section a

Executive Summary

This *Ice Age Floods Study of Alternatives and Environmental Assessment* examines various ways public and private sector entities throughout the northwestern United States can work collaboratively to tell the fascinating story of the cataclysmic floods of the region to the American people. The last Ice Age Floods (Floods) occurred some 12,000–17,000 years ago. Today, vivid reminders of their impact remain on the landscape of parts of western Montana, the Idaho panhandle, eastern and central Washington and northern Oregon. The powerful story of the Ice Age Floods is an important component of our Nation's natural history and geology, and presents a potentially very popular interpretive theme.

The *Ice Age Floods Study of Alternatives and Environmental Assessment* analyzes four distinct management options: two involving non-federal options and two that would require Congressional designation.

Common to three of the alternatives is the notion of developing a designated "Floods Pathways" tour route that would follow along the paths of the Floods. The Pathways would largely be an auto tour route along existing public highways and roads and would allow both visitors to the region and residents alike to follow the path of the Floods and view distinctive Floods features. In some places complementary land and water trails would lead to specific Floods features.

The funding for the *Study of Alternatives and Environmental Assessment* was secured from Congress through the National Park Service (NPS) Special Resource Study Program. The client of the study report is Congress, who in turn will consider whether or not some sort of designation or action may be appropriate on a national level.

The study format follows that required by Public Law 105-391, Title III. This program provides for an analysis of resources to determine if they are eligible

for inclusion into the National Park System or consideration for some other approach that also provides for the protection and public use of a specific resource. It is intended that the application of the study criteria will assist Congress in determining whether or not some sort of national designation for Ice Age Floods resources within the study region is appropriate.

The Story of the Floods

During the last Ice Age, a finger of the Cordilleran ice sheet crept southward into the Idaho Panhandle, blocking the Clark Fork River and creating Glacial Lake Missoula. As the waters rose behind this 2,000-foot ice dam, they flooded the valleys of western Montana. At its greatest extent, Glacial Lake Missoula stretched eastward a distance of some 200 miles, essentially creating an inland sea.

Periodically, the ice dam would fail. These failures were often catastrophic, resulting in a large flood of ice- and dirt-filled water that would rush down the Columbia River drainage, across northern Idaho and eastern and central Washington, through the Columbia River Gorge, back up into Oregon's Willamette Valley, and finally pour into the Pacific Ocean at the mouth of the Columbia River.

The glacial lake, at its maximum height and extent, contained more than 500 cubic miles of water. When Glacial Lake Missoula burst through the ice dam and exploded downstream, it did so at a rate 10 times the combined flow of all the rivers of the world. This towering mass of water and ice literally shook the ground as it thundered towards the Pacific Ocean, stripping away thick soils and cutting deep canyons in the underlying bedrock. With flood waters roaring across the landscape at speeds approaching 65 miles per hour, the lake would have drained in as little as 48 hours.

But the Cordilleran ice sheet continued moving south and blocking the Clark Fork River again and again, creating other Glacial Lake Missoulas. Over thousands of years, the lake filling, dam failure, and flooding were repeated dozens of times, leaving a lasting mark on the landscape of the Northwest. Many of the distinguishing features of the Ice Age Floods remain throughout the region today.

Together, these two interwoven stories of the catastrophic floods and the formation of Glacial Lake Missoula are referred to as the "Ice Age Floods." Therefore, in this *Study of Alternatives* the term Ice Age Floods is inclusive of both the formation of Glacial Lake Missoula and the subsequent floods.

While scientific research to date assists in telling this fascinating story, there is much inquiry and study that is still needed on the Ice Age events in the region. Conflicting theories on various aspects of the Floods remain to be debated and researched by future geological professionals, adding dimension to the educational aspect of the project.

Study Criteria

The "*Criteria for Parklands*" is an NPS publication that defines the process and criteria used to screen proposals for potential new park units. Criteria for the study are also provided by Public Law 105-391, Title III. Using the standards and requirements outlined in the "*Criteria,*" the objective of the *Study of Alternatives* was

threefold: first, to determine the significance of Ice Age Floods resources; second, to evaluate these resources for their suitability and feasibility as a potential new unit of the National Park System; and last, to examine a range of viable management approaches that identify various ways in which the coordinated interpretation of Ice Age Floods resources could be achieved. Highlights of the Study's findings are:

National Significance

By examining the NPS themes, which look at both natural and cultural resource themes, the Study found that the Floods region exceeds the basic requirements for consideration as a nationally significant resource. The Floods are the greatest scientifically documented floods known to have occurred, and the landscape of the Channeled Scablands in southeastern Washington was formed in a manner similar to that of channels on the planet Mars. Additionally, there are seven currently listed National Natural Landmarks within the study region that have Floods features as a principal component and resource value.

Threats to the Resource

Threats to the resources related to Floods features are generally considered minimal because of the size and number of Floods features in the four-state study region. While the protection of certain specific Floods features cannot be assured over the long-term, the scope and scale of the various Floods features across such a large landscape help to diminish most resource concerns.

Suitability

Based upon an evaluation of natural and cultural themes, various features of the Floods, along with the Floods pathways, are suitable for inclusion into the National Park System.

The Ice Age Floods are not presently represented in the National Park System. In addition many Floods features possess a high degree of integrity and are a good example of a collection of resources directly related to the theme.

Feasibility

The size, breadth, and multitude of ownerships throughout the study region make the area not feasible to consider for a traditional National Park, Monument or similar designation. However, it is feasible to interpret the Floods story along the Floods Pathways across parts of Montana, Idaho, Washington, and Oregon provided there is a high degree of cooperation among the various public and private entities within the four-state area.

Study Process

The Study process developed for the production of the *Ice Age Floods Study of Alternatives* was intended to provide an opportunity for interested individuals, organizations and communities throughout the Northwest to become actively involved. A study team composed of public and private sector representatives from throughout the four-state study region guided the conduct of the study. This included the interagency Ice Age Floods Task Force composed of local, tribal, state and federal public agency professionals in geology, interpretation, tourism and other fields. Also included on the study team were representatives from the nonprofit Ice Age Floods Institute, along with the study consultant, Jones & Jones of Seattle, Washington.

From the outset, given the size and complexity of the study region, four study zones were designated and zone chairpersons were identified. First, volunteers within each study zone took responsibility for inventorying Floods resources, building upon work already published by professional geologists from the U.S. Geological Survey, the Bureau of Land Management, area colleges and universities, and others. Next, various existing sites across the Nation, both within and outside the National Park System, were examined for their applicability to the project region. Finally, the study team advanced the concept of Floods Pathways for public viewing of Floods resources, and developed a range of four management alternatives, all with the common goal of providing a coordinated and collaborative interpretative approach to telling the story of the Ice Age Floods to the public.

Ice Age Floods Region and Floods Pathways Tour Route

Common to three of the alternatives developed by the study team for interpreting the Floods story is that the study area, which covers some 16,000 square miles across a four-state area, be defined as the Ice Age Floods Geologic Region. Within the Floods region, "Floods Pathways" could be identified as public tour routes, which follow the path of the Floods past various flood features. As designated, the Floods Pathways would extend from Missoula, Montana, to the Pacific Ocean. In most cases, the Floods Pathways would follow existing public highways and roads. A system of loops and spur routes would also be designated where some key Floods features were outside a linear auto route. Along the perimeter of the Floods Region are several communities that would serve as "gateways" to the Floods Region. In some cases, non-motorized hiking, bicycle, horse, kayaking, and canoeing trails could augment the driving route. Aerial and boat tours of Floods features could also be encouraged to gain a better understanding of the Floods epic story.

Floods Pathways would provide both visual and physical access to significant Floods features on public land, and would help link these features together as part of a coordinated effort among all levels of government, along with private sector support. Floods features on private lands could be viewed from public roads, and could be interpreted with the permission of the landowner. Final details concerning the locations of specific routes and interpretive facilities would be worked out as part of a future management planning process.

Regarding the lands upon which Floods features are located, the study team recommendation is to coordinate the interpretation of Floods resources on public lands. No Congressional authorization for acquisition of private land is either necessary or recommended.

Public Participation

There has been a high level of public interest and participation during the course of the study process. The public has attended meetings held throughout the four-state study region, including meetings in Missoula, Montana; Sandpoint, Idaho; Spokane, Seattle, and Richland, Washington; and Portland, Oregon. The local study zone groups have embarked on public outreach and

education programs have resulted in television and radio coverage and newspaper articles. A brochure was developed specifically for the project to acquaint the public with the purpose of the study. A webpage (www.nps.gov/iceagefloods) includes the Floods story, notice of public meetings, and information on the study report. Video tapes of the Floods story produced by the Washington State University Landscape Architecture Program in cooperation with the National Park Service, and another produced by Oregon Public Broadcasting, have been seen by thousands throughout the region and have stimulated interest in the project. The mailing list is made up of more than 1,100 interested citizens and organizations. Magazine articles, including a 1995 article in the *Smithsonian* magazine, have also stimulated interest in the Floods story.

Management Alternatives

The Study Team developed four distinct management alternatives to be considered by Congress. While each alternative varies in the approach it uses, common to each action alternative is a collaborative and coordinated approach for the interpretation of the Ice Age Floods story to the public. All management alternatives also place emphasis upon using Floods features on public lands to help convey the story, and three alternatives recommend the designation of a Floods Pathways auto tour route, with loops and spurs, throughout the four-state region.

The four management alternatives presented in the study include two alternatives that do not involve any federal designation, and two that would require authorization from Congress. They are described as follows:

Local/State Designation

Alternative 1—Existing Conditions: Under this alternative management would continue to be done at the local level. Flood resources on public lands would be managed individually without any coordinated effort.

Alternative 2—Quad-State Cooperation: Under this alternative, the State Legislatures of Montana, Idaho, Washington and Oregon would designate representatives to a quad-state commission that would promote the coordinated interpretation of the Floods story at the state and local level.

Federal Designation

Alternative 3—National Geologic Trail: Under this alternative, Congress would authorize the establishment of an Ice Age Floods National Geologic Trail. The Ice Age Floods National Geologic Trail would in essence be the national designation of the Floods Pathways concept. The trail would be managed by a National Park Service trail manager and small support staff. The NPS would be responsible for overall trail management and emphasis would be on coordination with various public and private entities. A trail advisory group would be formed to assist in coordination activities. It is further recommended that the NPS be given no new land ownership, acquisition, or regulatory authority in fulfilling this role.

Alternative 4—National Geologic Region: Under this alternative, Congress would designate the study area under a new designation as a National Geologic Region. As in Alternative 3, Congress

would also provide national designation for the Floods Pathways as the public tour route that links the Floods features throughout the National Geologic Region. The Floods Pathways would be managed by an Ice Age Floods Commission, appointed by the Secretary of the Interior, and composed of members nominated by the Governors of the four states, tribal governments and public agency officials. It is anticipated that the Commission would be composed of both public and private sector members and would have a paid executive director and small support staff. The role of the National Park Service in support of the Commission and staff would be largely in the area of interpretation and education assistance. In management of the National Geologic Region, the primary emphasis of the Commission would be on coordination with various public and private entities without any new land ownership, acquisition, or regulatory authority.

Common to Each Action Alternative

Common to each action management alternative would be the continued role of the nonprofit Ice Age Floods Institute in promoting education and public appreciation of the Floods story. Also common to each alternative would be the continued association with public agency geology, tourism, interpretive and education, and other professionals among local, tribal, state and federal agencies, and college and university officials. This association could be formalized through a written memorandum of agreement.

Most Effective and Efficient Management

Public Law 105-391 directs that the Secretary of the Interior "shall consider whether direct National Park Service management or alternative protection by other public agencies or the private sector is appropriate for the area . . ." and ". . . shall identify what alternative or combination of alternatives would in the professional judgment of the Director of the National Park Service be the most effective and efficient in protecting significant resources and providing for public enjoyment. . . ."

After careful consideration of the four management alternatives presented in the *Ice Age Floods Study of Alternatives and Environmental Assessment,* the National Park Service has determined that Management Alternative 3, which establishes the Ice Age Floods National Geologic Trail (Floods Pathways), is the most effective and efficient alternative.

Conclusion

Regardless of the future outcome, or designation provided, the study process has heightened public attention and awareness in the Ice Age Floods story and the role of the Floods in shaping this region of the United States. As the story of the Ice Age Floods continues to gain popularity, increasing numbers of people will want to view Floods features and learn more about the story. Representatives from all levels of government and private citizens and organizations have shown support for some kind of coordinated regional effort to help ensure the fascinating story of the Ice Age Floods is told to the American people in a coordinated manner.