WETLANDS AND FLOODPLAINS STATEMENT OF FINDINGS

Stehekin River Corridor Implementation Plan and Environmental Impact Statement

Lake Chelan National Recreation Area

North Cascades NPS Complex
Sedro-Woolley, WA

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Introduction

This Statement of Findings (SOF) is a required part of the Stehekin River Corridor Implementation Plan Final Environmental Impact Statement (SRCIP FEIS). The SRCIP was written to address new flood and erosion conditions brought by the passage of three 100-year floods in the past 15 years. These floods caused significant damage to NPS infrastructure and private property. They also compromised water quality and scenic resources by incorporating cabins and septic systems into the river.

The Stehekin River is the focal point of Lake Chelan NRA, and includes a wide, active floodplain in the lower valley between Lake Chelan and the boundary with North Cascades National Park (Figures 1 and 2). This area includes extensive riverine wetlands along the river and in old river channels, as well as areas seasonally flooded by Lake Chelan. Executive Orders 11988 (Floodplain Management) and 11990 (protection of Wetlands) require the NPS to evaluate likely impacts of actions that impact floodplains and wetlands. NPS Director's Order #77-2 (Floodplain Management) and #77-1 (Wetland Protection; NPS 2002a) provide policy and procedural guidance for complying with these orders, and include a requirement for disclosure of all proposed impacts to floodplains and wetlands, as well as mitigation measures to offset impacts.

This SOF pertains to the NPS selected Alternative 5, of the SRCIP FEIS, which is focused on protecting resources and planning for sustainable NPS administrative facilities, including public access. While all major actions in this plan follow NPS policy to enhance natural floodplain and wetland values, several actions in the selected alternative would impact these areas, while several others would restore their function. Actions that would likely impact floodplains and wetlands include installation of erosion protection measures along the river to protect the Stehekin Valley Road, a change in management of large wood at the river mouth, and in McGregor Meadows, installation of grade control structures and a new access road. Several new recreational opportunities, including a Lower Valley Trail and footbridge over the Stehekin River and river access point near the river mouth are also proposed. These actions will occur in or near the floodplain and/or forested and riverine wetlands.

Impacts from these actions are mitigated to some extent by both general management approaches and specific actions in the SRCIP. The plan embraces the concept of floodplain utilization, which allows floodwater to occupy floodplains by rejecting unsustainable management practices such as levee construction and dredging. It also takes a more conservative and practical approach to floodplain management that recognizes the channel migration zone as the appropriate regulatory floodplain for a steep, active mountain river. Specific actions that enhance floodplain and wetland values include the proposed relocation of 1.9 miles of the main Stehekin Valley Road out of the floodplain in and near McGregor Meadows, and restoration of wetlands and riparian zones at three sites in the valley. The selected alternative would preclude further encroachment of the road on the floodplain at McGregor Meadows by eliminating the need for future increases in road height and erosion control structures. Road relocation would leave only two sections of the main Stehekin Valley Road in the floodplain; about one mile at the river mouth and several hundred feet at Frog Island. Relocation of the NPS maintenance buildings, fuel storage, and three housing units near Harlequin Bridge would enhance floodplain values and bring the facilities into compliance with NPS policy and guidelines.

This SOF documents compliance with the Director's Orders and NPS policy and guidelines regarding floodplains and wetlands, and discloses potential impacts from the SRCIP selected alternative.

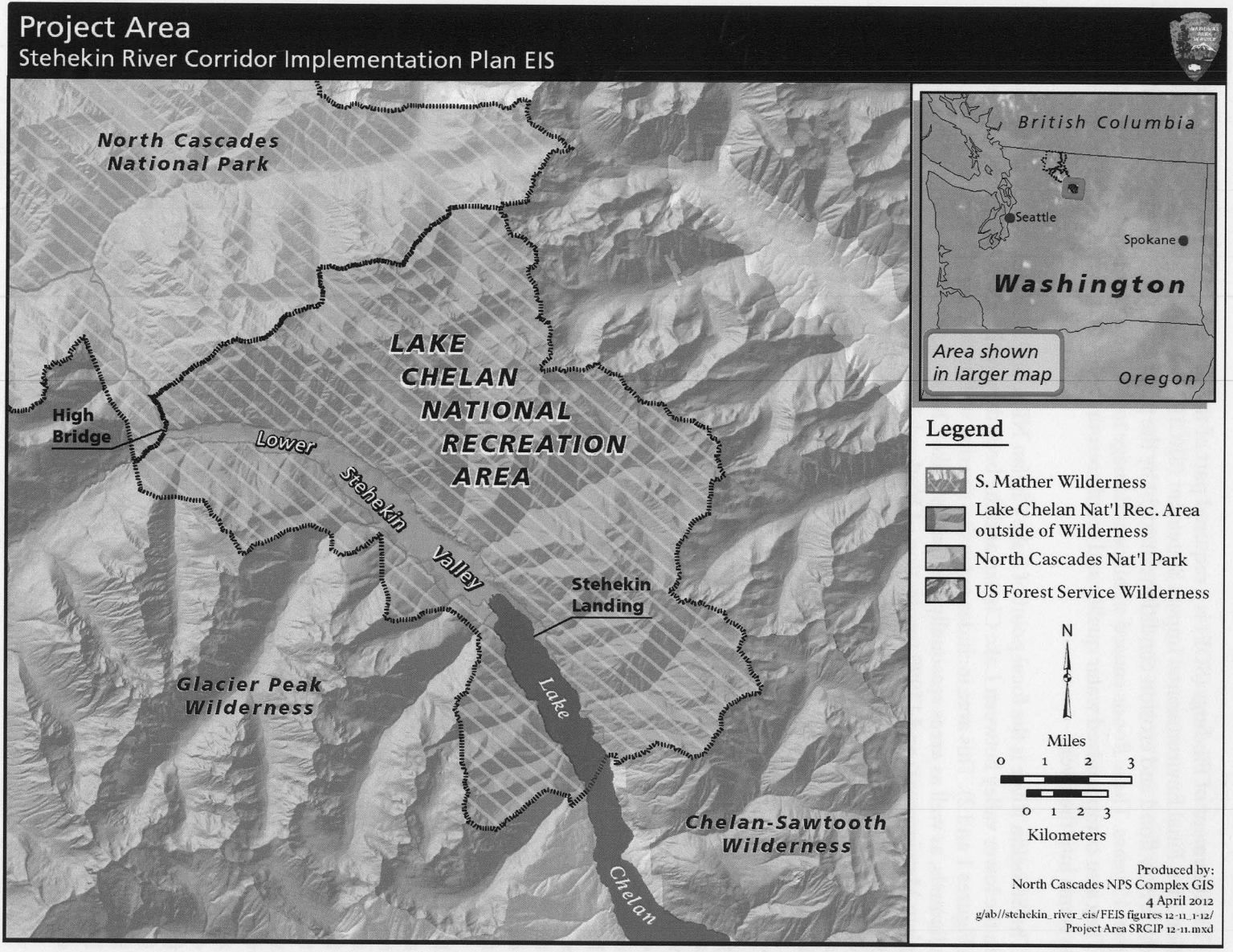


Figure 1: Location of the SRCIP Project on the Floor of the Lower Stehekin Valley

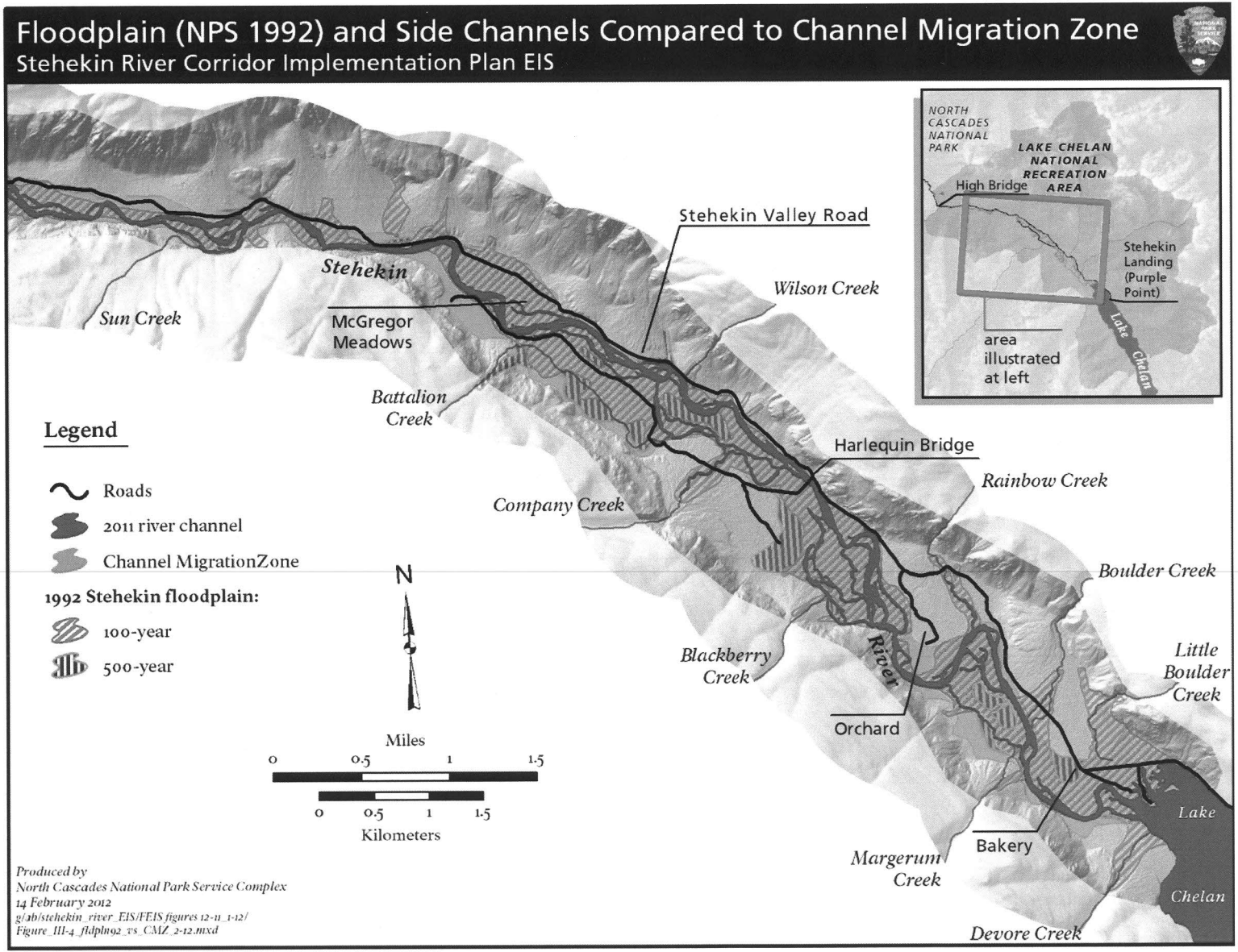


Figure 2: Channel Migration Zone and Regulatory Floodplains in the Lower Stehekin Valley

Site Description

The project area for the SRCIP FEIS includes the Lower Stehekin Valley, from High Bridge to the head of Lake Chelan, including Weaver Point (Figure 1). The Stehekin River is the largest tributary to 50 mile long Lake Chelan, the third deepest lake in North America at1,486 feet, more than 350 feet below sea level. The lake is known for its clarity and cold water temperature, and along with Stehekin Valley, for its remarkable scenery.

Lake Chelan NRA includes over 400 acres of private land, about 200 acres of which lies within the channel migration zone of the Stehekin River. All of the project area is outside designated wilderness.

Floodplain Conditions

The lower Stehekin River is flood-prone because of the circular shape of its watershed, steep slopes within the watershed, and the location of the headwaters on the wet Pacific Crest (Figures 1 and 2). Water delivered from three main tributaries merges in narrow bedrock box canyons above the lower valley. There is no storage of wood, gravel, or water within the canyons, except for potential debris dams, which adds a hazardous element to flooding in the lower valley.

The Stehekin River is also flood-prone because it can flood at two times each year. The headwaters of the Agnes Creek tributary and the main Stehekin River are far enough to the west to be within a rain-on-snow zone. Heavy, warm November and December rainfall trigger rapid snowmelt and flooding on these tributaries. The entire watershed receives most of its precipitation in the winter as snow, and warm spring temperatures and rain can trigger rapid snowmelt and flooding. Unlike fall flood peaks, which typically pass within a few days, spring floods are smaller, but last for several weeks between May and June.

Prior to the late 20th century, the Stehekin River was dominated by spring snowmelt flooding, like most east-slope Cascade Rivers. Since the 1970s, however, the Stehekin River has become prone to large fall rain-on-snow floods, which rise quickly and occur from mid-October through December (Figure 3). Hydrologic data collected on the river since 1911 confirm the significance of this shift, as analyzed by the U.S. Geological Survey (USGS). The passage of large fall floods in 1995, 2003 and 2006 has led to significant changes in the Stehekin River channel, and redefined the boundaries for the 100-year floodplain. As a result, recreational and administrative facilities and developments once thought to be safe from the river may become threatened by flooding and bank erosion, while other sites in the floodplain have already been compromised by larger, more frequent floods.

In the past 15 years, the Stehekin River has had the three largest floods on record (Table 1). The November 1995 and 2006 events were 100-year floods, while the October 2003 event (25,000 cfs), has a recurrence interval estimated by the USGS at 100 - 500 years. In addition to these exceptionally large floods, smaller but still significant fall events occurred in 1989 and 1990 and other significant spring floods passed in 1997 and 1999.

Figure 3: Magnitude and Timing of the Annual Peak Flood on the Stehekin River.

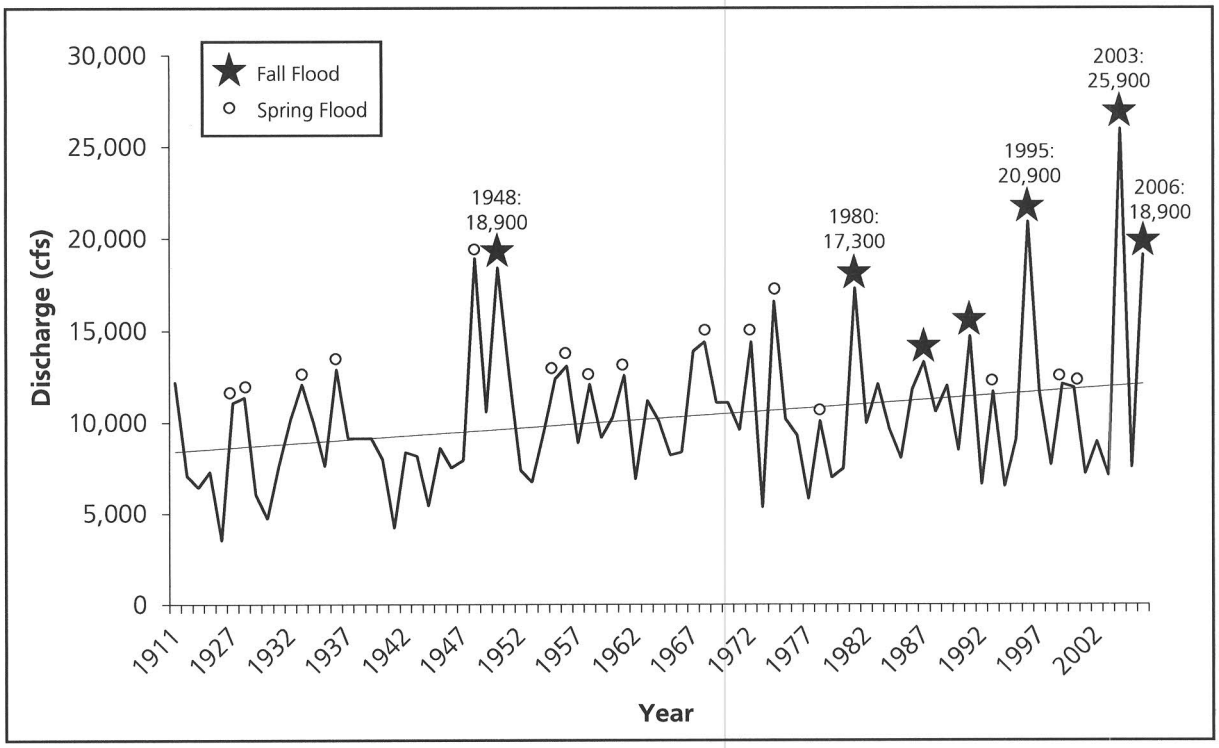


Table 1: Largest Floods on Record for the Stehekin River.

Date	Discharge (cfs)
October 20, 2003	25,600
November 29, 1995	21,000
November 7, 2006	19,100
May 29, 1948	18,900
June 20, 1950	18,400
December 26, 1981	17,300
June 16, 1974	16,600
November 24, 1990	14,700
June 2, 1969	14,400
June 10, 1972	14,400

Stehekin Valley Floodplain and Landforms

The Stehekin River floodplain is located along the floor of the Stehekin Valley in a deep glacial canyon, with peaks rising more than 7,000 feet above the river. The valley floor contains a long lateral moraine, debris cones from small tributaries, alluvial fans from three larger tributaries, and the Stehekin River and its floodplain. The terraces are comprised of gravel, cobbles, and boulders and are crossed by numerous old flood channels. Debris cones have slopes steeper than ten degrees and are covered with boulders, levees, and unstable channels at junctions with the Stehekin River floodplain.

Boulder, Rainbow, and Company Creeks deposited extensive alluvial fans on the Stehekin Valley floor. Parts of these landforms are above active parts of the fans, and are called fan terraces. Fan terraces represent stable sites above the floodplain and active alluvial fan surfaces. Due to the shift toward fall flooding, the alluvial fans have become less active because the headwaters for these tributaries are located in a more arid climate farther east of the Stehekin River headwaters.

Areas of sediment and large wood storage in the lower valley are marked by channel instability and wide floodplains. These deposition zones occur at McGregor Meadows, where valley width increases three-fold, where the river meets the backwater zone above the lake, and between the alluvial fans. Between deposition zones, the floodplain and river channel are relatively narrow on the upstream edge of the three alluvial fans. Within these areas the channel is stable, and there is relatively little storage of wood, gravel, or water. McGregor Meadows is the most unstable of the five deposition zones in the lower valley, and due to the steep gradient in this reach presents the most management challenges.

Small, steep, straight tributaries to the Stehekin River carry debris flows during large precipitation events. Debris flows occur about once every 25 years or so, and are often triggered by summer cloud-bursts, which are an unexpected but important contributor to flood hazards in the valley.

Wetlands

A wetland inventory was completed for the lower Stehekin Valley in 1990 for the General Management Plan (GMP; Figure 4). Mapping included field observations and pre-existing data such as National Wetlands Inventory maps, soil surveys, topographic maps, ortho-rectified aerial photography(1988), and the Stehekin Valley Habitat Types map (NPS 1993b in NPS 1995a:178). These inventories were supplemented by FHWA contractor surveys of wetlands along the Stehekin Valley road above Harlequin Bridge for this plan (FHWA 2011).

Previous surveys have included as wetlands those areas that have at least one of the following characteristics: hydrophytic soil types, hydrophytic vegetation, and/or hydrology (wet soil characteristics, wetland-dependent vegetation, and/or the presence of water). Wetlands within Lake Chelan NRA were classified according to the system developed by the United States Fish and Wildlife Service (USFWS) (Cowardin et al. 1979). These wetlands are first characterized by what kind of water they are associated with and then by the type of vegetation or substrate. In the lower Stehekin Valley wetlands fall into one of three categories: palustrine (wet vegetated areas), riverine (river or stream channels), or lacustrine (associated with a lake).

Palustrine wetlands are those freshwater areas not associated with lakes, but rather with persistent groundwater. Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and some saltwater wetlands. Palustrine wetlands include those areas called marshes, bogs, fens, and prairies as well as shallow permanent or intermittent ponds. Palustrine wetlands are further classified as forested, emergent wetland persistent, and scrub-shrub wetlands (Cowardin et al. 1979).

Based on the GMP (NPS 1995), palustrine wetlands cover approximately 159 acres within the lower Stehekin Valley (Figure 4). About 139 acres of this total are forested wetland, and the remaining 20 acres are scrub-shrub wetland. These areas may shift rapidly during flooding, depending on the erosive forces of the Stehekin River as the river changes course within its channel migration zone. The largest wetlands are a matrix of about 65 acres of palustrine forest and shrub

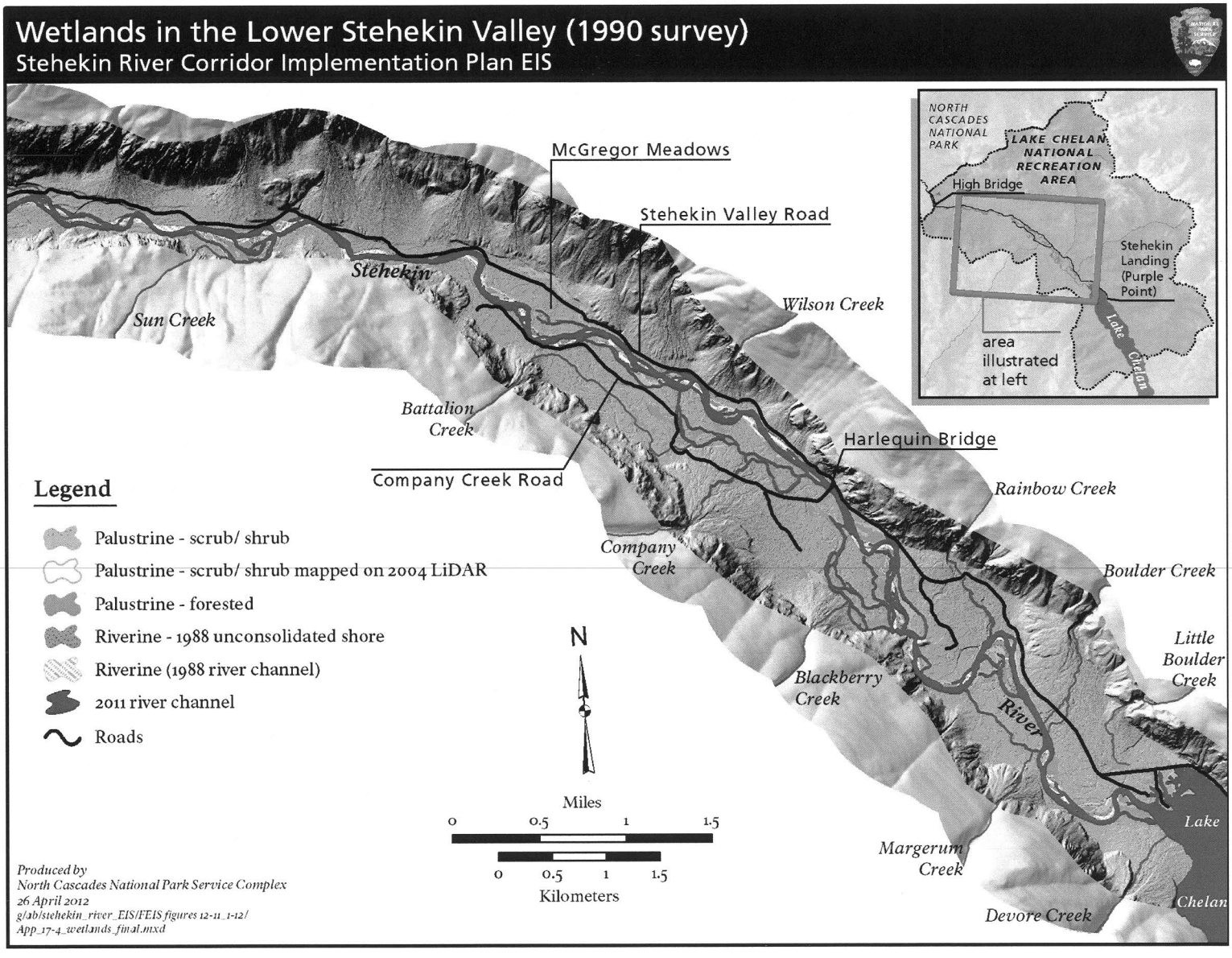


Figure 4: Wetlands in the Lower Stehekin Valley

and scrub wetlands on the right bank of the river near the mouth of Blackberry Creek. Other extensive wetlands occur at the head of Lake Chelan, along lower Coon Creek, and on the right bank of the Stehekin River from just above Harlequin Bridge to upper Company Creek Road (Figure 4).

Riverine wetlands include all wetlands and deepwater habitats contained within a channel, except for wetlands dominated by trees, shrubs, persistent emergent plants, emergent mosses, or lichens and those near saltwater. Water is usually, but not always, flowing in the channel and these wetlands may also be surrounded on their floodplain by other kinds of palustrine wetlands (Cowardin et al. 1979).

Based on the GMP (NPS 1995a:178), within the Stehekin Valley, riverine wetlands are comprised of unconsolidated shore (88 acres) and open-water riverine habitat (167 acres). Similar to the palustrine wetlands, riverine wetlands change frequently, depending on the location of the Stehekin River and its associated side channels and tributaries. For example, of the Weaver Point palustrine forested wetlands mapped in 1988 (8.7 acres), approximately half an acre had been converted to riverine wetland by 2006.

Most wetlands within Lake Chelan NRA remain undisturbed; however, according to the GMP, about 11 acres are affected by development (excluding roads). At the time of the GMP, there were eight private and two NPS buildings located within wetlands. A portion of the Stehekin Valley Road crosses a wetland at the lower end of McGregor Meadows, and the Company Creek Road crosses wetlands at the NPS Maintenance Area and just north of the hydropower station at Company Creek.

Major wetlands within the project area include shoreline areas along the Stehekin River and the open-water channel of the Stehekin River, where some proposed actions, such as the installation of rock barbs, may occur. The Stehekin Valley Road traverses several wetlands between Lake Chelan and Milepost 9.2. In addition to the installation of 6-8 rock barbs in riverine wetland, the other impact from the SRCIP to wetlands would occur in McGregor Meadows.

McGregor Meadows is a former agriculture site located between the road and the river. A 5.5-acre clearing is surrounded by a mixed conifer-deciduous stand. The low-lying meadow and its surrounding forest lie within the channel migration zone of the Stehekin River (Figure 4). Accumulation of about 50,000 cubic yards of gravel since 2000 have led to channel changes that are increasing the rate of conversion from upland to wetland and riverine habitats. For example, in 1993, just over 3 acres of palustrine forested wetlands were mapped within McGregor Meadows. An additional 0.75 acres were classified as scrub-shrub palustrine wetlands and approximately seven acres as riverine, unconsolidated shoreline. Much has changed in the intervening years. Flooding in 2003 and 2006 has left substantial accretions of sand and gravel over the forested upper part of the greater McGregor Meadows, and has scoured much of the meadows themselves, as well as the Stehekin Valley Road. A large logjam has formed at the head of No Name Creek, a side channel of the Stehekin River (Figure 6). The GMP did not include the length of No Name Creek in its palustrine-forested habitat. July 2007 (leaf-on) and February 2004 (leaf-off) imagery shows that there is approximately 8.7 acres of wetlands along the creek. The logjam has contributed another 1.9 acres to the wetlands. The scrub-shrub wetland habitat has been washed away, and the river occupies what was unconsolidated shoreline in 1988 (NPS 1995f).

The existing road into McGregor Meadows traverses a forested wetland as it enters the floodplain from the south. This wetland was not described in the 1993 inventory, but with the recent

channel agrradation and flooding, former river channels have become enlarged and are now classified as palsutrine shrub-scrub wetland. This wetland is located at the base of a glacial moraine and likely occupies an old river channel. It covers about 4 acres, and ranges in width from 50-80 feet (Figure 4). It is fed by groundwater from the hillslope above, as well as by two intermittent surface streams and flood water from the river during peak flow events. The wetland does not have standing water throughout the year, and typically dries out for several months in the late summer. Tree species in and near the wetland include red alder (Alnus rubra) and bigleaf maple (Acer macrophyllum). Shrub species include red osier dogwood and vine maple, while ground cover includes bracken fern, horsetail, and grasses.

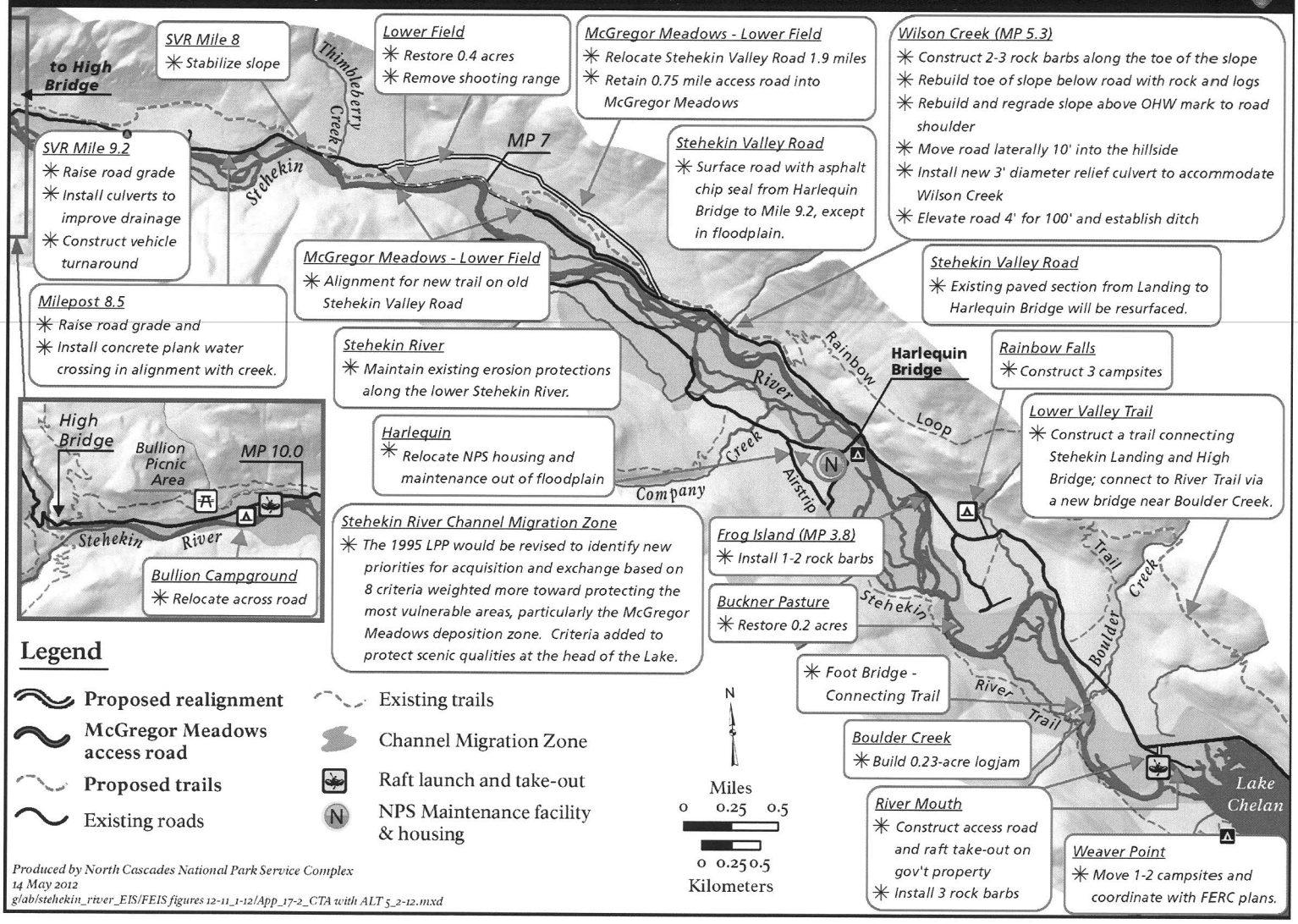
Proposed Actions

Under the selected alternative, new management actions that could adversely affect the Stehekin River floodplain and wetlands (Figure 5) include:

1. Erosion Protection Measures: In Alternative 5, new erosion protection measures would be installed at four sites along the main river channel. These sites include the river mouth, Boulder Creek, Frog Island, and Wilson Creek (Figure 5). Impacts to floodplain and wetland values are relatively minor at three of the sites because they are located at the edge of the channel migration zone. Impacts to floodplains at the river mouth bank stabilization site, however, are moderate and long term because it is located within the channel migration zone. Work at this site would involve construction of a small logjam, installation of three rock barbs, removal of about 100 feet of rip-rap, and dense replanting with native shrubs. The erosion and flooding issues at this site are directly influenced by operation of the Lake Chelan hydroelectric project. Seasonal increases in the lake level result in a backwater effect that extends at least ¼ mile up the river. The 6-8 rock barbs and two logjams proposed for these sites add to a growing number of structures along the lower Stehekin River in two main depositional zones.
2. Placement of Fill to Elevate the Stehekin Valley Road at two Sites. In the selected alternative the main valley road would be elevated 3-4 feet near Mileposts 8.5 and 9.2. At both sites drainage problems are associated with side streams that flood onto and follow the main road, which is at or below grade at both sites. Flooding leads to significant deposition of sand and silt and when culverts are plugged and to erosion of road fill and surface gravel. At Milepost 9.2 FHWA has designed a concrete plank low-water crossing to allow an unnamed intermittent stream to cross the road, while at Milepost 8.5 a vented, box culvert would be installed at the stream crossing, and a new 150 feet long channel would be constructed on both sides of the road to move the stream completely off of private property (50 feet of the channel) and connect it to the Stehekin River (100 feet of the channel). Placement of fill at both sites is on the edge of the floodplain in areas that typically are not flooded by the Stehekin River, and would therefore have minimal impact on floodplain or wetland values.
3. Large Woody Debris Management: Changes to the management of large woody debris on the lower 0.25 mile of the Stehekin River are proposed in Alternative 5. This area is within the backwater influence zone of Lake Chelan, and has seen a large increase in the volume of large wood (Appendix 16; Chelan Public Utilities District 2001). In this area, extensive accumulation of logs is influenced by unnatural manipulation of the Lake Chelan surface elevation.

   Proposed changes in management would allow for limited administrative and private use of large wood from the tops of logjams in the backwater zone below Boulder Creek. Conditions of use would include (1) wood taken only above ordinary high water mark, (2) removal could not destabilize logjams, and (3) all wood removed stays in the channel migration zone

Major Actions Proposed in Alternative 5 (Preferred)
Stehekin River Corridor Implementation Plan EIS



Produced by North Cascades National Park Service Complex
14 May 2012
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Figure 5: Major Actions in SRCIP / FEIS Alternative 5 (Preferred).

for restoration or erosion management. This change would allow the NPS some management flexibility when faced with threats to water quality by flooding of several dozen private cabins and drainfields.

4. Install Grade Control Structures in Lower McGregor Meadows. In keeping with the SRCIP floodplain management approach of floodplain utilization, and to prevent the river from cutting a permanent new path down the road, Alternative 5 proposes to install 1,000 linear feet of grade control structures beneath the road and several driveways at the lower end of McGregor Meadows (Figure 6). These structures would be designed to prevent the river from cutting major new channels down this road system, which is the only access to 15 private parcels. Grade control structures are beneficial because they spread water across the floodplain, limit head-cutting of side channels, and provide some stability to frequently flooded roads. Impacts include restricting the development of new channels, but since they would be constructed primarily beneath existing roads there would be little disturbance to floodplain or riparian vegetation.

5. Construct Reroute Access Connector to McGregor Meadows from Reroute. A road 940 - 1,200 feet long and 12 feet wide from the proposed reroute to McGregor Meadows would be built to allow continued access for private residents back down into McGregor Meadows (Figure 6). At its lower end, the road would cross about 300 feet of the floodplain and 0.2 acres (5 percent) of a small palustrine shrub scrub wetland. To avoid impacts to flooding of private property in this area, and to maintain wetland function, the road would be built at grade and would therefore be subject to periodic flooding.

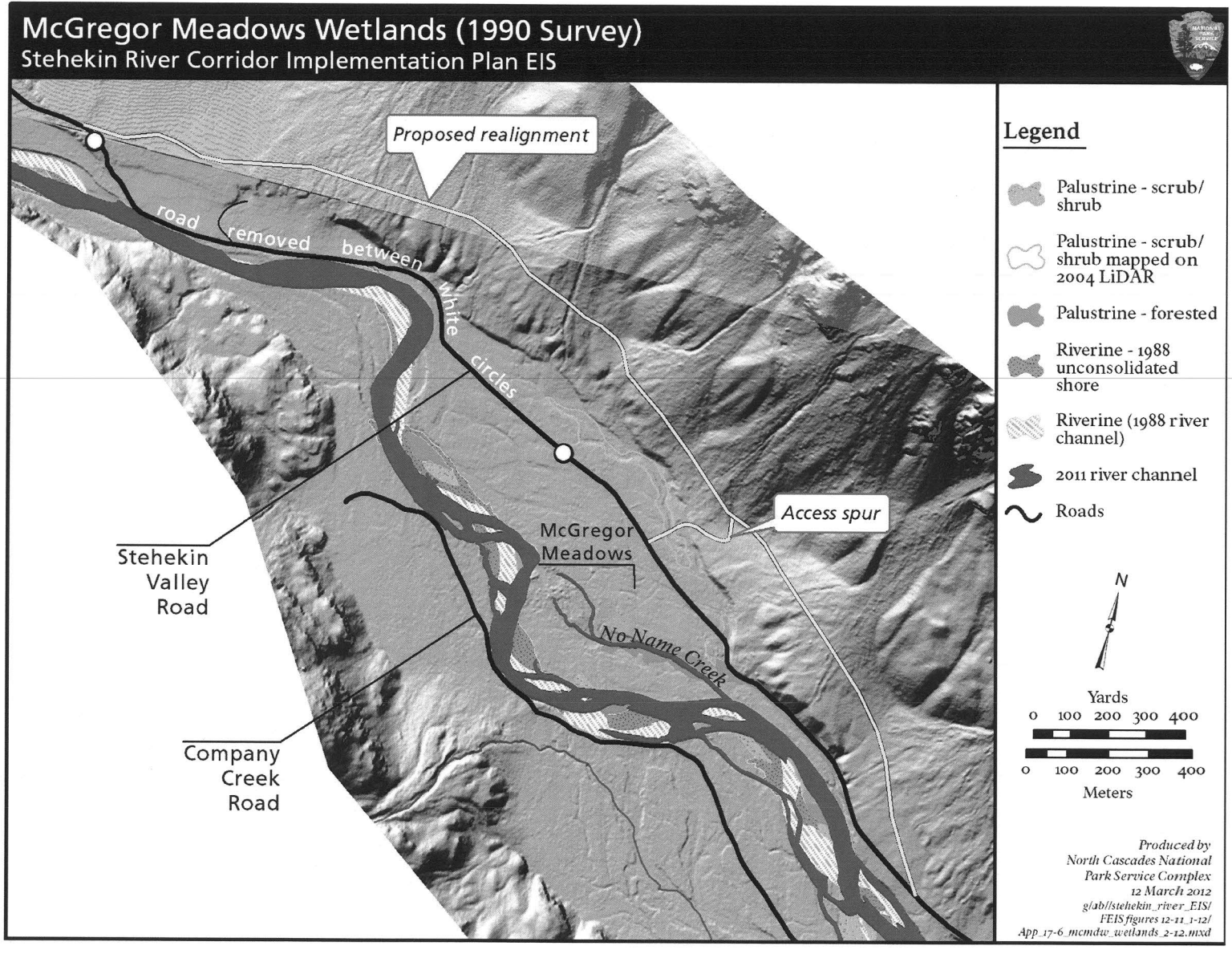
6. Encourage Relocation of Private Property from the Floodplain onto Alluvial Fans: Proposed revisions to the 1995 Lake Chelan NRA Land Protection Plan would encourage relocation of private property from flood-prone sites in the channel migration zone to sites on tributary alluvial fans. Over the long term, removal of development from flood-prone areas would greatly enhance floodplain values by precluding incorporation of septic systems and other debris into the river during flooding.

   The NPS proposes to concentrate some future private development out of the Stehekin River channel migration zone onto alluvial fans and terraces above the river floodplain. Twenty-nine acres on these landforms are identified for exchange with private developed land in the floodplain near river. Occupation of alluvial fans, while not ideal, represents a more sustainable site, given the flood-prone nature of the Stehekin River. Further, a 25% decline in snowpack in the last 50 years has led to decreased spring flood magnitude on these east- side tributary alluvial fans

7. New Recreational Opportunities: A new river access point would be provided near the Stehekin River mouth, which would require construction of 300-foot-long access road in the floodplain and a 30-foot-long ramp down a steep cut bank. The Lower Valley Trail would be constructed in a single complete project to connect Stehekin Landing with High Bridge using sections of existing trail (6.9 miles) and construction of new trail (6.3 miles) some of which would be in the channel migration zone. A 150-foot-long foot bridge over the Stehekin River would connect the Lower Valley Trail to the existing River Trail, potentially taking advantage of existing concrete bridge abutments in a stable reach of the river.

Cumulative Effects

The actions described above would contribute to cumulative effects from existing floodplain and wetland impacts in lower Stehekin Valley. There are currently 208 acres of private land in the



Note: Palustrine Scrub Shrub Wetlands in orange.

Figure 6: Proposed Actions in McGregor Meadows: In Preferred Alternative, 0.8 miles of Road would be Removed Between White Circles.

channel migration zone, which includes the floodplain, as well as NPS developments. About 70 percent of the parcels in the floodplain have structures. The NPS expects additional future private development within the channel migration zone, which it does not regulate, but the revised Land Protection Plan should steer some future and existing development to areas outside of the floodplain. It is difficult to determine how many acres would be affected since NPS acquisition/exchange is on a willing seller basis.

In the selected alternative, actions at three sites along the Stehekin River would install 6-8 new rock barbs. This would increase the number of barbs in the lower 12 miles of the river from the 30 that already exist. In terms of the amount of river shoreline impacted by erosion management structures, the selected alternative would increase the amount from the current 6.5 percent to 8.3 percent. Other management alternatives proposed in the SRCIP would result in larger increases in the number of barbs and of affected shoreline.

Several other stretches of the Stehekin Valley Road and Company Creek Road would remain adjacent to the Stehekin River and would be protected by rock barbs and bioengineering. While the selected alternative would relocate 1.9 miles of the Stehekin Valley Road from the floodplain, about 0.5 miles would remain near Lake Chelan (Figure 6). Much of the upper Company Creek Road would remain in the channel migration zone and is protected by 11 rock barbs and a 400 feet long levee constructed by the NPS in 1980 (Figure 6). The levee prevents some floodwater from entering the upper ends of former river channels now occupied by beaver ponds. These wetlands, however, are fed by surface streams and groundwater from the hillside and floodwater gets around the levee to enter the majority of these old channels. Impacts from the existing and proposed structures are provided in a reach analysis (Appendix 4) and in the SRCIP FEIS.

Development currently impacts about 11 of the 414 acres in the lower Stehekin Valley. The selected alternative would create 0.514 acres of new wetland, but would restore 4.6 acres for a net gain of about 4.1 acres. Restoration of the area near the NPS maintenance facility would restore some function to one of the largest palustrine wetlands in the valley.

Why Proposed Actions are Located in Floodplains and Wetlands

The proposed actions under the selected alternative call for removal of current NPS facilities from the floodplain and channel migration zone, except for areas of the Stehekin Valley Road that cannot be relocated and actions that would protect the road. While private development would remain in the floodplain, the revised Land Protection Plan would provide a mechanism for removal of those most threatened. It is beyond the scope of this plan or the 1995 General Management Plan to remove all development from the floodplain. In addition to private development, some NPS facilities would remain in the floodplain, and some private and public development would remain on alluvial fans and debris cones in different parts of the valley.

Actions that would occur in the floodplain include installation of erosion protection measures and rock barbs at three sites along the Stehekin Valley Road. In these cases, the road is between the river and the steep valley wall. Moving the road out of the floodplain and/or away from river conflicts would require blasting and/or heavy excavation work across cliffs or unstable slopes, cause major impacts to undisturbed wetlands, or to sensitive species.

A major goal of the proposed plan is to allow large floods to occupy the floodplain (floodplain utilization), thereby reducing flood and erosion damage to all areas in the lower valley. The NPS has considered but rejected alternatives involving large scale levee construction or channel

dredging due to cost, sustainability, and impacts to floodplain values. The Boulder Creek logjam and grade control structure (avulsion sill) and the McGregor Meadows grade control structures are designed to maintain sheet flow in extensive floodplain areas, including some private development. More than a dozen similar structures have been installed on both sides of the river in McGregor Meadows since the 1995 flood.

A change in management of large woody debris in the river mouth area acknowledges the incredible build-up of wood in the last 25 years and the effect of lake level manipulation on wood accumulation. This shift in policy also recognizes the impact flooding can have on water quality in this area, and the value of using wood in restoration and erosion management projects.

There are recreation sites currently in, or proposed to be in, the floodplain. Harlequin Campground is the largest camp in Lake Chelan NRA and is located in the floodplain. The site is low relative to the river and typically floods in both the spring and fall. NPS relocated the vault toilet to high ground in 2009, but the campsites remain in a regulatory floodplain. Flooding at the site occurs over a period of days or hours. Under the SRCIP, the Harlequin Campground group site would be closed during seasonal flooding. Alternative group camping would be available at the Purple Point Horse Camp.

It is not feasible to construct the river access point and access road out of the floodplain. The 300-foot-long access road would follow the route of an old road, and require removal of few trees. Construction of this river access point would give visitors a place to exit the river without disturbing private land owners or additional riparian areas in the floodplain. The river access point would provide access to the head of Lake Chelan for non-motorized boats. About 200 feet of the existing road on public land would be closed and restored.

Most of the Company Creek Road near Harlequin Bridge and above the Company Creek alluvial fan is also within the 100-year floodplain. In the selected alternative, floodwaters would be able to overtop riverbanks, except in the vicinity of the existing 400-foot long Company Creek levee. The current height of the levee along the Company Creek Road is 4-6 feet above the road. It continues to take pressure off the Company Creek Road by keeping floodwater from a small part of the floodplain. (The 1995 GMP and associated Floodplains Statement of Findings calls for maintaining the Company Creek Road in its existing location.)

There are no other viable options to locate the Reroute Access Connector off of the reroute due to steep slopes at other locations. The wetland impacted at the lower end of the connector is a long, linear feature that also could not be avoided by locating the connector at another nearby location.

Investigation of Alternative Sites

In analysis for the Draft and Final EIS, the NPS considered but rejected numerous other alternatives for each of the action sites mentioned above.

At Frog Island and Wilson Creek, moving the road away from the eroding bank would require substantial blasting and/or heavy excavation work on steep valley walls, leading to potential slope instability and rock fall hazards. Therefore the road is proposed to remain in place and not be rerouted on the valley wall. Proposed actions at Boulder Creek are also located on the edge of the channel migration zone. At this site, the proposed grade control structure (avulsion sill) and extended logjam would be on the edge of the Boulder Creek alluvial fan. No other sites were considered because no other location offers the same advantages.

No other options exist for the location of the river access point on federal land. Dense private development and a lack of existing access roads eliminated other sites for consideration.

Use of large woody debris from other parts of the Stehekin River is considered in the SRCIP under Alternative 4, where woody debris could be manipulated (under the same conditions as the selected alternative) and taken from areas below the Bullion raft launch, including at McGregor Meadows.

Relocation of private property to alluvial fans and alluvial fan terraces, while not ideal, is much less hazardous then retaining development in the floodplain. This is particularly true in McGregor Meadows where the potential exists for a major channel avulsion. Most of the valley floor is within the floodplain, and the NPS can only offer land for exchange that was once private. Alluvial fans and alluvial fan terraces are one of the most stable landforms in the Lower Stehekin Valley; because they are out of the reach of the main river, they are the best location for safe and sustainable development in the valley. No exchange properties are proposed in the most active parts of the alluvial fans.

Several options were initially considered for relocating the Stehekin Valley Road out of the floodplain at McGregor Meadows. Among these included rerouting the road along the Company Creek Road on the opposite side of the river. Reasons for rejecting this option included that major sections of the Company Creek Road are also within the floodplain and this reroute would have required a new bridge and approaches. Instead, the preferred reroute crosses several debris cones, which are prone to debris flows and snow avalanches, which occur less frequently than flooding along the existing road.

Description of Site-Specific Flood Risk

Recurrence Interval of Flooding

Information on flood recurrence intervals comes from USGS stream gauge data collected since 1911. The results from the most recent USGS Log Pearson III analysis of the gauge data are summarized in Table 2. The recurrence interval for flooding on the Stehekin River varies by the time of year and type of flood (Table 2). When spring and fall events are combined, as is typically done by federal agencies, the '100 year flood' has a discharge of about 21,400 cfs. When the spring and fall flood populations are considered separately, the 100 year fall event discharge is 33,500 cfs, and the 20,000 cfs discharge occurs about once every ten years.

Hydraulics of Flooding (Site Depth and Velocity)

Several models were used to characterize floodplain hydraulic conditions and hazards. These include a HEC2 floodplain model and map constructed by the NPS (Riedel 1993), 2-D models constructed by the NPS Water Resources Division at two sites, a 2001 Chelan PUD model of the backwater effect of Lake Chelan, and a 2012 NPS HECRAS model. These models were calibrated with recordings of flood heights from the 1995, 2003, and 2006 floods. These models are supplemented by a more than 30 years of river monitoring by the NPS and a study of paleo peak flows (Jarrett 1996).

The hydraulic models used to characterize hydraulic conditions use 21,400 cfs as the 100-year discharge. This SOF does not consider the higher 100-year discharge (Table 2) due to a small

Table 2: Comparison of Two Approaches for Determining Flood Magnitude and Frequency on the Stehekin River by the U.S. Geological Survey Using a Log Pearson III Analysis.

Recurrence interval (probability in given year)	Discharge (cfs) for combined fall and spring floods (# events 85)	Discharge (cfs) for spring floods alone (# events = 70)	Discharge (cfs) for fall floods alone (#events = 16)
10 - year (0.1)	14,950	13,740	21,360 cfs
20 -year (0.04)	17,560	15,100	26,220 cfs
50 - year (0.02)	19,490	16,190	29,850 cfs
100 - year (0.01)	21,400	17,910	33,490 cfs

number of fall peak annual events and because FEMA and other federal agencies have not adopted this approach. Flood conditions in the main areas where NPS roads and visitor use facilities such as camps and trails are within the floodplain (including all regulatory floodplains) are summarized in Table 3.

About 0.5 miles of the Stehekin Valley Road, a popular tourist site (Stehekin Valley Bakery), and several dozen private cabins are located in the floodplain near the river mouth. Flood conditions at this site are not severe (Table 3) due to the wide floodplain and a low stream gradient. Lake Chelan exerts a strong backwater effect on the lower Stehekin River that extends ¼ mile above the lake and raises the 100 year flood about 0.5 feet (Chelan PUD 2001). Fill placed along the left bank for the Silver Bay development and logjams in some side channels are thought to raise the elevation of the water surface in this area an additional foot.

Table 3: Site Specific 100–Year Recurrence Interval Flood Conditions for Parts of the Stehekin River Floodplain Occupied by NPS Facilities, Visitors, or Private Residents.

Site	Main Channel Depth and Velocity	Side Channel Depth and Velocity	Overbank Depth and Velocity
McGregor Meadows Road on floodplain (left bank)[1]	5-6 feet 12 feet/second	6 feet 4-5 feet/second	2 feet 3 feet/second
Upper Company Creek Road floodplain (right bank)	5-6 feet 12 feet/second	2 feet 2 feet/second	1-2 feet 1–2 feet/second
Harlequin Camp[2] (right bank)	9 feet 9-10 feet/second	4-5 feet 2-3 feet/second	3 feet 2-3 feet/second
NPS Maintenance Area[3] (right bank)	9 feet 9-10 feet/second	4-5 feet 2-3 feet/second	1-2 feet 2-3 feet/second
SV Road at Frog Island (station 107 left bank)	4.5 feet 4 feet/second	no side channel on left bank	1-2 feet 1-2 feet/second
SV Road at River Mouth (station 40 left bank)	6-7 feet 6 feet/second	5-6 feet 3-4 feet/second	1-2 feet 2 feet/second

[1] overbank flow is increasingly concentrated at the lower end of this area in channels and in No Name Creek
[2] popular site usually not occupied in fall flood season
[3] although the preferred alternative proposes to remove these facilities, this would not occur before 2018.

At Frog Island, where the Stehekin Valley Road is on the edge of the floodplain and erosion management structures are proposed, conditions during the 100-year flood would include water depths on the road of 1-2 feet, with velocity of approximately 1-2 feet/second. This is an important site since it connects the upper valley to the lower valley.

The NPS maintenance area is located on the right bank of the river, and has been flooded during each of the last three large floods. Flooding damaged the road into the facility as well as several maintenance shops and storage rooms, where floodwater depths reached 1-2 feet in buildings during the 2003 flood. This site is isolated from the Stehekin Valley Road by a major side channel of the river, where 100-year flood flow velocity and depth prohibit vehicle traffic. There is currently a back road out of the floodplain at this site that leads onto the Company Creek alluvial fan.

Harlequin Campground is the largest in the valley and is also located on the right bank of the river just below Harlequin Bridge. Flood flow depths at this site are three feet and it is adjacent to the river where main channel flood velocity is 9-10 feet/second with a depth of 9-10 feet. This popular site is usually not occupied in fall flooding, and the proposed Rainbow Falls campground and an existing campground near Stehekin Landing would be available during seasonal flooding.

The Stehekin Valley Road would be relocated out the floodplain, but a trail, access road, and private driveways and development would remain in floodplain on both sides of the river near McGregor Meadows (Figures 5 and 6). Flow depths in overbank areas are on the order of 2-3 feet, although main channel aggradation is sending more flow into the floodplain, and as a result side channels such as No Name Creek and others are carrying an increasing amount of the flow. Depth in these side channels, particularly on the left bank (McGregor Meadows side) reaches as much as six feet.

Along the proposed reroute, severe rainfall could trigger debris flows that inundate parts of several debris cones with water, mud and boulders to depths of five feet or more (Figure 6). Debris flow events are thought to occur about once every 25 years on a given system, although flooding occurs more frequently.

Time Required for Flooding to Occur (Amount of Warning Time Possible)

The amount of time required for warning of possible flooding in the lower Stehekin Valley ranges from a few hours to a day, depending on the nature of the flood hazard. The largest floods on the Stehekin River can take a week or more to build. During fall floods the Stehekin River can go from 10,000 to 20,000 cfs in a matter of hours, but the flood crest passes within one day. Most flood peaks occur at night or in the early morning, when most hazardous sites are unoccupied, but people are also more unsuspecting. The National Weather Service has developed a flood warning system for the valley. Since the 2003 flood, Stehekin Valley residents and visitors have the ability to view flood forecasts specifically for the Stehekin River on the internet. There is also a call-in system established by the NPS.

Spring floods take weeks to build, providing ample warning time for most events. Heavy spring rain or high temperatures on a large, late, melting snow pack can bring peak events within days. River discharge for the largest spring events are 14,000-15,000 cfs.

There is the possibility that a natural log or landslide dam could form in the canyons in the upper Stehekin River, and release a large, somewhat unexpected flood event in the lower valley. Such an event has not been recorded in the last 100 years, nor has it been identified by deposits or landforms in the valley.

Summer debris flows from small steep canyons can rise from intense thunderstorms in a few hours. These occur primarily on the north side of the valley where most development is located. On the steep debris flow canyons and debris cones along the proposed reroute, there may be only an hour or less or warning time.

Opportunity for Evacuation of the Site in the Event of Flooding

Evacuations of the Stehekin River floodplain would involve the public, valley residents, and NPS employees. In McGregor Meadows, people would move to the new access spur road toward the reroute, which would rapidly take them out of the floodplain and to the relocated Stehekin Valley Road. From there the road would provide access to Stehekin Landing, although it would also pass through the floodplain at Frog Island and near the river mouth.

Along the upper Company Creek Road, there is a small piece of high ground across from McGregor Meadows. The Company Creek alluvial fan terrace is above the highest flood levels, but would be isolated down valley by flooding at Harlequin Bridge. Flooding of the Stehekin Valley Road at the river mouth would temporarily cut-off the valley from the Stehekin Landing. During extensive flooding, the Stehekin Valley Road and Company Creek Road also would cross hazards at debris cones and bridges. Harlequin Campground would be seasonally closed during fall and spring flooding.

Figure 7: Cross–Section through McGregor Meadows looking Downstream with the Elevation of the 100-year Flood in Blue. Data from 2011 NPS - FHWA Hydraulic Model.

Geomorphic Considerations (Erosion, Sediment Deposition, Channel Adjustments)

Geomorphic considerations are outlined in a white paper prepared for the SRCIP (Riedel 2008). The Stehekin River is remarkable for the dramatic changes it undergoes in the lower valley. Above McGregor Meadows, the river transports small boulders, but within seven miles the river is stilled by the deep water of Lake Chelan. Superimposed on this pattern is a series of net wood and gravel transport and deposition zones.

Gradient is steep in reaches with straight, narrow channels where the river encounters the large tributary alluvial fans of Company, Rainbow and Boulder creeks. The relatively straight, steep reaches are net transport zones for sediment and large wood, and as a result are areas of relative channel stability. Wood and sediment storage zones between these reaches are characterized by the existence of massive log jams, multiple side channels, and channel instability. Within these unstable zones, erosion on the outside of river bends since 1962 ranges from ten to more than 200 feet.

Dense private development occurs in two deposition zones. At McGregor Meadows, an increase in floodplain width and decrease in stream gradient led to massive gravel deposition in the 2003 flood. At the river mouth, gravel and wood deposition is influenced by the lake backwater zone. Bank erosion and increases in floodplain width are occurring at both sites.

Annual total sediment load of the Stehekin River is estimated at 32,000 cubic yards/year; with about 17 percent or 5,600 cubic yards/year, transported along the bed of the river as gravel. Larger quantities of sediment move in waves during large flood events causing aggradation and channel instability in deposition zones (Riedel 2008).

Impacts to Wetlands from the Selected Alternative 5

A summary of wetland impacts from the selected alternative is shown in Table 4. The impacts would occur from several of the actions described above and would result in short-term localized negligible to moderate adverse effects on wetlands during construction and long-term negligible to moderate long-term impacts once implementation is complete. These impacts would be associated with specific areas and are described below, but would generally include adverse impacts from excavation for culverts, the McGregor Meadows access spur, and installation of erosion protection measures at three sites.

Road Rehabilitation

Several old culverts would be replaced with larger ones and several other new culverts would be placed along the reroute on the Stehekin Valley Road between Harlequin Bridge and the end of the road paving project at Milepost 9.2 (Table 4). These sites include ditch relief culverts (spaced approximately every 500 feet on the existing road and every 300 - 350 feet on the reroute) as well as culverts for perennial or intermittent streams.

Most of the impacts for culvert installation on the reroute would affect 'non-wetland waterways,' or intermittent first and second order streams. These sites are seasonally wet during snowmelt and periods of prolonged rainfall. They lack wetland soils, vegetation, or standing water. During

Table 4: SRCIP Adverse Impacts to Wetlands by Alternative

Site	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Adverse Impacts					
Culvert installation perennial and intermittent creeks	Two 60 inch culverts (Wilson Ck) Two 30 inch culverts (Milepost 8.5)	Same as Alternative 1 plus seven 60 inch culverts for reroute, one 72-inch culvert and two 36-inch culverts Low-water crossing (Milepost 8.5) Low-water crossing (Milepost 9.2)	Same as Alternative 2	Same as Alternative 1	Same as Alternative 2 except there would be a box culvert instead of a low-water crossing at Milepost 8.5
Wilson Creek	Log-cribbing 0.21 ac	Rock barbs (see below)	Logjam (see below)	Rock barbs (see below)	Same as Alternative 2
McGregor Meadows Grade Raise	0.2 ac	N/A	N/A	0.2 ac	N/A
Milepost 8.5 culvert	0.02 ac	0.02 ac	0.02 ac	0.02 ac	Same as Alternative 2
Barbs / Logjams (adverse)	0	6 - 8 barbs 0.45 - 0.59 ac **Barbs** 0.21 River mouth 0.07 - 0.14 Frog Island 0.14 - 0.21 Wilson Ck **Logjams** 0.01 River mouth 0.02 Boulder Ck	4 barbs 0.58 ac **Barbs** 0.14 Weaver Pt 0.14 Lower Field **Logjams** 0.02 Weaver Pt 0.17 River mouth 0.02 Boulder Ck 0.03 Frog Island 0.06 Wilson Ck	16 - 17 barbs 1.17 - 1.24 ac **Barbs** 0.14 Weaver Pt 0.21 River mouth 0.07 - 0.14 Frog Island 0.21 Wilson Ck 0.14 Lower Field 0.14 Milepost 7.0 0.21 Milepost 9.2 **Logjams** 0.02 Weaver Pt 0.01 River mouth 0.02 Boulder Ck	Same as Alternative 2
Reroute Access Connector	N/A	N/A	N/A	N/A	0.1 ac
Former Skinny Wilson Homestead	N/A	N/A	N/A	N/A	0.05 ac
Total	**0.43 ac**	**0.5 ac**	**0.6 ac**	**1.4 ac**	**0.65 ac**

**The culvert work would not impact wetlands, but would affect ephemeral stream channels.*

summer months these stream beds run dry and any water flowing from bedrock canyons above is underground in the coarse glacial gravels and debris flow deposits.

Excavation near the exposed ends of the culverts for rip-rap rundowns and ongoing maintenance could affect palustrine forested wetlands where these were located at perennial or intermittent drainages. Approximately seven perennial or intermittent drainages occur in the project area along the proposed reroute. Except for those on the reroute and at Milepost 5.3 (Wilson Creek), Milepost 8.5, Milepost 9.2, and Thimbleberry Creek, most culverts are or would be designed for snowmelt rather than for intermittent or perennial streams. Actions associated with culverts would have short-term minor adverse effects from construction, coupled with long-term negligible adverse effects from periodically cleaning out the culverts to maintain them. Ongoing repair of flood damage on the road would have minor long-term adverse impacts from introducing gravel into the river and adjacent wetlands.

Removal of more than one million gallons of water from the Stehekin River over a three-month period for road construction and paving would result in negligible adverse effects on riverine wetlands. Locations along the river were selected to avoid existing riparian vegetation or adverse effects on water flow in the Stehekin River. Intake screens would be used to avoid uptake of organic or mineral elements.

Erosion Protection Measures

Streambank stabilization and erosion prevention measures at four sites would result in minor to moderate adverse impacts to palustrine shrub scrub wetland (Table 4). Some of the affected areas are riverine wetlands, including Frog Island and Boulder Creek. Stehekin River mouth and Wilson Creek sites, where steep river cut-banks intersect upland forest, currently have no riparian zone. Adverse effects from initial construction of the barbs and logjams would be minimized over time by restoration and bioengineering associated with barbs and would result in short-term localized minor adverse impacts where located at the edge of the channel migration zone (Frog Island, Wilson Creek, and Boulder Creek), and moderate adverse effects where located within the channel migration zone (River Mouth).

Large Woody Debris

Collection of large woody debris from logjams in the lower one-half mile of the Stehekin River would affect some riverine wetland (riparian) areas adjacent to the Stehekin River through compaction and potential vegetation disturbance and sedimentation. Depending on the type of equipment used, the scale of removal, the success of mitigation measures, and access to the site, effects would be short term and negligible to minor.

Reroute Access Connector

The lower 80 linear feet of the 950-foot long road that would connect McGregor Meadows to the reroute would cross a small wetland that occupies an ancient river channel. This palustrine-scrub-shrub wetland covers about 4 acres and the proposed access road would impact approximately 0.10 acres (3 percent). Impacts associated with the road would be long-term and minor to moderate because the road would be built at grade and would not impede water flowing into or out of the wetland. Primary impacts would be from removal of native vegetation and soils and replacement of these with large rocks and coarse gravel to form the road base (Figure 6).

Justification for Wetland Impacts

The selected alternative would impact 0.65 acres of wetland because other options are limited for the two major actions to address flooding and erosion issues in the SRCIP. Riverbank modifications at two sites are unavoidable because the road is currently at the edge of the channel migration zone, and road relocation away from the river is limited by steep valley walls, cliffs, and rock falls. Rock barbs proposed for the Stehekin River mouth would have a larger impact on floodplain processes since they would be located in the middle of the channel migration zone. This site, however, includes a high bank and the only practical place for the NPS to build a needed river access point to avoid continuing impacts to private property. In addition, river avulsion at this site could threaten water quality by flooding of private cabins and septic systems, many of which are not raised. Ultimately, a major avulsion could threaten the Stehekin Valley Road. At all of these sites, installation of rock barbs would impact about 0.02 acres of the river bed, but would be accompanied by riparian restoration. At the river mouth access point, installation of rock barbs and bioengineering would replace about 100 feet of rip rap currently at the site.

The other main wetland impact is the 950 feet long Reroute Access Connector, which would cross a narrow wetland and about 300 feet of the floodplain. The road would impact about 0.14 acres of a palustrine shrub scrub wetland. No other site is available for the spur road because of steep slopes and unstable soils. Other possible alignments would involve substantial cut and fill and a much larger area of disturbance that could lead to sedimentation in the wetland. This project was included in the FEIS because of public concern over access to private property following proposed NPS relocation of the main road out of McGregor Meadows. There are currently 15 private parcels on approximately 35 acres that would be serviced by the spur road, which would also provide a rapid means of escape to higher ground for residents.

It is not possible for the Stehekin Valley Road to avoid crossing tributary streams. Therefore, localized impacts would occur from installation of larger culverts at about a dozen current stream crossings. At approximately seven sites on the 1.9 mile long McGregor Meadows reroute the culverts would be new, while at the other sites, larger culverts (Milepost 5.3), a box culvert with an opening top (Milepost 8.5), and a concrete plank ford (Milepost 9.2) would improve drainage beneath the Stehekin Valley Road.

Description and Explanation of Flood Risk Mitigation

The SRCIP includes only a few specific measures to reduce hazards to human life and property because all action alternatives propose to remove NPS facilities from regulatory floodplains. Relocation of the main Stehekin Valley Road around McGregor Meadows and the Lower Field will, however, expose those traveling along this road reroute to debris flow and snow avalanche hazards. These events typically occur during the winter and fall, when visitation is low. The NPS would mitigate these hazards by placing interpretive and warning signs at selected pullouts. These signs would inform people about the nature of the hazards and what precautions to take during periods of heavy rainfall. These precautions would include avoidance of bridges and culverts during periods of heavy rainfall and no parking within areas, where small streams are likely to carry debris flows.

These signs would be located along the road reroute and would have a negligible impact to the natural resources of the floodplain. Parts of the Stehekin Valley and Company Creek roads, one camp, and trails would remain within the floodplain, however.

Actions proposed in the selected alternative at several sites would enhance floodplain values and reduce flood hazard. These include restoration of riparian zones at McGregor Meadows, Lower Field, and Buckner Homestead hayfield and pasture, and removal of parts of the Stehekin Valley Road, fuel storage facilities, the NPS Maintenance area, and three NPS housing units from regulatory floodplains.

In this plan the NPS structures and facilities would be removed from the channel migration zone. Roads, trails, and campgrounds that remain in the floodplain would remain subject to periodic flooding. Chelan County enforces the National Flood Insurance Program on the more than 400 acres of private land in Lake Chelan NRA. Private structures and facilities would, however, remain within the regulatory floodplain, within standards and criteria of the National Flood Insurance Program (44 CFR 60) administered by Chelan County.

Description and Explanation of Floodplain and Wetland Mitigation Plans in the Selected Alternative

The SRCIP would provide general benefits to floodplains and wetlands by focusing management on the Stehekin River channel migration zone, rather than on static floodplain boundaries, and by embracing the concept of floodplain utilization. This approach would allow floodwater to spread across the floodplain to benefit floodplain and wetland functions. It rejects the unsustainable and ecologically damaging practices of dredging and levee construction. In addition, Alternative 5 would mitigate 0.65 acres of new impacts to wetlands with restoration of about 4.6 acres of wetland, which results in a net gain of about 4 acres of wetland with the potential for more as the river is allowed to occupy more of its channel migration zone. Combined, the actions proposed in the SRCIP would also improve the function of larger riparian wetland systems (Table 5). Specific restoration actions include:

1. Removal of the NPS Maintenance Facility, Fuel Storage, and Housing from the Floodplain: Because the maintenance area and fuel storage facility are class I and class II actions, respectively, and are within regulatory floodplains, they continue to have adverse effects on floodplains and wetlands. Relocation of this 5 acre site would result in major beneficial effects by removal of development from a 2-acre open-water palustrine wetland and adjacent floodplain, as well as by reducing the potential for water pollution from fuel storage, vehicles, and other machinery (Figure 8).

   The primary goals of restoration at this site would include removal of old cars, culverts and other material from the wetland, and replanting of disturbed areas with native wetland species. This project would be funded as part of the phased development of a new maintenance compound and housing area relocation, scheduled to begin in 2018.

2. Rerouting the Stehekin Valley Road: About 1.9 miles of the Stehekin Valley Road would be rerouted out of the floodplain around McGregor Meadows and the Lower Field (Figure 6). About 0.8 miles of the existing road would be obliterated, allowing the river to utilize this section of the floodplain, and to eventually create new riparian habitat and wetlands. This would result in about 1.46 acres of restored floodplain beneath the former road. Flooding and erosion at the lower end of the existing route into McGregor Meadows are projected to become worse, and ultimately it is expected that all of the private land owners would use the 950-feet long, 12-feet wide Reroute Access Connector. Future potential abandonment of additional sections of road in this area would provide additional opportunities for wetlands to expand or be created.

Table 5: SRCIP Beneficial Impacts to Wetlands by Alternative

Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5 (preferred)
Bioengineering Barbs and Logjams (beneficial)	0	0.5 acres	0.6 acres	1.17 - 1.31 acres	Same as Alternative 2
Riparian Restoration (beneficial)	1.5 acres Restoration Maintenance area: 1.5 acres	4.1 acres Restoration Maintenance area: 1.5 acres Road reroute 1.46 acres River mouth: 0.07 acres Wilson Creek: 0.21 acres Buckner: 0.34 acres Lower Field:0.36 acres Frog Island:0.21 acres	3.9 acres Restoration Same as Alternative 2 except: Road reroute: 1.0 acres Weaver Point: 0.18 acres	2.9 acres Restoration Same as Alternative 2 except for road reroute	Same as Alternative 2
Total Beneficial (Bioengineering, Restoration)	1.5 acres	4.6 acres	4.5 acres	4.1 acres	Same as Alternative 2

Removal of the road at the upper end of McGregor Meadows would allow flood water to move into the head of the wetland impacted by the spur road, and prevent water from following the road instead (Figure 6). Therefore the reroute will improve function of the wetland, and the spur access road crossing the lower end of the wetland will be built at grade to allow water to flow unimpeded to lower parts of the wetland.

Restoration actions, including obliteration of 0.8 miles of road in the floodplain and riparian revegetation in the Lower Field, which would occur in the two years following approval of a Record of Decision on this plan.

3. Restoration and Bioengineering: Riparian restoration and/or bioengineering (layered planting associated with rock barbs or logjams) would enhance floodplain and wetland function along the banks of the river at five sites, including more extensive restoration at the Lower Field (Figure 6) and Buckner Homestead hayfield and pasture (Figure 9). Maps and description for the rock barbs and bioengineering at Wilson Creek, Frog Island and the river mouth are provided in the FEIS and Table 4. Several of these sites currently have no riparian vegetation, and the river mouth project would also replace 100 feet of rip rap with dense planting of native shrubs and a rock barb.

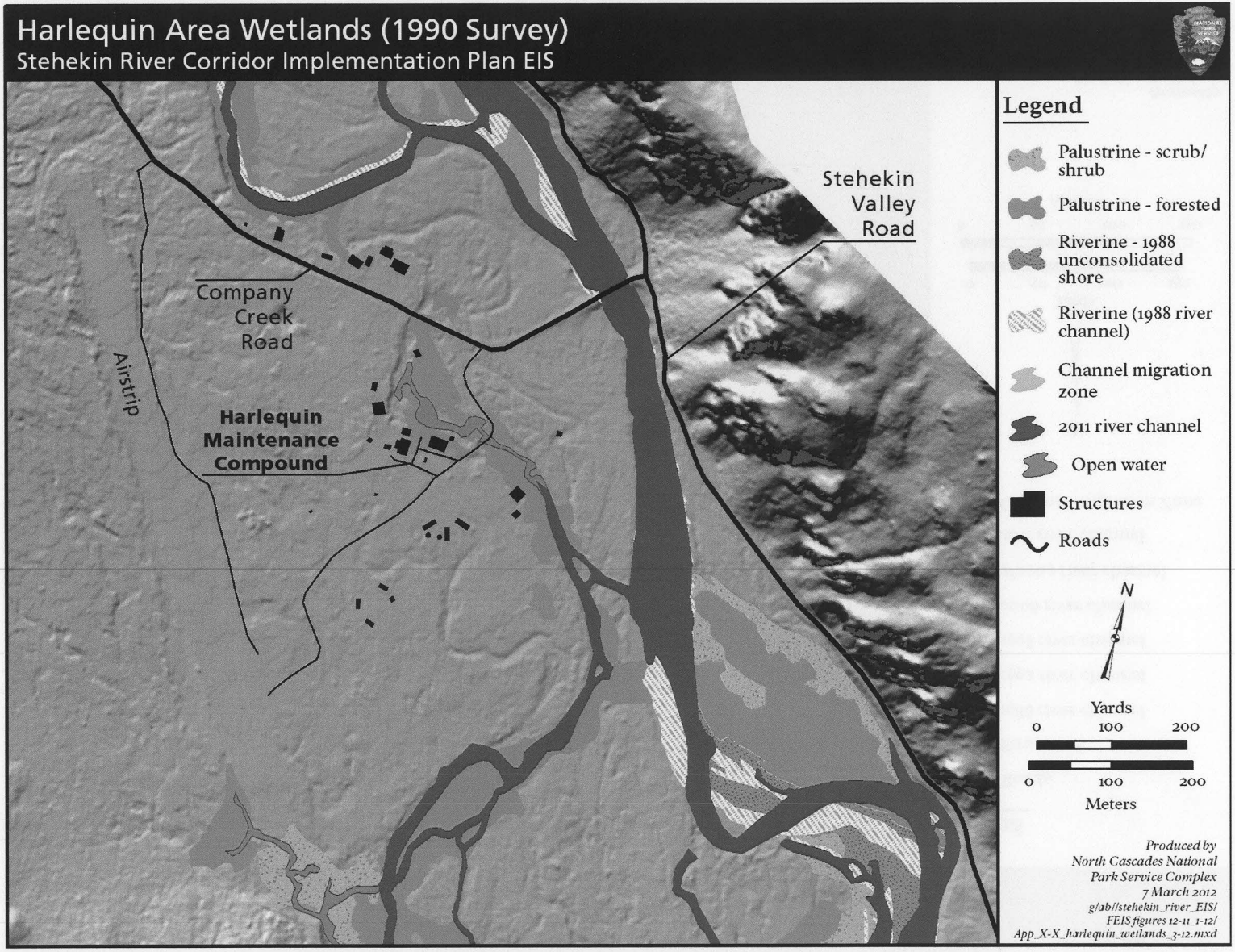


Figure 8: Wetlands Near the NPS Maintenance Compound That Would Be Restored Once the Facility is Relocated. Restoration benefits would include improved flow of water into and through the area, removal of old equipment, and replanting of riparian species.

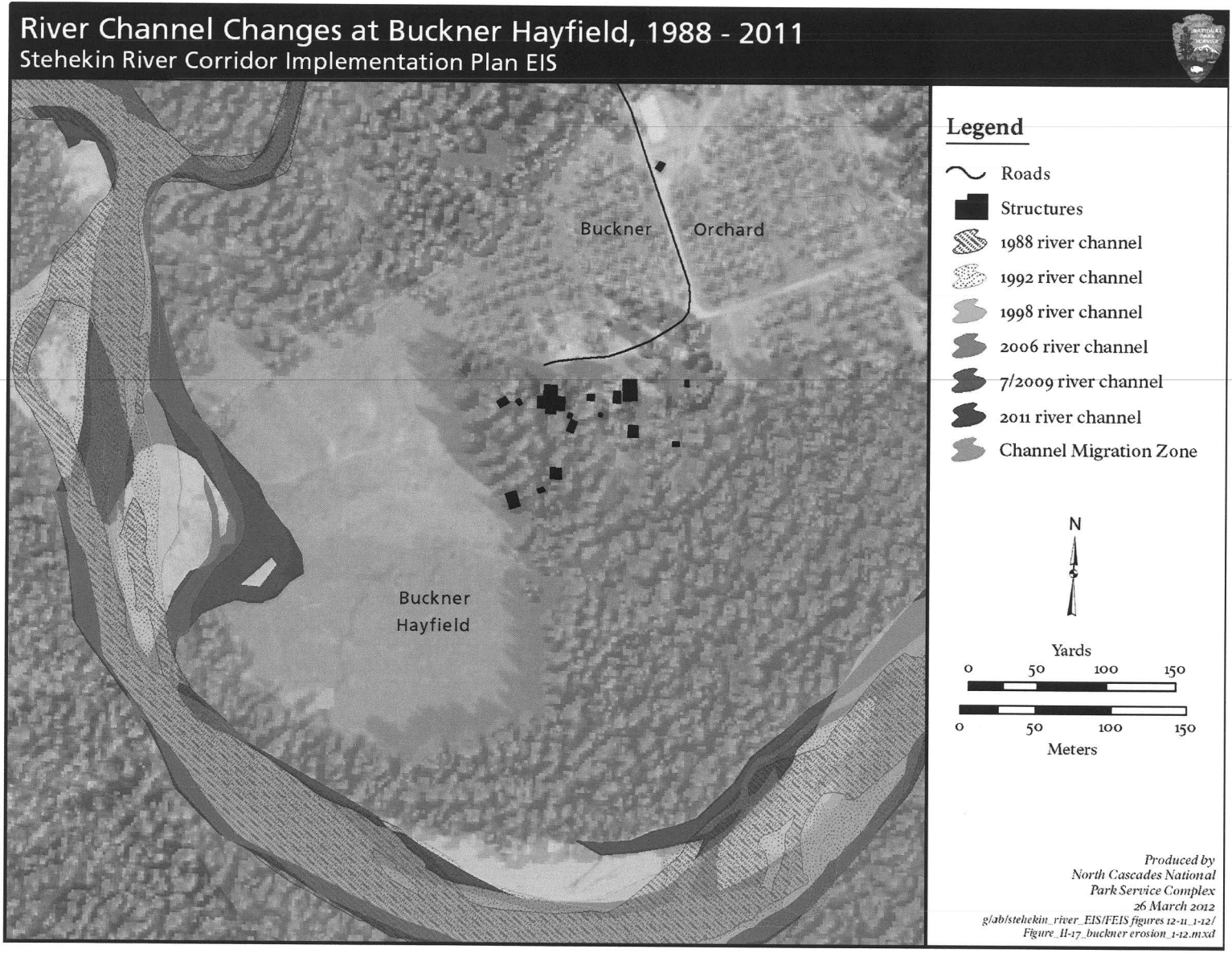


Figure 9: Location of Proposed Riparian Restoration at Buckner Homestead Hayfield and Pasture. The project would focus on a 300 feet x 30 feet area at the west end of the field where erosion by the river is greatest.

The Lower Field, Wilson Creek, and Frog Island riparian restoration would be funded as part of the implementation of the proposed road project by FHWA. Large scale maps of these actions are provided in Chapter 2 of the FEIS while impacts and restoration areas are shown in Table 4. Proposals have not been developed to fund the riparian restoration at the proposed river access point or Buckner Homestead hayfield and pasture. Pending signature of the SR-CIP Record of Decision, funding proposals would be developed.

4. Exchange and/or Acquistion of Private Property: An important part of the SRCIP is revision to the 1995 Land Protection Plan (LPP), which guides land exchange and acquisition within Lake Chelan NRA. The LPP is the primary tool for alleviating one of the major threats to the floodplain and riparian wetlands – cabins and septic drain-fields that could be inundated by Stehekin River flooding. The revised 2012 LPP focuses on removing development from the most threatened areas, in McGregor Meadows and in high flood hazard areas on debris cones. Removal of development in these areas would likely affect about 10-20 acres over the next 20 years, based on recent rates of NPS private land exchange/acquisition.

   Future opportunities to restore natural floodplain conditions by removing development is uncertain because this action would continue to be initiated by willing sellers and is based on the availability of funds allocated from Congress through the Land and Water Conservation Fund. There is currently $900,000 available and several private landowners have indicated interest.

Summary

This statement of findings accompanies a FEIS for the Stehekin River Corridor Implementation Plan and associated actions carried over from the 1995 LACH General Management Plan. The SRCIP was developed in response to recent major floods and resultant channel changes on the lower Stehekin River that have intensified flood and erosion threats to NPS facilities and natural resources within Lake Chelan NRA.

The major actions under the SRCIP selected alternative would result in both adverse and beneficial impacts to floodplains and wetlands. Proposed actions would adversely affect 0.65 acres of palustrine wetlands, while restoration would result in improvements to 4.6 acres of riverine and forested wetlands. The net increase in wetlands of 4 acres in the lower Stehekin Valley results in the SRCIP being in compliance with NPS Director's Order #77-2 (Wetland Protection; NPS 2002a) by achieving 'no net loss' of wetland acreage.

The SRCIP selected alternative proposes to allow limited large woody debris procurement on the lower 0.5 mile of the river above Lake Chelan (below Boulder Creek). This proposal recognizes the threat posed to the road and water quality by the unnatural conditions in the Lake Chelan backwater zone, which has resulted in channel aggradation and the massive build-up of large wood since 1980. Log removal would be allowed from the tops of large logjams with NPS permitting approval, as long as the jam was not destabilized and as long as the removed wood stays in the channel migration zone for restoration projects. Logjam manipulation would also continue to be allowed under specific emergency circumstances in this backwater zone, and the NPS would continue to assist private landowners with technical support for maintenance of the 1948 channel project.

Installation of rock barbs to protect the Stehekin Valley Road at three sites would result in an increase in the total amount of riverbank modified on the Stehekin River from 6.5-8.3%. At two

of these sites, however, the barbs would be located at the edge of the channel migration zone, where their impact on river migration and the creation of new floodplains and wetlands is minor. Near the Stehekin River mouth the installation of rock barbs in the middle of the channel migration zone are designed to replace 100 feet of rip rap at the site and to accommodate installation of a river access point. These structures would also provide some protection from a major river avulsion that could impact water quality by increased erosion and flooding of private cabins and septic systems.

Removal of about 0.8 miles of the Stehekin Valley Road from the floodplain at McGregor Meadows would result in the potential for new wetlands to be created in this extensive, low lying area. Relocation of the NPS maintenance and fuel-storage facilities would bring these facilities into compliance with their regulatory floodplains and NPS Director's Order #77-2 (Floodplain Management Guideline). The selected alternative would preclude further encroachment of the road on the floodplain at McGregor Meadows by eliminating the need for future increases in road height and erosion control structures. Placement of fill in this area to elevate the road would raise flood water elevations by 0.5 ft.

Harlequin Campground, some trails, and about 0.5 miles of the main Stehekin Valley Road and about 1.7 miles of the Company Creek Road would remain in the floodplain because practical alternatives do not exist. Flood hazards associated with continued occupation of these sites are not substantial due to adequate warning times and relatively low flood water depth and velocity.

The primary adverse impacts to the floodplain would continue to be impacts from retaining the 400-foot-long Company Creek levee, which inhibits floodplain utilization; from erosion protection measures installed over time along the river; and from allowing the road to remain adjacent to the floodplain and/or channel migration zone where reroutes cannot be undertaken. Impacts to floodplain values would also be offset by several proposed management actions. These include (1) removal of the maintenance area from the floodplain, (2) rerouting the Stehekin Valley Road out of McGregor Meadows, (3) removal of private development from the floodplain through land exchange/purchase from willing sellers to improve public safety and so that homes and septic systems do not become incorporated in logjams in future flood events, and (4) restoration of riparian areas in several locations in conjunction with the creation of new recreational opportunities.

Conclusion

Floodplain and wetland values would be impacted by several actions proposed in the SRCIP FEIS. These impacts would also be mitigated, to some extent, by several actions that enhance floodplain values. These include removal of NPS housing, maintenance buildings, and fuel storage from the floodplain, relocation of 1.9 miles of the Stehekin Valley Road from the floodplain, restoration of two riparian areas, and a re-vamped Land Protection Plan that proposes the removal of private development via willing seller land exchanges before that development is claimed by the river. For facilities that remain in the floodplain, flood hazards are relatively minor (depth < three feet, velocity < three ft/second) and advance warning of hours to days is likely.

Wetlands as defined by the Cowardin system would be impacted at several sites in the selected alternative on a total of 0.65 acres. No practical alternative exists for avoiding the small wetland that would be crossed by the proposed Reroute Access Connector. Most affected smaller wetlands are located where new, larger culverts would be installed beneath the Stehekin Valley Road

or along the McGregor Meadows reroute. Mitigation for wetlands impacts would also occur at several other sites where a total of 4.6 acres of wetland would be restored. The net increase in wetlands of approximately 4 acres in the lower Stehekin Valley would allow the SRCIP to be in compliance with NPS Director's Order #77-1 (Wetland Protection; NPS 2002a) by achieving 'no net loss' of wetland acreage. Future removal of more roads in this area when no longer needed could also result in additional benefits to wetlands.

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