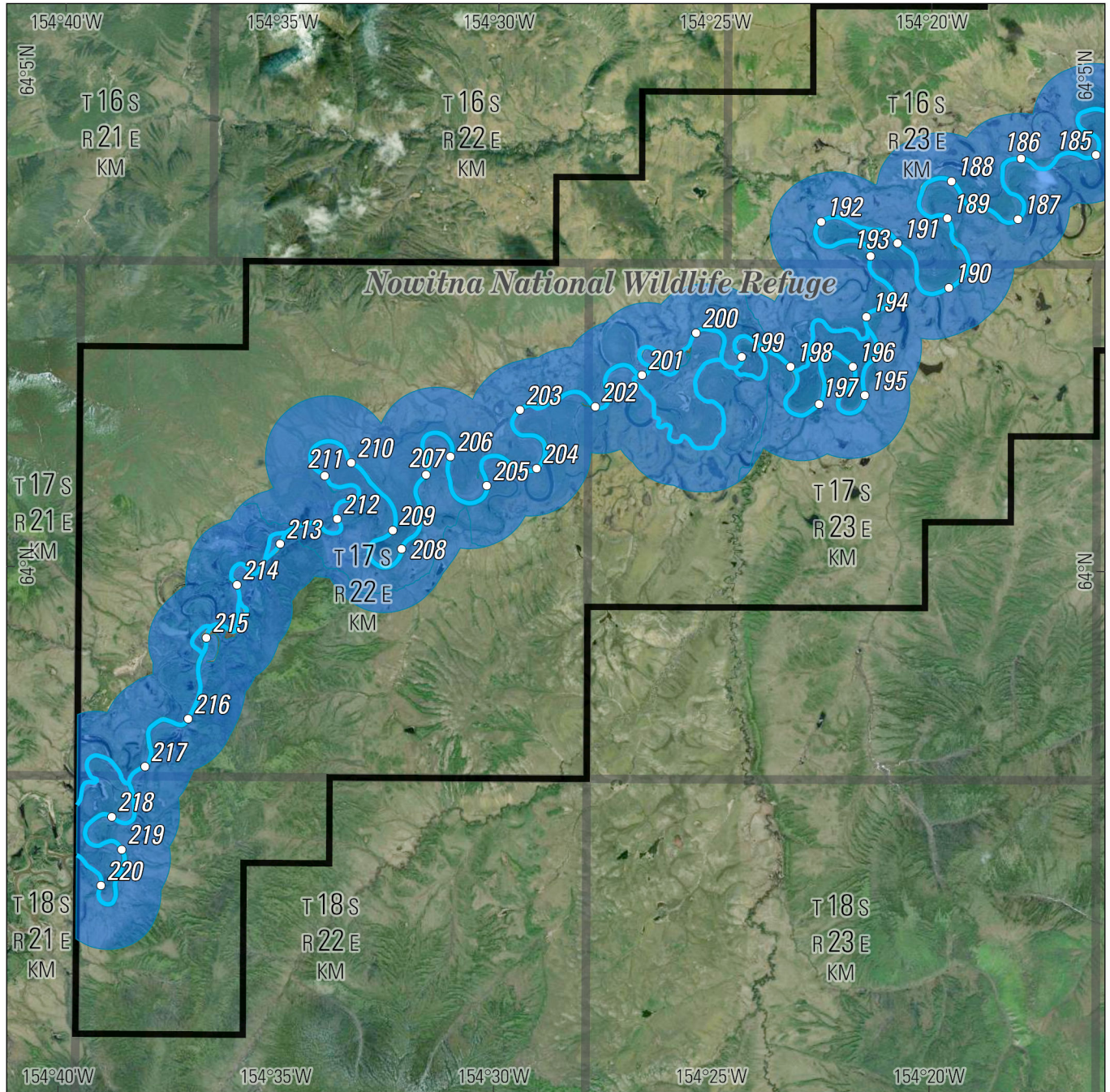
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure 4-2.8: Nowitna WSR Series - Alternative B (8 of 8)

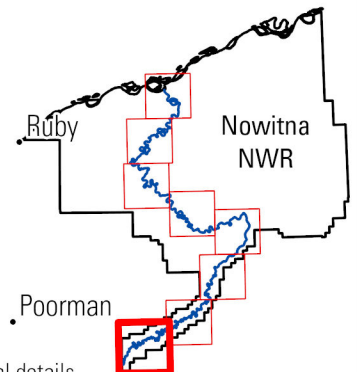


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
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Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

4.4 WILD AND SCENIC RIVERS

WSRs are streams or segments of streams designated by Congress under the authority of the WSRA of 1968 (Public Law 90-542, as amended; 16 USC 1271–1287) for the purpose of preserving the stream or stream section in its free-flowing condition, preserving water quality, and protecting the river’s ORVs. The WSRA defines ORVs as those characteristics that make the river worthy of special protection. ORVs are identified on a segment-specific basis, and they may include scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values. There are three types of potential classifications for eligible river segments—wild, scenic, and recreational—based on the built environment within the corridor. The potential classifications are based on the degree of human development along a segment, and they are used as a guide for future management activities. Wild means the most primitive, and recreational means the most developed.

The Service administers the Nowitna WSR, which flows through the Nowitna NWR. As required by the WSRA, the Service is responsible for creating a CRMP to provide for the protection of river values (the river’s free-flowing condition, water quality, and ORVs). This section will primarily focus on potential impacts on the Nowitna WSR’s free-flowing condition and the wild designation. For more detailed information on other river values, see **Section 4.5**, Hydrology and Water Quality; **Section 4.6**, Fisheries; **Section 4.7**, Cultural Resources; **Section 4.8**, Scenery; **Section 4.9**, Vegetation; **Section 4.10**, Wildlife; **Section 4.12**, Subsistence; and **Section 4.14**, Visitor Use.

4.4.1 Affected Environment

Deep in interior Alaska flows the Nowitna River, nestled in the heart of the Nowitna NWR, which forms much of the river’s watershed. The river is a life-giving force in the region and was selected among 25 Alaska rivers to be added to the National Wild and Scenic River System with the passage of ANILCA in 1980. The Nowitna WSR is a place of abundance and diversity and is one of the finest geological examples in Alaska of a meandering river. From its headwaters in the Kuskokwim Mountains, the Nowitna WSR runs north across the Nowitna NWR for 220 of its 317 miles before joining the mighty Yukon River. In its upper reaches, the Nowitna WSR’s clear waters run swiftly through the narrow channels over colorful gravel as the river winds toward the tundra-capped hills that form its canyon section. Below the canyon, the floodplain broadens and the Nowitna becomes a slowly meandering river typified by cut banks, sandbars, sloughs, and oxbow lakes. The river flows across a rich alluvial plain of lakes, marshes, and meandering streams and provides highly productive fish, waterfowl and moose habitat.

Frequent spring flooding caused by ice damming along the Nowitna WSR during breakup enriches floodplain lakes and sloughs with nutrients, as well as carbonates from the limestone bedrock in the river’s headwaters. The carbonates buffer the pH of the naturally acidic wetland waters and make these wetlands less acidic and more productive than many other areas in Alaska. On higher ground in the Nowitna WSR corridor, wetlands give way to a mosaic of spruce and deciduous forests, shaped by a natural regime of wildland fire and providing diverse wildlife habitats. In some areas, uncommonly large stands of old-growth white spruce provide nesting areas for raptors and excellent furbearer habitat. The combination of the Nowitna WSR’s diverse abiotic and biotic features, including the geology, hydrology, and biodiversity, creates a unique example of boreal riparian ecosystems.

Within the National Wild and Scenic River System, the Nowitna WSR is classified as wild because it is free of impoundments and is generally inaccessible except by trail. The watersheds and shorelines are

essentially primitive. No human facilities or modifications exist to impede the Nowitna River's free-flowing condition, either above or within the designated portions. The Nowitna WSR flows in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway.

The Nowitna WSR's superior qualities that make it stand out among Alaska rivers have been identified and described throughout its management history, both in studies recommending its inclusion in the National Wild and Scenic Rivers System and in subsequent management plans (USBOR 1973; USFWS 1987; USFWS 2009). However, the Nowitna WSR was designated by ANILCA without comprehensive descriptions and associated baseline conditions of the specific ORVs that made the river eligible for inclusion in the National Wild and Scenic Rivers System. This underscores how WSR management is continually changing and emphasizes the necessity for continuous evaluation and flexible management protocols to safeguard areas like the Nowitna WSR, even with limited data, to enhance conservation strategies.

In 2023, Service staff met with representatives from ADFG, Alaska Department of Environmental Conservation, Alaska Department of Natural Resources, U.S. Bureau of Indian Affairs, and residents of local communities to identify and describe the final ORVs (USFWS 2024b). In addition to the free-flowing condition and water quality, four ORVs were identified: ecology, fish, cultural, and scenery.

Water quality and the free-flowing condition are protected for all rivers in the National Wild and Scenic Rivers System. Flow regimes and water quality in the Nowitna WSR are not well studied but are generally considered to be natural and unimpaired. The river is mainly fed by snowmelt and warm-season precipitation, and maximum streamflow typically occurs in the spring during ice breakup. Ice jams during this time often cause flooding in the lower portion of the WSR. Summer flow levels can be dynamic in response to precipitation events. Water clarity varies seasonally and over the river's course. Clear water flows in the upper section, and the water becomes silty in the lower stretches during the summer months. Some unique aspects of the Nowitna WSR water's chemistry are described above. For more information regarding water in the Nowitna WSR, see **Section 4.5**, Hydrology and Water Quality.

The ecology ORV was defined to encompass the Nowitna WSR's unique combination of geology, hydrology, plant communities, and wildlife assemblage and to recognize the interconnectedness of these elements that yields intact, functioning ecosystems in the river corridor. The distinct water chemistry, flood regime, and meandering nature of the river generate diverse and highly productive riparian ecosystems that provide habitat for a broad, interconnected array of boreal plant and wildlife species (USFWS 2024b). For more information on these ecological components, see **Section 4.9**, Vegetation, and **Section 4.10**, Wildlife.

The Nowitna WSR's fish community diversity and assemblage are rare in the Arctic-Yukon-Kuskokwim Region and are recognized in the fish ORV. At least 19 fish species have been documented in the Nowitna WSR corridor, surrounding wetlands, and tributaries (USFWS 1990). The assemblage of fish species is dynamic, it supports subsistence and recreational activities, and it is sustained by a unique combination of water features, including swift water underlain by gravel; productive, shallow lakes; and slow-moving (still) water in the lower reaches (USFWS 2024b). For more information on Nowitna WSR fish, see **Section 4.6**, Fisheries.

Human relationships to the river and its resources through time are encompassed in the cultural ORV. The Nowitna WSR has undoubtedly provided resources for human use since people first came to the region in the late Pleistocene, and it continues to do so today. As an important location for resource harvest, travel, trade, and recreation, the Nowitna WSR has a long, rich, and unbroken cultural history, particularly for local Athabascans whose connection to the river goes back countless generations (USFWS 2024b). Today this relationship is expressed through hunting, fishing, recreation, and other activities in the river and corridor. For more information, see **Section 4.7**, Cultural Resources; **Section 4.12**, Subsistence; and **Section 4.14**, Visitor Use.

The scenic beauty of the Nowitna WSR both depends on and adds to the value of the river components described above. The diversity and dynamic nature of the area's geomorphology, fish, wildlife, plant communities, natural processes, seasons, and weather combine to create the stunning visual backdrop through which the river flows (USFWS 2024b). Few rivers in Alaska provide such a variety of scenery over a relatively short distance, and some sections of the river are truly awe inspiring. For more information, see **Section 4.8**, Scenery.

4.4.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no change to the current management, which is defined in the Revised CCP (USFWS 2009), of the Nowitna WSR and surrounding areas. The free-flowing condition and the wild designation of the Nowitna WSR would continue as described above.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Alternative B would introduce an enhanced inventory and monitoring program. Also, updated vegetation mapping would be used in future management and ultimately improve protection of the ORVs and water quality. While the potential impacts of WSR monitoring techniques remain uncertain, specific project designs and mitigation measures would be implemented to ensure the techniques do not affect the free-flowing condition or the wild designation.

The Service would implement strategies for monitoring the Nowitna WSR. The level of monitoring for determining impacts on the scenery ORV would be minimal. If significant changes from monitoring were anticipated, however, efforts would be made to explore alternative monitoring methods that minimize impacts on the free-flowing condition or the wild designation.

The Service would also adjust the Nowitna WSR corridor's boundary to comply with ANILCA. This would slightly reduce the corridor's overall footprint, compared with Alternative A. Changing the WSR boundary is expected to have no noticeable impact on the Service's management direction and capacity to protect the free-flowing condition or the wild designation.

Cumulative Effects

Since there would be no new direct or indirect impacts under Alternative A, there would be no cumulative impacts on the Nowitna WSR's free-flowing condition or characteristics that contribute to its classification as a wild river.

Under Alternative B, there would be no past, present, or foreseeable projects, such as road construction or new developments, that would have an impact on the Nowitna WSR's free-flowing

condition. The WSR would continue to have limited development along its banks, preserving the natural character and ensuring minimal human disturbance. This would also sustain its wilderness qualities and wild designation.

4.5 HYDROLOGY AND WATER QUALITY

4.5.1 Affected Environment

Hydrology

Most of the Nowitna NWR drains to the Nowitna River. The river originates in the Kuskokwim Mountains to the south, flows through the entire length of the Nowitna NWR, and forms a wide, meandering floodplain before emptying into the Yukon River in the north. The headwaters of the Nowitna, Titna, Lost, and Sulatna Rivers flow from the mountains into the Nowitna lowlands section. Oxbow lakes created by channel migration are common in the lowlands along the Nowitna River.

Weather and climate are the most substantial drivers of hydrology in the area. The hydrologic regime varies with changes in the average daily, monthly, and annual flow based on the regional temperature and precipitation. Weather and climate data have been collected at meteorological stations near Tanana, Alaska, and Galena, Alaska (NOAA 2024). The highest mean monthly precipitation at the Tanana station occurs during the summer. August is typically the wettest month with an average of 2.7 inches of precipitation. Precipitation decreases in October and remains low throughout the winter and spring (Burkart et al. 2023).

The timing, amount, and persistence of snow have major effects on surface and groundwater hydrology. The amount of water in the snowpack prior to melting in the spring and the timing and duration of snowmelt and ice breakup determine the shape and duration of the snowmelt stage peak. Normal monthly snowfall during May through September are less than an inch. From October through April, normal monthly snowfall at the Galena station is 2 to 6 inches higher than normal monthly snowfall at the Tanana station. The highest normal monthly snowfall at both stations is in December (15.8 inches at Galena and 10.3 inches at Tanana; Burkart et al. 2023).

In addition to measurements at the Tanana and Galena stations, the Service works with the Natural Resources Conservation Service to monitor snow depth at three stations on the Nowitna NWR. Snow depths are recorded from aerial overflights in the first week of December, February, March, April, and May (USFWS 2009). In the Nowitna NWR, February through April, snow depths range from 2 to 3 feet, with less snowpack in other winter months (Burkart et al. 2023).

The Nowitna River typically runs free of ice in May and freezes over in October. Maximum stream volumes are associated with spring breakup and snow melt. Ice damming during breakup can cause flooding along the Nowitna River, and ice jams on both the Yukon River and the lower Nowitna River can cause flooding of the entire floodplain for a distance of up to 100 miles from the mouth of the Yukon River (USFWS 1987). Permafrost conditions in the watershed prevent substantial percolation and summer rainstorms can result in a rapid stream rise of several feet. Such rain induced river volumes typically last several hours to a few days (USBOR 1973). Ice begins to form on the Nowitna River and its tributaries in October, and the rivers are typically completely ice covered by early November. Ice remains in place throughout the winter and river flows decrease as inputs from surface water sources diminish. The remaining flow transitions to being fed primarily from groundwater. By late winter, ice may reach 6 feet in thickness, with many tributary waters completely freezing. Waterbodies remain ice

covered for more than half the year. Discharge in rivers during the winter is typically limited to groundwater-fed base flows. During winter and early spring, rivers and streams are at their lowest flow for the year (Burkart et al. 2023).

The Nowitna WSR flows 220 miles along the entire length of the Nowitna NWR. To date, there have been no stream-gaging efforts to monitor flow in the Nowitna NWR (Burkart et al. 2023). However, in the summer of 2003, 2.3 miles upstream from its confluence with the Yukon River, the Nowitna River was 860 feet wide with a discharge of 17,600 cubic feet per second in June; in August, it was 441 feet wide with a discharge of 8,670 cubic feet per second (U.S. Geological Survey 2024).

Numerous oxbow lakes and sloughs provide excellent fish and wildlife habitat adjacent to the river. Flooding is important ecologically for building and maintaining channel, riparian, and floodplain habitats and the exchange of sediment, organic matter, and nutrients between the floodplain and stream channel (Poff et al. 1997). High water also recharges floodplain ponds and creates pathways for the movement of fish between the stream and floodplain habitats. The timing, duration, and frequency of floods of various magnitudes are important for the life cycle of fish and riparian vegetation (Poff et al. 1997). Flooding can occur during high flows associated with spring snowmelt and ice jams, and summer and fall rain events.

The importance of groundwater in the Nowitna NWR is not well understood, but it may play an important role in influencing surface water characteristics in the Nowitna WSR (Burkart et al. 2023). Shallow groundwater flow occurs in the upper soil layers and is confined to the unfrozen active layer when permafrost is present (Williams 1970). In shallow groundwater systems, surface water percolates through unfrozen soil layers into shallow aquifers, contributing to groundwater recharge and base flow for rivers and lakes. Additional information on permafrost is included in **Section 4.11**, Soils and Permafrost.

Water Quality

The physical and chemical characteristics of water in aquatic systems, collectively known as water quality parameters, are important measures and indicators of aquatic and terrestrial ecosystem health.

Section 303 of the Clean Water Act directs the establishment of water quality standards and implementation plans by states or authorized Tribes with Environmental Protection Agency (EPA) approval. Core components of water quality standards include (1) identifying designated uses (for example, drinking water, recreation, and propagation of fish, shellfish, and wildlife), (2) establishing qualitative or numeric criteria, and (3) developing antidegradation policies. Alaska's water quality standards are found in regulation promulgated by the Alaska Department of Environmental Conservation (18 Alaska Administrative Code, 70 Water Quality Standards). Section 303(d) of the Clean Water Act further specifies that states identify waters within their jurisdiction that are not meeting water quality standards. Currently, no lakes or rivers in the Nowitna WSR corridor are listed as impaired under Section 303(d) (ADEC 2024).

The only U.S. Geological Survey water quality sampling site on the Nowitna WSR is 2.3 miles above the river's confluence with the Yukon River (gage number 645408154143400). This site was sampled on June 6 and August 27, 2003. Specific conductivity (68 versus 155 microsiemens per centimeter [$\mu\text{S}/\text{cm}$]) and alkalinity (29 versus 64 milligrams per liter [mg/liter]) were approximately twice as high in August compared to June. During June, the suspended sediment concentration was 195 mg/liter . In late August,

suspended sediment concentration had dropped to 17 mg/liter (Burkart et al. 2023). This variability in concentration is expected with changing flow with higher suspended sediment loads largely correlated with spring runoff events.

The Service collected physical water quality data at study lakes in the Nowitna NWR from 1984 to 1986 as part of a large-scale fisheries and habitat survey on interior Alaska NWRs (Glesne et al. 2011). Lake types sampled included lowland and oxbow lakes. Many of these lakes are within the WSR corridor and may exchange surface water during floods (Burkart et al. 2023).

Snyder-Conn et al. (1992) conducted water quality and metals sampling of water, sediments, and fish in rivers of the Nowitna NWR during 1985, 1987, and 1988. Sample sites included four sites on the Nowitna River; California Creek above the confluence with the Titna River; the Sulatna River at the Nowitna NWR border; and the Sulatna, Sulukna, and Titna Rivers above or near their confluence with the Nowitna River. While some of these measurements are outside the Nowitna WSR corridor, they represent the best available data and have been included for reference. The pH of the Nowitna WSR at its mouth was near neutral (averaging 7.4 in 1987 and 7.6 in 1988; Snyder-Conn et al. 1992). The pH was slightly more basic (average of 8.0 in 1987 and 1988) on the upper Nowitna WSR near the southern Nowitna NWR boundary (Snyder-Conn et al. 1992).

Total alkalinity at stream and river sampling sites ranged from moderate to high with values from 51 to 521 mg/liter (Snyder-Conn et al. 1992). Specific conductivity across sites ranged from 78 to 380 $\mu\text{S}/\text{cm}$, depending on the location and year (Snyder-Conn et al. 1992). Specific conductivity was lowest in the upper Nowitna River (averaging 100 $\mu\text{S}/\text{cm}$ in 1987 and 78 $\mu\text{S}/\text{cm}$ in 1988) near the southern boundary of the Nowitna NWR. Turbidity ranged from low to high (4.7 to 183 nephelometric turbidity units [NTU]) at most sites. The Sulatna River, at a site near the southwestern boundary of the Nowitna NWR, exhibited extremely high values averaging 3,467 NTU in 1987 and 1,183 NTU in 1988 (Snyder-Conn et al. 1992).

In the Nowitna NWR, most trace element concentrations in water and sediment were within the range expected for uncontaminated watersheds with a few exceptions. Total recoverable manganese concentrations in 1985 samples of the Sulatna and Titna Rivers and the Nowitna WSR upstream from the Titna River exceeded the EPA secondary criteria for drinking water of 0.05 mg/liter for that year. In 1988 at the Sulatna River site, the measured dissolved concentration of manganese, which is typically lower than the total recoverable concentration, again exceeded this criteria (Snyder-Conn et al. 1992).

In 1985, total recoverable iron concentrations in the Sulatna and Titna Rivers and some sections of the Nowitna WSR all exceeded EPA secondary drinking water criteria of 0.3 mg/liter and the Alaska State criteria for protection of freshwater aquatic life from chronic toxicity of 1.0 mg/liter (if these conditions occur on 4 or more consecutive days) (Snyder-Conn et al. 1992). Again in 1987, the sites on the Nowitna River near the mouth and downstream of the southern boundary and the Sulatna River site exceeded the EPA secondary criteria; the Sulatna River also again exceeded the Alaska State criteria for protection of freshwater aquatic life.

At the sites sampled, there was a strong positive correlation between turbidity and iron and manganese concentrations in all years measured (Snyder-Conn et al. 1992). Cadmium was measured, but the method detection limits were very close to the concentrations measured and cannot be quantitatively interpreted. Both dissolved and total recoverable concentrations of copper were measured in 1985 and

1987; in most instances, dissolved concentrations exceeded total recoverable concentrations, indicating issues may have occurred in sampling or the laboratory analysis that make interpretation of these results problematic.

In 1985 based on measured hardness, dissolved and total recoverable lead concentrations on the Nowitna WSR just upstream of the Titna River were above the EPA and State criteria for protection of freshwater aquatic life from chronic toxicity (Snyder-Conn et al. 1992). The upper Nowitna River, where reported hardness was low (51 mg/liter as calcium carbonate in 1987 and 45 mg/liter as calcium carbonate in 1988), could be a concern for species sensitive to metals, including cadmium, copper, and lead, where the concentration at which they are considered toxic is based on hardness.

In 1987 and 1988, the Sulatna River, which had active placer mining activity upstream, had significantly higher turbidity, iron, and manganese concentrations than sites on the upper, middle, and lower Nowitna River; the Sulukna River; and California Creek. There is no direct evidence that the presence of placer mining was related to these water conditions in the Sulatna River. It is possible to observe elevated concentrations of contaminants due to natural erosion of highly mineralized areas, events such as flooding and fires (and fire suppression), and atmospheric deposition.

There are currently no active water quality monitoring sites along the Nowitna WSR.

4.5.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no change to the current management of the Nowitna WSR and the surrounding corridor. Current special values of the Nowitna NWR tied to river conditions, defined in the Revised CCP (USFWS 2009), would not be evaluated for change. Surface and groundwater resources, including water quantity and water quality, would not be evaluated for potential impacts. The Nowitna WSR would continue in its free-flowing condition. The general lack of monitoring would result in no changes to the availability of data or any designations on the 303(d) list, but it could hamper future protection of this resource.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, the Service would implement additional monitoring efforts within the Nowitna WSR corridor. This could lead to more informed management decisions regarding water resources and water quality. The Service would work to document the water quantity of rivers and lakes within the corridor to support water reservation applications. The Service would also work with partners to expand water quantity and quality monitoring for the Nowitna WSR. Increasing the monitoring efforts would expand water resources data in the corridor, which would lead to more informed future management decisions.

Under Alternative B, the Service would also reduce the total acreage of the Nowitna WSR corridor. This could change the management of certain tributaries or oxbow lakes that were within the previous corridor. Management of those areas would still fall under the Revised CCP (USFWS 2009) and would not substantially differ from management under this CRMP. However, the lack of monitoring efforts could continue in the areas removed from the corridor.

Cumulative Effects

The Central Yukon Resource Management Plan may impact water resources under both alternatives in this CRMP by altering management strategies in the upper Nowitna WSR watershed. Activities such as improperly mitigated and unpermitted mining or transportation could result in impacts on runoff patterns and water quality. Neither alternative in this EA would contribute to cumulative impacts on water quantity and quality. However, the additional monitoring under Alternative B would allow the Service to make better informed management decisions on any potential impacts and protect the river values through efforts to secure instream flow reservation.

4.6 FISHERIES

4.6.1 Affected Environment

The Nowitna River supports a remarkably diverse assemblage of northern fish species. It is also a migration corridor to one of only six known sheefish (*Inconnu* spp.) spawning areas in Alaska. Thus, the Nowitna River provides fish habitat that is rare in the Arctic-Yukon-Kuskokwim Region. At least 19 fish species have been documented in the Nowitna WSR corridor, surrounding wetlands, and tributaries.

The Nowitna River specifically provides exceptionally high-quality foraging habitat and is a continentally important migration corridor for populations of Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and chum salmon (*O. keta*). Salmon-use areas (migration, rearing, and spawning) are shown in **Figure 4-3**. Chinook salmon populations have significantly declined in recent years in the Nowitna River and elsewhere in Alaska, but not enough is known about why this is occurring and whether the trend will continue. The Nowitna WSR and its tributaries are also important habitat for sheefish and other species of whitefish (*Coregonus* spp.), as well as resident Dolly Varden (*Salvelinus malma*), Arctic grayling (*Thymallus arcticus*), and northern pike (*Esox lucius*).

The sheefish that migrate up the Nowitna WSR to the Sulukna River are one of only six known spawning populations of sheefish in Alaska's Yukon drainage. Sheefish are among the most targeted subsistence and sport fishing species in the region. Similar to salmon, this species' migratory habits make refuge stocks susceptible to harvest impacts outside the Nowitna NWR (USFWS 2009). The Nowitna WSR contains five other species of whitefish, including broad whitefish (*C. nasus*), humpback whitefish (*C. pidschian*), round whitefish (*Prosopium cylindraceum*), least cisco (*C. sardinella*), and occasionally, Bering cisco (*C. laurettae*) (USFWS 2024b). The abundant northern pike are also important for recreational sport fishing in the Nowitna NWR.

The use of the Nowitna WSR by various fish species is slightly different upstream and downstream of the Little Mud River confluence. Above the Little Mud River, the headwaters of the Nowitna River and the Nowitna River tributaries (Susulatna, Sulukna, and Titna Rivers) harbor critical spawning and rearing habitat for both anadromous⁶ and freshwater fish species. The upper section of the river also provides suitable habitat for resident fish species, including the Arctic grayling and Dolly Varden. Arctic grayling have been found in the main stem of the Nowitna River, above the confluence with the Big Mud River (USFWS 2009). Below the Little Mud River, the lower section of the Nowitna WSR supports summer foraging and overwintering habitat for multiple spawning populations of fish, including sheefish.

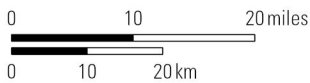
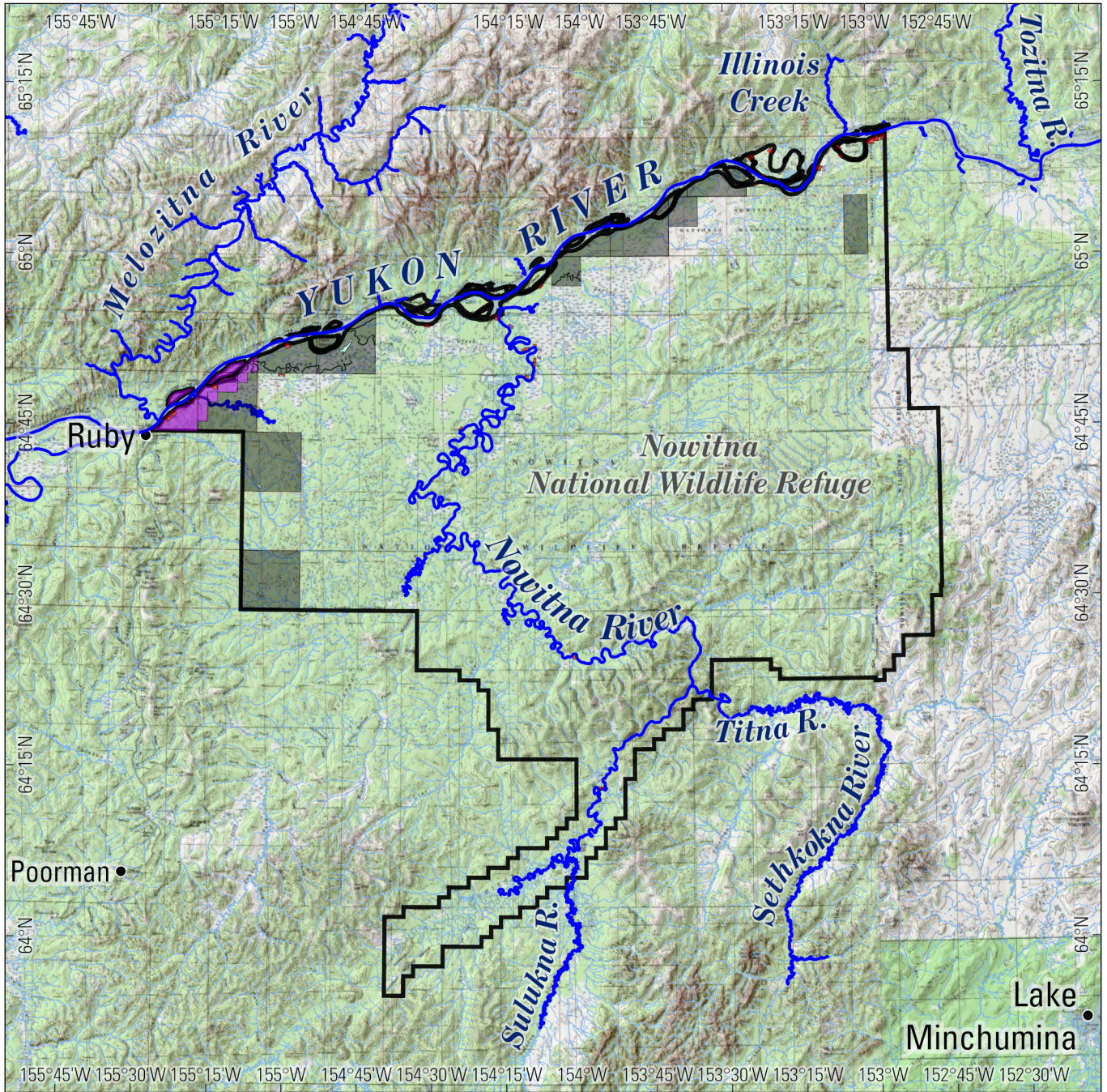
⁶ A fish or fish species that spends portions of its life cycle in both fresh and salt waters






Figure 4-3: Salmon-Use Areas¹



U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



-  Salmon use areas
-  Nowitna NWR boundary
-  Patented native allotment
-  Patented ANCSA village corporation
-  Patented ANCSA regional corporation



Produced in the Division of Realty
 Anchorage, AK
 Base Map Source: ESRI, Inc.
 Map Date: October 15, 2024
 Map ID #: 11-0062

Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

¹ ADF&G Anadromous Waters Catalog, 2024

The shallow floodplain lakes, marshes, and oxbows are uniquely important habitats that provide slack water for foraging on smaller prey fish and provide spring spawning lakes for northern pike (USFWS 2009). There are no federally listed, proposed, or candidate fish species in the Nowitna WSR and no critical habitat.

4.6.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no change to the current management of the Nowitna WSR and surrounding areas. Salmon-use areas would continue to occupy the areas listed in **Table 4-4**. The current special values of the Nowitna NWR tied to river conditions, defined in the Revised CCP (2009), would not change. Continuing to recognize fish as a distinct ORV would allow for a focused and specific approach to managing and conserving the river’s fish resources while acknowledging the significant role that fish populations and their habitat play in the ecological health and overall value of the Nowitna WSR and the broader region.

Table 4-4. Salmon-Use Areas – Alternative A

River	Distance (Miles)
Lost River	1.953
Nowitna River	212.417
Sulatna River	5.534
Sulukna River	1.249
Titna River	0.953
Unnamed river	4.063

Source: ADFG 2024c

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under both Alternative A and B, the Service would continue to manage the Nowitna WSR corridor according to the Revised CCP (USFWS 2009). Under Alternative B, the Service also would implement three additional fish ORV goals, each with its associated objectives, to better protect and enhance river values and the fish ORV.

The Service would develop and initiate fisheries and habitat surveys and ecological inventories to better understand the diverse fish community of at least 19 anadromous and freshwater fish species in the Nowitna WSR. A more comprehensive understanding would allow the Service to better manage and protect habitats in the face of changing environmental conditions.

The Service would improve the understanding of the unique characteristics that benefit suitable sheefish spawning habitat and support other whitefish species. This would support efforts to ensure that these resident species remain widespread in stable numbers throughout their native habitat. Monitoring the effects of changing conditions would allow the Service to protect and identify any potential management needs of fish species in the Nowitna WSR. There would be no ground disturbances; however, monitoring and surveys could have direct impacts on fish through temporary disturbance from biologists entering the water and from different survey methods used (for example, electrofishing and netting). These impacts would be on individual fish, and would not affect the fish population or fish ORV. The management actions under Alternative B would be focused on better understanding where there is

concern over a river value. Over time, these management actions would allow for a diverse population of sheefish and other species of whitefish to continue to thrive in the Nowitna WSR.

Under Alternative B, the Service would adjust the Nowitna WSR corridor’s boundary to comply with ANILCA. This would reduce the corridor’s overall size relative to Alternative A, resulting in 11.817 fewer miles of salmon-use areas in the corridor (**Table 4-5**). This administrative boundary adjustment would not be expected to have a discernible impact on the Service’s ability to manage the Nowitna WSR’s fish ORV. It also would not be expected to affect the fish ORV itself, such as the habitats and fisheries within the Nowitna River.

Table 4-5. Salmon-Use Areas – Alternative B

River	Distance (Miles)
Lost River	1.457
Nowitna River	210.001
Sulatna River	0.790
Sulukna River	1.549
Titna River	0.555
Unnamed river	0

Source: ADFG 2024c

Cumulative Effects

The impacts from past, present, and reasonably foreseeable future actions would occur for the lifetime of the management plan. These activities include updating the Bureau of Land Management’s Central Yukon Resource Management Plan, which is anticipated to be finalized in December 2024. This Bureau of Land Management plan would manage actions for mining and other upstream activities on Bureau of Land Management-administered lands in the upper Nowitna River watershed that could affect downstream conditions, including Nowitna WSR river values. Also, the impacts from improperly mitigated and unpermitted mining and other upstream activities could have adverse impacts on water quality and fish resources and habitat. These would impact the Service’s ability to manage the fish ORV in the Nowitna WSR. However, improving the understanding of river fish values, such as described under Alternative B, would help offset adverse cumulative effects. This is because the Service would be able to better manage and protect fish species and their habitats.

4.7 CULTURAL RESOURCES

4.7.1 Affected Environment

“Cultural resource” is a broad term used to refer to the diverse human record found in sites, structures, objects, and places created and/or used by people. It is inclusive of a wide variety of resources, including, but not limited to, archaeological sites, isolated artifacts, features, records, manuscripts, historic sites, and traditional cultural properties. Visitation of cultural resources brings the potential for unintentional effects, like those related to recreation, as well as intentional vandalism or unauthorized collection. Traditional cultural properties are resources associated with the cultural practices, traditions, beliefs, arts, crafts, or social institutions of a living community (USFWS 2016a). Traditional cultural properties could be historic properties if they meet the National Register of Historic Places (NRHP) criteria (36 CFR 60.4).

As defined in the National Historic Preservation Act and its implementing regulations found at 36 CFR 800, “historic properties” are cultural resources determined to be eligible for listing on the NRHP. In addition to meeting at least one of the four main NRHP eligibility criteria (association with a significant event, person, distinctive architecture or construction style, or potential for information), cultural resources also must exhibit integrity of at least one of the following to be eligible: location, design, setting, materials, feeling, workmanship, or association.

Cultural resources also include “archaeological resources,” as defined in the Archaeological Resources Protection Act of 1979, and other sites, structures, objects, items, and places as addressed in other statutes and regulations (for example, the American Indian Religious Freedom Act of 1978, Antiquities Act of 1906, NEPA, and Native American Graves Protection and Repatriation Act of 1990).

Cultural resources in the Nowitna WSR corridor include traditional cultural properties, historic properties, and archaeological resources. The Service acknowledges that the spiritual, physical, cultural, and historical connections of Alaska Native peoples and their Tribes to land, wildlife, and waters are of cultural significance. Alaska Native peoples’ customary and traditional ways of life sustain a Native identity experienced through activities, oral tradition (including place-names), ceremonies, songs, and dances, as well as an economy of sharing (USFWS, n.d.). Within the Nowitna WSR corridor, traditional activities, such as subsistence harvest (**Section 4.12**, Subsistence), and the settings in which these activities take place are of great importance to local communities. For some locals, there may be no distinction between prehistoric, historic, and modern interactions between people and the Nowitna River’s resources; all can be seen as part of a long continuum that extends to future generations (USFWS 2024b).

Research in the Tanana River watershed, part of the larger Yukon River basin within which the Nowitna NWR and WSR are situated, indicates that humans have inhabited the interior of Alaska for over 14,000 years (Holmes 1996, 2001), including some of the earliest dated archaeological sites in the Americas. The Nowitna River’s location and abundant natural resources have drawn people to its banks probably since their arrival to the region in the late Pleistocene. The area of interior Alaska around Nowitna NWR was unglaciated during the end of the last ice age, and paleontological remains from prehistoric animals, including mammoth, can be found within the river corridor and along the Yukon River main stem nearby. The presence of these prehistoric animals and the relatively close proximity of the highly valued Batza Tena obsidian source (approximately 140 miles north of the Yukon River) could signal that the Nowitna WSR was a hunting or scavenging ground and corridor to lithic raw material for some of the first inhabitants in the area. Little archaeological work has been conducted in the river corridor to date, but it is possible that archaeological resources dating far back in time may be located within the WSR corridor (USFWS 2009). Due to the meandering nature of the area’s streams, many older sites may already have been destroyed or covered by natural causes. There is a high likelihood of finding more recent sites on present stream banks, but older sites probably only remain on higher ground.

The Nowitna River was an important hunting area and travel corridor for Athabascan residents for many generations prior to the arrival of Europeans. In 1867, explorers Whymper and Dall from the Scientific Corps of the Western Union Telegraph Expedition visited an important trading site and settlement called Noghuykkaakk’et⁷ at the mouth of the Nowitna River (de Laguna 2000). At the time,

⁷ Published spelling variants include: Newicargut, Noghee Kkaakk’et, Noghuy Kkaakk’et, Novikakat, Nowikakat, Noya-kakat, and Noyokakat.

Noghÿkkaakk'et was a substantial village of some 150 residents and was a gathering place for trade among people coming from both the Yukon and Kuskokwim watersheds. Gregory Hakorcins (later changed to Kokrines), a Russian or Creole trader, established a trading post at Fourteen Mile in 1869. Hakorcins subsequently moved his post to the site on the Yukon River currently known as the Kokrines. This move resulted in the move of the entire village of Noghÿkkaakk'et (Hart 1981).

Jesuit scholar Father Jules Jetté recorded 212 Koyukon (Denaakk'e) place-names on the Nowitna (Nogheetno') River and its tributaries in the early 1900s when he lived in the area (Jetté 1910). At that time, seasonal residents of the Yukon River communities of Kokrines (or Bek'edeneekk'eze Denh) and Mouse Point (or Deeltsaa' Nooghoyeet) spent the fall and winter months in the Nowitna River region, coming to the Yukon River for fishing in June and July, and for the midwinter feast in December.

The discovery of gold near Ruby in 1907 triggered an influx of outsiders to the area, primarily to mining areas to the west of the Nowitna River (Hart 1981). Residents of Kokrines gradually moved downriver to the village of Ruby as it grew; by the 1950s, Kokrines no longer had year-round residents. Gold mining opportunities around Ruby waned by the 1920s, and many of the miners left the area to fight in World War I. Many remaining residents shifted their focus again to trapping for income. Trappers using the Nowitna River area generally outfitted at Tanana or Ruby and got their supplies to their base camps during open season by poling their boats up the river. They would bring out their furs in the spring by the same means following breakup (USBOR 1973). Despite this increase in trapping activities, local use of the Nowitna River resources never again reached the level that existed while people lived in Kokrines.

In more recent years, numerous studies and oral histories have documented the importance of the Nowitna River and its resources to the local Koyukon Athabascan people (for examples, see Brown et al. 2010 and the Oral History Program at the University of Alaska Fairbanks⁸). Subsistence culture and economies are adaptive by nature; therefore, use patterns have shifted over time, yet the Nowitna WSR remains culturally important to area residents as it has for thousands of years.

The surveyed portion of the WSR corridor contains two documented archaeological resources. One is a historic-aged cabin on a Native allotment within the Nowitna WSR. The other is Noghÿkkaakk'et, the settlement and trade center near the confluence of the Nowitna and Yukon Rivers (AHRS 2023). It is likely that many more archaeological sites remain undocumented within the corridor. Based on what is known about the cultural resources present in the corridor (both archaeological resources and those related to traditional use), there is great potential for locations within the WSR corridor to be determined eligible for inclusion on the NRHP, especially as they are documented further.

4.7.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, the Service would not develop a CRMP, and the Nowitna WSR would continue to be managed under the Revised CCP (USFWS 2009). All future undertakings that could affect cultural resources on federal land or actions that are funded, licensed, or permitted by the federal government would be subject to applicable legal and regulatory authorities related to the cultural resources described in the affected environment above, as well as those described in **Section 4.12**, Subsistence, and **Section 4.13**, Alaska Native Interests. This would continue to offer protection to cultural

⁸ <https://library.uaf.edu/aprca/oral-history>

resources from actions such as ground disturbance or infrastructure development in the Nowitna WSR corridor. This includes protections for historic properties eligible for inclusion on the NRHP, which could include traditional cultural properties.

The potential for accidental impacts, intentional vandalism, or unauthorized collection of cultural resources related to visitation within the WSR corridor would continue as it does currently.

Under Alternative A, the potential for direct and indirect impacts on cultural resources within the Nowitna WSR corridor due to natural processes, such as erosion, deposition, and wildfire, would continue. These impacts are linked to climate change through the natural processes that cause them (**Section 4.18**, Climate Change). The physical change in sites due to natural processes can result in exposure of previously unknown cultural resources, a loss of artifacts and features, or potentially complete destruction.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, cultural resources within the Nowitna NWR would continue to be subject to the same legal and regulatory authorities as discussed under Alternative A. Because of this, no impacts are anticipated on any cultural resources that may be within the area that would be newly excluded from the WSR corridor as part of amending the Revised CCP (USFWS 2009).

Impacts on cultural resources within the Nowitna WSR corridor would be similar to those described under Alternative A, except the Nowitna CRMP would be developed and the Revised CCP (USFWS 2009) would be updated accordingly. The development and implementation of the CRMP would not involve any ground-disturbing or visually intrusive activities that could result in impacts on cultural resources.

The definition of goals, objectives, and strategies under Alternative B for the Nowitna WSR's cultural ORV would encourage and guide the collection of knowledge related to cultural resources, emphasizing engagement with local communities to a greater degree than it would under Alternative A. The effort made to increase cultural resource-related data gathering and local engagement would foster greater opportunities for stewarding the Nowitna WSR's cultural values than under Alternative A.

Under Alternative B, the potential for accidental impacts, intentional vandalism, or unauthorized collection of cultural resources related to visitation within the WSR corridor would likely decrease, as compared with Alternative A, particularly in the long term. This is due to management mandated by the WSRA that would consider whether user capacity is adversely impacting the ORVs.

Cumulative Effects

Under Alternative A, reasonably foreseeable future actions with the potential to impact cultural resources in the Nowitna WSR corridor include ongoing cultural resource surveys and documentation; these are expected to contribute to information on cultural resources within the WSR corridor. The continued identification of cultural resources would offer opportunities for stewarding the Nowitna WSR's cultural values. Consideration of the future cumulative effects of undertakings on protected cultural resources would continue to be required, and adverse effects would be resolved on a site-by-site or project-by-project basis. Continuation of the current management would not be anticipated to contribute to cumulative adverse effects on cultural resources.

Under Alternative B, cumulative impacts on cultural resources within the Nowitna WSR corridor would be similar to those described under Alternative A. Over time, the greater emphasis put on knowledge gathering and local involvement and the consideration of user capacity in the CRMP under Alternative B would lead to more and better opportunities for stewarding the Nowitna WSR's cultural values than under Alternative A.

4.8 SCENERY

4.8.1 Affected Environment

This section describes the visual resources associated with the Nowitna WSR, located within the Nowitna NWR. This section is derived from the Service's Nowitna Wild and Scenic River Values report (USFWS 2024b). The visual resources discussed in this section include the scenic landscape viewed from the river and the air, and landscapes viewed while participating in recreational activities such as hunting and fishing. The Nowitna WSR's scenic landscapes include views of the flora, fauna, geological formations, mountains, lowlands, and wetlands during the long daylight hours of summer, as well as the dim of snow-blanketed winter.

The Nowitna WSR's scenery is exceptionally beautiful and diverse and is exemplary of an interior Alaska river. Over the course of 220 miles, the river transforms from a narrow, swift, gravel-bottomed watercourse to a broad, meandering floodplain river before it joins the Yukon River. The region's varied topography, from wetland-dominated lowlands to low, rolling hills and tundra-capped mountains, intensifies this river's scenic beauty while adding to the diversity of views. Seasonal changes weave a tapestry of color, shifting from the stark white of winter to the varied greens of spring and summer. Wildflowers flourish along the river's edge, creating swaths of vibrant hues. In autumn, deciduous foliage takes on gold, orange, and deep-red shades, with bright, golden larches and dark-green spruce standing out in sharp contrast. With the changing light of shifting clouds and dynamic weather, the result is a visual backdrop that is never the same from one moment to the next. The remote wilderness qualities and dominance of scenery untouched by human structures contribute to this stunning visual impact (USFWS 2024b).

In the upper portion of the Nowitna WSR, the relatively fast-flowing, narrow waterway skirts the base of low hills and strikes bedrock bluffs. The intimacy of the upper river gives way to the power of swift water flowing in a broader channel in the river's middle portion. The breathtaking backdrop of tundra-capped mountains is a stark reminder that this river is exemplary of the interior Alaskan sub-Arctic, a wild, desolate, and often harsh northern environment (USFWS 2024b). Also in the middle section, and arguably the most visually distinct section of the river, lies the majestic Nowitna River Canyon. Here, steep, gravelly hillsides drop down to flat, grassy banks cut by numerous streams and small waterfalls. In summer, wildflowers line the shore, hinting at a subtle shift in vegetation in the canyon. Colorful pebbles, including numerous agates, are scattered across the gravel bars, adding visual interest for visitors in the area.

Below the Nowitna River Canyon, the Nowitna WSR is ever broadening, with wider river views. Surrounding hills give way to broad, open horizons. The current slows, silt and sand replace gravels, and river meanders create constantly changing cut banks and sandbars, oxbow lakes, and sloughs. The summer vegetation is lush, and the rich productivity of this floodplain is evident on every turn. The mountains of the Kokrine Hills can be seen to the north, and they increasingly dominate the horizon as the river moves toward its confluence with the Yukon River (USFWS 2024b).

The entire Nowitna WSR corridor provides excellent examples of riparian and post-fire succession and a variety of boreal habitats and landscapes. The watershed's remote wilderness qualities contribute to the impact of the visual experience. The presence of such outstanding scenic diversity over a relatively short distance is exceptional (USFWS 2024b).

4.8.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Alternative A would continue the current management direction in the Revised CCP (USFWS 2009). The current management plan—the Revised CCP—does not specify monitoring for scenery for the Nowitna WSR. The WSR corridor boundary would not change.

The Nowitna River corridor would continue to provide high-quality scenery with outstanding opportunities for solitude and immersion in natural scenery. Existing management direction would continue to protect the primitive and untouched character of the river corridor, and existing guidelines for outstanding river values described in the Revised CCP (USFWS 2009) would be applied. There would continue to be no new impacts on scenery in the Nowitna WSR corridor.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

The CRMP contains desired conditions, standards, and guidelines related to the protection and enhancement of the scenery ORV. The desired conditions for scenery would instruct the Service to protect the individual natural components that contribute to an outstanding scenic setting. The CRMP's standards and guidelines would operationalize these desired conditions by stating what the Service should and should do to maintain the scenery ORV.

Construction of future structures is an allowable use in the Nowitna WSR corridor, as defined in the CRMP. If future cabins or other structures such as fish towers, weather stations, or communication towers are constructed, the CRMP requires those structures blend in or be aesthetically compatible with the natural setting. Viewsheds would be considered when constructing new structures or reviewing existing structures.

To better protect the varied, wild, and beautiful scenic experience for river users now and into the future, the CRMP proposes several monitoring actions to resolve any issues that affect scenery in the Nowitna WSR corridor. For each monitoring item, the CRMP prescribes indicators, thresholds, and management actions that would help the Service respond to degradation of the river's scenic resources. In most cases, indicators include data collection, outreach material development, and co-stewardship. The monitoring recognizes that management intervention can have negative impacts on certain river values, including scenery, even if the goal is to reduce impacts on other values.

Cumulative Effects

Past, present, and reasonably foreseeable future actions and conditions in the Nowitna WSR corridor that have affected and would likely continue to affect visual resources are wildfires and vegetation management. Vegetation management is anticipated to occur as described in **Table 4-1** above. It is site specific to an administrative cabin and would not affect significantly large areas within the Nowitna WSR corridor. Wildfire activity would not be influenced by actions described under Alternative A. Therefore, there would be no cumulative impacts on scenery under Alternative A, in combination with any or all

reasonably foreseeable future actions listed in **Table 4-1** above; this is because there would be no effect on scenery within the Nowitna WSR corridor.

The cumulative impacts under Alternative B would be the same as those described under Alternative A.

4.9 VEGETATION

4.9.1 Affected Environment

The Nowitna NWR consists primarily of black spruce (*Picea mariana*) forests, wetlands, ponds and streams, benchlands, and foothills. Land cover for the Nowitna WSR corridor shown in **Figure 4-4**.

Riparian vegetation is dominated by willow (*Salix* spp.), cottonwood (*Populus balsamifera* ssp. *balsamifera*), and white spruce (*Picea glauca*). Common riparian vegetation includes willow and alder (*Alnus viridis* ssp. *crispa* and *A. incana* ssp. *tenuifolia*) thickets along gravel bars at the water's edge, stands of cottonwood trees higher on the bank, and bands of white spruce varying in width on the higher banks. Stands of paper birch (*Betula alaskana*) and quaking aspen (*Populus tremuloides*) often mix with the white spruce forest along the river corridors. Of the land cover types in the Nowitna WSR corridor, all seral stages of terrestrial and aquatic habitats are represented in the Nowitna River floodplain.

Wetland vegetation is site specific and varied. Refuge wetlands include upland basins, ice-formed lakes on the flats, river-flooded lowlands, oxbows, and bog lakes. One or more of 12 species of pondweed (*Potamogeton* spp.) occur in almost all lakes. A variety of forbs grow on recently exposed soils along river shorelines.

Black spruce is the dominant tree species, followed by white spruce, paper birch, quaking aspen, and balsam poplar. While there are pure stands dominated by a single tree species, stands typically mix and grade into one another, depending on the underlying soil type, presence of permafrost, elevation, and slope aspect (Burkart et al. 2023).

The herbaceous vegetation type is dominated by grasses, sedges, and flowering plants that are common to interior Alaska ecosystems. The herbaceous communities along steep slopes in the canyon area appear to be unique, but they are not well studied.

Unusually dense and extensive stands of larch (*Larix laricina*) occur in areas along the Nowitna River, particularly in the upper and middle portions, where they flourish due to the unique chemistry of the Nowitna River's water. Limestone from bedrock in the river's headwaters is deposited in the floodplain during flood events and fosters the growth of larch. Larch-dominated forest communities such as this are rare statewide. Larch is a species of conservation concern in Alaska due to both the drastic population reductions caused by recent infestations of invasive, nonnative insects (such as larch sawfly [*Pristiphora erichsonii*] and eastern larch beetle [*Dendroctonus simplex*]; Rozell 2007; Holsten et al. 2008) and the geographic and potentially genetic separation of the Alaska population from the North American population (Boggs et al. 2019). The associated Larch Wetland Biophysical Setting is considered rare statewide and is classified as vulnerable (Boggs et al. 2019).

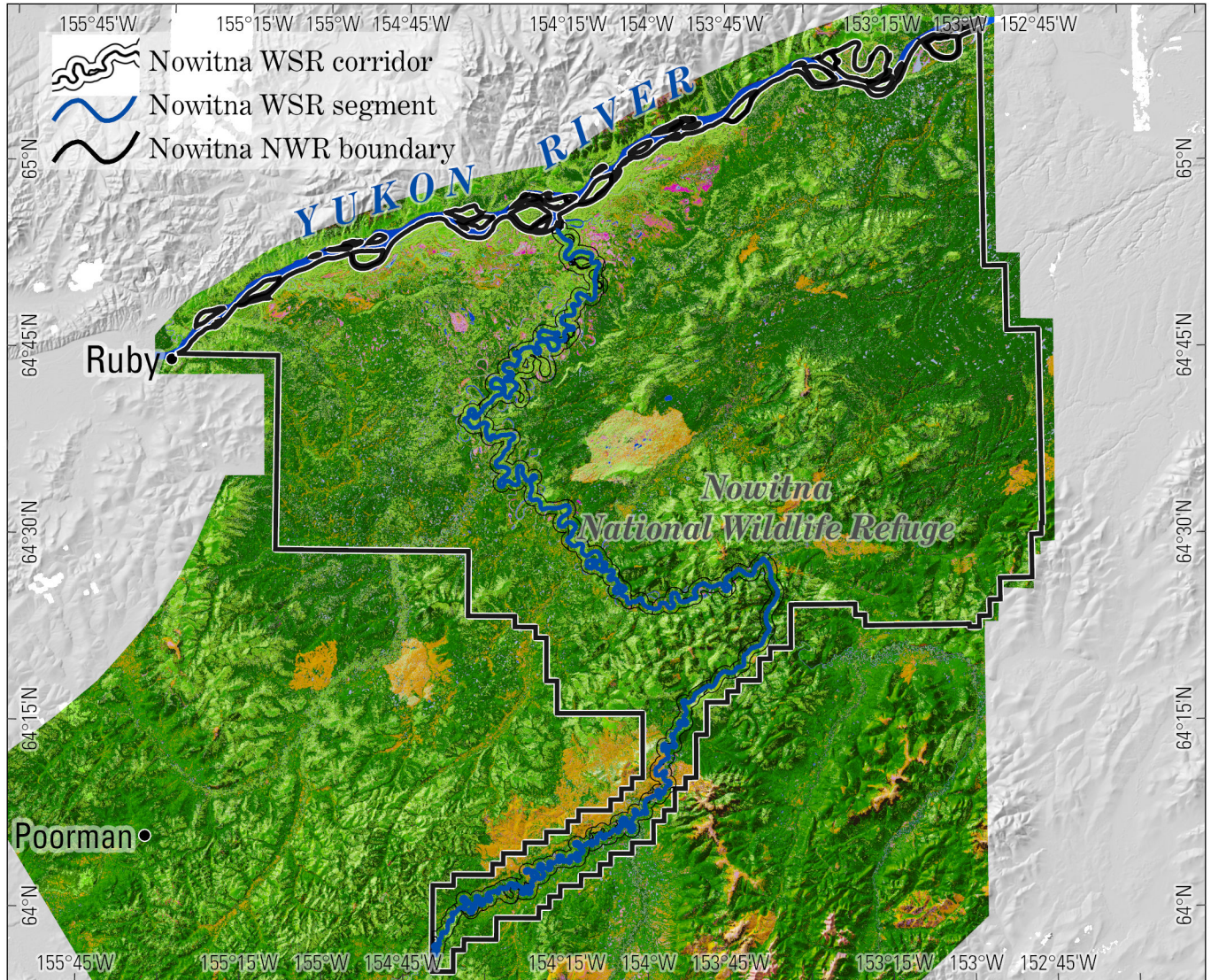
Notable mature white spruce stands are found along the Nowitna WSR, particularly in the lower portions and near its confluence with the Yukon River. White spruce is an ecological specialist that shows evidence of high vulnerability to climate change. Large stands of mature white spruce, such as

Figure 4-4: Land Cover¹



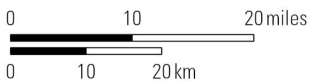
U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River

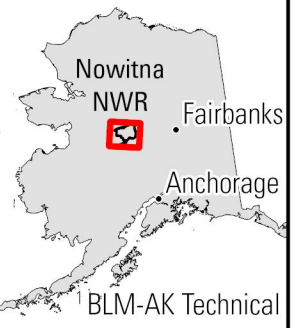


Level III Classification

- | | | | |
|--|-------------------------|--|--------------------------|
| | 1.1 Closed Needleleaf | | 3.1 Bryoid |
| | 1.2 Open Needleleaf | | 3.2 Wet Herbaceous |
| | 1.3 Woodland Needleleaf | | 3.3 Mesic/Dry Herbaceous |
| | 1.4 Closed Deciduous | | 4.1 Aquatic Bed |
| | 1.5 Open Deciduous | | 4.2 Emergent Vegetation |
| | 1.6 Closed Mixed | | 5.3 Clear Water |
| | 1.7 Open Mixed | | 5.4 Turbid Water |
| | 2.1 Tall Shrub | | 6.1 Sparsely Vegetated |
| | 2.2 Low Shrub | | 6.2 Rock/Gravel |
| | 2.3 Dwarf Shrub | | 9.2 Shadow |



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 Map ID #: 11-0063



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BLM-AK Technical Report 23, 2002

those found in the Nowitna WSR corridor, are becoming increasingly less common in Alaska. The species appears to be affected by climate dynamics, including changing temperature and precipitation patterns, fire regimes, and other environmental variables. In interior Alaska, stands of old-growth white spruce growing on well-drained alluvial and riparian soils are relatively rare. The associated White Spruce Floodplain Old-growth Forest Biophysical Setting is considered rare statewide (Boggs et al. 2019). Due to the demand for subsistence harvest of white spruce for house logs, there are additional management issues related to sustaining harvest while protecting ecosystems.

Invasive, nonnative plant species pose a significant risk to ecological stability and integrity. Terrestrial nonnative plant species in Alaska have been given invasiveness scores based on ecological impacts, biological characteristics and dispersal ability, distribution, and feasibility of control (Carlson et al. 2008). Many nonnative plant species in Alaska are of limited concern due to their low capacity for rapid expansion in a natural setting. Such is the case for the following nonnative plant species currently known to exist in the Nowitna WSR corridor: lambsquarters (*Chenopodium album*) in two places on the upper river and common plantain (*Plantago major*) in low numbers along both the upper and lower river. Nonnative plant species, including some that are considered highly invasive, occur more commonly in areas of human development, and human activities along the Nowitna WSR have the potential to transport unwanted species into the corridor. Nonnative plants observed in Ruby and/or along the Ruby-Poorman Road include the following species with relatively low invasiveness rank: common dandelion (*Taraxacum officinale*), pineapple-weed (*Matricaria matricarioides*), common plantain, alsike clover (*Trifolium hybridum*), red clover (*Trifolium pratense*), white clover (*T. repens*), meadow foxtail (*Alopecurus pratensis*), timothy (*Phleum pratense*), and lambsquarters.

Species with higher invasiveness ranking, such as oxeye daisy (*Leucanthemum vulgare*), chokecherry (*Prunus virginiana*), European bird cherry (*Prunus padus*), and Siberian peashrub (*Caragana arborescens*), occur in Ruby. Bird vetch (*Vicia cracca*) has been observed along the Ruby-Poorman Road and Long Creek about 25 miles south of Ruby. Numerous nonnative plants have been observed in Galena, including lambsquarters, common chickweed (*Stellaria media*), pineapple-weed, common plantain, common dandelion, alsike and red clover, timothy, Siberian pea shrub, chokecherry, European bird cherry, white sweet clover (*Melilotus alba*), and bird vetch. Of these, white sweet clover and bird vetch are considered the most invasive (Carlson et al. 2008), and removal efforts are ongoing. Efforts to remove Siberian pea shrub, chokecherry, and European bird cherry are also being considered in Galena. Broadleaf cattails (*Typha latifolia*) are native to some parts of interior Alaska but are not found in this region, except in the Galena area, where they may have been introduced for water treatment. They are now spreading to shallow lakes and wetlands near Galena.

The highly invasive plant species mentioned here as well as others are even more commonly found in larger communities across Alaska, including Fairbanks and Anchorage. Also found in other parts of the state, but not yet in this region, is the highly invasive aquatic Elodea (*Elodea* spp.). Monitoring for the presence of Elodea in waterbodies in the Nowitna WSR and surrounding region is ongoing.

4.9.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no change to the current management of the Nowitna WSR corridor. Current management of the Nowitna NWR's plant communities, as defined in the Revised CCP (USWFS 2009), would continue.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, the Service would continue to manage the Nowitna WSR corridor according to the Revised CCP (USFWS 2009), which is the same as under Alternative A. The Service would also implement additional goals and objectives to protect and enhance river values and vegetation. The Service would create an updated vegetation map of the Nowitna WSR corridor using remote sensing within 5 years of this plan, to be updated every 10 years over the life of the plan. The Service would implement a larch and old-growth white spruce distribution survey to monitor the changes in these forest communities. Understanding and monitoring the changes would allow for these communities to be better protected and to distinguish best management practices in the future.

Additionally, the Service would develop inventory and monitoring strategies for priority plants and habitats. This would result in enhanced conservation efforts within the Nowitna WSR and allow for early detection of changes and threats, such as disease or invasive species' infestations.

Another goal throughout the life of this management plan would be to identify and understand the impact of pathogen presence on plant communities within the Nowitna WSR to develop mitigation options. The effects of this would be beneficial for plant communities by allowing for intervention to mitigate negative impacts.

The impacts under Alternative B would be similar to those described under Alternative A; however, the additional goals and objectives to better understand vegetation distribution and dynamics would aid in maintaining baseline conditions over time.

Cumulative Effects

The impacts from past, present, and reasonably foreseeable future activities would occur for the lifetime of the management plan. These activities include brush and tree clearing around the Nowitna administrative cabin, which are projected to begin in 2024 and repeat every 5 years, depending on funding. The effects from these activities and from Alternative B could cause short-term disturbances to ground and riparian vegetation.

4.10 WILDLIFE

4.10.1 Affected Environment

The Nowitna River floodplain is the refuge's most biologically productive area. The distinct water chemistry, the flood regime, and the meandering nature of the river generate diverse and highly productive riparian ecosystems that provide habitat for a broad, interconnected array of boreal plants and wildlife species, including moose (*Alces americanus*), black bear (*Ursus americanus*), grizzly bear (*U. arctos horribilis*), wolf (*Canis lupus*), wolverine (*Gulo gulo*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), marten (*Martes americana*), porcupine (*Erethizon dorsatum*), snowshoe hare (*Lepus americanus*), river otter (*Lontra canadensis*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mink (*Neovison vison*), least weasel (*Mustela nivalis*), red squirrel (*Tamiasciurus hudsonicus*), wood frog (*Lithobates sylvaticus*), waterfowl, raptors, songbirds, and other birds.

Grouse (*Canachites canadensis* and *Bonasa umbellus*), owls (*Strix nebulosi*, *Bubo virginianus*, *Surnia ulula*, and *Aegolius funereus*), woodpeckers (*Dryobates villosus*, *D. pubescens*, *Picoides arcticus*, and *P. dorsalis*), chickadees (*Poecile* spp.), Canada Jays (*Perisoreus canadensis*), Common Ravens (*Corvus corax*), and redpolls (*Acanthis flammea* and *A. hornemanni*) are year-round residents of the Nowitna NWR.

Thousands of migratory birds come to the Nowitna River corridor each summer. The grassy margins of the river, surrounding lakes, and waterways provide some of the best breeding habitat in interior Alaska for Trumpeter Swans (*Cygnus buccinator*), Greater White-fronted Geese (*Anser albifrons*), Canvasbacks (*Aythya valisineria*), Sandhill Cranes (*Antigone canadensis*), and many other migratory waterfowl and songbirds.

The river corridor contains an uncommon old-growth white spruce (*Picea glauca*) forest community that is nourished by the Nowitna River's productive floodwaters and protected from wildfire by surrounding wetlands. These old-growth forests provide nesting areas for raptors and some of the best marten habitat in Alaska.

The Nowitna NWR contains a mixture of mature forest and early successional plant communities that provide excellent moose habitat. Moose abundance is highest along the river corridor, which in turn sustains increased populations of predators. Beavers are numerous in the river and adjacent oxbow lakes.

At this time, there are no federally listed threatened, endangered, or sensitive plants or animals on the Nowitna NWR. However, the Nowitna NWR has several continental birds of conservation concern, including Lesser Yellowlegs (*Tringa flavipes*), Short-eared Owl (*Asio flammeus*), and Olive-sided Flycatcher (*Contopus cooperi*) (USFWS 2021). Both the Lesser Yellowlegs and Olive-sided Flycatcher are associated with wetlands and riparian areas within the Nowitna WSR corridor. The Lesser Yellowlegs inhabits open boreal forest interspersed with wetlands, lakes, ponds, and wet meadows. The Olive-sided Flycatcher exists in mature spruce forests near habitat edges, such as burns and riparian areas. Short-eared Owl uses large, open areas such as grass lakes and meadows.

The Nowitna WSR corridor may be home to the rare Alaska tiny shrew (*Sorex minutissimus* or *S. yukonicus*). Four of the first known Alaska specimens of tiny shrew were collected on the Nowitna NWR (Dokuchaev 1997). Weighing under 2 grams, this is among the smallest known mammal species in the world. The Eurasian tiny shrew (*Sorex minutissimus*) is known to be widespread but scarce across Scandinavia and northern Asia to the Bering Strait. A morphological comparison of Alaska specimens to Eurasian tiny shrew from several Russian collections suggest that the Alaska variety may be a distinct species (Dokuchaev 1997). The shrew currently has a statewide conservation priority level of V (orange), indicating "unknown status and either high biological vulnerability or high action need" (Gotthardt et al. 2012).

4.10.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no change to the current management of the Nowitna WSR and surrounding areas. Current management of wildlife populations and habitats of the Nowitna NWR, as defined in the Revised CCP (USFWS 2009), would continue.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, the Service would continue to manage the Nowitna WSR corridor according to the Revised CCP (USFWS 2009), which is the same as under Alternative A. The Service would also implement additional goals and objectives to protect and enhance river values and wildlife. The Service would maintain the natural abundance and diversity of wildlife species found in the Nowitna WSR

corridor; these species include moose, black bear, grizzly bear, wolf, wolverine, red fox, lynx, marten, porcupine, hare, river otter, muskrat, mink, weasel, squirrel, wood frog, waterfowl, raptors, songbirds, and others. The maintenance of these species would allow for more resiliency across the WSR from natural and human-caused disturbances.

The Service would maintain a desired diversity of high-quality habitats that support the various life stages of the wildlife species. The Service would monitor habitat conditions and wildlife populations by implementing activities identified in an inventory and monitoring plan. This would maintain wildlife habitat.

Cumulative Effects

The past, present, and reasonably foreseeable future activities' impacts would occur during the lifetime of this management plan. The Service has not identified any past, present, or and reasonably foreseeable future activities relevant to wildlife. However, vegetation projects, including brush and tree clearing, could impact wildlife habitat. These projects could cause initial disturbances in wildlife habitats and a temporary increase in the spread of invasive plant species. Over the long term, habitat management would work to improve the area to benefit growth of native habitat for the wildlife that depend on it.

4.11 SOILS AND PERMAFROST

4.11.1 Affected Environment

Soils

The Nowitna NWR has loamy, wet to well-drained floodplain soils in river valleys and loamy to very gravelly soils in the lowlands. The uplands in Nowitna NWR include loamy to very gravelly, well- to poorly drained soils at the northern end of the uplands, and very gravelly, well-drained soils at the southern end of the uplands (Burkart et al. 2023).

The Nowitna NWR consists of hydrologic soil groups A/D, B, B/D, and D, as defined by the Natural Resources Conservation Service (NRCS 2024); see **Figure 4-5**. Group A/D soils have a very slow infiltration rate due to a high water table, but they have high infiltration and low runoff rates if drained. Group B soils consist of deep, well-drained soils with a moderately fine to moderately coarse texture and a moderate rate of infiltration and runoff. Group B/D soils naturally have a very slow infiltration rate due to a high water table, but they have a moderate rate of infiltration and runoff if drained. Group D consists of soils with a very slow infiltration rate and high runoff potential. This group consists of clays that have a high shrink-swell potential, soils with a high water table, soils that have a clay pan or clay layer at or near the surface, and nearly impervious material overlaid with shallow soils (NRCS 2024).

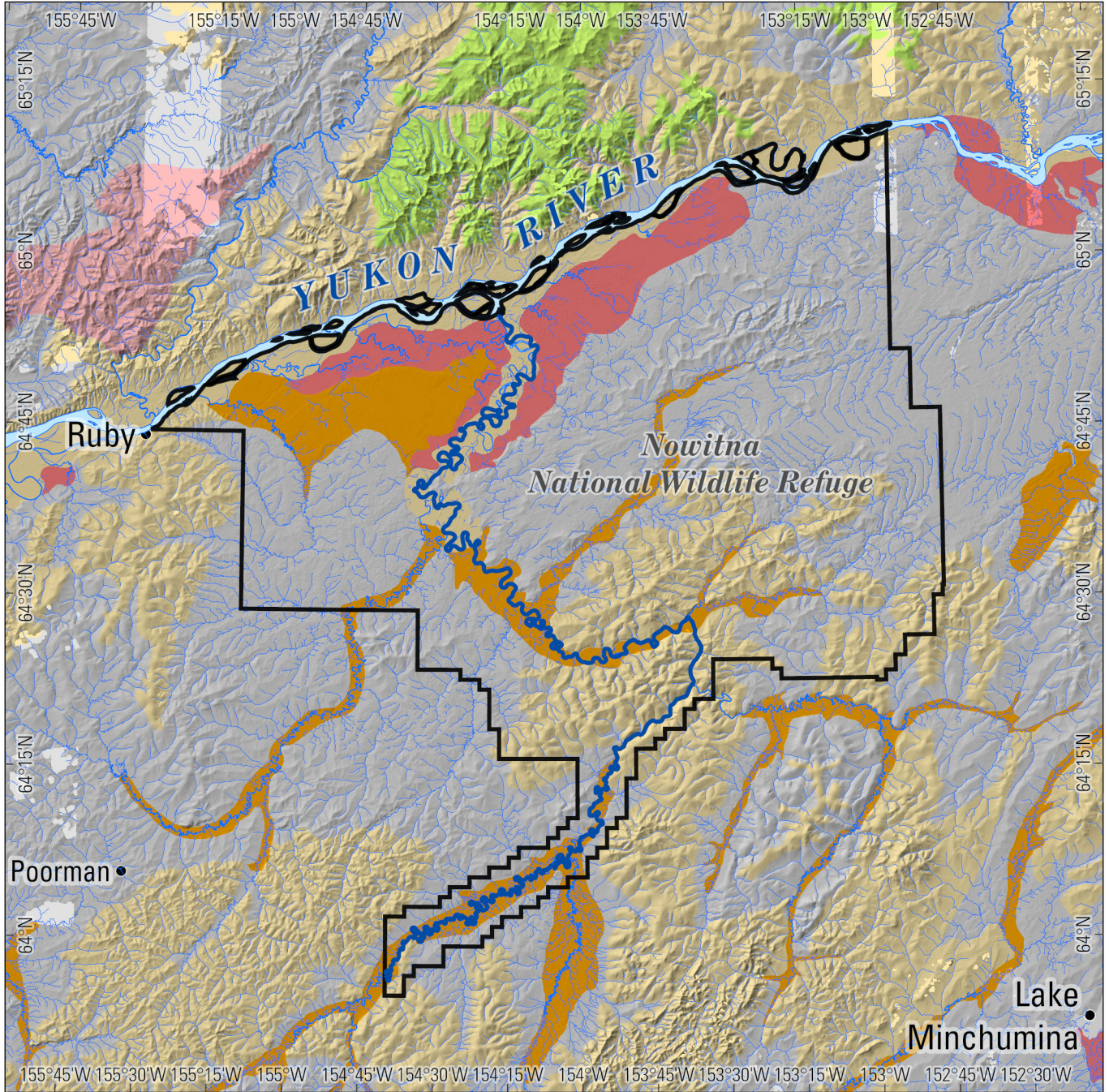
Soil texture and moisture are important in influencing ecosystem dynamics. Soils' interaction with ground and surface water can result in natural changes to the water quality. Soils play a large role in the characteristics of the active permafrost layer. Gravelly soils tend to be well drained with deep, active permafrost layers; organic-rich soils tend to be poorly drained with shallow, active permafrost layers.

Figure 4-5: Soil Groups¹



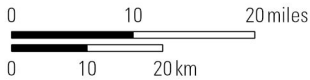
U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



Soil Hydrologic Group

- | | | | |
|--|-----------|--|-----------|
| | Group A | | Group C |
| | Group A/D | | Group C/D |
| | Group B | | Group D |
| | Group B/D | | |



- Nowitna WSR segment
- Nowitna NWR boundary



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¹ USA SSURGO,
 November 2023

Permafrost

Permafrost is a layer of ground that remains frozen (at or below 32 degrees Fahrenheit [0 degrees Celsius]) for 2 years or more (Burn 2023). Permafrost development and persistence rely on a cold climate and are controlled by air temperature, hydrology, soil type, vegetation, disturbance, and snowpack. As such, vast layers of permafrost extend throughout Alaska. In some regions, permafrost tends to be continuous, while in other areas it may be discontinuous or absent. The presence or absence of permafrost in soils strongly controls soil development and hydrology in Alaska (Hinzman et al. 2006; Jorgenson et al. 2013). Thawing of permafrost can have significant impacts on ecosystems and hydrology, and is becoming more prevalent due to changes in climate (O'Neill et al. 2023). Permafrost thawing can result in increased erosion or subsidence, impacting water resources (O'Neill et al. 2023). Thawing can also release previously frozen carbon and methane deposits (O'Neill et al. 2023).

In Alaska, the interaction of hydrology and permafrost plays a large role in ecosystem dynamics. Lakes and wetlands are common in permafrost areas because the frozen ground inhibits seepage and holds water close to or above the surface. In areas with permafrost, wetland vegetation reduces erosion by preventing the warming and thawing of ice-rich soils. Abundant wetlands in the northwest boreal zone of North America result largely from cool, short summers with low evapotranspiration and an impermeable permafrost layer that prevents infiltration and impedes drainage of the upper, unfrozen layer (Ford and Bedford 1987).

Permafrost can impede water infiltration and limit water flow, often leading to wet or saturated soil in the active layer⁹ (Hinzman et al. 2005). In the absence of permafrost, surface soils tend to be well drained and dry. Thawing of near-surface permafrost can deepen the active layer, enhance infiltration, and lead to deeper water-flow paths in soils or below the permafrost (sub-permafrost). In some areas of continuous or discontinuous permafrost, groundwater can flow through taliks¹⁰ in the permafrost.

Permafrost is thought to be discontinuous throughout Nowitna NWR (Jorgenson et al. 2008). As shown in **Figure 4-6**, the permafrost layers are isolated along the Nowitna WSR corridor near the confluence with the Yukon River. The probability of permafrost absence is typically higher along major waterways (Burkart et al. 2023). In the Nowitna WSR corridor described in the Nowitna CCP (USFWS 1987) there are an estimated 133,737 acres of discontinuous permafrost (84.6 percent) and 24,332 acres of isolated (5-10 percent frozen) permafrost (15.4 percent) (USFWS 2024c). This includes acreage only within FWS lands within the WSR corridor. It does not include acreage within private lands.

⁹ Surface layer that thaws during summer

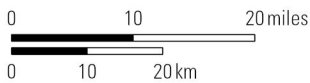
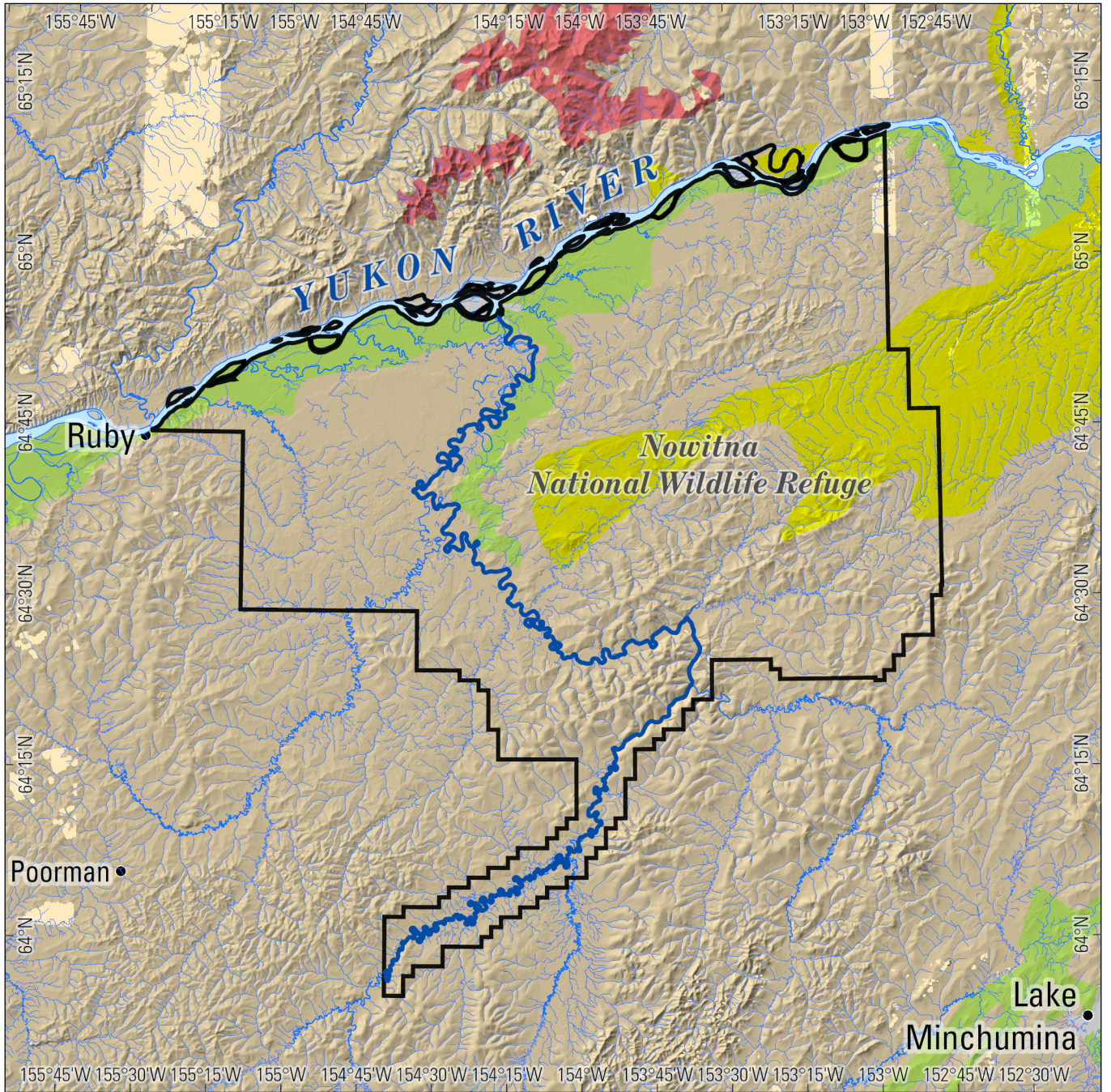
¹⁰ A layer or body of unfrozen ground that occurs in permafrost due to an anomaly in thermal, hydrologic, or hydrochemical conditions

Figure 4-6: Permafrost Distribution¹



U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



Permafrost Distribution

- Continuous
- Sporadic
- Discontinuous
- Isolated
- Discontinuous, no terrain data

- Nowitna WSR segment
- Nowitna NWR boundary



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¹Jorgenson, et al, 2008

4.11.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no change to the current management of the Nowitna WSR and the surrounding corridor. The current special values of Nowitna NWR tied to river conditions, as defined in the Revised CCP (USFWS 2009), would not change. Monitoring of soils in the Nowitna WSR corridor is not a high priority in the CCP, and Alternative A would not increase efforts to collect data, monitor changes in permafrost, or develop a detailed understanding of soils and permafrost within the Nowitna WSR corridor.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, the Service would implement additional monitoring efforts within the Nowitna WSR corridor. This could lead to more informed management decisions regarding soils and permafrost. The Service would work to inventory and map soils and permafrost within 10 years of adopting this plan.

Under Alternative B, the Service would also reduce the total acreage of the Nowitna WSR corridor. This could change the management of areas with differing soils or permafrost layers. Management of those areas would still fall under the Revised CCP (USFWS 2009) and would not substantially differ from those under this CRMP. However, monitoring efforts could continue to be minimal in areas removed from the corridor.

Because of the corridor change, the Nowitna WSR corridor would contain less total acreage of land influenced by permafrost. The newly defined corridor would include an estimated 111,863 acres of discontinuous permafrost (91.4 percent) and 10,295 acres of isolated permafrost (8.6 percent) (USFWS 2024c). This includes acreage only within FWS lands within the WSR corridor. It does not include acreage within private lands. There would be an increase from 84.6 percent discontinuous permafrost and 15.4 percent isolated permafrost in the corridor to 91.4 percent discontinuous permafrost and 8.6 percent isolated permafrost. The permafrost outside of the corridor would continue to be managed according to the Revised CCP (USFWS 2009).

Cumulative Effects

No cumulative impacts on permafrost or soils are anticipated from any past, present, or and reasonably foreseeable future activities.

4.12 SUBSISTENCE

4.12.1 Affected Environment

In 1980, Congress passed the ANILCA, which established the Nowitna NWR and designated the Nowitna WSR. One purpose of the Nowitna NWR is to provide the continued opportunity for rural residents to stay engaged in a subsistence way of life (ANILCA Section 101(c)). Subsistence is regarded as a way of life rather than merely a recreational activity. The meanings of subsistence are based on a culture that has been shaped over the years by family traditions, religion, relationships with particular animals and places, and a preference for natural foods (USFWS 2009). ANILCA Title VIII provides provisions to ensure public lands in Alaska are managed to provide the opportunity for continued subsistence uses on those lands.

The 1990 Nowitna NWR Fishery Management Plan identified Galena, Ruby, and Tanana as communities on the Yukon River near the Nowitna WSR for whom subsistence use at the refuge may be of great interest (USFWS 1990). While subsistence use area mapping often only captures a portion of the total use at any given time or by a given community, more recent ADFG subsistence use data confirm subsistence use by Galena (ADFG 2010b), Ruby, and Tanana residents within and around the Nowitna WSR (ADFG 2021). While Galena, Ruby, and Tanana are communities in the immediate vicinity of the Nowitna WSR, there may be additional communities that use the Nowitna NWR and WSR for subsistence purposes. This section provides an overview of the current level of subsistence use within the Nowitna WSR corridor using best information available directly from potentially affected subsistence communities, state and federal sources, and literature.

Based on studies by the ADFG, a wide variety of fish, wildlife, and vegetation are harvested by subsistence users in these communities for many purposes, including food, fuel, arts and crafts, tools, clothing, and traditional cultural practices. Of note is that the subsistence use areas described in these studies and summarized below represent subsistence use for a segment of the population at the time of the study; subsistence use is also likely to occur outside the mapped subsistence use areas. A brief overview of subsistence use patterns for Galena, Ruby, and Tanana residents is provided below.

Galena is important as a regional service hub and population center and as the site of the Nowitna NWR's headquarters. Residents in Galena rely on the Koyukuk and Nowitna NWRs for subsistence resources (USFWS 2009). Residents in Galena mainly gather subsistence resources along the Koyukuk and Yukon Rivers and their tributaries. Subsistence food sources include salmon, whitefish, pike, waterfowl, moose, and berries. Large mammal hunting by Galena residents focuses mainly on moose, although bear and caribou are taken, when available (USFWS 2009). Comprehensive community surveys indicate that for the community of Galena, moose, Chinook salmon, summer chum salmon, fall chum salmon, and coho salmon accounted for 79 percent of subsistence harvest in 2010. Galena residents harvest fish primarily from the Yukon River (USFWS 2009); however, some subsistence resource use areas for Galena residents lie within with the Nowitna WSR corridor. Subsistence harvests in the Nowitna WSR corridor by Galena residents include moose, fish, berries, and greens (ADFG 2010b).

Traditional Athabascan culture and subsistence practices are a focal point of life in Ruby (Alaska DCCED 2024b). Residents in Ruby mainly gather subsistence resources along the Yukon River corridor. However, the Nowitna River is also used for subsistence activities (USFWS 2009), and many Ruby residents have ancestral ties to the river (Brown et al. 2010). According to the Revised CCP (USFWS 2009), residents harvest moose, caribou, and black bear from the Koyukuk and Nowitna NWRs. Ruby residents harvest whitefish, sheefish, pike, and salmon from the two NWRs by using fish nets or fish wheels, or both (USFWS 2009). According to 2010 ADFG community harvest data, for Ruby, salmon comprised the most pounds harvested, followed by large land mammals, non-salmon fish, plants and berries, small land mammals, and nonmigratory birds (ADFG 2010a). Areas used for subsistence by residents of Ruby include moose hunting areas along much of the Nowitna WSR corridor (ADFG 2010b). Areas recognized for subsistence harvest of small land mammals, berries, and greens are present in the north end of the Nowitna WSR corridor (ADFG 2010b).

Traditional Athabascan ways of life persist in Tanana, including gathering of subsistence resources. Residents in Tanana mainly harvest these natural resources along the Yukon and Tanana River corridors and their tributaries, including the Nowitna River (USFWS 2009). Residents primarily depend on moose

and salmon, but they also harvest bear, caribou, non-salmon fish species, small game, berries, and other plant material, when available (USFWS 2009). According to 2014 ADFG community harvest data, salmon comprised the most pounds harvested for Tanana, followed by non-salmon fish, large land mammals, plants and berries, and migratory birds (ADFG 2014a). Areas used by Tanana residents for subsistence include moose hunting areas along much of the Nowitna WSR corridor (ADFG 2014b). Ptarmigan and grouse hunting areas are also present near the Nowitna River (ADFG 2014b). Smaller areas on Nowitna River tributaries have historically been used and continue to be used by Tanana residents to harvest plants and berries (ADFG 2014b).

4.12.2 Environmental Consequences

Under Title VIII of ANILCA, rural residents engage in subsistence activities on federal public lands, as defined in 50 CFR 100, 100.4(1), and (2). Traditional subsistence activities also take place on lands owned by village and regional Native corporations, as well as State lands. Subsistence activities outside federal public lands are subject to State regulations and landowner permission.

The Service follows existing laws (such as ANILCA, Title VIII) and agency guidance (the Service's Native American Policy [510 FW 1; USFWS 2016b] and the Service's Alaska Native Relations Policy [510 FW 2; USFWS, n.d.]¹¹) that protect the ability to use public lands for subsistence purposes. An ANILCA Section 810 evaluation is required for any decision to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands under any provision of law authorizing such actions (**Appendix C**). This section considers how the existing condition of subsistence resources would vary by alternative. The analysis considers whether the alternatives would impact the following:

- Abundance and availability of subsistence resources
- Access to subsistence resources

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, the Service would continue to manage the Nowitna WSR according to the existing management outlined in the Revised CCP (USFWS 2009), the WSRRA, and ANILCA. Under Alternative A, current levels of subsistence access would continue, maintained by the relevant laws and Revised CCP. Under Alternative A, the boundary of the Nowitna WSR corridor would not be adjusted to comply with ANILCA. The overall footprint of the Nowitna WSR corridor would remain unchanged. Subsistence uses would continue in and around the corridor. The availability of subsistence resources would depend on the health of species' populations and the habitats they rely on, as well as changing environmental conditions.

The Service would not implement visitor capacity limits for the Nowitna WSR. The Service would not create a visitor services plan for the Nowitna WSR. The Service would not establish specific indicators, triggers, thresholds, or monitoring protocols to respond to trends in resource conditions as they relate to visitor use. Current trends and any current level of competition between subsistence users and other visitor uses would be expected to continue.

¹¹ The Service's Draft Alaska Native Relations Policy (510 FW 2 or Chapter 2) supplements the Service's Native American Policy (510 FW 1).

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, legal and regulatory impacts on access to subsistence resources would be identical to those discussed under Alternative A.

Under Alternative B, the Service would implement a CRMP to protect the ecology, fish, cultural, and scenery ORVs for the Nowitna WSR. Implementation of the CRMP would not be anticipated to impact access to subsistence resources. Compared with Alternative A, implementation of the CRMP under Alternative B would contribute to the protection of ORVs that would lend support to maintaining or improving the condition of subsistence resources. This is because the CRMP outlines goals and strategies for ensuring the Nowitna WSR continues to provide abundant wildlife, fish, and plant resources for the customary and traditional uses of wild, renewable resources.

Under Alternative B, to protect the Nowitna WSR's ecology ORV, desired conditions would include maintenance of high-quality habitats and diversity and abundance of wildlife. The maintenance of habitats and species would contribute to the continued abundance and availability of subsistence resources. Maintaining fish and wildlife habitats would provide greater protection to the abundance of subsistence resources than under Alternative A.

Subsistence communities have noted trends of declining moose populations. Under Alternative B, a CRMP objective to protect the ecology ORV would involve conducting moose population estimates. Subsequently, this alternative would emphasize resource monitoring and therefore improve the potential for early corrective action. Because moose are an important subsistence species, better scientific information could contribute to the continued abundance and availability. Additionally, proposed river management would include strategies for monitoring and responding to changing environmental conditions in interior Alaska. For instance, one CRMP objective involves identifying climate vulnerabilities and management strategies for wildlife species. This could include species that subsistence communities rely on. **Section 4.9**, Vegetation, and **Section 4.10**, Wildlife, provide further information on impacts on vegetation and wildlife.

Management in the CRMP also involve goals of improving scientific knowledge and preventing the introduction and impact of invasive species. Such management would also lend support to species that subsistence communities rely on for subsistence uses. Further, implementation of the CRMP would involve data gathering efforts to inform management. Data gathering outlined in Alternative B would not limit access to subsistence resources.

Under Alternative B, to protect the cultural ORV, the CRMP would include objectives and strategies to achieve the following goal: "The Nowitna WSR continues to provide abundant wildlife, fish, and plant resources for the customary and traditional uses of wild renewable resources." Strategies would include continuation of an annual moose hunter check station, working with partners to monitor contaminants in fish, monitoring through subsistence harvest surveys, and investigation of berry harvest surveys and potential climate change impacts on berry harvest. As described above, these strategies would have a potential long-term beneficial impact on subsistence resources by contributing to continued availability and abundance of subsistence resources. These strategies would be compatible with subsistence and traditional use related access, protecting access, and the ability to use public lands for subsistence and travel purposes.

Under Alternative B, the CRMP would include the following goal: “Continue to foster high-quality hunting, fishing, trapping, wildlife observation, and boating opportunities in a relatively natural setting.” While additional management would involve documenting the recreational experience, there are no strategies that specifically focus on creating more recreational opportunities. As a result, Alternative B would not directly result in increased recreation access that could result in subsequent potential impacts on subsistence resource availability and abundance. Compared with Alternative A, competition for resources between subsistence users and recreational users would be similar, and current trends would continue.

Cumulative Effects

Under Alternative A, reasonably foreseeable future actions with the potential to impact subsistence resources in the Nowitna WSR corridor are continued recreational use, subsistence use, and non-subsistence use in the Nowitna WSR corridor. Resource use may result in reductions in fish or wildlife populations outside the Nowitna WSR corridor. For various reasons, such as climate change, there could be changes in the availability and abundance of some resources outside the Nowitna WSR corridor that local rural communities rely on; these changes could increase reliance on subsistence resources on federal lands. These potential changes could increase the importance of the Nowitna WSR corridor to subsistence communities. If non-subsistence use of the Nowitna WSR corridor increased markedly, increased competition for resources could result. However, based on current reported use of the Nowitna WSR corridor by subsistence users and the small changes in visitor use and other management expected, the cumulative effects are expected to be minor.

Under Alternative B, the cumulative impacts on subsistence resources within the Nowitna WSR corridor would be similar to those described under Alternative A. As described in **Section 4.7**, Cultural Resources, over time, the greater emphasis put on knowledge gathering and local involvement and the consideration of user capacity in the CRMP under Alternative B would lead to more and better opportunities for stewarding the Nowitna WSR’s cultural values, including subsistence resources, than under Alternative A.

As described in **Section 4.6**, Fisheries, by improving the understanding of Nowitna WSR fish values, as described under Alternative B, the Service would be able to better manage and protect fish species and their habitats. As described in **Section 4.9**, Vegetation, over the long term, vegetation management would work to maintain the growth of native plants and prevent invasive species from establishing. As described in **Section 4.10**, Wildlife, habitat management would work to improve the Nowitna WSR corridor to maintain native habitat and ecosystem processes for the wildlife that depend on them. Over time the aforementioned outcomes would contribute to ensuring the Nowitna WSR continues to provide abundant wildlife, fish, and plant resources for the customary and traditional uses of wild, renewable resources.

4.13 ALASKA NATIVE INTERESTS

4.13.1 Affected Environment

Residents of the communities of Galena,¹² Ruby,¹³ and Tanana¹⁴ rely on subsistence resources within the Nowitna NWR and WSR corridor. The community of Tanana is on the north bank of the Yukon River near the confluence of the Yukon and Tanana Rivers and 90 miles upriver of the Nowitna River confluence. The community of Ruby is on the south bank of the Yukon River about 35 miles below the confluence of the Nowitna River. The community of Galena is on the north bank of the Yukon River about 85 miles downstream of the Nowitna River confluence.

Louden Tribe,¹⁵ the Native Village of Ruby, and the Native Village of Tanana are federally recognized Tribes and are represented in part by Doyon, Limited (an ANCSA regional corporation) and the Tanana Chiefs Conference (an ANCSA nonprofit) (Alaska DCCED 2024a, 2024b, 2024c). The village corporation for Galena is the Gana-A'Yoo Village Corporation (Alaska DCCED 2024a). The village corporation for Ruby is the Dineega Corporation (Alaska DCCED 2024b). The village corporation for Tanana is Tozitna, Limited (Alaska DCCED 2024c).

The Alaska Native Allotment Act of 1906 allowed Alaska Natives to receive the title for 160 acres of land in Alaska. The Native Allotment Act was repealed in 1971, when the ANCSA became law. Under the ANCSA, in exchange for settling Alaska Native land claims, land and money were distributed to the ANCs established by ANCSA.

Alaska Native-owned lands and Native allotments are present throughout Alaska. There are several Native allotments along the Nowitna River (USFWS 2009). **Figure 4-1.1** through **Figure 4-1.8** display Alaska Native lands and Native allotments within the Nowitna WSR corridor. There are 780 acres of patented Native allotments across 9 allotments within the corridor. Dineega Corporation now owns one former Native allotment (80 acres), so the land is no longer classified as a Native allotment.

4.13.2 Environmental Consequences

The direct and indirect impact analysis area for Alaska Native interests is the Nowitna WSR corridor and adjacent Alaska Native lands and Native allotments. The effects of each alternative on Alaska Native interests are assessed in terms of management in the CRMP that is likely to impact the topics of concern discussed.

The Service would follow existing laws (such as ANILCA Sections 1110 and 1111) and regulatory guidance (such as 43 CFR 36.10) that address access to inholdings, protecting tribal access and the ability to use Alaska Native lands and Native allotments. The Service would also follow existing laws (such as ANILCA Sections 810, 811, and 1110) and agency guidance per the Service's Native American Policy (USFWS 2016b) and the Service's Alaska Native Relations Policy (USFWS, n.d.) that address subsistence and traditional use and access, protecting tribal access and the ability to use public lands for subsistence and travel purposes.

¹² The Denaakk'e name for Galena is Notaalee Denh. Denaakk'e is the language of the Koyukon Athabascan people.

¹³ The Denaakk'e name for Ruby is Tl'aa'ologhe.

¹⁴ The Denaakk'e name for Tanana is Hohudodetlaatl Denh.

¹⁵ This designation has recently changed from Galena Village.

Direct and Indirect Effects from Alternative A—No Action Alternative

Under the No Action Alternative, the Service would continue to manage the Nowitna WSR according to the existing management outlined in the Revised CCP (USFWS 2009), the WSRA, and ANILCA. Under the No Action Alternative, the Service would not develop and implement a CRMP. As a result, additional management for monitoring and responding to changing environmental conditions in interior Alaska, in relation to the Nowitna WSR, would not be developed and implemented.

Additionally, all public lands within the Nowitna WSR corridor would continue to be withdrawn from entry, sale, or other disposition. Designation of the Nowitna WSR corridor and the accompanying management intended to protect and enhance previously identified ORVs would continue to offer protection to subsistence resources of interest to tribal entities. The Service would continue to consult and cooperate with tribal entities regarding current and future concerns over access and use of Native and public lands, and any other issues as they arise. There would be no change in the number of acres of patented Native allotments.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, impacts related to existing management would be similar to those described under Alternative A. Additionally, Alternative B includes management direction for the protection of resources that could be of interest to Tribes and tribal entities. Under Alternative B, to protect the cultural ORV, the CRMP would include objectives and strategies to achieve the following desired condition: “The integrity of cultural, historical, archaeological, and ethnographic resources is safeguarded for future generations.” Objectives to achieve this goal include coordination with local Tribes to develop a better understanding of cultural resources or sites of cultural significance within the Nowitna WSR corridor and to design and implement protective and preservation measures. Compared with Alternative A, this additional management would be more protective of Alaska Native interests, such as cultural resources, and it would further encourage coordination between the Service and Alaska Natives. A more comprehensive understanding would allow the Service to better manage and protect resources and resource uses in the face of changing environmental conditions.

Under Alternative B, there would be additional management for monitoring and responding to changing environmental conditions in interior Alaska. Compared with Alternative A, these additional management measures would further contribute to the protection of resources that could be of interest to Tribes and tribal entities. For instance, one CRMP objective involves identifying climate vulnerabilities and management strategies for wildlife species. This could include species of interest to Tribes and tribal entities.

As described in **Section 4.7**, Cultural Resources, under Alternative B, cultural resources within the Nowitna NWR would continue to be subject to the same legal and regulatory authorities as those under Alternative A. Because of this, no impacts are anticipated on cultural resources that are of interest to Tribes.

Under Alternative B, the Service would adjust the boundary of the Nowitna WSR corridor to comply with ANILCA, which would reduce the overall size of the corridor relative to Alternative A. However, changing the WSR boundary is expected to have no noticeable impact on the Service’s management direction and capacity to protect Alaska Native interests.

Cumulative Effects

Under Alternative A, reasonably foreseeable future actions with the potential to impact Alaska Native interests in the Nowitna WSR corridor include ongoing cultural surveys and documentation efforts. As described in **Section 4.7**, Cultural Resources, continued identification of cultural resources would offer opportunities for stewarding the Nowitna WSR's cultural values. Continuation of the current management would not be anticipated to contribute to cumulative adverse effects on cultural resources within the WSR corridor. This would include cultural resources that could be of interest to Tribes and tribal entities within the area. The Service would continue to consult and cooperate with tribal entities regarding current and future concerns over access and use of Native and public lands, and any other issues as they arise.

Cumulative impacts on Alaska Native interests within the Nowitna WSR corridor under Alternative B would be similar to those described under Alternative A. As described in **Section 4.7**, Cultural Resources, over time, the greater emphasis put on knowledge gathering and local involvement and the consideration of user capacity in the CRMP under Alternative B would lead to more and better opportunities for stewarding the Nowitna WSR's cultural values, including those that could be of interest to Tribes and tribal entities, compared with under Alternative A. Under Alternative B, over time, data gathering efforts across the Nowitna WSR corridor would allow the Service to better manage and protect resources and resource uses in the face of changing environmental conditions, compared with Alternative A.

As described in **Section 4.12**, Subsistence, management of vegetation, fish, and wildlife under Alternative B would contribute to ensuring the Nowitna WSR continues to conserve wildlife, fish, and plant resources in their natural diversity for the customary and traditional uses of wild, renewable resources. Cumulatively, additional management would be more protective of Alaska Native interests, such as subsistence activities, and it would further encourage cooperation between the Service and Alaska Natives.

4.14 VISITOR USE

4.14.1 Affected Environment

Recreation and Visitor Access

The Nowitna WSR corridor possesses a combination of high-quality, remote, and undeveloped recreational opportunities. The primary purpose of most recreational visits is moose hunting. Other recreational opportunities include wildlife viewing, motorboating and floating, camping, photography, hiking, environmental education and interpretation, and agate rock hunting (USFWS 2009).

Water levels and river character vary notably along the Nowitna WSR's length and throughout the seasons, adding variety to recreational opportunities and recreational interest. The river's upper portion is fairly swift and narrow (less than 250 feet wide). The coarse, graveled bottom of the upper and middle portions usually averages 1 to 2 feet deep or less along riffles, and up to 6 feet deep in pools, which provides enough volume for nonmotorized boaters, except during dry periods. The middle portion widens slightly (200–250 feet wide) and meanders, with numerous gravel bars but few oxbows, offering high-quality camping opportunities. Here, the Nowitna WSR flows through a recreationally appealing canyon where the channel straightens, and large gravel, cobble, and bedrock are present on the river bottom. Below the canyon, the river slows and widens (200–450 feet wide) and the substrate is primarily sand and silt. The lower river meanders considerably, producing sandbars on the inside of

bends, high cut banks on the outside of bends, and numerous sloughs and oxbow lakes. Stream depth in this location is quite variable, ranging from approximately 3 to 12 feet, with maximum depths up to 60 feet; this generally allows for motorized boating even in dry periods.

Summer access to the Nowitna WSR is generally via float plane or motorized boat from the Yukon River. Access by boat from the Alaska Highway System typically starts from the Dalton Highway Bridge located 140 miles north of Fairbanks on the Dalton Highway, or from Nenana, which is 55 miles south of Fairbanks on the Parks Highway. There is a boat launch and parking area just north of the Dalton Highway Bridge at milepost 56 of the Dalton Highway. The mouth of the Nowitna River is about 200 river miles downstream (ADFG 2024a). The Nowitna River mouth is approximately 365 miles downstream of Nenana and 210 miles downstream of the village of Tanana, where the Tanana and Yukon Rivers meet. Boaters typically launch from Nenana or the Dalton Highway Bridge, though in recent years it has become possible to launch from the end of the Tanana Road. The end of the Tanana Road is 50 road miles from Manley Hot Springs and 201 miles from Fairbanks. The Yukon and Tanana Rivers and lower 40 miles of the Nowitna River can be run by prop boats, if operated with caution. Winter access to the Nowitna WSR is typically by snowmachine or ski-equipped airplane.

There are no recreational facilities such as trails, roads, or other visitor amenities, within the WSR corridor. Camping is allowed without permit, but camping at previously used sites is recommended (ADFG 2024a). There are several Native allotments, trapping cabins, and one administrative cabin located along the Nowitna WSR. However, most of these are not visible and generally do not detract from the river's wild character. Outside the moose hunting season and summer boat traffic on the Yukon River, visitors are unlikely to encounter each other (USFWS 2009).

Hunting

Wildlife harvest opportunities in the Nowitna WSR corridor include hunting seasons for moose, wolves, bears, grouse, ptarmigan, and waterfowl under both State and federal regulations. Harvest of furbearers occurs under State regulations. The Nowitna WSR corridor lies entirely within Alaska Game Management Unit 21B. By far the most popular of these harvest opportunities on the Nowitna WSR is fall moose hunting, which is available to both resident and nonresident hunters within the corridor. These hunts are managed through permits that include State registrations, State drawing, and federal registration permits. There are three big game guide-use areas that include portions of the Nowitna WSR corridor. Only one of these guide-use areas currently has a permitted big game guide. Big game guides are required to report the number of clients, moose taken, and areas hunted (USFWS 2009).

Fall hunting activities along the Nowitna River are monitored at the Nowitna River moose hunter check station, which is typically operated between late August and October 1. This voluntary check station has occurred annually since 1988, and it documents the number of hunters, hunter residence, and harvest of moose, bears, and wolves. Refuge staff and volunteers run the station; in 2010 and 2012, the Friends of Alaska National Wildlife Refuge oversaw volunteer recruitment (FANWR 2010, 2012). Between 1988 and 2023, an annual average of 123 moose hunters checked in to the Nowitna check station, with a minimum of 82 and maximum of 208. The number of moose harvested has averaged 41. The smallest seasonal harvest was 19, and the greatest number harvested was 56. The average hunter success rate has been 32 percent and has ranged between 18 and 44 percent (USFWS 2023).

Between 2003 and 2007, the moose population in Game Management Unit 21B was estimated to be approximately $4,049 \pm 1,600$ (ADFG 2024b). According to the Moose Trend Survey Summary (Bryant and Scotton 2021), the Nowitna moose population has been stable at a low density. Trend counts in the WSR corridor indicate cow numbers have declined in recent years and are well below average. Bull abundance is also down but considered healthy. Calf production and survival to fall improved in 2021 compared to a poor year in 2020, and are considered average. No additional hunting opportunities are warranted based on moose trend surveys, and a population estimate may be necessary (Bryant and Scotton 2021). In 2023, there was no winter moose hunt in Game Management Unit 21B due to hunting pressure and low population numbers (DOI 2023).

Trapping

Harvest of furbearers in the Nowitna WSR corridor is permitted under State trapping regulations. The Nowitna River corridor has been an important trapping area for centuries and was an important local source of income up until the past few decades. Most trapping is currently conducted by a few families with Native allotments or permitted cabins within or near the Nowitna WSR corridor.

Fishing

The most popular angling activity on the Nowitna WSR is fishing with rod and reel for northern pike and sheefish. Most sport fishing occurs within the lower 30 miles of the river and connected waters. In the past, the Service issued a small number of commercial use permits for guided fishing on the Nowitna WSR. Such permitted guides have primarily advertised opportunities to catch trophy-size northern pike. No permits have been issued since 2013.

4.14.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Alternative A would continue current management direction from the Revised CCP (USFWS 2009). Visitation would continue to be monitored using records from the Nowitna River moose hunter check station as well as from air taxi and guide reports.

The WSR corridor would not change. The WSR corridor would continue to provide the visitor opportunities discussed above. Existing management direction would continue to protect the primitive and untrammled character of the river corridor. The existing guidelines for recreation described in the Revised CCP (USFWS 2009) would be applied. Hunting and fishing opportunities would depend on the health of moose populations and fisheries in the Nowitna WSR corridor. The condition of hunting and fishing opportunities would likely continue to persist as described under the affected environment.

Under Alternative A, the Service would not implement visitor capacity limits for the Nowitna WSR, and the Service would not create a visitor services plan for the Nowitna WSR. The Service would not establish specific indicators, triggers, thresholds, or monitoring protocols to respond to trends in resource conditions as they relate to visitor use.

Under Alternative A, compatible visitor uses would continue; these include recreational opportunities such as hunting, fishing, wildlife observation and photography, and environmental education and interpretation (USFWS 2009). Education would be the primary management tool for recreation management, using brochures, maps, signs, and personal contacts (USFWS 2009). However, management could also include limiting commercial guiding and outfitting, regulating use and access,

and recommending changes in State and/or federal fishing, hunting, and trapping regulations (USFWS 2009). Management and prioritization of recreational opportunities in the Nowitna WSR would be subject to Nowitna NRW-level decision-making.

Under Alternative A, existing structures would continue to exist in the Nowitna WSR. Management of existing cabins and review of proposals for construction of new cabins for traditional uses would be in accordance with the Service's cabin regulations and regional cabin policy. Private, recreational-use cabins would not be authorized. The Nowitna WSR would continue to not have any designated trails, roads, or commercial facilities. Public access would continue to be limited to boating and fly-in access.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

The CRMP contains desired conditions, standards, and guidelines related to the protection and enhancement of primitive recreation. Desired conditions for recreation and visitor services would instruct the Service to protect the individual natural components that contribute to the outstanding recreational opportunities and a quality experience for visitors to the WSR corridor. The CRMP's standards and guidelines would operationalize these desired conditions by stating what the Service would do to maintain the primitive recreational setting and recreational access.

The CRMP would include management direction on the type and amount of visitor use that can occur without adverse impacts on the ORVs, water quality, and the free-flowing condition of river area; the quality of visitor experience; and public health and safety. Since the current use levels in the Nowitna WSR corridor are relatively low and do not appear to be threatening river values, the Service would not take any immediate actions to reduce visitor capacity. Management of user capacity would be implemented after the Service sets up a monitoring program. This would ensure that any impacts that develop over time are detected and mitigated. Overall, Alternative B would not result in any short-term changes to visitor use and visitor services; however, in the longer term, Alternative B would continue to maintain the ORVs that provide for high-quality visitor use and visitor services.

Opportunities for visitor use under the CRMP would be the same as those under Alternative A. The primitive setting and wild and untrammled character of the Nowitna River, paired with its lack of human-made public facilities, would continue to ensure the opportunities are unique and embody the wild character of the Nowitna WSR. Fishing, hunting, and other allowable uses named in the Revised CCP (USFWS 2009) would remain priority opportunities under the CRMP. The CRMP would detail desired conditions related to visitor use and access and develop a system to monitor and manage those opportunities. Because visitor use levels are not currently degrading resources in the Nowitna WSR, management would likely be implemented at the education level.

The CRMP would not negatively impact access to fishing, hunting, or other allowable uses in the Nowitna WSR corridor. The CRMP would result in similar opportunities for visitor use and access as those under Alternative A.

The CRMP would not include the creation of any new commercial or private facilities, access roads, cabins, or structures in the Nowitna WSR corridor. It would encourage the use of existing structures, as permitted. The CRMP would detail allowable uses regarding public facilities, and any proposed changes or additions to facilities would follow a strict permitting process managed by the Service. This

would not create any new access opportunities or recreational infrastructure, resulting in similar impacts on recreation and visitor services as under Alternative A.

The CRMP would propose several monitoring actions to resolve any issues that affect recreation and visitor services in the Nowitna WSR corridor. While monitoring interventions could limit short-term recreational access and opportunities, in the long term, they would better protect the primitive and solitary experience for river uses, compared with Alternative A.

Cumulative Effects

Under Alternative A, cumulative impacts on recreation and visitor services would be low and based primarily on the moose population and the health of the fisheries. The continued operation of the annual moose hunter check station would not contribute to cumulative effects on recreation and visitor services. The other past, present, and reasonably foreseeable future activities discussed in **Table 4-1** above would not result in long-term, adverse, cumulative impacts on recreation and visitor services.

The cumulative impacts under Alternative B would be similar as those described under Alternative A.

4.15 SOCIOECONOMICS

4.15.1 Affected Environment

The current socioeconomic conditions of the Nowitna NWR, where the proposed action would occur, are described in terms of population demographics, employment, and economic activity. The socioeconomic region of influence is the Yukon-Koyukuk Census Area portion of the Unorganized Borough of Alaska, within which the Nowitna NWR is contained. More precisely, the boundaries of the Nowitna WSR corridor lie within two census block groups within this larger census area. Data on population demographics, employment, and economic activity were collected at this geographic level. State-level data are provided for comparison. According to recently reported census data on racial and ethnic diversity, which measures diversity by the chance that two randomly chosen people in a state will share the same race and ethnicity (Brooks 2021), Alaska is the twelfth-most diverse state in the country (USCB 2021) with a 62.8 percent chance of randomly selected individuals having different ethnicities, compared to the national percentage of 61.1.

In 2022, the most recent period for which comprehensive data are available, the census block groups containing the Nowitna NWR had a total population of 1,375, which was 0.19 percent of the total Alaska state population of 733,583 (USCB 2024a). Employment is a key economic indicator because patterns of growth and decline in a region's employment are largely driven by economic cycles and local economic activity. In 2022, the average annual unemployment rate for the Yukon-Koyukuk Census Area was 7.3 percent, which was almost twice the state level of 2.9 percent (USCB 2024b). In 2022, of the 2,358 total jobs in the Yukon-Koyukuk Census Area, employment in educational services, and health care and social assistance accounted for approximately 586 jobs (USCB 2024b), representing a quarter of total employment (25 percent). In 2022, jobs in forestry, fishing, and related activities accounted for the greatest proportion of private sector employment (156 jobs), followed by retail trade (132 jobs); state and local government employment accounted for more than half of all employment in the Yukon-Koyukuk Census Area (1,471 jobs; BEA 2023).

The communities of Galena, Ruby, and Tanana on the Yukon River have been identified as populations dependent on subsistence use. Refer to **Section 4.12**, Subsistence, for more detailed information regarding subsistence resources and uses in these three communities.

Per capita income—an area’s income divided by its population—can be used to compare incomes across geographies. In 2022, per capita income was \$29,382 for the Yukon-Koyukuk Census Area, while per capita income for the state was \$42,828 (USCB 2024b).

Reasonably foreseeable trends and planned actions within the socioeconomic region of influence include increasing demand for subsistence and recreational hunting (as recorded by entries in the Nowitna NWR moose hunter check station) and continued management of the Nowitna NWR, as well as any other federal and nonfederal activities not yet undertaken but likely to occur. Notably, finalization of the Central Yukon Resource Management Plan, which is expected in December 2024, will result in management direction for actions related to mining and other upstream activities in the upper Nowitna River watershed that could affect downstream conditions, including Nowitna WSR river values.

4.15.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Under Alternative A, there would be no direct changes to the socioeconomic conditions. Continued management of the Nowitna WSR corridor according to the Revised CCP (USFWS 2009) and ANILCA would not create changes in local socioeconomic conditions. Although increasing demand for recreational use is anticipated, such an increase is not expected to notably contribute to local economies, either through direct spending or indirectly through increased employment in recreation-related supporting industries.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, the development and implementation of a CRMP is administrative in nature and does not involve any ground-disturbing activities. It would, therefore, would not result in direct effects on local economies. Administrative actions to define goals, objectives, and strategies for protecting and enhancing the Nowitna WSR’s ORVs would not measurably impact employment, income, or workforce levels.

Effects on local economies from the identification of any threats to and opportunities for stewarding the Nowitna WSR’s values, including water quality concerns, would be minimal. The development of a CRMP would contribute indirectly to the local economy through increases and decreases in local area spending associated with recreational use. However, such contributions are expected to be minimal. Similarly, minimal indirect effects on local economic activity would be expected from management that prohibits commercial timber salvage and commercial harvest of special forest products.

Cumulative Effects

Past, present, and reasonably foreseeable future actions that contribute to impacts on socioeconomic conditions include those from increasing demand for recreational use and continued management of the Nowitna NWR. They also include those from future management direction for actions related to mining and other upstream activities in the upper Nowitna River watershed following finalization of the Central Yukon Resource Management Plan. Recreation and mining are expected to continue as economic drivers, with jobs in forestry, fishing, and related activities comprising the bulk of the region’s

employment. Alternative B would result in less of an impact on socioeconomic conditions, relative to Alternative A, because it would emphasize ecological resiliency and resource protection. This emphasis would support the regional economy and local workforce.

4.16 ENVIRONMENTAL JUSTICE

4.16.1 Affected Environment

Environmental justice (EJ) refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies (CEQ 1997). Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires federal agencies to determine whether proposed actions would have disproportionately high and adverse environmental impacts on minority, low-income, and American Indian populations of concern. The region of influence for EJ is the Yukon-Koyukuk Census Area, with reference information provided at the state level for comparison.

To identify potential EJ communities in the vicinity of the Nowitna WSR corridor, EJ screening was performed on the census block groups that occur within the existing Nowitna WSR corridor. This analysis was conducted using the U.S. EPA webtool EJScreen on June 20, 2024. Based on block group–level demographic data, potentially vulnerable EJ communities have been identified (see **Table 4-6**, below).

Table 4-6. Environmental Justice Screening Results

Location	Low Income (%)	People of Color (%)	Low Life Expectancy (%)	Demographic Index ¹ (%)
Block group 022900002001	37	73	21	55
Block group 022900003001	58	89	23	73
Alaska	25	42	19	33

Source: EPA 2024a

¹ The demographic index in EJScreen is a combination of the percent low-income and percent minority, which are the two socioeconomic factors that were explicitly named in Executive Order 12898 on EJ. For each census block group, these two numbers are simply averaged together. The formula is as follows: demographic index = [(% people of color + % low income)/2].

4.16.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

As stated above, there would be no direct changes to socioeconomic conditions in the Nowitna WSR corridor under Alternative A. Continued management of the Nowitna WSR corridor according to the Revised CCP (USFWS 2009) and ANILCA would not result in effects on EJ populations. Although increasing demand for recreational use is anticipated, such an increase is not expected to notably contribute to local economies, either through direct spending or indirectly through increased employment in recreation-related supporting industries. Communities identified as having EJ populations would not be adversely impacted.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Overall, Alternative B is not anticipated to have any adverse impacts on human health or the environment, including EJ communities of concern. The development of a CRMP is administrative in

nature and does not involve any ground-disturbing activities. It would define goals, objectives, and strategies for protecting and enhancing the Nowitna WSR's ORVs, free-flowing condition, and water quality; it would also identify any threats to and opportunities for stewarding the Nowitna WSR's values, including water quality concerns. These measures would enhance natural resource values and place an emphasis on ecological resiliency and resource protection.

While beneficial to the Nowitna WSR and existing resource conditions, these actions would not result in changes to the local area economies. Therefore, Alternative B would not have disproportionately high or adverse effects on EJ communities in this area, compared to non-EJ communities.

Alternative B also is not anticipated to result in substantial environmental hazards or effects on differential patterns of consumption of natural resources. All interested parties would continue to be involved in commenting on the project and the decision-making process.

Increased recreation could result in a reduction of abundance and availability of harvestable resources due to increased competition between federally qualified subsistence users and other resource users. It could result in changes in resource distribution caused by recreational use. The communities of Galena, Ruby, and Tanana on the Yukon River have been identified as populations that depend on subsistence use. Refer to **Section 4.12**, Subsistence, and **Section 4.13**, Alaska Native Interests, for more detailed analysis regarding these topics. Overall, there would be no disproportionate impacts on EJ communities in the area of analysis.

Cumulative Effects

Past, present, and reasonably foreseeable future actions that contribute to impacts on socioeconomic conditions affecting EJ communities include those from increasing demand for recreational use and continued management of the Nowitna NWR, as well as future management direction for actions related to mining and other upstream activities in the upper Nowitna River watershed following finalization of the Central Yukon Resource Management Plan. Recreation and mining are expected to continue as economic drivers, with jobs in forestry, fishing, and related activities comprising the bulk of the region's employment. Alternative B would result in less of an impact on socioeconomic conditions affecting EJ communities, relative to Alternative A, because it would emphasize ecological resiliency and resource protection. This emphasis would support the regional economy, local workforce, and livelihoods of area residents, including the EJ communities that have been identified.

4.17 AIR QUALITY

4.17.1 Affected Environment

The Nowitna WSR corridor is in a remote and largely undeveloped area in interior Alaska, approximately 37 miles east of Ruby, Alaska. Although there are no long-term air quality monitoring stations in the Nowitna WSR corridor, based on regional monitoring and Service reports, existing air quality in the Nowitna WSR corridor is generally pristine. The primary exception is smoke and the associated particulate matter that can be present during summer months when wildfires from lightning strikes are common (ADEC Air Quality Division 2021).

Human-caused and natural air pollution impair visibility and occasionally impact public health. The main contributors to human-caused air pollution throughout interior Alaska are incomplete burning of fossil fuels used in motor vehicles, heating systems, and generators; prescribed burn emissions; and smoke

from wood stoves (ADEC and EPA 2018). In rural communities, seasonal dust from dirt roads also contributes to local air pollution. Human-caused pollution emissions emanating from nearby villages and the Ruby-Poorman Road may be transported into the Nowitna WSR corridor. Additionally, winter use of cabins within or near the WSR corridor can cause localized reductions in air quality through emissions from wood stoves, generators, and snowmachines.

Other sources of air pollution in interior Alaska include windblown dust from open riverbeds and on rare instances, ash emissions from remote volcanic eruptions (Sassen et al. 2007; Schaefer and Nye 2008). Windy conditions along the Yukon River can produce dust when sandbars are exposed during low-water conditions in summer, winter, and early spring. High-altitude Arctic haze persists in spring and originates as dust, smoke, and human-caused pollution from parts of Asia and Europe (Shaw 1995). Due to the limited amounts of snow, rain, or turbulent air to displace pollutants from the polar air mass in spring, Arctic haze can linger for more than a month in the northern atmosphere.

The Clean Air Act, as amended in 1990, requires the EPA to set national ambient air quality standards (NAAQS; 40 CFR 50) for pollutants considered harmful to public health and the environment. The EPA established NAAQS for outdoor concentrations of the six criteria air pollutants, which include carbon monoxide, lead, nitrogen oxides, ozone, particulate matter (including particulate matter less than 2.5 microns in diameter [PM_{2.5}] and particulate matter less than 10 microns in diameter [PM₁₀]), and sulfur dioxide.¹⁶ Other pollutants of concern include volatile organic compounds, which are human-made chemicals that are used and produced in the manufacture of paints, pharmaceuticals, and refrigerants. Volatile organic compounds are a precursor to ozone; when released into the atmosphere, volatile organic compounds can react with nitrogen oxides in the presence of sunlight to form ozone.

The NAAQS include primary standards established to protect public health, including sensitive populations (such as children, the elderly, or asthmatics), and secondary standards to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The Alaska Department of Environmental Conservation, Division of Air Quality is responsible for maintaining the NAAQS. This division may set standards that are equally or more stringent than the NAAQS.

Areas where air pollution persistently exceed the NAAQS are designated as “nonattainment” areas by the EPA. There are no nonattainment areas in the Nowitna WSR corridor. The nearest nonattainment area to the Nowitna WSR corridor is the Fairbanks-North Star Borough urban area (nonattainment for PM_{2.5} and maintenance¹⁷ for carbon monoxide¹⁸; EPA 2023a), which is approximately 190 air miles east of the Nowitna WSR corridor.

The EPA provides guidance for modeling air quality impacts and recommends an analysis area that includes both local (within 62 miles [EPA 1992]) and regional (between 62 and 125 miles [EPA 1992]) areas. Regional air pollutant data are available for the Yukon-Koyukuk Census Area, in which the Nowitna WSR corridor is situated. However, due to the proximity of the Fairbanks-North Star Borough

¹⁶ For more information on the current NAAQS, see the EPA web page: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>.

¹⁷ Maintenance areas refer to current attainment areas, which had been previously designated as nonattainment.

¹⁸ See 40 CFR 81.302 at <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-81/subpart-C/section-81.302>.

(which includes the Fairbanks-North Pole urban area), 2020 emission data for both geographic regions are shown below in **Table 4-7**.

Table 4-7. Air Pollutant Emissions (1,000 Tons) – 2020

Geographic Area	Carbon Monoxide	Nitrogen Oxides	PM ₁₀	PM _{2.5}	Sulfur Dioxide	Volatile Organic Compounds
Fairbanks-North Star Borough	1,299	17	131	110	9	323
Yukon-Koyukuk Census Area	418	21	32	26	2	538
Alaska	2,883	150	290	222	21	2,227
U.S. (including Alaska)	66,152	8,915	16,781	5,821	1,841	46,187

Source: EPA 2023b

Emissions data from 2020 indicate that Yukon-Koyukuk Census Area emissions were a fraction of those reported in the Fairbanks-North Star Borough. Prescribed fire emissions for each criteria pollutant accounted for approximately 9 percent to 16 percent of emissions in Alaska. In the Yukon-Koyukuk Census Area, wildfires accounted for over 90 percent of the particulate matter and sulfur dioxide emissions and 74 percent of carbon monoxide emissions (ADEC Air Quality Division 2021).

In attainment areas, the Prevention of Significant Deterioration program ensures that air quality in sensitive air quality Class I areas does not significantly deteriorate, while maintaining an allowable margin for future industrial growth by allowing only incremental increases in pollutant concentrations. Sensitive air quality Class I areas include national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that existed or were authorized as of August 7, 1977. They receive the highest degree of air quality protection under the Clean Air Act. The nearest Class I area to the Nowitna WSR corridor is Denali National Park, over 150 miles away, which is beyond the distance for which impacts may be expected on Class I areas (62 miles; EPA 1992).

4.17.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Alternative A would maintain the current management approach outlined in the Revised CCP (USFWS 2009). Under this alternative, the existing air quality conditions and trends within the Nowitna WSR corridor, which are generally pristine, would persist. Wildfires, prescribed burns, and dust emissions would remain the primary concerns for air quality in the region. The Service would continue to implement strategies established by the Alaska Wildland Fire Coordinating Group to mitigate smoke impacts from wildland fires. Current protective measures for natural resources would also remain in place, including requirements for soil erosion mitigation during surface-disturbing activities. There would continue to be no new impacts on air quality in the Nowitna WSR corridor.

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, impacts on local and regional air quality in the Nowitna WSR corridor generally would be similar to the impacts described under Alternative A. Alternative B would aim to maintain the natural biological diversity and integrity of plant communities (see **Section 4.9**, Vegetation).

In addition, development of future structures is an allowable use in the Nowitna WSR corridor as defined in the CRMP. Future structures would include, but not be limited to, cabins, fish towers, weather stations, and communication towers, and would consist of minor construction activities. Direct

impacts from equipment-related emissions and indirect impacts from windblown dust and surface disturbance are expected to be negligible, as construction activities would be localized and of short duration. Measures would be implemented to control potential fugitive dust emissions and manage any incidental impacts on nearby sensitive receptors. Under Alternative B, the CRMP would also identify visitor capacity, monitor changes in vegetation from human disturbance, and increase public awareness about the Nowitna WSR's ORVs. These are actions that can contribute to improvement of resources such as soils, permafrost, and vegetation, which can benefit air quality in the future.

Cumulative Effects

Past, present and reasonably foreseeable future actions that contribute to impacts on air quality include those from wildfire and prescribed burning, wood burning, industrial emissions, residential and municipal sources, construction equipment, and fugitive dust from vehicular traffic. Wildfire smoke is expected to continue to be a major source of air quality concerns; the increasing trend of severe wildfires is expected to continue in the reasonably foreseeable future due to climate change.

4.18 CLIMATE CHANGE

4.18.1 Affected Environment

The Nowitna WSR corridor experiences extreme seasonal solar radiation variability due to its high-latitude environment. Daylight hours vary from a minimum of about 4 hours in winter to more than 20 hours in summer (University of Alaska Fairbanks 2023). The Nowitna WSR corridor is inland with a continental climate (cut off from the ocean's moderating effects), which is characterized by large temperature variability, long and cold winters, warm and short summers, low humidity, and unpredictable precipitation. Summer maximum temperatures range from the upper 70 degrees Fahrenheit with extreme readings in the 90s. Winter temperatures may be minus 50 degrees Fahrenheit or lower for 2 or 3 weeks at a time. Lowlands experience frequent temperature inversions in winter (University of Alaska Fairbanks 2023). Fairbanks, which is approximately 190 air miles east of the Nowitna WSR corridor, has some of the world's strongest inversions, sometimes 30 to 40 degrees Fahrenheit colder at the ground than at several hundred feet aboveground (Wendler and Nicpon 1975).

Annual precipitation usually varies from about 10 to 30 inches with upland areas receiving more precipitation than lower areas. The seasonal precipitation pattern is normally at a minimum in spring and at a maximum in late summer. Summer thunderstorms are common over the hills and upland areas. Climate also strongly influences fire severity and frequency, with the greatest aerial extent of burning occurring in the hottest, driest years.

Climate change refers to the change in the state of the climate, as determined by changes in its properties (such as temperature or precipitation) that persist for an extended period (IPCC 2018). Human activities, principally through greenhouse gas emissions, have unequivocally caused global warming (IPCC 2023). Global temperatures have increased by approximately 1.8 degrees Fahrenheit above preindustrial levels (IPCC 2023).

Annual average temperatures across Alaska increased at a rate of approximately 0.7 degrees Fahrenheit per decade between the late 1970s and 2016 (Reidmiller et al. 2018), and they have increased by about 3 degrees Fahrenheit since 1925 (NOAA 2023). Statewide average temperatures in Alaska have been increasing at an accelerated rate since 2013, with the warmest and second-warmest years on record being 2019 and 2016, respectively (NOAA 2023). A 2019 summer heatwave brought record-high

temperatures to southern and interior Alaska with daily high temperatures exceeding normal by more than 20 degrees Fahrenheit (Huntington et al. 2023). Most of the warming in interior Alaska since 1976 has occurred in winter (approximately 7.7 degrees Fahrenheit) and spring (4.4 degrees Fahrenheit), with the least amount of change (2 degrees Fahrenheit) in the fall (UAF 2023).

Subarctic-wide precipitation is increasing. While there was considerable interannual variability in average precipitation between 1950 and 2022, there was an increase of approximately 10 percent in annual total precipitation over this period, with more substantial increases in winter than summer (Moon et al. 2023).

Interior Alaska is expected to see some of the greatest changes by the end of the century. These changes include rising average annual temperatures by approximately 13 degrees Fahrenheit, with the greatest temperature increases happening during winter (by more than 20 degrees Fahrenheit; UAF 2024). Other changes include decreased water availability and increased fire activity resulting in greater dominance of deciduous trees on the landscape.

Warming temperatures pose serious threats to interior Alaska, where average annual temperatures are just below freezing and a small increase in temperature can result in large impacts. Warmer temperatures and a longer growing season are expected to increase evapotranspiration enough to outweigh a regional increase in precipitation, resulting in drier conditions (Rupp and Springsteen 2009). By the end of the century, wildfires exacerbated by hotter temperatures and drier conditions are projected to triple in Alaska under a moderate greenhouse gas emissions scenario, and to quadruple under a high emissions scenario (Trainer et al. 2009).

Greenhouse gas emissions trap absorbed radiation and result in warming of the atmosphere. The principal greenhouse gas emissions from human activities include carbon dioxide, methane, nitrous oxide, and several trace gases. Emission inventories provide an overview of annual greenhouse gas emissions and impacts. The EPA indicates that in 2022, United States greenhouse gas emissions resulted in 6,343 million metric tons of carbon dioxide equivalent (CO₂e),¹⁹ which is an increase of 0.2 percent from 6,329 million metric tons of CO₂e in 2021. State-level data, which are available until 2021, show Alaska's emissions were 37.9 million metric tons of CO₂e, which were 0.6 percent of national emissions (EPA 2024b).

Greenhouse gas emissions in the Fairbanks-North Star and Yukon-Koyukuk Census Area, where the Nowitna WSR is located, were available from the EPA's 2020 National Emissions Inventory data. As shown in **Table 4-8**, below, in 2020, Fairbanks-North Star Borough emissions accounted for approximately 52 percent of methane emissions, 35 percent of carbon dioxide emissions, and 26 percent of nitrous oxide emissions in Alaska (EPA 2023a). The high proportion of methane and carbon dioxide emissions were primarily from wildland fire emissions (94 percent and 82 percent, respectively), which accounted for 57 percent of carbon dioxide and methane emissions from wildland fires in Alaska.

¹⁹ CO₂e is a common metric used to express overall greenhouse gas emissions from different types of greenhouse gases; it incorporates the relative contribution from each gas according to its radiative efficiency potential and how long it stays in the atmosphere. The CO₂e is the number of metric tons of carbon dioxide emissions with the same global warming potential as 1 metric ton of another greenhouse gas and it is calculated using Equation A-1 in 40 CFR 98.

Table 4-8. Greenhouse Gas Emissions – 2020

Geographic Area	Carbon Dioxide (metric tons)	Methane (metric tons)	Nitrous Oxide (metric tons)	CO₂e* (1,000 metric tons)
Fairbanks-North Star Borough	10,559,516	55,595	27	12,224
Yukon-Koyukuk Census Area	2,410,004	13,419	1	2,810
Alaska	29,898,982	106,446	104	33,099
U.S. (including Alaska)	4,399,047,734	5,479,984	108,655	4,592,015

Source: EPA 2023a

*The 100-year time horizon global warming potential applied are carbon dioxide = 1; methane = 29.8; nitrogen dioxide = 273 (IPCC 2021). The global warming potential is a unit of measure that allows comparisons of the global warming impacts of different gases. The larger the global warming potential, the more the given gas warms the earth, compared to carbon dioxide, over that time period (usually 100 years).

In terms of CO₂e, Fairbanks-North Star Borough greenhouse gas emissions accounted for 37 percent of total emissions in Alaska in 2020.

Compared with national emissions, the Fairbanks-North Star Borough's emissions accounted for approximately 0.2 percent of carbon dioxide emissions, 1.0 percent of methane emissions, less than 0.1 percent of nitrous oxide emissions, and 0.3 percent of CO₂e. The Yukon-Koyukuk Census Area emissions accounted for approximately 0.1 percent of carbon dioxide emissions, 0.2 percent of methane emissions, less than 0.1 percent of nitrous oxide emissions, and 0.1 percent of CO₂e (see **Table 4-8** above). Although Alaska emits a relatively small percentage of national greenhouse gas emissions (ranked 41 among U.S. states in 2019 [USEIA 2019; Goodfellow and Birnbaum 2023]), on a per capita basis, Alaska ranks as the second-highest greenhouse gas emitter in the nation. This is in part due to its small populations, harsh winters, and energy-intensive industries (EPA 2023a; USEIA 2023).

Another indicator of climate change is the landscape's capacity for carbon sequestration. Carbon is absorbed (or sequestered) and stored in vegetation and soils (including permafrost). As vegetation grows, it absorbs carbon from the air and stores it in wood, in plant matter, and under the soil. Once vegetation is burned, harvested, or otherwise dies, it releases some carbon back into the atmosphere. Changes in permafrost conditions can also affect the rate of greenhouse gas release to the atmosphere. Arctic permafrost stores large amounts of organic carbon (the remains of plants, animals, and microbes that lived and died over hundreds to thousands of years; Schuur et al. 2022). As permafrost temperatures continue to increase across the Arctic (Moon et al. 2023), permafrost threatens to release stored carbon to the atmosphere. For more information on existing permafrost trends, see **Section 4.11, Soils and Permafrost**.

4.18.2 Environmental Consequences

Direct and Indirect Effects from Alternative A—No Action Alternative

Alternative A would maintain the current management approach outlined in the Revised CCP (USFWS 2009). The Revised CCP (USFWS 2009) does not include specific climate change monitoring plans, but it acknowledges the importance of addressing climate change and integrating future climate scenarios into management strategies. The plan emphasizes maintaining healthy ecosystems to support resiliency and adaptation to climate change; however, it currently does not include measures to monitor or mitigate climate impacts directly.

Under this alternative, climate change is predicted to result in substantial increases in landscape flammability. During the next 20–30 years, interior Alaska will experience the most rapid change in fire activity and associated changes in vegetation dynamics, a shift from conifer dominance to deciduous dominance across interior Alaska, more frequent large fire seasons, and a decrease in the magnitude and periodicity of small fire seasons (Kurkowski et al. 2008; Rupp and Springsteen 2009).

Direct and Indirect Effects from Alternative B—Proposed Action Alternative

Under Alternative B, climate change impacts in the Nowitna WSR corridor generally would be similar to the impacts described under Alternative A. However, with the emphasis on ecological resiliency and through development of a monitoring strategy, this alternative would contribute the least to climate change. Alternative B would aim to maintain the natural biological diversity and integrity of plant communities (see **Section 4.9**, Vegetation).

Under Alternative B, the Service would implement additional monitoring efforts within the Nowitna WSR corridor to improve scientific knowledge of climate variability on permafrost, hydrology, fire ecology, and soils. This would lead to more informed management decisions regarding soils, permafrost, and hydrology (see **Section 4.11**, Soils and Permafrost) that may lead to improvement in preservation and capture of carbon stocks in soils, permafrost, and vegetation.

Potential development of lands and facilities, including, but not limited to, cabins, fish towers, weather stations, and communication towers, may consist of minor construction activities. Direct impacts from equipment-related emissions and indirect impacts from surface disturbance on carbon stocks are expected to be negligible. This is because construction activities would be localized, short duration, and minimal, consistent with the wild classification of the Nowitna WSR. Under Alternative B, the CRMP would identify visitor capacity, monitor changes in vegetation from human disturbance, and increase public awareness about the Nowitna WSR's ORVs. These actions can contribute to improvement of resources, such as soils and vegetation, that can store carbon.

An acreage reduction of the Nowitna WSR corridor, which would result in the management of resources that affect climate change to continue under the Revised CCP (USFWS 2009), would not substantially differ from management directives under the CRMP. However, monitoring efforts could continue to be minimal in areas removed from the corridor.

Cumulative Effects

Climate change is cumulative in nature. Past and present actions that have resulted in effects on climate change include those from wildfire and prescribed burning, wood burning, industrial emissions, residential and municipal sources, construction equipment, and vehicles. Other present and reasonably foreseeable future actions that would affect climate change include brush and tree clearing activities that ensure the Nowitna administrative cabin complies with FireWise requirements. Alternative B would result in less cumulative impacts on climate change, relative to Alternative A, because it would emphasize ecological resiliency and resource protection.

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Chapter 5. List of Preparers and Sources

5.1 LIST OF PREPARERS

An interdisciplinary team of staff from the Service and AECOM prepared this CRMP and EA. The following tables contain people who prepared or contributed to the development of this CRMP and EA.

Table 5-1. List of Preparers–Service

Team	Name	Role/Responsibility
Management	Karin Bodony	Biologist/environmental educator, ORV background
	Douglas Calvin	Deputy Refuge Manager
	Nicole Gustine	Project manager
	David Zabriskie	Refuge Manager
Interdisciplinary	Jake Adams	Archaeology, cultural
	Randy Brown	Fisheries
	Greta Burkart	Water resources
	Jon Gerken	Fisheries
	Hunter Gravley	Vegetation
	Ray Hander	Fisheries
	Jeremy Havener	Subsistence
	Jeremy Karchut	Archaeology, cultural
	Robbin Lavine	Subsistence
	Andrea Medeiros	Communication strategies
	Scott McGee	GIS, landownership
	Meg Perdue	Water quality
	Jennifer Reed	Visitor use
	Wyatt Snodgrass	Fisheries
	John Trawicki	WSR policy, water resources
	Shane Walker	Refuge planning
Michael Winfree	Water rights	
Emily Yurcich	Climate change, Refuge planning	

Table 5-2. List of Preparers–AECOM (Consultant)

Team	Name	Role/Responsibility
Management	Brandt Bates	Deputy project manager, WSR
	Derek Holmgren	Project manager
Interdisciplinary	Jared Baxter	Lands and realty and recreation
	Noelle Crowley	Scenic resources, recreation and visitor services
	Kevin Doyle	Cultural, tribal, and subsistence
	Rob Lavie	GIS specialist
	Perry Lown	Cultural, subsistence, and Alaska Native interests
	Nicole Morris	Wildlife, vegetation, and fisheries
	Kim Murdock	Technical editor
	Allison Piazzoni	Scenic resources, recreation and visitor services
	Shine Roshine	Air quality and climate change
	Eddie Sanchez	Decision file
	Cindy Schad	Word processing
	Josh Schnabel	Socioeconomics and EJ
	David Scott	Water resources and quality, soils, and permafrost
	Andy Spellmeyer	Section 508 compliance
	Megan Stone	Subsistence and Alaska Native interests
Morgan Trieger	Wildlife, vegetation, and fisheries	

5.2 LIST OF SOURCES CONSULTED

Chapter 2, Involvement, Consultation, and Coordination, describes the Tribes; federal, state, and local agencies; and other individuals consulted during the CRMP and EA drafting and review process, including the individuals in the following table.

Table 5-3. List of Individuals Consulted

Name	Organization
Tirzah Bryant	Louden Tribe
David Esse	Bureau of Land Management – Central Yukon Field Office
Jeff Fisher	State of Alaska – Department of Environmental Conservation
Catherine Heroy	State of Alaska – Department of Natural Resources
Cade Kellam	ADFG
Terri Lomax	State of Alaska – Department of Environmental Conservation
Sarah Meitl	State of Alaska – Office of History and Archaeology
Jennifer Nolanwing	ADFG
Glenn Stout	ADFG
Lisa Stuby	ADFG
Noel Turner	Bureau of Land Management – Central Yukon Field Office

Appendix A

Nowitna Wild and Scenic River Comprehensive
River Management Plan

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Appendix A. Nowitna Wild and Scenic River Comprehensive River Management Plan

A.1 INTRODUCTION

A.1.1 Background

Under Section 3(d)(1) of the Wild and Scenic Rivers Act (WSRA), the U.S. Fish and Wildlife Service (Service) has developed this comprehensive river management plan (CRMP) in consultation with state, local, and tribal governments and the public to guide long-term management and public use in a wild and scenic river (WSR) corridor. The CRMP is designed to protect and enhance the values that led to the river's designation and to specify public and administrative uses of the river corridor that are consistent with protection of the river's values. The Service expects this plan to have a lifespan of approximately 20 years.

The Service has developed this CRMP in accordance with the mandates of the WSRA, the National Environmental Policy Act (NEPA), and other relevant laws, regulations, and policies. Development of this CRMP was accompanied by environmental analysis in a separate environmental assessment; this environmental analysis informed the content of the final CRMP.

A.1.2 Purpose of the Nowitna CRMP

The purpose of this CRMP, pursuant to the WSRA, as amended by the Alaska National Interest Lands Conservation Act (ANILCA), is to protect and enhance the river values (the free-flowing condition, water quality, and outstandingly remarkable values [ORVs]) for which the Nowitna WSR was designated and to identify data gaps and monitoring opportunities to protect these river values within the Nowitna WSR corridor. The ORVs for the Nowitna WSR are ecology, fish, cultural, and scenery (USFWS 2024a). In addition, the Nowitna WSR is classified as a wild river because it is free of impoundments, is generally inaccessible except by trail, has essentially primitive watersheds or shorelines, and has unpolluted waters.

In accordance with the WSRA, the CRMP will protect and enhance the river values of the designated Nowitna WSR for the benefit and enjoyment of present and future generations. Based on the baseline conditions (at the time of designation), the existing conditions, and existing management direction, the CRMP will do the following:

- Clearly identify and describe the river's ORVs.
- Describe existing resource conditions with a focus on the river values.
- Identify threats to the ORVs and strategies to protect them.
- Define goals with desired future conditions and objectives that are specific, measurable, achievable, results oriented, time fixed, and spatially explicit.
- Identify potential development of lands and facilities consistent with the wild classification.
- Identify user capacities compatible with the desired conditions and other management directions.
- Identify water quality concerns and instream flow requirements.

- Develop management strategies, actions, and practices to support the river values.
- Establish collaborative roles between the Service, the State of Alaska, Tribes, and members of the public.
- Establish corridor boundaries consistent with Section 3(b) of the WSRA. The corridor boundary will adhere to the ANILCA, which stipulates that boundaries shall include an average of not more than 640 acres per mile on both sides of the river, and mineral withdrawals shall be situated within one-half mile of each bank of the river.
- Identify regulatory authorities to assist in the protection of river values.
- Develop a monitoring strategy to document current and future conditions and/or effectiveness of management actions.

A.1.3 Planning Context

While developing and implementing the CRMP, the Service is obligated to adhere to laws, regulations, and policies; be consistent with Service plans, including amendments; follow government-to-government consultation protocols; and coordinate with individuals and groups interested in the planning and implementation of CRMP management actions. This section highlights applicable laws, regulations, and policies.

WSRA of 1968 (16 United States Code [USC] 1271–1287): Enacted in 1968, the WSRA establishes the framework for protecting and managing designated WSRs in the United States. It outlines the process for designating rivers as wild, scenic, or recreational, and requires the development of management plans for designated rivers.

ANILCA of 1980, as amended (16 USC 140h-3233, 43 USC 1602–1784): The Nowitna WSR was designated on the Nowitna National Wildlife Refuge (NWR) by ANILCA. ANILCA Section 606(a) states the boundary of the WSR corridor shall include an average of not more than 640 acres per mile on both sides of the river (measured from the ordinary high-water mark). The boundary shall not include any lands owned by the State or a political subdivision of the State, nor shall such boundary extend around any private lands adjoining the river in such manner as to surround or effectively surround such private lands.

ANILCA, Title VIII, Section 810 (Public Law 96-487), subtitled Subsistence and Land Use Decisions, outlines the requirements for addressing impacts on subsistence uses of resources in the federal land-use decision-making process in Alaska. An ANILCA Section 810 evaluation is required for any decision to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands under any provision of law authorizing such actions.

National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 USC 668dd–668ee): This act establishes a unifying mission for the National Wildlife Refuge System (System). The mission first and foremost focuses on the conservation of fish, wildlife, plants, and their habitats. It requires the preparation of a comprehensive conservation plan (CCP) for each unit of the System. Furthermore, it reinforces and expands the “compatibility standard” of the Refuge Recreation Act, which requires that public uses must be determined to be compatible with refuge and agency missions and purposes before they can be allowed and establishes a process for determining compatibility. The act also identifies six

priority wildlife-dependent recreation uses; clarifies the authority of the Secretary of the Interior to accept donations of money for land acquisition; and places restrictions on the transfer, exchange, or other disposal of lands within the System.

NEPA of 1969, as amended (42 USC 4321–4347): NEPA requires federal agencies to assess the environmental impacts of proposed actions, including the development of CRMPs for WSRs. It mandates the preparation of environmental impact statements or environmental assessments and public involvement in the decision-making process.

The Federal Water Pollution Control Act of 1972, as amended by the Clean Water Act of 1977 (33 USC 1251 et seq.): This act’s objective is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters by regulating the discharge of pollutants into waters of the United States. The act also makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit is obtained under the Clean Water Act.

Executive Order 11988 (Floodplain Management): This executive order requires federal agencies to avoid actions that would adversely affect floodplains and to minimize the impact of actions that do occur in floodplains. It applies to CRMPs for WSRs to ensure responsible management of floodplain areas.

Executive Order 11990 (Protection of Wetlands): This executive order directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance their natural values. It applies to CRMPs for WSRs to ensure the protection of wetlands within river corridors.

Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments): This executive order requires federal agencies to have an accountable process to assure opportunities for meaningful and timely input by tribal officials in the development of regulatory policies on matters that have tribal implications and to strengthen the government-to-government relationship with federally recognized Indian Tribes.

Executive Order 13112 (on Invasive Species): This executive order directs all federal agencies to ensure their actions do not promote the introduction or spread of invasive species. The intent of the order is to enhance the response and coordination of federal agencies in dealing with invasive species.

National Historic Preservation Act: Under Section 106 of the National Historic Preservation Act of 1966 and its implementing regulations at 36 Code of Federal Regulations (CFR) 800, federal agencies are required to consult with State Historic Preservation Offices regarding the eligibility of historic and cultural properties for nomination to the National Register of Historic Places (NRHP), and on determinations of effect from federal undertakings and management decisions.

A.1.4 Coordination and Regulatory Authorities

A.1.4.1 Coordination

The Nowitna WSR benefits from partnerships supporting research, monitoring, planning, and management operations within the WSR corridor. Coordination includes input from tribal, local, state, and federal government entities. The CRMP is designed to be compatible with local and statewide planning goals of all agencies with jurisdiction over the corridor’s resources. The Service has benefited

from coordination with partners including the State of Alaska in fish and wildlife research related to the Nowitna WSR and intends to continue to support such efforts.

A cooperating agency is any federal, tribal, state, or local government agency that enters into formal agreement with the lead federal agency to help develop an environmental analysis. Entities that intended to participate as a cooperating agency were provided a memorandum of understanding to be signed and returned to the Service. The Bureau of Indian Affairs and State of Alaska signed memoranda of understanding for the environmental assessment for this CRMP.

The federal government works on a government-to-government basis with federally recognized Tribes because they are recognized as separate governments. Under Executive Order 13175, the federal government also consults with Alaska Native Claims Settlement Act (ANCSA) corporations on the same basis as Tribes. As a matter of practice, the Service coordinates with all tribal governments, associated Native communities, Native organizations, and tribal individuals whose interests might be directly and substantially affected by activities on public lands. Tribes and ANCSA corporations work with the Service by sharing knowledge and resources to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks.

Section 106 of the National Historic Preservation Act requires federal agencies to consult with tribal nations for undertakings on tribal lands and for historic properties of significance to the Tribes that may be affected by an undertaking (36 CFR 800.2(c)(2)). Executive Order 13175 stipulates that during the NEPA process, federal agencies must consult with Tribes identified as being directly and substantially affected. Consultation with the State Historic Preservation Office was not necessary for the CRMP. Because no specific actions are being identified in the CRMP that have the potential to affect historic properties, the Service concluded that National Historic Preservation Act Section 106 consultation for this planning effort was not required.

A.1.4.2 Regulatory Authorities

The Alaska Department of Fish and Game (ADFG) has primary responsibility for managing Alaska's fish and resident wildlife populations. The Service has primary responsibility for management of migratory birds, endangered species, and other species mandated by federal law. On all refuge lands, the Service and ADFG share a concern for all fish and wildlife resources and their habitats, and both are engaged in fish and wildlife conservation, management, and protection programs. In 1982, the Service and ADFG signed a master memorandum of understanding that defines the cooperative management roles of each agency and sets the framework for cooperation between the two agencies. In 1992, the federal government adopted final subsistence management regulations for federal public lands that established the Federal Subsistence Board, which makes the decisions on regulatory proposals affecting the harvest of fish and wildlife on federal public lands in Alaska.

The State of Alaska establishes fishing, hunting, and trapping regulations at the direction of the Alaska Board of Fisheries and Board of Game, while the Federal Subsistence Management Program establishes fishing, hunting, and trapping regulations on federal public lands at the direction of the Federal Subsistence Board (50 CFR 100). State harvest regulations apply to Service lands unless superseded by federal regulations. If Service restrictions on hunting, fishing, or trapping were needed, they would be implemented through Service proposals to the Alaska Board of Fisheries and Board of Game and the

Federal Subsistence Board, through closures or restrictions under 50 CFR 36.41, or through a public rulemaking process.

The Environmental Protection Agency (EPA) develops and enforces regulations that implement environmental laws enacted by Congress, including those associated with the federal Clean Water Act. The EPA has the authority to implement pollution control programs. The Service cooperates closely with the Alaska Department of Environmental Conservation (ADEC) and the EPA for the purpose of establishing water quality standards and for preventing, eliminating, or diminishing the pollution of state waters consistent with the federal Clean Water Act.

The ADEC, Division of Water oversees the federal Clean Water Act for the state and is responsible for establishing water quality standards, managing the Alaska Pollutant Discharge Elimination System permit program, and identifying waters that do not meet water quality standards under Clean Water Act Section 303(d) (impaired waters). The Service coordinates with the ADEC on all proposed activities that involve discharges into surface waters to ensure Service-authorized activities do not exceed State of Alaska water quality standards.

The Alaska Department of Natural Resources, Division of Mining, Land and Water authorizes water rights. A water right is a legal right to use surface or subsurface water or reserve instream flow under the Alaska Water Use Act. A water right allows a specific amount of water from a specific water source to be diverted, impounded, or withdrawn for a specific use or reservation of sufficient water to maintain a specified instream flow. In addition to managing water rights, the State of Alaska owns and manages the submerged lands under navigable waterways across the state.

In segments of the river in which the State holds title to the submerged lands, the Service would pursue an agreement with the State with the goal of coordinating management to protect and enhance the values for which the Nowitna WSR was added to the National Wild and Scenic River System (NWSRS). The State is a cooperator in the development of this CRMP.

A.2 REGIONAL SETTING AND RIVER VALUES

A.2.1 River Setting

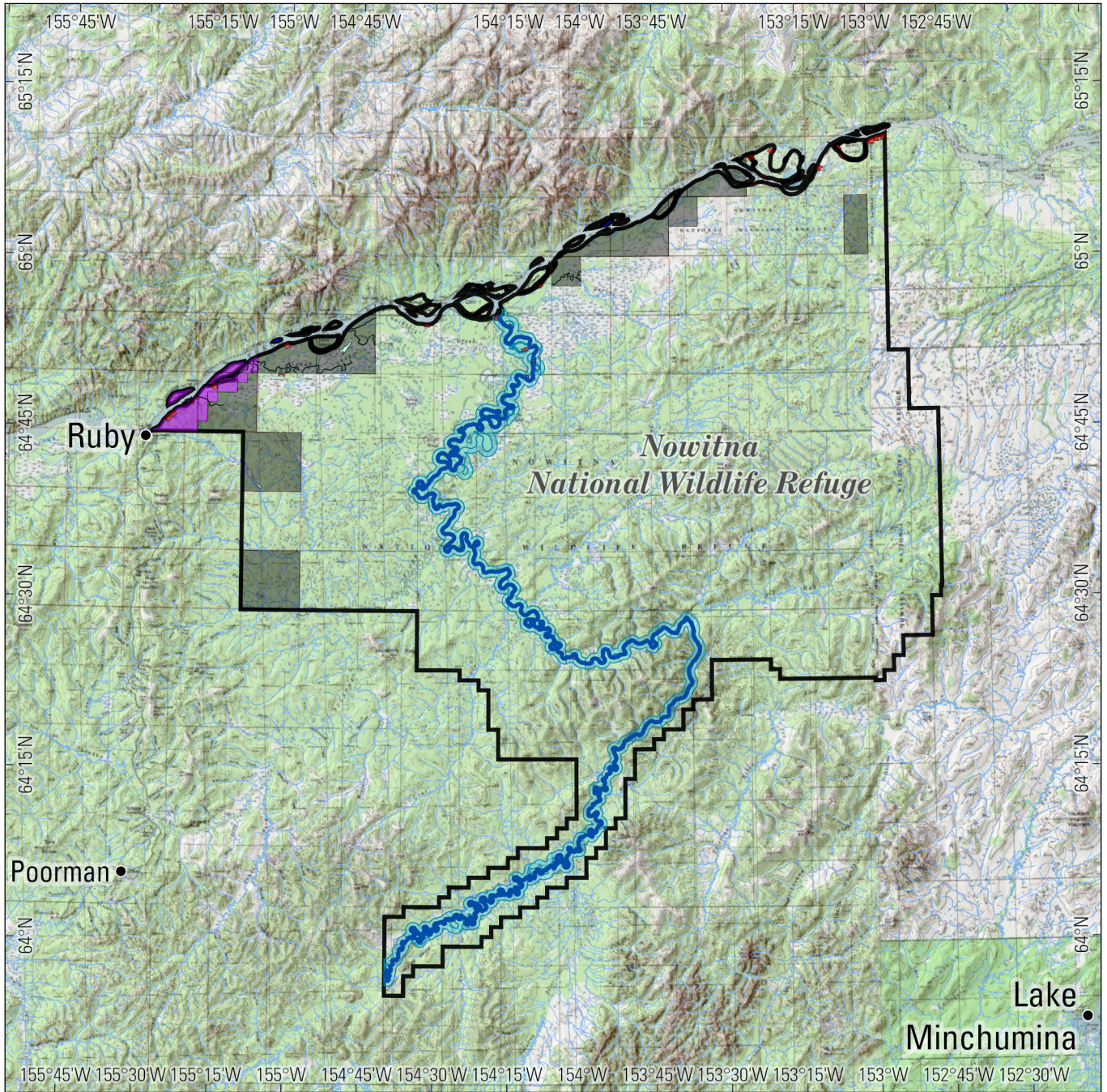
Deep in interior Alaska flows the Nowitna River, nestled in the heart of the Nowitna NWR, which forms much of the river's watershed (**Figure A1**). The river is a life-giving force in the region and was selected among 25 Alaska rivers to be added to the NWSRS with the passage of ANILCA in 1980. The Nowitna WSR is a place of abundance and diversity and is one of the finest geological examples in Alaska of a meandering river. From its headwaters in the Kuskokwim Mountains, the Nowitna WSR runs north across the Nowitna NWR for 220 of its 317 miles before joining the mighty Yukon River (**Figure A2.1** through **Figure A2.8**). In its upper reaches, the Nowitna WSR's clear waters run swiftly through the narrow channels over colorful gravel as the river winds toward the tundra-capped hills that form its canyon section. Below the canyon, the floodplain broadens and the Nowitna becomes a slowly meandering river typified by cut banks, sandbars, sloughs, and oxbow lakes. The river flows across a rich alluvial plain of lakes, marshes, and meandering streams and provides highly productive fish, waterfowl, and moose habitat.

Figure A1: Nowitna WSR Overview









U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
Alaska

Nowitna Wild & Scenic River



0 5 10 15 miles

0 5 10 15 km

-  Nowitna NWR boundary
-  Nowitna WSR segment
-  Nowitna WSR corridor
-  Patented native allotment
-  Patented ANCSA village corporation
-  Patented ANCSA regional corporation



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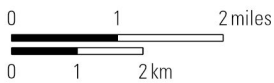
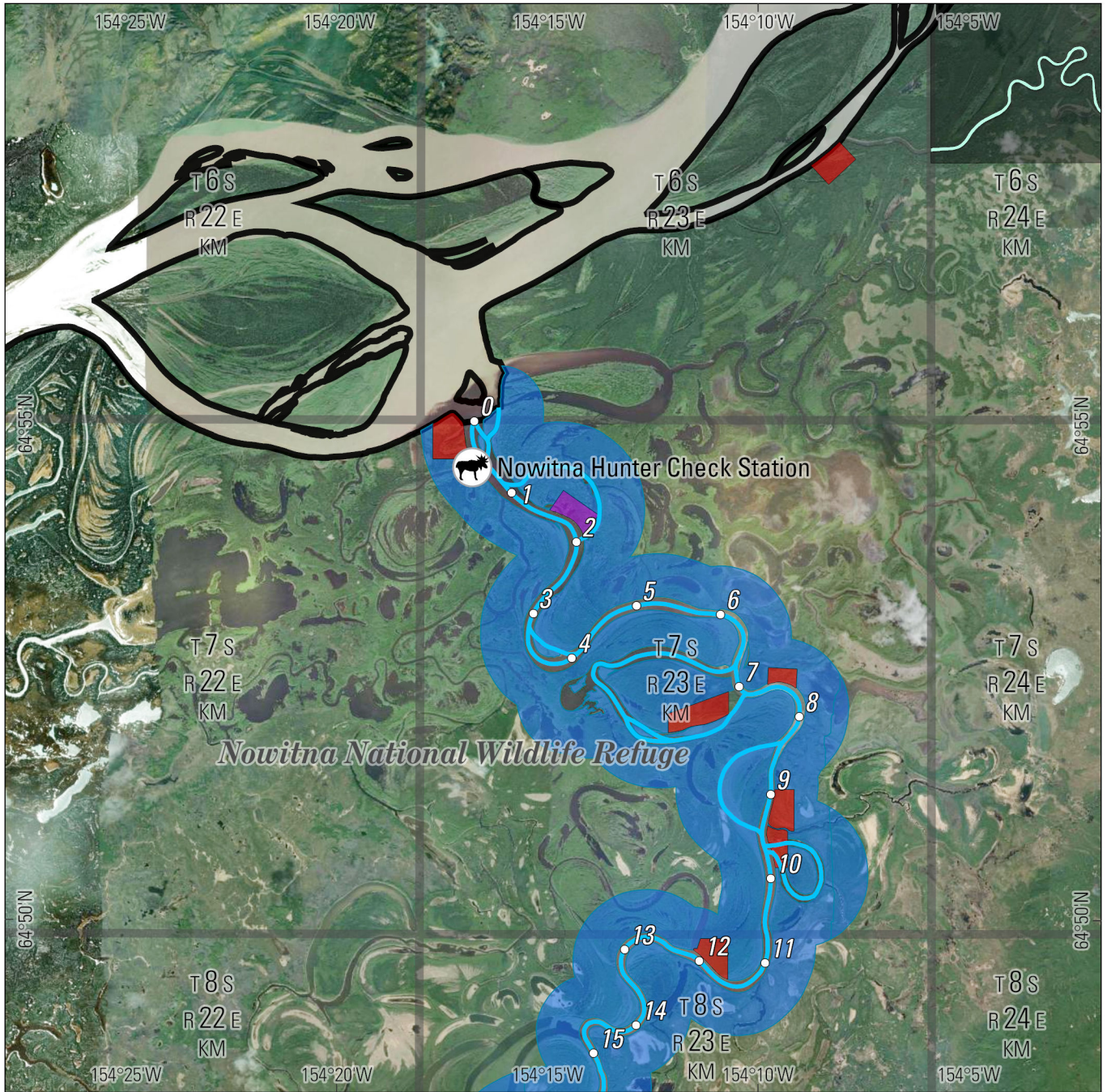
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure A2.1: Nowitna WSR Series (1 of 8)

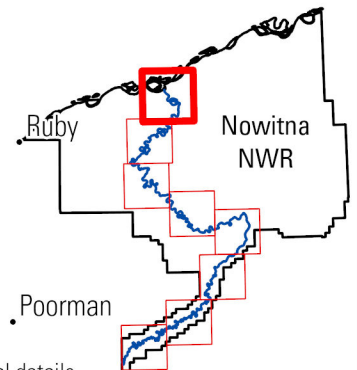


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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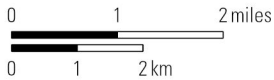
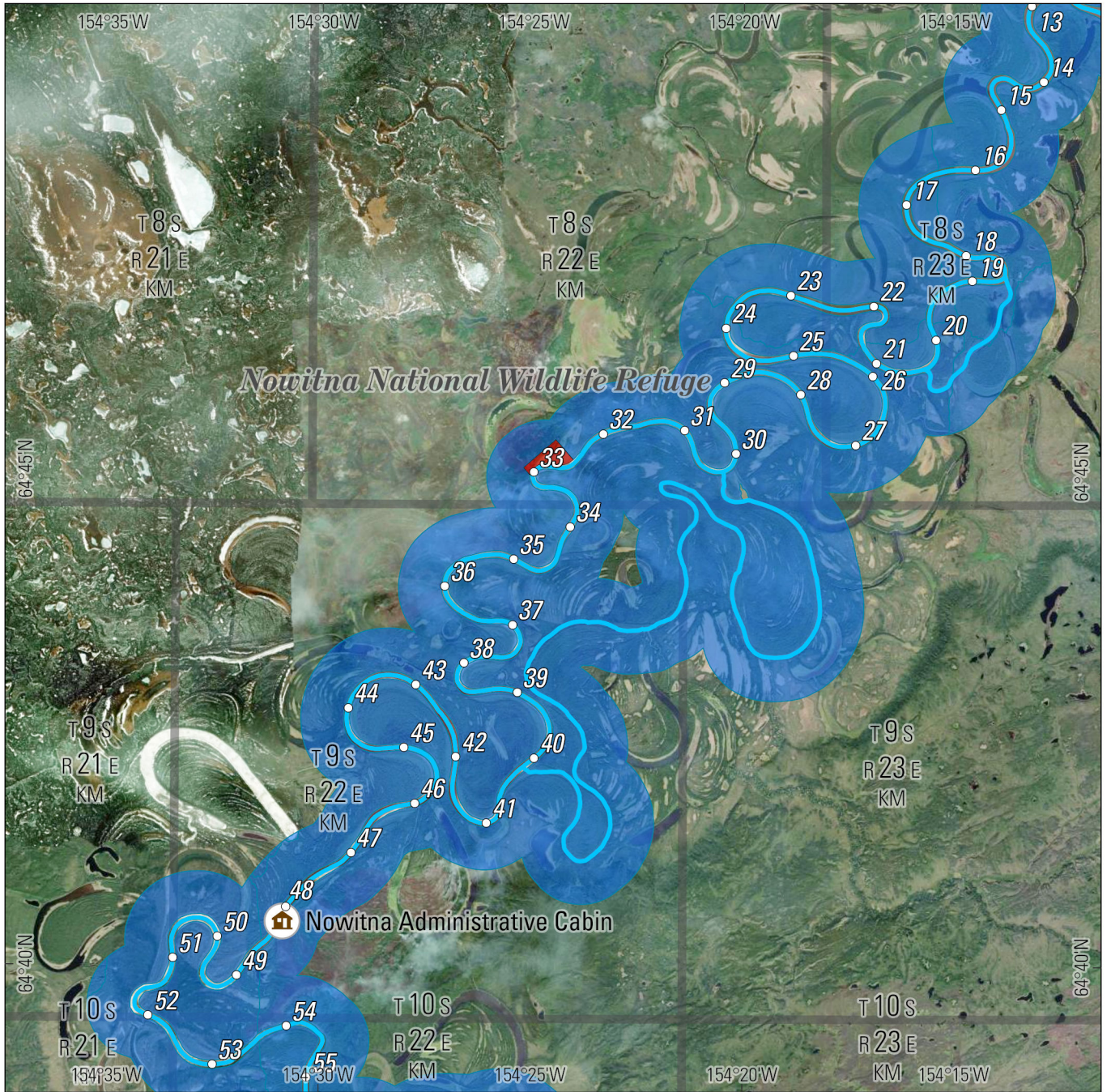
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure A2.2: Nowitna WSR Series (2 of 8)

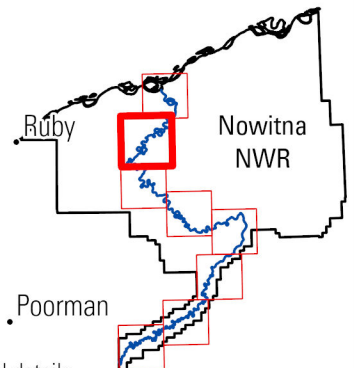


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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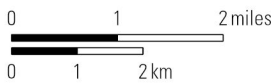
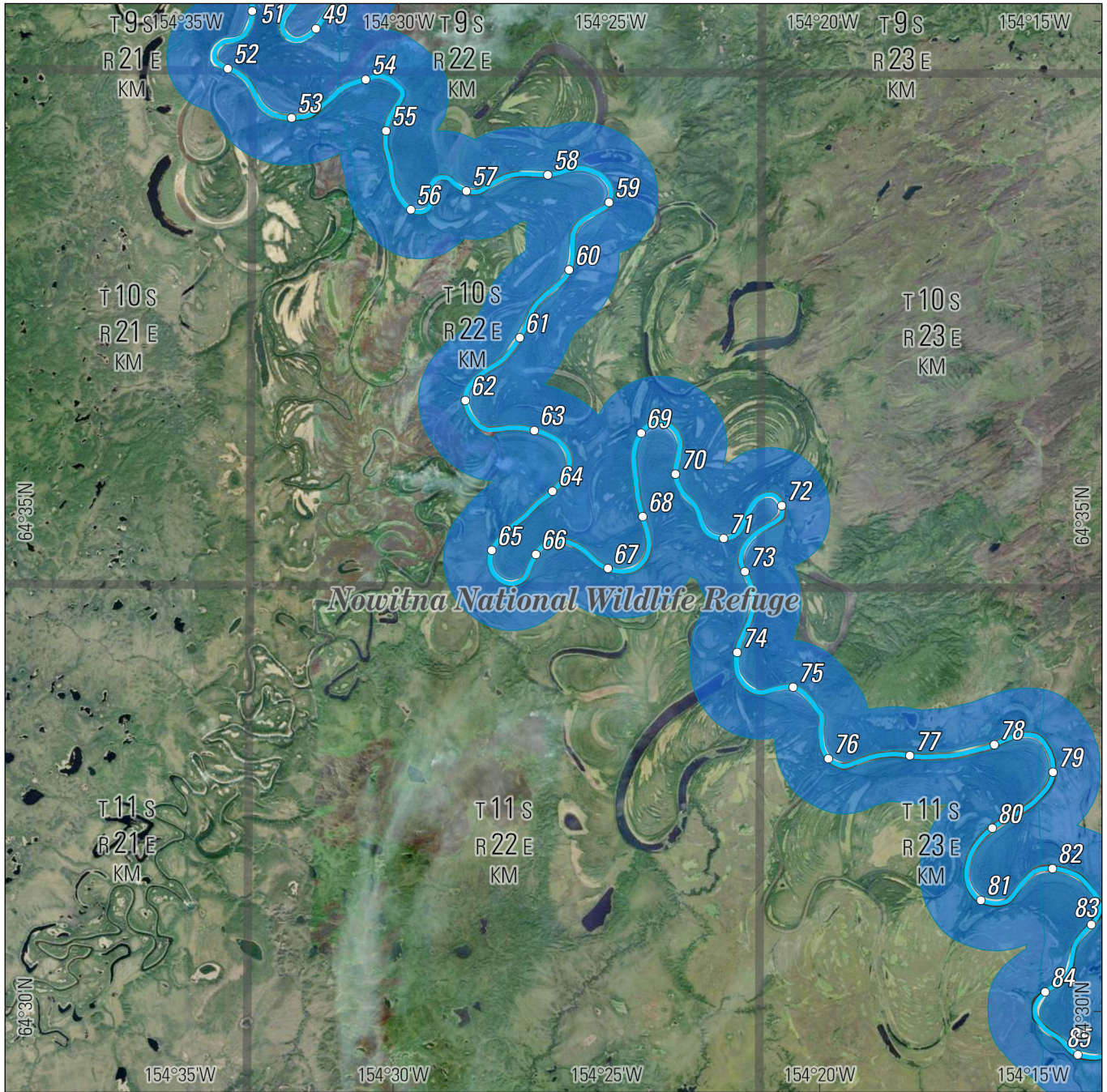
Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Figure A2.3: Nowitna WSR Series (3 of 8)

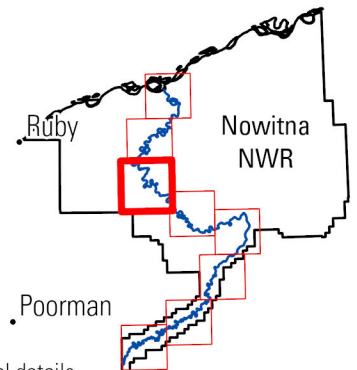


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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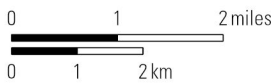
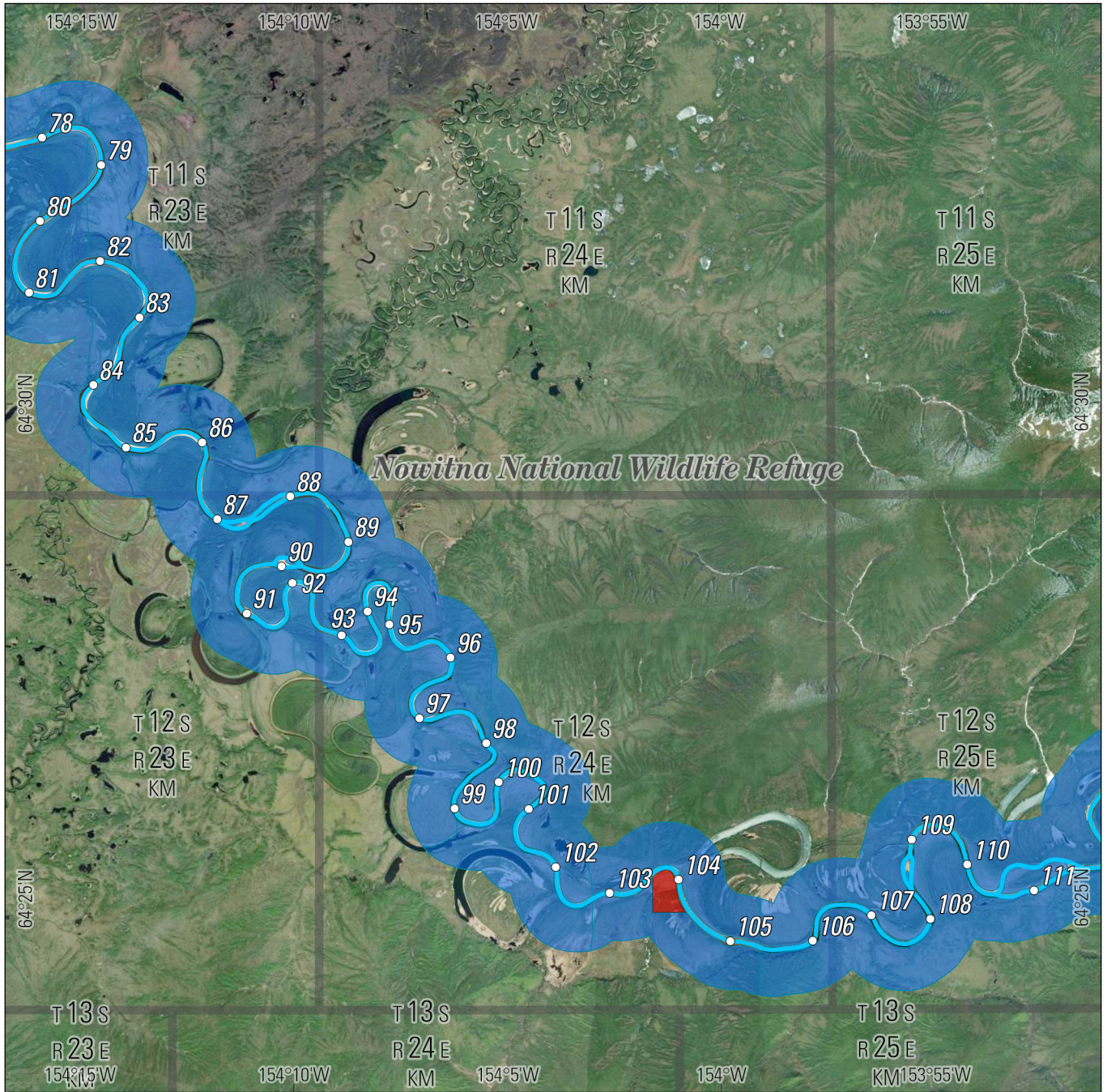
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Figure A2.4: Nowitna WSR Series (4 of 8)

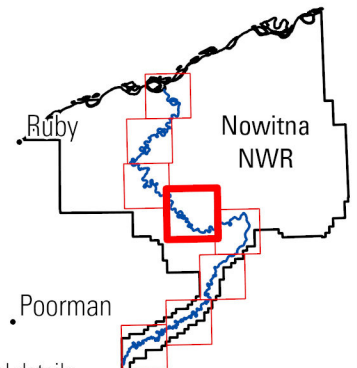


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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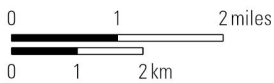
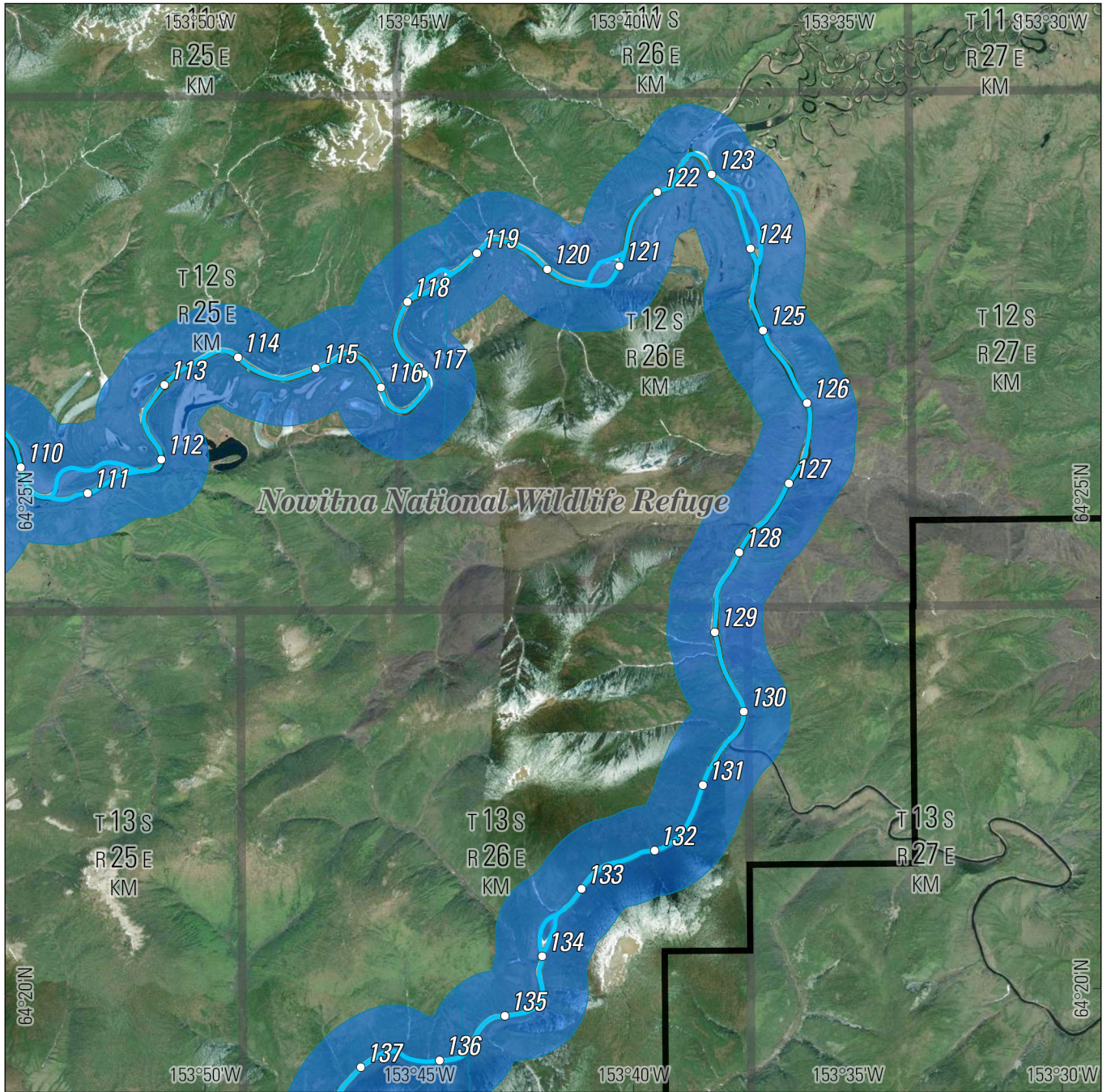
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Figure A2.5: Nowitna WSR Series (5 of 8)

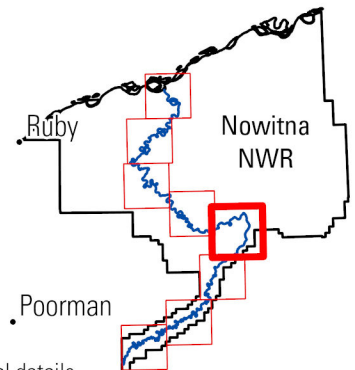


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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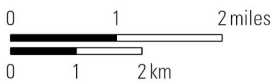
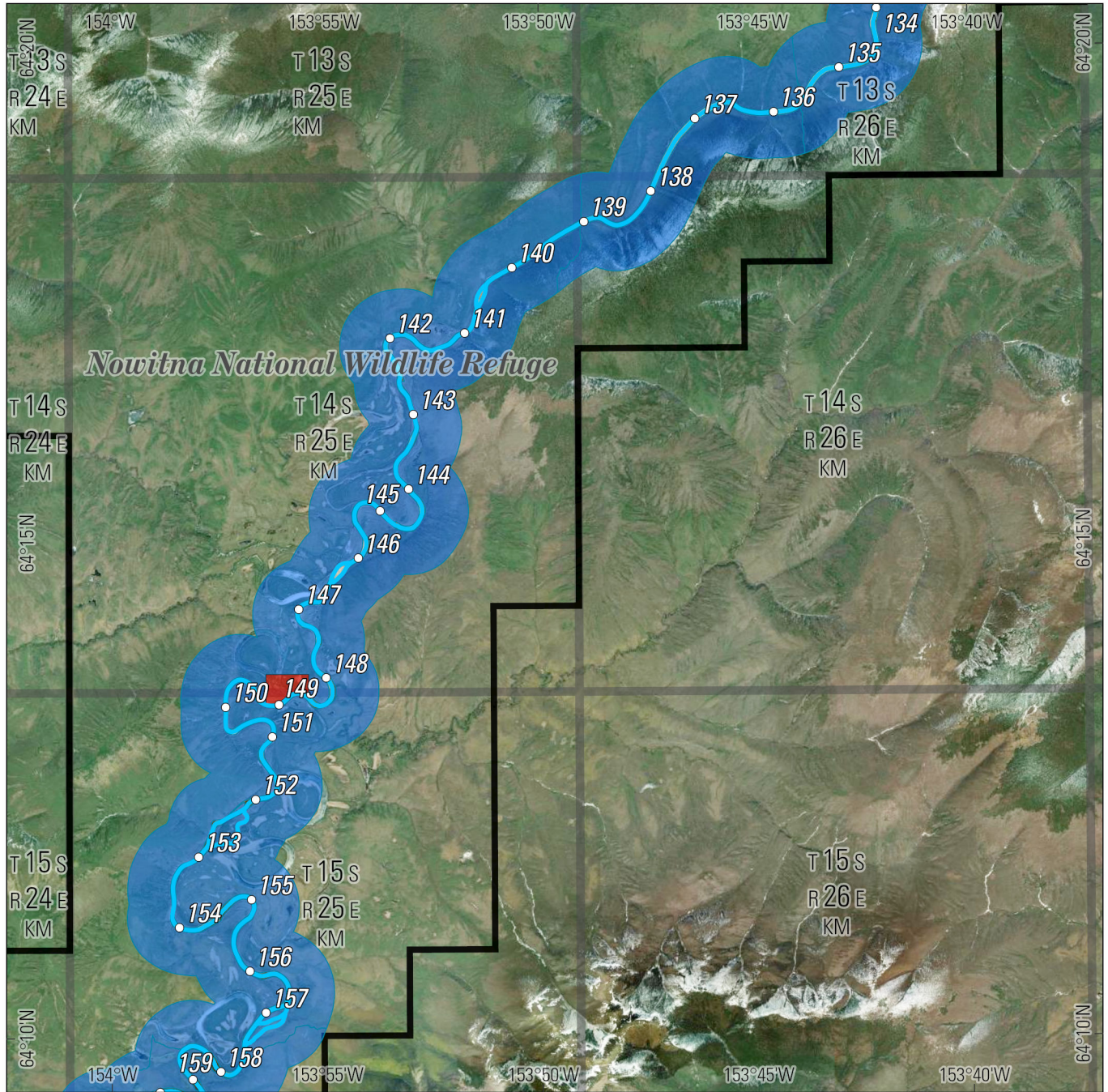
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Figure A2.6: Nowitna WSR Series (6 of 8)

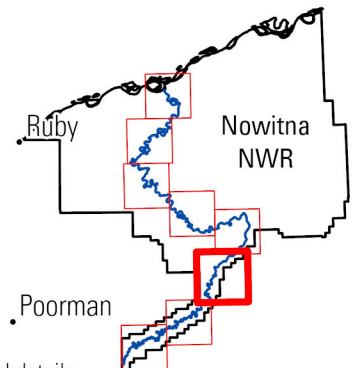


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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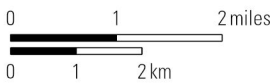
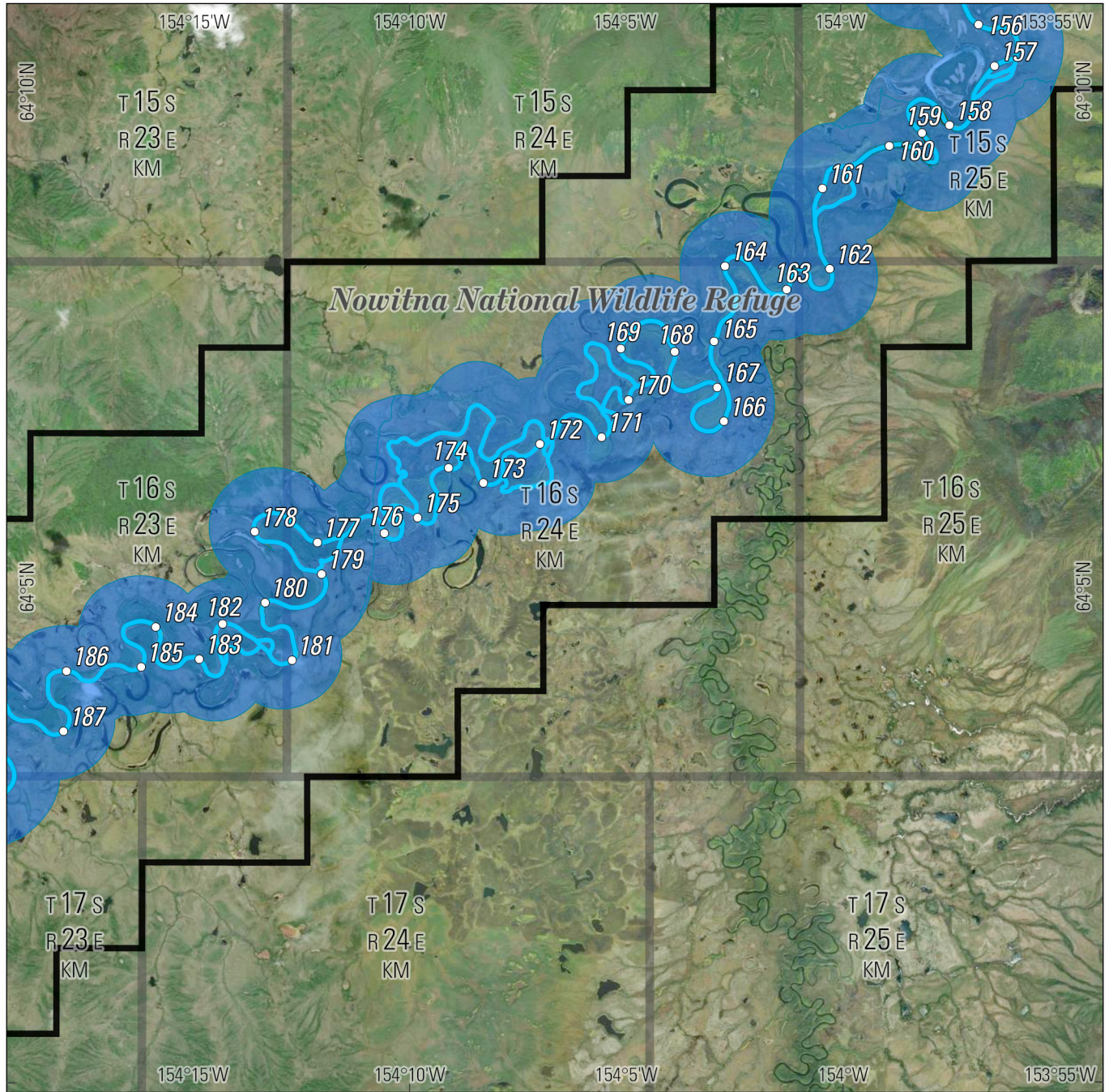
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Figure A2.7: Nowitna WSR Series (7 of 8)

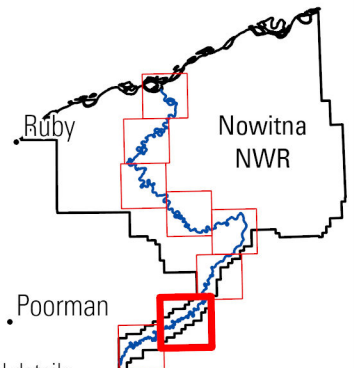


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
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- Patented ANCSA regional corporation



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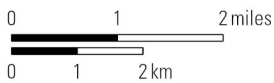
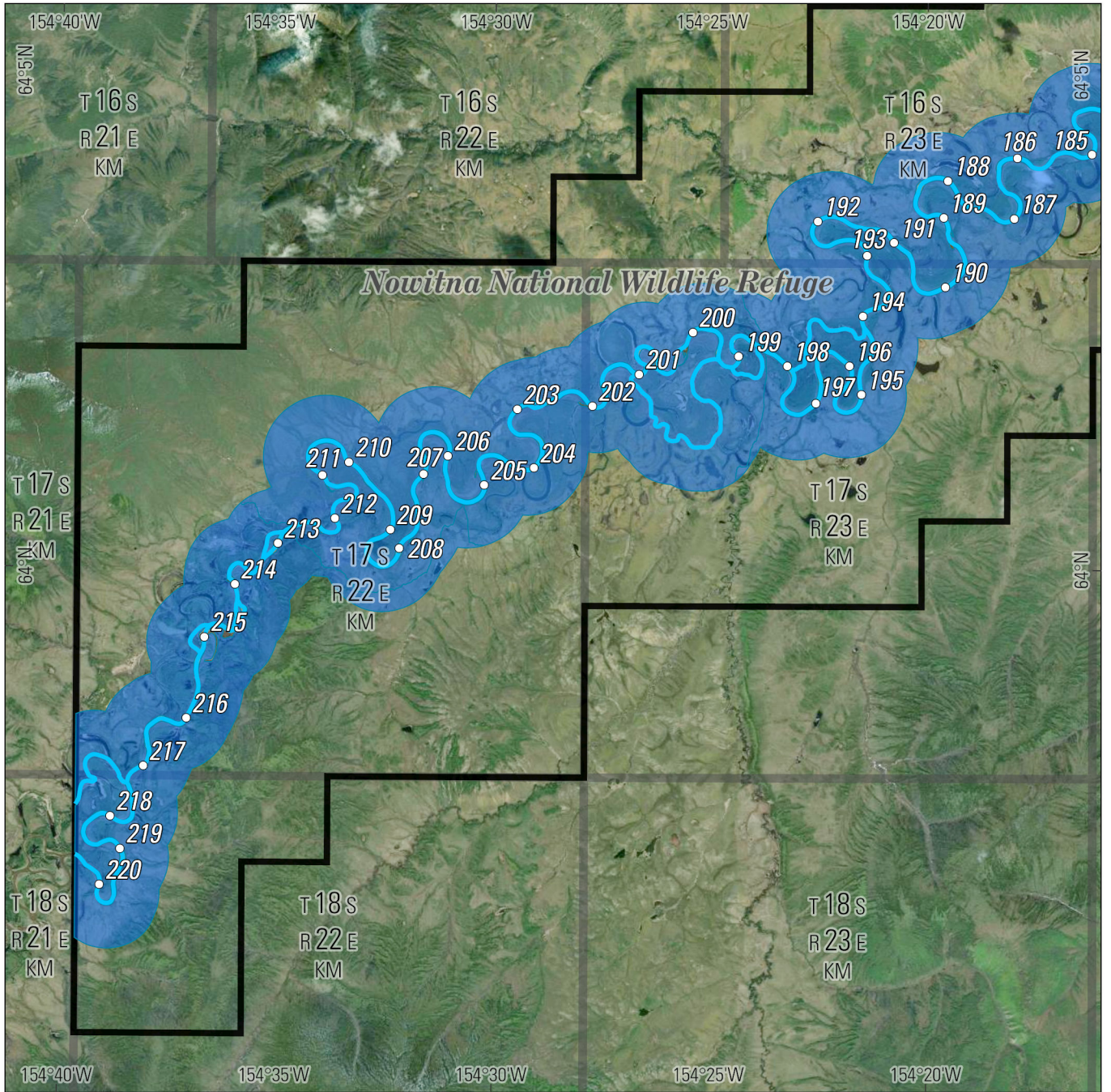
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Figure A2.8: Nowitna WSR Series (8 of 8)

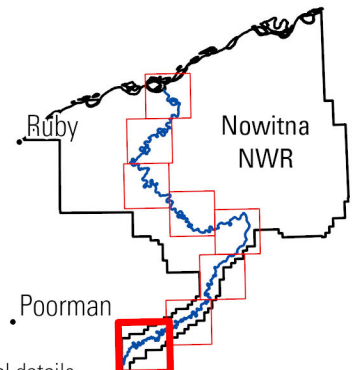


U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



- Nowitna River with river miles
- Nowitna NWR boundary
- Nowitna WSR corridor
- Patented native allotment
- Patented ANCSA village corporation
- Patented ANCSA regional corporation



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 Map Date: October 15, 2024
 Map ID #: 11-0059

Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

Frequent spring flooding caused by ice damming along the Nowitna WSR during breakup enriches these lakes and sloughs with nutrients, as well as carbonates from the limestone bedrock in the river's headwaters. The carbonates buffer the pH of the naturally acidic wetland waters and makes these wetlands less acidic and more productive than many other areas in Alaska. On higher ground in the Nowitna WSR corridor, wetlands give way to a mosaic of spruce and deciduous forests, shaped by a natural regime of wildland fire and providing diverse wildlife habitats. In some areas, uncommonly large stands of old-growth white spruce provide nesting areas for raptors and excellent furbearer habitat. The combination of the Nowitna WSR's diverse abiotic and biotic features, including the geology, hydrology, and biodiversity, creates a unique example of boreal riparian ecosystems.

The Nowitna WSR's superior qualities that make it stand out among Alaska rivers have been identified and described throughout its management history, both in studies recommending its inclusion in the NWSRS and in subsequent management plans (USBOR 1973; USFWS 1987a; USFWS 2009). However, the Nowitna WSR was designated by ANILCA without comprehensive descriptions and associated baseline conditions of specific ORVs that made the river eligible for inclusion in the NWSRS. This underscores how WSR management is continually changing and emphasizes the necessity for continuous evaluation and flexible management protocols to safeguard areas like the Nowitna WSR, even with limited data, to enhance conservation strategies.

In 2023, Service staff met with representatives from the ADFG, ADEC, Alaska Department of Natural Resources, U.S. Bureau of Indian Affairs, and residents of local communities to identify and describe final ORVs (USFWS 2024a). In addition to the free-flowing condition and water quality, four ORVs were identified: ecology, fish, cultural, and scenery.

The free-flowing condition and water quality are protected for all rivers in the NWSRS. Flow regimes and water quality in the Nowitna WSR are not well studied but are generally considered to be natural and unimpaired. The river is mainly fed by snowmelt and warm-season precipitation, and maximum streamflow typically occurs in the spring during ice breakup. Ice jams during this time often cause flooding in the lower portion of the WSR. Summer flow levels can be dynamic in response to precipitation events. Water clarity varies seasonally and over the river's course. Clear water flows in the upper section, and the water becomes silty in the lower stretches during the summer months. For more information regarding water in the Nowitna WSR, see **Section A.2.2**, Free-Flowing Condition; **Section A.2.3**, Water Quality; and **Section A.2.5.1**, Ecology.

The ecology ORV encompasses the Nowitna WSR's unique combination of geology, hydrology, plant communities, and wildlife assemblage and to recognize the interconnectedness of these elements that yields intact, functioning ecosystems in the river corridor. The distinct water chemistry, flood regime, and meandering nature of the river generate diverse and highly productive riparian ecosystems that provide habitat for a broad, interconnected array of boreal plant and wildlife species (USFWS 2024a). For more information on these ecological components, see **Section A.2.5.1**, Ecology.

The Nowitna WSR's fish community diversity and assemblage are rare in the Arctic-Yukon-Kuskokwim Region and are recognized in the fish ORV. At least 19 fish species have been documented in the Nowitna WSR corridor, surrounding wetlands, and tributaries. The assemblage of fish species is dynamic, it supports subsistence and recreational activities, and it is sustained by a unique combination of water features, including swift water underlain by gravel; productive, shallow lakes; and slow-moving

(still) water in lower reaches (USFWS 2024a). For more information on Nowitna WSR fish, see **Section A.2.5.2, Fish**.

Human relationships to the river and its resources through time are encompassed in the cultural ORV. The Nowitna WSR has undoubtedly provided resources for human use since people first came to the region in the late Pleistocene, and it continues to do so today. As an important location for resource harvest, travel, trade, and recreation, the Nowitna WSR has a long, rich, and unbroken cultural history, particularly for local Athabascans whose connection to the river goes back countless generations (USFWS 2024a). Today this relationship is expressed through hunting, fishing, recreation, and other activities in the river and corridor. For more information, see **Section A.2.5.3, Cultural**.

The scenic beauty of the Nowitna WSR both depends on and adds to the value of the river components described above. The diversity and dynamic nature of the area's geomorphology, fish, wildlife, plant communities, natural processes, seasons, and weather combine to create the stunning visual backdrop through which the river flows (USFWS 2024a). Few rivers in Alaska provide such a variety of scenery over a relatively short distance, and some sections of the river are awe inspiring. For more information, see **Section A.2.5.4, Scenery**.

A.2.2 Free-Flowing Condition

No human facilities or modifications exist to impede the Nowitna WSR's free-flowing condition, either above or within the designated portions. The Nowitna WSR flows in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway.

A.2.2.1 Hydrology

Most of the Nowitna NWR drains to the Nowitna River. The river originates in the Kuskokwim Mountains to the south, flows through the entire length of the refuge, and forms a wide, meandering floodplain before emptying into the Yukon River in the north. The headwaters of the Nowitna, Titna, Lost, and Sulatna Rivers flow from the mountains into the Nowitna lowlands section. Oxbow lakes created by channel migration are common in the lowlands along the Nowitna River.

Weather and climate are the most substantial drivers of hydrology in the area. The hydrologic regime varies with changes in average daily, monthly, and annual flow based on the regional temperature and precipitation. Weather and climate data have been collected at meteorological stations near Tanana, Alaska, and Galena, Alaska (NOAA 2024). The highest mean monthly precipitation at the Tanana station occurs during the summer. August is typically the wettest month with an average of 2.7 inches of precipitation. Precipitation decreases in October and remains low throughout the winter and spring (Burkart et al. 2023).

The timing, amount, and persistence of snow have major effects on surface and groundwater hydrology. The amount of water in the snowpack prior to melting in the spring and the timing and duration of snowmelt and ice breakup determine the shape and duration of the snowmelt stage peak. Normal monthly snowfall during May through September is less than an inch. From October through April, normal monthly snowfall at the Galena station is 2 to 6 inches higher than normal monthly snowfall at the Tanana station. The highest normal monthly snowfall at both stations is in December (15.8 inches at Galena and 10.3 inches at Tanana; Burkart et al. 2023).

In addition to measurements at the Tanana and Galena stations, the Service works with the Natural Resources Conservation Service to monitor snow depth at three stations on the Nowitna NWR. Snow depths are recorded from aerial overflights in the first week of December, February, March, April, and May (USFWS 2009). In the Nowitna NWR, February through April snow depths range from 2 to 3 feet, with less snowpack in other winter months (Burkart et al. 2023).

The Nowitna River typically runs free of ice in May and freezes over in October. Maximum stream volumes are associated with spring breakup and snow melt. Ice damming during breakup can cause flooding along the Nowitna River, and ice jams on both the Yukon River and the lower Nowitna River can cause flooding of the entire floodplain for a distance of up to 100 miles from the mouth of the Yukon River (USFWS 1987). Permafrost conditions in the watershed prevent substantial percolation, and summer rainstorms can result in a rapid stream rise of several feet. Such rain induced river volumes typically last several hours to a few days (USBOR 1973). Ice begins to form on the Nowitna River and its tributaries in October, and the rivers are typically completely ice covered by early November. Ice remains in place throughout the winter and river flows decrease as inputs from surface water sources diminish. The remaining flow transitions to being fed primarily from groundwater. By late winter, ice may reach 6 feet in thickness, with many tributary waters completely freezing. Waterbodies remain ice covered for more than half the year. Discharge in rivers during the winter is typically limited to groundwater-fed base flows. During winter and early spring, rivers and streams are at their lowest flow for the year (Burkart et al. 2023).

The Nowitna WSR flows 220 miles across the entire length of the refuge. To date, there have been no stream-gaging efforts to monitor flow in the Nowitna NWR (Burkart et al. 2023). However, in the summer of 2003, 2.3 miles upstream from its confluence with the Yukon River, the Nowitna River was 860 feet wide with a discharge of 17,600 cubic feet per second in June; in August, it was 441 feet wide with a discharge of 8,670 cubic feet per second (USGS 2024).

Numerous oxbow lakes and sloughs provide excellent fish and wildlife habitat adjacent to the river. Flooding is important ecologically for building and maintaining channel, riparian, and floodplain habitats and the exchange of sediment, organic matter, and nutrients between the floodplain and stream channel (Poff et al. 1997). High water also recharges floodplain ponds and creates pathways for the movement of fish between the stream and floodplain habitats. The timing, duration, and frequency of floods of various magnitudes are important for the life cycle of fish and riparian vegetation (Poff et al. 1997). Flooding can occur during high flows associated with spring snowmelt and ice jams, and summer and fall rain events.

The importance of groundwater in the Nowitna NWR is not well understood, but it may play an important role in influencing surface water characteristics in the Nowitna WSR (Burkart et al. 2023). Shallow groundwater flow occurs in the upper soil layers and is confined to the unfrozen active layer when permafrost is present (Williams 1970). In shallow groundwater systems, surface water percolates through unfrozen soil layers into shallow aquifers, contributing to groundwater recharge and base flow for rivers and lakes.

A.2.2.2 Instream Flow

The WSRA declares that certain rivers that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values “shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit of present

and future generations.” Section 13(c) recognizes the importance of instream flow protection in achieving a primary goal of the WSRRA: to protect the free-flowing condition on a selected river. Herein, instream flow simply refers to the amount of water flowing in a river (IWSRCC 2022).

The WSRRA provides for the assumption or creation of federal reserved water rights sufficient to carry out the purposes of the WSRRA. Additionally, Nowitna NWR has explicit, yet unquantified, federal reserved water rights through ANILCA, which declared refuge purposes upon establishing the Nowitna NWR “(i) to conserve fish and wildlife populations and habitats in their natural diversity. . . (iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes outlined in paragraph (i), water quality and necessary water quantity within the refuge.”

The National Wildlife Refuge System Administration Act and Service manuals (403 FW 1–3) direct the Service to obtain, to the extent practicable, water supplies of adequate quantity and quality for refuge purposes and trust resources, and to obtain the legal right to use that water through State laws, regulations, and procedures. In Alaska, the purposes for an instream flow reservation under the Alaska Water Use Act (Alaska Statutes 46.15.145 implemented by 11 Alaska Administrative Code [AAC] 93.141) include the protection of fish and wildlife habitat, migration, and propagation; recreation and park purposes; navigation and transportation; and sanitation and water quality. Using existing data or through the collection of hydrologic and biologic data, the Service files an application with the State of Alaska Department of Natural Resources for instream water rights (water reservations) to fulfill NWR purposes and the purposes of the WSRRA.

Stream gage monitoring data are critical for acquiring and protecting State or federal reserved water rights, or both. Furthermore, stream gage monitoring data are critical to protect riverine processes (channel-maintenance flows) and understanding required flows that protect WSR ORVs. The data are also essential to developing strategies that protect aquatic habitat, riparian habitat, the floodplain, water-dependent ORVs, and instream flows. To date, there have been no refuge-wide streamflow or water quality studies. Streamflow has been measured in the Yukon River downstream of the Nowitna NWR’s boundaries at Ruby, with the period of record ending in 1978.

Understanding the natural flow regime (flow rates, volume, and timing) of surface water flow is critical for determining the extent to which future management actions may protect and enhance streamflow and water-dependent ORVs. The Service plans to conduct a comprehensive investigation of water quantity to support instream flow water rights filings for the refuge. Management of instream flow for the Nowitna WSR includes developing long-term stream gage stations and recording the water level and discharge at multiple locations along the Nowitna WSR corridor and tributaries. Discrete surface water discharge measurements will be conducted six times per year, targeting periods of significant hydrologic flow, including, but not limited to, spring breakup and summer low flows. The number of annual discrete samples required may decrease in frequency over time. Streamflow data collection will be conducted in cooperation with the Service’s Water Resources Branch and other collaborators. Surface water discharge data from the water quantity investigation will be used to apply for instream flow water rights.

A.2.3 Water Quality

The physical and chemical characteristics of water in aquatic systems, collectively known as water quality parameters, are important measures and indicators of aquatic and terrestrial ecosystem health.

Section 303 of the Clean Water Act directs the establishment of water quality standards and implementation plans by states or authorized Tribes with EPA approval. Core components of water quality standards include (1) identifying designated uses, such as drinking water, recreation, and propagation of fish, shellfish, and wildlife; (2) establishing qualitative or numeric criteria; and (3) developing antidegradation policies. Alaska's water quality standards are found in regulations promulgated by the ADEC and 18 AAC 70, Water Quality Standards. Section 303(d) of the Clean Water Act further specifies that states identify waters within their jurisdiction that are not meeting water quality standards. Currently, no lakes or rivers in the Nowitna WSR corridor are listed as impaired under Section 303(d) (ADEC 2024).

In past studies, of sites on the Nowitna River and its tributaries specific conductivity ranged from 78 to 380 $\mu\text{S}/\text{cm}$ (microsiemens per centimeter), depending on the location and year (Snyder-Conn et al. 1992). Specific conductivity was lowest in the upper Nowitna River (78–100 $\mu\text{S}/\text{cm}$) near the Nowitna NWR's southern boundary. Turbidity was low to high (4.7–160 nephelometric turbidity units [NTU]) at most sites. The Sulatna River, at a site near the southwestern boundary of the Nowitna NWR, exhibited extremely high values averaging 3,467 NTU in 1987 and 1,183 NTU in 1988 (Snyder-Conn et al. 1992).

The only U.S. Geological Survey water quality sampling site on the Nowitna River is 2.3 miles above the river's confluence with the Yukon River (gage number 645408154143400). This site was sampled on June 6 and August 27, 2003. Specific conductivity (68 versus 155 $\mu\text{S}/\text{cm}$) and alkalinity (29 versus 64 milligrams per liter [mg/liter]) were approximately twice as high in August compared to June. During June, the suspended sediment concentration was 195 mg/liter. In late August, suspended sediment concentration had dropped to 17 mg/liter (Burkart et al. 2023). This variability in concentration is expected with changing flow, with higher suspended sediment loads largely correlated with spring runoff events.

The Service collected physical water quality data at study lakes in the Nowitna NWR from 1984 to 1986 as part of a large-scale fisheries and habitat survey on interior Alaska NWRs (Glesne et al. 2011). Lake types sampled included lowland and oxbow lakes. Many of these lakes are within the WSR corridor and may exchange surface water during floods (Burkart et al. 2023).

Snyder-Conn et al. (1992) conducted water quality and metals sampling of water, sediments, and fish in rivers of the Nowitna NWR during 1985–1988. Sample sites included four sites on the Nowitna River; California Creek above the confluence with the Titna River; the Sulatna River at the Nowitna NWR border; and the Sulatna, Sulukna, and Titna Rivers above or near their confluence with the Nowitna River. While some of these measurements are outside the Nowitna WSR corridor, they represent the best available data and have been included for reference. The pH of the Nowitna WSR at its mouth was near neutral (Snyder-Conn et al. 1992). The pH was slightly more basic (average of 8.0 at each site) at the Nowitna WSR near the southern NWR boundary (Snyder-Conn et al. 1992). Total alkalinity at stream and river sampling sites ranged from moderate to high with values ranging from 51 to 521 mg/liter (Snyder-Conn et al. 1992).

In the Nowitna NWR, most trace element concentrations in water and sediment were within the range expected for uncontaminated watersheds with a few exceptions. Total recoverable manganese concentrations in 1985 samples of the Sulatna and Titna Rivers and the Nowitna WSR upstream from the Titna River exceeded the EPA secondary criteria for drinking water of 0.05 mg/liter for that year. In

1988 at the Sulatna River site, the measured dissolved concentration of manganese, which is typically lower than the total recoverable concentration, again exceeded this criteria (Snyder-Conn et al. 1992).

Both dissolved and total recoverable concentrations of copper were measured in 1985 and 1987; in most instances, dissolved concentrations exceeded total recoverable concentrations, indicating issues may have occurred in sampling or the laboratory analysis that make interpretation of these results problematic. Cadmium was measured, but the method detection limits were very close to the concentrations measured and cannot be quantitatively interpreted. Total lead concentrations in the Titna River and Nowitna WSR, just upstream of the Titna River, were at the EPA and State criterion (when total hardness is 100 mg/liter as calcium carbonate) for protection of freshwater aquatic life from chronic toxicity. Low hardness (45–85 mg/liter as calcium carbonate) was reported for the upper Nowitna River, suggesting that species could be sensitive to the lead concentrations observed.

In 1985, total recoverable iron concentrations in the Sulatna and Titna Rivers and some sections of the Nowitna WSR all exceeded EPA secondary drinking water criteria of 0.3 mg/liter and the Alaska State criteria for protection of freshwater aquatic life from chronic toxicity of 1.0 mg/liter (if these conditions occur on 4 or more consecutive days) (Snyder-Conn et al. 1992). Again in 1987, the sites on the Nowitna River near the mouth and downstream of the southern boundary and the Sulatna River site exceeded the EPA secondary criteria; the Sulatna River also again exceeded the Alaska State criteria for protection of freshwater aquatic life.

At the sites sampled, there was a strong positive correlation between turbidity and iron and manganese concentrations in all years measured (Snyder-Conn et al. 1992). In 1987 and 1988, the Sulatna River, which had active placer mining activity upstream, had significantly higher turbidity, iron, and manganese concentrations than sites on the upper, middle, and lower Nowitna River; the Sulukna River; and California Creek. There is no direct evidence that the presence of placer mining was related to these water conditions in the Sulatna River. It is possible to observe elevated concentrations of contaminants due to natural erosion of highly mineralized areas, events such as flooding, fires (and fire suppression), and atmospheric deposition. There are currently no active water quality monitoring sites along the Nowitna WSR.

A.2.4 ORVs Background

Section I(b) of the WSRRA requires administering agencies (the Service in the case of the Nowitna River) to protect a WSR's values. Section I(b) states:

“It is hereby declared to be policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.”

Consistent with the guidelines provided in the Interagency Wild and Scenic Rivers Coordinating Council (IWSRCC) publication of the WSR Study Process (IWSRCC 1999), to qualify as an ORV, a resource must not only be river related or river dependent—owing its existence to the presence of the river—but it must be unique, rare, or exemplary within a relevant region of comparison.

Each river in the NWSRS is managed with the goal of protecting and enhancing the values that caused it to be designated. These values include the river’s free-flowing condition, water quality, and the river-related resource values that have been found to be outstandingly remarkable for each WSR. These specific river values, known as ORVs, are identified by an interdisciplinary team of resource specialists with knowledge of an area’s resource distribution.

ANILCA Section 602 designated the Nowitna WSR but did not mention river-related values. The management direction of the Nowitna WSR was initially outlined in the Nowitna National Wildlife Refuge Comprehensive Conservation Plan, Environmental Impact Statement, Wilderness Review, Wild River Plan (or Nowitna CCP) (USFWS 1987a). According to this plan, the Nowitna Wild River [WSR] was designated because of its natural, free-flowing condition; water quality; and ORVs identified as wildlife, geology, and primitive setting.

In 2009, the Koyukuk/Northern Unit Innoko/Nowitna National Wildlife Refuges’ Revised CCP (or Revised CCP) (USFWS 2009) replaced the management direction for the Nowitna National Wildlife Refuge Comprehensive Conservation Plan, Environmental Impact Statement, Wilderness Review, Wild River Plan and associated records of decision. The Revised CCP for the Nowitna NWR noted that the Nowitna WSR possesses ORVs in multiple categories that were informally identified by refuge staff during the CCP development process. The identified ORVs include:

- Scenic—forested river corridor, diverse landscape, and different examples of succession
- Geologic—agates
- Hydrologic—free-flowing condition, oxbow lakes, and wetlands
- Fisheries—sheefish and whitefish populations
- Wildlife and habitats—nationally significant species of migratory waterfowl and large game
- Cultural, historic, and prehistoric—transportation corridor and abandoned camps
- Subsistence—hunting, trapping, house logs, berry picking, and firewood
- Recreational—hunting, fishing, wildlife observation and photography, floating, and camping trips

While both the Nowitna CCP and Revised CCP were validated through a public process, Interagency guidelines²⁰ for ORVs in the Wild and Scenic River Study Process (IWSRCC 1999) were not formally applied. In 2009, refuge staff informally applied the IWSRCC’s guidance, focusing their efforts on describing river values and providing direction regarding the protection of these values. The changes to the previously identified river values (1987 and 2009) align the values with established guidelines and make the process of addressing these values more efficient and formal within the CRMP (see **Table A-1**, below).

²⁰ “Department of the Interior and Agriculture Interagency Guidelines for Eligibility, Classification and Management of River Areas,” published in the Federal Register (Vol. 47, No. 173; September 7, 1982, pp. 3945439461), provides direction to agencies in the study and administration of WSRs.

Table A-I. Previous Identification of ORVs for the Nowitna WSR

Nowitna CCP (1987a)	Revised CCP (2009)	CRMP Pre-planning (2020)	CRMP (2024)
<ul style="list-style-type: none"> •Geology •Primitive setting •Wildlife 	<ul style="list-style-type: none"> • Scenery • Geology • Hydrology • Fish • Wildlife and habitats • Cultural, historic, and prehistoric • Subsistence • Recreation 	<ul style="list-style-type: none"> • Scenery • Geology • Fish • Wildlife • Cultural (prehistoric and historic) • Subsistence • Recreation • Plant community 	<ul style="list-style-type: none"> • Ecology • Fish • Cultural • Scenery

To facilitate the processes of finalizing ORVs with public involvement and of developing CRMPs for WSRs in Alaska, a river value identification workshop was held in Fairbanks, Alaska, in January 2020. The workshop also provided opportunities to prioritize interim WSR management direction prior to the completion of CRMPs. Interdisciplinary river management teams were assisted by the River Management Society’s River Training Center (using tools and resources developed by the IWSRCC) to identify interim findings of ORVs and river values for each of the Service-administered WSRs. In anticipation of finalizing ORV designations and developing a Nowitna CRMP, the staff at Nowitna NWR continued the internal review of Nowitna WSR values throughout 2020 using the process recommended during the workshop to summarize and document available information. Sources of information included the original U.S. Bureau of Outdoor Recreation study (USBOR1973) and associated field notes, held by the Alaska Resources Library and Information Services in Anchorage; other publications; and files from the refuge. When available, water resources information, including flow and water quality study data, were included. As a result of the efforts made in 2020, eight ORVs were identified for the Nowitna WSR: scenery, geology, fish, wildlife, cultural (prehistoric and historic), subsistence, recreation, and plant community.

In 2023, the Service staff met with representatives from the ADFG, ADEC, Alaska Department of Natural Resources, U.S. Bureau of Indian Affairs, residents of local communities, and members of local tribal organizations to identify and describe the final river ORVs to be used in the Nowitna CRMP. Many of the river values identified in previous documents were retained, but they were reorganized into four ORVs: ecology, fish, cultural, and scenery.

Information from previous ORV assessments was examined to identify commonalities and overlaps among previously identified ORVs and to group them into more comprehensive and streamlined river-related values. Changes to the previously identified river values are intended to optimize how they are addressed in the CRMP. Combining multiple resources into one river value does not in any way reduce the value of the individual parts. All river values apply to the entire river corridor, are treated equally, and retain the same status for protection under the CRMP. The final ORVs are ecology, fish, cultural, and scenery. The ORV descriptions below also appear in the Nowitna River Wild and Scenic Values report (USFWS 2024a).

The ecology ORV recognizes the relationship between the river’s unique geology, hydrology, plant communities, and wildlife. It aims to manage and protect these values collectively as part of the river’s

broader ecological value. It also acknowledges that these features are deeply interconnected and changes or impacts in one area can have a ripple effect throughout the ecosystem. Collectively recognizing all these river values within the ecology ORV allows management and conservation efforts to take a more holistic approach to ensure the overall health and balance of the Nowitna WSR's natural systems.

The Nowitna WSR supports a remarkably diverse assemblage of fish species. It is a migration corridor to one of only six known sheefish spawning areas in Alaska, thus providing fish habitat that is rare in the Arctic-Yukon-Kuskokwim Region. Initially, Nowitna River fish were included within the wildlife ORV (USFWS 1987a); they were later recognized as a separate ORV (USFWS 2009). Continuing to recognize fish as a distinct ORV allows for a focused and specific approach to managing and conserving the river's fish resources while acknowledging the significant role that fish populations and their habitat play in the ecological health and overall value of the Nowitna WSR and the broader region.

The cultural ORV encompasses many aspects of the relationship between humans and the Nowitna WSR that have been consistently recognized throughout management of the Nowitna WSR. The cultural ORV for the Nowitna WSR incorporates several river values described in past documents, including "historic or prehistoric," "subsistence," "primitive setting," and "recreation." Subsistence, recreation, and other cultural values were described in the 1973 Nowitna WSR report and were identified within the primitive setting ORV in 1987. Subsistence, recreation, and a combined prehistoric/historic/cultural ORV were identified in 2009 and 2020. The decision to use the term "cultural" as an encompassing term reflects an inclusive and respectful approach to acknowledging the diverse cultural contributions and heritage associated with human use of the river. For example, there is no local distinction between prehistoric, historic, and modern interactions between people and the river's resources; all are part of a long continuum that extends to future generations. Additionally, some activities such as boating, camping, hunting, and fishing in the river's remote, undeveloped setting are common across these previously identified values. By encompassing the full range of human interactions with the river and its resources in the past, present, and future, the cultural ORV recognizes an enduring relationship between humans and the environment that is exemplary in the state.

The scenic quality of the Nowitna WSR was initially recognized within the primitive setting ORV (USFWS 1987a). Primitive setting included the river's remoteness, diverse landscape, wildlife, river character, and the geological qualities of the Nowitna WSR. Scenery was identified as a distinct ORV in 2009 and 2020. In the process of developing final ORV determinations, scenery was briefly considered as a component of the ecology ORV; however, conversations with staff, partners, and local communities resulted in the decision to keep scenery as a separate ORV. The scenic qualities are a result of the river's diverse course and setting; however, the scenic qualities do not directly support the overall health and balance of the Nowitna WSR's natural systems in the ways that components of the ecology ORV do. The outstandingly remarkable scenic qualities of the river have been consistently recognized and are considered exemplary in Alaska's boreal region.

A.2.5 Baseline and Existing Conditions

The year a WSR is designated represents the baseline condition against which subsequent conditions of river values are assessed (IWSRCC 2018). The baseline condition serves as the basis on which the degree or intensity of any existing impacts can be measured, and future impacts assessed, should they occur. Often, existing conditions are relied on to represent the condition against which subsequent

conditions of river values are assessed. All future activities are to be measured from this baseline to ensure continued high-quality conditions and, with respect to river values, to eliminate adverse effects (protect) or improve conditions (enhance) within the river corridor.

The remote and often inaccessible nature of the rivers in Alaska that were being considered for inclusion in the NWSRS during the 1970s presented challenges. Limited information was available about many resource values in these remote regions, making it difficult to provide detailed descriptions of the baseline conditions. Because of the remote, undeveloped nature of the Nowitna WSR and its watershed, conditions within the corridor have likely changed relatively little since the time of designation. The existing conditions described here for the Nowitna WSR's ORVs and other related resources will provide a benchmark for future management. The condition descriptions below also appear in the Nowitna Wild and Scenic River Values report (USFWS 2024a).

A.2.5.1 Ecology

The combination of the Nowitna WSR's abiotic and biotic features, including the geology, hydrology, and biodiversity, creates a unique example of boreal riparian ecology. The Nowitna WSR is one of the finest examples of a geologically old, meandering river in Alaska. Over its course, the Nowitna River comprises a complete transition from a narrow, swift, gravel-bottom river in its upper reaches to a relatively broad, slowly meandering river typified by cutbanks, sandbars, sloughs, and oxbow lakes in the lower floodplain region. Spring flooding enriches the oxbow lakes and sloughs with nutrients, as well as carbonates from the limestone bedrock in the river's headwaters that increase productivity in the floodplain. The river corridor encompasses a broad range of boreal habitats influenced by terrain, wildfire history, and the winding nature of the river itself.

The river's distinct water chemistry, flood regime, and meandering nature generate diverse and highly productive riparian habitats within which a broad, interconnected array of northern wildlife species exists, including moose, black and grizzly bears, wolf, wolverine, red fox, lynx, marten, porcupine, snowshoe hare, river otter, muskrat, mink, weasel, squirrel, wood frog, waterfowl, raptors, songbirds, and other birds. The grassy margins of the river, surrounding lakes, and waterways provide some of the best breeding habitat in interior Alaska for Trumpeter Swan, Greater White-fronted Goose, Canvasback, Sandhill Crane, and many other migratory waterfowl. A mixture of mature forest and early successional plant communities provides excellent moose habitat. Moose abundance is highest along the river corridor, which in turn sustains increased populations of predators. Beavers are numerous in the river and adjacent oxbow lakes.

Extensive stands of larch, a species of conservation concern in Alaska, exist in areas along the river's upper and middle portions. These trees owe their presence to the buffering action of dissolved carbonates and bicarbonates transported by the Nowitna River from its headwaters. Additionally, the river corridor contains uncommon old-growth white spruce forest communities that are nourished by the Nowitna WSR's productive floodwaters and protected from wildfire by surrounding wetlands. Here, white spruce trees grow to an impressive size and are among the oldest found in Alaska, with many mature trees that are between 200 and 350 years old. These old-growth forests provide nesting areas for raptors and some of the best marten habitat in Alaska.

Taken as a whole, the diverse and abundant assemblage of boreal species is unique statewide and a defining characteristic of the Nowitna WSR. No other river in Alaska possesses the unique geology and diversity of wildlife and vegetation of the Nowitna WSR.

Geology

The Nowitna River drainage is stratigraphically and structurally complex. The basement rock is dominantly a Precambrian or Paleozoic metamorphic complex, including a lower group of limestones and greenstones and an upper group of mainly schists and quartzites. These rocks are overlain by Ordovician limestones. Exposed along the Nowitna River are crystalline limestone, quartzite, schist, slate, phyllite, greenstone, gneiss, and volcanics. In its middle section, the Nowitna River flows through a canyon where the channel straightens and large gravel, cobble, and bedrock are present on the river bottom. Here the rocks are crystalline limestone, greenstone, schist, and slate. Garnets, petrified wood, chalcedony, and agates are present with agates occurring in great numbers. These agates are thought to have come from volcanics bordering the upper Nowitna River above the Sulukna River.

In addition to these quartz rocks, bones of Pleistocene animals may occasionally be found along the river as the river slowly erodes its banks. A unique geological process is demonstrated in the Nowitna River drainage, which contributes to the outstanding productivity of the river and associated oxbow lakes, sloughs, and wetlands in the lower section. Nowitna River water contains dissolved bicarbonates and carbonates brought down from limestone deposits in the river's headwaters. These provide an inorganic source of carbon for photosynthetic metabolism by aquatic macrophytes and algae and also serve as an effective buffer against rapid pH changes. Frequent spring flooding (often caused by ice damming during breakup) enriches adjacent oxbow lakes and sloughs with these nutrients and carbonates, which buffer the pH of the naturally acidic wetland waters and make nutrients more available for plant uptake. As a result, wetlands in the Nowitna River floodplain are less acidic and more productive than they are in many other areas in Alaska. This unique geological process supports all other recognized ORVs for the Nowitna River.

Meandering River and Floodplain

The Nowitna WSR is an excellent example of an interior Alaska meandering river. The river's path of deep, sweeping turns is ever changing as it winds across its floodplain basin. The river topples trees along the outer cutbank side of bends where the water is swift, and deposits sediment on sand and gravel bars on the insides of the bends. Thus, the river is always shaping the landscape and creating new habitats for plants and wildlife. Herbs and willows sprout on gravel bars to become habitat for songbirds and moose. Spring meltwater pushes ice chunks downriver, scouring willows along the shore that will soon resprout to provide nutritious food for moose and beaver. Spring ice jams can back the river up for more than a hundred miles, affecting water levels and bringing nutrients to adjacent lakes and wetlands, as well as permitting the transfer of fish between the river and adjacent lakes and sloughs. Over time, riverbank erosion shortcuts across the river's long, looping bends to create isolated oxbow lakes that are ideal for nesting swans, geese, and ducks. All these river actions contribute to the diversity and productivity of wildlife habitats that make the Nowitna WSR special.

The entire Nowitna River floodplain depends on the river to shape and influence its wetland and forest communities. In the river's upper portion, the floodplain extends only a few miles to each side of the active channel. Here, long, looping sloughs and narrow lakes hint at where the main channels were in the river's past. Downriver in the Nowitna canyon, the floodplain narrows, sometimes spanning less

than a quarter mile where the river winds between tundra-capped hills. Below the canyon, the floodplain widens again, now to 3 or 4 miles across, and oxbow lakes begin to appear. Near the confluence of the Sulatna River, the Nowitna WSR leaves the hills and spills on to the broad flats that extend to the Yukon River. Here the floodplain basin extends 6 to 9 miles across and is covered with myriad oxbow lakes, sloughs, and wetlands. Through this broad network of wetlands and lakes, rich with wildlife, the Nowitna WSR winds through the ecosystems it shapes and nourishes. The rich ecology of the river corridor is a reflection of this larger floodplain and the vital interactions between the river and land.

The Nowitna floodplain basin is depicted in **Figure A3** using a digital elevation model. Oxbow lakes and old river meanders are also visible. The segment of river shown is about 3 miles downriver of the confluence of the Sulatna where the floodplain begins to significantly widen.

Wildlife

The Nowitna River floodplain is the refuge's most biologically productive area. The distinct water chemistry, flood regime, and meandering nature of the river generate diverse and highly productive riparian ecosystems that provide habitat for a broad, interconnected array of boreal plants and wildlife species, including moose, black bear, grizzly bear, wolf, wolverine, red fox, lynx, marten, porcupine, snowshoe hare, river otter, beaver, muskrat, mink, least weasel, red squirrel, wood frog, waterfowl, raptors, songbirds, and other birds.

Grouse, owls, woodpeckers, chickadees, Canada Jay, Common Raven, and redpolls are year-round residents of the NWR. Thousands of migratory birds come to the Nowitna River corridor each summer. The grassy margins of the river, surrounding lakes, and waterways provide some of the best breeding habitat in interior Alaska for Trumpeter Swan, Greater White-fronted Goose, Canvasback, Sandhill Crane, and many other migratory waterfowl and songbirds.

The river corridor contains an uncommon old-growth white spruce forest community that is nourished by the Nowitna River's productive floodwaters and protected from wildfire by surrounding wetlands. These old-growth forests provide nesting areas for raptors and some of the best marten habitat in Alaska.

The refuge contains a mixture of mature forest and early successional plant communities that provide excellent moose habitat. Moose abundance is highest along the river corridor, which in turn sustains increased populations of predators. Beavers are numerous in the river and adjacent oxbow lakes.

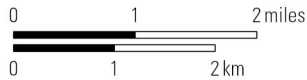
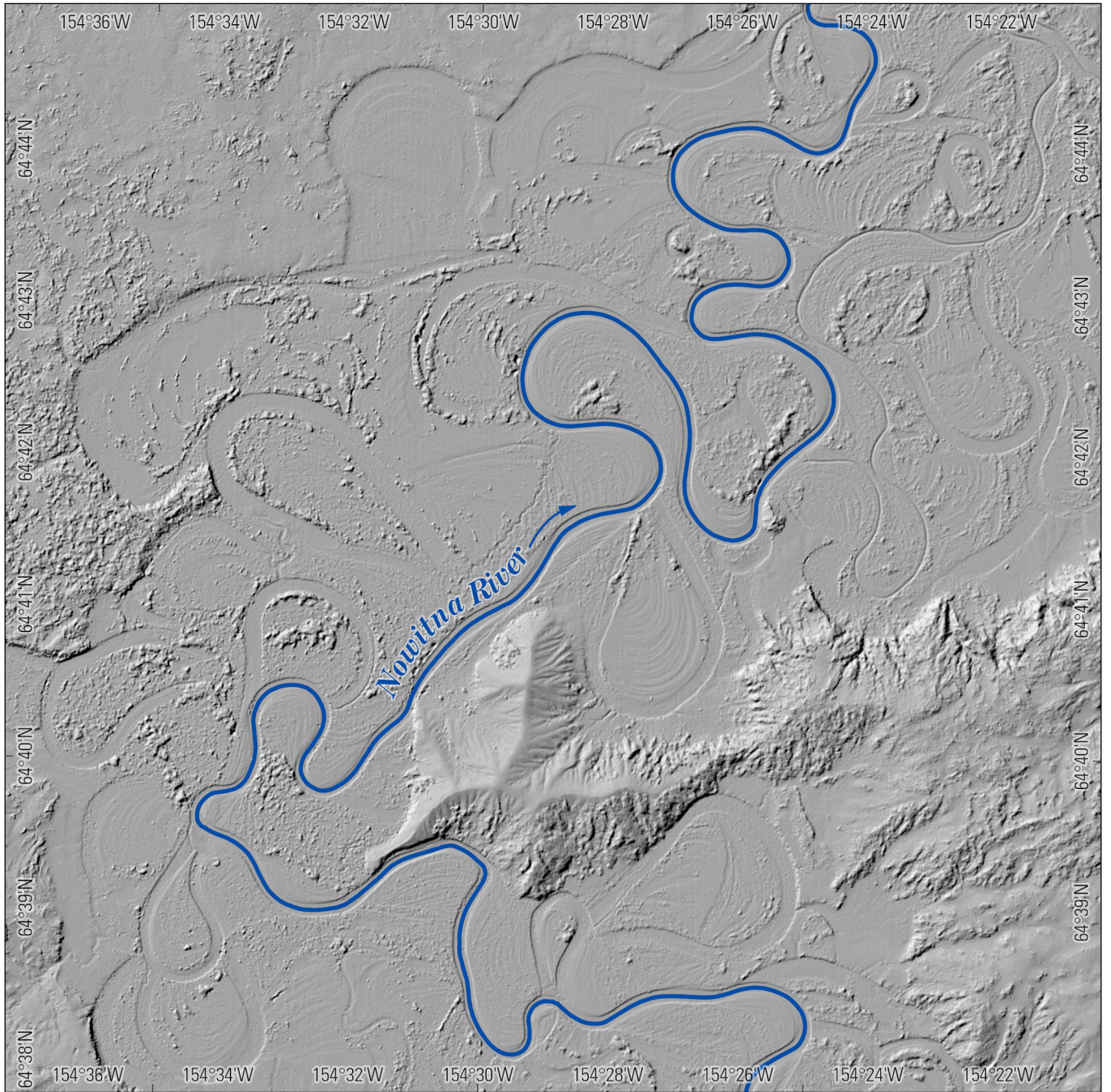
At this time, there are no federally listed threatened, endangered, or sensitive plants or animals in the Nowitna NWR. However, the Nowitna NWR has several continental birds of conservation concern, including Lesser Yellowlegs, Short-eared Owl, and Olive-sided Flycatcher (USFWS 2021). Both the Lesser Yellowlegs and Olive-sided Flycatcher are associated with wetlands and riparian areas within the Nowitna WSR corridor. The Lesser Yellowlegs inhabits open boreal forest interspersed with wetlands, lakes, ponds, and wet meadows. The Olive-sided Flycatcher exists in mature spruce forests near habitat edges such as burns and riparian areas. Short-eared Owl uses large, open areas such as grass lakes and meadows.


Figure A3: Digital Elevation Model

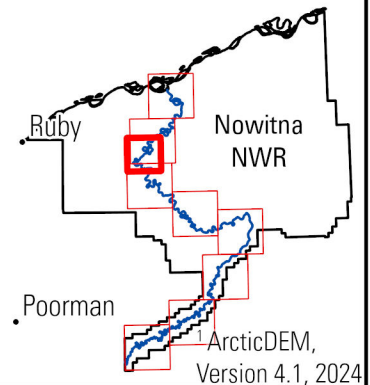


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Alaska

Nowitna Wild & Scenic River



 Nowitna WSR segment



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The Nowitna WSR corridor may be home to the rare Alaska tiny shrew. Four of the first known Alaska specimens of tiny shrew were collected in the Nowitna NWR (Dokuchaev 1997). Weighing under 2 grams, this is among the smallest known mammal species in the world. The Eurasian tiny shrew is known to be widespread but scarce across Scandinavia and northern Asia to the Bering Strait. A morphological comparison of Alaska specimens to Eurasian tiny shrew from several Russian collections suggest that the Alaska variety may be a distinct species (Dokuchaev 1997). The shrew currently has a statewide conservation priority level of V (orange), indicating “unknown status and either high biological vulnerability or high action need” (Gotthardt et al. 2012).

Vegetation

The Nowitna NWR consists primarily of black spruce forests, wetlands, ponds, and streams; benchlands; and foothills. The acres of land cover types for the Nowitna WSR corridor are described in **Table A-2** and shown in **Figure A4**.

Riparian vegetation is dominated by willow, cottonwood, and white spruce. Common riparian vegetation includes willow and alder thickets along gravel bars at the water’s edge, stands of cottonwood trees higher on the banks, and bands of white spruce varying in width on the higher banks. Stands of paper birch and quaking aspen often mix with the white spruce forest along the river corridors. Of the land cover types in the Nowitna WSR corridor, all seral stages of terrestrial and aquatic habitats are represented in the Nowitna River floodplain.

Table A-2. Acres of Land Cover Types in the Nowitna WSR Corridor

Land Cover Class Level II/III/IV	Surface Area within Nowitna WSR Corridor *					
	Level II		Level III		Level IV	
	Acres	Percent of Cover	Acres	Percent of Cover	Acres	Percent of Cover
I.0 Forest	107,223.97	87.65%				
I.1 Closed Needleleaf			731.23	0.60%		
I.2 Open Needleleaf			42,487.14	34.73%		
I.21 Open Needleleaf Lichen					3,239.61	2.65%
I.3 Woodland Needleleaf			18,842.20	15.40%		
I.31 Woodland Needleleaf Lichen					3,045.95	2.49%
I.4 Closed Deciduous			22,244.61	18.18%		
I.41 Closed Paper Birch					15,737.31	12.86%
I.42 Closed Aspen					0.00	0.00%
I.43 Closed Balsam Poplar/Cottonwood					0.00	0.00%
I.44 Closed Mixed Deciduous					1,632.37	1.33%
I.5 Open Deciduous			333.86	0.27%		
I.51 Open Paper Birch					93.37	0.08%
I.52 Open Aspen					0.00	0.00%

Land Cover Class Level II/III/IV	Surface Area within Nowitna WSR Corridor *					
	Level II		Level III		Level IV	
	Acres	Percent of Cover	Acres	Percent of Cover	Acres	Percent of Cover
1.53 Open Balsam Poplar/Cottonwood					0.00	0.00%
1.54 Open Mixed Deciduous					19.48	0.02%
1.6 Closed Mixed Needleleaf/Deciduous			19,951.83	16.31%		
1.7 Open Mixed Needleleaf/Deciduous			2,633.08	2.15%		
2.0 Shrub	8,806.58	7.20%				
2.1 Tall Shrub			1,280.94	1.05%		
2.2 Low Shrub			7,398.33	6.05%		
2.21 Low Shrub Willow/Alder					0.00	0.00%
2.22 Low Shrub Tussock Tundra					2,246.38	1.84%
2.23 Low Shrub Lichen					187.26	0.15%
2.24 Low Shrub Other					0.00	0.00%
2.3 Dwarf Shrub			127.31	0.10%		
2.31 Dwarf Shrub Lichen					37.59	0.03%
2.32 Dwarf Shrub Other					0.00	0.00%
3.0 Herbaceous	2,012.11	1.64%				
3.1 Bryoid			353.20	0.29%		
3.11 Lichen					0.22	0.00%
3.12 Moss					352.97	0.29%
3.2 Wet Herbaceous			828.35	0.68%		
3.21 Wet Graminoid					477.51	0.39%
3.22 Wet Forb					0.00	0.00%
3.3 Mesic/Dry Herbaceous			830.57	0.68%		
3.31 Tussock Tundra					198.36	0.16%
3.32 Mesic/Dry Sedge Meadow					67.42	0.06%
3.33 Mesic/Dry Grass Meadow					364.90	0.30%
3.34 Mesic/Dry Graminoid					38.05	0.03%
3.35 Mesic/Dry Forb					99.41	0.08%
4.0 Aquatic Vegetation	141.77	0.12%				
4.1 Aquatic Bed			10.03	0.01%		
4.2 Emergent Vegetation			131.76	0.11%		
5.0 Water	3,929.13	3.21%				
5.1 Snow			0.00	0.00%		

Land Cover Class Level II/III/IV	Surface Area within Nowitna WSR Corridor *					
	Level II		Level III		Level IV	
	Acres	Percent of Cover	Acres	Percent of Cover	Acres	Percent of Cover
5.2 Ice			0.00	0.00%		
5.3 Clear Water			2,576.78	2.11%		
5.4 Turbid Water			1,352.34	1.11%		
6.0 Barren	216.83	0.18%				
6.1 Sparsely Vegetated			197.84	0.16%		
6.2 Rock/Gravel			18.99	0.02%		
6.3 Mud/Silt/Sand			0.00	0.00%		
9.0 Cloud/Shadow	0.00	0.00%				
9.1 Cloud			0.00	0.00%		
9.2 Shadow			0.00	0.00%		
10.0 Other	0.00	0.00%				
TOTALS	122,330.39	100.00%	122,330.39	100.00%	27,838.16	22.76%

Source: Bureau of Land Management et al. 2002

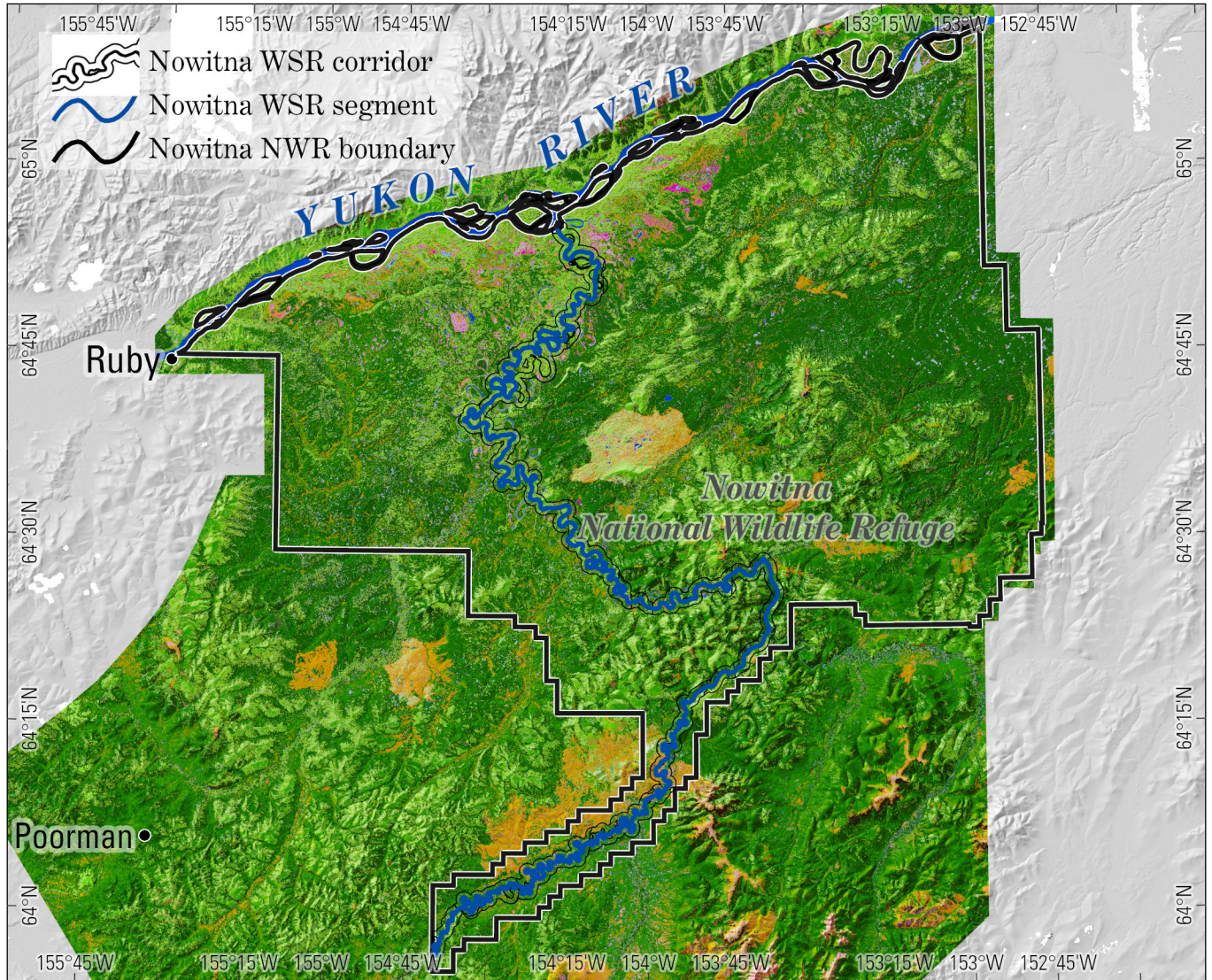
Note: * Includes acreage only within public (FWS) lands within the WSR corridor. Does not include acreage within private lands.

Figure A4: Land Cover¹



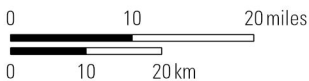
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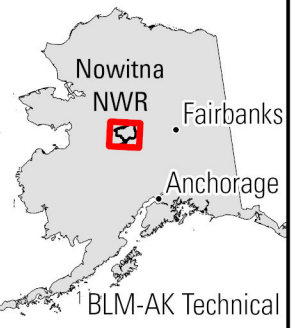


Level III Classification

- | | |
|-------------------------|--------------------------|
| 1.1 Closed Needleleaf | 3.1 Bryoid |
| 1.2 Open Needleleaf | 3.2 Wet Herbaceous |
| 1.3 Woodland Needleleaf | 3.3 Mesic/Dry Herbaceous |
| 1.4 Closed Deciduous | 4.1 Aquatic Bed |
| 1.5 Open Deciduous | 4.2 Emergent Vegetation |
| 1.6 Closed Mixed | 5.3 Clear Water |
| 1.7 Open Mixed | 5.4 Turbid Water |
| Needleleaf/Deciduous | 6.1 Sparsely Vegetated |
| 2.1 Tall Shrub | 6.2 Rock/Gravel |
| 2.2 Low Shrub | 9.2 Shadow |
| 2.3 Dwarf Shrub | |



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BLM-AK Technical
 Report 23, 2002

Wetland vegetation is site specific and varied. Refuge wetlands include upland basins, ice-formed lakes on the flats, river-flooded lowlands, oxbow lakes, and bog lakes. One or more of 12 species of pondweed occur in almost all lakes. A variety of forbs grow on recently exposed soils along river shorelines.

Black spruce is the dominant tree species followed by white spruce, paper birch, quaking aspen, and balsam poplar. While there are pure stands dominated by a single tree species, stands typically mix and grade into one another, depending on the underlying soil type, presence of permafrost, elevation, and slope aspect (Burkart et al. 2023).

The herbaceous vegetation type is dominated by grasses, sedges, and flowering plants that are common to interior Alaska ecosystems. The herbaceous communities along steep slopes in the canyon area appear to be unique, but they are not well studied.

Unusually dense and extensive stands of larch occur in areas along the Nowitna River, particularly in the upper and middle portions, where they flourish due to the unique chemistry of the Nowitna River's water. Limestone from bedrock in the river's headwaters is deposited in the floodplain during flood events and fosters the growth of larch. Larch-dominated forest communities such as this are rare statewide. Larch is a species of conservation concern in Alaska due to both the drastic population reductions caused by recent infestations of invasive, nonnative insects, such as larch sawfly and eastern larch beetle (Rozell 2007; Holsten et al. 2008), and the geographic and potentially genetic separation of the Alaska population from the North American population (Boggs et al. 2019). The associated Larch Wetland Biophysical Setting is considered rare statewide and is classified as vulnerable (Boggs et al. 2019).

Notable mature white spruce stands are found along the Nowitna WSR, particularly in the lower portions and near its confluence with the Yukon River. White spruce is an ecological specialist that shows evidence of high vulnerability to climate change. Large stands of mature white spruce, such as those found in the Nowitna WSR corridor, are becoming increasingly less common in Alaska. The species appears to be affected by climate dynamics, including changing temperature and precipitation patterns, fire regimes, and other environmental variables. In interior Alaska, stands of old-growth white spruce growing on well-drained alluvial and riparian soils are relatively rare. The associated White Spruce Floodplain Old-growth Forest Biophysical Setting is considered rare statewide (Boggs, et al. 2019). Due to the demand for subsistence harvest of white spruce for house logs, there are additional management issues related to sustaining harvest while protecting ecosystems.

A.2.5.2 Fish

The Nowitna River supports a remarkably diverse assemblage of northern fish species. Also, it is a migration corridor to one of only six known sheefish spawning areas in Alaska. Thus, the Nowitna River provides fish habitat that is rare in the Arctic-Yukon-Kuskokwim Region. At least 19 fish species have been documented in the Nowitna WSR corridor, surrounding wetlands, and tributaries. The assemblage of fish species is dynamic; supports subsistence and recreational activities; and is sustained by a unique combination of water features, including swift water underlain by gravel, productive shallow lakes, and slow-moving (still) water in lower reaches.

This river specifically provides exceptionally high-quality foraging habitat and is a continentally important migration corridor for populations of Chinook, coho, and chum salmon (see salmon-use areas in **Table A-3** and **Figure A5**). Chinook salmon populations have significantly declined in recent years both in the Nowitna River and elsewhere in Alaska, but not enough is known about why this is occurring and whether the trend will continue.

Table A-3. Salmon-Use Areas

River	Distance (Miles)
Lost River	1.457
Nowitna River	210.001
Sulatna River	0.790
Sulukna River	1.549
Titna River	0.555
Unnamed river	0

Source: ADFG 2024c

The Nowitna WSR and its tributaries are also important habitat for sheefish and other species of whitefish, as well as resident Dolly Varden, Arctic grayling, and northern pike. The sheefish that migrate up the Nowitna WSR to the Sulukna River are one of only six known spawning populations of sheefish in Alaska's Yukon River drainage. There could be a correlation between the sheefish spawning areas and upriver limestone deposits that affect water quality. Sheefish are among the most targeted subsistence and sport fishing species in the region. Like salmon, this species' migratory habits make refuge stocks susceptible to harvest impacts outside the NWR (USFWS 2009). The Nowitna WSR contains five other species of whitefish, including broad whitefish, humpback whitefish, round whitefish, least cisco, and, occasionally, Bering cisco. The abundant northern pike are also important for recreational sport fishing in the Nowitna WSR.

The use of the Nowitna WSR by various fish species is slightly different above and below the Little Mud River. Above the Little Mud River, the headwaters and tributaries (Susulatna, Sulukna, and Titna Rivers) of the Nowitna WSR watershed harbor critical spawning and rearing habitat for both anadromous and freshwater fish species. The river's upper section also provides suitable habitat for Arctic grayling and resident Dolly Varden. Below the Little Mud River, the lower section of the Nowitna WSR supports summer foraging and overwintering habitat for multiple spawning populations of fish, including sheefish. The shallow floodplain lakes, marshes, and oxbows are uniquely important habitats that provide slack water for foraging on smaller prey fish and provide spring spawning lakes for northern pike.

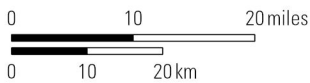
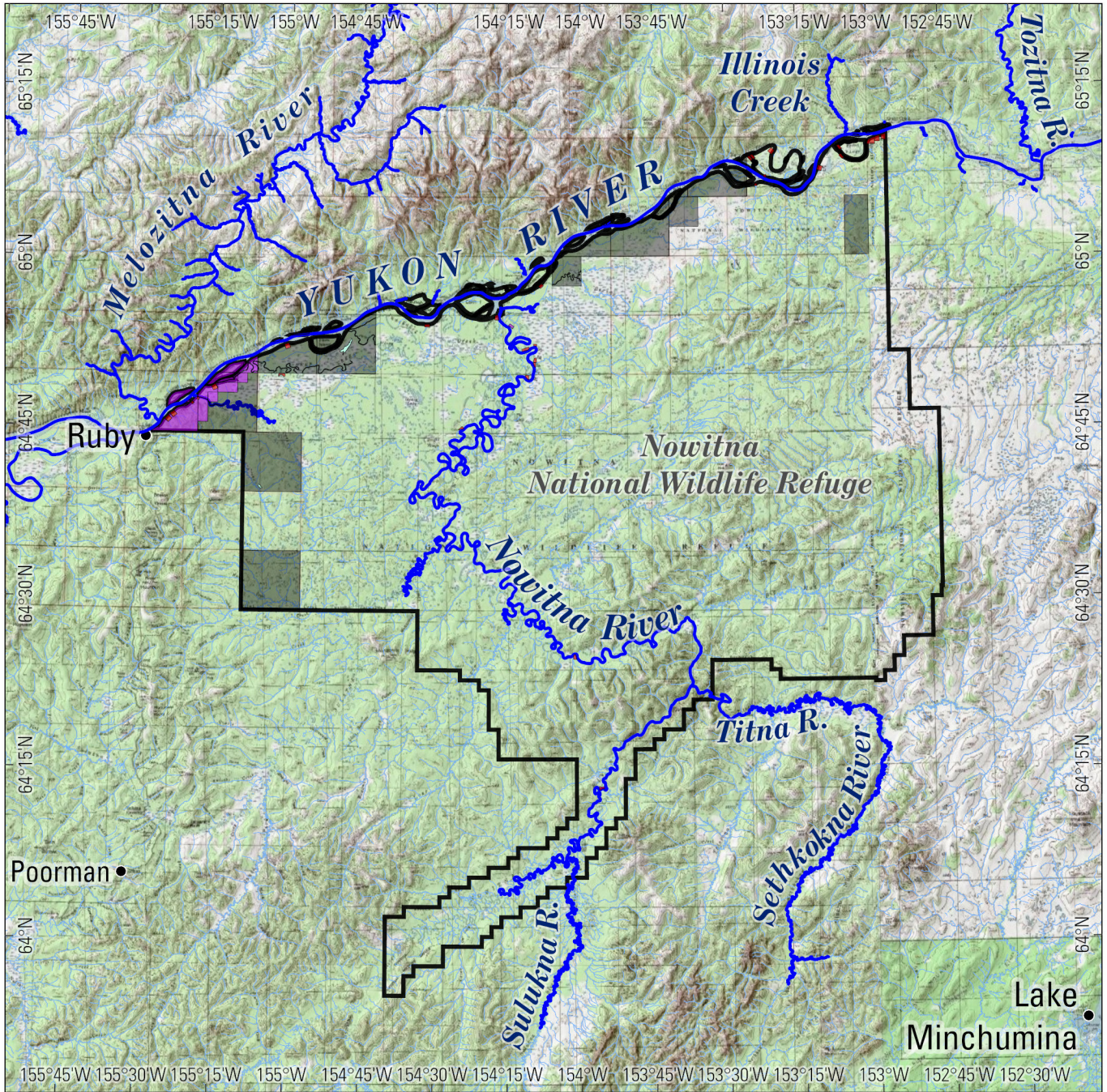
The Nowitna WSR and its unique nature provide valuable in-river habitat and a vital connection to upstream spawning habitats for a large diversity of fish species. The excellent water quality and natural seasonal patterns of dynamic flow regimes contribute to this remarkable diversity and abundance of fish. The river's role in the life cycles of such a diversity and abundance of fish, particularly sheefish, is exceptional and rare to find anywhere else in Alaska.






Figure A5: Salmon-Use Areas¹



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-  Salmon use areas
-  Nowitna NWR boundary
-  Patented native allotment
-  Patented ANCSA village corporation
-  Patented ANCSA regional corporation



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¹ ADF&G Anadromous Waters Catalog, 2024

A.2.5.3 Cultural

Though the Nowitna WSR is constantly changing, the human relationship to the river and its resources has remained remarkably constant over thousands of years. The deep heritage and diverse cultural contributions that have developed through human use of the river are part of a long continuum extending from the distant past to future generations. The cultural ORV encompasses many aspects of the relationship between humans and the Nowitna WSR throughout time and includes activities such as boating, camping, hunting, and fishing in the river's remote, undeveloped setting. By encompassing the full range of human interactions with the Nowitna WSR and its resources in the past, present and future the cultural ORV recognizes an enduring relationship between humans and the environment that is exemplary in the state.

Currently, most activity on the Nowitna WSR is associated with hunting, especially moose, and fishing (pike and sheefish). Other activities include boating and canoeing, camping, rock collecting, wildlife observation, and photography. Trapping activities, which were the foundation of trade in earliest times, continue along the Nowitna WSR today. Gravel bars in the middle section of the river contain numerous agates that attract rock hunters. The Nowitna WSR provides a unique opportunity for public use because it is relatively close to Fairbanks and road access compared to other popular rivers, including the Koyukuk and Yuki Rivers, and other destinations farther down the Yukon River. There continues to be local dependence on resources such as fish, game, waterfowl, berries, and timber. The presence of all these resources is directly tied to the unique productivity of the Nowitna River's waters and the river-meandering action that produces a mosaic of wildlife habitats.

Because of the diversity and abundance of fish and wildlife residing in the river corridor and the unique proximity of the Nowitna WSR's headwaters and its tributaries to tributaries of the Tanana, Kuskokwim, and Innoko Rivers, the Nowitna WSR has long been an important location for travel, trade, recreation, and resource harvest for people from across Alaska. As a result, the Nowitna WSR is intertwined with a rich cultural history. Hunting, fishing, trapping, camping, and boat travel on the Nowitna River are culturally important activities passed down from those who depended on the river for survival thousands of years. Generations of Koyukon Athabascans, primarily from the communities of Kokrines, Tanana, and Ruby, once lived seasonally and year-round in the Nowitna River drainage. Families traveled the Nowitna River in all seasons, surviving by hunting, fishing, trapping, and gathering other necessities from the land and waters. Descendants of these families continue to spend time along the Nowitna River, nourished by and connected to the land and river as their ancestors were. Koyukon Athabaskan culture is built around a respectful relationship to the natural environment and its resources and honoring the wisdom and tradition of elders (see **Figure A6**). Traditional ecological knowledge continues to be passed on between generations, building a strong stewardship ethic among communities and cultures that rely on the Nowitna WSR. A strong cultural connection also exists for some Alaskans from other parts of the state who through their visits over many years have come to cherish the river and their connection to its environment.

Human cultural ties to the Nowitna River likely go back to some of the earliest human arrivals to Alaska. The long, unbroken cultural connection between people and the resources of the Nowitna WSR is exemplary for Alaska.

Figure A6: Koyukon Land Ethics

- The land is our source of life, thought and culture. You cannot separate the land from our culture and our people.
- Our knowledge of the land comes from experience and close observation, and the wisdom shared by our elders.
- This land is vast and seems uninhabited, but people have been here for thousands of years, living from the land, learning from it, and being part of it. Always leave camping places clean, take away any trash, and honor traditional care for the environment.
- Everything around us has life. The land, animals and plants have spirits that are aware of us. We live in community with other living things and recognize that they know more than we do. This is not superstition but a way of being in the world that has evolved over thousands of years, passed down from one generation to the next.
- Skill and knowledge are essential for hunting, but equally important is a hunter's favor with the animals. Everything in nature has a spirit that is aware and sensitive and can be offended. Animals will give themselves only to people who are humble and treat them with respect. If a person violates nature their luck may vanish.
- Animals understand words spoken from far away. A person must not speak about what they intend to harvest or be boastful about their catch.
- Anything that is harvested must be treated respectfully. Animals remain aware long after they are harvested and know how they are cared for. Do not touch or bother any living thing unnecessarily. Never harvest more than you can use or waste anything gathered.
- Never forget that animals and plants give themselves to you to provide life. Always be grateful that something took care of you. Show gratitude in appropriate ways, according to what is harvested.
- Respect and care for one another and share the harvest with other people in your family and community. Respect the traditional use areas of individuals and families and don't harvest anything from other people's use areas.
- Bring children with you out on the land. That is how they learn their culture and how to respect the land. Young people have to know how to take care of themselves if they break down. Be honest, tell the truth, and teach about your culture.
- Never forget that fish and animals give themselves to us to provide life. The land has fed and nurtured us from the beginning. We care for it in return. Always leave enough fish and animals to reproduce for the future.
- We must not take the earth for granted. We love and respect our land, and it takes care of us. In turn, we care for it to ensure that the plants, animals, water and air are healthy for future generations.

This summary was created in 2024 with the help of Koyukon Athabascan elders, including elders from Hughes, Huslia, Koyukuk, Galena and Ruby. Enaa baasee' (thank you very much).

Cultural Resources

Cultural resources in the Nowitna WSR corridor include traditional cultural properties, historic properties, and archaeological resources. The Service acknowledges that the spiritual, physical, cultural, and historical connections of Alaska Native peoples and their Tribes to land, wildlife, and waters are of cultural significance. Alaska Native peoples' customary and traditional ways of life sustain a Native identity experienced through activities, oral tradition (including place-names), ceremonies, songs, and dances, as well as an economy of sharing (USFWS, n.d.). Within the Nowitna WSR corridor, traditional activities, such as subsistence harvest, and the settings in which these activities take place are of great importance to local communities. For some locals, there may be no distinction between prehistoric, historic, and modern interactions between people and the Nowitna River's resources; all can be seen as part of a long continuum that extends to future generations (USFWS 2024a).

The Nowitna River's location and abundant natural resources have drawn people to its banks probably since their arrival to the region in the late Pleistocene. The area of interior Alaska around Nowitna NWR was unglaciated during the end of the last ice age, and paleontological remains from prehistoric animals, including mammoth, can be found within the river corridor and along the Yukon River main stem nearby. The presence of these prehistoric animals and the relatively close proximity of the highly valued Batza Tena obsidian source (approximately 140 miles north of the Yukon River) could signal that the Nowitna WSR was a hunting or scavenging ground and corridor to lithic raw material for some of the first inhabitants in the area. Little archaeological work has been conducted in the river corridor to date, but it is possible that archaeological resources dating far back in time may be located within the WSR corridor (USFWS 2009). Due to the meandering nature of the area's streams, many older sites may already have been destroyed or covered by natural causes. There is a high likelihood of finding more recent sites on present stream banks, but older sites probably only remain on higher ground.

The Nowitna River was an important hunting area and travel corridor for Athabascan residents for many generations prior to the arrival of Europeans. In 1867, explorers Whymper and Dall from the Scientific Corps of the Western Union Telegraph Expedition visited an important trading site and settlement called Noghÿkkaakk'et²¹ at the mouth of the Nowitna River (de Laguna 2000). At the time Noghÿkkaakk'et was a substantial village of some 150 residents and was a gathering place for trade among people coming from both the Yukon and Kuskokwim watersheds. Gregory Hakorcins (later changed to Kokrines), a Russian or Creole trader, established a trading post at Fourteen Mile in 1869. Hakorcins subsequently moved his post to the site on the Yukon River currently known as the Kokrines. This move resulted in the move of the entire village of Noghÿkkaakk'et (Hart 1981).

Jesuit scholar Father Jules Jetté recorded 212 Koyukon (Denaakk'e)²² place-names on the Nowitna (Nogheetno') River and its tributaries in the early 1900s when he lived in the area (Jetté 1910). At that time, seasonal residents of the Yukon River communities of Kokrines (or Bek'edeneekk'eze Denh) and Mouse Point (or Deeltsaa'e Nooghoyeet) spent the fall and winter months in the Nowitna River region, coming to the Yukon River for fishing in June and July, and for the midwinter feast in December. Some Denaakk'e names for villages and river features are shown in **Figure A7**.

²¹ Published spelling variants include: Newicargut, Noghee Kkaakk'et, Noghÿ Kkaakk'et, Novikakat, Nowikakat, Noya-kakat, and Noyokakat.

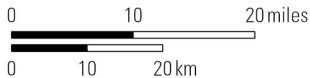
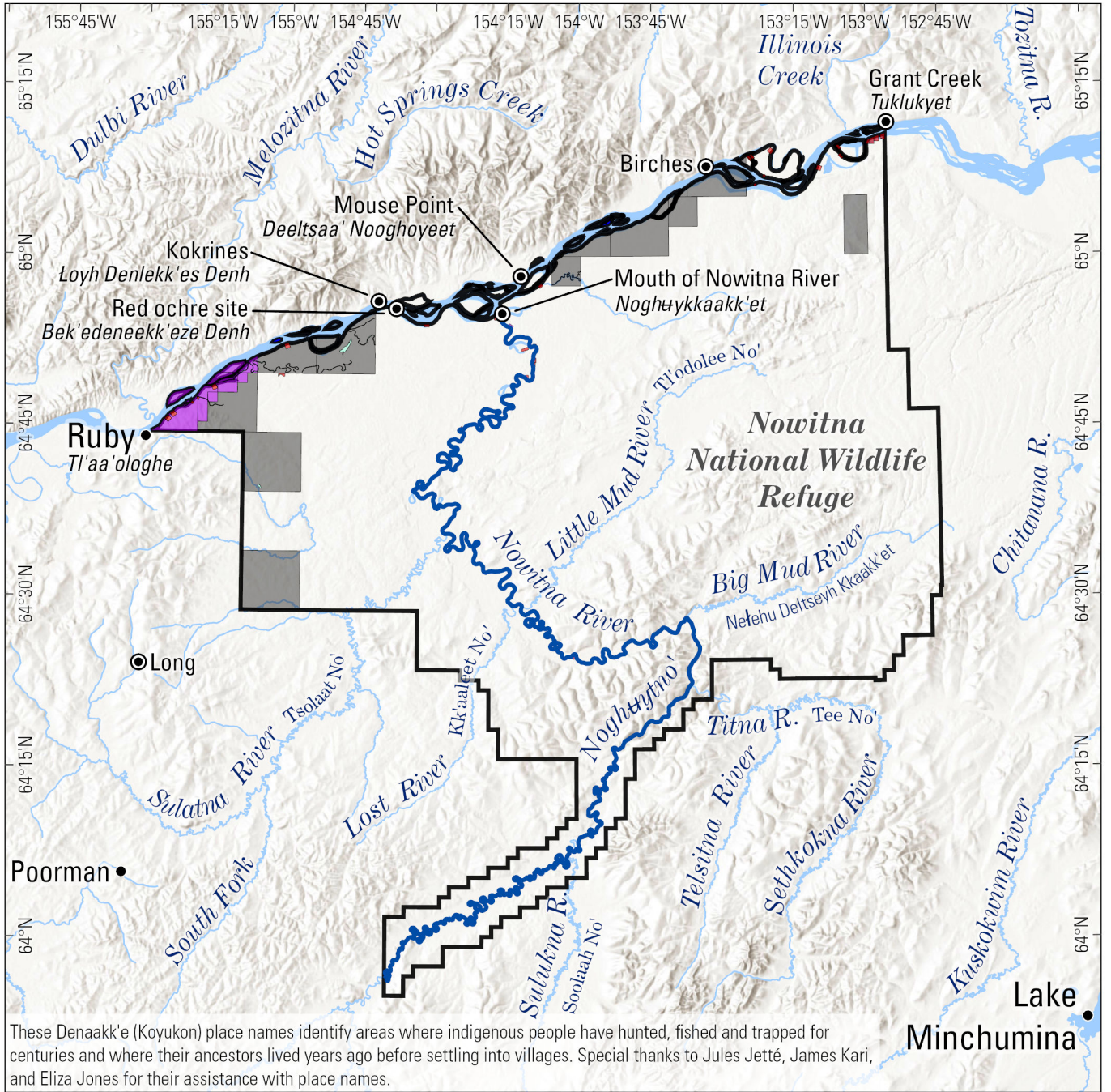
²² Denaakk'e is the language of the Koyukon Athabascan people.






Figure A7: Denaakk'e Place-Names



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 Alaska

Nowitna Wild & Scenic River



-  Nowitna NWR boundary
-  Nowitna WSR segment
-  Patented native allotment
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The discovery of gold near Ruby in 1907 triggered an influx of outsiders to the area, primarily to mining areas to the west of the Nowitna River (Hart 1981). Residents of Kokrines gradually moved downriver to the village of Ruby as it grew; by the 1950s, Kokrines no longer had year-round residents. Gold mining opportunities around Ruby waned by the 1920s, and many of the miners left the area to fight in World War I. Many remaining residents shifted their focus again to trapping for income. Trappers using the Nowitna River area generally outfitted at Tanana or Ruby and got their supplies to their base camps during open season by poling their boats up the river. They would bring out their furs in the spring by the same means following breakup (USBOR 1973). Despite this increase in trapping activities, local use of the Nowitna River resources never again reached the level that existed while people lived in Kokrines.

In more recent years, numerous studies and oral histories have documented the importance of the Nowitna River and its resources to the local Koyukon Athabascan people (for examples, see Brown et al. 2010 and the Oral History Program at the University of Alaska Fairbanks²³). Subsistence culture and economies are adaptive by nature; therefore, use patterns have shifted over time, yet the Nowitna WSR remains culturally important to area residents as it has for thousands of years.

The surveyed portion of the WSR corridor contains two documented archaeological resources. One is a historic-aged cabin on a Native allotment²⁴ within the Nowitna WSR. The other is Noghuykkaakk'et, the settlement and trade center near the confluence of the Nowitna and Yukon Rivers (AHRS 2023). It is likely that many more archaeological sites remain undocumented within the corridor. Based on what is known about the cultural resources present in the corridor (both archaeological resources and those related to traditional use), there is great potential for locations within the WSR corridor to be determined eligible for inclusion on the NRHP, especially as they are documented further.

Subsistence Resources

In 1980, Congress passed ANILCA, which established the Nowitna NWR and designated the Nowitna WSR. One purpose of the refuge is to provide the continued opportunity for rural residents to stay engaged in a subsistence way of life (ANILCA Section 101(c)). Subsistence is regarded as a way of life rather than merely a recreational activity. The meanings of subsistence are based on a culture that has been shaped over the years by family traditions, religion, relationships with particular animals and places, and a preference for natural foods (USFWS 2009). ANILCA Title VIII provides provisions to ensure that public lands in Alaska are managed to provide the opportunity for continued subsistence uses on those lands. In accordance with federal agency responsibilities under ANILCA, the Service ensures that rural residents engaged in subsistence uses have the opportunity for continued subsistence uses on public lands, including within WSR corridors and NWRs.

The 1990 Nowitna NWR Fishery Management Plan identified Galena, Ruby, and Tanana as communities on the Yukon River near the Nowitna WSR for whom subsistence use at the refuge may be of great interest (USFWS 1990). While subsistence use area mapping often only captures a portion of the total use at any given time or by a given community, more recent ADFG subsistence use data confirm subsistence use by Galena (ADFG 2010b), Ruby, and Tanana residents within and around the Nowitna

²³ <https://library.uaf.edu/aprca/oral-history>

²⁴ Alaska Native allotment is defined as a parcel or parcels of land totaling up to 160 acres, conveyed by restricted deed to an Alaska Native under the terms and conditions of the Alaska Native Allotment Act of 1906 (and 1956 amendment) and the Alaska Native Veteran Allotment Act of 1998 (43 USC 357, 357a, 357b).

WSR (ADFG 2021). While Galena, Ruby, and Tanana are communities in the immediate vicinity of the Nowitna WSR, there may be additional communities that use the Nowitna NWR and WSR for subsistence purposes. This section provides an overview of the current level of subsistence use within the Nowitna WSR corridor using best information available directly from potentially affected subsistence communities, state and federal sources, and literature.

Based on studies by the ADFG, a wide variety of fish, wildlife, and vegetation are harvested by subsistence users in these communities for many purposes, including food, fuel, arts and crafts, tools, clothing, and traditional cultural practices. Of note is that the subsistence use areas described in these studies and summarized below represent subsistence use for a segment of the population at the time of the study; subsistence use is also likely to occur outside the mapped subsistence use areas. A brief overview of subsistence use patterns for Galena, Ruby, and Tanana residents is provided below.

Galena is important as a regional service hub and population center and as the site of the refuge's headquarters. Residents in Galena rely on the Koyukuk and Nowitna NWRs for subsistence resources (USFWS 2009). Residents in Galena mainly gather subsistence resources along the Koyukuk and Yukon Rivers and their tributaries. Subsistence food sources include salmon, whitefish, pike, waterfowl, moose, and berries. Large mammal hunting by Galena residents focuses mainly on moose, although bear and caribou are taken, when available (USFWS 2009). Comprehensive community surveys indicate that for the community of Galena, moose, Chinook salmon, summer chum salmon, fall chum salmon, and coho salmon accounted for 79 percent of subsistence harvest in 2010. Galena residents harvest fish primarily from the Yukon River (USFWS 2009); however, some subsistence resource use areas for Galena residents lie within with the Nowitna WSR corridor. Subsistence harvests in the Nowitna WSR corridor by Galena residents include moose, fish, berries, and greens (ADFG 2010b).

Traditional Athabascan culture and subsistence practices are a focal point of life in Ruby (Alaska DCCED 2024b). Residents in Ruby mainly gather subsistence resources along the Yukon River corridor. However, the Nowitna River is also used for subsistence activities (USFWS 2009), and many Ruby residents have ancestral ties to the river (Brown et al. 2010). According to the Revised CCP, residents harvest moose, caribou, and black bear from the Koyukuk and Nowitna NWRs. Whitefish, sheefish, pike, and salmon are harvested by Ruby residents from the two NWRs by using fish nets or fish wheels, or both (USFWS 2009). According to 2010 ADFG community harvest data, for Ruby, salmon comprised the most pounds harvested, followed by large land mammals, non-salmon fish, plants and berries, small land mammals, and nonmigratory birds (ADFG 2010a). Areas used for subsistence by residents of Ruby include moose hunting areas along much of the Nowitna WSR corridor (ADFG 2010b). Areas recognized for subsistence harvest of small land mammals, berries, and greens are present in the north end of the Nowitna WSR corridor (ADFG 2010b).

Traditional Athabascan ways of life persist in Tanana, including gathering of subsistence resources. Residents in Tanana mainly harvest these natural resources along the Yukon and Tanana River corridors and their tributaries, including the Nowitna River (USFWS 2009). Residents primarily depend on moose and salmon, but they also harvest bear, caribou, non-salmon fish species, small game, berries, and other plant material, when available (USFWS 2009). According to 2014 ADFG community harvest data, salmon comprised the most pounds harvested for Tanana, followed by non-salmon fish, large land mammals, plants and berries, and migratory birds (ADFG 2014a).

Areas used by Tanana residents for subsistence include moose hunting areas along much of the Nowitna WSR corridor (ADFG 2014b). Ptarmigan and grouse hunting areas are also present near the Nowitna River (ADFG 2014b). Smaller areas on Nowitna River tributaries have historically been used and continue to be used by Tanana residents to harvest plants and berries (ADFG 2014b).

Recreation and Visitor Access

The Nowitna WSR corridor possesses a combination of high-quality, remote, and undeveloped recreational opportunities. The primary purpose of most recreational visits is moose hunting. Other recreational opportunities include wildlife viewing, motorboating and floating, camping, photography, hiking, environmental education and interpretation, and agate rock hunting (USFWS 2009).

Water levels and river character vary notably along the Nowitna WSR's length and throughout the seasons, adding variety to recreational opportunities and recreational interest. The river's upper portion is fairly swift and narrow (less than 250 feet wide). The coarse, graveled bottom of the upper and middle portions usually averages 1 to 2 feet deep or less along riffles, and up to 6 feet deep in pools, which provide enough volume for nonmotorized boaters, except during dry periods. The middle portion widens slightly (200–250 feet wide) and meanders, with numerous gravel bars but few oxbows, offering high-quality camping opportunities. Here, the Nowitna WSR flows through a recreationally appealing canyon where the channel straightens and large gravel, cobble, and bedrock are present on the river bottom. Below the canyon, the river slows and widens (200–450 feet wide), and the substrate is primarily sand and silt. The lower river meanders considerably, producing sandbars on the inside of bends, high cut banks on the outside of bends, and numerous sloughs and oxbow lakes. Stream depth in this location is quite variable, ranging from approximately 3 to 12 feet, with maximum depths up to 60 feet; this generally allows for motorized boating even in dry periods.

Summer access to the Nowitna WSR is generally via float plane or motorized boat from the Yukon River. Access by boat from the Alaska Highway System typically starts from the Dalton Highway Bridge located 140 miles north of Fairbanks on the Dalton Highway, or from Nenana, which is situated 55 miles south of Fairbanks on the Parks Highway. There is a boat launch and parking area just north of the Dalton Highway Bridge at milepost 56 of the Dalton Highway. The mouth of the Nowitna River is about 200 river miles downstream (ADFG 2024a). The Nowitna River mouth is approximately 365 miles downstream of Nenana and 210 miles downstream of the village of Tanana, where the Tanana and Yukon Rivers meet. Boaters typically launch from Nenana or the Dalton Highway Bridge, though in recent years it has become possible to launch from the end of the Tanana Road. The end of the Tanana Road is 50 road miles from Manley Hot Springs and 201 miles from Fairbanks. The Yukon and Tanana Rivers and lower 40 miles of the Nowitna River can be run by prop boats, if operated with caution. Winter access to the Nowitna WSR is typically by snowmachine or ski-equipped airplane.

There are no recreational facilities such as trails, roads, or other visitor amenities within the WSR corridor. Camping is allowed without permit, but camping at previously used sites is recommended (ADFG 2024a). There are several Native allotments, trapping cabins, and one administrative cabin located along the Nowitna WSR. However, most of these are not visible and generally do not detract from the river's wild character. Outside the moose hunting season and summer boat traffic on the Yukon River, visitors are unlikely to encounter each other (USFWS 2009).

Hunting

Wildlife harvest opportunities in the Nowitna WSR corridor include hunting seasons for moose, wolves, bears, grouse, ptarmigan, and waterfowl under both State and federal regulations. Harvest of furbearers occurs under State regulations. The Nowitna WSR corridor lies entirely within Alaska Game Management Unit 21B. By far the most popular of these harvest opportunities on the Nowitna WSR is fall moose hunting, which is available to both resident and nonresident hunters within the corridor. These hunts are managed through permits that include State registration, State drawing, and federal registration permits. There are three big game guide-use areas that include portions of the Nowitna WSR corridor. Only one of these guide-use areas currently has a permitted big game guide. Big game guides are required to report the number of clients, moose taken, and areas hunted (USFWS 2009).

Fall hunting activities along the Nowitna River are monitored at the Nowitna River moose hunter check station, which is typically operated between late August and October 1. This voluntary check station has occurred annually since 1988, and it documents the number of hunters, hunter residence, and harvest of moose, bears, and wolves. Refuge staff and volunteers run the station; in 2010 and 2012, the Friends of Alaska National Wildlife Refuge oversaw volunteer recruitment (FANWR 2010, 2012). Between 1988 and 2023, an annual average of 123 moose hunters checked in to the Nowitna check station, with a minimum of 82 and maximum of 208. The number of moose harvested has averaged 41. The smallest seasonal harvest was 19, and the greatest number harvested was 56. The average hunter success rate has been 32 percent, and has ranged between 18 and 44 percent (USFWS 2023).

Between 2003 and 2007, the moose population in Game Management Unit 21B was estimated to be approximately $4,049 \pm 1,600$ (ADFG 2024b). According to the Moose Trend Survey Summary (Bryant and Scotton, 2021), the Nowitna moose population has been stable at a low density. Trend counts in the WSR corridor indicate cow numbers have declined in recent years and are well below average. Bull abundance is also down but considered healthy. Calf production and survival to fall improved in 2021 compared to a poor year in 2020, and are considered average. No additional hunting opportunities are warranted based on moose trend surveys, and a population estimate may be necessary (Bryant and Scotton 2021). In 2023, there was no winter moose hunt in Game Management Unit 21B due to hunting pressure and low population numbers (DOI 2023).

Trapping

Harvest of furbearers in the Nowitna WSR corridor is permitted under State trapping regulations. The Nowitna River corridor has been an important trapping area for centuries and was an important local source of income up until the past few decades. Most trapping is currently conducted by a few families with Native allotments or permitted cabins within or near the Nowitna WSR corridor.

Fishing

The most popular angling activity on the Nowitna WSR is fishing with rod and reel for northern pike and sheefish. Most sport fishing occurs within the lower 30 miles of the river and connected waters. In the past, the Service issued a small number of commercial use permits for guided fishing on the Nowitna WSR. Such permitted guides have primarily advertised opportunities to catch trophy-size northern pike. No permits have been issued since 2013.

A.2.5.4 Scenery

The scenery of the Nowitna WSR is exceptionally beautiful, diverse, and exemplary of an interior Alaska river. Over the course of only 220 miles, the river transforms from a narrow, swift, gravel-bottomed watercourse to a broad, meandering floodplain river before it joins the Yukon River. The region's varied topography, from wetland-dominated lowlands to low, rolling hills and tundra-capped mountains, intensifies the scenic beauty of this river while adding to the diversity of views. Seasonal changes weave a tapestry of color, shifting from the stark white of winter to the varied greens of spring and summer. Wildflowers flourish along the river's edge, creating swaths of vibrant hues. In autumn, deciduous foliage takes on gold, orange, and deep-red shades, with bright, golden larches and dark-green spruce standing out in sharp contrast. With the changing light of shifting clouds and dynamic weather, the result is a visual backdrop that is never the same from one moment to the next. The remote wilderness qualities and dominance of scenery untouched by human structures contribute to this stunning visual impact.

In the Nowitna WSR's upper portion, the relatively fast-flowing, narrow waterway skirts the base of low hills and striking bedrock bluffs. The intimacy of the upper river gives way to the power of swift water flowing in a broader channel in the river's middle portion. The breathtaking backdrop of tundra-capped mountains is a stark reminder that this river is exemplary of the interior Alaskan sub-Arctic, a wild, desolate, and often harsh northern environment.

Also in the middle section, and arguably the most visually distinct section of the river, lies the majestic Nowitna River Canyon. Here, steep, gravelly hillsides drop down to flat, grassy banks cut by numerous streams and small waterfalls. In summer, wildflowers line the shore, hinting at a subtle shift in vegetation in the canyon. Colorful pebbles, including numerous agates, are scattered across the gravel bars, adding visual interest for visitors in the area. Below the Nowitna River Canyon, the Nowitna WSR is ever broadening, with wider river views. Surrounding hills give way to broad, open horizons. The current slows, silt and sand replace gravels, and river meanders create constantly changing cut banks and sandbars, oxbow lakes, and sloughs. The summer vegetation is lush, and the rich productivity of this floodplain is evident on every turn. The mountains of the Kokrine Hills can be seen to the north, and they increasingly dominate the horizon as the river moves toward its confluence with the Yukon River.

The entire Nowitna WSR corridor provides excellent examples of riparian and postfire succession and a variety of boreal habitats and landscapes. The watershed's remote wilderness qualities contribute to the impact of the visual experience. The presence of such outstanding scenic diversity over a relatively short distance is exceptional.

A.2.5.5 Conditions of Resources Related to the Outstandingly Remarkable Values

Throughout the CRMP's development, natural and cultural resources and environmental conditions beyond those defined as ORVs have been studied. Although these resources in and of themselves did not rise to the level of outstandingly remarkable, in many cases, aspects of them are related to the river values because of the interconnection between environmental and social relationships.

Soils and Permafrost

The Nowitna NWR has loamy, wet to well-drained floodplain soils in river valleys and loamy to very gravelly soils in the lowlands. The uplands in Nowitna NWR include loamy to very gravelly, well to poorly drained soils at the northern end of the uplands and very gravelly, well-drained soils at the southern end of the uplands (Burkart et al. 2023).

The Nowitna NWR consists of hydrologic soil groups A/D, B, B/D, and D, as defined by the Natural Resources Conservation Service (NRCS 2024; **Table A-4**). The Nowitna WSR corridor typically consists of hydrologic soil groups B and B/D, as shown in **Figure A8**. Group A/D soils have a very slow infiltration rate due to a high water table, but they will have high infiltration and low runoff rates if drained. Group B soils consist of deep, well-drained soils with a moderately fine to moderately coarse texture and a moderate rate of infiltration and runoff. Group B/D soils naturally have a very slow infiltration rate due to a high water table, but they will have a moderate rate of infiltration and runoff if drained. Group D consists of soils with a very slow infiltration rate and high runoff potential. This group is composed of clays that have a high shrink-swell potential, soils with a high water table, soils that have a clay pan or clay layer at or near the surface, and nearly impervious material overlaid with shallow soils (NRCS 2024).

Table A-4. Acres of Soil Groups in the Nowitna WSR Corridor

Soil Group	Area of Nowitna NWR Corridor (Acres)*
A/D	5,409
B	55,796
B/D	53,944
D	7,181

Source: NRCS 2024

Note: Includes acreage only within public (FWS) lands within the WSR corridor. Does not include acreage within private lands.

Soil texture and moisture are important in influencing ecosystem dynamics. Soils’ interaction with ground and surface water can result in natural changes to the water quality. Soils play a large role in the characteristics of the active permafrost layer. Gravelly soils tend to be well drained with deep, active permafrost layers; organic-rich soils tend to be poorly drained with shallow, active permafrost layers.

Permafrost

Permafrost is a layer of ground that remains frozen (at or below 32 degrees Fahrenheit [0 degrees Celsius]) for 2 years or more (Burn 2023). Permafrost development and persistence rely on a cold climate and are controlled by air temperature, hydrology, soil type, vegetation, disturbance, and snowpack. As such, vast layers of permafrost extend throughout Alaska. In some regions, permafrost tends to be continuous, while in other areas it may be discontinuous or absent. The presence or absence of permafrost in soils strongly controls soil development and hydrology in Alaska (Hinzman et al. 2006; Jorgenson et al. 2013). Thawing of permafrost can have significant impacts on ecosystems and hydrology, and is becoming more prevalent due to changes in climate (O’Neill et al. 2023). Permafrost thawing can result in increased erosion or subsidence, impacting water resources (O’Neill et al. 2023). Thawing can also release previously frozen carbon and methane deposits (O’Neill et al. 2023).

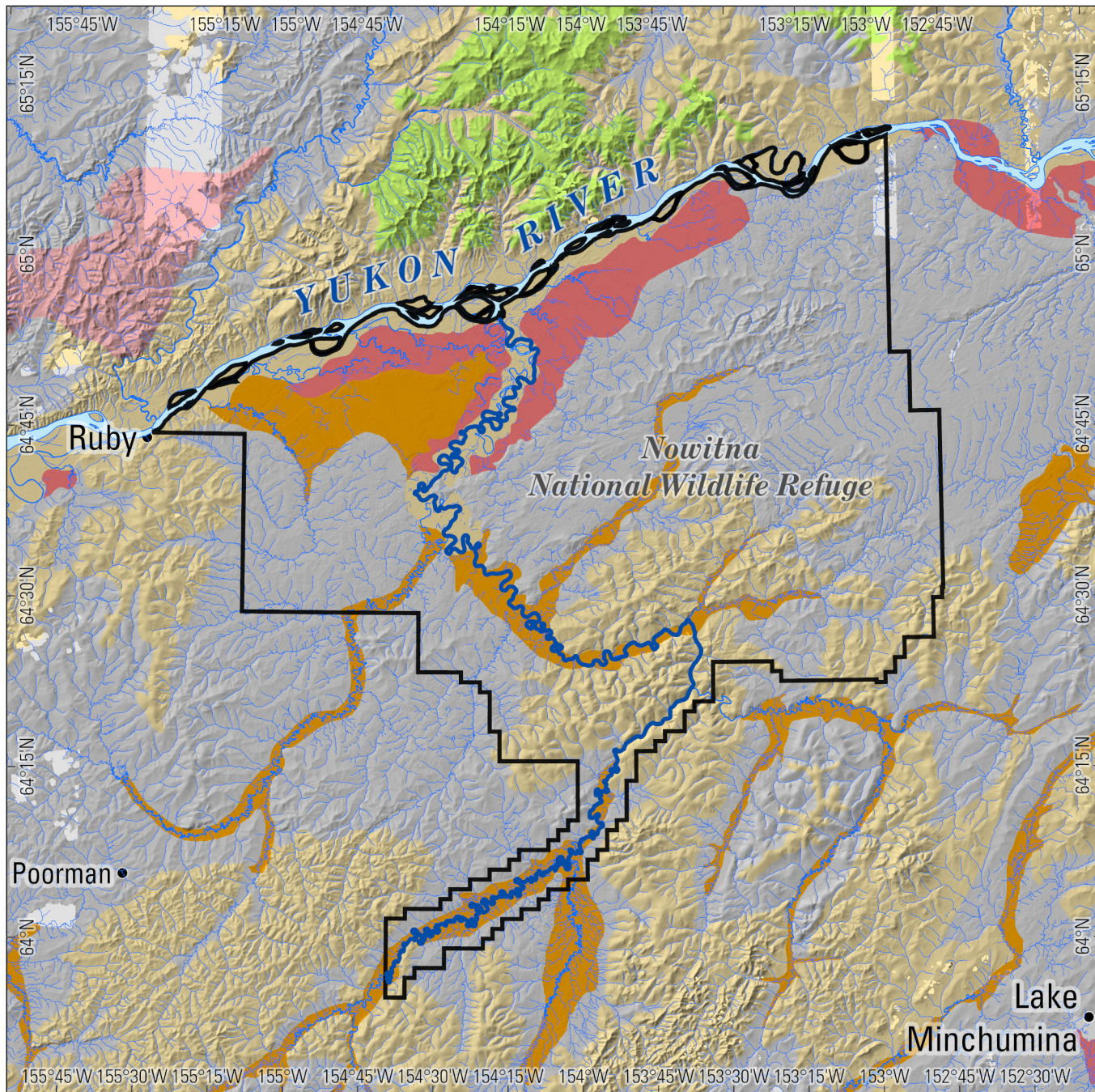
In Alaska, the interaction of hydrology and permafrost plays a large role in ecosystem dynamics. Lakes and wetlands are common in permafrost areas because the frozen ground inhibits seepage and holds water close to or above the surface. In areas with permafrost, wetland vegetation reduces erosion by preventing the warming and thawing of ice-rich soils. Abundant wetlands in the northwest boreal zone of North America result largely from cool, short summers with low evapotranspiration and an impermeable permafrost layer that prevents infiltration and impedes drainage of the upper, unfrozen layer (Ford and Bedford 1987).

Figure A8: Soil Groups¹



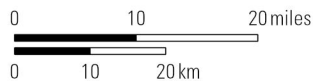
U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



Soil Hydrologic Group

- | | | | |
|--|-----------|--|-----------|
| | Group A | | Group C |
| | Group A/D | | Group C/D |
| | Group B | | Group D |
| | Group B/D | | |



- Nowitna WSR segment
- Nowitna NWR boundary



Produced in the Division of Realty
 Anchorage, AK
 Base Map Source: ESRI, Inc.
 Map Date: October 15, 2024
 Map ID #: 11-0064

Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

¹ USA SSURGO, November 2023

Permafrost can impede water infiltration and limit water flow, often leading to wet or saturated soil in the active layer²⁵ (Hinzman et al. 2005). In the absence of permafrost, surface soils tend to be well drained and dry. Thawing of near-surface permafrost can deepen the active layer, enhance infiltration, and lead to deeper water-flow paths in soils or below the permafrost (sub-permafrost). In some areas of continuous or discontinuous permafrost, groundwater can flow through taliks²⁶ in the permafrost.

Permafrost is thought to be discontinuous throughout Nowitna NWR (Jorgenson et al. 2008a). As shown in **Figure A9**, the permafrost layers are isolated along the Nowitna WSR corridor near the confluence with the Yukon River. The probability of permafrost absence is typically higher along major waterways (Burkart et al. 2023). In the Nowitna WSR corridor, there are an estimated 111,863 acres of discontinuous permafrost (91.4 percent) and 10,295 acres of isolated (5-10 percent frozen) permafrost (8.6 percent) (USFWS 2024c). This includes acreage only within FWS lands within the WSR corridor. It does not include acreage within private lands.

Climate Change

The Nowitna WSR corridor experiences extreme seasonal solar radiation variability due to its high-latitude environment. Daylight hours vary from a minimum of about 4 hours in winter to more than 20 hours in summer (UAF 2023). The Nowitna WSR corridor is inland with a continental climate (cut off from the ocean's moderating effects), which is characterized by large temperature variability, long and cold winters, warm and short summers, low humidity, and unpredictable precipitation. Summer maximum temperatures range from the upper 70 degrees Fahrenheit with extreme readings in the 90s. Winter temperatures may be minus 50 degrees Fahrenheit or lower for 2 or 3 weeks at a time. Lowlands experience frequent temperature inversions in winter (UAF 2023). Fairbanks, which is approximately 190 air miles east of the Nowitna WSR corridor, has some of the world's strongest inversions, sometimes 30 to 40 degrees Fahrenheit colder at the ground than at several hundred feet aboveground (Wendler and Philip Nicpon 1975).

Annual precipitation usually varies from about 10 to 30 inches, with upland areas receiving more precipitation than lower areas. The seasonal precipitation pattern is normally at a minimum in spring and at a maximum in late summer. Summer thunderstorms are common over the hills and upland areas. Climate also strongly influences fire severity and frequency, with the greatest aerial extent of burning occurring in the hottest, driest years.

Climate change refers to the change in the state of the climate, as determined by changes in its properties (such as temperature or precipitation) that persist for an extended period (IPCC 2018). Human activities, principally through greenhouse gas emissions, have unequivocally caused global warming (IPCC 2023). Global temperatures have increased by approximately 1.8 degrees Fahrenheit above preindustrial levels (IPCC 2023).

²⁵ Surface layer that thaws during summer

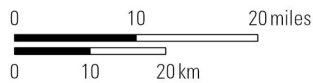
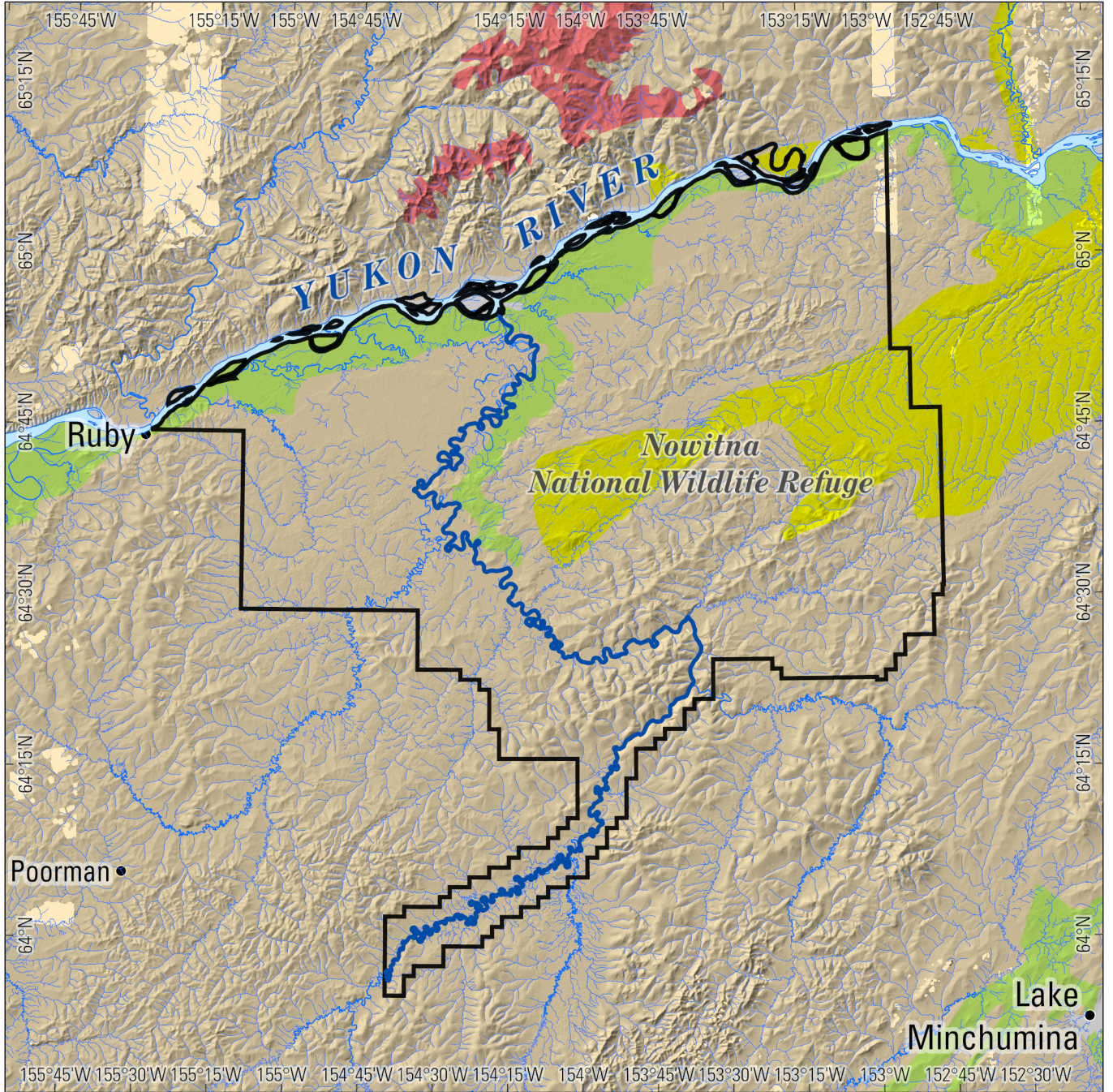
²⁶ A layer or body of unfrozen ground that occurs in permafrost due to an anomaly in thermal, hydrologic, or hydrochemical conditions

Figure A9: Permafrost Distribution¹



U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



Permafrost Distribution

- Continuous
- Sporadic
- Discontinuous
- Isolated
- Discontinuous, no terrain data

- Nowitna WSR segment
- Nowitna NWR boundary



Produced in the Division of Realty
 Anchorage, AK
 Base Map Source: ESRI, Inc.
 Map Date: October 15, 2024
 Map ID #: 11-0065

Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

¹Jorgenson, et al, 2008

Annual average temperatures across Alaska increased at a rate of approximately 0.7 degrees Fahrenheit per decade between the late 1970s and 2016 (Reidmiller et al. 2018), and they have increased by about 3 degrees Fahrenheit since 1925 (NOAA 2023). Statewide average temperatures in Alaska have been increasing at an accelerated rate since 2013, with the warmest and second-warmest years on record being 2019 and 2016, respectively (NOAA 2023). A 2019 summer heatwave brought record-high temperatures to southern and interior Alaska with daily high temperatures exceeding normal by more than 20 degrees Fahrenheit (Huntington et al. 2023). Most of the warming in interior Alaska since 1976 has occurred in winter (approximately 7.7 degrees Fahrenheit) and spring (4.4 degrees Fahrenheit), with the least amount of change (2 degrees Fahrenheit) in the fall (UAF 2023).

Subarctic-wide precipitation is increasing. While there was considerable interannual variability in average precipitation between 1950 and 2022, there was an increase of approximately 10 percent in annual total precipitation over this period, with more substantial increases in winter than summer (Moon et al. 2023).

Interior Alaska is expected to see some of the greatest changes by the end of the century. These changes include rising average annual temperatures by approximately 13 degrees Fahrenheit, with the greatest temperature increases happening during winter (by more than 20 degrees Fahrenheit; UAF 2024). Other changes include decreased water availability and increased fire activity resulting in greater dominance of deciduous trees on the landscape. Warming temperatures pose serious threats to interior Alaska, where average annual temperatures are just below freezing and a small increase in temperature can result in large impacts. Warmer temperatures and a longer growing season are expected to increase evapotranspiration enough to outweigh a regional increase in precipitation, resulting in drier conditions (Rupp and Springsteen 2009). By the end of the century, wildfires exacerbated by hotter temperatures and drier conditions are projected to triple in Alaska under a moderate greenhouse gas emissions scenario, and to quadruple under a high emissions scenario (Trainer et al. 2009).

Greenhouse gas emissions trap absorbed radiation and result in warming of the atmosphere. The principal greenhouse gas emissions from human activities include carbon dioxide, methane, nitrous oxide, and several trace gases. Emission inventories provide an overview of annual greenhouse gas emissions and impacts. The EPA indicates that in 2022, United States greenhouse gas emissions resulted in 6,343 million metric tons of carbon dioxide equivalent (CO₂e),²⁷ which is an increase of 0.2 percent from 6,329 million metric tons of CO₂e in 2021. State-level data, which are available until 2021, show Alaska's emissions were 37.9 million metric tons of CO₂e, which were 0.6 percent of national emissions (EPA 2024b).

Another indicator of climate change is the landscape's capacity for carbon sequestration. Carbon is absorbed (or sequestered) and stored in vegetation and soils (including permafrost). As vegetation grows, it absorbs carbon from the air and stores it in wood, in plant matter, and under the soil. Once vegetation is burned, harvested, or otherwise dies, it releases some carbon back into the atmosphere. Changes in permafrost conditions can also affect the rate of greenhouse gas release to the atmosphere.

²⁷ CO₂e is a common metric used to express overall greenhouse gas emissions from different types of greenhouse gases; it incorporates the relative contribution from each gas according to its radiative efficiency potential and how long it stays in the atmosphere. The CO₂e is the number of metric tons of carbon dioxide emissions with the same global warming potential as 1 metric ton of another greenhouse gas and it is calculated using Equation A-1 in 40 CFR 98.

Arctic permafrost stores large amounts of organic carbon (the remains of plants, animals, and microbes that lived and died over hundreds to thousands of years; Schuur et al. 2022). As permafrost temperatures continue to increase across the Arctic (Moon et al. 2023), permafrost threatens to release stored carbon to the atmosphere.

Air Quality

The Nowitna WSR corridor is in a remote and largely undeveloped area in interior Alaska, approximately 37 miles east of Ruby, Alaska. Although there are no long-term air quality monitoring stations in the Nowitna WSR corridor, based on regional monitoring and Service reports, existing air quality in the Nowitna WSR corridor is generally pristine. The primary exception is smoke and the associated particulate matter that can be present during summer months when wildfires from lightning strikes are common (ADEC 2021).

Human-caused and natural air pollution impair visibility and occasionally impact public health. The main contributors to human-caused air pollution throughout interior Alaska are incomplete burning of fossil fuels used in motor vehicles, heating systems, and generators; prescribed burn emissions; and smoke from wood stoves (ADEC and EPA 2018). In rural communities, seasonal dust from dirt roads also contributes to local air pollution. Human-caused pollution emissions emanating from nearby villages and the Ruby-Poorman Road may be transported into the Nowitna WSR corridor. Additionally, winter use of cabins located within or near the WSR corridor can cause localized reductions in air quality through emissions from wood stoves, generators, and snowmachines.

Other sources of air pollution in interior Alaska include windblown dust from open riverbeds and on rare instances, ash emissions from remote volcanic eruptions (Sassen et al. 2007; Schaefer and Nye 2008). Windy conditions along the Yukon River can produce dust when sandbars are exposed during low-water conditions in summer, winter, and early spring. High-altitude Arctic haze persists in spring and originates as dust, smoke, and human-caused pollution from parts of Asia and Europe (Shaw 1995). Due to the limited amounts of snow, rain, or turbulent air to displace pollutants from the polar air mass in spring, Arctic haze can linger for more than a month in the northern atmosphere.

The Clean Air Act, as amended in 1990, requires the EPA to set national ambient air quality standards (NAAQS; 40 CFR 50) for pollutants considered harmful to public health and the environment. The EPA established NAAQS for outdoor concentrations of the six criteria air pollutants, which include carbon monoxide, nitrogen oxides, ozone, particulate matter (including particulate matter less than 2.5 microns in diameter [PM_{2.5}] and particulate matter less than 10 microns in diameter [PM₁₀]), and sulfur dioxide.²⁸ Other pollutants of concern include volatile organic compounds, which are human-made chemicals that are used and produced in the manufacture of paints, pharmaceuticals, and refrigerants. Volatile organic compounds are a precursor to ozone; when released into the atmosphere, volatile organic compounds can react with nitrogen oxides in the presence of sunlight to form ozone.

The NAAQS include primary standards established to protect public health, including sensitive populations (such as children, the elderly, or asthmatics), and secondary standards to provide public welfare protection, including protection against decreased visibility and damage to animals, crops,

²⁸ For more information on current NAAQS, see the EPA web page: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>.

vegetation, and buildings. The ADEC Division of Air Quality is responsible for maintaining the NAAQS. This division may set standards that are equally or more stringent than the NAAQS.

Areas where air pollution persistently exceed the NAAQS are designated as “nonattainment” areas by the EPA. There are no nonattainment areas in the Nowitna WSR corridor. The nearest nonattainment area to the Nowitna WSR corridor is the Fairbanks-North Star Borough urban area (nonattainment for PM_{2.5} and maintenance²⁹ for carbon monoxide;³⁰ EPA 2023a), which is approximately 190 air miles east of the Nowitna WSR corridor.

The EPA provides guidance for modeling air quality impacts and recommends an analysis area that includes both local (within 62 miles [EPA 1992]) and regional (between 62 and 125 miles [EPA 1992]) areas. Regional air pollutant data are available for the Yukon-Koyukuk Census Area, in which the Nowitna WSR corridor is situated. However, due to the proximity of the Fairbanks-North Star Borough (which includes the Fairbanks-North Pole urban area), 2020 emission data for both geographic regions are shown below in **Table A-5**.

Table A-5. Air Pollutant Emissions (1,000 Tons) – 2020

Geographic Area	Carbon Monoxide	Nitrogen Oxides	PM ₁₀	PM _{2.5}	Sulfur Dioxide	Volatile Organic Compounds
Fairbanks-North Star Borough	1,299	17	131	110	9	323
Yukon-Koyukuk Census Area	418	21	32	26	2	538
Alaska	2,883	150	290	222	21	2,227
US (including Alaska)	66,152	8,915	16,781	5,821	1,841	46,187

Source: EPA 2023b

Emissions data from 2020 indicate that Yukon-Koyukuk Census Area emissions were a fraction of those reported in the Fairbanks-North Star Borough. Prescribed fire emissions for each criteria pollutant accounted for approximately 9 to 16 percent of emissions in Alaska. In the Yukon-Koyukuk Census Area, wildfires accounted for over 90 percent of the particulate matter and sulfur dioxide emissions and 74 percent of carbon monoxide emissions (ADEC 2021).

Invasive Species

Invasive, nonnative plant species pose a significant risk to ecological stability and integrity. Terrestrial nonnative plant species in Alaska have been given invasiveness scores based on ecological impacts, biological characteristics and dispersal ability, distribution, and feasibility of control (Carlson et al. 2008). Many nonnative plant species in Alaska are of limited concern due to their low capacity for rapid expansion in a natural setting. Such is the case for the following nonnative plant species currently known to exist in the Nowitna WSR corridor: lambsquarters in two places on the upper river and plantain in low numbers along both the upper and lower river. Nonnative plant species, including some that are considered highly invasive, occur more commonly in areas of human development, and human activities along the Nowitna WSR have the potential to transport unwanted species into the corridor. Nonnative plants observed in Ruby and/or along the Ruby-Poorman Road include the following species with

²⁹ Maintenance areas refer to current attainment areas that had been previously designated as nonattainment.

³⁰ See 40 CFR 81.302 at <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-81/subpart-C/section-81.302>.

relatively low invasiveness rank: common dandelion, pineapple-weed, common plantain, alsike clover, red clover, white clover, meadow foxtail, common timothy, and lambsquarters.

Species with higher invasiveness rankings, such as oxeye daisy, chokecherry, European bird cherry, and Siberian peashrub, exist in Ruby. Bird vetch has been observed along the Ruby-Poorman Road and Long Creek about 25 miles south of Ruby. Numerous nonnative plants have been observed in Galena, including lambsquarters, common chickweed, pineapple-weed, common plantain, common dandelion, alsike and red clover, common timothy, Siberian pea shrub, chokecherry, European bird cherry, white sweet clover, and bird vetch. Of these, white sweetclover and bird vetch are considered the most invasive (Carlson et al. 2008), and removal efforts are ongoing. Efforts to remove Siberian pea shrub, chokecherry, and European bird cherry are also being considered in Galena. Broadleaf cattails are native to some parts of interior Alaska; however, they are not found in this region except in the Galena area, where they may have been introduced for water treatment. They are now spreading to shallow lakes and wetlands near Galena.

The highly invasive plant species mentioned here, as well as others, are even more commonly found in larger communities across Alaska, including Fairbanks and Anchorage. Also found in other parts of the state, but not yet in this region, is the highly invasive aquatic Elodea. Monitoring for the presence of Elodea in waterbodies in the Nowitna WSR and surrounding region is ongoing.

Alaska Native Interests

Residents of the communities of Galena,³¹ Ruby,³² and Tanana³³ rely on subsistence resources within the Nowitna NWR and WSR corridor. The community of Tanana is on the north bank of the Yukon River near the confluence of the Yukon and Tanana Rivers and 90 miles upriver of the Nowitna River confluence. The community of Ruby is on the south bank of the Yukon River about 35 miles below the confluence of the Nowitna River. The community of Galena is on the north bank of the Yukon River about 85 miles downstream of the Nowitna River confluence.

Louden Tribe,³⁴ the Native Village of Ruby, and the Native Village of Tanana are federally recognized Tribes and are represented in part by Doyon, Limited (an ANCSA regional corporation) and the Tanana Chiefs Conference (an ANCSA nonprofit) (Alaska DCCED 2024a, 2024b, 2024c). The village corporation for Galena is the Gana-A'Yoo Village Corporation (Alaska DCCED 2024a). The village corporation for Ruby is the Dineega Corporation (Alaska DCCED 2024b). The village corporation for Tanana is Tozitna, Limited (Alaska DCCED 2024c).

The Alaska Native Allotment Act of 1906 allowed Alaska Natives to receive the title for 160 acres of land in Alaska. The Native Allotment Act was repealed in 1971, when ANCSA became law. Under ANCSA, in exchange for settling Alaska Native land claims, land and money were distributed to the Alaska Native corporations established by ANCSA.

³¹ The Denaakk'e name for Galena is Notaaalee Denh.

³² The Denaakk'e name for Ruby is Tl'aa'ologhe.

³³ The Denaakk'e name for Tanana is Hohudodetlaatl Denh.

³⁴ This designation has recently changed from Galena Village.

Alaska Native-owned lands and Native allotments are present throughout Alaska, and there are several Native allotments along the Nowitna River (USFWS 2009). **Figure A2.1** through **Figure A2.8** displays Alaska Native lands and Native allotments within the Nowitna WSR corridor. There are 780 acres of patented Native allotments across 9 allotments within the corridor. Dineega Corporation now owns one former Native allotment (80 acres), so the land is no longer classified as a Native allotment.

A.2.6 WSR Classification and Corridor Boundary

A.2.6.1 WSR Classification

When a river is added to the NWSRS, it is given a classification—wild, scenic, or recreational. These names have less to do with recreation, scenery, or wilderness, and more to do with measures of the level of development along the river at the time of designation. ANILCA added the Nowitna WSR to the NWSRS. The Nowitna WSR is classified as wild. As defined in Section 2(b) of the WSR, wild river areas are those rivers, or sections of rivers, that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and no significant known pollution to its waters. These represent vestiges of primitive America.

A.2.6.2 WSR Corridor Boundary

The WSR requires that each federally administered river in the NWSRS have a legally established boundary. Establishing a WSR boundary that includes identified river-related values is essential as a basis from which to provide necessary protection. ANILCA Section 606(a) states the boundary shall include an average of not more than 640 acres per mile on both sides of the river (measured from the ordinary high-water mark). The boundary shall not include any lands owned by the State or a political subdivision of the State, nor shall such boundary extend around any private lands adjoining the river in such manner as to surround or effectively surround such private lands. This CRMP amends the river corridor using current mapping capabilities that were not available when the Nowitna WSR was designated or at the time of CCP development (USFWS 1987a, 2009).

A.2.6.3 Boundary Establishment and Modification

Section 3(b) of the WSR requires publication of a Federal Register Notice of Availability of the boundaries and classification of designated rivers. The WSR corridor boundaries may be modified if it is determined that the existing boundaries are inadequate for protecting values for which the river was designated (for example, if the river has moved significantly outside of the existing boundaries). The boundaries and classifications, and subsequent boundary amendments, become effective 90 days after they have been forwarded to the President of the Senate and the Speaker of the House of Representatives (IWSRCC 2017).

A.2.6.4 Delineation

The corridor boundary of the Nowitna WSR was first described in the Nowitna CCP (USFWS 1987a). This description was based on the Public Land Survey System, whereby sections (1 square mile) and townships (aggregation of 36 sections) provide a foundation for legal descriptions of public and private lands. The Nowitna WSR corridor was described in terms of townships, sections, and aliquot parts (subdivisions of a section). Consequently, the corridor boundary was represented as a “stair-step” polygon comprised of a series of straight lines oriented in north–south and east–west directions (**Figure A10**). This corridor was roughly centered on the centerline of the Nowitna River and was of variable width with respect to the centerline. Some portions of the corridor boundary were a mile or more away from the centerline, and other portions of the corridor boundary were less than one-half mile from the centerline. As such, the Nowitna CCP description of the Nowitna WSR corridor was 18,044 acres larger than the maximum allowed by ANILCA Section 606(a).

To rectify the over-maximum acreage of the 1987 Nowitna WSR corridor, the Service used geographic information system software to create a digital representation of the corridor that adhered to the requirements of ANILCA Section 606(a). The multistage process is detailed in Attachment A and outlined in the steps below:

- 1) Create a polygon that follows the ordinary high-water mark of the extreme left and right banks of the Nowitna River.
- 2) From the polygon created in Step 1, generate a line that represents the centerline of the main channel of the Nowitna River.
- 3) From the polygon created in Step 1, generate buffer zones extending one-half mile outward from the extreme left and right banks of the Nowitna River. These one-half-mile buffer zones represent an area of 320 acres per linear river mile on each bank of the river, for an aggregate of 640 acres per linear river mile.
- 4) From the buffer zones created in Step 3, remove privately owned land and any land necessary to prevent privately owned land from being effectively surrounded.
- 5) Use the polygon created in Step 1 to remove the river from the polygon created in Step 4 to remove the river and islands that lie between the ordinary high-water mark of the extreme left and right banks of the Nowitna River.

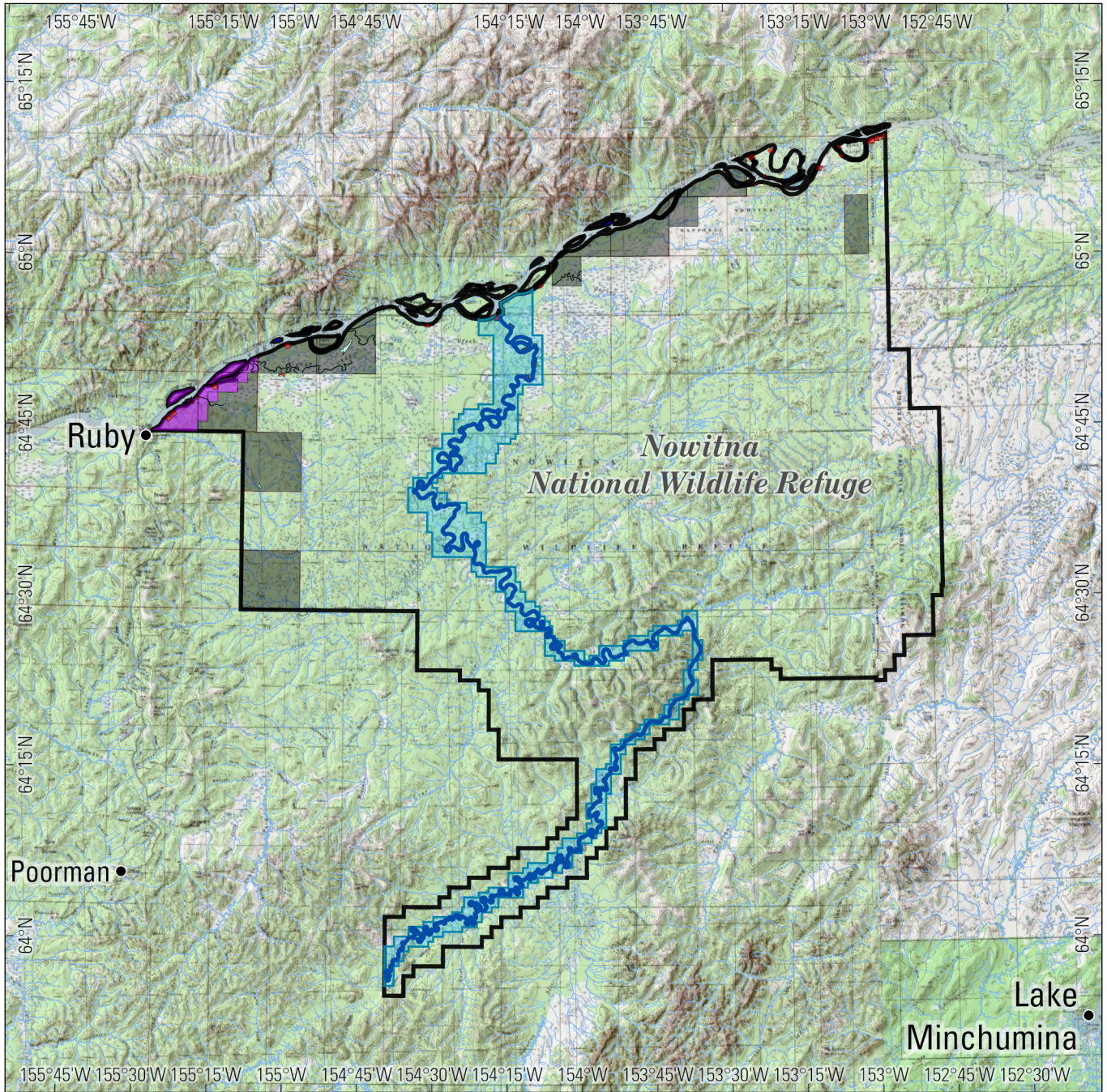
The resulting polygon (**Figure A1** above) represents a one-half-mile-wide corridor extending outward from the ordinary high-water mark of the extreme left and right banks of the Nowitna River and excludes private land parcels and the area of the river itself (IWSRCC 2017). The final polygon encompasses 122,330 acres; given the length of the centerline of the main channel of 220 miles, the final polygon is 18,776 acres less than the maximum allowed area of 141,106 acres. This acreage deficit is due to the meandering course of the Nowitna River, which results in areas where the one-half-mile-wide buffer zones overlap, thus reducing the overall acreage. This updated corridor encompasses all river-related values while adhering to the acreage limit stipulated by ANILCA Section 606(a).

Figure A10: Nowitna WSR Overview - Nowitna CCP









U.S. Fish & Wildlife Service
Nowitna National Wildlife Refuge
 Alaska

Nowitna Wild & Scenic River



0 5 10 15 miles

0 5 10 15 km

-  Nowitna NWR boundary
-  Nowitna WSR segment
-  Nowitna WSR corridor
-  Patented native allotment
-  Patented ANCSA village corporation
-  Patented ANCSA regional corporation



Produced in the Division of Realty
 Anchorage, AK
 Base Map Source: ESRI, Inc.
 Map Date: October 15, 2024
 Map ID #: 11-0060

Boundaries shown are graphic depictions. Refer to supporting documents for additional details.

A.3 MANAGEMENT DIRECTION

A.3.1 Introduction

The Service prepares step-down management plans when required by policy or when the plans may be necessary to provide more detailed objectives, strategies, and/or implementation schedules for meeting the management direction identified in CCPs. Service Manual 602 FW 4 Chapters 1–4 outline policy and procedures for step-down management plans. This CRMP is a step-down management plan that expands on the following in the Revised CCP:

Goal 8: Maintain the special values of the Nowitna Wild River and Koyukuk Wilderness and the wild character of the refuge.

Objective 1: Continue to monitor activities on the Nowitna Wild River and in the Koyukuk Wilderness for compliance with the WSRA and Wilderness Act and ANILCA. If problems are detected, appropriate actions would be taken.

This chapter provides management direction that must be followed when managing the Nowitna WSR corridor. Management direction involves the following:

- Continuation of current management in the Revised CCP. This is described below in **Section A.3.2, Continuation of Current Management**.
- A minor revision of the Revised CCP. This is described below in **Section A.3.3, Revised CCP Minor Revision**.
- A step-down management plan that expands on the Revised CCP containing goals, desired conditions, objectives, and strategies for river values and other resources and uses occurring in the corridor. This is described below in **Section A.3.4, Nowitna WSR Management**.

A.3.2 Continuation of Current Management

This CRMP is a step-down management plan that expands on the Revised CCP. It does not replace the Revised CCP. Current management and monitoring that are relevant to the Nowitna WSR corridor are consolidated in **Attachment B** and will continue to be used to manage the Nowitna WSR corridor.

A.3.3 Revised CCP Minor Revision

Service Manual Part 602 FW Chapters 1–4 outline policy and procedures for revising CCPs and step-down management plans. In compliance with the Service’s minor revisions to CCPs process, the Revised CCP (USFWS 2009) would be modified to update the Nowitna WSR corridor to conform with ANILCA requirements. Other updates include changing the “Nowitna Wild River” to the “Nowitna Wild and Scenic River” and updating the ORVs to those identified in the CRMP. These and other updates are explained in the minor CCP amendment memo in the environmental assessment that was prepared for this CRMP. The WSR corridor for this CRMP is described above in **Section A.2.6, WSR Classification and Corridor Boundary**.

A.3.4 Nowitna WSR Management

This section provides management direction for the Nowitna WSR corridor. While some direction applies generally across the corridor, most is organized by resource area or use. This management applies to all future projects and activities within the corridor.

In addition to the management direction included in this chapter, Revised CCP components apply to the Nowitna WSR corridor. When CRMP and CCP components conflict, the more restrictive components generally prevail. A project- or activity-level evaluation, however, may be required to resolve the conflict.

A.3.4.1 Definitions of Management Direction

This chapter provides plan components and other content for the Nowitna WSR corridor. Plan components include goals, desired conditions, objectives, and strategies. A goal is a descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units. An objective is a concise statement of what the Service wants to achieve, how much the Service wants to achieve, when and where the Service wants to achieve it, and who is responsible for the work. An objective is derived from goals and provides the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. All objectives must be specific, measurable, achievable, results oriented, and time fixed. A strategy is a specific action, tool, technique, or combination of actions, tools, and techniques used to meet objectives.

A.3.4.2 Management Direction

Section 10(a) of the WSRA requires that river-administering agencies protect and enhance the river values (the free-flowing condition, water quality, and ORVs) for which a segment was designated. The ORVs for the Nowitna WSR are ecology, fish, cultural, and scenery. The process used to identify these values is documented in the Nowitna Wild and Scenic River Values report (USFWS 2024a).

Currently, the Service is unaware of any conditions within the river corridor that are adversely impacting the ORVs. However, to ensure this requirement is met, the CRMP includes proposed non-ground-disturbing inventory and monitoring actions. The CRMP also includes potential management actions to ensure the river values are protected and enhanced into the future. The potential management actions may require additional site-specific review prior to implementation. The goals, desired conditions, objectives, and strategies outlined below were developed to ensure the Nowitna WSR continues to meet the overarching purpose to protect and enhance river values, while also meeting related goals and objectives defined in the Revised CCP.

Vision Statement

The Service works with partners using sound biological research and monitoring to ensure proper management and co-stewardship of the Nowitna WSR to safeguard its waters and the diverse array of fish, wildlife, and boreal habitats it supports while honoring the long narrative of human interaction with this place and respectful harvest of its resources, established deep cultural values, and need for continued opportunities for enjoyment of the river's scenery and bounty.

Nowitna WSR Corridor Management

Theme 1: Protect the free-flowing condition of the Nowitna WSR

Free-flowing Water Goal: Conditions are managed to ensure sufficient flows protect or enhance the river's free-flowing condition³⁵ with a natural range of flows that provide optimum conditions for fish, wildlife, plants, and hydrological processes that shape the landscape.

³⁵ Free-flowing condition: Flowing in natural condition without modification, diversion, or impoundment.

Desired Conditions: The Nowitna WSR corridor is a dynamic, free-flowing river, without lateral or longitudinal impediments. The resulting hydrologic, geomorphic, and ecological complexity throughout the Nowitna WSR corridor promote and enhance the ORVs.

Objective: Collect data to quantify streamflows necessary to protect the Nowitna WSR's ORVs and file for a water reservation 10–15 years after the approval of this plan.

Strategies:

- Work with the Service Water Resources Branch to document the water quantity and biological use of rivers and lakes to support water reservation applications.
- Work with partners to expand water quantity monitoring for the Nowitna WSR.

Theme 2: Protect water quality in the Nowitna WSR

Water Quality Goal 1. Conditions are managed to ensure the unique physical, chemical, and biological characteristics support the Nowitna WSR's ORVs and meet or exceed the Alaska water quality standards (18 AAC 70) and other applicable water quality standards.

Desired Conditions: Unique physical, chemical, and biological characteristics, supported by the hydrologic properties of the river, meet or exceed all applicable water quality standards.

Objective 1.1: Within 5 years of the approval of this plan and throughout the life of the CRMP, work with the Service Water Resource Branch to design and implement a water quality inventory and monitoring program that includes consideration of factors potentially affecting water quality.

Strategy:

- Provide refuge staff with training, time, and support to conduct aquatic fieldwork.

Water Quality Goal 2. Engage with Service staff (Water Resources Branch, Ecological Services, etc.) and partners to assess water quality and collaborate to support river values.

Objective 2.1: Throughout the life of the plan, continue to develop, facilitate, and strengthen partnerships to further water quality data collection on the Nowitna WSR and its tributaries.

Strategies:

- Participate in the Alaska Stream and Lake Temperature Action Plan development and implement monitoring protocols on the Nowitna WSR to generate river-specific data that also contribute to a statewide database.
- Partner with others (Yukon River Intertribal Watershed Council, Village of Ruby, etc.) to expand water quality monitoring for the Nowitna River.
- Work with ADEC's Water Quality Monitoring and Assessment section to understand minimum data requirements for the State to use the data for making water quality impairment and attainment decisions.

Theme 3: Ecology ORV

Ecology Goal 1: Maintain the natural diversity of high-quality habitats found in the Nowitna WSR corridor, which supports a broad, interconnected array of northern wildlife species at various life stages, including moose, black bear, grizzly bear, wolf, wolverine, red fox, lynx, marten, porcupine, hare, river otter, muskrat, mink, weasel, squirrel, wood frog, waterfowl, raptors, songbirds, and others.

Desired Conditions: The natural biological diversity and integrity of plant communities within the Nowitna WSR riparian ecosystem are maintained.

Objective 1.1: Create an updated vegetation map of the Nowitna WSR corridor using remote sensing within 5 years of the approval of this plan, to be updated every 10 years over the life of the plan, to improve understanding of diversity and change in plant community type distribution.

Strategy:

- Work with Service staff and partners to determine processes, cost, expertise, and other requirements necessary to accomplishing this goal.

Objective 1.2: Within 5 years of the approval of this plan, implement a larch and old-growth white spruce forest distribution survey within in the Nowitna WSR to better steward these plant communities. Repeat the survey every 10 years to monitor change in these forest communities.

Strategies:

- Determine the feasibility of boat-based and aerial-based techniques to accomplish this survey and associated costs.
- Work with partners (universities, local communities, etc.) to maximize the effectiveness of this effort.

Objective 1.3: Identify climate vulnerabilities and management strategies for high-priority habitats within the Nowitna WSR corridor. Complete a status report within 5 years of the approval of this plan.

Strategies:

- Collaborate with partners (universities and federal and state agencies) to identify habitats of concern.
- Conduct a thorough literature review.
- Target research on the Nowitna WSR toward this goal as opportunities arise.
- Work with partners to identify and monitor pests, invasive species, and diseases affecting plant communities within the WSR corridor.

Objective 1.4: Identify and incorporate inventory and monitoring strategies for priority Nowitna WSR plants and habitats into the inventory and monitoring plan within 5 years of the approval of this plan.

Strategies:

- Provide refuge staff with training, time, funding, and support to develop and implement plant and habitat monitoring strategies related to the Nowitna WSR.
- Upon funding, hire a full-time habitat biologist to fully integrate this plan with other plans, including the Revised CCP, inventory and monitoring plan, and fire management plan.

Objective 1.5: Annually review the Nowitna fire management plan and ensure practices are in line with habitat goals throughout the life of this plan.

Strategies:

- Hold an annual meeting prior to the start of the fire season between Nowitna biologists and the fire management officer—and possibly also Bureau of Land Management staff—to discuss habitat goals and priorities, including best practices for invasive species prevention.
- Consider Nowitna WSR priorities and recommendations whenever the Nowitna Fire Management Plan is updated.

Objective 1.6: Throughout the life of this plan, work with partners to identify the potential for or impact of pathogen presence on plants within the Nowitna WSR and explore mitigation options.

Strategies:

- Opportunistically survey for the presence and extent of pests, invasive species, and diseases affecting plants and plant communities within the Nowitna WSR corridor during aerial and ground- or boat-based work.
- Annually review regional and statewide forest health inventories developed by partners (Alaska Division of Forestry and Fire Protection, United States Forest Service, and others) to identify potential impacts on the Nowitna WSR.
- Work with partners to address specific concerns with targeted surveys, monitoring, and/or management.

Ecology Goal 2: Maintain the natural abundance and diversity of wildlife species found in the Nowitna WSR corridor, including moose, black bear, grizzly bear, wolf, wolverine, red fox, lynx, marten, porcupine, hare, river otter, beaver, muskrat, mink, weasel, squirrel, wood frog, waterfowl, raptors, songbirds, and others.

Desired Conditions: Wildlife populations in the Nowitna WSR ecosystem continue to thrive in their natural abundance and diversity.

Objective 2.1: Annually support the implementation of the Inventory and Monitoring Plan as it pertains to the Nowitna WSR.

Strategy:

- Provide refuge staff with training, time, and support necessary to accomplish the annual goals of the Inventory and Monitoring Plan that relate to the Nowitna WSR.

Objective 2.2: Conduct a moose population estimate for the Nowitna WSR within 2 years of adopting this plan, and approximately every 5 years thereafter.

Strategy:

- Provide refuge staff with the training, time, and support necessary to accomplish surveys that relate to the Nowitna WSR.

Objective 2.3: Identify climate vulnerabilities and management strategies for wildlife species found in the Nowitna WSR corridor. Complete a status report within 5 years of the approval of this plan.

Strategies:

- Collaborate with partners (universities and federal and state agencies) to identify species of concern.
- Conduct a thorough literature review.
- Target research on the Nowitna WSR toward this goal as opportunities arise.

Objective 2.4: Throughout the life of this plan, work with partners to identify the potential for or impact of parasites and diseases on wildlife species found within the Nowitna WSR and corridor and explore mitigation options.

Strategies:

- Opportunistically survey for the presence and extent of pests, invasive species, and diseases affecting plants and plant communities within the Nowitna WSR corridor during aerial and ground- or boat-based work.
- Maintain awareness of wildlife parasites and diseases occurring in the state and potential management strategies through communication with partners (ADFG, United States Geological Survey, Service's Alaska Migratory Birds Office, and others).
- Work with partners to address specific concerns (such as avian influenza, ticks, rabies, and tularemia) with targeted surveys, monitoring, and/or management.

Objective 2.4: Support wildlife species that seasonally occur within the Nowitna WSR corridor by working with partners and adjacent landowners to identify and protect essential wildlife habitat outside the management area, as needed.

Strategies:

- Work with partners to increase awareness of their role in stewarding the Nowitna WSR.
- Maintain awareness of new and changing conditions and management in areas outside the Nowitna WSR that could impact migratory wildlife species.

Ecology Goal 3: Improve the scientific knowledge of the Nowitna River's abiotic ecosystem components and ecological, fluvial, and geomorphic processes (including wildland fire, flooding, and succession) to inform management within the Nowitna WSR in the face of changing environmental conditions.

Desired Conditions: The unique abiotic and biotic features of the boreal riparian ecosystem continue to support ecological function and healthy fish and wildlife populations today and into the future.

Objective 3.1: Improve scientific understanding of the potential effects of climate variability on permafrost, hydrology, fire ecology, and soils in the Nowitna WSR corridor and possible impacts on wildlife and habitats. Identify and incorporate recommended monitoring strategies into the Inventory and Monitoring Plan within 10 years of adopting this plan.

Strategies:

- Use literature review, collaboration with partners, and targeted research to identify information needs and implement monitoring strategies.
- Support continued and enhanced acquisition of weather data for the Nowitna WSR through existing and new partnerships as opportunities arise.

Objective 3.2: Complete or update permafrost, hydrography, and soil inventories and maps within 10 years of adopting this plan to improve scientific understanding of relationships between abiotic factors, climate change, plant communities, and wildlife in the Nowitna WSR corridor.

Strategies:

- Work with partners (universities, tribal organizations, etc.) to identify information needs, appropriate products, and associated costs.
- Provide refuge staff with the training, time, and support necessary to meet this objective.
- Seek opportunities for refuge staff to participate in broader-scale efforts in the Nowitna NWR and surrounding areas.

Ecology Goal 4: Minimize the introduction and impacts of invasive terrestrial and aquatic species through education, monitoring, early detection, and rapid response.

Desired Conditions: Highly invasive nonnative species continue to be absent in the Nowitna WSR corridor.

Objective 4.1: On an annual basis, increase public awareness of invasive species, including identification of species of concern, techniques to prevent introduction and spread, and ways observations may be reported.

Strategies:

- Provide outreach materials on an annual basis to guides and transporters to minimize the import of nonnative aquatic and terrestrial species.
- Provide outreach materials and programs on a biennial basis to local communities by working with tribal organizations, schools, etc.

Objective 4.2: Conduct biennial early detection surveys at critical access points and areas of high human use in the Nowitna WSR and corridor to detect the presence of aquatic and terrestrial invasive plant species.

Strategies:

- Identify locations of hunting camps and other human use areas from law enforcement, guides, and transporters, and through direct observation.
- Identify areas of concern for Elodea infestation in the lower Nowitna WSR.
- Work with local partners to conduct boat-based surveys in the lower Nowitna WSR.
- Communicate with Service staff and external partners, such as the Alaska Invasive Species Partnership, Fairbanks Soil and Water Conservation District, and Alaska Exotic Plants Information Clearinghouse, to report and address exotic plant observations and keep aware of new or rising concerns and best detection and response strategies.

Objective 4.3: Conduct canoe-based surveys of the upper Nowitna WSR at least once every 5 years to detect the presence of aquatic and terrestrial invasive plant species, in addition to recording and reporting any observations collected opportunistically.

Strategies:

- Ensure biologists conducting annual goose float surveys or other boat-based surveys in the river corridor are aware of invasive plant species, are provided identification and survey tools, and document and report any suspected invasive species observed.
- Use past reports and the Alaska Exotic Plants Information Clearinghouse database to identify areas where past invasive species' observations and infestations have occurred.
- Communicate with Service staff and external partners, such as the Alaska Invasive Species Partnership, Fairbanks Soil and Water Conservation District, and Alaska Exotic Plants Information Clearinghouse, to report and address exotic plant observations and keep aware of new or rising concerns and best detection and response strategies.

Objective 4.4: Apply rapid response protocols as identified in the Alaska Region Rapid Response Plans within 1 year of detection of highly invasive, nonnative species.

Strategies:

- Develop materials and conduct outreach about invasive species' prevention, early detection, and reporting methods to local communities, guides, transporters, and visitors to facilitate rapid detection.
- Communicate with Service staff and external partners, such as the Alaska Invasive Species Partnership, Fairbanks Soil and Water Conservation District, and Alaska Exotic Plants Information Clearinghouse, to keep aware of new or rising concerns and best detection and response strategies.
- Preplan response strategies, including maintaining relationships with Service staff and external partners that can assist with rapid response.

Theme 4: Fish ORV

Fish Goal 1: Build a collective understanding of the uniquely diverse and dynamic fish community of at least 19 anadromous and freshwater fish species found in the Nowitna WSR to identify and protect habitat and maintain natural diversity and abundance of fish in the face of changing environmental conditions.

Desired Conditions: The fish ecosystem diversity (species presence, habitat complexity, and ecosystem services provided) in the Nowitna WSR are undiminished now and into the future.

Objective 1.1: In cooperation with ADFG and other partners, develop and initiate fisheries and habitat surveys for the Nowitna WSR and tributaries within 5 years of the approval of this plan.

Strategies:

- Create a summary report of what is known about Nowitna River fish (species occurrence, habitat use, locations of habitat critical to various life stages, and data needs).
- To increase current knowledge of existing fish species diversity, work with partners and the Service's Fairbanks Field Office and Water Resource Branch to develop inventory and monitoring protocols for fish and their habitats.
- Incorporate monitoring for the presence of invasive species into habitat surveys.
- Investigate potential impacts of climate change, including precipitation patterns, breakup phenology, and fire frequency, on fish species occurring in the Nowitna WSR.

Objective 1.2: Complete or update permafrost, hydrography, geology, and soil inventories and maps within 10 years of adopting this plan to improve scientific understanding of relationships between abiotic factors, climate change, and the fish community in the Nowitna WSR.

Strategies:

- Work with partners to identify past work, prioritize future information needs, and determine processes, costs, expertise, and other requirements necessary to accomplish this goal.
- Seek opportunities for NWR staff to participate in broader-scale efforts in the Nowitna NWR and surrounding areas.

Objective 1.3: Throughout the life of this plan, work with partners and adjacent landowners to identify and protect essential habitat of Nowitna WSR fish species that spend parts of their life cycle outside the management boundaries.

Strategies:

- Work with partners to increase awareness of their role in stewarding the Nowitna WSR.
- Maintain awareness of new and changing conditions and management in areas outside the Nowitna WSR that could impact fishery resources.

Fish Goal 2. Improve the scientific knowledge of the unique geomorphology, hydrology, and other characteristics of the Nowitna WSR that combine to make suitable sheefish spawning habitat and support other whitefish species.

Desired Conditions: Healthy populations of sheefish and other species of whitefish continue to spawn in the Nowitna WSR.

Objective 2.1: Obtain data on composition (abundance, range, etc.) for sheefish within 5 years of the approval of this plan.

Strategy:

- Expand on past research and initiate a sheefish habitat study to identify key spawning habitat requirements.

Objective 2.2: Throughout the life of the plan, facilitate information exchange related to habitat use by sheefish in other areas to better understand sheefish in the Nowitna WSR.

Strategy:

- Collaborate with partners to gather information about sheefish habitat.

Fish Goal 3: Monitor effects of changing conditions on pike to identify any potential management needs.

Desired Conditions: Healthy populations of pike continue to thrive in the Nowitna WSR.

Objective 3.1: Obtain data on composition (abundance, age structure, etc.) and habitat conditions for pike in the Nowitna WSR within 10 years of the plan's approval.

Strategies:

- Document any past research on pike abundance and harvest levels.
- Track water temperature or other river conditions expected to affect pike populations.
- Develop a monitoring strategy for pike or pike habitat, or both.

Theme 5: Cultural ORV

Goal 1: Build a collective understanding of the cultural resources found along the Nowitna WSR that provide important links to the human history of travel, trade, recreation, and resource harvest of the river corridor, including historic and archaeological sites, cultural landscapes, and ethnographic resources.

Desired Conditions: The integrity of cultural, historic, archaeological, and ethnographic resources is safeguarded for future generations.

Objective 1.1. Within 5 years of the approval of this plan, conduct cultural resource surveys to identify resources and potential threats.

Strategies:

- Work with Service archaeologists and other knowledge bearers to identify and prioritize areas to be surveyed.
- Investigate potential climate change impacts on the security of cultural resources.
- Identify cultural resources that are at risk for being lost due to erosion.
- Work with Service archaeologists and other partners (universities, local communities, etc.) in conducting cultural resource surveys.

Objective 1.2. Throughout the life of the plan, upon discovery of any cultural resources or sites of cultural significance within the Nowitna WSR corridor, the NWR staff will work with its archaeologist and local Tribes to gain a better understanding of the cultural resource and its history and work to design and implement protective and preservation measures pursuant to the resource type.

Strategy:

- Have NWR and regional archaeological staff consult and collaborate with tribal partners and the State Historic Preservation Office to complete cultural surveys, evaluation and management recommendations, and data recovery, if necessary.

Objective 1.3: Throughout the life of the plan, develop a narrative history of the river's use within the Nowitna WSR. Develop a summary report or outreach materials, or both, within 10 years of this plan's completion.

Strategy:

- Conduct elder interviews and a thorough literature review of historical documents, place-names, and oral history recordings to develop a narrative history of the Nowitna WSR.
- Document traditional ecological knowledge specific to the Nowitna WSR.

Goal 2: Ensure the Nowitna WSR continues to provide abundant wildlife, fish, and plant resources for the customary and traditional uses of wild renewable resources.

Desired Conditions: The Nowitna WSR provides river users with opportunities to harvest wild renewable resources now and into the future.

Objective 2.1: Throughout the life of the plan, evaluate valuable wild renewable resources to ensure healthy sustainable food sources are available for harvest.

Strategies:

- Continue cooperating with the State of Alaska to conduct the annual moose hunter check station at the mouth of the Nowitna WSR to document trends in river use and wildlife harvest.
- Work with partners such as the Service's Fisheries and Ecological Services and the State of Alaska to monitor contaminants in fish, especially those that are top predators and important to subsistence users, and other harvestable wildlife.

- Monitor fish harvest, as needed, through subsistence harvest surveys, guide-use reporting, etc.
- Investigate berry harvest and the potential for climate change to impact this resource.

Goal 3: Continue to foster high-quality hunting, fishing, trapping, wildlife observation, and boating opportunities in a relatively natural setting.

Desired Conditions: The Nowitna WSR provides river users high-quality opportunities for wildlife-dependent activities now and into the future.

Objective 3.1: Periodically communicate with river users to monitor trends in visitation levels and the quality of experiences.

Strategies:

- Document recreational experiences on the Nowitna WSR during village visits, at the Nowitna River moose hunter check station, and through other outreach efforts.
- Investigate the use of social media to gain feedback on visitor experiences.
- Distribute guide-use evaluation forms to document user experiences on the Nowitna WSR.

Objective 3.2: Increase awareness and stewardship of the Nowitna WSR within local communities, diverse groups, and the general public and promote a sense of ownership and responsibility for the protection of the Nowitna WSR's river values.

Strategies:

- Develop materials and conduct outreach to local communities, guides, transporters, visitors, and the general public to foster stewardship of the Nowitna WSR for future enjoyment.
- Identify key audiences and develop Leave No Trace outreach and environmental education programs.
- Encourage local community participation in river conservation efforts through volunteer programs, community events, river cleanups and partnerships.

Theme 6: Scenery ORV

Goal 1. Protect the Nowitna WSR's natural viewshed (characterized by a varied topography, diverse plant communities, and dynamic water features) to ensure it continues to support a rich and diverse scenic experience for river users.

Desired Conditions: The Nowitna WSR provides a varied, wild, and beautiful scenic experience for river users now and into the future.

Objective 1.1. Monitor changes in vegetation, water clarity, and human disturbance that may impact the scenic qualities of the Nowitna WSR on an annual basis and resolve any issues as they arise.

Strategies:

- Use the annual goose production survey to monitor changes that may impact the scenic quality on the upper and middle portion of the Nowitna WSR.
- Work with partners to conduct biennial boat-based surveys of high-use areas in the lower and middle corridor and perform cleanups as necessary.
- Work with law enforcement to ensure the regulations regarding public storage of camping and other equipment are enforced.
- Investigate the potential impacts of climate change on scenic values.
- Collect data on natural intactness and human disturbances, develop outreach materials, and encourage co-stewardship.

Objective 1.2. Ensure current and any potential future cabins or other structures, such as fish towers, weather stations, and communication towers, blend in or will be compatible with the natural surroundings.

Strategies:

- Use the cabin permitting process to mandate that permitted cabins are not situated directly on the bank of the river (set back a minimum of 100 feet, leaving at least a 50-foot buffer of standing vegetation, following Firewise³⁶ best practices).
- Consider the expansive viewshed that exists on the Nowitna WSR between the confluence of the Sulukna River and the confluence of the Little Mud River when considering permitting of towers or other structures.

Objective 1.3. Increase public awareness about the Nowitna WSR's scenic value and foster a sense of stewardship among river users through annual outreach programs and communications.

Strategies:

- Develop and distribute outreach materials to local communities, guides, transporters, visitors, and the general public via village visits, the Nowitna River moose hunter check station, websites, social media, etc.
- Encourage local community participation in river conservation efforts through volunteer programs, community events, and partnerships that promote a sense of ownership and responsibility for the protection of the Nowitna WSR's river values.
- Develop Leave No Trace outreach materials and environmental education programs for key audiences.

A.3.5 Development of Lands and Facilities

This CRMP determines the appropriate types and levels of development (for example, trails and boat launches) for the WSR. These management decisions are based primarily on the WSR's wild classification. The Nowitna WSR is classified as wild because it is free of impoundments and it is generally inaccessible, except by trail. The watersheds and shorelines are essentially primitive with no

³⁶ A national program that provides communities and neighborhoods with a collaborative framework to mitigate wildfire risk.

significant known pollution to its waters. Any developments would be designed and constructed to ensure the free-flowing condition, water quality, and ORVs of the river are not adversely impacted.

A.3.6 Evaluation of Water Resource Projects

Section 7(a) of the WSRRA directs federal agencies to evaluate federally assisted or permitted water resource projects to ensure existing conditions of designated river values are not diminished. No Section 7 water resource projects have been identified at this time. If water resource projects are identified later, they will meet the requirements of Section 7 of the WSRRA and NEPA prior to implementation. Depending on the location of the water resource project proposal, the Service will use one of the following evaluation standards:

- Water resources projects within the Nowitna WSR corridor—The Service will evaluate water resources project proposals under the “direct and adverse effect” standard.
- Water resources projects below, above, or on a stream tributary of the Nowitna WSR corridor—The Service will evaluate water resources project proposals under the “invade the area or unreasonably diminish” standard.

A.4 VISITOR USE MANAGEMENT AND CAPACITY

A.4.1 Overview

To identify a visitor capacity, managers of federal lands identify the maximum kinds and amounts of visitor use that will maintain and achieve desired conditions. In this CRMP, the use of the term “visitor capacity” is synonymous with the term “user capacity,” which is a CRMP component required by the WSRRA. Section 3(d)(1) of the WSRRA directs agencies to address visitor capacities for public use in a CRMP to ensure that use levels in the river area do not threaten river values or established desired conditions. Visitor capacity determinations are not required for other uses; however, the extent of these activities is considered in identifying the current conditions for the assessment to inform visitor capacity decisions.

The goal for visitor use management within the Nowitna WSR corridor is to provide opportunities for the public to enjoy and experience the river while also protecting the river values for which the river was designated. Public use is defined as visitor use and WSR-specific administrative use within the WSR corridor. Visitor capacity determinations are not required for other uses, including subsistence activities (IWSRCC 2018),³⁷ but are considered in assessing baseline and current conditions to inform visitor use capacity. The Nowitna WSR supports a wide variety of subsistence activities, including motorized and nonmotorized boating, hunting, fishing, trapping, plant harvesting, and camping activities. Current conditions and use patterns for recreational, commercial, and administrative uses are discussed in **Section A.4.2**, Current Visitor Use, through **Section A.4.4**, Administrative Use.

A.4.2 Current Visitor Use

Shortly after the passage of ANILCA, expectations that the designation would increase recreational use of the Nowitna WSR have not come to fruition. The Nowitna WSR provides opportunities for a variety of recreational activities and attracts visitors from local communities and around the state. The amount of visitor use that the Nowitna WSR receives varies substantially by location and the time of year.

³⁷ <https://www.rivers.gov/sites/rivers/files/2023-02/user-capacities.pdf>

Understanding demand for visitor use is useful for determining trends and planning for future use. Because this river is relatively remote and difficult to access, visitation is not expected to increase substantially. However, there has not been in-depth research or comprehensive monitoring to document characteristics of use, including the amount, type, timing, and distribution of activities and behaviors, especially for non-hunting visitation. **Table A-6**, below, lists sources of information about visitor use.

Table A-6. Visitor Use Data Collection

Data Type	Dates Collected	Information
Moose hunter check station	Annually – been going on since 1988	Voluntary – only required in 1997. Currently, only registered hunters in a group are counted.
Commercial guide-use reports	Annually since 2010	One permitted guide uses camps outside the corridor. Not all clients spend the entire time in the Nowitna WSR corridor.
Air taxi operators reports	Annually	Refuge special-use permits are issued annually, but use depends on client request. No clients have been reported in recent years.
Recreational floaters	Annually (informally)	Annual narratives (1982–1996), incidental observations during NWR fieldwork, and reports from other users

A.4.2.1 Recreational and Subsistence Hunting

A primary visitor use for the Nowitna NWR is moose hunting. The best hunting is found near grass lakes some distance from the river area (USFWS 2024b). With this, the actual use by hunters of the Nowitna River is for access to upland hunting areas, either by boat or floatplane, and camping on the riverbanks. Refuge records indicate that hunters camp on the riverbanks, and the duration of stay ranged from 3 days to 3 or 4 weeks (USFWS 1982). During the 1987 hunting season, 26 hunting groups were recorded along 223 miles of the Nowitna River (USFWS 1987b). In 2023, 30 separate hunting parties were recorded (USFWS 2023) during the hunting season.

The Service manages an annual moose hunter check station during the hunting season to track moose hunting data. Information collected summarizes overall hunter success rates, the numbers of hunters in the group, and the location of residency for each hunter. For the 2023 State moose hunting season, (September 5 to 25), 94 hunters registered at the moose hunter check station. A total of 28 moose—comprised of 28 bulls and zero cows—were harvested under these State hunting permits (USFWS 2023). These recent totals are lower than what was recorded in the 1980s. According to a 1987 Nowitna National Wildlife Refuge Annual Narrative Report, annual moose harvest from 1981 to 1986 ranged from 49 to 79 animals (USFWS 1987b). Of the 94 State-permitted hunters for 2023, 15 percent were local residents (from Ruby, Tanana, and Galena), 43 percent were Fairbanks residents, 37 percent were other residents (from Anchorage, Juneau, Wasilla, etc.), and 5 percent were nonresidents. The annual narrative reports, spanning from 1982 to 1989, indicated an increase in moose hunting on the refuge by Fairbanks residents (USFWS 1982, 1983, 1984, 1985, 1986, 1987b, 1988, 1989).

Federal subsistence moose hunt results indicated that 14 permits were issued in 2023, with three bull moose harvested. Federal moose hunting permits were permitted for September 26 to October 1. All

14 permits were issued to local residents (4 were Ruby residents and 10 were Tanana residents). Information on recreational and subsistence black bear hunting is less known (USFWS 2023).

A.4.2.2 Waterfowl Harvest

Fall waterfowl harvest is open to Alaska residents and non-residents under State Migratory Game Bird Hunting Regulations. Residents of qualified rural areas may also participate in the Federal Alaska Subsistence Spring/Summer Migratory Bird Harvest. A State hunting license and State duck stamp are required to hunt in any season by anyone who does not qualify for license and duck stamp exemptions. Non-resident hunters and some resident hunters are required to have a Federal Duck Stamp.

Waterfowl have always been an important subsistence resource for people living in the Nowitna region. For thousands of years people have depended on geese, ducks and other migratory birds for food, particularly in springtime when other sources of food were less available. Subsistence harvest of waterfowl continues to this day, though in lower quantities than in the past.

Subsistence harvest surveys have been conducted periodically in Tanana, Ruby and Galena since the 1980s. Species harvested include Greater White-fronted Goose, Canada Goose, Tundra Swan, Mallard, Northern Pintail, and American Wigeon. Waterfowl are primarily harvested in spring but are also hunted in the fall season. In a 1984 subsistence survey in Ruby, 40 of 48 households reported participation in spring waterfowl hunting and 17 in fall waterfowl hunting, with 10 households reporting hunting in both spring and fall (USFWS 1984). Results of surveys conducted by ADFG indicate that in terms of estimated pounds harvested, waterfowl harvest in the early-2010s was about a third of what it had been in the mid-1980s in Galena and Tanana. However, residents were still participating in both spring and fall waterfowl harvest in the 2010s, and it is expected that hunting during both seasons continues today (Brown et al. 2015, Brown et al. 2016, Case and Halpin 1990, Marcotte 1990).

Because of challenging travel conditions, spring waterfowl hunting is generally limited to a fairly small area around each village and is likely occurring only in very low levels within the Nowitna WSR corridor. This activity is probably only conducted by families with Native Allotments or permitted cabins located in or near the Nowitna WSR corridor. Waterfowl may be hunted along the Nowitna WSR during the fall moose hunt, but conversations with hunters at the moose hunter check station indicate that hunting for spruce and ruffed grouse is more popular.

A.4.2.3 Fishing

Fishing is often conducted in conjunction with other activities, such as hunting or river float trip. Northern pike and sheefish are the most sought-after species, and fishing is generally light from June to August and greatest in September during moose season. Data on current use trends are lacking, since the activity is often incidental to other activities.

A.4.2.4 Non-hunting Recreation

Current levels of recreational boating use are not well documented, but they are estimated to be less than five groups of unknown size per summer. Groups are unlikely to encounter others while floating the Nowitna WSR, if they boat outside the September moose hunting season.

A.4.2.5 Trapping

Trapping has been a common visitor use, primarily for residents of nearby Ruby and Tanana. Eight cabins permitted to refuge trappers were reported in 1985. In a typical year, such as 1985, six trappers operated out of the cabins from late October through April (USFWS 1985). In the past several decades, trapping activity has decreased; currently, one family has a cabin permit and traps in the WSR corridor during the winter.

A.4.3 Current Commercial Use

Game Management Unit 21B consists of that portion of Game Management Unit 21 in the Yukon River drainage upstream from Ruby and east of the Ruby-Poorman Road, downstream from and excluding the Tozitna River and Tanana River drainages, and excluding the Melozitna River drainage upstream from Grayling Creek. Game Management Unit 21B contains all of the Nowitna NWR (ADFG 2024d) and has one authorized commercial hunting guide.

Annually, the permitted hunting guide for Game Management Unit 21B averages six clients during the fall hunting season. The typical stay per client ranges from 7 to 12 days. On average, two to three commercial air taxi operators are issued special-use permits, but they have not provided services to clients on the Nowitna NWR recently. Historically, there was one commercial use permit issued for guided fishing, but no permits have been issued since 2013.

A.4.4 Administrative Use

There is one administrative cabin located along the Nowitna WSR between river mile 48 and 49. It is not visible from the river and does not detract from the river's wild character. On average, two refuge staff use the cabin three to four times a year for logistic support during field surveys. The refuge staff conduct surveys throughout the year (**Attachment C**), and the annual Nowitna River goose production float survey in July is the only boat-based study occurring along a significant length of the Nowitna WSR.

A.4.5 Visitor Use Management Monitoring

In many locations, natural resource conditions and recreational use levels can be correlated; however, existing use on the Nowitna WSR does not currently reveal a negative correlation. Tracking changes to the primary indicators, thresholds, and objectives will ensure river values are protected in the Nowitna WSR corridor.

An “indicator” is a specific resource or social attribute that can be measured to track changes in conditions associated with human use. Indicators in combination with thresholds warn river managers about deteriorating conditions and help river managers assess progress towards attaining desired conditions.

Indicator: Presence of trampled vegetation or bare soil

River Values: Water quality, ecology ORV, fish ORV, and scenery ORV

Threshold: This will be determined after monitoring occurs as identified in the CRMP monitoring strategy.

Objective: Observations of new trampling of vegetation beyond the existing footprint at campsites do not increase.

Rationale: Compaction of soil, trampling of vegetation, and erosion cause sedimentation to negatively impact the ecology and fish ORVs and water quality. The scenery ORV could be negatively impacted by campsite footprints increasing in size caused by trampled vegetation, cutting of brush, or unattended property left in the Nowitna WSR corridor.

Indicator: Presence of riparian, terrestrial, and aquatic invasive species

River Values: Water quality, ecology ORV, fish ORV, and scenery ORV

Threshold: This will be determined after monitoring occurs as identified in the CRMP monitoring strategy.

Objective: Detection of highly invasive riparian, terrestrial, or aquatic invasive species does not increase.

Rationale: Riparian and aquatic invasive plant species are known to degrade water quality and disrupt natural function of riparian ecosystems. Early detection and rapid response to growth and/or spread of existing infestations and new invader species prevents infestations from growing so rapidly that treatment becomes unmanageable.

A.4.6 Visitor Capacity

Visitor capacity is defined as the maximum amounts and types of visitor use that an area can accommodate while achieving and maintaining the desired resource conditions and visitor experiences that are consistent with the purposes for which the area was established (IVUMC 2019). To identify visitor capacities, the Service followed the Visitor Use Framework and recommended steps from the IWSRCC to identify user capacity for the Nowitna WSR.

For the capacity analysis, the Service analyzed the Nowitna WSR as one geographic river management area, since the access, use, and desired conditions are the same for the entire corridor. Current conditions and use patterns for recreational, commercial, and administrative uses described in **Section A.4.2**, Current Visitor Use, through **Section A.4.4**, Administrative Use, illustrate that overall use is low to moderate, depending on the time of year and location. Visitation is not expected to increase substantially. To maintain desired conditions and protect the river values, current use levels can be maintained, and no management actions are recommended at this time. Existing conditions are within the thresholds for the area, and visitor use does not appear to be currently threatening the river values.

While the exact number of users is not known, estimates can be made based on available information. Visitation to the Nowitna WSR is estimated at 300 annual users, with most use occurring in August and September. Based on the analysis above, the amount of use on the Nowitna WSR could increase moderately while continuing to protect and enhance the river values.

A.4.6.1 Future Analyses

The above analysis uses the best available information to identify a visitor capacity for the Nowitna WSR. To manage into the future, the Nowitna NWR staff will implement new data collection methods via a monitoring strategy for the purposes of assessing changes to resource conditions and visitor experiences, so that threats to conditions essential to the river's values' defining characteristics can be identified early. The strategy must include indicators (the attributes that can be measured to track changes in conditions) and thresholds (the minimally acceptable conditions) so that managers know

when to take timely actions to uphold their responsibilities to maintain, and where possible, enhance the river values.

Should there be changes, including amount, type, timing, distribution of activities and behaviors, and those outlined below, the refuge staff may reevaluate and update the visitor capacity based on the results of their monitoring efforts. The criteria that may warrant a reevaluation of capacity or updating strategies to manage to capacity include, but are not limited to:

- There is evidence that thresholds are being approached.
- There is evidence that Nowitna WSR conditions are trending away from desired conditions (**Section A.3.4.2, Management Direction**).
- The refuge staff have meaningful new knowledge or understanding of the relationship between visitor use and impacts on resources or visitor experiences.

The visitor use management strategy takes an adaptive approach to respond to changing conditions and to provide flexibility in responding to resource concerns. The Service recognizes that identified visitor capacities may need to be reviewed and revised as more data become available. In addition to immediately establishing a monitoring strategy with identified indicators and thresholds to measure changes affecting river values, if in the future, thresholds are approached and events or actions are found to have the potential to threaten river values, the Service will increase education and outreach efforts about the threats and how visitors can mitigate them. This is in addition to other visitor use management tools managers use to mitigate threats, as well as intensifying the monitoring strategy to assess the need for management actions. If it is determined more intensive management actions, such as decreasing the visitor capacity, are needed, the monitoring strategy would be revised to also evaluate the efficacy of the management actions taken.

A.5 CRMP MONITORING

A.5.1 Introduction

Monitoring is the periodic and ongoing measurement of specific variables related to a resource condition or river corridor experience. It proactively tracks conditions and trends, and assesses the effectiveness of various management actions. The WSRA does not explicitly require monitoring for designated rivers. However, monitoring is an important aspect of protecting and enhancing river values (the free-flowing condition, water quality, and ORVs) and addressing visitor use.

A.5.2 Current Monitoring

The Nowitna WSR is currently monitored and managed under guidance of the Revised CCP and associated step-down plans to measure resource and social conditions to make sure progress is being made toward meeting the refuge's purposes, goals, and objectives. The monitoring includes determining how the refuge staff are implementing the plan and whether actions being taken are effective in meeting plan objectives. Refuge staff use an adaptive management approach (that is, information gained from monitoring is used to evaluate and modify refuge objectives and management direction, as needed). Monitoring is coordinated with appropriate partner agencies and organizations to enhance the efficiency and usefulness of the results. The approach builds on past and present monitoring work.

The Revised CCP (Section 4: Implementation and Monitoring) recognizes numerous step-down plans that describe specific management strategies and details necessary to implement the goals and objectives

related to each plan’s topic. These step-down plans contain guidance for monitoring some resources that are specifically related to the Nowitna River’s values (the free-flowing condition, water quality, and ORVs). Several additional documents also provide priorities and recommendations for monitoring specific to the Nowitna WSR’s values. These plans and documents, in addition to the goals of this CRMP, form the backbone of monitoring on the Nowitna WSR. As associated step-down plans are updated, care should be taken to ensure that priorities and needs of the CRMP are recognized and included.

Specific details regarding monitoring strategies for the Nowitna WSR are contained within the refuge step-down plans, in other guiding documents, and in the goals section of this CRMP. A generalized list of CRMP monitoring priorities is shown in **Table A-7**, below, along with the associated reference.

Attachment C contains more specific information about the relevant monitoring strategies found in the following documents:

- Executive Summary: Wildlife Inventory Plan Koyukuk/Nowitna/Innoko National Wildlife Refuge Complex 2014 (USFWS 2014)
- Identification of Priority Resources of Concern: Methods and Results, Koyukuk, Nowitna, and Innoko National Wildlife Refuges (USFWS 2022)
- Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska (Burkart et al. 2023)
- Koyukuk/Nowitna National Wildlife Refuge Complex Cultural Resource Guide (USFWS 1995)
- Koyukuk, Northern Unit Innoko and Nowitna National Wildlife Refuge Wildland Fire Management Plan (USFWS 2010)
- Nowitna National Wildlife Refuge Fishery Management Plan (USFWS 1990)
- Plan of Study: Hydrologic Resources Investigation Nowitna National Wildlife Refuge (USFWS 1998)
- Whitefish Biology, Distribution, and Fisheries in the Yukon and Kuskokwim River Drainages in Alaska: A Synthesis of Available Information (USFWS 2012)

Attachment C also identifies whether the strategies are currently being implemented or are recommended for implementation as part of this plan.

Table A-7. Generalized List of CRMP Monitoring Priorities

River Value	Monitoring Strategy	Step-down Plan or Other Guidance
Free-flowing condition	Establish flow, followed by monitoring for change.	Plan of Study: Hydrologic Resources Investigation Nowitna National Wildlife Refuge CRMP free-flowing water goal Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska

River Value	Monitoring Strategy	Step-down Plan or Other Guidance
Water quality	Establish conditions for water temperature, turbidity, and chemistry. Prioritize areas important to Nowitna River fish and areas with the potential for upstream mining. Monitor for deviation from standards.	Plan of Study: Hydrologic Resources Investigation Nowitna National Wildlife Refuge CRMP water quality goal I Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska
Ecology ORV	Monitor abundance of priority wildlife and plant species and distribution and diversity of plant communities.	Koyukuk/Nowitna/Innoko National Wildlife Refuge Complex Inventory and Monitoring Plan CRMP ecology goal I
Ecology ORV	Monitor habitat diversity and the spatial distribution of plant communities, particularly rare or sensitive plant communities.	CRMP ecology goal I Koyukuk, Nowitna, and Innoko National Wildlife Refuge Wildland Fire Management Plan
Fish ORV	Monitor abundance of priority fish species and the condition of critical habitat areas.	Service's Nowitna National Wildlife Refuge Fishery Management Plan Koyukuk/Nowitna/Innoko National Wildlife Refuge Complex Inventory and Monitoring Plan CRMP fish goal
Fish ORV	Monitor for contaminants in fish, especially fish that are top predators and important to subsistence users.	Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska
Ecology, fish, cultural, and scenery	Monitor for the presence of invasive terrestrial and aquatic species within the river and corridor.	CRMP ecology goal 4 Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska
Cultural and scenery	Monitor the viewshed, including the impacts of visitor use, including trash, stored field gear, or other visible impacts of visitor use.	CRMP cultural goal 3 CRMP scenery goal I
Cultural	Identify and document sites of potential archaeological importance.	Nowitna Cultural Resource Management Guide CRMP cultural goal I

Currently, refuge staff observe the Nowitna River corridor annually during ongoing monitoring and management activities. This includes an annual goose production float survey in the upper and middle sections (July), aerial moose (May and November) and goose (July) production surveys, and a moose hunter check station and law enforcement activities (September). These activities provide opportunities for the Service to ensure it is meeting requirements of the WSRRA as well as the goals and objectives of

the Revised CCP. The moose hunter check station is operated annually for 4 weeks on the lower river to ensure compliance with hunting regulations and to provide an opportunity to meet directly with the largest user group on the river. Additional public use data are obtained from annual guide-use reports for the NOW-03 Guide Use Area. The goals included in this plan provide recommendations for more directed monitoring of corridor conditions in the future.

A.5.3 CRMP Monitoring Strategy and Implementation

The CRMP monitoring objective is to protect the Nowitna WSR’s free-flowing condition, water quality, and ORVs (ecology, fish, cultural, and scenery). Monitoring is conducted to assess the relative success of CRMP management strategies and to ensure changes stay within acceptable levels that will not compromise the protection and enhancement of the river values.

This section helps the Service determine whether steps must be taken to address issues degrading river values. Indicators in **Table A-8**, below, have been identified to assess the success in protection and enhancement of river values. For each monitoring focus, a threshold (or standard to meet) is set. This threshold value indicates the point at which river management objectives are no longer met, triggering action to be taken to meet the standard. In many cases, the priority is to establish existing conditions to assist in the determination of deviation from desired conditions. The existing low use of the Nowitna WSR means that current conditions of many indicators are likely far from needing action to meet standards. In cases where limited data are currently available, reaching a threshold could result in further investigation, monitoring, and evaluation. Additional monitoring strategies may be codesigned and implemented as new needs arise or more resources become available.

Table A-8. Nowitna WSR Monitoring

River Value	Monitoring Focus	Threshold	Action
Free-flowing condition	Natural flow, seasonal flow patterns, and natural flood regime	Deviation from documented flow, seasonal flow patterns, and/or natural flood regime	Work with partners to initiate studies to understand the mechanism of flow change and potential impacts, and develop management actions to mitigate impacts.
Water quality	Basic water chemistry and physical characteristics or toxic and other deleterious organic and inorganic substances	Water quality exceeds State of Alaska freshwater water quality criteria for pH, dissolved oxygen, temperature, total dissolved solids, and turbidity	Work with partners, including ADEC, to identify the cause of conditions and take management actions to restore water quality.
Ecology ORV	Healthy condition of priority wildlife, fish, and plant species	Observed population decline that exceeds normal variation	Work with partners to identify the cause of decline and take appropriate management actions to restore the natural abundance.
Ecology ORV	Habitat diversity and spatial distribution of plant communities	Change from existing conditions that has a potential negative impact on rare or sensitive plant communities or other ecosystem components	Identify causes of the change and determine appropriate management actions to mitigate effects, if possible.

River Value	Monitoring Focus	Threshold	Action
Fish ORV	Natural diversity and abundance of fish species	Observed population decline that exceeds normal variation	Work with partners to identify the cause of decline and take appropriate management actions to restore the natural population levels.
Fish ORV	Suitability of important fish habitat	Observed degradation of fish habitat that has potential to negatively impact populations	Identify causes of degradation and determine appropriate management actions to restore conditions or mitigate effects.
Fish and cultural ORVs	Contaminant levels in fish, especially top predators and those important to subsistence users	Observed contaminants in fish at levels that are unsafe for humans or that pose a threat to ecosystems	Work with the Service's Fisheries and Ecological Services and the State of Alaska to identify sources of contamination and conduct appropriate mitigation efforts.
Ecology, fish, and scenery ORVs and water quality	Presence of riparian, terrestrial, and aquatic invasive species	Detection of highly invasive riparian, terrestrial, or aquatic species	Follow appropriate Service rapid response plans to control or eliminate invasive species or mitigate effects.
Ecology, fish, and scenery ORVs	Presence of wildlife and plant disease, pathogens, and pests	Detection of disease, pathogens, or pests that have the potential to significantly affect fish, wildlife, or plant species	Work with partners to initiate necessary studies and/or take appropriate management action.
Cultural ORV	Documentation of cultural sites	Discovery of archaeological or historic sites, particularly those at risk of erosion by river action	Work with the Service's regional archaeologist, the State Historic Preservation Office, and/or other partners to document the site and evaluate it for inclusion on the NRHP.
Cultural and scenery ORVs	Natural condition of river corridor and impacts of visitor use	Presence of trash, trampling, erosion, or other impacts of visitor use	Clean and rehabilitate disturbed sites. Increase messaging to the public about appropriate camp etiquette, including Leave No Trace practices.
All	Natural condition of soils at dispersed campsites	New trampling of vegetation beyond the existing footprint; new, fully bare soil areas beyond existing footprint	Use area measurements and photographs to track changes. Increase Leave Not Trace outreach. Close and rehabilitate newly disturbed sites beyond the original footprint.

A.5.4 Future Monitoring Strategy Modification

Some components of the monitoring strategy may need to be adjusted in the future as better data are collected. The monitoring plan may be modified if more effective or efficient monitoring methodologies become available; if changes to objectives, indicators, metrics, measurement, and assessment frequencies or thresholds are needed as understanding of the river values improves; to more effectively answer monitoring questions; or to better ensure protection of river values. Assessing the need for modifying the monitoring plan should occur at established intervals and be completed in collaboration with appropriate partners, community members, and subject matter experts. Any modifications will be documented in the project file, and the CRMP will be updated administratively.

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Attachment A

Digitizing Standards for Wild & Scenic River Corridors

In most cases, the boundaries of Wild & Scenic River corridors are derived from the ordinary high-water line of the left and right banks of the designated rivers. This requires that the riverbanks be digitized before any other products can be produced.

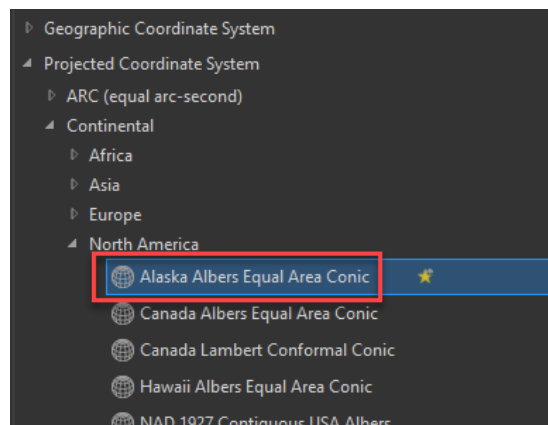
Because there may be more than one person digitizing the riverbanks, it is essential that everyone follow standard digitizing procedures for this project. This document describes the process for digitizing only the **ordinary high-water line of the extreme left and right banks** of the rivers, and any islands between the left and right banks. *It does not address any other products derived from the riverbanks; those products will be created by the cartographers in the Region 7 Division of Realty.*

General Procedure

- 1) Use the ESRI World Imagery layer as the reference for the riverbanks.
- 2) DO NOT USE STREAM MODE DIGITIZING.
- 3) Digitize at a map scale of 1:3,000.
- 4) Manually place vertices to achieve an accurate representation of the riverbanks.
- 5) Send completed data to Scott McGee, R7 Division of Realty (scott_mcgee@fws.gov)

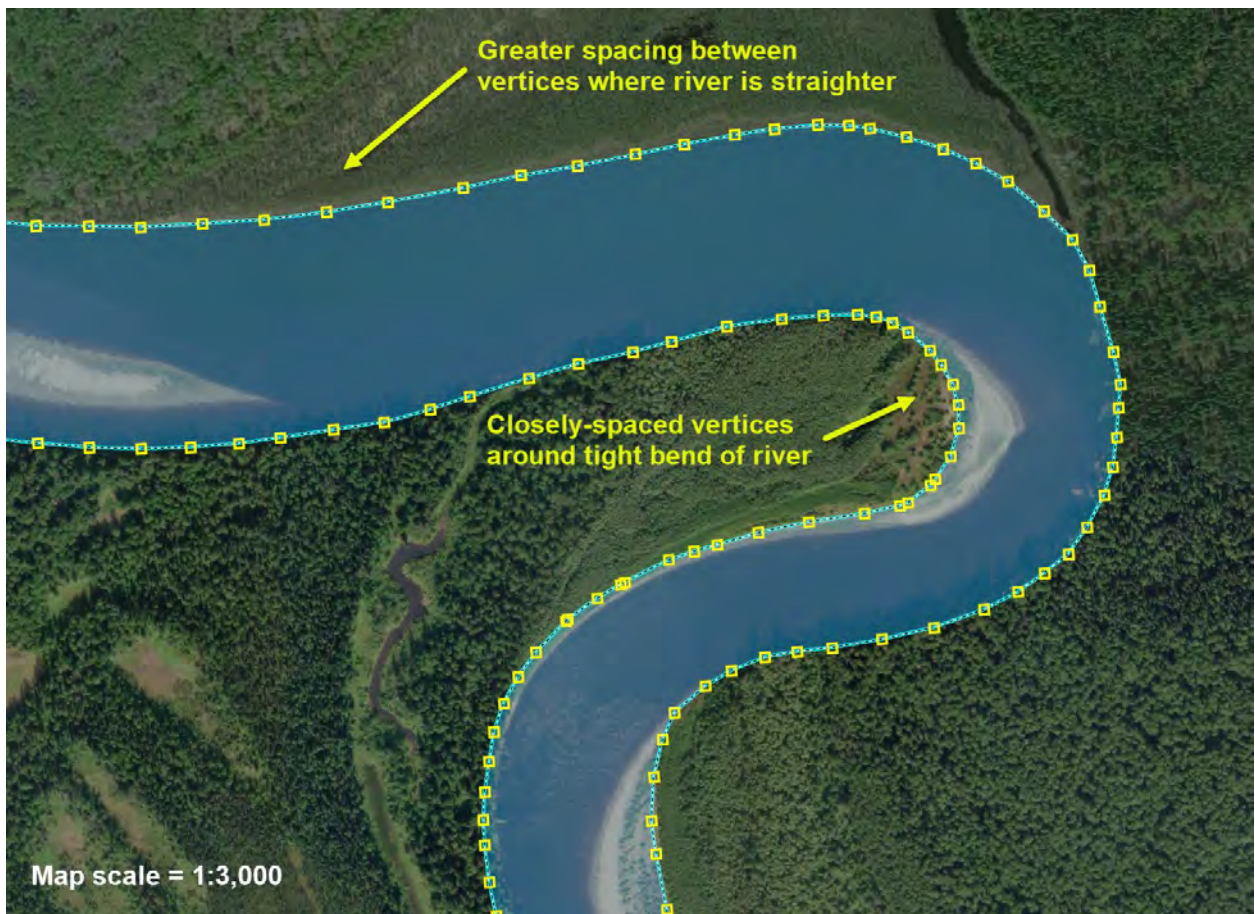
Detailed Procedure

- 1) You must use the **ESRI World Imagery** satellite image layer as the reference from which to identify and digitize the riverbanks. This imagery is the best, most current, most consistent satellite imagery that is available across the entire state of Alaska. Using this imagery will ensure that all rivers digitized are consistent with each other.
- 2) **DO NOT USE STREAM MODE DIGITIZING.** Stream mode digitizing is faster than manually placing each vertex, but you have less control of the placement and density of vertices that are automatically placed. This results in significantly more vertices than are needed and it creates lines that can be jagged in nature when you zoom in. Manually placing vertices takes more time than stream mode digitizing, but it results in a better, more accurate representation of the riverbanks. This is important because other products (river centerline, river corridors) will be derived from the digitized riverbanks, so the digitized riverbanks must be of the highest quality. Additionally, the products produced for this project will be used for many years, for many purposes, and by many people and agencies. It is therefore essential that the digitized riverbanks be of the highest quality possible, even if it takes more time and effort to digitize them. In this project, quality is more important than the time it takes to produce a product.
- 3) Create a new, empty feature class to contain the digitized riverbanks. For this project, don't be concerned with adding specific attribute fields; just accept the default fields that are created. For the coordinate system, specify the following **projected coordinate system**:



- 4) The nominal **map scale** for digitizing the riverbanks is **1:3,000**. This is the scale at which you must perform the digitizing. In cases where there is much river detail or where there are tight bends in the river that are difficult to digitize at 1:3,000, it is acceptable to zoom in to a larger scale, although the maximum map scale available for the ESRI World Imagery is 1:1,100.
- 5) Digitize a polygon that represents the ordinary high-water line of the extreme left and right banks of the river. Designation of the left and right banks is determined by the viewer's position. When the viewer is looking downstream (in the direction of the river's flow), the left bank is on the viewer's left and the right bank is on the viewer's right.

The goal of this project is to digitize a polygon that faithfully represents the riverbanks without being too jagged or having an excessive number of vertices. Aim for a visually smooth-looking line at the nominal map scale of 1:3,000. In areas where the river is relatively straight, fewer vertices are needed, while more vertices will be needed along tight bends in order to produce a smooth line. See the following example.



- 6) In many cases, the extreme left and right banks of the river will surround islands. In these cases, after you have digitized the river polygon, you will need to split the river polygon at the ordinary high-water line of the island(s), and then delete the polygon(s) that represents the island(s). The result will be a polygon that represents only the water of the river. See the following example.

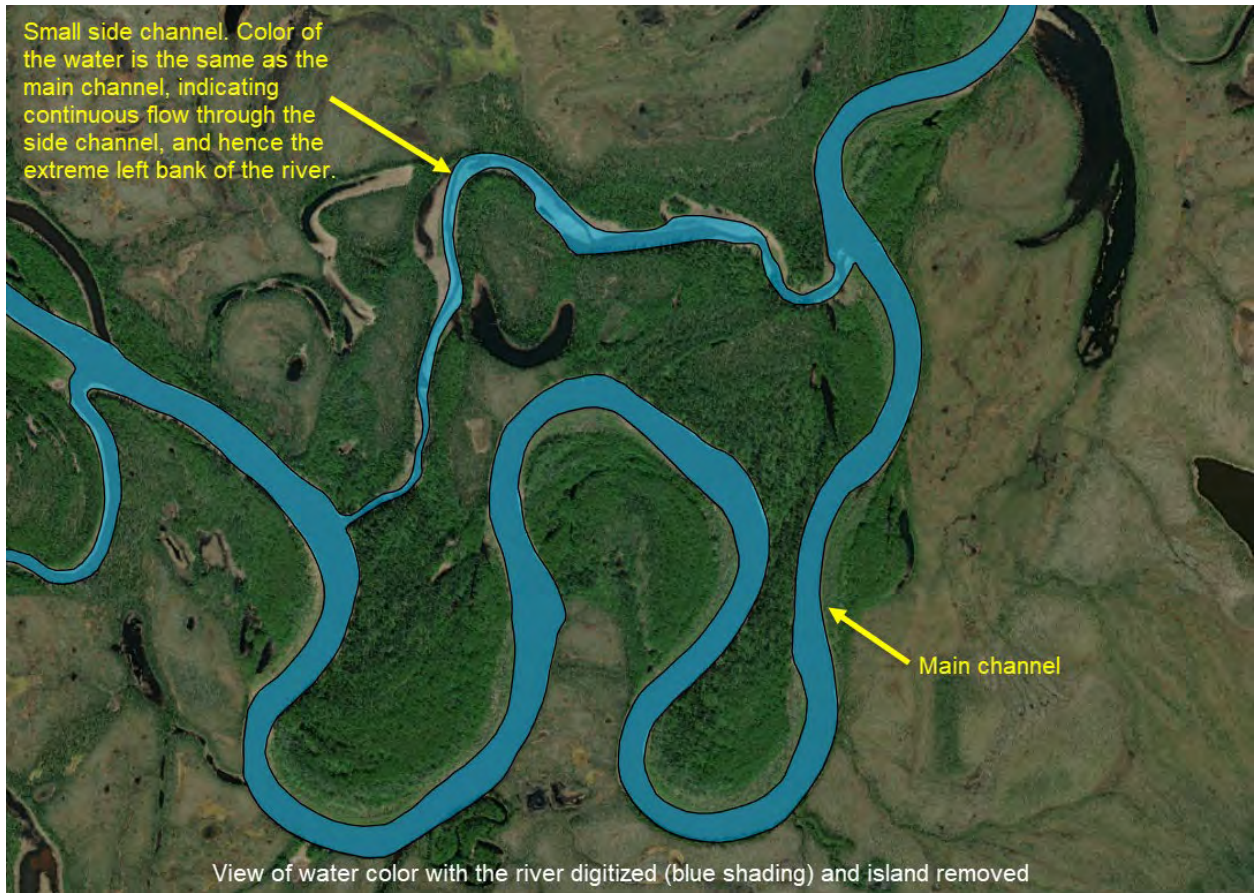


- 7) Visually estimate the line of ordinary high-water. This is just an approximation of where you believe the average high-water line is located, but it should be possible to get it relatively close to the actual location. Factors to consider are the time of year the satellite image was acquired, color of the river water, and steep vegetation-free cutbanks versus low-angle vegetation-free sand/gravel bars. Examples of these factors are given below.
- 8) **Satellite image acquisition date.** All imagery shown by the ESRI World Imagery layer was acquired during non-winter months – typically from late spring to early fall. Generally speaking, low-water periods are in late winter to early spring before snowmelt increases river volume. Conversely, glacial rivers may experience extreme high water levels during periods of prolonged sunshine due to increased melting of glaciers. You can determine the acquisition date of the imagery used in the ESRI World Imagery layer by adding the following layer to your ArcPro project:

https://services.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer/4

- 9) **Color of the river water.** In some cases, it is possible to use the color of the river water to help determine where the extreme left and right banks of the river are located. For example, there may be a small side channel that branches off the main river channel. If the small channel does not connect back to the main channel, it could be a dead remnant of a former flowing river channel. In this case, you would not digitize the side channel, but rather cut across the mouth of it where it connects to the main channel. In other cases, the small side channel may reconnect to the main channel some distance downstream. In this situation, you can use the color of the river water as an indicator of continuous flow through the side channel. If the color of the water in the side channel is the same as that of the main channel, that is evidence that the extreme left or right bank of the river should be digitized along the side channel. See the examples below.

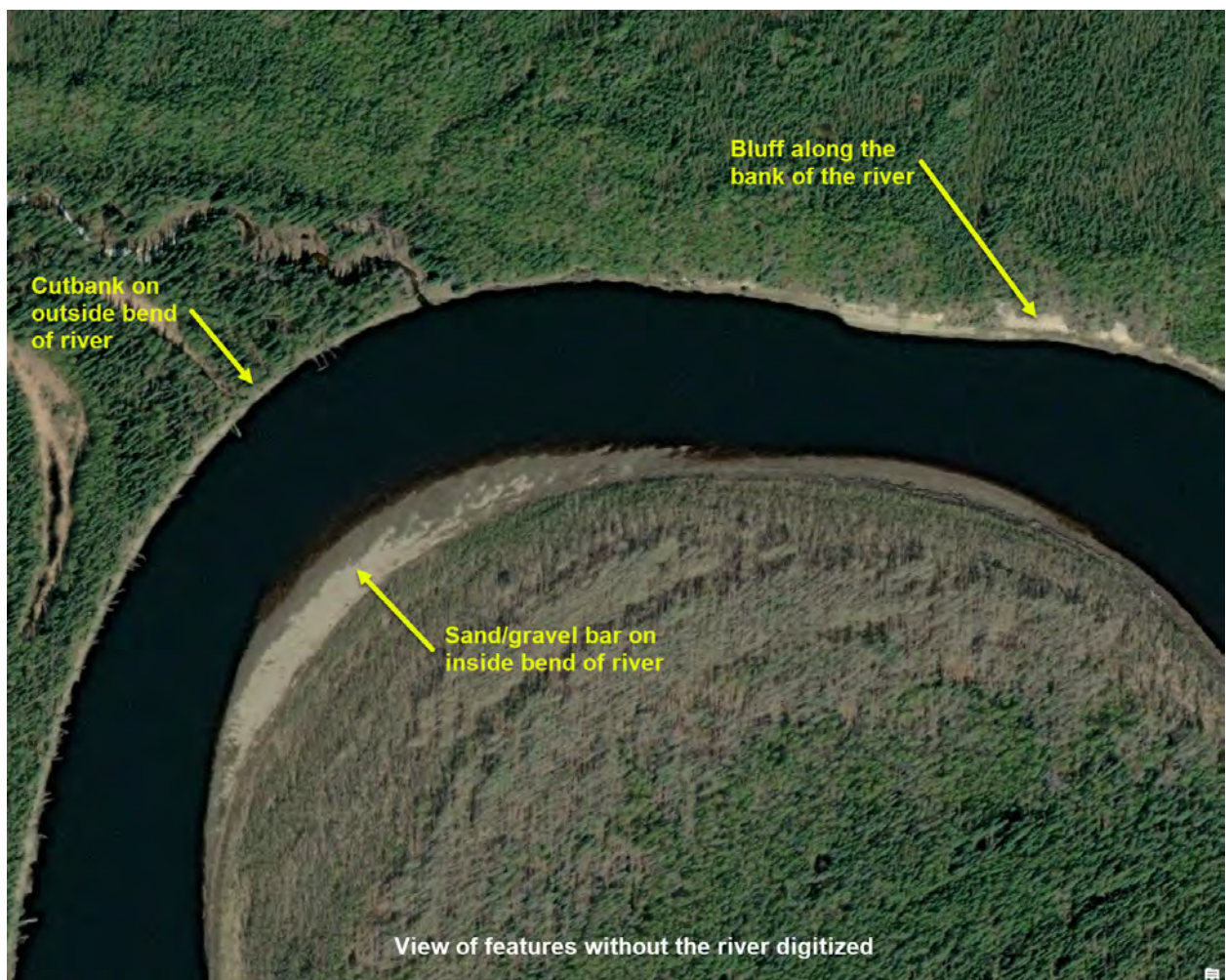


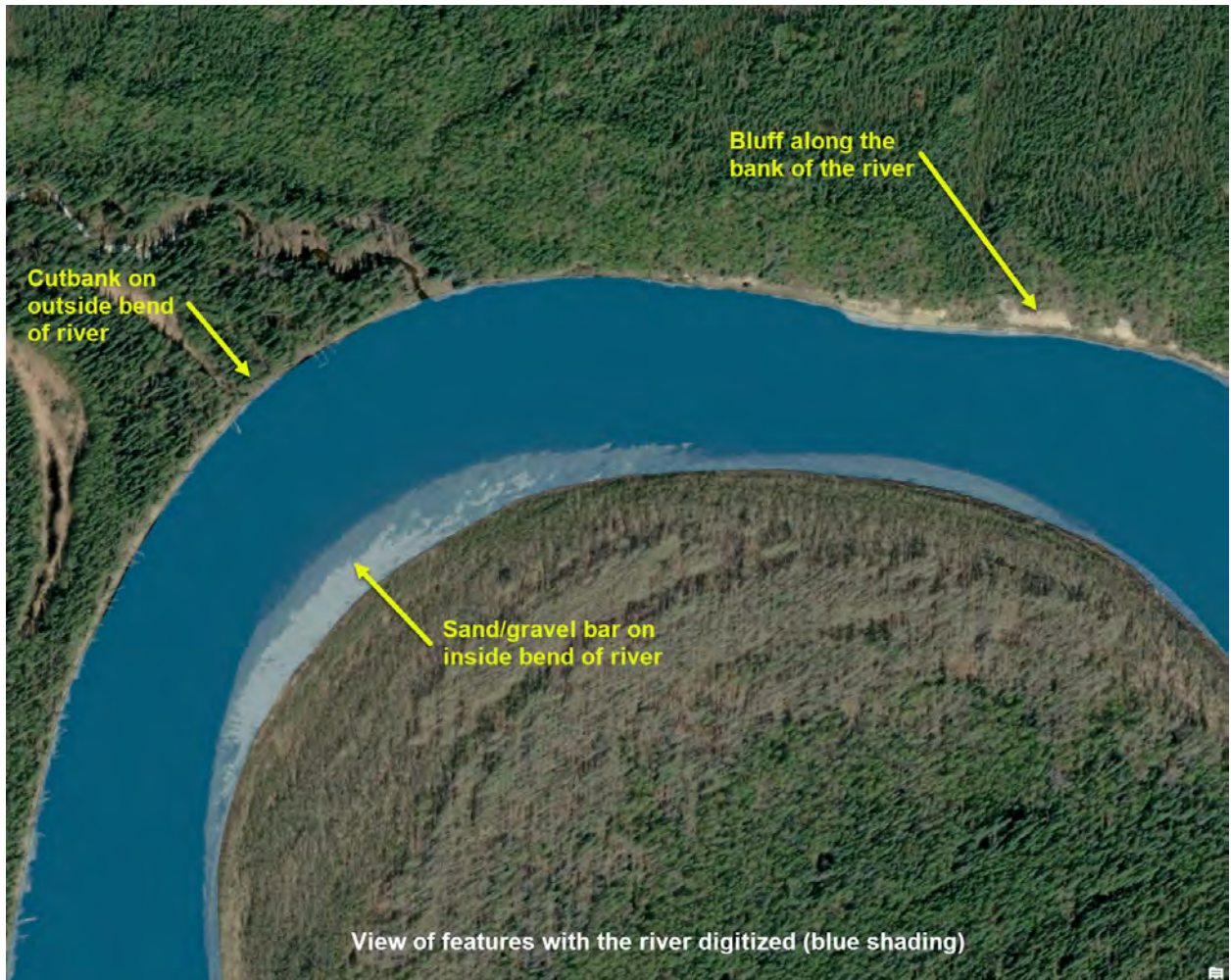


In other cases, there might be a small side channel that branches off a turbid glacial river, and in which the color of the water is different from the main channel. This might be an indication that the side channel is fed more by the surrounding terrain than by the main channel. In this case, you likely would not digitize the small side channel as the left of right bank of the river.

- 10) **Cutbanks/bluffs versus sand/gravel bars.** Generally speaking, vegetation-free areas are usually periodically underwater, which is an indication that they are likely below the ordinary high-water line. An exception to this, and one which is common on Alaska rivers, is steep-sloped, vegetation-free cutbanks and bluffs along a river. These typically occur around the outer bend of rivers, along areas of high topographic relief adjacent to the river, or areas where the river is incised into the terrain. In areas such as these, determination of the ordinary high-water line cannot be based solely on the absence of vegetation. Rather, you will have to closely examine the imagery and estimate, based on the surrounding terrain, where the ordinary high-water line is likely to be located.

Conversely, other vegetation-free areas typically include sand and gravel bars which are typically found along the inner bend of rivers. These are areas where the water velocity is slower, thereby depositing sand and gravel. In these areas, the ordinary high-water line can usually be estimated as being around three-quarters (or more) of the distance between the water and the adjacent vegetated areas. Refer to the examples below.





- 11) In many cases tree branches will overhang the riverbanks. In these situations, do not digitize along the edges of the branches/vegetation. Rather, visually estimate where you believe the riverbank is beneath the overhanging branches/vegetation and digitize that.
- 12) When you have completed digitizing the ordinary high-water line of the left and right banks of the river, you should have only one polygon. Use the metadata feature of ArcPro (or ArcMap) to add your author information and any other pertinent details about your digitizing work. Then send the complete, zipped file geodatabase to Scott McGee in the R7 Division of Realty (scott_mcgee@fws.gov). He will then review the digitized river, incorporate it into the larger WSR geodatabase, and create the various derivative feature classes.

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ATTACHMENT B: CURRENT MANAGEMENT DIRECTION

Current management direction from the Revised CCP that is relevant to the Nowitna WSR corridor is consolidated below in **Table Att. B-I** and will continue to be used to manage the Nowitna WSR corridor. The following are definitions for terms used as identified in the Revised CCP Chapter 2.5:

Allowed—The activity, use, or facility is allowed under existing NEPA analysis, appropriate use findings, refuge compatibility determinations, and applicable laws and regulations of the Service, other federal agencies, and the State of Alaska.

May be allowed—The activity, use, or facility may be allowed subject to site-specific NEPA analysis, an appropriate use finding (when required), a specific refuge compatibility determination (when required), and compliance with all applicable laws and regulations of the Service, other federal agencies, and the State of Alaska.

May be authorized—The activity, use, or facility may be allowed; a special-use permit or other authorization is required.

Table Att. B-I. Current Management Direction (Revised CCP) for the Nowitna WSR Corridor

Resource	Current Management Direction
Revised CCP Decision Summary	
Ecosystem Management - Prescribed Fire	Allowed in Minimal and Wild River Management.
Travel – Snowmobiles	Permitted for traditional activities, on or off designated trails, in period of adequate snow cover and on ice-covered rivers, subject to reasonable regulation.
Public Use – Admin Field Sites	Use of existing sites allowed including replacement of existing facilities as necessary; new sites may be allowed in Wild River and Minimal Management.
Recreation – Boat Launches and Docks	May be allowed.
Public Use – Visitor Contact Facilities	May be allowed under Minimal and Wild River Management categories.
Transportation - Includes transmission lines, pipeline, telephone and electrical power lines, oil and gas pipelines, communications systems, roads, airstrips, and other necessary related facilities. Does not include facilities associated with on refuge oil and gas development.	May be authorized under Wild River Management and Minimal Management categories but will require a CCP amendment.
Revised CCP	
Ecosystem and Landscape Management	
Collecting Information on and Monitoring Ecosystem Components Data gathering, monitoring, and maintaining a comprehensive database of selected ecosystem components (plants, animals, fish, water, and air).	Allowed
Research and Management Access and collection of data necessary for management decisions or to further science by the Service.	Allowed
Access and collection of data necessary for management decisions or to further science by ADFG.	Allowed

Resource	Current Management Direction
Access and collection of data necessary for management decisions or to further science by other researchers.	May be authorized
Research and Management Facilities May be permanent or temporary structures or camps, including weirs, counting towers, and sonar counters.	May be allowed
Fish and Wildlife Habitat Management	
Describing, Locating, and Mapping Habitats Development of quantitative, written, and graphic descriptions of fish and wildlife habitat, including water, food, and shelter components.	Allowed
Habitat Management <i>Mechanical Treatment:</i> Activities such as cutting, crushing, or mowing of vegetation; water control structures; fencing; and artificial nest structures.	May be allowed (with exceptions consistent with section 2.3.5 Revised CCP)
<i>Chemical Treatment:</i> Use of chemicals to remove or control non-native species.	May be allowed
<i>Manual Treatment:</i> Use of hand tools to remove, reduce, or modify hazardous plant fuels or exotic plant species, or to modify habitats (e.g., remove beaver dams).	May be allowed
Aquatic Habitat Modifications Activities such as stream bank restoration, passage structures, fish barriers, or removal of obstacles which result in physical modification of aquatic habitats to maintain or restore native fish species.	May be allowed (consistent with section 2.3.5 Revised CCP)
Fire Management—Prescribed Fires Fire ignited by management actions to meet specific management objectives.	May be allowed
Fire Management—Wildland Fire Use The planned use of naturally occurring fires to meet management objectives.	May be allowed
Fire Management—Fire Suppression Management actions intended to protect identified resources from a fire, extinguish a fire, or alter a fire's direction of spread.	Allowed
Non-native and Pest Plant Control Monitoring, extirpation, control, removal and/or relocation, and other management practices for pest and nonnative plant species.	May be allowed
Water Quality and Quantity Management Monitoring of water quality and quantity to identify baseline data and for management purposes; includes installation of gauging stations.	Allowed
Fish and Wildlife Population Management	
Reintroduction of Species The reintroduction of native species to restore natural diversity of fish, wildlife, and habitats.	May be allowed

Resource	Current Management Direction
<p>Fish and Wildlife Control The control, relocation, sterilization, removal, or other management of native species including predators, to maintain natural diversity of fish, wildlife, and habitats; favor other fish or wildlife populations; protect reintroduced, threatened, or endangered species or to restore depleted native populations.</p>	May be allowed
<p>Non-native Species Management The removal or control of non-native species (including predators).</p>	May be allowed
<p>Pest Management and Disease Prevention and Control Relocation or removal of organisms that threaten human health or survival of native fish, wildlife, or plant species. Management practices directed at controlling pathogens that threaten fish, wildlife, and people, such as rabies and parasite control.</p>	May be allowed
<p>Fishery Restoration Actions taken to restore fish access to spawning and rearing habitat, or actions taken to restore populations to historic levels. Includes harvest management, escapement goals, habitat restoration, stocking, egg incubation boxes, and lake fertilization.</p>	May be allowed
<p>Fishery Restoration Facilities Fisheries facilities may be permanent or temporary and may include hatcheries, fish ladders, fish passages, fish barriers, and associated structures.</p>	May be allowed
<p>Fishery Enhancement Activities applied to a fish stock to supplement numbers of harvestable fish to a level beyond what could be naturally produced based upon a determination or reasonable estimate of historic levels.</p>	May be allowed
<p>Fishery Enhancement Facilities May be permanent or temporary and may include hatcheries, egg incubation boxes, fish ladders, fish passages, fish barriers, and associated structures.</p>	May be authorized
<p>Native Fish Introductions Movement of native fish species within a drainage on the Refuge to areas where they have not historically existed.</p>	May be allowed
Subsistence Activities	
<p>Fishing, Hunting, Trapping, and Berry Picking The taking of fish and wildlife and other natural resources for personal consumption, as provided by law.</p>	Allowed
<p>Collection of House Logs and Firewood Harvesting live standing timber greater than 6 inches diameter at breast height for personal or extended family use.</p>	May be authorized

Resource	Current Management Direction
Collection of House Logs and Firewood Harvesting live standing timber between 3- and 6- inches diameter at breast height for personal or extended family use.	20 trees or less per year allowed; more than 20 trees per year may be authorized
Collection of Plant Materials Harvesting trees less than 3 inches diameter at breast height, dead standing or downed timber, grass, bark, and other plant materials used for subsistence purposes.	Allowed
Temporary Facilities Establishment and use of tent platforms, shelters, and other temporary facilities and equipment directly related to the taking of fish and wildlife.	Tent platforms may be authorized; all others may be allowed
Subsistence Access - subject to reasonable regulations under provisions of Section 811 of ANILCA	
Use of snowmobiles, motorboats, four-wheelers, and other means of surface transportation traditionally employed for subsistence purposes.	Allowed
Access	
Foot	Allowed
Dogs and Dog Teams	Allowed
Other Domestic Animals Includes horses, mules, llamas, etc. (certified weed-free feed required).	Allowed
Nonmotorized Boats Includes canoes, kayaks, rafts, etc.	Allowed
Use of snowmobiles, motorboats, airplanes, and nonmotorized surface transportation methods for traditional activities and for travel to and from villages and home sites.	Allowed
Off-Road Vehicles (All-Terrain Vehicles) Includes air boats and air-cushion vehicles.	Not allowed (with exceptions consistent with section 2.2.12.2 Revised CCP)
Helicopters Includes all rotary-wing aircraft.	May be authorized
Public Use, Recreation, and Outreach Activities	
Hunting, Fishing, Wildlife Observation, Wildlife Photography, Interpretation and Environmental Education Note: All activities listed are priority public uses.	Allowed
Trapping, Walking, Hiking, Camping at Undeveloped Sites, and Dog Sledding	Allowed
General Photography	Allowed
Outreach Activities	Allowed
Designated Off-Road Vehicle (All-Terrain Vehicle) Trails and Routes	May be allowed
Cleared Landing Strips and Areas Includes unimproved areas where airplanes land. Minor brush cutting or rock removal by hand is allowed for maintenance.	May be allowed

Resource	Current Management Direction
<p>Constructed Hiking Trails Includes bridges, boardwalks, trailheads, and related facilities.</p>	May be allowed
<p>Designated Hiking Routes Unimproved and unmaintained trails; may be designated by signs, cairns, and/or on maps.</p>	Allowed
<p>Boat Launches and Docks Designated sites for launching and storing watercraft or tying up a float plane.</p>	May be allowed
<p>Visitor Contact Facilities A variety of staffed and unstaffed facilities providing information on the Refuge and its resources to the public; facilities range from visitor centers to kiosks and signs. (See section 2.4.15 Revised CCP)</p>	May be allowed
<p>Hardened Campsites Areas where people can camp that are accessible by vehicle or on foot but where the only facilities provided are for public health and safety and/or resource protection; may include gravel pads for tents, hardened trails, and/or primitive toilets.</p>	Allowed
<p>Temporary Facilities Includes tent frames, caches, and other similar or related facilities; does not include cabins. See also SUBSISTENCE, COMMERCIAL USES, and Administrative Facilities.</p>	Tent platforms may be authorized; all others may be allowed
Cabins	
<p>Administrative Cabin Any cabin primarily used by refuge staff or other authorized personnel for the administration of the Refuge.</p>	May be allowed
<p>Subsistence Cabin Any cabin necessary for health and safety and to provide for the continuation of ongoing subsistence activities; not for recreational use.</p>	Existing cabins allowed to remain; new cabins may be authorized
<p>Commercial Cabin Any cabin which is used in association with a commercial operation, including but not limited to commercial fishing activities and recreational guiding services.</p>	Existing cabins allowed to remain; new cabins may be authorized
<p>Other Cabins Cabins associated with authorized uses by other government agencies.</p>	May be authorized
Administrative Facilities	
<p>Administrative Field Camps Temporary facilities used by refuge staff and other authorized personnel to support individual (generally) field projects; may include, but not limited to, tent frames and temporary/portable outhouses, shower facilities, storage/maintenance facilities, and caches.</p>	May be allowed

Resource	Current Management Direction
<p>Administrative Field Sites Permanent facilities used by refuge staff or other authorized personnel for the administration of the Refuge. Includes administrative cabins and related structures (see Cabins) and larger multi-facility administrative sites necessary to support ongoing field projects, research, and other management activities. Temporary facilities, to meet short-term needs, may supplement the permanent facilities at these sites.</p>	Use of existing sites allowed including replacement of existing facilities as necessary; new sites may be allowed
<p>Hazardous Materials Storage Sites, including appropriate structures and equipment, necessary for the storage and transfer of fuels and other hazardous materials used for administrative purposes; must be in compliance with all federal and State requirements.</p>	May be allowed
<p>Boat Launches and Docks Designated sites for launching and storing watercraft or tying up a float plane.</p>	May be allowed
<p>Radio Repeater Sites Sites used to maintain radio communications equipment; may include helispots for access.</p>	May be allowed
Commercial Uses - Commercial Recreation	
Guiding and Outfitting	May be authorized
Transporting	May be authorized
Fixed-Wing Air Taxis	May be authorized
Helicopter Air Taxis	May be authorized
Commercial Uses - Mineral Exploration	
<p>Surface Geological Studies Includes surface rock collecting and geological mapping activities (includes helicopter or fixed-wing access).</p>	May be authorized
<p>Geophysical Exploration and Seismic Studies Examination of subsurface rock formations through devices that set off and record vibrations in the earth. Usually involves mechanized surface transportation but may be helicopter supported; includes studies conducted for the Department of the Interior.</p>	May be authorized
<p>Core Sampling Using helicopter transported motorized drill rig to extract subsurface rock samples; does not include exploratory wells; includes sampling conducted for Department of the Interior.</p>	May be authorized
<p>Other Geophysical Studies Helicopter-supported gravity and magnetic surveys and other minimal impact activities that do not require mechanized surface transportation.</p>	May be authorized
Commercial Uses - Other Commercial Activities	
Commercial Filming, Videotaping, and Audio taping	May be authorized

Resource	Current Management Direction
Commercial Fishery Support Facilities At or below 1979 levels.	Allowed
Commercial Fishery Support Facilities Above 1979 levels.	May be authorized
Commercial Timber and Firewood Harvest	May be authorized
Transportation and Utility Systems Includes transmission lines, pipelines, telephone and electrical power lines, oil and gas pipelines, communication systems, roads, airstrips, and other necessary related facilities. Does not include facilities associated with on-refuge oil and gas development.	May be authorized; would require a Revised CCP amendment
Navigation Aids and Other Facilities Includes air and water navigation aids and related facilities, communication sites and related facilities, facilities for national defense purposes and related air/water navigation aids, and facilities for weather, climate, and fisheries research and monitoring; includes both private and government facilities.	May be authorized

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ATTACHMENT C: CURRENT MONITORING

Current monitoring from the following sources that are relevant to the Nowitna WSR corridor is consolidated below in **Table Att. C-I** and will continue to be used for monitoring in the Nowitna WSR corridor:

- Executive Summary: Wildlife Inventory Plan Koyukuk/Nowitna/Innoko National Wildlife Refuge Complex 2014 (USFWS 2014)
- Identification of Priority Resources of Concern: Methods and Results, Koyukuk, Nowitna, and Innoko National Wildlife Refuges (USFWS 2022)
- Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska (Burkart et al. 2023)
- Koyukuk/Nowitna National Wildlife Refuge Complex Cultural Resource Guide (USFWS 1995)
- Koyukuk, Northern Unit Innoko and Nowitna National Wildlife Refuge Wildland Fire Management Plan (USFWS 2010)
- Nowitna National Wildlife Refuge Fishery Management Plan (USFWS 1990)
- Plan of Study: Hydrologic Resources Investigation Nowitna National Wildlife Refuge (USFWS 1998)
- Whitefish Biology, Distribution, and Fisheries in the Yukon and Kuskokwim River Drainages in Alaska: a Synthesis of Available Information (USFWS 2012)

Table Att. C-1. Current and Recommended Monitoring Related to the Nowitna WSR Corridor

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Executive Summary: Wildlife Inventory Plan Koyukuk/Nowitna/Innoko National Wildlife Refuge Complex (USFWS 2014)					
Ecology ORV	Moose	Aerial moose surveys of standardized trend areas are flown every year during November (post-hunt/rut).	Because moose are the most important subsistence and sport hunting species, the Service has to answer questions on the status and health of populations on the refuge. Annual information on bull/cow ratios, calf/cow ratios, recruitment, harvest patterns, and predation has been collected since 1981 and provided to the Subsistence Division, ADFG advisory committees, Native groups, the Regional Office, and the public.	x (1999)	
Ecology ORV	Moose	Large-scale moose population estimates are obtained for significant portions of the Complex every 5–10 years using the Geospatial Population Estimator Method.	The plan includes specific criteria on age and sex ratios obtained from trend counts that trigger concern for a population, and at which point more data and possible regulatory proposals are warranted.	x (1999)	
Ecology ORV	Moose	Annual moose twinning surveys are conducted in May at peak calving.	The information provides an index for moose habitat quality and cow body condition, and informs future management.	x (1998)	
Ecology ORV	Moose	Nowitna River moose hunter check station is operated.	Moose hunter check stations are operated on both the Nowitna and Koyukuk Rivers to obtain accurate and immediate harvest totals in the most intensely hunted areas.	x (1988)	
Ecology ORV	Geese	Nowitna River goose production float surveys (canoe) are conducted.	Goose production trend surveys along three rivers in the Complex and concurrent aerial molting surveys in three areas provide an index of total adults; breeding pairs; and young, molting, and nonbreeding adults. They also provide an estimate of the minimum total numbers present.	x (1976)	

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Ecology ORV	Swans	Swan production: The inventory and management plan identifies a minimal number of trend maps to be surveyed aerially every year. A refuge-wide survey that is part of the statewide cooperative survey is planned for every fifth year.	Annual trend surveys and follow-up distribution studies should be conducted at or near the 5-year migratory birds management statewide Trumpeter Swan census to better enumerate population changes for each species on the refuge. A study conducted from 2004 to 2006 showed 100 percent Trumpeter Swans on the Nowitna NWR with no Tundra Swans nesting on the refuge.	x (1968)	
Ecology ORV	Raptors	Refuge staff are currently conducting a Complex-wide raptor nest inventory (begun in 2009) and are evaluating adding a bald eagle and osprey nesting and productivity component to the Inventory and Monitoring Plan.	Raptors are a species that are very sensitive to disturbance and hence serve as indicator species.	x (2009)	
Ecology ORV	Beavers	Fall aerial beaver cache survey: The inventory and monitoring plan identifies a minimal number of trend maps to be surveyed aerially, rotating annually between the Koyukuk/Kaiyuh ³⁸ Unit of Innoko and the Nowitna NWRs.	Beavers have a significant impact on wetland regimes on the Complex. Trapping historically held beaver numbers much lower than present levels. The Complex staff has been surveying beavers at part of the Inventory and Monitoring Plan since 1991.	x (1991)	
Ecology ORV	Wolves	Standardized aerial wolf surveys using the ADFG sampling unit population estimator method have been implemented on the Nowitna, Kaiyuh Unit of Innoko, and Koyukuk NWRs as part of the Complex Inventory and Monitoring Plan since 1991. Surveys are to be repeated every 5 to 10 years and perhaps more often if dictated by resource problems or controversies. The Sampling Unit Population Estimator aerial snow track surveys are supplemented with an annual incidental wolf pack observation record.	Wolf density and predation rate information in combination with moose density data are required to estimate sustainable harvests of ungulates. The Service must be able to make supportable comments to sport and subsistence hunting regulation proposals.	x (1991)	

³⁸ The Kaiyuh Unit of Innoko NWR has also been called the Northern Unit of Innoko NWR.

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Ecology ORV	Landscape monitoring	Development, design, and testing of ecosystem- or landscape-based monitoring protocols for habitats and plant species include moose browse, wetland lake species diversity and distribution, snow depth and density, permafrost, soils, phenology, biomass, insect and disease presence, and weather.	ANILCA not only mandates conservation of animal species but also of their habitats. Moreover, it has become increasingly evident that monitoring of single animal species, while perhaps necessary for management purposes, often provides incomplete insight as to why changes in abundance occur over time. Much of the collected data are used in correlation with wildlife surveys to help explain population fluctuations.	x (1994)	
Ecology ORV	Climate monitoring	Climate change–related investigations on the Complex include snow depth monitoring, spring snow and ice phenology surveys (aerial), temporal and spatial moose willow mapping, phenological monitoring of plants and animals, and permafrost monitoring.	Climate change has become a part of daily language, and the effects of a changing climate on our lives and the health of refuge resources in the far north are not well understood. The Service continues to seek out projects that will increase understanding of how changes in climate may affect ecosystems in the Complex.	x (1988)	
Identification of Priority Resources of Concern: Methods and Results, Koyukuk, Nowitna, and Innoko National Wildlife Refuges (USFWS 2022)					
Ecology ORV	Larch	Larch are monitored along the Nowitna River.	As a species, larch is of conservation concern due to both the drastic population reductions caused by infestations of larch sawfly and the geographic and potentially genetic separation of the Alaska population from to the North American population. Unusually extensive areas of larch forest occur in the upper and middle portions of the Nowitna River drainage. Larch-dominated forest communities such as this are rare statewide.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Ecology and cultural ORVs	White spruce	Old-growth white spruce are monitored along the Nowitna River.	White spruce is an ecological specialist that shows evidence of vulnerability to climate change. Large stands of mature white spruce are becoming increasingly less common in Alaska. Notable mature white spruce stands are found in the lower Nowitna River corridor. Large old-growth white spruce trees are sought after for cabin logs.		x
Water Resources Inventory and Assessment: Koyukuk, Nowitna, and Innoko National Wildlife Refuges, Alaska (Burkart et al. 2023)					
Ecology ORV	Abiotic and vegetation mapping	Support initiatives and cooperate with the Service's Inventory and Monitoring Program, National Wetland Inventory, and other partners to complete or update baseline permafrost, wetland, hydrography, soil, and vegetation inventories and maps.	The Service supports these initiatives to enhance the ability to evaluate the ecological impacts of climate change and local anthropogenic activity and infrastructure development.		x
Ecology ORV, fish ORV, and water quality	Climate monitoring	Coordinate with other agencies to support the establishment of new meteorological stations and maintenance and operation of existing long-term climate monitoring stations.	Reliable long-term climate data, especially reliable year-round precipitation estimates, are needed to aid in modeling efforts to better predict responses to climate change.	x (1992)	
Ecology ORV, fish ORV, and water quality	Climate monitoring	Develop alternative management strategies for aquatic ecosystems expected to be impacted by climate change. Use the resist-accept-direct framework to evaluate the potential for alternative management strategies in a changing climate.	The extent to which climate change will alter natural hydrologic systems is unknown, but implementing these recommendations should help the refuges' staff manage water quality and quantity to conserve fish and wildlife populations in a changing environment.		x
Fish ORV	Anadromous fish	Identify additional anadromous fish habitat. When anadromous habitats are identified, submit nominations for inclusion in the State of Alaska's Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes.	The Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes is important because it specifies which streams, rivers, and lakes are important to anadromous fish species and therefore afforded protection under Alaska Statute 16.05.871.	x (1980s)	

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Water	Water quality	Support expansion of the U.S. Geological Survey and Intertribal Watershed Council's long-term water quality monitoring efforts for the Nowitna River.	Working with partners improves communication and increases the amount and value of data collection by sharing resources and providing a broader context for data analysis.		x
Water	Water quality and quantity	Work with the Service's Water Resource Branch and others to document baseline conditions, establish water quality and quantity requirements, and develop a strategy to monitor and protect flow and water quality-dependent ORVs on the Nowitna WSR.	The Service's Water Resource Branch can provide expertise to develop and implement data collection related to these needs.		x
Ecology and fish ORVs	Invasive species	Complete Step I Strategic Tasks defined in the Service 2020 Rapid Response Plan for Elodea in Alaska.	This step outlines actions that entities should take immediately to increase capacity to respond to any new report of Elodea in Alaska. This is an integral step for rapid response.		x
Water	Climate monitoring	Support studies to develop a better understanding of interactions between permafrost and groundwater.	The presence or absence of permafrost strongly affects hydrology. Relationships between groundwater, permafrost, and climate change are not well understood on the Complex and changes could have significant impacts on fish, wildlife, and habitats.		x
Fish ORV and cultural ORV	Contaminants (fish)	Work with the Service's Fisheries and Ecological Services and the State of Alaska to monitor contaminants (with a focus on methylmercury) in fish, especially fish that are top predators and important to subsistence users.	Contaminants found in subsistence resources such as fish can pose health risks to subsistence users. There is more methylmercury (a neurotoxin) in predatory and long-lived fish such as pike.	x (2006)	
Water	Water quality	Evaluate the ADEC's water quality monitoring efforts associated with ongoing mining efforts in the regions of hydrologic influence to ensure monitoring is statistically rigorous enough to detect negative impacts on water quality.	Properly managed mining operations should not have negative impacts on water quality within the watershed. Water quality monitoring must be able to detect negative impacts so that they can be corrected to preserve water quality and ecosystem health.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Water	Water quality	Collect data on waters suspected of impairment and nominate those that are impaired to ADEC for inclusion on the 303(d) list.	Section 303(d) of the Clean Water Act requires states to create a list of impaired water comprised of all waters where the required pollution controls are not sufficient to attain or maintain applicable water quality standards.		x
Water	Water quality	Review the State's guidance for nominating Tier 3 waters as outstanding national resource waters and determine whether it is appropriate for assessing waters in the refuges that may meet eligibility.	Outstanding national resource waters are waterbodies that are of exceptional recreational or ecological significance and are designated under state water quality standards and the federal Clean Water Act. These waters receive enhanced protection against degradation.		x
Water	Water quality	Ensure the responsible agency is performing adequate monitoring to detect potential water quality issues associated with areas of known or suspected contamination.	Both natural and anthropogenic factors can affect the water quality of surface and groundwater. Water quality degradation in the refuges is a concern due to changes in environmental conditions, altered inputs of nutrients, or contaminants from external sources.		x
Water, fish, ecology, and cultural ORVs	Water quantity	Work with the Service's Water Resource Branch to initiate stream gaging and lake monitoring efforts needed to apply for reservations of water.	When the United States reserves public land for uses such as NWRs, it also implicitly reserves sufficient water to satisfy the purposes for which the reservation was created. Water requirements need to be assessed prior to application for water reservations.		x
Water	Water quantity	Document the biological use of rivers and lakes on the refuges to support water reservation applications.	When the United States reserves public land for uses such as NWRs, it also implicitly reserves sufficient water to satisfy the purposes for which the reservation was created. Water requirements need to be assessed prior to application for water reservations.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Water	Water quantity	Work with the Service's Water Resource Branch to complete applications for water reservations using biological and hydrologic data for the streams and lakes.	Alaska's instream flow law is unique within the United States in that it allows federal, state, and local government agencies to apply for a reservation of water. The applicant must support the quantification with sound hydrologic and biological proof of need. Reserved water rights were written in the Alaska Lands Act for most refuges, although quantification is necessary to validate those rights.		x
Fish and ecology ORVs	Invasive species	To prevent the introduction and spread of aquatic invasive species during refuge activities, initiate a Hazard Analysis Critical Control Point analysis with support of the Regional Invasive Species Program.	Hazard Analysis and Critical Control Point planning features five integrated steps that can reduce the risk of spreading invasive species and other nontargets via human-based pathways and examines activities to determine whether and when invasive species might be unintentionally moved.		x
Water, fish, and ecology ORVs	Water quality	Participate in planning and review of large-scale development projects, including addressing the implications of state and federal mining leases.	Both natural and anthropogenic factors can affect the water quality of surface and groundwater. Water quality degradation in the refuges is a concern due to changes in environmental conditions, altered inputs of nutrients, or contaminants from external sources. Potential agents of change to water quality include climate change, mining, proposed oil and gas development, and inputs of contaminants from long-range and near-field sources.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Water	Water quality	Design and implement a water temperature monitoring network in the Nowitna and Innoko NWRs. Collaborate with the Service's Water Resource Branch and the Alaska Refuges Inventory and Monitoring Program to identify sampling sites and develop a data management plan and site-specific monitoring protocols.	Water temperature determines the rate of chemical and biological reactions and is a major factor in aquatic ecosystem health. Cold-water species such as salmon require temperatures that do not exceed certain thresholds for survival and viability. Climate projections for the refuge predict warmer summer climatic conditions in the future that will likely result in increases in surface water temperatures.		x
Water	Water quality	Provide existing staff with time and support for training to conduct aquatic fieldwork.	Sufficient staff time and training are often limiting factors in the accomplishment of ecosystem monitoring activities.		x
Nowitna National Wildlife Refuge Fishery Management Plan (USFWS 1990)					
Fish ORV	Fish	Conduct fish distribution and habitat utilization studies by sampling with standard sampling gear.	Information on fish distribution and habitat utilization on the Nowitna NWR is currently very limited.		x
Fish ORV	Sheefish and northern pike	Conduct radio telemetry surveys to determine key spawning and overwintering areas for sheefish and northern pike.	Sheefish and pike were specifically identified by Congress in ANILCA when citing the purposes for creating Nowitna NWR. Sheefish is regionally important for both subsistence and recreational fishing. Pike is an important predator in the boreal ecosystem, and the fish is valued both for subsistence and recreational harvest.		x
Fish ORV	Sheefish	Estimate and monitor trends in sheefish population on spawning grounds.	Sheefish is specifically mentioned in the establishing purposes set forth in ANILCA for Nowitna NWR. Sheefish is regionally important for both subsistence and recreational fishing.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Fish ORV	Sheefish and northern pike	Describe characteristics of populations of sheefish and northern pike in terms of age, length, and maturation.	Sheefish and pike were specifically identified by Congress in ANILCA when citing the purposes for creating Nowitna NWR. Sheefish is regionally important for both subsistence and recreational fishing. Pike is an important predator in the boreal ecosystem, and the fish is valued both for subsistence and recreational harvest.		x
Fish ORV	Sheefish and northern pike	Sample potential rearing areas downstream and in river-connected lakes for relative abundance of juvenile sheefish and northern pike.	Sheefish and pike were specifically identified by Congress in ANILCA when citing the purposes for creating Nowitna NWR. Sheefish is regionally important for both subsistence and recreational fishing. Pike is an important predator in the boreal ecosystem, and the fish is valued both for subsistence and recreational harvest.		x
Fish and cultural ORVs	Fish	Monitor sport fish harvests.	Sport fishing on Nowitna NWR should be maintained in balance with maintenance of healthy fish populations.		x
Fish ORV	Chum salmon	Conduct radio telemetry surveys to determine key spawning areas for chum salmon in the Nowitna River watershed.	Pacific salmon species, including chum salmon, are a management concern due to their importance for subsistence, their high vulnerability to climate change, and their roles as both keystone and trust species. Congress specifically identified salmon in ANILCA among the purposes for which Nowitna NWR was created. Nowitna NWR waters provide globally important habitat for spawning and rearing salmon and critical anadromous migration corridors.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Fish ORV	Coho salmon	Conduct radio telemetry surveys to determine key spawning areas for coho salmon in the Nowitna River watershed.	Pacific salmon species, including coho salmon, are a management concern due to their importance for subsistence, their high vulnerability to climate change, and their roles as both keystone and trust species. Congress specifically identified salmon in ANILCA among the purposes for which Nowitna NWR was created. Nowitna NWR waters provide globally important habitat for spawning and rearing salmon and critical anadromous migration corridors.		x
Fish ORV	Salmon	Sample potential rearing areas downstream and determine relative abundance to identify important reaches for rearing salmon.	Pacific salmon species are a management concern due to their importance for subsistence, their high vulnerability to climate change, and their roles as both keystone and trust species. Congress specifically identified salmon in ANILCA among the purposes for which Nowitna NWR was created. Nowitna NWR waters provide globally important habitat for spawning and rearing salmon and critical anadromous migration corridors.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Fish ORV	Chum salmon	Monitor fall chum escapement trends in the Nowitna River through test netting.	Pacific salmon species, including fall chum salmon, are a management concern due to their importance for subsistence, their high vulnerability to climate change, and their roles as both keystone and trust species. Congress specifically identified salmon in ANILCA among the purposes for which Nowitna NWR was created. Nowitna NWR waters provide globally important habitat for spawning and rearing salmon and critical anadromous migration corridors.		x
Fish ORV	Fish	Collect tissue samples for electrophoretic stock identification.	Electrophoresis provides an important method for measuring the genetic discreteness of stocks and for the study of genetic relationships among stocks. This can be valuable information in fisheries management.		x
Fish ORV	Fish	Evaluate test netting trends to develop a plan to expand monitoring effort for fall chum escapement, should preliminary findings warrant an increase in effort.	Pacific salmon species, including fall chum salmon, are a management concern due to their importance for subsistence, their high vulnerability to climate change, and their roles as both keystone and trust species. Congress specifically identified salmon in ANILCA among the purposes for which Nowitna NWR was created. Nowitna NWR waters provide globally important habitat for spawning and rearing salmon and critical anadromous migration corridors.		x
Fish and cultural ORVs	Fish	Conduct creel census of subsistence harvest along the Nowitna River.	One of the establishing purposes of Nowitna NWR is to provide the opportunity for continued subsistence uses by local residents.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Water and fish ORV	Water quality and quantity	Collect water quality and quantity data from established monitoring stations on the Nowitna, Sulukna, Titna, and Sulatna Rivers.	Both natural and anthropogenic factors can affect the water quality of surface and groundwater. Water quality degradation in the Nowitna NWR is a concern due to changes in environmental conditions, altered inputs of nutrients, or contaminants from external sources. Changes occurring in tributaries of the Nowitna River may affect water quality in the main stem.		x
Water and fish ORV	Water quantity and fish	Quantify the minimum flow necessary to maintain fishery habitat on the Sulukna River.	The Sulukna River has important spawning habitat for Nowitna River fish species, including sheefish, humpback and broad whitefish, least cisco, and potentially salmon and Dolly Varden.		x
Plan of Study: Hydrologic Resources Investigation Nowitna National Wildlife Refuge (USFWS 1998)					
Water	Water quantity	Conduct stream discharge gaging on the Nowitna main stem and tributaries annually for at least 5 years to establish a baseline. Collect continuous stage records at a given transect within the selected stream reach.	A minimum of 5 full years of mean daily discharge records on a stream is required by the State Department of Natural Resources to quantify water necessary to protect fish and wildlife habitats. Five years of discharge records allow for the reasonably accurate calculation of mean annual and seasonal discharges.		x
Water	Water quantity	Conduct periodic measurement of discharge in each reach to develop the stage/discharge relationship (rating curve).	This rating curve (mathematical relationship) is used to convert the continuous stage record to a mean daily discharge record.		x
Water	Water quantity	At each study reach, determine the river water surface elevation associated with adjacent water-dependent riparian plant communities important to waterfowl and mammal species, such as nesting habitats and winter habitats.	This is needed to determine water quantities necessary to support wildlife populations and habitat.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Water	Water quality	Collect physical water quality parameters (water temperature, pH, specific conductivity, dissolved oxygen content, and turbidity) several times each year at each stream-gaging station.	This is done for the purpose of documenting baseline water quality trends.		x
Water	Water quality	Collect water samples for laboratory analysis several times each year. Send these samples to a water quality laboratory and analyze them for basic physical and chemical parameters, including pH, specific conductance, total dissolved solids, hardness, sodium, potassium, calcium, magnesium, carbonate, bicarbonate, sulfate, total and ortho phosphorus, nitrate, nitrite, arsenic, lead, iron, and zinc.	This is done for the purpose of documenting baseline water quality trends.		x
Water	Water quantity	Document the average high-water stage.	This is done for the purpose of documenting baseline flow characteristics.		x
Fish ORV	Fish	Document fishery resources, life stage, and absence or presence for each fish species.	Nineteen species of fish have been reported on the Nowitna NWR. However, more species may be present since few comprehensive fishery inventories have been completed to date.	x (1985)	
Water and fish ORV	Fish	Quantify, where possible, habitat suitability (depth, velocity, cover, spawning substrate, etc.) of each fish species.	Information on fish distribution and habitat utilization on the Nowitna NWR is currently very limited.		x
Whitefish Biology, Distribution, and Fisheries in the Yukon and Kuskokwim River Drainages in Alaska: a Synthesis of Available Information (USFWS 2012)					
Fish ORV	Whitefish (including sheefish)	Assist in collection of high-quality, drainage-wide, annual harvest data for sheefish, broad whitefish, and humpback whitefish. Investigate the demographic composition of the harvest.	An estimate of the number of fish of each species harvested is essential for population assessment or harvest management studies. Annual harvest data for broad and humpback whitefish within the Yukon and Kuskokwim River drainages are very poor.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Fish ORV	Whitefish	Contribute to the development of genetics baselines for known populations of broad and humpback whitefish and subsequent development of population baselines capable of distinguishing among populations or groups of populations.	Genetics baseline data may permit the proportional contributions of multiple populations of a priority species in the harvests.		x
Fish ORV	Whitefish	Attempt to locate and confirm broad and humpback whitefish spawning areas in the Nowitna River drainage.	Locating spawning habitats is the first step toward any population assessment work, genetics collections, or habitat protection activities. Once identified, spawning habitats may be protected from development impacts.		x
Fish ORV	Whitefish (including sheefish)	Collect population-specific length and age data for sheefish, broad whitefish, and humpback whitefish.	Shifts in age or length distributions may reveal population declines or large recruitment events.		x
Fish ORV	Broad whitefish	Contribute to the development of methods to estimate the abundance or otherwise monitor variation in broad whitefish spawning populations.	While monitoring broad whitefish populations may be the first step to any population assessment, activities will be to identify the spawning populations. The abundance of the spawning population may enable monitoring of the effects of a fishery.		x
Koyukuk/Nowitna National Wildlife Refuge Complex Cultural Resource Guide (USFWS 1995)					
Cultural ORV	Archaeological overview	Prepare an overview of the current state of knowledge for interior archaeology in collaboration with other interior Alaska refuges. The overview should include a summary of the past and present environments, history of research, and regional cultural histories, and a summary of current knowledge and directions of research. Linguistic and physical anthropological information should be incorporated.	Little or no archaeological work has been done on most interior Alaska refuges.		x

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Cultural ORV	Ethnographic interviews	Interviews of particularly knowledgeable individuals conducted in the Koyukuk/Nowitna National Wildlife Refuge Complex's villages would be particularly helpful. Refuge staff is interested in information on species' distributions and abundances, resource use, fire history, historic settlements and camps, place-names, and local history.	Knowledge of fish and wildlife population dynamics, ecology, and behavior is integral to people and cultures dependent on these resources. This local knowledge, though generally not quantifiable, can be an excellent supplement to information collected by quantifiable scientific means. It can provide current information on population status and perceived changes, as well as historical perspective on what things were once like.	X (1992)	
Cultural ORV	Archaeological field surveys	Survey the Nowitna River corridor for sites.	To locate new sites, update old site information, and confirm the locations of archivally reported sites, field work is necessary.		x
Cultural ORV	Archaeological field surveys	Search for Nogħuykkaakk'et	The site on the Alaska Heritage Resources Survey is reported at the mouth of the Nowitna River but has never actually been located.	x (2023)	
Koyukuk, Northern Unit Innoko and Nowitna National Wildlife Refuge Wildland Fire Management Plan (USFWS 2010)					
Ecology, fish, and cultural ORVs	Fire management	Ensure the natural character, vigor, and species diversity of the refuge boreal forest and tundra ecosystems by perpetuating a fire regime (both natural and prescribed) that maintains a mosaic of habitats native to interior Alaska.	Fire is the main driver of ecosystem change within the refuge. New fire management practices need to be continually integrated into refuge habitat management. The fire management plan provides management strategies that enable the refuge staff to conserve, protect, and enhance habitats. Objectives within the fire management plan address ecological relationships and human health and safety.	x (1980s)	

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Ecology, fish, and cultural ORVs	Nowitna WSR fire management unit	Protect identified Nowitna WSR fire management unit values: <ul style="list-style-type: none"> • Intermixed Doyon, Limited land and Native allotments • Critical year-round moose habitat • Resident sheefish habitat in the Nowitna River • The character of the Nowitna River, a “wild river” under the federal WSRA, and its corridor 	Protecting the unit ensures fire management aligns with other refuge goals and priorities and the needs of other landowners within the refuge’s boundaries.	x (1980s)	
Ecology, fish, and cultural ORVs	Nowitna WSR fire management unit	Do not allow the use of aerial retardant or heavy equipment due to the proximity to the Nowitna River.	This prohibition protects Nowitna River water quality.	x (1980s)	
Ecology, fish, and cultural ORVs	Nowitna WSR fire management unit	<u>Full Suppression</u> (one parcel in the northernmost portion): <ul style="list-style-type: none"> • Protect Native allotments and Doyon, Limited lands using aggressive suppression to minimize the presence of uncontrolled fire. • Consider fire for resource benefit strategies only if initial attack is not initiated and/or suppression forces are not available. 	This is done to protect the interests of other landowners within the refuge’s boundaries.	x (1980s)	

River Value	Monitoring Focus	Activity	Rationale	Ongoing (Year Initiated)	Anticipated
Ecology, Fish, and cultural ORVs	Nowitna WSR fire management unit	<p><u>Limited Suppression</u> (the remainder of the fire management unit):</p> <ul style="list-style-type: none"> • Allow fires to spread while providing protection for human life and site-specific values. • Manage most natural ignitions to maintain fire's natural role in the boreal spruce ecosystem, to provide an array of early seral and seral habitats and reduce the risk of catastrophic wildfires. • If management action is needed, use low-impact suppression methods, including minimum-impact suppression tactics, whenever possible. 	This allows the natural fire regime to persist for the benefit of fire-dependent ecosystems and landscape diversity while protecting human life and other values specifically identified in the plan.	x (1980s)	

Note: This is a table of monitoring activities prescribed by other refuge step-down plans and documents that are relevant to the Nowitna WSR.

ATTACHMENT D: ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS		Full Phrase
$\mu\text{S}/\text{cm}$		microsiemens per centimeter
AAC		Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation	
ADFG	Alaska Department of Fish and Game	
ANCSA	Alaska Native Claims Settlement Act	
ANILCA	Alaska National Interest Lands Conservation Act	
CCP	comprehensive conservation plan	
CFR	Code of Federal Regulations	
CO_2e	carbon dioxide equivalent	
Complex	Koyukuk, Nowitna, and Innoko National Wildlife Refuge Complex	
CRMP	comprehensive river management plan	
EPA	Environmental Protection Agency	
IWSRCC	Interagency Wild and Scenic Rivers Coordinating Council	
mg/liter	milligrams per liter	
NAAQS	national ambient air quality standards	
NEPA	National Environmental Policy Act	
NRHP	National Register of Historic Places	
NTU	nephelometric turbidity units	
NWR	National Wildlife Refuge	
NWSRS	National Wild and Scenic River System	
ORV	outstandingly remarkable value	
$\text{PM}_{2.5}$	particulate matter less than 2.5 microns in diameter	
PM_{10}	particulate matter less than 10 microns in diameter	
Service	United States Fish and Wildlife Service	

System	National Wildlife Refuge System
USC	United States Code
WSR	wild and scenic river
WSRA	Wild and Scenic Rivers Act

ATTACHMENT E: SPECIES NAMES

Common Name	Denaakk'e ³⁹ Name	Latin Name
Alaska tiny shrew	loodolts'eyhdle = shrew	<i>Sorex minutissimus</i> or <i>Sorex yukonicus</i>
American Wigeon	seseeye	<i>Mareca Americana</i>
alder	kk'es	<i>Alnus viridis</i> ssp. <i>crispa</i> and <i>A. incana</i> ssp. <i>tenuifolia</i>
alsike clover		<i>Trifolium hybridum</i>
Arctic grayling	tleghebaaye	<i>Thymallus arcticus</i>
Bering cisco		<i>Coregonus laurettae</i>
beaver	noye'e	<i>Castor canadensis</i>
bird vetch		<i>Vicia cracca</i>
black bear	daaletl'edze or hūzen ⁴⁰	<i>Ursus americanus</i>
black spruce	ts'ebaa t'aal	<i>Picea mariana</i>
broad whitefish	telaaghe	<i>Coregonus nasus</i>
broadleaf cattail		<i>Typha latifolia</i>
Canada Goose	belaalzene	<i>Branta canadensis</i>
Canada Jay	zūghe	<i>Perisoreus canadensis</i>
Canvasback	nendaale = duck	<i>Aythya valisineria</i>
chickadees	k'ets'ehūtoone and k'elots'eggegge	<i>Poecile atricapilla</i> and <i>P. hudsonica</i>
Chinook salmon	ggaal	<i>Oncorhynchus tshawytscha</i>
Chokecherry		<i>Prunus virginiana</i>
chum salmon	noolaaghe	<i>Oncorhynchus keta</i>
coho salmon	saanlaaghe	<i>Oncorhynchus kisutch</i>
common chickweed		<i>Stellaria media</i>
common dandelion		<i>Taraxacum officinale</i>
common plantain		<i>Plantago major</i>
Common Raven	dotson'	<i>Corvus corax</i>
cottonwood	t'eghet	<i>Populus balsamifera</i> ssp. <i>balsamifera</i>
Dolly Varden	hok'elbaaye	<i>Salvelinus malma</i>
eastern larch beetle		<i>Dendroctonus simplex</i>
Elodea		<i>Elodea</i> spp.
Eurasian tiny shrew		<i>Sorex minutissimus</i>
European bird cherry		<i>Prunus padus</i>
Greater White-fronted Goose	k'edot'aagge'	<i>Anser albifrons</i>
grizzly bear	tlaaghoze	<i>Ursus arctos horribilis</i>
grouse	doldoye and tsonggude	<i>Canachites canadensis</i> and <i>Bonasa umbellus</i>
humpback whitefish	hologhe	<i>Coregonus pidschian</i>
lambquarters		<i>Chenopodium album</i>
larch	taat'eghet	<i>Larix laricina</i>
larch sawfly		<i>Pristiphora erichsonii</i>
least cisco	tsaabaaye	<i>Coregonus sardinella</i>
least weasel	koneede	<i>Mustela nivalis</i>

³⁹ Denaakk'e is the language of the Koyukon Athabaskan people. Denaakk'e terms in this table may be found in the Koyukon Athabaskan Dictionary (Jetté and Jones 2000).

⁴⁰ These terms mean "black one." The actual name (ses) is reserved for use by men.

Common Name	Denaakk'e³⁹ Name	Latin Name
Lesser Yellowlegs	dzolnołge	<i>Tringa flavipes</i>
lynx	kaazene	<i>Lynx canadensis</i>
Mallard	tletlkkughuyh	<i>Anas platyrhynchos</i>
Marten	sooge	<i>Martes americana</i>
meadow foxtail		<i>Alopecurus pratensis</i>
mink	deets'oodze	<i>Neovison vison</i>
moose	deneege	<i>Alces americanus</i>
muskrat	bekenaale	<i>Ondatra zibethicus</i>
northern pike	k'oolkkoye	<i>Esox lucius</i>
Northern Pintail	k'eelnaalde	<i>Anas acuta</i>
Olive-sided Flycatcher	dũhtseeneeye	<i>Contopus cooperi</i>
owls	nołduł, negoodzeghe, k'etleedzodze and etkeeh doldoye	<i>Strix nebulosi</i> , <i>Bubo virginianus</i> , <i>Surnia ulula</i> , and <i>Aegolius funereus</i>
oxeye daisy		<i>Leucanthemum vulgare</i>
paper birch	kk'eeyh	<i>Betula alaskana</i>
pineapple-weed		<i>Matricaria matricariodes</i>
pondweed		<i>Potamogeton</i> spp.
porcupine	legedze	<i>Erethizon dorsatum</i>
quaking aspen	t'egheł kk'ooge'	<i>Populus tremuloides</i>
red clover		<i>Trifolium pratense</i>
red fox	nohbaaye	<i>Vulpes vulpes</i>
red squirrel	tsegheldaale	<i>Tamiasciurus hudsonicus</i>
redpolls	delotodelghoze	<i>Acanthis flammea</i> and <i>A. hornemanni</i>
river otter	belaazone	<i>Lontra canadensis</i>
round whitefish	hyłten'	<i>Prosopium cylindraceum</i>
Sandhill Crane	deldoole	<i>Antigone canadensis</i>
sheefish	telaaghe	<i>Stenodus leucichthys nelma</i>
Short-eared Owl	kk'oondzaah	<i>Asio flammeus</i>
Siberian peashrub		<i>Caragana arborescens</i>
snowshoe hare	ggũh	<i>Lepus americanus</i>
timothy		<i>Phleum pratense</i>
Trumpeter Swan	tobaa = swan	<i>Cygnus buccinator</i>
Tundra Swan	tobaa	<i>Cygnus columbianus</i>
white clover		<i>Trifolium repens</i>
white spruce	ts'ebaa	<i>Picea glauca</i>
white sweet clover		<i>Melilotus alba</i>
whitefish	łook'e = fish	<i>Coregonus</i> spp.
willow	kk'ũyh	<i>Salix</i> spp.
wolf	teekkone	<i>Canis lupus</i>
wolverine	nełtseel	<i>Gulo gulo</i>
wood frog	noghũye	<i>Lithobates sylvaticus</i>
woodpeckers	dekeltlaale	<i>Dryobates villosus</i> , <i>D. pubescens</i> , <i>Picoides arcticus</i> , and <i>P. dorsalis</i>

ATTACHMENT F: GLOSSARY

Archaeological resources: any material remains of past human life or activities which are of archaeological interest, including: pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials, that are at least 100 years of age (as defined in the Archaeological Resources Protection Act of 1979).

Cultural resources: a broad term used to refer to the diverse human record found in sites, structures, objects, and places created and/or used by people. It is inclusive of a wide variety of resources, including, but not limited to, archaeological sites, isolated artifacts, features, records, manuscripts, historical sites, and traditional cultural properties. Visitation of cultural resources brings the potential for unintentional effects, like those related to recreation, as well as intentional vandalism or unauthorized collection.

Free-flowing: The condition of a river, or section of a river, moving in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway. A river must be in a free-flowing condition to be eligible for inclusion in the National Wild and Scenic Rivers System.

Historic Properties: are cultural resources determined to be eligible for listing on the NRHP. In addition to meeting at least one of the four main NRHP eligibility criteria (association with a significant event, person, distinctive architecture or construction style, or potential for information), cultural resources also must exhibit integrity of at least one of the following to be eligible: location, design, setting, materials, feeling, workmanship, or association. (As defined in the National Historic Preservation Act and its implementing regulations found at 36 CFR 800).

Monitoring: Evaluation of the condition of river value-related indicators to determine whether they are protected and enhanced or to detect adverse impacts and to inform the need for adaptive management actions.

Objective: A concise statement of what the Service wants to achieve, how much the Service wants to achieve, when and where the Service wants to achieve it, and who is responsible for the work. An objective is derived from goals and provides the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. All objectives must be specific, measurable, achievable, results oriented, and time fixed.

Other Use: Use within a WSR corridor other than public use, such as federally authorized mining, forestry, grazing, subsistence hunting and fishing, road use and management, administrative use for other than WSR purposes, and use on non-federal lands in a WSR corridor that have a potential to affect river values. Other use also includes any use on federal or non-federal lands that border upon or are adjacent to a WSR corridor that may substantially interfere with public use and enjoyment of river values.

Outstandingly remarkable value (ORV): A scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar river-related value that is a unique, rare, or exemplary feature and is significant when compared with similar values from other rivers at a regional or national scale.

Public use: Visitor use and WSR-specific administrative use within a WSR corridor.

River corridor: A river and the adjacent area within the boundaries of a designated river, or a river and the adjacent area generally within one-quarter mile of the banks of a congressionally authorized study river. This includes portions of undesignated tributaries within the corridor.

River values: The values for which a river is designated or congressionally authorized for study. These are the river's free-flowing condition, water quality, and ORVs.

Subsistence uses defined in ANILCA, Title VIII, Section 803: The "customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter or sharing; and for customary trades."

Strategy: A specific action, tool, technique, or combination of actions, tools, and techniques used to meet objectives.

Traditional cultural properties: Resources associated with the cultural practices, traditions, beliefs, arts, crafts, or social institutions of a living community (USFWS 2016). Traditional cultural properties are also considered historic properties.

User capacity: The maximum amounts and kinds of public use that a WSR collectively or by analysis area can accommodate without degrading river values.

Visitor experience: The perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area.

Visitor use: Human presence in an area for recreational purposes, including education, interpretation, inspiration, and physical and mental health.

Visitor use management: The proactive and adaptive process for managing characteristics of visitor use and the natural and managerial setting using a variety of strategies and tools to achieve and maintain desired resource conditions and visitor experiences.

Wild (WSR classification): Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These rivers represent vestiges of primitive America.

Wild and scenic river (WSR): A river and the adjacent area within the boundaries of a component of the National Wild and Scenic Rivers System.

WSR-specific administrative use: Use within a WSR corridor by the river manager, including ranger patrols, maintenance activities, field research, staff visits to administer contracts or facilities, search and rescue, and interpretative programs for the purpose of protection or enhancement of river values.

ATTACHMENT G: LIST OF PREPARERS

An interdisciplinary team of staff from the Service and AECOM prepared this CRMP. The following tables contain people who prepared or contributed to the development of this CRMP.

Table G-I. List of Preparers–Service

Team	Name	Role/Responsibility
Management	Karin Bodony	Biologist/environmental educator, ORV background
	Douglas Calvin	Deputy Refuge Manager
	Nicole Gustine	Project manager
	David Zabriskie	Refuge Manager
Interdisciplinary	Jake Adams	Archaeology, cultural
	Randy Brown	Fisheries
	Greta Burkart	Water resources
	Jon Gerken	Fisheries
	Hunter Gravley	Vegetation
	Ray Hander	Fisheries
	Jeremy Havener	Subsistence
	Jeremy Karchut	Archaeology, cultural
	Robbin Lavine	Subsistence
	Andrea Medeiros	Communication strategies
	Scott McGee	GIS, landownership
	Meg Perdue	Water quality
	Jennifer Reed	Visitor use
	Wyatt Snodgrass	Fisheries
	John Trawicki	WSR policy, water resources
	Shane Walker	Refuge planning
Michael Winfree	Water rights	
Emily Yurcich	Climate change, Refuge planning	

Table G-2. List of Preparers–AECOM (Consultant)

Team	Name	Role/Responsibility
Management	Brandt Bates	Deputy project manager, WSR
	Derek Holmgren	Project manager
Interdisciplinary	Jared Baxter	Lands and realty and recreation
	Noelle Crowley	Scenic resources, recreation and visitor services
	Kevin Doyle	Cultural, tribal, and subsistence
	Rob Lavie	GIS specialist
	Perry Lown	Cultural, subsistence, and Alaska Native interests
	Nicole Morris	Wildlife, vegetation, and fisheries
	Kim Murdock	Technical editor
	Allison Piazzoni	Scenic resources, recreation and visitor services
	Shine Roshine	Air quality and climate change
	Eddie Sanchez	Decision file
	Cindy Schad	Word processing
	Josh Schnabel	Socioeconomics and EJ
	David Scott	Water resources and quality, soils, and permafrost
	Andy Spellmeyer	Section 508 compliance
	Megan Stone	Subsistence and Alaska Native interests
Morgan Trieger	Wildlife, vegetation, and fisheries	

Tribes; federal, state, and local agencies; and other individuals were consulted during the CRMP drafting and review process, including the individuals in the following table.

Table G-3. List of Individuals Consulted

Name	Organization
Tirzah Bryant	Louden Tribe
David Esse	Bureau of Land Management – Central Yukon Field Office
Jeff Fisher	State of Alaska – Department of Environmental Conservation
Catherine Heroy	State of Alaska – Department of Natural Resources
Cade Kellam	ADFG
Terri Lomax	State of Alaska – Department of Environmental Conservation
Sarah Meitl	State of Alaska – Office of History and Archaeology
Jennifer Nolanwing	ADFG
Glenn Stout	ADFG
Lisa Stuby	ADFG
Noel Turner	Bureau of Land Management – Central Yukon Field Office

Appendix B

CCP Minor Revision Memorandum

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United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Koyukuk/Nowitna National Wildlife Refuge
P.O. Box 287
Galena, Alaska 99741



Memorandum

To: Regional Refuge Chief

Through: Refuge Supervisor

From: Project Leader, Koyukuk/Nowitna National Wildlife Refuge; Galena, Alaska

Subject: Minor Revisions to 2009 Revised Comprehensive Conservation Plan for the Koyukuk/Northern Unit Innoko/Nowitna National Wildlife Refuges

Policy

The U.S. Fish and Wildlife Service (Service) prepares step-down management plans when required by policy (602 FW 4) or when they may be necessary to provide more detailed objectives, strategies, and/or implementation schedules for meeting the management direction identified in CCPs. The Service developed a Comprehensive River Management Plan (CRMP) for the Nowitna Wild and Scenic River (WSR) in accordance with the Wild and Scenic Rivers Act and the Alaska National Interest Lands Conservation Act (ANILCA).

The CRMP is a step-down plan that does not alter the original intent of any part of the CCP and is considered a minor amendment to the CCP. This is the first Nowitna WSR CRMP as one was not developed during the original 1987 Nowitna Comprehensive Conservation Plan (CCP) nor the Revised Comprehensive Conservation Plan for the Koyukuk/Northern Unit Innoko/Nowitna National Wildlife Refuges (Revised CCP) in 2009, though the designation was recognized and an attempt was made to identify Outstandingly Remarkable Values (ORVs).

Revised Comprehensive Conservation Plan Compliance

The CRMP expands on the following in the Revised CCP:

“Goal 8: Maintain the special values of the Nowitna Wild River and Koyukuk Wilderness and the wild character of the Refuge.

Objective 1: Continue to monitor activities on the Nowitna Wild River and in the Koyukuk Wilderness for compliance with the Wild and Scenic Rivers Act (WSRA) and Wilderness Act and ANILCA. If problems are detected, appropriate actions would be taken.”

The CRMP expands on the above goal and objective to further identify specific goals, desired conditions, objectives, and strategies to protect and enhance river values including working with

partners to increase data collection and address known data gaps to better steward the Nowitna WSR.

Rationale for Changes

1. The change from the Nowitna Wild River to the Nowitna Wild and Scenic River reflects the nomenclature identified in the Service's draft Wild and Scenic River policy. More specifically it identifies that the river is included in the National Wild and Scenic Rivers System and not referring to the classification type.
2. The mileage for the Nowitna Wild and Scenic River changed from 223 to 220 miles because the Service uses high-resolution satellite imagery and geographic information system software to create a digital representation of the river's centerline for the CRMP. At the time of designation, the length of the Nowitna was not specified and only identified the start and end points. It is likely that U.S. Geological Survey topographic maps were used to estimate the river length at 223 miles in the CCP. The mileage change is more accurate and uses current mapping capabilities that were not available when the CCP was developed.
3. The outstandingly remarkable values changed from scenery, geology, hydrology, fish, wildlife and habitats, cultural/historic/prehistoric, subsistence, and recreation to ecology, fish, cultural, and scenery. The changes to the outstandingly remarkable values resulted from using the Interagency Wild and Scenic Rivers Coordinating Council's guidelines and working with cooperating agencies, residents of local communities, and member of local tribal organizations to identify and describe the outstandingly remarkable values.

Revised Comprehensive Conservation Plan Amendment

Through this memorandum, the Service amends the CCP to incorporate the following changes as identified in the Nowitna WSR CRMP. Amendments to the CCP are indicated with strikethrough and re-written in underlined text:

Replace all instances of "Nowitna Wild River" with Nowitna Wild and Scenic River.

1.4 Refuge Purposes (page 1-10)

The lower ~~223~~ miles of the Nowitna River is managed as a ~~Wild River under the Wild and Scenic Rivers Act~~. This segment of the river was recognized for its scenic, geologic, wildlife, historic, and recreational values.

The lower 220 miles of the Nowitna Wild and Scenic River is managed as a wild river under the Wild and Scenic Rivers Act. This segment of the river was recognized for its ecology, fish, cultural, and scenery outstandingly remarkable values.

Figure 2-3. Nowitna Management Categories (page 2-19)

Replace map with the final wild and scenic river corridor map included in the CRMP.

2.3.5 Wild and Scenic Rivers (page 2-22)

The lower ~~223~~ mile section of the Nowitna River corridor has been designated as a ~~Wild River~~

within the Nowitna Refuge. The river contains outstandingly remarkable scenic, geologic, hydrologic, fish and wildlife, cultural, historic, and recreational values identified informally by refuge staff during this planning process:

- scenic—forested river corridor, diverse landscape, and different examples of succession;
- geologic—agates;
- hydrologic—free flowing state, oxbow lakes, and wetlands;
- fisheries—sheefish and whitefish populations;
- wildlife and habitats—nationally significant species of migratory waterfowl and large game;
- cultural/historic/prehistoric—transportation corridor and abandoned camps;
- subsistence—hunting, trapping, house logs, berry picking, and firewood;
- recreational—hunting, fishing, wildlife observation and photography, floating, fishing, and camping trips.

The lower 220-mile section of the Nowitna Wild and Scenic River corridor was designated as a wild river within the Nowitna Refuge. The outstandingly remarkable values for the Nowitna Wild and Scenic River are:

- Ecology – The ecology ORV recognizes the relationship between the river’s geology, hydrology, plant communities, and wildlife and acknowledges that these features are deeply interconnected and together create a unique example of boreal riparian ecology. The Nowitna WSR’s notable species richness and abundance are due in part to the river’s unique geology. Dissolved carbonates and bicarbonates carried downriver from the limestone bedrock in the river’s headwaters are washed into floodplain lakes and sloughs during spring ice-jam flooding. The carbonates buffer the pH of the naturally acidic wetland waters, making them less acidic and more productive than many other areas in Alaska. These conditions contribute to the presence of outstanding habitat for plants and wildlife including waterfowl, moose, furbearers, larch and white spruce in the Nowitna WSR corridor. Taken as a whole, the diverse and abundant assemblage of boreal species is unique statewide and a defining characteristic of the Nowitna WSR.
- Fish - The Nowitna WSR supports a remarkably diverse assemblage of fish species. At least 19 fish species have been documented in the Nowitna WSR corridor, surrounding wetlands, and tributaries. The river is a migration corridor to one of only six known sheefish spawning areas in Alaska, thus providing fish habitat that is rare in the Arctic-Yukon-Kuskokwim Region. It also provides exceptionally high-quality foraging habitat and is a continentally important migration corridor for populations of Chinook, coho, and chum salmon. Other species of whitefish as well as resident Dolly Varden, Arctic grayling, and northern pike flourish in the Nowitna WSR and its tributaries. The river’s role in the life cycles of such a diversity and abundance of fish, particularly sheefish, is exceptional and rare to find anywhere else in Alaska.
- Cultural - The Nowitna WSR supports a remarkably diverse assemblage of fish species. At least 19 fish species have been documented in the Nowitna WSR corridor, surrounding wetlands, and tributaries. The river is a migration corridor to one of only six

known sheefish spawning areas in Alaska, thus providing fish habitat that is rare in the Arctic-Yukon-Kuskokwim Region. It also provides exceptionally high-quality foraging habitat and is a continentally important migration corridor for populations of Chinook, coho, and chum salmon. Other species of whitefish as well as resident Dolly Varden, Arctic grayling, and northern pike flourish in the Nowitna WSR and its tributaries. The river's role in the life cycles of such a diversity and abundance of fish, particularly sheefish, is exceptional and rare to find anywhere else in Alaska.

- Scenery – The scenery of the Nowitna WSR is exceptionally beautiful and diverse and is exemplary of an Interior Alaska river. The entire Nowitna WSR corridor provides excellent examples of a variety of boreal habitats and landscapes at many stages of riparian and post-fire succession. Remote wilderness qualities of the watershed contribute to the impact of the visual experience. The presence of such outstanding scenic diversity over relatively short distance is exceptional. The scenic qualities of the Nowitna WSR are a result of the river's diverse course and geologic setting and are considered exemplary in Alaska's boreal region.

3.5.8 Nowitna River Unit (Nowitna) (page 3-82)

~~The dominant feature of this 325,000-acre unit is the 223-mile segment of the Nowitna River that was designated by ANILCA as a Wild River in the National Wild and Scenic River System.~~

The dominant feature of this 325,000-acre unit is the 220-mile segment of the Nowitna Wild and Scenic River that was designated by ANILCA as a wild river in the National Wild and Scenic River System.

Figure 3-13. Nowitna Wild River Corridor (page 3-85)

Replace map and with the final wild and scenic river corridor map included in the CRMP.

Revised Comprehensive Conservation Plan Decision Summary Changes

~~“Goal 8: Wild Character. Maintain the special values of the Nowitna Wild River and Koyukuk Wilderness and the wild character of the Refuge.~~

~~Objectives: Continue to monitor activities on the Nowitna Wild River and Koyukuk Wilderness for compliance with the Wild and Scenic Rivers and Wilderness acts and ANILCA; take appropriate action if noncompliance is identified.”~~

“Goal 8: Wild Character. Maintain the special values of the Nowitna Wild and Scenic River and Koyukuk Wilderness and the wild character of the Refuge.

Objectives: Continue to monitor activities on the Nowitna Wild and Scenic River and Koyukuk Wilderness for compliance with the Wild and Scenic Rivers and Wilderness acts and ANILCA; take appropriate action if noncompliance is identified.”

Appendix C

Section 810 Analysis

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Nowitna National Wildlife Refuge Evaluation of the Effects on Subsistence Use and Needs

Preliminary ANILCA Section 810 Evaluation and Finding for Nowitna WSR Comprehensive River Management Plan and Environmental Assessment

I. Introduction

To comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) this summary evaluates the potential restrictions to subsistence activities that could result from the development of a Comprehensive River Management Plan (CRMP) for the Nowitna Wild and Scenic River (WSR).

II. Evaluation Process

Section 810(a) of ANILCA states:

“In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands . . . the head of the federal agency . . . over such lands . . . shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be effected until the head of such Federal agency -

(1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to section 805;

(2) gives notice of, and holds, a hearing in the vicinity of the area involved; and

(3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands, (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition, and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions.”

ANILCA created new conservation system units of the National Wildlife Refuge System in Alaska. The Nowitna National Wildlife Refuge was established by Section 302(6) (B) of ANILCA for the following purposes:

“(i) to conserve fish and wildlife populations and habitats in their natural diversity, including but not limited to trumpeter swans, white-fronted geese, canvasbacks and other waterfowl and migratory birds, moose, caribou, martens, wolverines, and other furbearers, salmon, sheefish, and northern pike.

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents;

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.”

Title VI of ANILCA added river segments to the National Wild and Scenic Rivers System. Part B of Title VI designates selected rivers within the National Wildlife Refuge System, including the Nowitna WSR, as follows:

“602. DESIGNATION.—Section 3(a) of the Wild and Scenic Rivers Act, as amended (16 U.S.C. 1274(a)), is further amended by adding the following new paragraphs:

... (40) NOWITNA, ALASKA.—That portion from the point where the river crosses the west limit of township 18 south, range 22 east, Kateel River meridian, to its confluence with the Yukon River within the boundaries of the Nowitna National Wildlife Refuge; to be administered by the Secretary of the Interior.”

III. Proposed Action on Federal Lands

The proposed action is to establish and implement a CRMP that protects the Nowitna WSR river values in accordance with the Wild and Scenic Rivers Act (WSRA) and ANILCA. Alternative B (Proposed Action Alternative) would expand on the existing management direction identified in the Revised CCP (USFWS 2009) to further identify goals, desired conditions, objectives, and strategies to protect and enhance river values. This alternative also identifies opportunities to work with partners to increase data collection and address known data gaps to better steward the Nowitna WSR. More information can be found in Section 3.2.2 of the Nowitna CRMP Environmental Assessment (EA).

IV. Affected Environment

Game Management Unit 21B encompasses the U.S. Fish and Wildlife Service (Service) managed lands within the Nowitna WSR corridor except for private inholdings (native allotments and village corporation lands). Most of the lands within the Nowitna WSR corridor are Federal public lands available for subsistence use by qualified rural residents. Subsistence resources including fish, wildlife, and vegetation are harvested by subsistence users for many purposes including food, fuel, arts and crafts, tools, clothing, and traditional cultural practices.

People most affected by the proposed action live in the communities of Galena, Ruby, and Tanana and use the Nowitna WSR corridor for subsistence resource use (ADFG 2021). Residents of Galena subsistence harvests in the Nowitna WSR corridor include moose and fish, as well as berries and greens (ADFG 2010). Residents in Ruby mainly gather subsistence resources along

the Yukon River corridor. However, the Nowitna WSR is also used for subsistence activities (USFWS 2009) and many Ruby residents have ancestral ties to the river (Brown et al. 2010). Subsistence resource use by Ruby residents includes moose hunting along much of the Nowitna WSR corridor (ADFG 2010). Areas recognized for subsistence harvest of small land mammal, berries and greens are present in the north end of the Nowitna WSR corridor (ADFG 2010). According to 2014 ADFG community harvest data, salmon comprised the most pounds of subsistence resources harvested by Tanana residents, followed by non-salmon fish, large land mammals, plants and berries, and migratory birds (ADFG 2014a). Areas used by Tanana residents for subsistence include moose hunting areas along much of the Nowitna WSR corridor (ADFG 2014b). Ptarmigan and grouse hunting areas are also present near the Nowitna River (ADFG 2014b). Smaller areas located on Nowitna WSR tributaries have historically been used and continue to be used by Tanana residents to harvest plants and berries (ADFG 2014b).

More information on subsistence resources and uses is described in Chapter 2.4.12 of the Revised CCP for the Koyukuk, Northern Unit Innoko, Nowitna National Wildlife Refuges (USFWS 2009) and Chapter 4.12 of the draft Nowitna CRMP EA.

V. Subsistence Uses and Needs Evaluation

To determine the potential impact of the proposed Nowitna CRMP on existing subsistence activities, three evaluation criteria were analyzed relative to existing subsistence resources that could be impacted. The evaluation criteria are as follows:

- the potential to reduce important subsistence fish and wildlife populations by (a) reductions in numbers, (b) redistribution of subsistence resources, or (c) habitat losses;
- what affect the action might have on subsistence fisher or hunter access; and
- the potential for the action to increase fisher or hunter competition for subsistence resources.

Alternative B (Proposed Action Alternative)

The proposed action is not expected to cause a significant decline of wildlife species or displacement of subsistence resources in the Nowitna WSR corridor. Alternative B would expand on the existing management direction by developing a plan to protect and enhance the river values of the Nowitna WSR. This includes management direction, actions, and monitoring of fish and wildlife species. The CRMP identifies additional data collection that will increase fish and wildlife scientific information that will contribute to a better understanding of subsistence resources abundance and availability.

The proposed action is not expected to significantly restrict current subsistence access. Implementation of the CRMP would not be anticipated to impact access to subsistence resources. The proposed action contributes to the protection of Nowitna WSR to maintain the condition of subsistence resources. The CRMP identifies management actions that continue to provide abundant wildlife, fish, and plant resources for the customary and traditional uses of wild renewable resources.

Additionally, in accordance with the WSRA, the Nowitna CRMP is required to protect river values which include the Outstandingly Remarkable Values (ORVs) identified for the river. Among the identified Nowitna WSR ORVs is a cultural ORV which recognizes human interactions with the river and its resources, including subsistence harvest.

The proposed action is not expected to significantly restrict or increase competition for subsistence resources in the Nowitna WSR corridor. Most of the use on the Nowitna WSR occurs during the fall moose hunting season and includes both a State of Alaska hunting season and a Federal subsistence season. Since 1988 all moose hunting activities along the Nowitna River have monitored at the Nowitna River moose hunter check station. An annual average of 19 local resident hunters and 110 non-local hunters have checked in during the fall season (1988-2023) (Personal comm 2024). In 2023, 15% of the hunters were local residents of Galena, Ruby, and Tanana. Of the remaining hunters, 48% were from Fairbanks and 37% were other residents (Anchorage, Juneau, Wasilla, etc.) (USFWS 2023). While competition between subsistence users and recreational hunters exists on the Nowitna WSR, the proposed action includes a visitor use management strategy that will monitor use trends including potential competition for subsistence resources.

VI. Availability of Other Lands

The Nowitna WSR CRMP considers management options of lands currently designated as a National Wild and Scenic River in compliance with the WSRA and ANILCA. Therefore, no other lands are available for consideration.

VII. Alternatives Considered

The proposed action is a management plan to protect and enhance the river values of a designated wild and scenic river. The draft Nowitna CRMP EA analyzes the management plan's effect on subsistence resources and uses with public input. To date, no Tribal consultation has been requested.

No other alternatives were identified that would reduce or eliminate the proposed action from the lands because the management plan for those lands is required by the WSRA and ANILCA.

Findings

This preliminary analysis concludes that the proposed action will not result in a significant restriction of subsistence uses. A final analysis and determination will be made after public comments on the draft EA and this analysis have been received and considered.

Supporting documents

Alaska Department of Fish and Game (ADFG). 2010. Technical Paper No. 410. The Harvests and Uses of Wild Resources in Mountain Village, Marshall, Nulato, Galena, and Ruby, Alaska, 2010. Available at: <https://www.adfg.alaska.gov/techpap/TP%20410.pdf>

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Appendix D

Acronyms and Abbreviations

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Appendix D. Acronyms and Abbreviations

ACRONYMS AND ABBREVIATIONS	Full Phrase
μS/cm	microsiemens per centimeter
ADFG	Alaska Department of Fish and Game
ANC	Alaska Native corporation
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
CCP	comprehensive conservation plan
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO ₂ e	carbon dioxide equivalent
CRMP	comprehensive river management plan
EA	environmental assessment
EJ	environmental justice
EPA	Environmental Protection Agency
GIS	geographic information system
mg/liter	milligrams per liter
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
Nowitna CCP	Nowitna National Wildlife Refuge Final Comprehensive Conservation Plan
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
NWR	National Wildlife Refuge
ORV	outstandingly remarkable value
PM _{2.5}	particulate matter less than 2.5 microns in diameter

PM ₁₀	particulate matter less than 10 microns in diameter
Revised CCP	Revised Comprehensive Conservation Plan for the Koyukuk, Northern Unit Innoko, and Nowitna NWRs
Service	United States Fish and Wildlife Service
USC	United States Code
WSR	wild and scenic river
WSRA	Wild and Scenic Rivers Act

Appendix E

Glossary

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Appendix E. Glossary

Archaeological resources: Any material remains of past human life or activities which are of archaeological interest, including: pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials, that are at least 100 years of age (as defined in the Archaeological Resources Protection Act of 1979).

Cultural resources: A broad term used to refer to the diverse human record found in sites, structures, objects, and places created and/or used by people. It is inclusive of a wide variety of resources, including, but not limited to, archaeological sites, isolated artifacts, features, records, manuscripts, historical sites, and traditional cultural properties. Visitation of cultural resources brings the potential for unintentional effects, like those related to recreation, as well as intentional vandalism or unauthorized collection.

Free-flowing: The condition of a river, or section of a river, moving in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway. A river must be in a free-flowing condition to be eligible for inclusion in the National Wild and Scenic Rivers System.

Historic Properties: Cultural resources determined to be eligible for listing on the NRHP. In addition to meeting at least one of the four main NRHP eligibility criteria (association with a significant event, person, distinctive architecture or construction style, or potential for information), cultural resources also must exhibit integrity of at least one of the following to be eligible: location, design, setting, materials, feeling, workmanship, or association. (As defined in the National Historic Preservation Act and its implementing regulations found at 36 CFR 800).

Monitoring: Evaluation of the condition of river value-related indicators to determine whether they are protected and enhanced or to detect adverse impacts and to inform the need for adaptive management actions.

Objective: A concise statement of what the Service wants to achieve, how much the Service wants to achieve, when and where the Service wants to achieve it, and who is responsible for the work. An objective is derived from goals and provides the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. All objectives must be specific, measurable, achievable, results oriented, and time fixed.

Outstandingly remarkable value (ORV): A scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar river-related value that is a unique, rare, or exemplary feature and is significant when compared with similar values from other rivers at a regional or national scale.

Public use: Visitor use and WSR-specific administrative use within a WSR corridor.

River corridor: A river and the adjacent area within the boundaries of a designated river, or a river and the adjacent area generally within one-quarter mile of the banks of a congressionally authorized study river. This includes portions of undesignated tributaries within the corridor.

River values: The values for which a river is designated or congressionally authorized for study. These are the river's free-flowing condition, water quality, and ORVs.

Section 7 determination: The official finding of a Section 7 evaluation. The finding either approves or prohibits a project based on the appropriate evaluation standard. A determination is usually documented as the last section of a Section 7 evaluation and is also transmitted in a memorandum or letter to the federal assisting agency.

Section 7 evaluation: An evaluation that determines whether hydropower project works licensed by the Federal Energy Regulatory Commission would be located on or directly affecting a WSR, and analyzes the effects of proposed federally assisted water resources projects on WSRs. Federal actions may not proceed unless the WSR-administering agency has determined in writing that the proposed project fully meets the requirements of the WSRA.

Subsistence uses defined in ANILCA, Title VIII, Section 803: The "customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife.

Strategy: A specific action, tool, technique, or combination of actions, tools, and techniques used to meet objectives.

Traditional cultural properties: Resources associated with the cultural practices, traditions, beliefs, arts, crafts, or social institutions of a living community (USFWS 2016). Traditional cultural properties are also considered historic properties.

User capacity: The maximum amounts and kinds of public use that a WSR collectively or by analysis area can accommodate without degrading river values.

Visitor experience: The perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area.

Visitor use: Human presence in an area for recreational purposes, including education, interpretation, inspiration, and physical and mental health.

Visitor use management: The proactive and adaptive process for managing characteristics of visitor use and the natural and managerial setting using a variety of strategies and tools to achieve and maintain desired resource conditions and visitor experiences.

Wild (WSR classification): Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These rivers represent vestiges of primitive America.

Wild and scenic river (WSR): A river and the adjacent area within the boundaries of a component of the National Wild and Scenic Rivers System.

WSR-administering agency: One of the four federal land management agencies that may be charged with administration of a component of the National Wild and Scenic Rivers System. These agencies are the Bureau of Land Management, National Park Service, Service, and U.S. Forest Service.

WSR-specific administrative use: Use within a WSR corridor by the river manager, including ranger patrols, maintenance activities, field research, staff visits to administer contracts or facilities, search and rescue, and interpretative programs for the purpose of protection or enhancement of river values.

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Appendix F

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