4.0 Environmental Consequences and Mitigation Approaches

This chapter analyzes the potential effects of Alternative 1 (Full-Build), Alternative 2 (Partial-build), and Alternative 3(No Action) on the environmental resources described in Chapter 3. Where appropriate, it also identifies mitigation strategies that could be implemented to avoid or reduce adverse effects. Analysis is generally presented separately for each alternative and each restoration site, except where there would be no material difference between the effects under the different alternatives, or the effects at each site.

4.1 Overview of Analysis Approach

Analysis of Incremental Effects

Incremental effects refers to the effects specific to a particular proposed action or activity, independent of other activities taking place at the Seashore. Consistent with NEPA requirements, the analysis in this chapter considered the context, intensity, and duration of potential incremental effects.

Context describes the setting within which effects are analyzed. Incremental effects were evaluated in the local context of the immediate project area, except for impacts on traffic, which were analyzed in the context of the whole of Marin County.

Intensity is a measure of an effect's severity. In this analysis, impacts were identified as *beneficial* or *adverse*; beneficial impacts would improve resource conditions and adverse impacts would negatively alter or deplete resources. Adverse effects were further qualified as **negligible**, **minor**, **moderate**, or **major**. These terms are defined for each resource area in the *Assessment Methods* section of each analysis below.

Duration refers to the timeframe over which an effect persists. This analysis identified effects as **short-term** or **long-term**. The duration of time describing short and long-term are defined for each impact topic individually. Information specific to particular resource areas is provided in the *Assessment Methods* sections below.

Analysis of Potential to Impair Park Resources

Current NPS management policies (National Park Service 2000) and NPS Director's Order 12 (*Conservation Planning, Environmental Impact Analysis, and Decision Making)* require decision makers to determine whether a proposed action could lead to an impairment of park resources or

values before approving the action. *Impairment* is defined as "an impact that … would harm the integrity of park resources or values, including the opportunities that would otherwise be present for the enjoyment of those resources or values." In general, an impact is more likely to constitute an impairment if it affects a resource or value whose conservation is necessary to specific purposes identified in the legislation or proclamation that created the park; is essential to the park's natural or cultural integrity, or to the public's opportunities to enjoy the park; or is specifically identified as a goal in the park's General Management Plan or other relevant NPS planning documents (National Park Service 2000).

At Point Reyes National Seashore, the park resources and values that are subject to the no-impairment standard include the physical, biological, and ecological processes that created the park and continue to act upon it, as well as the cultural resources that reflect the area's legacy of Native American use. With these values in mind, analysis of incremental effects factored in consideration of the proposed action's potential to result in impairment of natural and cultural resources at the Seashore.

Analysis of Cumulative Effects

A complete summary of cumulative effects analysis is described in Section 1.4. For the purpose of document review, the actions considered part of the cumulative impacts section are presented again in Table 4-1.

Table 4-1. Actions Included in Cumulative Effects Analysis

Action	Overview
Coastal Watershed Restoration, Drake's Estero Road Crossing Improvements	This action includes the replacement or enhancement of road crossing facilities to accommodate natural hydrologic process and fish passage at six sites within the Drake's Estero watershed. It is in the planning phases, with EAs slated for public release in fall 2004. Implementation, anticipated for summer 2005, would require state and federal permits similar to those required for the proposed action analyzed in this EA.
Horseshoe Pond Restoration to Coastal Lagoon	This action involves the removal of spillway and dam materials to restore natural hydrologic and shoreline process to a 35-acre area immediately west of the mouth of Drake's Estero. It would also restore or enhance the access road, borrow quarry, and former waste lagoon to more natural conditions. With appropriate compliance complete, the project was implemented in fall 2004.
Glenbrook Dam and Quarry Restoration Project	This action involves the removal of dam remains and restoration of the borrow areas at the mouth of Glenbrook Creek in the Estero de Limantour. Implementation is scheduled to be complete by fall 2005. It would require a number of state and federal permits as well as minimum tool clearance for operations within a designated wilderness area.
Giacomini Wetlands Restoration Project	PRNS and Golden Gate National Recreation Area (GGNRA) are conducting a large-scale wetland restoration project at the southern end of Tomales Bay. This project would restore natural hydrologic and ecological processes and functions to the historic tidal marsh, which was diked in the 1940s for operation of a dairy ranch. The project is currently in the alternatives development phase. A draft EIS/Environmental Impact Report (EIR) is scheduled for 2005, with possible implementation of a portion of the project in late 2006.
Dune Restoration Project	This action involves the removal of nonnative European beach grass from the dune areas within the Seashore. Removal methods and restoration strategies are currently being tested near Abbott's Lagoon and would be employed at a larger scale under a line-item construction project planned for FY 2007.
Fire Management Program	NPS has completed a Fire Management Plan for the Seashore and is conducting environmental analysis of program alternatives. The preferred alternative would result in prescribed fire and mechanical treatment on no more than 3,000 acres per year within identified park fire management units (FMUs). While 27% of the Drake's Bay/Drake's Estero watershed is included in active treatment FMUs under the Plan, NPS does not anticipate treatment on more than 10% of any one watershed within Drake's Bay in any given year. The draft environmental impact statement for the Fire Management Plan is now in public review, with comments expected by June 2004. NPS anticipates implementation beginning in FY2005.

NPS is also in the process of revising the General Management Plan for Point Reyes National Seashore. This is a long-term strategic planning document that would establish management direction in the park for the next 10–20 years. Public scoping has been conducted and NPS expects the planning process to be completed by FY 2006 or 2007. Because management planning is still in the early stages, details are considered outside the scope of "reasonably foreseeable" actions that NEPA requires lead agencies to address in the analysis of cumulative effects. However, it is reasonable to assume that all programs and actions implemented under a revised General Management Plan would be consistent with the mission and vision captured in this EA, and would include environmental safeguards similar to those incorporated in the actions explicitly analyzed.

4.2 Effects on the Physical Environment

Effects on Visual Resources

Policies and Regulations

Visual intrusions in coastal areas are considered in association with the federal consistency review by the California Coastal Commission (CCC). The CCC's protection of coastal viewsheds relates specifically to constructed facilities as observed within the coastal zone and from the water. In support of this protection, the CCC conducts consistency review of projects on federal lands to determine concurrence and identify whether permitting is necessary.

NPS management policies (National Park Service 2000) make numerous references to aspects of aesthetics as central issues in the considerations that go into resource management. It specifically includes "aesthetic values, such as scenic vistas … and clear night skies" among the resources that NPS must protect.

Assessment Methodology

The proposed action's likely effects on visual resources were evaluated qualitatively, based on anticipated short- and long-term change in the visual character of the sites as a result of restoration activities, as experienced by the public. Topics addressed included

- the project's potential to alter existing natural viewsheds, and
- the project's potential to introduce new sources of light or glare into the vicinity of the sites.

The following specific questions were factored into the analysis, as required by NPS Director's Order #77.

- Could the action or activity be seen from the park? From a developed overlook, road, or trail?
- Would the action or activity be continuously or intermittently seen? Are there any alternative sites that would be less visible from the park, or would not be visible from the park?
- Could the action impact a scenic vista along a road or a scenic view? How long would the proposed activity affect an area?

Table 4-2 summarizes the descriptors used to evaluate effects on visual resources.

Table 4-2. Descriptors for Visual Resources Effects

Type of Effect	Beneficial—Project activities would improve the integrity of visual resources at and surrounding the project site(s), would result in a more natural viewscape, and/or would introduce visual elements that support park purposes, as identified in relevant planning documents.

	Adverse—Project activities would degrade visual resources at and surrounding the project site(s) and/or would introduce discordant built elements into a natural or largely natural viewscape.
Duration of Effect	Short-term—Effects would be limited to the construction period and days/weeks immediately preceding and following.
	Long-term—Effects would persist for months or years following the completion of construction.
Intensity of Effect	Negligible—Effects would be very slight and the area affected would be very small. Effects would be unlikely to alter the quality of visitors' experience of the project site(s) and surrounds.
	Minor—Effects would be slight and/or the area affected would be small. The proposed action would have a limited adverse effect on the quality of visitors' experience of the project site(s) or surrounds.
	Moderate—Effects would be more noticeable and a greater proportion of the project site(s) and surrounding area would be affected. Visitors' experience of the site and surrounds would be noticeably degraded.
	Major—Effects would be extremely conspicuous and a large proportion of the project area would be affected. Visitors' experience of the area would be substantially degraded.

Evaluation of Impacts

Alternative 1: Full-Build Approach (preferred alternative at Limantour Beach Marsh and Muddy Hollow)

Aesthetic Effects

Limantour Beach Marsh

As described in Chapter 3, views of the Limantour Beach Marsh site are largely natural in character, but the site currently includes an earthen embankment that supports a paved walkway, with a culvert functioning as the spillway between the pond and the tidal marsh. An additional paved embankment spur extends south from the main crossing. A second fill area extends into the tidal marsh from the Lower Muddy Hollow trail approximately 300 feet west of the pond embankment. All of these built features currently represent visual intrusions into a largely natural viewshed.

Alternatives 1 would entail replacing the existing embankment crossing with a bridge constructed of weathered steel and timber, and removal of the second fill area to the west. During construction, the presence of heavy equipment and the disruption associated with dewatering, earthwork, and bridge construction would degrade the visual character of the immediate site vicinity. However, this effect would be temporary (limited to the construction window). In addition, the number of visitors to the area would probably decrease substantially during construction because of limited access, so a reduced number of visitors would experience the degraded views during construction. Consequently, visual disruption would be temporary, resulting in short term minor effects.

Following the completion of bridge construction, restoration of hydrologic connectivity would allow the marsh system to readjust to a more natural, fully functional configuration so that over the long term channel and marsh plain conditions would more closely resemble the area's historic geomorphology. Over time, natural recruitment would revegetate the marsh plain with an appropriate balance of vegetation. In addition, the spoils management area adjacent to the Muddy Hollow Trail would be contoured to a natural appearance and revegetated. This would result in an improved appearance by comparison with the present disturbed hillside, where the scar from past borrow activities is currently evident.

The bridge structure itself would represent an unnatural feature and would be slightly higher than the existing embankment, but the increase in height would be minimal. Because the bridge

framework would have less visual massing than the solid embankment, and its coloration should fit in with surrounding colors, is not expected to have an adverse effect on the viewshed. Most people would find the bridge a more attractive approach to the beach than the existing embankment, providing a more substantial gateway to Limantour Beach and a visual reminder of the restoration of tidal process occurring directly beneath the structure. In the long-term, this would represent a beneficial effect on visual resources.

Muddy Hollow

As at Limantour Beach Marsh, views of the Muddy Hollow site are dominated by natural features, with the exception of the dam embankment and the Muddy Hollow and Estero Trail alignments. The dam embankment is heavily vegetated and blends with the surrounding landscape but is still an evident nonnatural feature. In addition, although Muddy Hollow Pond is attractive and has a quasi-natural appearance, it is not a natural feature of the landscape and appears out of place in what is topographically/geomorphically the upper portion of an estuary system. Alternative 1 would result in the removal of the existing Muddy Hollow dam, eliminating the impoundment upstream of the dam site and reestablishing throughgoing streamflow and tidal exchange.

As discussed above for Limantour Beach Marsh, the presence of heavy equipment during construction, and the disruption associated with dam removal, would degrade the visual character of the immediate site vicinity. However, as at Limantour Beach, this effect would be temporary (limited to the construction window), and the number of visitors to the area would decrease during construction because of limited access, so a reduced number of visitors would experience the degraded views during construction. Consequently, this effect is considered minor adverse in the short-term, but no mitigation is required.

Immediately following dam removal, the drained pond area would likely be less attractive than the existing impoundment because of the blanket of sediment expected to cover what is now the pond bottom, and the absence of terrestrial vegetation in the area now below the waterline. However, this effect would begin to repair itself as vegetation establishes in the first wet season after the dam is removed. The former pond site would become increasingly attractive and natural in appearance in subsequent years, as channelform evolves toward a more functional configuration and vegetation (and wildlife use) become increasingly established. In the first few months or years after dam removal, some visitors may experience the site's altered visual character as a minor effect on their enjoyment of the Muddy Hollow and Estero Trails.

Over the long term, key visual effects of Alternative 1 would include the removal of an intrusive built element (the dam) from the Muddy Hollow viewshed and restoration of stream/tidal marsh geomorphology and vegetation patterns more closely resembling the area's historic condition. This is considered a beneficial effect.

Glenbrook Crossing

Like Limantour Beach Marsh and Muddy Hollow, the Glenbrook Crossing viewshed is largely natural but is disrupted by the presence of an intrusive built feature (the embankment crossing) and by geomorphic and habitat alteration that has occurred as a result of interrupted stream process (the conspicuously aggraded reach and excessive riparian vegetation immediately upstream of the crossing). Alternative 1 would remove the existing crossing embankment and recontour the stream channel toward a more stable condition.

As at Limantour Beach Marsh and Muddy Hollow, the presence of heavy equipment during construction, and the disruption associated with dam removal, would degrade the visual character of the immediate site vicinity. However, as at the other sites, this effect would be temporary (limited to the construction window). Moreover, the number of visitors to the Glenbrook Crossing site is much smaller than at the other two sites because the site is more remote, and visitor usage would be minimized or eliminated by trail closure; consequently, the number of visitors affected

by construction-related changes in the site's appearance would be very small. This effect is considered minor, and no mitigation is required.

Immediately following construction, the spoils management area would be contoured to a natural appearance and revegetated. This would result in a greatly improved appearance by comparison with the present disturbed hillside. The improvement would likely be apparent within the first wet season following construction, and is considered a beneficial effect.

As at Muddy Hollow, the Glenbrook Crossing site would continue to appear somewhat disturbed during the months following removal of the crossing and recontouring of the channel. However, this effect would begin to repair itself with remobilization/redistribution of sediment in the channel during the first wet season after construction (see related discussion in *Hydrology, Hydraulics, and Water Quality* below). The site's appearance would continue to improve in subsequent seasons, with continued evolution of the channel toward full natural function, and progressive reestablishment of riparian vegetation. During the first few months or years after restoration, some visitors may experience the site's altered appearance as an adverse effect, but the number of people affected would be small and the duration would be temporary, so this effect is considered minor.

Over the long term, key visual effects of Alternative 1 would include the removal of an intrusive built element (the crossing embankment) from the Glenbrook Crossing viewshed and restoration of stream geomorphology and riparian vegetation patterns more closely resembling the area's historic condition. This is considered a beneficial effect.

Effects Related to Light and Glare

The following discussion focuses on glare effects, because the proposed activities would introduce no short- or long-term sources of additional light at any of the project sites.

Limantour Beach Marsh

During construction at Limantour Beach Marsh, the presence of heavy construction equipment would introduce a small amount of additional glare generated by reflective metal and glass surfaces into the vicinity of the site. However, because the increase in glare would be comparatively small and would be of short duration (limited to the active construction window), this effect is considered negligible and no mitigation is required.

Following construction, the new bridge structure may slightly increase glare in the project vicinity. However, because the bridge would be constructed of weathered steel and treated timber, it would be minimally reflective, and no adverse effect on visitors' experience of the site is expected. No mitigation is required.

Muddy Hollow

As at Limantour Beach Marsh, the presence of construction equipment and materials at Muddy Hollow would introduce a small amount of additional glare into the vicinity of the site. However, because the increase in glare would be comparatively small and would be of short duration (limited to the active construction window), this effect is considered negligible and no mitigation is required.

Over the long term, glare at Muddy Hollow is likely to decrease, because the impounded water upstream of the dam site would no longer be present. This is considered a beneficial effect. No mitigation is required.

Glenbrook Crossing

As described for the other two sites, the presence of construction equipment and materials at Glenbrook Crossing would introduce a small amount of additional glare into the vicinity of the site. However, the increase in glare would be comparatively small and would be of short duration

(limited to the active construction window). In addition, because of trail closures, the number of people affected would be minimal. This effect is considered negligible and no mitigation is required.

No long-term effect on glare is anticipated at Glenbrook Crossing.

Alternative 1 Contribution to Cumulative Effects on Visual Resources

To the extent that construction periods overlap, the actions listed in Table 4-1 could result in a cumulative effect on visual resources in the Drake's Bay/Drake's Estero watershed. The actions most likely to be constructed during overlapping periods are the Drake's Estero Road Crossing Improvements and potentially the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. These actions would require earthwork, and the associated disruption would represent a net adverse effect on visual resources. However, the construction windows would be fairly short, and visitor access to all sites would be restricted during construction, so the detriment would be limited in duration and would be observed by a greatly reduced number of visitors. Consequently, cumulative short-term effects on visual resources are considered minor. The contribution of Alternative 1 to this net effect, while adverse, would be minor because the construction window would be short and visitors would be largely unable to access the sites during active construction.

Over the long term, the actions listed in Table 4-1 would contribute to visual improvements in the Drake's Bay/Drake's Estero watershed, by removing intrusive built elements from the viewscape and restoring natural habitats and processes. Long-term cumulative effects on visual resources are expected to be highly beneficial, and under Alternative 1, the proposed action would be an important contributor to this net benefit.

Alternative 1 Conclusion on project Visual Resource effects

Under Alternative 1, short-term adverse minor impacts to visual resources would occur as a result of construction activities. The installation of signs describing the restoration activities and intent, as well as distribution of flyers and education at the Visitors Centers would mitigate some of these impacts. With these outreach activities in place, the long-term impacts would be beneficial as visitors are educated about restoration and natural process. Interpretation of the restoration activities and the ecological recovery is a unique education opportunity for visitors.

Alternative 1 would not result in impairment to park visual resources.

Table 4.3 Alternative 1: Overall Effects on Visual Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Aesthetic effects	Minor adverse *	Beneficial
	Light and Glare	Negligible adverse	No effect
Muddy Hollow Pond	Aesthetic effects	Minor adverse *	Beneficial
	Light and Glare	Negligible adverse	No effect
Glenbrook Crossing	Aesthetic effects	Minor adverse *	Beneficial
	Light and Glare	Negligible adverse	No effect
All Sites	Cumulative	Minor adverse	Beneficial

*mitigation through interpretive description of restoration

Alternative 2: Partial-Build Approach (Preferred Alternative at Glenbrook Crossing)

Aesthetic Effects

Limantour Beach Marsh

Short- and long-term effects of Alternative 2 on visual resources at Limantour Beach Marsh are expected to be very similar to those described above for Alternative 1. As with Alternative 1, construction effects would be temporary and minor. Long-term effects are expected to be beneficial because Alternative 2 would result in restoration of natural hydrology/geomorphology and vegetation, and would replace the unattractive embankment crossing with a more attractive boardwalk structure.

Muddy Hollow

Effects of Alternative 2 on visual resources at Muddy Hollow would be similar to those described above for Alternative 1. Under Alternative 2, however, construction-related effects would be greater because construction would occur in phases over a period of years. Correspondingly, the transition to the final naturalized condition would be more protracted, with built elements (the dam and temporary low-level outlet) remaining in place for a longer period; but, as with Alternative 1, any adverse effect on visitors' visual experience of the area could likely be offset by providing information signage to explain the restoration project and the changes taking place. Long-term visual effects would be beneficial under Alternative 2, as under Alternative 1.

Glenbrook Crossing

Short- and long-term effects of Alternative 2 on visual resources at Glenbrook Crossing would be similar to those described above for Alternative 1. As with Alternative 1, construction effects would be temporary and minimal. The transition to the final visually improved condition could be more protracted under Alternative 2 than Alternative 1, because less channel regrading would be accomplished during construction. However, long-term effects are expected to be beneficial because Alternative 2 would remove the intrusive embankment structure and facilitate readjustment of the unnaturally aggraded area upstream of the crossing site. In addition, existing mature riparian vegetation would remain in place upstream of the crossing site under Alternative 2.

Effects Related to Light and Glare

Alternative 2 would not introduce any short- or long-term sources of additional light at any of the project sites. Effects related to glare would be very similar at all three sites to those described above for Alternative 1, except that the duration of temporary, construction-related effects would differ slightly because of the slight difference in construction windows; this effect would be most marked at Muddy Hollow, where construction under Alternative 2 would be phased over 2 (non-consecutive) years. No long-term adverse effect related to increased glare is expected.

Alternative 2 Contribution to Cumulative Effects on Visual Resources

Under Alternative 2, the proposed action's contributions to short- and long-term cumulative impacts in the Drake's Bay/Drake's Estero watershed would essentially the same as those identified for Alternative 1. The only short-term difference would be that the construction window would last for more than one season at Muddy Hollow, resulting in a more protracted contribution to visual disruption. However, effects would still be minor because of the limited area affected. The principal long-term difference would be the presence of a boardwalk rather that a bridge following construction at Limantour Beach Marsh. This would not materially alter the proposed action's contribution to net long-term benefits.

Alternative 2 Conclusion on project Visual Resource effects

Actions under Alternative 2 would be extended over a period of two years. This alternative would result in short-term adverse minor impacts to visual resources would occur as a result of construction activities in both construction years. The installation of signs describing the

restoration activities and intent, as well as distribution of flyers and education at the Visitors Centers would mitigate some of these impacts. With these outreach activities in place, the long-term impacts would still be beneficial as visitors are educated about restoration and natural process. Interpretation of the restoration activities and the ecological recovery is a unique education opportunity for visitors.

Alternative 2 would not result in impairment to park visual resources.

Table 4.4 Alternative 2: Overall Effects on Visual Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Aesthetic effects	Minor adverse *	Beneficial
	Light and Glare	Negligible adverse	No effect
Muddy Hollow Pond	Aesthetic effects	Minor adverse *	Beneficial
	Light and Glare	Negligible adverse	No effect
Glenbrook Crossing	Aesthetic effects	Minor adverse *	Beneficial
	Light and Glare	Negligible adverse	No effect
All Sites	Cumulative	Minor adverse	Beneficial

*mitigation through interpretive description of restoration

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and existing management practices would continue. The sites would continue in their current condition, with intrusive built elements and degraded or altered habitats remaining in place, and **no effect** on visual character or light and glare is anticipated.

In the long-term, potential catastrophic failure, and resulting scar could result in minor impacts to visual resources.

Cumulative Effects on Visual Resources

Because it would not alter the existing visual character of the Drake's Bay/Drake's Estero watershed, the No Action Alternative would not contribute to cumulative effects on visual resources.

In the long-term, potential catastrophic failure, and resulting scar could result in minor impacts to visual resources.

Conclusion on project Visual Resource effects

Under Alternative 3, no effects to visual resources would occur as a result of direct park actions. In the long-term, ongoing maintenance activities would result in negligible adverse effects to visual resources. No additional outreach and education opportunities would be available to park visitors.

Alternative 3 would not result in impairment to park visual resources.

Table 4.5 Alternative 3: Overall Effects on Visual Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All sites	Visual Resources	No effect	Minor adverse
	Cumulative	No effect	Minor adverse

Effects on Wilderness

Policies and Regulations

The Wilderness Act of 1964 (P.L. 88-577 established a National Wilderness Preservation System, allowing Congress to designate wilderness areas for preservation and protection of their natural condition. "The areas shall be administered… in such a manner as will leave them unimpaired for future use and enjoyment as wilderness." Wilderness is defined in the act as "an area where the earth and community of life are untrammelled by man, where man himself is a visitor who does not remain." The Glenbrook Crossing project area, and the trail reroute associated with the Muddy Hollow Pond site are within the Philip Burton Wilderness.

NPS management policies (National Park Service 2000) include a chapter on Wilderness Preservation and Management and outlines a process for conducting compliance and evaluation of impacts associated with activities and equipment within the Wilderness.

Enabling legislation of the Seashore includes language that acknowledges the alterations to the landscape and the need to include "… maximum protection, restoration, and preservation of the natural environment… (PL 94-544 1976)."

Assessment Methodology

The proposed action's likely effects on Wilderness resources were evaluated qualitatively, based on anticipated short- and long-term change in the character of the sites as a result of restoration activities and their potential to alter existing wilderness values.

The following specific questions were factored into the analysis, as required by the minimum requirement decision guide (See Appendix B).

Table 4-6 summarizes the descriptors used to evaluate effects on Wilderness resources.

Table 4-6. Descriptors for Wilderness Effects

Type of Effect	Beneficial—Actions would maintain, support or protect wilderness character. This may include promotion of natural process or naturalness to enhance ecological sustainability in the Wilderness area.
	Adverse—Actions would degrade wilderness resource values, through reduction of wildness in the designated wilderness areas.
Duration of Effect	Short-term—Effects of the actions would result in visible Wilderness effects for less than two years.
	Long-term—Effects would persist beyond two years following the completion of construction.
Intensity of Effect	Negligible—Effects would be localized and limited to a confined area.
	Minor—Effects would be slight and/or the area affected would be small. The proposed action would have a limited effect on the wilderness character, naturalness, and natural function of the area.
	Moderate—Effects would be more noticeable and a greater proportion of the project site(s) and surrounding area would be affected. Wilderness character would be noticeably degraded, with a loss of wildness and naturalness.
	Major—Effects would be extremely conspicuous and a large proportion of the project area would be affected. Wilderness values and character would be permanently and substantially degraded.

Evaluation of Impacts

Alternative 1: Full-Build Approach (preferred alternative at Limantour Beach Marsh and Muddy Hollow)

Limantour Beach Marsh

Limantour Beach Marsh project area is not within the Philip Burton Wilderness

Muddy Hollow

The Muddy Hollow Pond is within the Environmental Protection—Natural Environment. The tidal areas below the Muddy Hollow dam are within the Estero de Limantour Environmental Protection—Reserves management sub-zone. The Estero trail reroutes associated with this project site would be included in the Environmental Protection—Wilderness and Natural Environment sub-zones. Only the trail reroute portion of the Muddy Hollow project is within the Philip Burton Wilderness.

The trail reroute would take advantage of existing slopes to construct a trail that would be sustainable in the long-term. Many trails in the park are adapted from old roadbeds and are problematic to maintain. Where new routes are installed, the construction techniques and scale are designed to allow for better trail maintenance in the long-term.

The proposed method of installing the trail reroute is through the use of a specialized trail building machinery. The use of this machinery would create a trail that would, in the long-term, be sustainable and could be maintained through the employment of hand crews. In this area of highly erodible soils, heavy trail use, and aggressive vegetation growth, creation of a sustainable trail tread at appropriate grades is desireable, and best achived using specially designed equipment.

Currently, trails within these areas are former roads. The scale and condition requires use of mechanized equipment to maintain water bars and drainage devices along the most problematic sections. The use of mechanized equipment to create a sustainable trail would result in minor short-term adverse effects on wilderness, but in the long-term, the sustainable trail would reduce the need for mechanized equipment to actually maintain the facility. The long-term effect of this trail reroute on wilderness resources and values is considered beneficial.

Glenbrook Crossing

Glenbrook Crossing and the associated trail reroute are located approximately one mile into the Wilderness area from the proposed access at Upper Muddy Hollow parking area. The intent of actions at this location are to remove a non-conforming structure from the Wilderness and restore natural hydrologic process to Glenbrook Creek.

The construction activities are estimated to take three weeks, requiring daily access to the site and work at the site. The contractor would be required to stage at the parking area and run a shuttle between the access and the site to minimize trips between the sites.

The deconstruction activities themselves would require large-scale operations for the duration of the construction period. During this time, the Wilderness values would be effected and short-term impacts are considered moderate in this localized area. In the long-term, the removal of a non-conforming structure and restoration of natural hydrologic process in a planned manner, would be beneficial to Wilderness values and resources.

At the Glenbrook site, there is a 15-foot vertical elevation difference in the bed of the creek at the road crossing location. Restoration planning has identified a 2% grade as providing stability in the channel. Under Alternative 1, the restoration would include excavation of a 30-foot wide corridor at a 2% grade upstream approximately 600 feet until it intersects with the existing channel and floodplain. Fill would be placed downstream, approximately 850 feet, with constructed woody

debris/boulder structures installed at or below grade to reduce potential downcutting and to provide structure in the newly created channel bed.

Alternative 1 would result in the removal of the well-established riparian corridor upstream of the crossing and would depend on engineered grades to provide stability in the channel. This alternative has been identified to minimize sediment erosion and transport from the site as a result of the proposed construction activities. The level of construction effort and manipulation is extensive and would result in localized short-term moderate adverse impacts to the wilderness values in this area.

Currently, a visitor on the trail does not necessarily realize the scale or effect of the former road facility on the creek or natural process. These actions, though extensive, would create opportunities to educate the public about wilderness, non-conforming structures, restoration, and protection. The construction activities would be a visible action that would prompt visitor interest and allow for dissemination of this information.

The trail reroute would be located upstream of the existing crossing, and would take advantage of existing slopes to construct a trail that would be sustainable in the long-term. Many trails in the park are adapted from old roadbeds and are problematic to maintain. Where new routes are installed, the construction techniques and scale are designed to allow for better trail maintenance in the long-term.

The use of this machinery would create a trail that would, in the long-term, be sustainable and could be maintained through the employment of hand crews. In this area of highly erodible soils, heavy trail use, and aggressive vegetation growth, creation of a sustainable trail tread at appropriate grades is desireable, and best achived using specially designed equipment.

Currently, trails within these areas are former roads. The scale and condition requires use of mechanized equipment to maintain water bars and drainage devices along the most problematic sections. The use of mechanized equipment to create a sustainable trail would result in minor short-term adverse effects on wilderness, but in the long-term, the sustainable trail would reduce the need for mechanized equipment to actually maintain the facility. The long-term effect of this trail reroute on wilderness resources and values is considered beneficial.

Alternative 1 Contribution to Cumulative Effects on Wilderness Resources

Of the projects identified in Table 4-1, the Glenbrook Dam and Quarry Restoration Project and Fire Management Plan may also result in impacts to Wilderness. These effects would also be considered localized, and would be the result of restoration actions intended to remove non-conforming structures and restore natural process to the wilderness portions of the park.

While localized effects at particular sites would be more intense, the cumulative impacts on wilderness resources evaluated through this process are considered moderate in the short-term. In the long-term removal of non-conforming wilderness structures, creation of more sustainable trail corridors, and reintroduction or restoration of natural process is considered a long-term benefit to wilderness resources.

Alternative 1 Conclusion on project Wilderness effects

Under Alternative 1, localized short-term adverse impacts to wilderness resources are considered adverse moderate. In the long-term, the proposed actions would result in benefits to the wilderness by restoring natural process to a confined system. This would also provide for visitor recognition that structures are not consistent with wilderness. Interpretation of the restoration activities and the ecological recovery is a unique education opportunity for visitors.

Alternative 1 would not result in impairment to park wilderness resources.

Table 4.7 Alternative 1: Overall Effects on Wilderness Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Wilderness	Not applicable	Not applicable
Muddy Hollow Pond*	Wilderness	Minor adverse*	Beneficial
Glenbrook Crossing	Wilderness	Moderate adverse	Beneficial
All Sites	Cumulative	Moderate adverse	Beneficial

*Trail reroute only –pond area is not in the Wilderness

Alternative 2: Partial-Build Approach (Preferred Alternative at Glenbrook Crossing)

Limantour Beach Marsh

Limantour Beach Marsh project area is not within the Philip Burton Wilderness

Muddy Hollow

At this project site, potential impacts under Alternative 2 are the same as those evaluated on the trail reroute described under Alternative 1 above. This includes minor adverse impacts in the short-term associated with trail construction techniques, but beneficial long-term impacts related to a more sustainable and properly built trail.

Glenbrook Crossing

Glenbrook Crossing and the associated trail reroute are located approximately one mile into the Wilderness area from the proposed access at Upper Muddy Hollow parking area. The intent of actions at this location are to remove a non-conforming structure from the Wilderness and restore natural hydrologic process to Glenbrook Creek.

The construction activities are estimated to take three weeks, requiring daily access to the site and work at the site. The contractor would be required to stage at the parking area and run a shuttle between the access and the site to minimize trips between the sites.

At the Glenbrook site, there is a 15-foot vertical elevation difference in the bed of the creek at the road crossing location. Under Alternative 2, the downstream reach would be treated in a similar manner as described in Alternative 1, though the extent of treatment may only extend 600 feet below the crossing, rather than 850 described in Alternative 1. The channel would be filled creating a 2-3% grade with constructed boulder/woody debris structures installed at or below grade to reduce potential downcutting and to provide structure in the newly created channel bed. Upstream, the restoration actions would include limited excavation upstream up to approximately 200 feet, as well as installation of two boulder/woody debris structures. The volumes excavated upstream would be balanced with the fill requirements necessary downstream.

This limited upstream excavation would reduce potential direct effects on existing riparian habitat and depend on this heavily vegetated area to provide some level of stability in the bed profile. Compared with Alternative 1, the work is less intrusive and depends on natural process to develop a level of stability. The tradeoff, however, is that the sediment transport levels would also be higher, as the system adjusts over time. The level of construction effort and manipulation is extensive, but is far less extensive than the approach described under Alternative 1. While the same equipment would be required, the duration of construction and extent of intrusion associated with construction activities are reduced from Alternative 1. In addition, Alternative 2 leaves much of the upstream riparian complex and allows for the channel to more completely evolve through natural dynamic processes. When considering these treatments and minimization of impacts where possible, the short-term impacts are considered minor at this site. In the long-term, the removal of non-conforming structure and restoration of natural process is considered beneficial.

Currently, a visitor on the trail does not necessarily realize the scale or effect of the former road facility on the creek or natural process. These actions, though extensive, would create opportunities to educate the public about wilderness, non-conforming structures, restoration, and protection. The construction activities would be a visible action that would prompt visitor interest and allow for dissemination of this information.

The trail reroute actions would be the same as those described under Alternative 1, above.

Alternative 2 Contribution to Cumulative Effects on Wilderness Resources

Cumulative effects on Wilderness resources are considered to be the same as those described in Alternative 1. While localized effects at particular sites would be intense, the cumulative impacts on wilderness resources evaluated through this process are considered minor in the short-term. In the long-term removal of non-conforming wilderness structures, and creation of more sustainable trail corridors is considered beneficial to wilderness resources.

Alternative 2 Conclusion on project Wilderness effects

Under Alternative 2, localized short-term adverse impacts to wilderness resources are considered adverse minor. In the long-term, the proposed actions would result in benefits to the wilderness by restoring natural process to a confined system. This would also provide for visitor recognition that structures are not consistent with wilderness. Interpretation of the restoration activities and the ecological recovery is a unique education opportunity for visitors.

Alternative 2 would not result in impairment to park wilderness resources.

Table 4.8 Alternative 2: Overall Effects on Wilderness Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Wilderness	Not applicable	Not applicable
Muddy Hollow Pond *	Wilderness	Minor adverse*	Beneficial
Glenbrook Crossing	Wilderness	Minor adverse	Beneficial
All Sites	Cumulative	Minor adverse	Beneficial

* Trail reroute only –pond area is not in the Wilderness

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and these facilities would remain. There would not be effects to wilderness at the Limantour site. Existing trails associated with the Muddy Hollow and Glenbrook project sites require extensive maintenance sometimes requiring mechanized equipment. Under no action, the existing status would continue resulting in minor adverse effects to wilderness associated with ongoing trail maintenance requirements.

At Glenbrook, there is a high potential that the culvert and fill would fail catastrophically. Currently, water pipes around the culvert, and the last 20 feet of the culvert are eroded through, resulting in headcutting of the road embankment. This would result in immediate and extensive changes to the channel and corridor, with no accommodation for access around the site. While this could be perceived as "wildness", the catastrophic failure of a man-made structure within wilderness would be considered a moderate impact. With failure, there would no longer be an opportunity to effectively remove the facility while minimizing potential impacts to habitat and stream condition.

The other potential action that could occur at Glenbrook is the replacement of the existing culvert, thereby maintaining this non-conforming facility in the wilderness, which would also be considered an adverse impact.

It is likely the culvert and facility would remain at Glenbrook for the next two years, without maintenance. The short-term presence of a non-conforming structure is considered a minor adverse impact to Wilderness. In the long-term, however, there is a high likelihood that the culvert would fail catastrophically. This would result in localized moderate impacts in the long-term.

Cumulative Effects on Wilderness Resources

Because it would not alter the existing structures or condition of non-conforming structures within wilderness, within the Drake's Bay/Drake's Estero watershed, the No Action Alternative would maintain minor adverse cumulative effects on wilderness resources in the short-term. In the long-term, the potential catastrophic failure of the Glenbrook Crossing would result in localized effects at the site, but cumulatively would be considered minor adverse effects on Wilderness Resources.

Conclusion on project Wilderness Resource effects

Under Alternative 3, no direct effects to wilderness resources would occur as a result of direct park actions. However, the presence of non-conforming structures (at Glenbrook) and the maintenance requirements of the trails are considered minor adverse short-term impacts. In the long-term, catastrophic failure or maintenance activities to replace a culvert would result in localized moderate adverse effects at the Glenbrook site. No additional outreach and education opportunities would be available to park visitors.

Alternative 3 would not result in impairment to park wilderness resources.

Table 4.9 Alternative 3: Overall Effects on Wilderness Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Wilderness	Not applicable	Not applicable
Muddy Hollow Pond	Wilderness	No effect	No effect
Glenbrook Crossing	Wilderness	Minor adverse	Moderate adverse
All Sites	Cumulative	Minor adverse	Minor adverse

Effects on Air Quality

Policies and Regulations

Federal and State Guidance. Air quality is regulated under the federal and California Clean Air Acts and amendments. Pursuant to these regulations, the state and federal governments have established ambient air quality standards for 6 "criteria" pollutants: carbon monoxide, ozone, particulate matter of less than 10 microns in diameter, oxides of nitrogen, sulfur dioxide, and lead. Within the San Francisco Bay Area Air Basin, the BAAQMD ensures that these standards are not exceeded. The BAAQMD also issues permits for various activities that may affect air quality.

Air Quality Management at Point Reyes National Seashore. Scenic resources are extremely sensitive to air pollution. For example, even a very small amount of fine particulate matter can affect a viewer's ability to perceive colors, contrast, texture, and form of features, landmarks, and panoramas. Consequently, visual air quality is very important to park visitors.

PRNS is classified as a mandatory Class I area under the Federal Clean Air Act and its amendments. This classification requires the NPS to prevent significant deterioration of air quality as a result of park activities. The NPS is responsible for protecting the Seashore from impacts to ambient air quality and air quality related values, such as visibility and the protection of natural and cultural resources from the effects of contaminants.

Assessment Methods

Analysis of effects on air quality focused on construction, because "operation" of the restored sites (including monitoring, maintenance, and inspection visits by NPS staff) is not expected to result in substantial pollutant emissions or in a substantial change in emissions by comparison with current operations and maintenance practice.

This analysis was performed in accordance with guidelines published by the Bay Area Air Quality Management District (BAAQMD) (1999). Although construction vehicle exhaust represents a source of pollutants, its contribution to construction-related emissions is comparatively minor; the primary concern with regard to construction-related emissions is generation of fugitive dust, with a specific concern for inhalable particulate matter (PM10), which is associated with a variety of health effects; the BAAQMD does not require quantification of construction emissions if project proponents agree to implement specific, stipulated dust control measures. Accordingly, this analysis took a qualitative approach and prioritized the potential for PM10 generation.

Table 4-10 below summarizes the descriptors used to evaluate effects on air quality.

Table 4-10. Descriptors for Air Quality Effects

Type of Effect	Beneficial—The proposed action would improve or maintain air quality while lowering the potential for substantial pollutant releases.
	Adverse—The proposed action would result in degradation of current air quality or increase the potential for substantial pollutant releases.
Duration of Effect	Short-term—Effects on air quality last would persist no more than 3 days beyond the completion of construction.
	Long-term— Effects on air quality would persist more than 3 days beyond the completion of construction.
Intensity of Effect	Negligible—Dust and emissions would be barely perceptible or detectable, and would affect an undeveloped area with no recreational facilities or trails, no habitable structures, etc.
	Minor—Dust and emissions would be detectable but would be localized within an area of low-density development, would be of short duration (several hours or less), and would have no lasting effects.
	Moderate—Dust and emissions would be readily perceptible but would be localized in an area of low-density development, would limit use of the area for no more than 1 day, and would result in no damage to property or other lasting effect.
	Major—Dust and emissions would be readily noticeable, would occur in a developed area resulting in a potential hazard to human health and/or potential for property damage or other lasting effect.

Evaluation of Impacts

Build Alternatives, All Sites

Restoration activities, including earthwork at all three sites, construction of a new bridge or boardwalk at Limantour Beach Marsh, and channel recontouring at Glenbrook crossing, have the potential to temporarily increase pollutant emissions under both Alternative 1 and Alternative 2. As discussed in the *Methodology* section above, the key concern in this regard is the potential for increased generation of fugitive dust (PM10). To address the potential for increased PM10 generation, NPS has committed to requiring the construction contractor(s) selected for project implementation to implement dust control measures consistent with the current guidelines of the

BAAQMD. These measures are described under *Environmental Commitments* in Chapter 2. As the federal land manager, NPS would be responsible for inspections and visual monitoring to ensure effective implementation of these measures. With these commitments in place, and monitoring and corrective action provided by the NPS, effects on air quality as a result of construction activities are expected to be minor short-term and adverse, and no mitigation is required. No long-term effects are anticipated as a result of this project.

Cumulative Effects—Build Alternatives

To the extent that construction periods overlap, the actions listed in Table 4-1 could result in a cumulative effect on air quality in the Drake's Bay/Drake's Estero watershed and downwind portions of the SFBAAB. The actions most likely to overlap are the Drake's Estero Road Crossing Improvements, and the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. These actions would require earthwork, and would have the potential to increase emissions of fugitive dust as well as adding tailpipe emissions from earthwork equipment. Fire planning is tied directly to the air quality issues, and would be subject to existing conditions at the time an actual burn was approved and implemented. PM10 and ozone precursors (ROG, NO_x) are the greatest concern, because of the SFBAAB's nonattainment status for these criteria pollutants.

The duration of construction actions identified as potentially overlapping would be comparatively short, and the number of pieces of equipment and volume of earthwork required would be small. Thus, the cumulative volume of pollutants generated during overlapping construction windows would be small, and is expected to disperse rapidly as it is transported downwind; the likelihood of measurable contributions to exceedance is considered very small. Moreover, NPS would require contractors to adhere to the BAAQMD's Feasible Control Measures for PM10 and to ensure that earthwork equipment is properly tuned and meets applicable emissions standards. Because of the limited area affected, the BMPs in place to control PM10 and tailpipe emissions, and the relatively short construction window, which further limits the proposed action's potential to generate pollutants, the proposed action's contribution to any cumulative effect is expected to be adverse short-term minor effects under either build alternative.

No cumulative long-term effect on air quality in the Drake's Bay/Drake's Estero watershed and adjacent downwind portions of the SFBAAB has been identified. The listed actions are not expected to substantially change patterns of vehicle use in the area.

Conclusion for action effect on Air Resources

Under both action alternatives, production of emissions and associated dust would be similar. NPS would require contractors to adhere to the BAAQMD's Feasible Control Measures for PM10 and to ensure that earthwork equipment is properly tuned and meets applicable emissions standards. The analysis concludes that Alternative 1 and Alternative 2 would result in short-term minor adverse impacts to air quality. The project would not result in long-term effects to air resources.

Alternative 1 or Alternative 2 would not result in impairment to park air resources.

Table 4.11 Alternatives 1 and 2: Overall Effects on Air Quality under Build Alternatives

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All sites	Air Quality	Adverse minor	No effect
	Cumulative	Adverse minor	No effect

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and existing management practices would continue. No change in conditions or practices relevant to air quality is expected under the No Action Alternative. There would be no effect.

Contribution to Cumulative Effects

Because it would not alter conditions or practices relevant to air quality, the No Action Alternative would not contribute to cumulative air quality effects.

Conclusion for Air Resources

Under Alternative 3, no construction emissions or dust generation would take place as a result of direct actions. Alternative 3 would result in no effect to park air resources.

Alternative 3 would not result in impairment to park air resources.

Table 4.12 Alternative 3: Overall Effects on Air Quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All sites	Air Quality	No effect	No effect
	Cumulative	No effect	No effect

Effects Related to Geology, Geologic Hazards, and Soils

Policies and Regulations

Federal Guidance. As directed by NPS Management Policies, soil resources are subject to the "no impairment" clause that guides NPS decision-making to protect of the integrity of the important resources and values within the parks (NPS 2000, §1.4.6). The NPS is directed to protect geologic features from the adverse effects of human activity, while allowing natural processes to continue (NPS 2000, §4.1.5 and §4.8.2). Management action taken by the parks would prevent to the greatest extent possible the unnatural erosion, physical removal, contamination, and other potentially irreversible impacts to soil (NPS 2000, §4.8.2.4).

Hydric soils, associated with wetland features such as bogs, marshes, and some wetlands, are afforded special protection by Executive Order 11990, Protection of Wetlands and the Clean Water Act § 404 as regulated by the U.S. Army Corps of Engineers, and the State Regional Water Quality Control Board. Specific procedural guidance to NPS staff on the protection of wetlands and areas of hydric soils is outlined in Director's Order #77-1, Wetland Protection. Assessment of potential impacts to hydric soils is addressed as a wetland impact in this document.

Within many areas of the park, the soil resources have been heavily manipulated through previous land uses including gravel extraction, road construction, grading, plowing, grazing, logging, etc. The soil resources in impacted areas have been previously disturbed. Activities conducted within these previously disturbed areas cannot restore natural soil horizon patterns, but can restore natural grades and improve the potential redevelopment of organic surface soils through actions such as topsoiling or revegetation.

As the project areas fall within the California Coastal Zone, defined as lands within one mile of the California Coast, PRNS will be seeking a consistency review and possibly a county coastal permit pursuant to the California Coastal Act.

Assessment Methods

Effects related to geology, geologic hazards, and soils were evaluated qualitatively, based on professional judgment in light of available information on the geology of the restoration sites and the surrounding area. No geologic mapping, engineering geologic studies, or engineering analyses were conducted for this EA; they would be completed as part of the final design process.

The principal concerns in analyzing effects related to geology, geologic hazards, and soils center on the potential for a proposed action to create or increase the risk to life and property as a result of existing geologic conditions, including seismic hazards. Because the proposed action would not result in the construction of any structures intended for human occupancy, this analysis focused on the potential for damage to restoration facilities, and the potential for restoration activities, including earthwork, to exacerbate existing risks, such as slope failure hazard and liquefaction hazard.

Table 4-13 summarizes the descriptors used to evaluate effects related to geology, geologic hazards, and soils.

Table 4-13. Descriptors for Geology, Geologic Hazards, and Soils Effects

Type of Effect	Beneficial—The proposed action would improve or maintain existing conditions with regard to geologic hazards to life and property.
	Adverse—The proposed action would increase risks to life or property related to geologic hazards such as seismicity and slope instability.
Duration of Effect	Short-term—Effects would be confined to the construction period.
	Long-term—Effects would persist beyond the construction period.
Intensity of Effect	Negligible—Risk to safety and property would not be measurably increased.
	Minor—Risks to safety and property would increase slightly, but the number of persons potentially affected would be very small, and the financial risk would be small and easily recoupable.
	Moderate—Risks to safety and property would be markedly increased. A larger number of persons would potentially be affected, and/or the financial risk would be greater.
	Major—Risks to safety and property would be substantially increased. A large number of persons would potentially be affected, and/or there would be substantial financial risk, with losses difficult to recoup without adverse economic effects.

Evaluation of Impacts

Alternative 1: Full-Build Approach (preferred alternative at Limantour Beach Marsh and Muddy Hollow)

All sites

Geology

At each of the sites, the materials are mapped as Quarternary alluvium. There is no bedrock at the surface, and actions proposed under Alternative 1 would result in minor impacts. The construction of dams has altered the natural sediment transport and depositional processes affecting the overall geologic conditions within these project areas.

The replacement of fill back to quarried areas would restore topographic characteristics of the area, though the layering would remain permanently disturbed. At all sites, the proposed actions

would result in minor adverse effects to geology in the short-term, but in the long-term restoration of more natural processes is considered a beneficial effect on geology and geologic process.

Surface Fault Rupture and Groundshaking

No faults recognized as active by the State of California traverse any of the restoration sites. Consequently, neither the new bridge proposed for Limantour Beach Marsh nor the restored geomorphology at Muddy Hollow and Glenbrook Crossing is expected to be subject to surface fault rupture. However, the restoration sites are located in a seismically active area, in proximity to several important active faults, and are thus likely to experience strong groundshaking during the lifetime of the proposed action.

Under Alternative 1, the only structure to be constructed is the proposed bridge at Limantour Beach Marsh. Geotechnical analyses of the site indicate bedrock at approximately 20 feet below ground surface, so footings would not likely be effected by liquifaction, and remain stable. This risk cannot be entirely avoided, but would be reduced by ensuring that design and construction of the new bridge meet or exceed the requirements of all applicable codes. The risk of damage and corollary financial loss would be further reduced by retaining a qualified engineering consultant to ensure that design and construction are appropriate for the ground accelerations anticipated with the maximum credible earthquake on nearby active faults. At other sites, deconstruction is indented to remove the facility, thereby reducing risk of failure under such a scenario. The environmental commitments incorporated into the project (see Chapter 2) are thus expected to minimize risks related to groundshaking to the extent feasible. Potential effects are expected to be minor, and no mitigation is required.

Seismically Induced Liquefaction

Because few site-specific data are available at this time, it is difficult to assess the risk of seismically induced liquefaction and other types of seismic ground failure at the restoration sites. However, based on general understanding of site conditions, liquefaction is a possibility at both the Limantour Beach Marsh and Muddy Hollow sites, where well-sorted unconsolidated sands are likely present in the subsurface and the water table is shallow. Initial results of geotechnical analysis indicate bedrock at a shallow level below Limantour Beach Pond making risk at this site low.

As with groundshaking, the principal concern with liquefaction and other types of seismic ground failure is the potential for damage to the proposed bridge at Limantour Beach Marsh; no permanent facilities would be constructed at the other sites under Alternative 1. To reduce the risk of damage and financial loss as a result of liquefaction, the design phase of Alternative 1 would include site-specific geotechnical investigations, with the goal of characterizing subsurface site conditions and supporting engineering design appropriate to minimize risks associated with seismically induced ground failure to the extent feasible (see description under *Environmental Commitments* in Chapter 2). This pertains to the bridge at Limantour Beach Marsh and to proposed earthworks at all sites.

Actions under alternative 1 would reduce the potential of seismically induced liquifaction through the removal of embankments effecting water storage capacity and elevation. The environmental commitments incorporated into the project (see Chapter 2) are thus expected to reduce risks related to groundshaking on the bridge structure to the extent feasible resulting in negligible long-term adverse effects.

Under Alternative 1 there is some potential at all three sites that liquefaction or other seismically induced ground failure could mobilize sediment, resulting in water quality degradation. The proposed action, including controlled deconstruction of existing unengineered earthen fill facilities retaining large volumes or sediment or water, would reduce the existing potential of catastrophic failure. A return to natural conditions is considered beneficial in the long-term.

Landslide Hazards

The risk of slope failure, including seismically induced landsliding, has not been assessed in detail for the restoration area. However, landsliding is a possibility at Muddy Hollow and Glenbrook Crossing, where steep slopes are located close to the restoration site. In addition, restoration at Glenbrook Crossing would entail the creation of quasi-natural floodplain terrace geomorphology, with flat benches separated by steeper risers. If improperly designed or constructed, the reconstructed terraces could be subject to localized failure. To ensure that project earthwork does not increase landslide hazard, the design phase of Alternative 1 would include site-specific geotechnical investigations that support appropriate design, and restoration earthwork would meet or exceed the applicable codes and standards (see *Environmental Commitments* in Chapter 2). In addition, to ensure that excavation, grading, and fill placement during construction do not create or contribute to slope failure hazard, NPS and the restoration contractor would ensure that work proceeds in accordance with accepted industry standards for good earthwork practices. Consequently, Alternative 1 is not expected to exacerbate existing landslide hazard. No mitigation is required.

As discussed in *Hydrology, Hydraulics, and Water Quality* below, the area's high-gradient drainages, such as Glenbrook Creek, are commonly subject to debris flows. The concern with regard to debris flows is that when they follow stream channels—as they did in Glenbrook Creek during the floods of January 1982—they can lead to rapid channel bed aggradation, potentially choking the channel and damaging structures, or contributing to channel migration, overtopping, and/or erosion, with corollary effects on slope process and water quality. Of the three restoration sites, Glenbrook Crossing is the most likely to be affected by debris flows. Alternative 1 would improve the conveyance capacity of the Glenbrook Creek channel and is thus expected to improve its ability to convey debris flows as well as dilute (water-dominated) floodflows. Moreover, debris flows are part of the natural landscape evolution process in the project area, as in much of coastal California. Restoring debris flow conveyance capacity and removing the culvert crossing that both impedes debris flow passage and is at risk of debris flow damage would represent a beneficial effect. No mitigation is required.

Soils

The soils at each of the sites would not preclude actions proposed under Alternative 1. Investigation of soil saturation and compaction requirements may result in the need to dry excavated soils prior to placement. Areas for drying would be included in the fill disposal sites and determinations would be made in the field at the time of construction as to the need to implement such actions. For the purpose of this planning process, such drying areas are described in the project description, and evaluated as part of this document. Soils at each site would not effect the potential for restoration at any of the sites. The restoration actions themselves, would result in short-term minor impacts to soils during and following construction. In the long-term, the recountouring and stabilization of sites is considered beneficial to park soil resources.

Alternative 1 Contribution to Cumulative Effects Related to Geology, Geologic Hazards and Soils

Negligible cumulative short-term adverse effects related to geology, geologic hazards, or soils in the Drake's Bay/Drake's Estero watershed would result in combination with other proposed projects identified in Table 4-1. In the long-term, removal of structures from Muddy Hollow and Glenbrook would reduce the potential of failure under evaluated risk factors. This is considered a long-term benefit related to geology, geologic hazard and soils.

Alternative 1 Conclusion on Effects Related to Geology, Geologic Hazards and Soils

Under alternative 1, structures are removed from Muddy Hollow and Glenbrook Crossing sites, reducing the potential of failure under evaluated risks factors. The resulting conditions, including the constructed bridge facility at the Limantour Marsh area would be designed with potential risk under consideration. Restoration of natural hydrologic and shoreline process would change

existing slope and local soil conditions, resulting in potential short-term negligible adverse effects. In the long-term, however, removal of existing unengineered earthen facilities would reduce site susceptibility to failure in association with geologic hazards. The long-term effect of actions proposed under Alternative 1 are considered beneficial.

Alternative 1 would not result in impairment of park geology, geologic hazards or soil resources.

Table 4.14 Alternative 1: Overall Effects on Geology, Geohazards, and Soils

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All sites	Geology	Minor adverse	Beneficial
	Geohazard	Minor adverse	Beneficial
	Soils	Minor adverse	No effect
	Cumulative	No effect	No effect

Alternative 2: Partial-Build Approach (Preferred Alternative at Glenbrook Crossing)

All Sites

Geology

Under Alternative 2, the effects to geology are considered the same as those evaluated under Alternative 1.

Surface Fault Rupture and Groundshaking

As with Alternative 1, the risk of damage to restoration facilities as a result of surface fault rupture is considered low under Alternative 2, because no faults recognized as active by the State of California traverse any of the restoration sites. However, because of the nature of boardwalk construction and pier depths, strong groundshaking is a concern, and could result in substantial damage to the proposed boardwalk at Limantour Beach Marsh. In addition, if an earthquake were to occur during the first year or two after Alternative 2 begins, while the Muddy Hollow reservoir is undergoing progressive dewatering, groundshaking could damage the low-level outlet and impede the implementation of the phased dewatering plan; if the outlet were severely damaged, or the new earthwork failed, the reservoir could drain rapidly, resulting in increased erosion and adverse water quality impacts in the tidal system.

As with Alternative 1, risks related to strong seismic groundshaking cannot be entirely avoided. However, they would be reduced by ensuring that design and construction of the new boardwalk, the temporary low-level outlet, and associated earthworks meet or exceed the requirements of applicable codes. As discussed for Alternative 1, the risk of seismic damage and corollary financial loss would be further reduced by retaining a qualified engineering consultant to ensure that design and construction are appropriate for the ground accelerations anticipated with the maximum credible earthquake on nearby active faults. Actions under alternative 1 would reduce the potential of seismically induced liquifaction through the removal of embankments effecting water storage capacity and elevation. As with Alternative 1, the environmental commitments incorporated into the project (see Chapter 2) are thus expected to reduce risks related to groundshaking to the extent feasible resulting in negligible long-term adverse effects.

Seismically Induced Liquefaction

As described above for Alternative 1, general understanding of site conditions suggests that while liquefaction may not be a strong possibility at both the Limantour Beach Marsh and Muddy Hollow sites, the installation of shallower piers associated with the boardwalk could become unstable under a large earthshaking scenario. Liquefaction is probably less likely at Glenbrook

Crossing, where shallow subsurface sediments are expected to be poorly sorted, but it may still be a concern.

As with groundshaking, the principal concern with liquefaction and other types of seismic ground failure is the potential for damage to the proposed boardwalk at Limantour Beach Marsh and the temporary low-level outlet at Muddy Hollow. As with Alternative 1, the design phase of Alternative 2 would include site-specific geotechnical investigations, with the goal of characterizing subsurface site conditions and supporting appropriate engineering design to reduce risks associated with seismically induced ground failure to the extent feasible (see *Environmental Commitments* section in Chapter 2). This pertains to the boardwalk at Limantour Beach Marsh, to the temporary low-level outlet at Muddy Hollow, and to proposed earthworks at all sites. Effects would be minor, and no mitigation is required.

As with Alternative 1, there is some potential at all three sites that liquefaction or other seismically induced ground failure could mobilize sediment, resulting in water quality degradation under Alternative 2. The proposed action, including controlled deconstruction of existing unengineered earthen fill facilities retaining large volumes or sediment or water, would reduce the existing potential of catastrophic failure. A return to natural conditions is considered a beneficial long-term effect.

Landslide Hazards

The potential landslide hazards affecting Alternative 2 are the same as those described under Alternative 1, above.

Soils

The potential effects of and to soils associated with Alternative 2 are the same as those described under Alternative 1, above.

Alternative 2 Contribution to Cumulative Effects Related to Geology, Geologic Hazards and Soils

Alternative 2 would result in negligible cumulative short-term adverse effects related to geology, geologic hazards, or soils in the Drake's Bay/Drake's Estero watershed would result in combination with other proposed projects identified in Table 4-1. In the long-term, removal of structures from Muddy Hollow and Glenbrook would reduce the potential of failure under evaluated risk factors. This is considered a long-term benefit related to geology, geologic hazard and soils.

Alternative 2 Conclusion on Effects Related to Geology, Geologic Hazards and Soils

Under Alternative 2, structures are removed from Muddy Hollow and Glenbrook Crossing sites, reducing the potential of failure under evaluated risks factors. The resulting conditions, including the constructed boardwalk at the Limantour Marsh area would be designed with potential risk under consideration. Restoration of natural hydrologic and shoreline process would change existing slope and local soil conditions, resulting in potential short-term negligible adverse effects. In the long-term, removal of existing unengineered earthen facilities would reduce site susceptibility to failure in association with geologic hazards. The long-term effect of actions proposed under alternative 2 are beneficial.

Alternative 2 would not result in impairment of park geology, geologic hazards or soil resources.

Table 4.15 Alternative 2: Overall Effects on Geology, Geohazards, and Soils

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All sites	Geology	Minor adverse	Beneficial

Geohazard	Minor adverse	Beneficial
Soils	Minor adverse	No effect
Cumulative	No effect	No effect

Alternative 3: No Action

All Sites

Under Alternative 3, no restoration would take place and existing management practices, including trail maintenance and removal of debris and trash from the culverts at Limantour Beach Marsh and Glenbrook Crossing would continue. Vegetation removal would also continue to be necessary to maintain the Muddy Hollow dam.

Because no construction or other new earthwork activities would take place under the No Action Alternative, it would not result in any impact related to soil conditions. Existing site hazards related to geology and seismicity would remain unchanged, including the following.

- Potential for earthquake damage to existing dam at Muddy Hollow, and corollary risk of increased erosion downstream of the dam if impounded water were released suddenly. Water quality could also be adversely affected, if sediment now trapped behind the dam were remobilized either during sudden dewatering or during subsequent storm events. The Muddy Hollow dam does not meet current applicable construction standards, and, as described in the *Public Health and Safety* section of Chapter 3, the U.S. Bureau of Reclamation has identified its condition as "seriously deficient."
- Potential for landslide and/or seismically induced landslide at Muddy Hollow and Glenbrook Crossing; corollary risk of adverse impacts on water quality as slide material is dissected and remobilized.
- The risk of catastrophic failure at the Glenbrook Crossing could result in debris flow impacts to the habitat downstream of the proposed project area.
- The existing Glenbrook crossing facility is subject to failure as a result of geologic hazard and could become the source of a debris flow as a result of structural failure under flood flow conditions.

Contribution to Cumulative Effects Related to Geology, Geologic Hazards, and Soils

As discussed above, no cumulative short-term effect related to geology, geologic hazards, or soils in the Drake's Bay/Drake's Estero watershed has been identified. The risk of failure as a result of any potential risk factor would remain higher under Alternative 3 than either of the action alternatives, and would result in minor adverse long-term effects related to geology, geologic hazard and soils and is considered minor in the long-term.

Alternative 3 Conclusion on Effects Related to Geology, Geologic Hazards and Soils

Under Alternative 3, existing unengineered structures would remain, pooling excessive water or sediment behind these aged facilities. Alternative 3 would not result in short term effects to existing slope and local soil conditions. In the long-term, however, the existing unengineered earthen facilities would remain susceptible to failure in association with geologic hazards. In the long-term, the risk of failure associated with no action would result in localized moderate adverse effects.

Alternative 3 would not result in impairment of park geology, geologic hazards or soil resources.

Table 4.16 Alternative 3: Overall Effects on Geology, Geohazards, and Soils

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All sites	Geology	No effect	Minor adverse
	Geohazard	No effect	Moderate adverse
	Soils	No effect	Moderate adverse
	Cumulative	No effect	Minor adverse

Effects on Hydrology, Hydraulics, and Water Quality

Policies and Regulations

Federal Guidance. The Clean Water Act is the primary federal law that protects the quality of the nation's surface waters. It operates on the principle that discharges into the nation's waters are unlawful unless specifically authorized by permit.

CWA § 404 regulates the discharge and fill of discharge and dredged materials into "waters of the United States" which include oceans, bays, rivers, streams, lakes, ponds, and some wetlands. Section 404 permits are granted only for the least environmentally damaging practicable alternative.

CWA § 402 regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System NPDES program administered by the Environmental Protection Agency (EPA). The EPA delegates administration of the NPDES program to Regional Water Quality Control Boards (RWQCBs); PRNS is in the jurisdiction of the San Francisco Bay RWQCB. Most construction projects which will disturb more than one acre of land are required to apply to their RWQCB for a NPDES General Permit for Construction Activities. Applicants must file a public notice of intent to discharge stormwater, and prepare and implement a stormwater pollution prevention plan. This plan describes proposed activities and Best Management Practices to minimize pollutant discharge and soil erosion. Permitees are required to conduct annual monitoring and reporting to assure that Best Management Practices are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

CWA § 401 requires agencies, which obtain a federal permit to conduct discharge-producing activities, to also obtain a state certification for the activity. Section 401 certification for projects at PRNS fall under the jurisdiction of the San Francisco Bay Area RWQCB.

Under CWA § 303(d), the state of California has established water quality standards to protect the beneficial uses of state waters. This statute requires states to identify water bodies whose water quality is "impaired" or "limited" by the presence of pollutants or contaminants. The statute also requires the state to establish limits for discharge into water bodies which correspond with the maximum quantity of a particular contaminant that the water body can assimilate without experiencing water quality declines.

State Guidance. The California Porter-Cologne Water Quality Control Act created the State Water Resources Control Board and 9 RWQCBs to protect the state's surface water through implementation of the Federal CWA. In addition to assuring implementation of the CWA, the Porter-Cologne Act requires the development and periodic review of water quality control plans (Basin Plans) that describe the beneficial uses of California's major rivers and groundwater basins and establish water quality objectives for those waters.

Point Reyes National Seashore Activities. The NPS is currently sponsoring several research and monitoring efforts aimed at improving water quality at PRNS. Work now in progress includes:

- Expansion of the PRNS water quality monitoring program to include sites throughout the Seashore
- Assessment of the water quality impacts of rangeland use
- Identification of artificial water impoundments in designated wilderness areas that offer habitat for the California red-legged frog (*Rana aurora draytonii*) in order to develop a management plan that will ensure the maintenance of the most critical breeding habitat impoundments
- Development of a Geographic Information Systems (GIS) water resources atlas for PRNS
- Establishment of stream gauges in high-priority locations throughout the Seashore.

In addition, the NPS is currently developing a Water Resources Management Plan for PRNS. This plan is intended to be a comprehensive yet flexible management tool to document existing water resources and systems, identify inventory and monitoring needs, and establish guidance for water resource management for the Seashore over the next 10-15 years.

Analysis of effects related to hydrology, hydraulics, and water quality included both qualitative and quantitative studies. The following reports prepared for the Point Reyes National Seashore Coastal Watershed Restoration Project were key sources of quantitative information.

- *Feasibility Study for Restoration at Muddy Hollow Pond, Limantour Beach Marsh, and Glenbrook Crossing—Final Report* (nhc 2004).
- *Muddy Hollow Pond Erosion and Sediment Delivery Analysis* (Jones & Stokes and nhc 2003b).
- *Glenbrook Crossing Erosion and Sediment Delivery Analysis* (Jones & Stokes and nhc 2003a).

Additional nonquantitative analyses were performed as part of this EA.

Table 4-17 summarizes the descriptors used to evaluate effects on hydrology, hydraulics, and water quality.

Table 4-17. Descriptors for Hydrology, Hydraulics, and Water Quality Effects

Type of Effect	Beneficial—The proposed action would restore natural hydrologic and shoreline conditions by removing impediments to floodflows, stabilizing riverbanks, etc.; improve water quality; or improve or maintain aquatic habitat. The proposed action would improve or maintain groundwater hydrologic function and quality.

	Adverse—The proposed action has the potential to alter natural surface water drainage, impede groundwater recharge, or alter groundwater flow by excess withdrawals. The proposed action could alter or prevent progress towards natural hydrologic and shoreline process. The proposed action has the potential to degrade surface- or groundwater quality, impede progress toward improved water quality, or degrade aquatic habitat.
Duration of Effect	Short-term—Effects would last less than two (2) years.
	Long-term—Effects would persist beyond two (2) years.
Intensity of Effect	Negligible—Adverse effects would be barely detectable, and would be limited to the immediate project vicinity for a period of several days or less. There is no potential for impairment of designated beneficial uses.
	Minor—Adverse effects would be detectable, but would be limited in areal extent. There is no potential for impairment of beneficial uses.
	Moderate—Adverse effects would be apparent at the local scale and affect an area beyond the immediate project vicinity. Beneficial uses may be affected for short periods (storm based) of time. Health and/or ecosystem concerns could arise.
	Major—Adverse effects would be substantial, highly noticeable, and regional. Beneficial uses would be affected for extended periods (seasonal), and health and/or ecosystem effects are likely.

Evaluation of Impacts

Alternative 1: Full-Build Approach (preferred alternative at Limantour Beach Marsh and Muddy Hollow)

Effects on Surface Water Hydrology, Hydraulics, and Water Quality

Surface Water Effects at Limantour Beach Marsh Site. Construction of a bridge at the Limantour Beach Marsh site would remove approximately 100 linear feet of the existing earthen embankment including the culverted pond spillway, and restore natural flow conditions to this area. Restoring the hydraulic connection would convert the pond habitat to intertidal habitat and conditions throughout the Estero, and over time would allow a more natural tidal channel/tidal marsh plain geometry to develop in the area now occupied by freshwater marsh and pond.

Following bridge construction, hydrologic flow patterns would begin to dissect the aggraded pond floor. Ultimately, an integrated tidally influenced habitat would likely develop. Overland flow would continue as a source of local freshwater input to the system. The rate of drainage development and integration would depend largely on rainfall patterns, tidal inundation patterns, and natural revegetation in the first few years after restoration. Substantial adjustment could likely be accomplished in one or two storm events of sufficient magnitude, but adjustment would be slower if the years following restoration are comparatively dry.

Initially, assuming that flow through the Laguna Creek channel from Laguna Pond to Limantour Beach Pond continues to be unregulated, channel development is expected to be most rapid at the change in vertical profile between the existing pond bottom and the tidal plain. Input from overland flow on the slopes and small tributary drainages adjacent to the pond area would probably contribute to the development of dendritic drainage, modified by restored tidal ebb and flow. The tributary drainages may incise or channelize slightly in response to the decrease in mean base level. Monitoring would be conducted to ensure that the system approaches a functional geomorphology. The anticipated long-term evolution of drainage geomorphology toward a functional tidal condition is considered a benefit.

Drainage readjustment would restore a mobile saltwater-freshwater interface. Water chemistry in the former pond—now tidal channel/tidal marsh—area would reflect the tidal influence, and would be expected to be brackish, freshening inland. Ramifications of this change, and potential biological impacts are discussed in the *Biological Resources* section of this chapter. However, because the changes in vegetation and habitat use that are likely to result would represent a return to a more natural condition reflecting improved hydrologic and hydraulic function, this is considered a benefit.

Erosion during the adjustment period could affect water quality in the Estero system, because sediment eroded from the restoration area would be carried downgradient into the Estero. Sediment in areas disturbed by earthwork, bridge construction, and removal of the downstream berm are expected to be mobile in the first year following restoration. Erosion would be at a maximum during storm events, when tides are higher and tidal currents are likely to be stronger, tending to keep sediment in motion, and in particular, to keep fine-grained sediment suspended. However, water quality impacts associated with the project would be short-term adverse minor effects. Because tidal systems are naturally dynamic no mitigation is required.

While the contributing drainage area to the pond exceeds 2 square miles, the major contributing drainage, Laguna Creek, flows through the Laguna Pond prior to discharging to the Limantour Beach Pond. In this way, sediment contribution to the area from the watershed is very low in comparison with most downstream pond areas. For this reason, excess erosion during the adjustment period following restoration is not likely a problem associated with the Limantour Marsh restoration.

Following reequilibration of the system, sediment would continue to be more mobile than it is under existing conditions, because it would be affected both by restored surface water drainage and by restored tidal processes. The restoration of natural tidal process at this site would result in the ongoing redistribution of fine-grained sediment within the estuarine area, with sediment mobility (and water turbidity) expected to peak during storm events. However, this is a natural condition in tidal settings, and restoration of this process to Limantour Beach Marsh is considered a benefit.

The creation of habitat to offset changes associated with the removal of the pond would not affect surface water dynamics as they would be isolated from the main freshwater or tidal source and flow areas.

Surface Water Effects at Muddy Hollow Site. Removing the existing dam at the Muddy Hollow site would eliminate the barrier that maintains the reservoir's artificial lake environment, restoring the surface hydrologic connection between the upper reaches of Muddy Hollow Creek and the creek's natural outflow to the southernmost arm of the Estero de Limantour system. Base level for the restored system would be consistent with tidal range throughout the Estero, likely triggering channel incision into the aggraded former reservoir floor as the stream channel readjusts. Incision is expected to be most marked in the delta area, where the most post-dam aggradation has occurred. Following the incision phase, the channelform would continue to develop through processes of bank erosion/channel widening and bar formation (see additional discussion in Jones & Stokes and nhc 2003b).

Over time, a natural downstream transition from creek/floodplain to tidal channel/tidal marsh plain would reestablish in Muddy Hollow, resembling historic patterns shown on aerial photographs (e.g., nhc 2004). The rate of channel development would depend largely on rainfall patterns in the first few years after restoration; substantial channel adjustment could likely be accomplished in one or two storm events of sufficient magnitude. Thus, if restoration is carried out during the summer of a wet year, the channel incision phase could be completed during the following winter; in any case, the majority of channel incision would likely be complete the following year (2 years'

total duration). An additional period of about 3 years would likely see complete readjustment to a healthy, dynamic channel geometry and function (NHC 2004).

Channel erosion during the post-restoration adjustment phase would increase the mobility of sediment in the Muddy Hollow/Estero system. Delivery of sediment to the Estero would be controlled to some extent by the check structures proposed for construction on the former reservoir floor. The check structures are planned to operate as part of a program of monitoring and adaptive management, as described in Chapter 2—excessive sediment delivery would serve as a signal to initiate additional adaptive action. Thus, periodic pulses of increased sedimentation to the Estero would likely be unavoidable. This would include all grain size fractions, including fine sediment, which is the greatest concern from a water quality standpoint.

Increased sediment delivery to the Estero would peak during storm events, when erosion is at a maximum. These are also times when tides are higher and tidal currents are likely to be stronger, tending to keep sediment in motion, and in particular, to keep fine-grained sediment suspended. Water quality would thus undergo periodic degradation as a result of increased turbidity for several years following restoration. Effects would be minimized to the extent feasible by NPS's proposed monitoring and adaptive management program; with this program in place, sustained effects are not expected to exceed a minor level.

Increased sediment delivery following restoration could also have adverse effects on channel geomorphology below the restored area. Delivery of sediment pulses in excess of the system's capacity could cause tidal channels to bifurcate or braid excessively, with potential changes to channel width:depth ratios, the long-term geometry of the saltwater-freshwater interface, and the system's habitat potential. Erosion of the deltaic sediment prism during large storms in the first few seasons after restoration is a particular concern; such erosion could deliver large volumes of sediment to the downstream tidal system, with potentially dramatic effects on downstream channelform. The installation of the grade control structures (described in Chapter 2) and adaptive management and monitoring would result in a short-term minor adverse impact in association with increased sediment delivery.

Turbidity is expected to return to prerestoration (existing) levels as the channel adjustment phases wanes. After channel readjustment is complete, more bedload sediment would be delivered to the Estero via a restored Muddy Hollow Creek than under existing conditions, because, as shown by Jones & Stokes and nhc (2003b), the dam and reservoir presently interrupt the transport of all but the suspended fraction of Muddy Creek's sediment load. Delivery of bedload sediment is expected to increase gradually as the check structures degrade over time. The long-term increase in sediment delivery is regarded as a benefit because it represents a return to natural surface drainage function.

Activities to construct the trail reroute would not affect surface water resources. In addition, construction of a sustainable trail would reduce potential for erosion and gullying that would result in sediment mobilization and delivery to stream resources.

Surface Water Effects at Glenbrook Crossing Site. The principal outcome of Alternative 1 at the Glenbrook Crossing site would be the removal of a non-conforming structure from the Philip Burton Wilderness Area and the restoration of surface hydrologic connectivity between the channel reaches interrupted by the existing culverted crossing and 11-foot drop in profile. Alternative 1 would include earthwork to (1) lower the aggraded reach and reconstruct a more natural channel and floodplain geometry upstream of the crossing site, and (2) raise the scoured bed below the crossing. Earthwork is intended to approach a stable channel and floodplain geomorphology. However, some channel adjustment is still expected to take place after restoration is completed, probably comprising the following three stages described by Jones & Stokes and nhc 2003b).

- Rapid channel incision up- and downstream of the former crossing site.
- Deposition of coarse sediment transported from the upper watershed along the channel; recruitment of woody debris into channel sediment and growth of vegetation along channel banks, increasing channel stability.
- Long-term bed adjustments as woody debris deteriorates.

The restored creek channel would be contoured to contain most of the 2-year flood. The expectation is that bedload would be mobile in each year's larger flood events, and that disturbed materials in the restoration area are likely to be especially vulnerable to erosion. The upstream extent of channel incision is difficult to predict, but headcutting would be constrained by the bedrock channel reach upstream of the crossing site. The channel is not expected to widen substantially (Jones & Stokes and nhc 2003a).

Most of the channel incision is expected to take place during the first year or two after restoration, and could be accomplished in a single storm of sufficient magnitude.[5] A subsequent period of intensive channel adjustment would probably continue for about 5 years. During this phase, the area would remain a source of increased sediment supply. This would likely include a substantially greater proportion of coarse bedload, which is currently blocked by the crossing, comprising both material remobilized from the aggraded and restored reaches, and "background" load delivered by ongoing flow from the upper watershed. The coarse bedload fraction typically moves episodically in streams like Glenbrook Creek where discharge is variable, and the coarsest fraction may only move at flood stage.

Erosion during the adjustment period would episodically effect downstream water quality and habitat in Glenbrook Creek. This work would not likely result in observable changes within the Estero. Bedload is expected to drop out of transport before it reaches the Estero, although suspended load may be delivered this far. This effect would be addressed to the extent feasible by NPS's proposed monitoring and adaptive management program.

Concerns about the effects of increased erosion and sediment mobility on water quality would also be addressed to the extent feasible by monitoring and adaptive management included in the proposed action. Monitoring visits should be conducted at the close of the storm season, on or about April 1 of each year. If the rainy season is unusually protracted, as it was in the El Niño years 1995 and 1998, monitoring should be repeated in early June, or should be delayed until June 1. Water quality effects are expected to moderate adverse in the short-term and minor adverse in the long-term.

Long-term (post–10 year) sediment delivery to areas downstream of the crossing site would remain elevated by comparison with existing conditions because bedload transport from the upper watershed would be essentially uninterrupted after the crossing is removed. This is considered a benefit, because it represents a return to natural surface drainage function. Following the adjustment period, downstream turbidity is expected to approach prerestoration levels; the crossing does not control transport of suspended load from upstream sources, and removing it would probably have little effect on long-term turbidity levels.

Activities to construct the trail reroute would not affect surface water resources. In addition, construction of a sustainable trail would reduce potential for erosion and gullying that would result in sediment mobilization and delivery to stream resources.

Effects on Groundwater Hydrology and Quality under Alternative 1

[5] I.e., a storm producing a flood event in excess of the 2-year channel-forming discharge.

Groundwater Effects at Limantour Beach Marsh Site. There will be no short-term and long-term effects on groundwater at Limantour Beach Marsh under Alternative 1 because the project site is not an important recharge area, and the construction window would be very short. No mitigation is required.

Groundwater Effects at Muddy Hollow Site. There would be no short-term effects on groundwater at Muddy Hollow under Alternative 1, because the project site is not an important recharge area, and the construction window would be very short.

Over the longer term, removal of the dam and restoration of hydraulic connectivity/full tidal exchange at Muddy Hollow could have a small effect on the salinity of waters recharging local shallow groundwater, which could effect the pump station approximately 1 mile upstream. The present rate and volume of freshwater infiltration via the pond is unknown, but it is possible that replacing this body of standing water with stream and tidal channel habitat could decrease the volume of infiltration. Restoration would also intermittently replace freshwater infiltration with brackish/saline water, potentially increasing the salinity of local groundwater. The Muddy Hollow well and pump station are more than one mile up valley from the project area. The depth of the well (more than 100 feet) and low use levels imply that the project would not result in impacts to the existing production well. In the long term, effects to groundwater associated with treatment at the Muddy Hollow site would be adverse but negligible.

Groundwater Effects at Glenbrook Crossing Site. Alternative 1 would change the groundwater table in the local area around the project site, but would result in localized negligible effects to groundwater in the short-term, but would not effect watershed groundwater hydrology in the long-term.

Alternative 1 Contribution to Cumulative Effects on Hydrology, Hydraulics, and Water Quality

NPS would require projects listed in Table 4-1 to incorporate water quality–protection BMPs similar to those included in the proposed action, so the likelihood of substantial adverse effects on water quality during construction of any of these actions is minor. Nonetheless, to the extent that construction periods overlap, there is some potential for a short-term cumulative effect on water quality in the Drake's Bay/Drake's Estero watershed. Because incremental contributions should be small, however, the short-term impact would be a minor adverse effect.

To the extent that they would directly or indirectly affect surface or groundwater hydrology or quality, the actions listed in Table 4-1 are expected to result in incremental benefits to hydrologic and estuarine process. This would be particularly true of the Drake's Estero road crossing improvements, the restoration of Horseshoe Pond to a functioning coastal lagoon, and the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. Consequently, the long-term cumulative effect of these actions would include moderate benefits to surface water (stream and tidal system) hydrology and water quality, and possibly also minor benefits (certainly no detriment) to groundwater quality. Under Alternative 1, the proposed action would be an important contributor to these benefits.

Alternative 1 Conclusion on Effects on Hydrology, Hydraulics, and Water Quality

Evaluation of potential impacts to hydrology, hydraulics and water quality under Alternative 1 shows the likelihood of short-term minor to moderate localized adverse impacts as hydrologic configurations and conditions adjust as a result of the restoration activities. Shifts in water regime, channel and estuarine configuration would occur, but be muted in scale through proposed adaptive management measures including installation of passive grade control, adaptive monitoring and management actions.

In the long-term, the actions identified under Alternative 1 would be considered beneficial as natural hydrologic and estuarine process are restored to a new, functional dynamic equilibrium at these sites. The restoration actions would facilitate sustainable, naturally functioning hydrologic systems that would not require continued maintenance.

The actions proposed under Alternative 1 would not result in impairment to park hydrology, hydraulics, and water quality.

Table 4.18 Alternative 1: Overall Effects on Hydrology, Hydraulics, and water quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Surface water effects	Minor adverse	Beneficial
	Ground water effects	No effect	No effect
	Water quality	Minor adverse	Beneficial
Muddy Hollow Pond	Surface water effects	Minor adverse	Beneficial
	Ground water effects	No effect	Negligible adverse
	Water quality	Minor adverse	Minor adverse
Glenbrook Crossing	Surface water effects	Minor adverse	Beneficial
	Ground water effects	Negligible adverse	No effect
	Water quality	Moderate adverse	Minor adverse
All Sites	Cumulative	Minor adverse	Beneficial

Alternative 2: Partial-Build Approach (Preferred Alternative at Glenbrook Crossing)

Effects on Surface Water Hydrology, Hydraulics, and Water Quality

Surface Water Effects at Limantour Beach Marsh Site. Replacing the existing embankment crossing at Limantour Beach Marsh with a boardwalk result in similar effects as those described under Alternative 1. A key difference between Alternative 1 and Alternative 2 relates to the need to support the boardwalk on pilings spaced every 6–8 feet within the tidal flat complex. While removing the earthen fill from the pond and recontouring the tidal flat would dramatically improve hydraulic function at Limantour Beach Marsh, the pilings could cause debris and sediment to accumulate in the channel over the long term, ultimately obstructing flow. This could be a minor adverse effect, but would be mitigated by including debris, sediment, and trash clearing in regular maintenance activities.

Surface Water Effects at Muddy Hollow Site. As with Alternative 1, removing the existing dam at the Muddy Hollow site would eliminate the barrier that maintains the reservoir's artificial lake environment, restoring the surface hydrologic connection between the upper reaches of Muddy Hollow Creek and the Estero de Limantour and lowering base level consistent with tidal elevations in the Estero. The key difference between Alternatives 1 and 2 is that phased removal of the dam under Alternative 2 would result in more accommodation of base level adjustment. Consequently, under Alternative 2, the channel and floodplain system would have one winter to evolve progressively downstream as water level in the reservoir is progressively lowered. Channel development would be further guided and controlled by the check structures proposed for construction on the former reservoir floor, beginning in Phase 1.

The basic processes of channel and floodplain evolution, and associated water quality effects under Alternative 2 would be similar to those described above for Alternative 1. Water quality effects during this phase could be addressed by continued adaptive management, and the level of sustained effect is expected to be minor.

Over the long term, Alternative 2, like Alternative 1, would increase the net delivery of sediment to the Estero by comparison with existing conditions, because the dam and reservoir presently interrupt the transport of all but the suspended fraction of Muddy Hollow Creek's sediment load. As described for Alternative 1, this is considered a benefit because it would represent a return to natural surface drainage function. Once the adjustment period is over, turbidity—and hence water quality—should return to pre-restoration levels; transport of suspended load, which is not substantially impeded by the dam, is not expected to change materially.

Surface Water Effects at Glenbrook Crossing Site. Alternative 2, like Alternative 1, would restore surface connectivity between the channel reaches that are now interrupted by the culverted Muddy Hollow Trail crossing. The footprint of the channel reconfiguration and of direct impacts would be smaller than that required in Alternative 1. Following removal of road fill to the disposal area, Alternative 2 minimize excavation of accumulated fill stored upstream of the road crossing approximately 100-200 linear feet, allowing the established riparian corridor to remain. Excavation upstream would be determined by the fill required downstream for channel regrading and would be placed downstream in the same manner described under Alternative 1. Limiting the upstream excavation only to the extent necessary to create the downstream gradient is a softer, more balanced approach that relies more on natural processes of erosion and sediment transport to fully restore the channel to a more functional geometry. In addition, under Alternative 2, existing mature riparian vegetation would remain in place upstream of the crossing site rather than being removed as would occur under Alternative 1. Grade control structures similar to those proposed for Alternative 1 would be installed, including two additional structures upstream.

Although the overall pattern of channel evolution would be similar to that described above for Alternative 1, sediment delivery to downstream reaches and the ponds during channel adjustment would likely be greater under Alternative 2 than under Alternative 1. As with Alternative 1, the increased load would likely include a higher proportion of coarse bedload, which is presently blocked by the crossing; this would include material remobilized from the aggraded and restored reaches, as well as "background" load delivered by ongoing flow from the upper watershed. Because coarse bedload is only intermittently mobile in streams like Glenbrook Creek where discharge varies markedly, coarse sediment is expected to move downstream in an intermittently advancing front.

As described for Alternative 1, the upstream extent of incision is difficult to predict, but the mature riparian vegetation left in place is expected to help control channel development, preventing excessive bank erosion. Headcutting would be constrained by the bedrock channel reach upstream of the crossing site. The channel is not expected to widen substantially (Jones & Stokes and nhc 2003a).

Because of increased reliance on natural process, outcomes under Alternative 2 are more difficult to predict than with Alternative 1. Patterns of erosion, sediment loading, and increased turbidity would probably be broadly similar to those envisioned for Alternative 1, although they might be greater because more channel adjustment would be required, despite the additional stability provided by vegetation left in place.

Erosion during the adjustment period would episodically effect downstream water quality in Glenbrook Creek and possibly also in the Estero, with the greatest effect felt during and immediately after storm events. Much bedload, and in particular, coarse bed load, is expected to drop out of transport before it reaches the Estero, although suspended load would be delivered this far. This effect would be addressed to the extent feasible by NPS's proposed monitoring and adaptive management program, but would likely represent a moderate effect.

Concerns about the effects of increased erosion and sediment mobility on water quality would also be addressed to the extent feasible by monitoring and adaptive management included in Alternative 2. Overall, water quality effects are expected to be moderate.

As identified for Alternative 1, long-term (post–10 year) sediment delivery to areas downstream of the crossing site would remain elevated by comparison with existing conditions because bedload transport from the upper watershed would be essentially uninterrupted after the crossing is removed. This is considered a benefit, because it represents a return to natural surface drainage function. Following the adjustment period, downstream turbidity is expected to approach prerestoration levels; the crossing does not control transport of suspended load from upstream sources, and removing it would probably have little effect on long-term turbidity levels.

Effects on Groundwater Hydrology and Quality under Alternative 2

At all three sites, effects on groundwater under Alternative 2 are expected to be very similar to those described above for Alternative 1. This includes no effect in the short and long-term at Limantour Beach Marsh, no effect in the short-term and negligible adverse in the long-term at Muddy Hollow Pond, and negligible adverse in the short-term and no effect in the long-term at the Glenbrook Crossing site.

Alternative 2 Contribution to Cumulative Effects on Hydrology, Hydraulics, and Water Quality

Under Alternative 2, the proposed action's contribution to cumulative effects on hydrology, hydraulics, and water quality would be very similar to those identified above for Alternative 1. The only substantive short-term difference would relate to the phased removal of the dam at Muddy Hollow, which would extend and could amplify the proposed action's contribution to cumulative construction-related effects on water quality. Nonetheless, short-term contributions are expected to be minor under Alternative 2 as described for Alternative 1, while long-term effects, and the proposed action's contributions to long-term effects, would represent marked benefits.

Alternative 2 Conclusion on Effects on Hydrology, Hydraulics, and Water Quality

Evaluation of potential impacts to hydrology, hydraulics and water quality under Alternative 2 shows the likelihood of short-term minor adverse impacts as hydrologic configurations and conditions adjust as a result of the restoration activities. Shifts in water regime, channel and estuarine configuration would occur, but be muted in scale through proposed adaptive management measures including installation of passive grade control, adaptive monitoring and management actions. The longer construction window proposed under Alternative 2 for Muddy Hollow would extend potential effects, and delay natural recovery and revegetation at the site.

In the long-term, the actions identified under Alternative 2 would result in minor to moderate benefits as natural hydrologic and estuarine process are restored to a new, functional dynamic equilibrium at these sites. The restoration actions would facilitate sustainable, naturally functioning hydrologic systems that would not require continued maintenance.

The actions proposed under alternative 2 would not result in impairment to park hydrology, hydraulics, and water quality.

Table 4.19 Alternative 2: Overall Effects on Hydrology, Hydraulics, and water quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Surface water effects	Minor adverse	Beneficial
	Ground water effects	No effect	No effect
	Water quality	Minor adverse	Beneficial
Muddy Hollow Pond	Surface water effects	Minor adverse	Beneficial
	Ground water effects	No effect	Negligible adverse
	Water quality	Minor adverse	Minor adverse
Glenbrook Crossing	Surface water effects	Minor adverse	Beneficial

	Ground water effects	Negligible adverse	No effect
	Water quality	Moderate adverse	Minor adverse
All Sites	Cumulative	Minor adverse	Beneficial

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and existing management practices would continue. There would be no direct effect on hydrology, hydraulics, or water quality in surface drainages, nor would there be any direct effect on groundwater recharge, flow, or quality.

However, both the existing dam at Muddy Hollow and the existing embankment at Glenbrook Crossing are structurally unsound, and there is some concern about the potential for sudden failure during a large storm event or as a result of seismic shock, if these structures remain in place for a protracted period. Failure of the dam at Muddy Hollow would likely result in sudden release of the water impounded in the reservoir, with a potential for substantial erosion in the tidal habitats of the Estero. A large amount of sediment would probably be remobilized during and following dam failure, as well. The potential impacts evaluated as part of the action alternatives would proceed in an uncontrolled and catastrophic manner. The potential of catastrophic failure would focus the impacts, exaggerating the duration of damage and increasing the time before equilibrium is reached. Dam failure could thus have moderate to major adverse effects on surface drainage processes, water quality, and tidal habitat quality in the Estero system.

Failure of the Glenbrook embankment crossing would likely occur in conjunction with a high flow event, and could actually trigger a debris flow type response. This could result in the distribution and deposition of large volumes of material in a single event, effecting far greater areas of habitat in the process. Effects on stream process both upstream and downstream as well as impacts downstream to water quality would be similar in intensity (moderate to major adverse impacts) to those described for Muddy Hollow.

By contrast with the controlled sediment remobilization expected under Alternatives 1 and 2, effects of sudden failure at either the Muddy Hollow or Glenbrook structure would be impossible to mitigate in advance, and could only be addressed after the fact, in an emergency recovery mode.

Contribution to Cumulative Effects on Hydrology, Hydraulics, and Water Quality

Under Alternative 3, the proposed action would not contribute to construction-related water quality degradation, but it would have the potential to result in a minor adverse contribution over the long term, should either the Muddy Hollow Dam or the embankment at Glenbrook Crossing fail suddenly.

Conclusion on Effects on Hydrology, Hydraulics, and Water Quality

Evaluation of potential impacts to hydrology, hydraulics and water quality under Alternative 3 would not lead to short-term effects as a result of direct construction activities.

In the long-term, the actions identified under Alternative 3 could potentially result in minor to moderate adverse impacts to water resources. At Muddy Hollow and Glenbrook, inaction could facilitate catastrophic failures leading to moderate adverse impacts to the adjacent water resources and associated habitats. Such events would lead to large-scale complete changes in habitat, and require longer periods of time to recover. Such events, occurring in association with unnatural features, result in impacts to the stream channel or ecosystem that are not within the range of natural variability, thereby increasing the time required to recover dynamic equilibrium.

Alternative 3, however, would not result in impairment to park hydrology, hydraulics, and water quality.

Table 4.20 Alternative 3: Overall Effects on Hydrology, Hydraulics, and water quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Surface water effects	No effect	Minor adverse
	Ground water effects	No effect	No effect
	Water quality	No effect	Minor adverse
Muddy Hollow Pond	Surface water effects	No effect	Moderate adverse
	Ground water effects	No effect	Negligible adverse
	Water quality	No effect	Moderate adverse
Glenbrook Crossing	Surface water effects	No effect	Moderate adverse
	Ground water effects	No effect	No effect
	Water quality	No effect	Moderate adverse
All Sites	Cumulative	No effect	Moderate adverse

4.3 Effects on the Biological Environment

Effects on Vegetation and Wildlife

Policies and Regulations

NPS Management Policies 2001 state "The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals." The policies go on to state that the above statement includes flowering plants, ferns, mosses, lichens, algae, fungi, and microscopic plants, bacteria, mammals, birds, reptiles, amphibians, fishes, arthropods, worms, and microscopic animals. The NPS is to preserve and restore the natural abundance, diversities, dynamics, distributions, habitats, and behaviors of these native species. Additionally, the NPS is to prevent the introduction of exotic (non-native) species into units of the National Park System. The policy manual NPS-77 (Natural Resource Management Guidelines) also provides general guidelines on wildlife and vegetation management.

The NPS also is required to comply with the Fish and Wildlife Coordination Act; the Marine Mammal Protection Act; the Wilderness Act; the Convention on International Trade in Endangered Species; and maritime and other international agreements. The NPS also is required to comply with The Migratory Bird Treaty Act (1918) as amended, which prohibits taking, killing, or possessing migratory birds, nests, or eggs. As a refuge for tule elk, Point Reyes National Seashore is directed to participate in a Federal/State cooperative program for preservation and enhancement of tule elk in California under the Tule Elk Preservation Act (1976).

Executive Order 13112 directs federal agencies to minimize introduction and spread of exotic species to federal lands. In addition, the 2001 NPS Management Policies § 4.4.4.2, call upon NPS employees to distinguish which non-native species are most likely to cause damage to natural resources, and to give high priority to controlling the spread of these.

Heavy equipment use proposed under the action alternatives has the potential to import plant materials from outside the Park, and to transport plant materials between Project sites. The Park

would require that Best Management Practices (see Environmental Commitments section) are employed to minimize the chance of new invasive species becoming established within in the Park, or moving between sites within the Park, as a result of proposed actions.

Assessment Methodology

Baseline conditions for analysis of effects on biological resources were identified based on a combination of literature research and fieldwork. Fieldwork included

- reconnaissance-level surveys to assess the suitability of habitat on and around the restoration sites for use by common and special-status wildlife species,
- wetland delineations and special-status plant surveys (Allen and Parsons 2003; Parsons 2003a, 2003b; Parsons and Allen 2003)

Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.21.

Table 4.21 Descriptors for Vegetation and Wildlife

Type of Effect	Beneficial: the proposed action would improve habitat for plant or animal, and protect and/or restore the natural abundance and distribution of plant or animal species Adverse: the proposed action would degrade habitat for a plant or animal, and cause a decrease in the natural abundance and distribution of a plant or animal species
Duration of Effect	Short-term: effects on the habitats of species would persist for two years or less; immediate changes in the abundance and/or distribution of special-status species may occur during the construction period, but a return to original conditions would be expected within two generations of that species Long-term: effects on the habitats of species would persist for two years or more beyond the construction period; changes in the abundance and/or distribution of special-status species would continue beyond two generations of that species
Intensity of Effect	Negligible: the proposed action would not measurably alter habitats for species, or create a measurable difference in the distribution and abundance of special-status species Minor: adverse effects to habitats of species would be perceptible, but would be localized in extent; changes in the distribution and abundance of special-status species would be minor and restricted to the Project site Moderate: adverse effects to habitats of species would be apparent and readily noticeable, but would be localized in extent; changes in the distribution and abundance of species would be moderate in intensity and restricted to the Project site and sites immediately adjacent; changes in distribution and abundance of species may be permanent, unless (if adverse) actively managed Major: adverse effects to habitats of species would be substantial, and would effect a significant portion of the Drakes Estero Watershed; changes in the distribution and abundance of species would be substantial, and would effect a large geographic area; changes in distribution and abundance of these species is irreversible, even (if adverse) with active management

Evaluation of Impacts

Build Alternatives, All Sites

Effects on Vegetation and Wildlife

At all three sites, construction activities have the potential to promote further spread of nonnative plants that are present there now, and could also introduce invasive nonnative plant species that are not now present. Such species could displace native plants, potentially changing the species composition on or around the construction site. This would represent an adverse effect, potentially ranging in severity from minor to major. Requiring the construction contractor(s) to

implement the following measures would reduce the potential for construction to spread nonnative plants to the extent feasible.

- Educating construction supervisors and mangers about weed identification and the importance of controlling and preventing the spread of noxious weed infestations.
- Cleaning construction equipment of external soil at an offsite location before the equipment is brought onsite.
- Minimizing surface disturbance to the greatest extent possible.

With these mitigation measures in place, effects are expected to be minor.

In addition, as discussed in *Hydrology, Hydraulics, and Water Quality*, construction activities have the potential to increase erosion and sedimentation, potentially decreasing water quality downstream active construction areas. However, as described in Chapter 2, the proposed action would incorporate a range of BMPs designed to protect water quality during construction, so effects are not expected exceed a minor level, and no mitigation is required.

The third concern related to construction activities is the potential for construction-related noise and vibration to disturb wildlife. The noise effects are discussed fully under *Effects related to Noise.* Adverse effects related to construction noise and vibration would be short-term and minor at all three sites under both build alternatives, and do not require additional mitigation.

Over the long term, following restoration, the proposed action would benefit water quality at all three sites by restoring tidal circulation at Limantour Beach Marsh and Muddy Hollow, and hydraulic connectivity at Glenbrook Crossing. The amount of ponded freshwater habitat would decrease at all three sites, and particularly at Muddy Hollow, but this is considered a net benefit because it would represent a return to conditions more closely resembling the area's historic habitat mosaic. More specifically, as tidal exchange is improved at Limantour Beach Marsh and Muddy Hollow, the area of available subtidal aquatic habitat would increase. These channels may be used as rearing habitat by estuarine and marine fishes, and may also provide habitat for additional phytoplankton, zooplankton, and benthic invertebrates, all of which would represent potential food sources for both common and special-status fishes.[2] All of these long-term effects are considered beneficial.

Post-restoration changes in site hydrology would result in long-term changes in vegetative communities at all three sites. Specifically, at Limantour Beach Marsh, the existing freshwater pond/marsh environment would be replaced with a more natural transition from freshwater through brackish to salt marsh habitat. At Muddy Hollow, ponded fresh water would be replaced with stream and tidal channel and floodplain/tidal marsh plain; some of the present alder-dominated riparian forest would give way to willow riparian scrub, and the upgradient extent of coastal brackish and salt marsh would increase slightly as tides are allowed their full natural range. At both of these sites, there may also be an increase in grassland and/or coastal scrub extent as areas that are now ponded become dryer; this is expected to offset the short-term loss of coastal scrub and grassland habitat that would result from demolition activities to remove the unnatural barriers at each site. In addition, at Glenbrook Crossing, the expanded riparian area now supported by the perched floodplain would decrease in extent, consistent with more functional streamflow. All of these long-term changes are considered beneficial, and no mitigation is required.

As the habitats on the three sites evolve, there would be corresponding changes in the wildlife communities that use the sites. In particular, the bird community at the Muddy Hollow site would

[2] See *Effects on Special-Status Species* below for additional discussion.

change as ponded open water is converted to intertidal marsh plain and subtidal channels. Similar changes would occur on a much more restricted scale at Limantour Beach Marsh. However, other ponds throughout the Seashore would continue to support those populations that require open freshwater (areas of ponded water include nearby Laguna Pond, upper and lower Limantour Estero). The availability of dense riparian vegetation may expand downgradient in association with newly exposed habitat. As with open water habitat, other nearby sites offer adequate riparian habitat to compensate for the small reduction. These changes in habitat availability represent a return to habitat patterns more closely resembling the historic condition and as such are considered a long-term benefit. An additional benefit expected as a result of restoration is improved dispersal of terrestrial and aquatic wildlife, including special-status species, up- and downstream of the project sites, as a result of increased habitat connectivity.

Build Alternatives' Contribution to Cumulative Effects on Vegetation and Wildlife

Construction of most of the actions listed in Table 4-1 would temporarily disrupt common habitats such as coastal shrub/nonnative grassland and would likely also disturb wildlife. To the extent that construction windows overlap, these effects would be additive, and would accrue to represent a short-term adverse cumulative effect on vegetation and wildlife. However, because of the comparatively small individual footprints of the project sites, the small number of workers and pieces of equipment involved at each site, the noise BMPs that would be required, and the limitations on tool use in the wilderness, the net level of effect is expected to be minor. The proposed action would result in minor short-term adverse effects to vegetation and wildlife.

Long-term cumulative effects on vegetation and wildlife are expected to be beneficial, because all of these actions would foster a return to conditions more closely resembling the historic habitat mosaic in the Drake's Bay/Drake's Estero watershed, and the habitat would not remain subject to catastrophic failure. The actions proposed under either Alternatives 1 and 2, would restore natural process and improve sustainability of these ecological systems. This is considered beneficial in the long-term.

Build Alternatives' Conclusion on effects on Vegetation and Wildlife

Alternatives 1 and 2 would result in similar impacts to vegetation, wildlife, and habitat as a result of the direct construction activities, short-term and long-term habitat changes. Overall the changes to vegetation and wildlife habitat are considered adverse minor in the short term, with recovery, however, the long-term effects are considered beneficial.

The build alternatives would not result in impairment to park vegetation or wildlife resources.

Table 4.22 Alternatives 1 and 2: Overall Effects on Vegetation and Wildlife

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Vegetation	Minor adverse	Beneficial
	Wildlife	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial

Alternative 3: No Action

Effects on Vegetation and Wildlife

Under Alternative 3, no restoration would take place and existing management practices would continue. The sites would remain in their current condition, and would continue to support the same vegetative and wildlife communities currently present. Therefore, there would be no direct effects on vegetation and wildlife resources under the No Action Alternative.

As discussed in *Hydrology, Hydraulics, and Water Quality* above, there is some concern about the potential for failure of the Muddy Hollow dam and/or Glenbrook Crossing embankment in a large storm event or as a result of seismic shock. As discussed above, dam or embankment failure could

have substantial adverse effects on downstream channel process and water quality, with the potential for corollary (indirect) minor adverse effects on aquatic and marsh plain habitat and wildlife.

Contribution to Cumulative Effects on Vegetation and Wildlife

Under Alternative 3, cumulative effects on vegetation and wildlife would be as identified above for the build alternatives. Because no construction would take place, there would be no short-term cumulative effects on biological resources. In the long-term, if the Muddy Hollow Dam or the embankment at Glenbrook Crossing were to fail suddenly, the resulting adverse effects on aquatic and marsh plain habitats could represent minor adverse contribution to an otherwise beneficial cumulative framework.

Conclusion on Effects to Vegetation and Wildlife

Under Alternative 3, there would be no effect to existing vegetation and wildlife within the project area during the short term. In the long-term, potential failure of these earthen facilities under either flood flow or geologic hazard scenarios would result in minor adverse effects to vegetation and wildlife resources. Recovery time of these resources as a result of potential uncontrolled (catastrophic) failure would be more protracted and could prevent these areas from reaching stable physical or ecological equilibrium.

Alternative 3 would not result in impairment of park biological resources.

Table 4.23 Alternative 3: Overall Effects on Vegetation and Wildlife Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Vegetation	No effect	Minor adverse
	Wildlife	No effect	Minor adverse
	Cumulative	No effect	Minor adverse

Effects on Wetland Resources

Policies and Regulations

Wetlands are addressed specifically in this assessment because, as they serve as habitat for a high percentage of the plants and animals and they are protected by numerous laws and directives.

Section 4.6.5 of the NPS Management Policies addresses the restoration of wetlands on NPS lands, "When natural wetland characteristics or functions [of wetlands] have been degraded or lost due to previous or on-going human actions, the Service will, to the extent practicable, restore them to predisturbance conditions" (NPS 2000).

The protection of wetlands within NPS units is facilitated through the following:

- Rivers and Harbors Act § 10
- Clean Water Act § 404
- Executive Order 11990, Protection of Wetlands
- NPS Director's Order #77-1, Wetland Protection and Procedural Manual #77-1 (DO #77-1 and PM #77-1)

Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act authorize the U.S. Army Corps of Engineers to grant permits for construction and disposal of dredged material in waters of the United States, which includes wetlands and riparian zones. Executive Order 11988 requires that federal agencies minimize the amount of infrastructure placed in floodplains.

Executive Order 11990 requires that agencies work to minimize the destruction, loss, or degradation of wetlands. Director's Order 77-1 and Procedural Manual 77-1 provide specific procedures for implementing Executive Order 11990.

Assessment Methods

For this assessment, wetlands that could be subject to impacts were identified using the Army Corps of Engineers jurisdictional delineation and the USFWS - Cowardin Method surveyed in the field (Cowardin et al. 1979). These data layers then were overlain with the boundaries of the Project planning area. This information provided a conservative and broad estimate of the extent of known and potential wetlands within the planning area. The approximate number of acres that would be subject to impacts was estimated using standard techniques.

The parameters that were considered in the assessment of impacts on wetlands include the following:

- Plant species composition of the wetland, including abundance and species richness of invasive non-native plant species;
- Hydrologic features that maintain the wetland; and
- Wetland soils.

These parameters parallel those used by the Army Corps of Engineers when defining wetlands. It is assumed that if these parameters are altered as a result of restoration activities, the wetland would be subject to impacts, which could be either beneficial or adverse.

Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.24.

Table 4.24 Descriptors for Wetlands

Type of Effect	Beneficial: the proposed Project would enhance or restore processes necessary for wetland vegetation, soils, or hydrology to develop, or increase the areal extent of wetlands
	Adverse: the proposed action would shift plant species composition to a higher percentage of non-wetland indicator species; alter hydrologic features/factors that are required to maintain the wetland; alter soil properties that are required to maintain the wetland; or reduce the areal extent of wetlands;
Duration of Effect	Short-term: effects on wetlands would persist for two years or less
	Long-term: effects on wetlands would persist for two years or more beyond the construction period
Intensity of Effect	Negligible: the proposed action would not measurably alter wetlands
	Minor: effects to wetlands would be perceptible, but would be localized in extent
	Moderate: effects to wetlands would be apparent and readily noticeable, but would be localized in extent; these changes may be permanent, unless (if adverse) actively managed
	Major: effects to wetlands would be substantial, and would effect a significant portion of the Drakes Estero Watershed; changes would be irreversible, even (if adverse) with active management

Impacts and Mitigation Measures

Alternative 1: Full-Build Approach (preferred alternative at Limantour Beach Marsh and Muddy Hollow)

Effects on Wetlands

The proposed action would result in minimal to no permanent loss of wetlands subject to jurisdiction or oversight either by the Corps or the California Coastal Commission (CCC). As

discussed under Chapter 3, the Corps regulates fill or excavation in wetlands either under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbor Act. The CCC oversees activities within a more broadly defined group of wetlands in coastal areas through authorities granted to the state under the federal Coastal Act. Internally, the NPS also evaluates activities within wetlands and floodplains that could potentially cause a "net loss" of wetlands. Regulatory and management oversight of activities in wetlands has increased in recent decades due to the important functions that they perform for both humans and wildlife. The proposed action would greatly enhance the functionality of wetlands present by increasing hydrologic connectivity with downstream habitats.

Wetland Effects at Limantour Beach Marsh. At Limantour Beach Marsh, the proposed action focuses on removal of fill from the area, which would not likely result in impacts to potential Corps' jurisdictional Section 404 and Section 10 wetlands and waters (see Table 4-27). The Corps has not verified this delineation, so impact estimates could change. However, the proposed action calls for very little in the way of new fill or excavation activities. Activities associated with berm removal would result in negligible adverse effects on Corps' jurisdictional wetlands and waters from either permanent or temporary "fill" and/or excavation activities.

Impacts to wetlands potentially subject to oversight by the CCC (See Table 4-28) come from temporary impacts associated with excavation that would cause a change in the type of wetland, but not permanent loss. Excavation of the existing beach access berm for installation of a bridge structure would impact 0.14 acre of Palustrine Scrub-Shrub and Emergent wetlands. However, these impacts would be temporary, with these areas expected to rapidly convert to Estuarine Emergent wetlands with the improved hydrologic connectivity between Limantour Marsh and Limantour Pond. Approximately 0.09 acre of Estuarine Emergent and 0.12 acre of Palustrine Scrub-Shrub wetlands would be excavated during removal of the already breached outer berm, but these lowered areas would transition into Estuarine Emergent wetlands similar to the adjacent marshplain. Excavation of the secondary beach access berm would temporarily impact 0.15 acre of Palustrine Scrub-Shrub, 0.16 acre of Estuarine Emergent, and 0.02 acre of Estuarine Scrub-Shrub wetlands. These areas would either rapidly reestablish following project implementation or largely become Estuarine Emergent wetlands. Excavation impacts to wetlands potentially subject to CCC oversight total 0.58 acre. Excavation activities would result in short-term minor adverse effects to wetlands. In the long-term there would be no permanent loss, and effects on potential CCC wetlands are characterized as adverse negligible.

Some additional minor impacts to wetlands would result from abandonment of the existing Pond spillway and removal of the secondary beach access berm. Abandonment of the Pond spillway would, at least on the western side of the beach access berm, cause the constructed channel (<0.01 acre) to go dry and potentially become a Corps' non-jurisdictional upland, although it is probable that it would revegetate with hydrophytic species. In addition, removal of the secondary beach access berm could potentially act to dewater some depressional wetland features that have established between a dune and the berm. Acreage of these features totals 0.11 acre. Short-term impacts to wetlands associated with construction and project implementation are considered minor adverse. Long-term impacts associated with permanent loss of wetlands subject to NPS oversight would be minor adverse.

Excavation activities associated with the California red-legged frog enhancement would either convert wetlands from seasonal to perennial or would result in excavation of upland areas to capture and hold water, thereby expanding and likely offsetting the losses described in association with the impacts discussed above. These depressional features would intersect the groundwater table and provide winter breeding habitat for the frogs.

While the proposed action would cause some short-term and long-term impacts to wetlands, it would also increase functionality of the wetlands present. The primary benefit would result from the increase in hydrologic connectivity with downstream water bodies (Limantour Estero and

Marsh), thereby boosting the potential for marine and estuarine organisms to benefit from increases in carbon export from the Laguna Creek watershed. Currently, the Pond likely plays a much smaller role comparatively than does Muddy Hollow Pond in detaining flood flows and sediment from their respective watersheds, and it is unlikely that these types of functions would increase under any restoration or management scenario. Retention of Laguna Creek flood flows probably occurs primarily on the broad floodplains of lower Laguna, along with detention of most of the creek's sediment loads. Also, as the Pond is already largely vegetated, any nutrient loading from Laguna Creek or surrounding uplands is already rapidly converted to plant matter that can be incorporated into the estuarine food web. However, increasing connectivity with downstream water bodies would greatly increase export of these and other carbon sources to the estuary and increase habitat for other important marine and estuarine food chain components such as benthic invertebrates and fish. The short-term effects to wetland function would be minor adverse. In the long-term, as sites recover, the effects of the project on wetland function would be beneficial.

Wetland Effects at Muddy Hollow. At Muddy Hollow, the proposed action would result in a very minor amount of permanent fill to Section 404 and Section 10 jurisdictional features (see Table 4-27). Activities that would affect Corps' jurisdictional wetlands include removal of the constructed spillway on the southwest side of the Pond through filling, construction of a willow or brush layer sediment trapping structure in the center of the Pond, and potentially, the installation of grade control structures in Muddy Hollow Creek that would be largely below the existing grade of the channel bottom. These actions would impact approximately 0.17 acre of Non-Tidal Waters, 0.001 acre of Non-Tidal Wetlands, and 0.002 acre of Section 10 waters. Impacts to Corps' jurisdictional wetlands from "fill" would be minor adverse in the long-term. There would be no temporary impacts (as defined by the Corps) to wetlands from fill activities such as temporary stockpiling, however short-term effects are considered minor adverse.

Impacts to wetlands potentially subject to oversight by the CCC are similar to those described above (see Table 4-28). To a large degree, the proposed action would result in more of a shift in the type of wetlands present, rather than any permanent losses through dredging, filling, or diking.

Approximately 0.08 acre of Palustrine Rock bottom would be impacted by filling of the constructed spillway channel, and most of this area would likely revert to historic upland habitats such as Coastal Scrub or Grassland, thereby making the fill a permanent loss of wetlands. In addition, removal of the dam structure would eliminate approximately 0.60 acre of Palustrine Forested wetlands that have established on the dam top and sides due to seepage. However, approximately two-thirds of this feature would probably convert into other potential jurisdictional habitats such as Estuarine and Palustrine Emergent wetlands when the Project Site is reconnected to Limantour Estero. Approximately 0.09 acre of Lacustrine Unconsolidated Bottom wetlands would be impacted by construction of the willow or brush sediment trapping structure, but this area would probably rapidly convert from Lacustrine to Palustrine Emergent and Palustrine Scrub-Shrub wetlands. A small (<0.001 acre) of Palustrine Forested may be temporarily impacted by installation of grade control structures below the existing grade of Muddy Hollow Creek to minimize future incision or deepening of the channel with dam removal. Also, approximately 0.01 acre of Estuarine Emergent wetland on the outboard side of the dam would be excavated for construction of a "starter" channel, but this impact would be temporary, with the excavated area rapidly transitioning into Estuarine Intertidal Unconsolidated Bottom. Excavation and fill impacts to wetlands potentially subject to CCC oversight total 0.78 acre. Because activities would only temporarily impact wetlands and cause a very small amount of conversion of wetland to upland habitat, impacts to CCC potential jurisdictional wetlands are characterized as minor adverse in the short and long-term.

Following drainage of the pond, it is likely that the steeper, western edge of the Pond (<0.01 acre) might convert back to historic upland conditions once it is drained, because the dam has artificially elevated water levels in this area. While these particular impacts may not be subject to regulatory oversight, the NPS is mandated to minimize losses of wetlands from a broader range of activities.

Short-term impacts to wetlands associated with construction and project implementation would be moderate adverse. Permanent impacts to or loss of wetlands subject to NPS oversight would be minor adverse in the long-term.

While the proposed action would cause some short-term and long-term impacts to wetlands, it would also greatly increase functionality of the wetlands present. The primary benefit would result from the increase in hydrologic connectivity with downstream water bodies (Limantour Estero and Marsh), thereby boosting the potential for marine and estuarine organisms to benefit from increases in carbon export from the Muddy Hollow watershed. While the Pond does currently function as a floodwater and sediment detention basin, conversion of the Open Water to vegetated marsh and riparian areas would increase the potential for the Project Site to not only detain nutrients, but transform them into plant matter that can be incorporated into the estuarine food web. Loss of open, standing water habitat would decrease primary productivity associated with algal and zooplankton communities, but it would increase food chain components such as emergent plants and benthic invertebrates. Impacts to wetland functionality would be beneficial, and long-term, although there may be some short-term, minor, adverse impacts to functioning of Project Site and downstream wetlands from increased erosion and sedimentation immediately following project implementation.

Wetland Effects at Glenbrook Creek. At Glenbrook Creek, the proposed action would cause approximately 0.19 acre of impacts to Non-Tidal Waters from elevating the downstream portion of the creek through fill and 0.03 and 0.04 acre of impacts to Adjacent Waters and Wetlands, respectively, from removal of an erosional gully through filling (Table 4-27). Impacts to Corps' jurisdictional wetlands from "fill" would be minor, adverse, and long-term. There would be no temporary impacts (as defined by the Corps) to wetlands from fill activities such as temporary stockpiling.

Impacts to wetlands potentially subject to oversight by the CCC come from both permanent and temporary impacts associated with excavation and fill (see Table 4-28). Excavation of the aggraded portion of Glenbrook Creek upstream of the road crossing would impact approximately 1.1 acre of Palustrine Forested wetland, while filling of the incised or deepened portion of Glenbrook Creek downstream of the crossing would affect 0.15 acre of Palustrine Scrub-Shrub and 0.04 acre of Palustrine Forested wetlands. Both activities are expected to result in only temporary impacts to wetlands, with stream channel and associated wetlands rapidly reestablishing following project implementation. Removal of the road crossing itself has the potential to impact less than 0.001 acre of Palustrine Forested and Palustrine Scrub-Shrub wetlands growing along the southern base of the crossing. Filling of the erosional gully would impact 0.03 acre of Palustrine Forested and 0.04 acre of Palustrine Emergent wetlands. Fill and excavation impacts to wetlands potentially subject to CCC oversight total 1.36 acres. Fill and excavation activities would result in short-term moderate adverse impacts to CCC wetlands. In the long-term, the small amount of potential permanent loss (0.07 acre) of potential CCC wetlands would result in similar, minor adverse effects.

Permanent impacts to or loss of wetlands subject to NPS oversight would be minor, adverse, and long-term.

As with the other Project Sites, while the proposed action would cause some short-term and long-term impacts to wetlands, it would also increase functionality of the wetlands present. The current culverted road crossing has created discontinuities in transport of floodwaters, sediment, and carbon matter to downstream sections of Glenbrook Creek. While the upstream sections are performing floodwater, sediment, and nutrient retention functions to some degree, the downstream sections are less able to perform these functions because the stream channel has incised or deepened in elevation, thereby disconnecting the stream from some or most of its floodplain. In addition, the incision is actually creating water quality problems through suspension of sediment. By eliminating the road crossing infrastructure and correcting the elevation differences between

the upstream and downstream sections of the creek, the proposed action would increase functionality of the downstream section of creek. These functions include detention of flood flows, dissipation of flood flow energy, retention of sediment and nutrients, and supplying organic matter and large woody debris for use as refugia and food source for aquatic organisms. In the short-term, impacts associated with the construction activities would have moderate adverse effects on wetland functionality from increased erosion and sedimentation immediately following project implementation. As the system recovers and natural process is restored, the long-term effects to wetland function are considered beneficial.

Short-Term Construction Impacts

At all three Project Sites, construction activities have the potential to have localized short-term adverse impact on wetlands. Requiring the construction contractor(s) to implement the measures identified in section 2.3, Environmental Commitments would reduce the potential for construction to adversely affect wetlands to the extent feasible. With the environmental commitments in place, project effects to wetlands are expected to be minor.

Alternative 1 Contribution to Cumulative Effects on Wetlands

In combination with activities proposed under other projects within the Seashore and vicinity, the proposed actions would have only a minor, cumulative, adverse effect on wetlands. Most of these adverse impacts would be temporary and, over the long term, the proposed projects would be expected to have a beneficial effect on wetlands and wetland functionality.

Alternative 1 Conclusion on effects on Wetlands

Overall, Alternative 1 would result in minor short-term adverse impacts associated with conversion or direct impacts as a result of construction. In the long-term, the recovery or conversion to more ecologically sustainable wetlands and habitat is considered a benefit to wetlands and wetland functionality at all the Project Sites.

Table 4.25 Alternative 1: Effect on Wetland Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Section 401 regulated wetlands	Negligible adverse	Negligible adverse
	CCC Regulated Wetlands	Minor adverse	Negligible adverse
	NPS DO-71 Wetlands	Minor adverse	Minor adverse
	Wetland Functionality	Minor adverse	Beneficial
Muddy Hollow Pond	Section 401 regulated wetlands	Minor adverse	Minor adverse
	CCC Regulated Wetlands	Minor adverse	Minor adverse
	NPS DO-71 Wetlands	Moderate adverse	Minor adverse
	Wetland Functionality	Minor adverse	Beneficial
Glenbrook Crossing	Section 401 regulated wetlands	Minor adverse	Minor adverse
	CCC Regulated Wetlands	Moderate adverse	Minor adverse
	NPS DO-71 Wetlands	Moderate adverse	Minor adverse
	Wetland Functionality	Minor adverse	Beneficial
All Sites	Cumulative effects	Minor adverse	Beneficial

Alternative 1 would not result in impairment to Park wetland resources.

Alternative 2: Partial-Build Approach (Preferred Alternative at Glenbrook Crossing)

Effects on Wetlands

The proposed action would have very similar effects to Alternative 1 on wetlands subject to jurisdiction or oversight either by the Corps (see Table 4-27), the CCC (see Table 4-28), or the NPS.

Wetland Effects at Limantour Beach Marsh. As with Alternative 1, the proposed action would result in negligible impacts to potential Corps' jurisdictional Section 404 and Section 10 wetlands and waters (Table 4-27). The Corps has not verified this delineation, so impact estimates could change. However, the proposed action calls for very little in the way of new fill or excavation activities. There would be negligible effects on Corps' jurisdictional wetlands and waters from either permanent or temporary "fill" and/or excavation activities.

Impacts to wetlands potentially subject to oversight by the CCC would be very similar to those described under Alternative 1, with a few exceptions (see Table 4-28). Excavation of the existing beach access berm for installation of a causeway would impact 0.31 acre of Palustrine Scrub-Shrub and Emergent wetlands, compared to 0.14 acre of wetlands for installation of a bridge under Alternative 1. As with Alternative 1, these impacts would be temporary, with these areas expected to rapidly convert to Estuarine Emergent wetlands with the improved hydrologic connectivity between Limantour Marsh and Limantour Pond. Excavation impacts to wetlands potentially subject to CCC oversight total 0.75 acre. Excavation activities would result in short-term minor adverse effects to wetlands. In the long-term there would be no permanent loss, and effects on potential CCC wetlands are characterized as adverse negligible.

Impacts to wetlands potentially subject to oversight by the NPS are identical to those described under Alternative 1. Permanent impacts to or loss of wetlands subject to NPS oversight would be minor, adverse, and long-term.

Effects of the proposed action on wetland functions would be identical to those described under Alternative 1. The short-term effects to wetland function would be minor adverse. In the long-term, as sites recover, the effects of the project on wetland function would be beneficial.

Wetland Effects at Muddy Hollow. Areal impacts to Section 404 and Section 10 jurisdictional features would be very similar to that under Alternative 1, with one exception (see Table 4-27). Phasing removal of the dam and draining of the pond would require installation of a culvert underneath the dam that would connect to the excavated channel in the existing Limantour Marsh. Inclusion of a culvert would probably result in both minor (<0.001 acre) temporary and permanent impacts to Section 404 wetlands from installation of the culvert and placement of riprap at the culvert ends, respectively. Therefore, the proposed action would impact approximately 0.17 acre of Non-Tidal Waters, 0.001 acre of Non-Tidal Wetlands, and 0.002 acre of Section 10 waters. Impacts to Corps' jurisdictional wetlands from "fill" would be minor, adverse, and long-term. There would very minor short-term impacts (as defined by the Corps) to wetlands from fill activities such as culvert installation.

Impacts to wetlands potentially subject to oversight by the CCC are identical to those described under Alternative 1 (see Table 4-28), although there would be a very minor (<0.001 acre) shift in the type of impact from excavation to fill. Short-term activities would impact wetlands and only cause a very small amount of conversion of wetland to upland habitat, resulting in minor adverse impacts to CCC potential jurisdictional wetlands. In the long-term, this conversion is characterized as a minor adverse effect.

Impacts to wetlands potentially subject to oversight by the NPS are also identical to those described under Alternative 1. Short-term impacts to wetlands associated with deconstruction and pond removal would be moderate adverse. Permanent impacts to or loss of wetlands subject to NPS oversight would be minor, adverse, and long-term.

Effects of the proposed action on wetland functions would be very similar to those described under Alternative 1, although the timeframe over which these functions would improve would be longer relative to Alternative 1. Impacts to wetland functionality would be beneficial, and long-term, although there may be some short-term, minor, adverse impacts to functioning of Project Site and downstream wetlands from increased erosion and sedimentation immediately following project implementation.

Wetland Effects at Glenbrook Creek. Impacts to Section 404 jurisdictional wetlands would be identical to those described under Alternative 1 (see Table 4-27). The proposed action would cause approximately 0.19 acre of impacts to Non-Tidal Waters from elevating the downstream portion of the creek through fill and 0.03 and 0.04 acre of impacts to Adjacent Waters and Wetlands, respectively, from removal of an erosional gully through filling. Impacts to Corps' jurisdictional wetlands from "fill" would be minor, adverse, and long-term. There would be no temporary impacts (as defined by the Corps) to wetlands from fill activities such as temporary stockpiling.

Impacts to wetlands potentially subject to oversight by the CCC would be very similar to Alternative 1 (see Table 4-28), with the exception that only limited excavation would be conducted upstream of the Glenbrook Crossing, resulting in less impact on the palustrine forested area. Therefore, impacts to wetlands potentially subject to CCC oversight are smaller than under Alternative 1, totaling 0.51 acre, approximately ½ of that affected by Alternative 1. Excavation and fill activities would result in short-term minor adverse effects to wetlands and only a small amount of potential permanent loss (0.07 acre), effects on potential CCC wetlands. Because of the fill actions, the long-term effects are also considered minor adverse.

Similarly, permanent impacts to or loss of wetlands subject to NPS oversight would be minor, adverse, and long-term.

The proposed action would have effect wetland functions as described under Alternative 1, although scaling back excavation of the upstream portion of the stream channel could extend the timeframe over which erosion from incision of the aggraded upstream channel occurs. Alternative 2 would leave the existing riparian corridor in place, and allow it to regulate sediment erosion from the project site. This could increase the amount of time during which the Project Site actually represents a source of sediment. In the short-term, increased erosion and sediment loading into the creek immediately following project implementation are considered a minor adverse effect. In the long term, the effect of the project on wetland functionality would be considered beneficial.

Short-Term Construction Impacts

Impacts to wetlands from construction activities would be very similar to those described under Alternative 1, although, at Muddy Hollow, the timeframe of construction would be extended from to two or more seasons and thereby increase the potential for an adverse effect. As with Alternative 1, the construction contractor(s) would be required to implement best management practices to reduce the potential for construction to adversely affect wetlands to the extent feasible. With these mitigation measures in place, effects are still expected to be adverse minor.

Alternative 2 - Contribution to Cumulative Effects on Wetlands

In combination with activities proposed under other projects within the Seashore and vicinity, the proposed actions would have result in minor, cumulative, adverse effect on wetlands. Most of these adverse impacts would be temporary and, over the long term, the proposed projects would be expected to have beneficial effects on wetlands and wetland functionality.

Alternative 2 - Conclusion on effects on Wetlands

Alternative 2 would result in minor short-term adverse impacts associated with conversion or direct impacts as a result of construction. The extended duration associated with Muddy Hollow and the smaller impact area at Glenbrook do not change the overall impacts to wetlands between Alternative 1 and 2. In the long-term, the recovery or conversion to more ecologically sustainable wetlands are considered beneficial to wetlands and wetland functionality at all the Project Sites.

Table 4.26 Alternative 2: Effect on Wetland Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Section 401 regulated wetlands	Negligible adverse	Negligible adverse
	CCC Regulated Wetlands	Minor adverse	Negligible adverse
	NPS DO-71 Wetlands	Minor adverse	Minor adverse
	Wetland Functionality	Minor adverse	Beneficial
Muddy Hollow Pond	Section 401 regulated wetlands	Minor adverse	Minor adverse
	CCC Regulated Wetlands	Moderate adverse	Minor adverse
	NPS DO-71 Wetlands	Moderate adverse	Minor adverse
	Wetland Functionality	Minor adverse	Beneficial
Glenbrook Crossing	Section 401 regulated wetlands	Minor adverse	Minor adverse
	CCC Regulated Wetlands	Moderate adverse	Minor adverse
	NPS DO-71 Wetlands	Moderate adverse	Minor adverse
	Wetland Functionality	Minor adverse	Beneficial
All sites	Cumulative effects	Minor adverse	Beneficial

Alternative 2 would not result in impairment to Park wetland resources.

Table 4.27 Potential area of impact on Corps regulated wetlands within the Project Area from implementation of Alternatives 1 and 2.

	Wetlands Subject or Potentially Subject to Corps' Jurisdiction (acres)						
	Tidal Water	Tidal Wet	N-T Water	N-T Wet	Adj Water	Adj Wet	Section 10
Muddy Hollow							
Alternative 1			0.17	0.001			0.002
Alternative 2			0.17	0.001			0.002
Limantour Beach Marsh							
Alternative 1							
Alternative 2							
Glenbrook Creek							
Alternative 1			0.19		0.03	0.04	
Alternative 2			0.19		0.03	0.04	

Table 4.28 Potential area of excavation or fill on CCC regulated wetlands within the Project Area from implementation of Alternatives 1 and 2.

	Wetlands Potentially Subject to CCC Oversight (acres)										
	L1UB	PRB	PEM	PEM/ SS	PSS	PSS/ PFO	PFO	E2UB	E2E M	E2SS	Total
Muddy Hollow											
Alternative 1	0.09	0.08					0.60		0.01		**0.78**
Alternative 2	0.09	0.08					0.60		0.01		**0.78**

Limantour Beach Marsh											
Alternative 1				0.07	0.35				0.14	0.02	**0.58**
Alternative 2				0.16	0.43				0.14	0.02	**0.75**
Glenbrook Creek											
Alternative 1			0.04		0.15		1.17				**1.36**
Alternative 2			0.04		0.15		0.32				**0.51**

Alternative 3 – No Action

Effects on Wetlands

Wetland Effects at Muddy Hollow, Limantour Beach Marsh, and Glenbrook Creek. Currently, wetland conditions within the three Project Sites are dependent on the stability of existing structures retaining water and maintaining current hydrologic profiles. While the Limantour Beach pond dam is relatively stable, the Glenbrook Crossing is degraded, with water piping around the culvert and seeps through the embankment causing sloughing of the road. While the size of Muddy Hollow Pond has decreased since construction of the dam, most sediment deposition is occurring further up-valley, and current surface area would likely remain consistent. The dam has been identified as in "seriously deficient condition" (BOR 2000).

Despite this, it is reasonable to believe that in the short-term, facilities and wetlands would remain in their current, stable condition. of the streambed channel downstream of the road crossing appears to be disconnecting the floodplain terrace from the creek and, thereby, potentially decreasing the extent of wetlands subject to CCC and NPS oversight. In addition, incision downstream of the road crossing is also reducing the amount and type of wetland functions performed by this portion of Glenbrook Creek as described in Chapter 3 under Wetlands. Should the NPS continue to maintain the road crossing infrastructure, it is likely that this degradation trend would continue, causing losses of wetlands and wetland functions.

Continued degradation of the facilities at Glenbrook and Muddy Hollow could result in catastrophic failure and uncontrolled impacts to the habitat downstream. Should the culvert and crossing catastrophically fail during a storm, substantial portions of the floodplain wetlands (Section 404 Non-Tidal Wetlands and/or Palustrine Forested) that have established upstream of the crossing on aggraded sediments would likely be lost through erosion as the streambed channel incised or dropped in elevation in order to move into equilibrium with the downstream portion of the channel, which is much lower in elevation. In addition, this erosion would cause this portion of the creek to act as a source of sediment rather than a sink and thereby potentially increase downstream water quality problems.

The Muddy Hollow Pond dam also has the potential to fail catastrophically, although it is in better condition than the Glenbrook Creek culvert and crossing. Should this fail during a storm, there would be potential for a substantial amount of sediment from the Pond to move downstream into the established Coastal Salt Marsh, thereby impacting these wetlands. Rapid draining of the Pond, combined with decreases in elevation of the Pond bottom due to sediment movement, could encourage extensive incision of the highly aggraded, deltaic materials in Muddy Hollow Creek, thereby impacting the extensive floodplain wetlands (Section 404 Non-Tidal Wetlands; Palustrine Forested) present there. As with Glenbrook Creek, this erosion would cause this area to act as a source of sediment rather than a sink and thereby potentially increase water quality problems in Limantour Estero.

Somewhat similar problems would occur if the Limantour Beach Marsh berm failed, although the amount of incision and sediment remobilization would be considerably less than at Muddy

Hollow. Therefore, the impacts to wetlands and wetland functions both within the Project Site and downstream of it in Limantour Marsh would be much lower.

Maintenance of the existing structures at Glenbrook Creek and Muddy Hollow Project Sites could be considered negligible in the short-term. In the long-term, high potential for catastrophic failure and severe impacts on wetlands and wetland functions would result in moderate adverse effects. At Limantour Beach Marsh, maintenance of the existing structure would be considered a long-term, minor, adverse effect on wetlands, because the effects of any catastrophic failure would be considerably less than at the other two Project Sites.

Alternative 3 - Contribution to Cumulative Effects on Wetlands

In combination with activities proposed under other projects within the Seashore and vicinity, maintenance of the existing structures would have a short-term, adverse, negligible effect on wetlands within PRNS and adjoining coastal areas. However, the possible catastrophic failure of at least two of the structures proposed for removal (Glenbrook Creek crossing, Muddy Hollow dam would potentially result in minor adverse cumulative impacts in the long term.

Alternative 3 - Conclusion on Effects on Wetlands

Overall, the No Action Alternative would have adverse, negligible impacts in the short-term and localized minor to moderate, adverse impacts on wetlands and wetland functionality in the long-term. The severity of impact for each Project Site depends to a large degree on the potential for and consequences of catastrophic failure of the existing infrastructure. Limantour Beach Marsh has the lowest potential for catastrophic failure of the culverted berm, and failure would have the least impact on Project Site and downstream and upstream wetlands. Conversely, the potential for catastrophic failure, and associated impacts are much higher at Glenbrook Creek and Muddy Hollow, and should these structures fail, these and adjoining areas would be likely to incise and thereby cause more extensive losses of wetlands and wetland functions.

The No Action Alternative would not result in impairment to Park wetland resources.

Table 4.29 Alternative 3: Effect on Wetland Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Section 401 regulated wetlands	No effect	Minor adverse
	CCC Regulated Wetlands	Negligible adverse	Minor adverse
	NPS DO-71 Wetlands	Negligible adverse	Minor adverse
	Wetland Functionality	Negligible adverse	No effect
	Cumulative effects	No effect	Minor adverse
Muddy Hollow Pond	Section 401 regulated wetlands	No effect	Moderate adverse
	CCC Regulated Wetlands	Negligible adverse	Moderate adverse
	NPS DO-71 Wetlands	Negligible adverse	Moderate adverse
	Wetland Functionality	Negligible adverse	Moderate adverse
	Cumulative effects	No effect	Minor adverse
Glenbrook Crossing	Section 401 regulated wetlands	No effect	Moderate adverse
	CCC Regulated Wetlands	Negligible adverse	Moderate adverse
	NPS DO-71 Wetlands	Negligible adverse	Moderate adverse
	Wetland Functionality	Negligible adverse	Moderate adverse
	Cumulative effects	No effect	Minor adverse
All Sites	Cumulative effects	No effect	Minor adverse

Effects on Special Status Species

Federal and State Guidance. NPS Management Policies (NPS, 2000) provide a higher level of protection for animal species listed as threatened or endangered by the Federal Endangered Species Act: "The National Park Service will identify and promote the conservation of all federally listed threatened, endangered, or candidate species within Park boundaries and their critical habitats... The National Park Service also will identify all state and locally listed threatened, endangered, rare, declining, sensitive, or candidate species that are native to and present in the Parks, and their critical habitats... All management actions for protection and perpetuation of special status species will be determined through the Park's resource management plan."

Additionally, Park managers are to ensure that Park operations do not adversely impact endangered, threatened, candidate, or sensitive species and their critical habitats, within or outside the Park and must consider federal and state listed species and other special-status species in all plans and NEPA documents (NPS-77 Natural Resource Management Guidelines).

The Federal and California State Endangered Species Acts (ESAs) define the plant and animal species that are to be especially protected due to their imperiled status. These mandates list the protected animals as threatened or endangered, and protect habitat necessary to their continuance. The acts are administered by:

- The U.S. Fish and Wildlife Service (Federal ESA, terrestrial and freshwater species),
- The National Oceanic and Atmospheric Administration's Marine Fisheries Service (Federal ESA, marine and anadromous fishes), and
- The California Department of Fish and Game (California ESA).

The Federal and California State Endangered Species Acts categories for special-status species defined below in Table 4.30.

Table 4.30 Federal and California State ESAs Definitions

***Federal endangered**:* Any species that is in danger of extinction throughout all or a significant portion of its national range.
Federal threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its national range.
California endangered: Any species that is in danger of extinction throughout all or a significant portion of its range in the state.
California threatened: Any species that is likely to become an endangered species with the foreseeable future throughout all or a significant portion of its state range.
California rare (plants only): A native plant that, although not currently threatened with extinction, is present in small numbers throughout its range, such that it may become endangered if its present environment worsens.

Furthermore, the Federal Endangered Species Act may specify *critical habitat* – habitat necessary for the survival of a listed species, subspecies, or population – and may limit human activities in these designated areas.

The Federal Endangered Species Act requires federal agencies to consult with the USFWS before taking actions that (1) could jeopardize the continued existence of any federally listed plant or animal species (e.g., listed as threatened or endangered) or species proposed for listing, or (2) could result in the destruction or adverse modification of critical or proposed critical habitat. The USFWS provided upon request a list of species that must be considered for this document.

Under the National Environmental Quality Act, PRNS is required to consider whether an action may violate federal, state, or local laws or requirements imposed for the protection of the environment. For this reason, species listed under the California Endangered Species Act (i.e., those considered endangered or threatened) by the California Department of Fish and Game are included in this analysis. Species proposed for listing in either of the two categories are also included.

The Federal Migratory Bird Treaty Act enacts the provisions of treaties between North American and European countries. Over 800 bird species are protected under the legislation. It mandates federal agencies to consider impacts to protected breeding birds during implementation of projects on Federal lands, including disruption to nesting and egg-laying activities.

Local and Non-Governmental Guidance. The California Native Plant Society (CNPS) lists plant species which merit special protection but which may or may not appear on Federal and California Endangered Species lists. PRNS considers impacts to CNPS-listed species when undertaking a construction or restoration project. The Seashore also recognizes a number of species as locally rare or of special concern, even though they are not officially listed. Species in these categories, as well as those listed by the Federal of California ESAs, are collectively referred to in this document as "special-status species."

The Federal and California State Endangered Species Acts categories for special-status species are defined in Table 4.31.

Table 4.31 California Native Plant Society Definitions

CNPS List 1A:	Presumed Extinct in California
CNPS List 1B:	Rare or Endangered in California and Elsewhere
CNPS List 2:	Rare or Endangered in California, More Common Elsewhere
CNPS List 3:	Need More Information
CNPS List 4:	Plants of Limited Distribution

Assessment Methods

Point Reyes National Seashore supports 27 federally protected species. Within the Project Areas of the Coastal Watershed Restoration – Geomorphic Restoration Project special status species are known to occur, including:

- Coastal California steelhead (*Oncorhynchus mykiss,* federally listed Threatened Species; FT)
- Essential Fish Habitat for coho salmon (*Oncorhynchus kisutch*; federally listed Threatened Species; FT).
- California red-legged frog (*Rana aurora draytonii,* federally listed Threatened Species; FT)
- Critical Habitat for the California red-legged frog
- Western snowy plover (*Charadrius alexandrinus nivosus;* federally endangered Species; FE)

- Breeding habitat for listed neotropical migrant bird species and habitat protected through the Neotropical Migratory Bird Act.

Baseline conditions of these species and their habitat has been identified based on a combination of literature review and field surveys. Fieldwork included:

Reconnaissance-level surveys to assess the suitability of habitat in and adjacent to the Project sites for use by common and special-status wildlife species, wetland delineation and special-status plant species (Parsons and Allen *numerous)*, and California red-legged frog surveys (Fellers and Guscio 2002)

Potential effects of the proposed action on special-status species was assessed qualitatively, based on the professional judgment of PRNS employees in light of existing environmental conditions and familiarity with similar, completed projects. Temporary, construction-related effects are distinguished from long-term effects related to post-restoration adjustments in habitat patterns. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.32.

Table 4.32. Descriptors for Special Status Species

Type of Effect	Beneficial: the proposed action would improve habitat for a special-status plant or animal, and protect and/or restore the natural abundance and distribution of a special-status plant or animal species Adverse: the proposed action would degrade habitat for a special-status plant or animal, and cause a decrease in the natural abundance and distribution of a special-status plant or animal species
Duration of Effect	Short-term: effects on the habitats of special-status species would persist for two years or less; immediate changes in the abundance and/or distribution of special-status species may occur during the construction period, but a return to original conditions would be expected within two generations of that species Long-term: effects on the habitats of special-status species would persist for two years or more beyond the construction period; changes in the abundance and/or distribution of special-status species would continue beyond two generations of that species
Intensity of Effect	Negligible: the proposed action would not measurably alter habitats for special-status species, or create a measurable difference in the distribution and abundance of special-status species Minor: adverse effects to habitats of special-status species would be perceptible, but would be localized in extent; changes in the distribution and abundance of special-status species would be minor and restricted to the Project site Moderate: adverse effects to habitats of special-status species would be apparent and readily noticeable, but would be localized in extent; changes in the distribution and abundance of special-status species would be moderate in intensity and restricted to the Project site and sites immediately adjacent; changes in distribution and abundance of species may be permanent, unless (if adverse) actively managed Major: adverse effects to habitats of special-status species would be substantial, and would effect a significant portion of the Drakes Estero Watershed; changes in the distribution and abundance of special-status species would be substantial, and would effect a large geographic area; changes in distribution and abundance of these species is irreversible, even (if adverse) with active management.

Evaluation of Impacts

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Plants

No federally threatened or endangered plant species are identified within the project work areas.

As discussed in Chapter 3, three special-status plants have been identified as having the potential to occur at the project sites: the Point Reyes bird's-beak (FSC), fragrant fritillary (FSC), and Marin checker lily (FSC). In order to minimize potential construction-related effects on these species, a qualified botanist would survey the sites before construction begins. Where possible,

rare plant sites would be identified and construction fencing would exclude the plants from the work area. Site planning would avoid, to the greatest extent possible, impacts to these special status plant species. With these measures in place, effects should not exceed the minor level.

Over the long term, restoration would improve and/or expand habitats that may support populations of Point Reyes bird's-beak, Marin checker lily, and fragrant fritillary, including coastal salt marsh, grasslands, and scrub habitats. Consequently, the proposed action is expected to have an overall beneficial effect on these special-status plants. No mitigation is required.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Plants

The proposed restoration actions as part of the build projects would avoid direct impacts to special status plants. There are two projects identified in the cumulative effects (Table 4-1) including the Glenbrook dam and quarry restoration and Giacomini Restoration that also include habitat supporting the fragrant fritillary and Point Reyes birds-beak. The proposed activities under the build alternatives would actually expand salt marsh habitat (benefiting the Point Reyes birds-beak) which would also occur as a part of the Glenbrook Dam and Quarry Restoration and Giacomini Restoration. The cumulative impacts to special status species would be negligible adverse in the short-term, and beneficial in the long-term.

Build Alternatives' conclusions on Effects on Special-Status Plants

The project would not result in impacts to federally threatened or endangered plant species. The project would, to the greatest extent possible, avoid direct impacts to special status plants, but deconstruction activities could result in short-term minor adverse effects associated with changes to circulation and depositional patterns. The project build alternatives would result in smoothing of physical and ecological gradients, and in the long-term would result in expansion of habitat beneficial to special status plants in the area.

Alternative 1 or Alternative 2 would not result in impairment of park special-status plant species.

Table 4.33 Alternatives 1 and 2: Overall Effects on Special Status Plants

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Threatened or Endangered Plants	No effect	No effect
	FSC plants	Minor adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial

Alternative 3 – No Action

Effects on Special-Status Plants

Under the No Action alternative, there would not be any direct actions that would result in impacts to special status plant species.

Alternative 3 - Contribution to Cumulative Effects on Special-Status Plants

Alternative 3 would not contribute to cumulative impacts to special status species associated with projects identified under Table 4-1.

Build Alternatives' conclusions on Effects on Special-Status Plants

Alternative 3 would not result in impacts or impairment to special status plant species in the short-term or in the long-term.

Table 4.34 Alternative 3: Overall Effects on Special Status Plants

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Threatened or Endangered Plants	No effect	No effect

FSC plants	No effect	No effect
Cumulative	No effect	No effect

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Fishes

Coastal California steelhead (FT) are the only special-status fish species with the potential to be affected by the project. Steelhead are known to be present in the Glenbrook, Muddy Hollow, and Laguna watersheds. In order to ensure that no steelhead are not adversely affected by construction activities, a qualified biologist would monitor dewatering and would relocate any steelhead found in dewatered reaches to nearby suitable habitat, as described under *Environmental Commitments* in Chapter 2. Dewatering pump intakes would be screened to ensure that no fish are injured by pumping. Relocation would follow applicable CDFG and NOAA Fisheries guidelines. With these measures in place, minor adverse effects (likely indirect) on steelhead are possible with the capture and movement of individuals from the construction zone. Following restoration, the proposed action would have a long-term beneficial effect on steelhead, by improving inland passage and rearing habitat at Limantour Beach Marsh, Muddy Hollow, and particularly at Glenbrook Crossing.

The project area also includes areas (particularly Muddy Hollow and Limantour Beach Pond) that could support the tidewater goby (FE). The proposed restoration activities within these two areas could create or enhance habitat to support the tidewater goby. The restoration activities would not effect the species in the short term but could result in beneficial effects supporting or enhancing habitat in the long-term.

Given the similarity of the species and habitat utilization, the effects to steelhead habitat are identical to those for Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH). The more flexible life-history of steelhead trout is likely the reason that they remain in these watersheds while coho have been lost. Restoration actions would address a number of impediments to fish passage. The short-term minor adverse impacts associated with construction would result in greater available access to habitat resulting in long-term beneficial effects to EFH.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Fish

In the short-term, combined effects from the restoration actions would result in short-term minor cumulative effects. The long-term cumulative effect on special-status species is regarded as a benefit because, as identified above, all of these actions would foster a return to conditions more closely resembling the historic habitat mosaic in the Drake's Bay/Drake's Estero watershed. This would be particularly true for steelhead and potential coho, which would benefit from improvements in lagoonal/estuarine habitat and inland passage. Under either build alternative, the proposed action would be an important contributor to this beneficial effect.

In the Drakes Bay watershed, the large-scale geomorphic and hydrologic adjustments could result cumulatively in minor adverse short-term impacts to EFH within the Drakes Bay area. In the long-term, restoration of natural hydrologic process and removal of fish passage impediments would be beneficial to EFH within the Drakes Bay area.

Build Alternatives' conclusions on Effects on Special-Status Fish

Restoration actions under the build alternatives would result in increased sediment loading following deconstruction, but would restore habitat and access to habitat available to the fish in the long-term. Based on this analysis, the project build alternatives would result in short-term minor effects to special status fish (namely steelhead) and EFH within the project watersheds. The proposed actions, intended to restore hydrologic connectivity and access to the Muddy Hollow and Glenbrook watersheds would result in long-term beneficial effects to steelhead, potential coho salmon habitat, and EFH.

Alternative 1 or Alternative 2 would not result in impairment of park special-status fish species.

Table 4.35 Alternatives 1 and 2: Overall Effects on Special Status fish species

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Steelhead	Minor adverse	Beneficial
	Tidewater goby	No effect	Beneficial
	EFH	Minor adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial

Alternative 3 – No Action

Effects on Special-Status Fish

Steelhead are known to be present in the Glenbrook, Muddy Hollow, and Laguna watersheds. These species would not be directly effected under Alternative 3. The project sites pose differing conditions effecting the long-term success of steelhead.

Under no action, the habitat barrier at the Glenbrook Crossing would remain, with conditions worsening over time and posing increased potential for catastrophic failure and impacts. At Muddy Hollow and Limantour Beach marsh, the dam structures are considered impediments to fish migration from the ocean back to freshwater streams. The dams do not allow for natural salinity gradients to which the fish may adjust, rather the dams are sites where distinct and abrupt water conditions are located. This effect has been described as a physiological barrier to fish passage (SWRCB 1995). Fish that reside within Muddy Hollow pond would remain, though the habitat is not permanent, as the earthen dam would continue to degrade in the long-term.

The project area also includes areas (particularly Muddy Hollow and Limantour Beach Pond) that could support the tidewater goby (FE). The potential for restoration of these species would not likely be possible without potential restoration activities identified as Alternatives 1 and 2.

The existing structures impede access to Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH). Under no action, these impediments would remain.

In the long-term, potential for catastrophic failure of these facilities would result in moderate adverse effects as the changes to habitat evaluated under the build alternatives would be compounded by the additional sediment contained in the dam or crossing structures.

Alternative 3 - Contribution to Cumulative Effects on Special-Status Fish

In the short-term, the no action alternative would not contribute to cumulative impacts to the special status fish species and EFH. In the long-term, potential catastrophic (unplanned) failure would result in minor cumulative adverse impacts to special status fish species and EFH.

Alternative 3 - Conclusions on Effects on Special-Status Fish

Under the no action alternative, there would be no effect on special status fish species and EFH in the short term. In the long-term, the potential for catastrophic failure would result in minor to moderate adverse impacts to steelhead and EFH in the project area.

Alternative 3 would not result in impairment of park special-status fish species.

Table 4.36 Alternative 3: Overall Effects on Special Status fish species

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Muddy Hollow Pond	Steelhead	No effect	Moderate adverse

	Tidewater goby	No effect	Minor adverse
	EFH	No effect	Moderate adverse
Limantour Beach Pond	Steelhead	No effect	Minor adverse
	Tidewater goby	No effect	Minor adverse
	EFH	No effect	No effect
Glenbrook Crossing	Steelhead	No effect	Moderate adverse
	Tidewater goby	No effect	No effect
	EFH	No effect	Moderate adverse
All Sites	Cumulative	No effect	Minor adverse

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Amphibians

The only special-status amphibian likely to be affected by the proposed action is the California red-legged frog. Red-legged frogs typically aestivate during the mid-summer period and would be unlikely to use aquatic and shoreline habitat during at least the early portion of the construction window, although they might return to the area before construction was completed. If California red-legged frogs are present within the construction area during the construction period, earthwork or other activities may result in direct mortality or injury. Installation of construction fencing around sensitive habitats (see Chapter 2) would reduce potential effects on the frog by confining construction activities and traffic to the immediate construction footprint. The NPS would also have a qualified biological monitor onsite during key parts of the construction window.

In addition to the known sites, the USGS-BRD is currently surveying Wilderness sites within the Seashore, and has documented 11 sites where CRLF use was not previously documented (Fellers and Osbourn, 2004). The completion of biologic and geomorphic investigations describing factors contributing to habitat suitability and sustainability within Wilderness and other breeding habitat within the Seashore would result in the development of a prioritized list and plan to maintain the highest quality Wilderness CRLF breeding habitat.

A biological assessment (BA) is currently in preparation for the proposed action. As part of the BA process, NPS would work with USFWS to identify appropriate mitigation for adverse impacts on red-legged frogs and their habitat.

Muddy Hollow Pond

At the Muddy Hollow Pond, restoration actions would result in permanent removal of the dam facility and conversion of the pond (critical breeding habitat) to a more naturally graded tidal and freshwater marsh area. Surveys at the site (Fellers and Guscio 2002) have identified individuals using the pond, though no breeding activities or tadpoles have been observed. The pond does contain bass and trout that could be effective predators against establishment of a large population. The proposed actions at Muddy Hollow Pond may affect, and are likely to adversely affect the California red-legged frog and potential critical breeding habitat.

Limantour Beach Pond

At the Limantour Beach Pond, restoration actions would result in permanent removal of the dam facility and conversion of the pond habitat to a more naturally graded tidal and freshwater marsh area. Surveys at the site (Fellers and Guscio 2002) identified breeding actions at the pond, and estimated a total of 50 individuals using the pond. The proposed actions at the Limantour Beach Pond may affect, and are likely to adversely affect the California red-legged frog and critical breeding habitat.

As part of the proposed restoration, existing topographic depressions to the east of the existing pond would be accentuated (through excavation) to intersect the groundwater table. It has been observed that frogs using seasonally saline habitat will move to adjacent habitat when necessary.

In addition to creating appropriate water regime, the habitat enhancement would include placement or planting of pond edge plants to provide cover and structure for the frogs.

Glenbrook Crossing

At the Glenbrook Crossing site, restoration actions would result in short-term impacts to critical non-breeding habitat. The project actions would modify, but not change the long-term habitat condition at this project site. These actions may effect, but are not likely to adversely effect the California red-legged frog or its critical non-breeding habitat.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Amphibians

Some of the proposed marsh restoration activities associated with Horseshoe Pond, Giacomini Wetland, and the Coastal Restoration Project would result in the conversion of freshwater or low salinity aquatic environments to estuarine aquatic habitat. Based on field surveys projects at Horseshoe, Limantour Beach Pond, and Giacomini would result in impacts to pond habitat that are known to support the California red-legged frog. In addition, Muddy Hollow Pond is considered critical habitat, however field surveys (Guscio and Fellers 2002) documented only limited use of the pond by the CRLF.

More than 120 sites within the park have been documented to support California red-legged frog breeding. The proposed project activities would result in the conversion of two currently freshwater resources into estuarine habitat. As documented at Horseshoe Pond, the CRLF may continue to use this type of habitat, even under brackish water conditions. Cumulatively, planned projects within the park would potentially result in changes or conversion of habitat at three documented breeding habitat sites.

The cumulative impacts of activities occurring within the Drakes Bay area would result in minor adverse impacts to the California red-legged frog. This project would not jeopardize the persistence of California red-legged frogs in the project area or within the park.

Build Alternatives' conclusions on Effects on Special-Status Amphibians

The effects of changing habitat associated with the proposed restoration activities would result in localized short-term moderate adverse effects on the California red-legged frogs and the critical habitat at Limantour Beach Pond and Muddy Hollow Pond. In the long-term, enhancement actions adjacent to Limantour Beach Pond are expected to offset long-term impacts, resulting in minor adverse effects to the individuals. At the Glenbrook Crossing, non-breeding habitat would be effected, and only temporarily. The actions at Glenbrook Crossing would result in localized minor adverse effects in the short-term, with long-term beneficial effects as the system moves towards natural equilibrium. The proposed action alternatives would not result in impairment of park special-status amphibian species. The build alternatives would not jeopardize the persistence of California red-legged frogs in the project area or within the park.

Table 4.37 Alternatives 1 and 2: Overall Effects on Special Status Amphibians

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Muddy Hollow Pond	CRLF	Minor adverse	Minor adverse
	CRLF Critical Habitat	Moderate adverse	Moderate adverse
Limantour Beach Pond	CRLF	Moderate adverse	Minor adverse
	CRLF Critical Habitat	Moderate adverse	Moderate adverse
Glenbrook Crossing	CRLF	Minor adverse	Beneficial
	CRLF Critical Habitat	Minor adverse	Beneficial
All sites	Cumulative effects	Minor adverse	Minor adverse

Alternative 3 – No Action

Effects on Special-Status Amphibians

Under no action, there would not be effects to California red-legged frog or habitat as a result of direct activities at any of the project locations. In the long-term, degradation of earthen dam facilities and normal weather may result in loss of dam facilities (Muddy Hollow Pond) or intrusion of salt water flow through dune breaching (Limantour Beach Pond). Any of these potential impacts would occur in the long-term.

Alternative 3 - Contribution to Cumulative Effects on Special-Status Amphibians
In the short-term, the no action alternative would not contribute to cumulative impacts to the California red-legged frog. In the long-term, potential catastrophic (unplanned) failure would result in minor cumulative adverse impacts to these resources in conjunction with projects identified in Table 4-1.

Alternative 3 - Conclusions on Effects on Special-Status Amphibians
Under the no action alternative, there would be no effect on special status amphibians in the short term. In the long-term, the potential for catastrophic failure would result habitat loss similar to that described for the build alternatives, and therefore minor to moderate localized adverse impacts at these sites.

Alternative 3 would not result in impairment of park special-status amphibians.

Table 4.38 Alternative 3: Overall Effects on Special Status Amphibians

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Muddy Hollow Pond	CRLF	No effect	Minor adverse
	CRLF Critical Habitat	No effect	Minor adverse
Limantour Beach Pond	CRLF	No effect	Moderate adverse
	CRLF Critical Habitat	No effect	Moderate adverse
Glenbrook Crossing	CRLF	No effect	Minor adverse
	CRLF Critical Habitat	No effect	Minor adverse
All sites	Cumulative effects	No effect	Minor adverse

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Reptiles

The northwestern pond turtle (*Clemmys marmorata marmorata*) is the only special-status reptile that has been identified as having the potential to occur on or adjacent to the restoration sites. The construction period for the proposed project overlaps with the active period for northwestern pond turtle (March–October/November). Therefore, the operation of construction equipment in or adjacent to aquatic habitat that may be used by the species could result in injury or mortality of pond turtles. Actions identified in the environmental commitments, including site fencing would limit the potential for direct impacts to the pond turtles. The deconstruction activities would result in changes to the existing habitat and are considered a localized moderate adverse effect at Muddy Hollow Pond and Limantour Beach Pond in the short-term.

Over the long term, the shift in habitat patterns anticipated as a result of restoration would result in a loss of habitat for northwestern pond turtle, most notably at Muddy Hollow Pond. These changes would result in minor adverse effects on the turtle in the long-term.

There is not likely an effect on the turtle as a result of activities at the Glenbrook Crossing site.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Reptiles
The northwestern pond turtle has been documented in many park ponds including both brackish and freshwater conditions. Northwestern pond turtles are known to occur in aquatic habitats that range in salinity content from fresh to brackish to seawater. Turtles typically nest in grassy upland areas adjacent to ponds. The operations associated with the pond deconstruction could result in indirect impacts to the turtle. The deconstruction activities, in combination with actions at the Horseshoe Pond restoration site represent minor adverse cumulative impacts in short term. As habitat stabilizes, there would likely be some, though reduced use in association with the restored habitat, resulting in long-term negligible adverse cumulative effects on special status reptiles.

Build Alternatives' conclusions on Effects on Special-Status Reptiles
The build alternatives would result in indirect impacts on the northwestern pond turtle through changes in habitat at Muddy Hollow and Limantour Beach Pond. These changes represent a localized moderate adverse impact in the short-term and minor adverse impacts in the long-term within the project area. The project actions at Glenbrook Crossing would not effect the northwestern pond turtle.

Alternative 1 or Alternative 2 would not result in impairment of park special-status reptile species.

Table 4.39 Alternatives 1 and 2: Overall Effects on Special Status Reptiles

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Muddy Hollow Pond	Northwestern Pond Turtle	Moderate adverse	Moderate adverse
Limantour Beach Pond	Northwestern Pond Turtle	Moderate adverse	Moderate adverse
Glenbrook Crossing	Northwestern Pond Turtle	No effect	No effect
All Sites	Cumulative effects	Minor adverse	Negligible adverse

Alternative 3 - No Action

Effects on Special-Status Reptiles

The northwestern pond turtle is the only special-status reptile that has been identified as having the potential to occur on or adjacent to the restoration sites. Under no action, there would be no direct effects to special status reptile species. In the long-term, potential failure of facilities (particularly Limantour Beach Pond and Muddy Hollow Pond) could result in minor impacts to the potential habitat and use by the northwestern pond turtle.

Alternative 3 - Contribution to Cumulative Effects on Special-Status Reptiles
The northwestern pond turtle (*Clemmys marmorata marmorata*) has been documented in many park ponds including both brackish and freshwater conditions. Northwestern pond turtles are known to occur in aquatic habitats that range in salinity content from fresh to brackish to seawater. Turtles typically nest in grassy upland areas adjacent to ponds. In the short-term, Alternative 3 would not result in cumulative impacts to special status reptiles. In the long-term, the potential for catastrophic failure could result in minor adverse cumulative impacts on special status reptiles.

Alternative 3 - Conclusions on Effects on Special-Status Reptiles
In the short-term the no action alternative would not result in direct or indirect impacts on the northwestern pond turtle within the project area. In the long-term, potential catastrophic failure could result in minor long-term impacts to the special status reptile species. The project actions at Glenbrook Crossing would not effect the northwestern pond turtle.

Alternative 3 would not result in impairment of park special-status reptile species.

Table 4.40 Alternatives 3: Overall Effects on Special Status Reptiles

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Muddy Hollow Pond	Northwestern Pond Turtle	No effect	Minor adverse
Limantour Beach Pond	Northwestern Pond Turtle	No effect	Minor adverse
Glenbrook Crossing	Northwestern Pond Turtle	No effect	No effect
All Sites	Cumulative effects	No effect	Minor adverse

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Birds

With the concern about western snowy plover and migratory bird nesting disturbance in mind, NPS would not initiate construction until August 1. Surveys would be conducted at sites where construction may be initiated prior to August 1 to verify that no late-nesting birds are present on or immediately adjacent to the restoration sites. Surveys would be conducted by a qualified biologist and would use approved methods. If nesting migratory birds or active nests are identified during the surveys, NPS would delay the onset of construction at the affected site until the young have fledged and left the nest.

Only one site, the Limantour Beach Pond is near beach that would be used by the plovers for nesting. Limantour Beach Pond and Muddy Hollow Pond are near marsh habitat that plovers could use for foraging activities in the fall. SNPL surveys extend to mid-September. Since 2000, no SNPL have been observed nesting on the Limantour Beach Area. Before initiating work at the Limantour Beach Project site, a biological monitor would walk the site prior to starting equipment to insure that there are no feeding plovers at the site.

However, several special-status bird species may use habitats at the restoration sites, including the tricolored blackbird, osprey, salt marsh common yellowthroat, and California black rail. Noise, vibration, visual, and proximity-related disturbances associated with construction could adversely affect any of these species. The principal concern in this regard would be the potential for disruption of nesting; disturbance of nesting pairs can cause them to abandon their young, reducing breeding success. At other times, these species are highly mobile and would be expected to relocate if disturbed. With the concern about nesting disturbance in mind, NPS would not initiate construction until August 1, after the close of the migratory bird nesting period. Surveys would be conducted at sites where construction would be initiated prior to August 1 to verify that no late-nesting birds are present on or immediately adjacent to the restoration sites (see Chapter 2). Surveys would be conducted by a qualified biologist and would use approved methods. If nesting migratory birds or active nests are identified during the surveys, NPS would delay the onset of construction at the affected site until the young have fledged and left the nest. With these environmental commitments in place, negligible adverse effect on special-status birds is expected during construction. No effects would likely occur in the long-term.

Key long-term effects on bird habitat, including habitat used by special-status birds, are discussed above in *Effects on Vegetation and Wildlife*.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Birds

The proposed build alternatives would be conducted after the breeding season for special status birds has concluded. This would avoid direct cumulative impacts to potential special status bird species in the project area. As a result, this project in combination with those identified in Table 4-1 would result in negligible short-term cumulative effects, and no effect in the long-term.

Build Alternatives' conclusions on Effects on Special-Status Birds

Analysis of Alternatives 1 and 2 indicates that there would not be impacts to bird reproduction and nesting, associated with project construction window. For resident birds, construction noises would persist for a period of 2-3 weeks at each site, but construction would avoid direct impacts. Standard mitigations to avoid impacts to the western snowy plover would include morning surveys adjacent to the work area. If snowy plovers are encountered, equipment would not be started until after the plovers fly away from the area.

The project would result in negligible short-term effects on special status birds, and as a result of restoration of marsh habitat at Limantour Beach Pond and Muddy Hollow, potential black rail, salt marsh common yellowthroat, and sora habitat would expand in the local area. The long-term effects therefore would be beneficial to the special status bird species and their habitat. Because of the timing of the project, the actions at Glenbrook crossing would not result in impacts to special status bird species in the short or long-term.

Alternative 1 or Alternative 2 would not result in impairment of park special-status bird species.

Table 4.41 Alternatives 1 and 2: Overall Effects on Special Status Birds

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Federal T&E birds	Negligible adverse	No effect
	Special status birds	Negligible adverse	No effect
	Cumulative	Negligible adverse	No effect

Alternative 3 - No Action

Effects on Special-Status Birds

Under no action, there would not be impacts to special status birds as a result of construction activities. In the long-term, there is potential for these facilities to fail, unexpectedly and catastrophically. These uncontrolled failures could result in minor adverse impacts to the habitat (riparian and marsh) that supports a variety of special status bird species.

Alternative 3 - Contribution to Cumulative Effects on Special-Status Birds

The no action alternative would not contribute to short-term cumulative effects to special status bird species. In the long-term, unplanned, catastrophic failure could result in negligible cumulative adverse impacts to the habitat supporting special status bird species.

Alternative3 - Conclusions on Effects on Special-Status Birds

Analysis of Alternatives 3 indicates that there would not be impacts to bird reproduction and nesting as the result of construction activities. In the long-term, the potential for catastrophic failure would result in minor impacts to the habitat of special status bird species.

Alternative 3 would not result in impairment of park special-status bird species.

Table 4.42 Alternative 3: Overall Effects on Special Status Birds

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Federal T&E birds	No effect	Minor adverse
	Special status birds	No effect	Minor adverse
	Cumulative	No effect	Negligible adverse

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Mammals

The Point Reyes mountain beaver is the only special-status mammal that has been identified as having the potential to occur in the vicinity of the project sites; the species is known to use colluvial hollows in the project watersheds. However, the Limantour Beach Marsh, Glenbrook Crossing, and Muddy Hollow sites are not in areas considered suitable habitat for the mountain beaver. There is potential that the trail reroutes associated with both Muddy Hollow and Glenbrook crossing would cross colluvial hollows providing potential habitat. In order to avoid disturbance of mountain beavers during construction at the higher-elevation Glenbrook Crossing site, a qualified biologist would perform preconstruction surveys for the species in the vicinity of these routes. If individuals of the species are found, NPS staff would identify a suitable route within the general area to avoid direct impacts to the habitat. With this measure in place, short-term effects on the Point Reyes mountain beaver would be negligible.

The proposed action would have no long-term effect on the Point Reyes mountain beaver or its habitat.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Mammals

The cumulative impacts on special status mammals would not result in any additional impacts to special status mammals, particularly the Point Reyes Mountain Beaver. Negligible cumulative short-term effect on special-status mammals may occur.

Build Alternatives' conclusions on Effects on Special-Status Mammals

The build alternatives would result in the potential for indirect impacts, and would be negligible in the short term, but in the long-term no effect on Point Reyes mountain beaver is likely. Alternative 1 or Alternative 2 would not result in impairment of park special-status mammal species.

Table 4.43 Alternatives 1 and 2: Overall Effects on Special Status Mammals

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Special status mammals	Negligible adverse	No effect
	Cumulative	Negligible adverse	No effect

Alternative 3 – No Action

Effects on Special-Status Mammals

Under no action, there would be no effects to special status mammal species in the short or long-term.

Alternative 3 - Contribution to Cumulative Effects on Special-Status Mammals

The cumulative impacts on special status mammals would not result in any short-term or long-term impacts to special status mammals, particularly the Point Reyes Mountain Beaver.

Alternative3 - Conclusions on Effects on Special-Status Mammals

The no action alternative would not result in the potential for direct or indirect impacts, and would be no effect to special status mammal species in the short or long-term. Alternative 3 would not result in impairment of park special-status mammal species.

Table 4.44 Alternative 3: Overall Effects on Special Status Mammals

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect

All Sites	Special status mammals	No effect	No effect
	Cumulative	No effect	No effect

Build Alternatives – Alternative 1 and 2

Effects on Special-Status Invertebrates

Special status invertebrate species that could occur within the project area include Myrtle's silverspot butterfly (FT) and the globose dune beetle (FSC). The project is within the range of the Myrtle's silverspot butterfly at PRNS. However, the majority of the species habitat is upland nectar and breeding host plants. Therefore, it is not anticipated that construction activities would result in the take of the species, but could result in minimal indirect habitats through the loss of habitat. The Limantour Beach Pond project site includes dune habitat that could support the globose dune beetle.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Invertebrates

The cumulative impacts on special status invertebrates would not result in any additional impacts to the myrtle's silverspot butterfly in the short or long-term. The project could affect small areas of dune habitat that could support globose dune beetle and impacts are considered minor adverse. The short-term cumulative impacts to the Myrtle's silverspot butterfly are considered to be negligible, with no effect on the species in the long-term.

Build Alternatives' conclusions on Effects on Special-Status Invertebrates

The build alternatives would result in the potential for indirect impacts, and would be minor in the short term, but in the long-term no effect on special status invertebrates is likely. For this reason, it is concluded that the proposed build actions would result in minor short-term impacts to special status invertebrate species. In the long-term, restoration of more natural conditions and processes would result in beneficial effects to special status invertebrate species, specifically the globose dune beetle.

Alternative 1 or Alternative 2 would not result in impairment of park special-status invertebrate species.

Table 4.45 Alternatives 1 and 2: Overall Effects on Special Status Invertebrates

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Special status invertebrates	Negligible adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial

Alternative 3 - No Action

Effects on Special-Status Invertebrates

Under no action, there would be no short or long-term effects on special status invertebrate species as a result of direct action.

Build Alternatives' Contribution to Cumulative Effects on Special-Status Invertebrates

Under no action, there would be no cumulative short or long-term effects on special status invertebrate species as a result of direct action

Build Alternatives' conclusions on Effects on Special-Status Invertebrates

Under no action, there would be no short or long-term effects on special status invertebrate species as a result of direct action

Alternative 3 would not result in impairment of park special-status invertebrate species.

Table 4.46 Alternative 3: Overall Effects on Special Status Invertebrates

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Special status invertebrates	No effect	No effect
	Cumulative	No effect	No effect

4.4 Effects on the Social Environment

Effects on Cultural Resources

Policies and Regulations

Overview

Federal Agencies are mandated to protect cultural resources by the National Historic Preservation Act, Section 106. Although NHPA § 106 requires a slightly different impact analysis than does the National Environmental Policy Act (NEPA), compliance obligations under these two federal mandates are typically integrated into a single NEPA assessment document. These differences are described below under "Assessment Methods."

The NHPA requires that before initiating an action, the NPS must evaluate the project's potential adverse effects on resources eligible for listing on the National Register of Historic Places. In addition, the NPS must solicit comments from the Advisory Council on Historic Preservation, the California State Historic Preservation Office (SHPO), and other interested parties. The NPS and the SHPO must come to an agreement regarding mitigation for adverse effects on historic resources. This agreement must be outlined in a Memorandum of Agreement between the two agencies.

The Native American Graves Protection and Repatriation Act (NAGPRA) prescribes procedures for appropriate treatment of Native American burials and associated grave goods. These requirements have been incorporated into the mitigation measures identified in the following analysis.

In addition, NPS Director's Order #28 provides guidance for managing archeological resources, cultural landscapes, historic and pre-historic structures, museum objects, and ethnographic resources. When evaluating potential impacts to these resources, NPS managers must consider the resources' significance, context, and integrity.

NPS policy and legislation directs the agency to consult with local tribal government prior to initiating an action that may effect the human environment.

Assessment Methods

Under Section 106 of the NHPA the NPS must evaluate a project's potential direct impacts, operational impacts, and indirect impacts on cultural resources.

Direct effects are those where the actions associated with the project are the cause of the impacts.

Operational effects occur as a result of associated operations like staging.

Indirect effects are ones where the actions result in changes to local context such that cultural resources would be affected. As such, direct and operational effects for cultural resources are the equivalent of direct impacts under NEPA, while indirect effects on cultural resources correspond to indirect and cumulative impacts.

Different from NEPA, NHPA § 106 process considers only the adverse effects upon cultural resources, not potentially beneficial ones. A qualitative scale of impact intensity (negligible, minor, moderate, major) is also foreign to the Section 106 process - effects are either adverse (when the integrity of the historic property is diminished due to the undertaking) or they are not. Duration is not typically factored when assessing effects during the Section 106 process.

Cultural resources investigations performed for the proposed action included a records search, consultation with Native American representatives with interest in the project area, and field survey work. The following paragraphs provide additional detail.

To identify known cultural resources in the project area, Archaeological Services Center conducted a records search at the Northwest Information Center of the California Historical Resources Information System, housed at Sonoma State University in Rohnert Park. The records search covered the entire APE. Resources consulted included the state database of previous studies and previously recorded cultural resources sites; the NRHP; the California Register of Historic Resources; *California Historical Landmarks* (California Office of Historic Preservation 1990); *Historic Spots in California* (Hoover et al. 1990); and *Five Views: An Ethnic Historic Site Survey for California* (California Office of Historic Preservation 1988). Results were summarized in a report by Newland (2004).

In November and December of 2001, the entire APE was subjected to archaeological survey under the direction of Michael Newland from the ASC. Frank Ross of the Federated Indians of the Graton Rancheria and Mark Rudo, an NPS archaeologist, also participated in the survey. A combination of reconnaissance and intensive survey techniques was used; in particular, areas where vegetation permitted, and potentially sensitive areas, were intensively examined.

On February 18, 2003, Mark Rudo and Jessica Maxey of the NPS surveyed the reported location of CA-Mrn-236/H. Their survey covered the site location as identified by Jablonowski et al. (1999) and the surrounding area to a diameter of approximately 5 meters from the visible surface materials, and included surface scraping and random troweling to a depth of approximately 5 inches. Results of this survey are described under *Cultural Resources* in Chapter 3.

For the purpose of this evaluation, Section 106 effect categories are considered, and a qualitative scale is used to show impact intensity. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4-47.

Table 4-47. Descriptors for Cultural Resources Effects

Type of Effect	Beneficial—The proposed action would protect the significant characteristics of cultural resources from adverse effects, or would restore them to some desired condition.

	Adverse—The proposed action would result in adverse changes in the significant characteristics of cultural resources. Adverse changes may include perceptible and measurable effects, as well as imperceptible psychological or emotional effects.
Duration of Effect	Short-term—Changes would be limited to the construction period and would be reversible.
	Long-term—Changes would be permanent and irreversible.
Intensity of Effect	Negligible—The proposed action would result in barely perceptible changes in the significant characteristics of the resource.
	Minor—The proposed action would result in perceptible and measurable changes in the significant characteristics of the resource, but would affect only a small percentage of its significant characteristics, and would not reduce its interpretive potential.
	Moderate—The proposed action would result in perceptible and measurable changes in the significant characteristics of the resource, but would affect only a moderate percentage of its significant characteristics, and would not reduce its interpretive potential.
	Major—The proposed action would result in perceptible and measurable changes in a substantial proportion of the significant characteristics of the resources; the changes could or would reduce its interpretive potential.

Evaluation of Impacts

Build Alternatives

Limantour Beach Marsh

Removal of the existing crossing and southerly embankment spur and construction of a new bridge or boardwalk would occur adjacent to CA-Mrn-236/H, a prehistoric campsite and historic-period ceramic scatter (see *Cultural Resources* in Chapter 3 for a description of this feature). Disturbing or damaging CA-Mrn-236/H would represent an adverse effect on cultural resources. In order to minimize potential effects on the site, NPS archaeological staff has defined an appropriate avoidance area and would clearly delimit it with temporary construction fencing or other barriers for the duration of site preparation and construction activities. No ground disturbing work would occur within the site boundaries. With these measures in place, effects to CA-Mrn-236/H would be avoided.

Because the project area has a long history of human occupation and numerous previously recorded sites are present within a short distance of Limantour Beach Marsh, additional unknown cultural resources may be present, and could be inadvertently unearthed, damaged, or destroyed during ground-disturbing activities required for project construction. Damage to, or destruction of, previously unknown cultural resources could represent an adverse effect. To avoid or minimize any such effect, NPS would require the construction contractor to implement the following measures to protect cultural resources (See *Environmental Commitments* - Section 2.3).

With these measures in place, effects on unknown cultural resources would be mitigated to the extent feasible. In addition, because the project is focused on the removal of placed fill in historic tidal or wetland areas, the chances that additional sites would be excavated is low.

Although there are no known human burials within the immediate site vicinity, because of Point Reyes' long history of human occupation, there is some potential for ground-disturbing activities required for project construction to inadvertently unearth unknown buried human remains. Damage to, or destruction of, human remains would represent an adverse effect. To avoid or minimize effects related to disturbance of human remains, NPS would require implementation of

the following measures, as specified in the Native American Graves Protection and Repatriation Act (43 CFR, Part 10, Subpart B, Section 10.4).

With these measures in place, effects on human remains would be mitigated to the extent feasible and are expected to be minor. However, because the act of unearthing buried human remains may constitute the majority of the impact, some potential for effects of greater severity remains.

Muddy Hollow and Glenbrook Crossing

Because no known sites are present within the APE at Muddy Hollow or Glenbrook, the potential for Alternative 1 or 2 to disturb or damage cultural resources is less than at Limantour Beach Marsh. However, because of the Point Reyes area's long history of human use, unknown resources, including human burials, may be present, and disturbing or damaging such resources would constitute an adverse effect. In order to protect unknown cultural resources, NPS would implement the same measures for unknown cultural resources and human remains required (and described above) for Limantour Beach Marsh. With these measures in place, potential adverse effects on cultural resources would be mitigated to the extent feasible, and are expected to be negligible. However, because the act of unearthing buried cultural resources, particularly human remains, may constitute the majority of the impact, some potential for effects of greater severity remains.

Build Alternatives' Contribution to Cumulative Effects on Cultural Resources

Throughout coastal California, the Native American cultural legacy, including culturally important sites and traditional cultural practices, has been substantially affected by land management over the past several decades. However, consistent with NPS's vision and mission, actions listed in Table 4-1 incorporate environmental commitments (Section 2-3) to minimize their potential to contribute to this pattern of long-term loss and degradation. It is not possible to provide complete assurance that construction would not disturb unknown, buried cultural resources, but mitigation included in NPS actions provides procedures to minimize the resulting damage, consistent with applicable federal and state laws and regulations. Consequently, no cumulative short- or long-term effect on cultural resources in the Drake's Bay/Drake's Estero watershed is anticipated as a result of the actions listed in Table 4-1. No further analysis is required.

Build Alternatives' conclusion regarding Cultural Resources

Under Alternatives 1 and 2, the proposed restoration designs would avoid impacts to documented cultural resource areas. The analysis concludes that the project would result in no short-term or long-term effects on cultural resources. If operations reveal previously undocumented resources, the NPS would implement management measures described above to ensure that resources are preserved and protected in an appropriate manner. Alternative 1 or Alternative 2 would not result in impairment of park cultural resources.

Table 4.48 Alternatives 1 and 2: Overall Effects on Cultural Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Cultural resources	No effect	No effect
Muddy Hollow Pond and Glenbrook Crossing	Cultural resources	No effect	No effect
All Sites	Cumulative	No effect	No effect

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and existing management practices would continue. Ongoing maintenance activities such as road and trail repairs and maintenance would still have some potential to result in damage to unknown cultural resources

and to CA-Mrn-236/H, but this potential would remain unchanged from existing conditions. There would be no effect on cultural resources.

Contribution to Cumulative Effects on Cultural Resources

As discussed above, no cumulative short- or long-term effect on cultural resources specific to the Drake's Bay/Drake's Estero watershed is anticipated, and no further analysis is required.

No Action Alternative conclusion regarding Cultural Resources

Under Alternative 3, no action would take place within the project area therefore, no effect on cultural resources would occur as a result of this project. Alternative 3 would not result in impairment of park cultural resources.

Table 4.49 Alternative 3: Overall Effects on Cultural Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Cultural resources	No effect	No effect
	Cumulative	No effect	No effect

Effects Related to Noise

Policies and Regulations

NPS Policies

NPS Director's Order #47 addresses the problem of excessive or inappropriate levels of noise on park lands. It requires park managers to

- measure baseline acoustic conditions,
- determine which existing or proposed human-made sounds are consistent with park purposes,
- set acoustic management goals and objectives based on those purposes, and
- determine which noise sources are impacting the park and need to be addressed by management.

It also charges park managers with evaluating and addressing self-generated noise, and with constructively engaging with those responsible for other noise sources that impact parks to explore what can be done to better protect parks.

Assessment Methods

"Operation" of the restored areas, including inspection and maintenance visits, is not expected to generate substantial noise, or to materially change the level of introduced noise at the project sites by comparison with existing conditions. Consequently, analysis of project-related noise impacts focused on construction-related noise, including noise related to construction traffic and noise generated by onsite construction activities. Noise impacts were evaluated qualitatively, based on experience with similar projects in open-space settings.

Table 4-50 summarizes the descriptors used to evaluate noise-related effects.

Table 4-50. Descriptors for Noise Effects

Type of Effect	Beneficial—The proposed action would preserve or improve existing noise levels at and surrounding the project site.
	Adverse—The proposed action would increase noise levels at and surrounding the project site.
Duration of Effect	Short-term—Noise increases would be limited to the construction period.
	Long-term—Noise increases would persist after the construction period. Project operation would generate noise.
Intensity of Effect	Negligible—Noise increases would be barely perceptible, and would affect only the immediate project site.
	Minor—Noise increases would be perceptible but small, and would affect a very limited area around the project site.
	Moderate— Noise increases would be perceptible and could be annoying, or would affect a larger area.
	Major—Noise increases would be substantial or would affect a large area or population.

Evaluation of Impacts

Build Alternatives 1 and 2, All Sites

Construction required to restore the three project sites would result in temporary, intermittent increases in the level of ambient noise in areas adjacent to the sites. Because these sites—in particular Limantour Beach Marsh and Muddy Hollow—are located on heavily used recreational trails, they are frequently visited by recreators as well as park staff, and construction noise could be disruptive or disturbing to recreational use. However, the construction window would be comparatively short, and recreational access to the immediate vicinity of active restoration construction sites would be curtailed during construction, with trails temporarily closed to prevent recreational traffic to the sites. In addition, as discussed in Chapter 2, NPS is committed to implementing a number of BMPs to reduce construction noise as much as possible.

As discussed in *Biological Resources* above, noise and vibration from pile-driving is expected to be the most disruptive aspect of construction noise generation. Pile driving would be limited to a comparatively short period during the overall construction window, but could still be experienced as a localized moderate adverse impact, and could substantially detract from the recreational experience. To address this effect, NPS plans to publicize the timing of construction activity in general, and pile driving in particular, via the park website, the park newsletter, and signage at the restoration sites. With these measures in place, noise disruption from construction would be mitigated to the extent feasible, and effects are expected to be minor.

Where conversion of habitat occurs, the project would affect the long-term biophony of the area. At Muddy Hollow Pond, the conversion of a freshwater pond to intertidal marsh would result in a different species complex using the area, and thus, a change in the natural sounds produced by the wildlife. While the results of the build alternatives would result in changes to the biophony of the area, the impacts are considered negligible adverse in the short term, but a new biophony would develop at these areas following completion of the restoration, and thus, no effect in the long-term.

Build Alternatives - Contribution to Cumulative Noise Effects

To the extent that construction periods overlap, the actions listed in Table 4-1 could result in a small cumulative effect on noise levels in the Drake's Bay/Drake's Estero watershed. The actions

most likely to overlap are the Drake's Estero Road Crossing Improvements and the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. All of these actions would require earthwork, and would have the potential to increase noise levels. However, the duration of construction on the actions identified as potentially overlapping would be comparatively short, and the total number of pieces of equipment operating at one time would be extremely limited. In addition, the nature of the equipment that could be used at the Glenbrook Quarry site would be restricted by the minimum tool requirements for work in designated wilderness areas, and NPS would require contractors to adhere to noise-reduction BMPs similar to those described for the proposed action. Cumulative noise effects are thus expected to be minor, and would be of comparatively short duration. Under either build alternative, the proposed action's contribution, although potentially important relative to the overall cumulative noise effect, would nonetheless be minor, and would not require additional mitigation.

No long-term cumulative effect on noise levels in the Drake's Bay/Drake's Estero watershed has been identified. No further analysis is required.

Build Alternatives - Conclusion on Noise Effects

Under either Alternative 1 or Alternative 2, and in combination with the proposed environmental commitments, short-term adverse minor effects would occur on the natural soundscape. Following construction, no additional operations at the site would affect the soundscape, therefore there is no effect in the long-term. The action alternatives would not result in impairment of the park soundscape resource.

4.51 Alternatives 1 and 2: Overall Effects on Soundscapes

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Soundscape	Minor adverse	No effect
	Cumulative	Minor adverse	No effect

Alternative 3 - No Action

Under the No Action Alternative, no restoration would take place and existing management practices would continue, including vegetation removal at Muddy Hollow Dam. Therefore, the No Action Alternative would not affect ambient noise conditions or biophony at any of the project sites.

Contribution to Cumulative Noise Effects

Because no construction would take place under the No Action Alternative, there would be no contribution to short-term cumulative noise effects. As discussed above, no long-term cumulative noise effect has been identified for the Drake's Bay/Drake's Estero watershed, and no further analysis is required.

Conclusion on Noise Effects

Under Alternative 3 no construction would occur, therefore there would be no effect to the soundscape in both the short-term and long-term. Alternative 3 would not result in impairment of the park soundscape resource.

Table 4.52 Alternative 3: Overall Effects on Soundscapes

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Soundscape	No effect	No effect
	Cumulative	No effect	No effect

Effects on Public Health and Safety

Policies and Regulations

Dam Safety

Dam safety is overseen by the U.S. Bureau of Reclamation. On National Seashore lands, maintenance of dams is prescribed and implemented through NPS and U.S. Bureau of Reclamation inspection programs. Muddy Hollow Pond is a dam included in the NPS dam inventory and is surveyed and documented on a regular basis.

Mosquito Control and Mosquito-Borne Disease

The Marin-Sonoma Vector Control Districts (VCDs) is responsible for controlling mosquitoes as pest species and disease vectors within its jurisdiction. The VCD would not have jurisdiction on state or federal lands.

Decisions about when and how to control mosquitoes as a nuisance to human populations are undertaken at the discretion of the VCD with jurisdiction. Factors influencing the decision may include the number of service calls received from a given locality, the proximity of mosquito sources to population centers, and the density of mosquito larvae present in a mosquito production source. Once a recurring mosquito production source has been identified the VDC usually adopts a regular schedule of abatement activities.

Any proposed abatement activities by the VCD adjacent to, or on park lands would have to be coordinated through the NPS and comply with Integrated Pest Management guidelines and would likely require separate environmental compliance.

Assessment Methods

Because construction would be required to comply with applicable health and safety codes, and public access to the construction sites would be restricted, construction is not expected to affect public health or safety materially. Public health and safety analysis accordingly concentrated on long-term effects.

This analysis addressed two issues:

- current and continuing safety of the existing dam and embankment structures, and
- effects on mosquito population levels and the potential for spread of mosquito-borne diseases.

Effects on dam safety were evaluated qualitatively, based on professional judgment in light of current engineering practice. Effects on mosquito populations and mosquito-borne disease transmission were evaluated on the basis of the potential for restoration to create or expand habitats conducive to mosquito reproduction.

Table 4-53 summarizes the descriptors used to evaluate effects on public health and safety.

Table 4-53. Descriptors for Public Health and Safety Effects

Type of Effect	Beneficial—The proposed action would result in a reduction in human health or safety concerns, or would improve human health or safety.

	Adverse—The proposed action would result in additional or exacerbated public health or safety concerns.
Duration of Effect	Short-term—Effects on human health or safety would be transitory, persisting for less than 1 month, such as safety concerns related to smoke from a prescribed burn.
	Long-term—Effects on human health or safety would be lasting or permanent, such as contamination of a water source for domestic use.
Intensity of Effect	Negligible—Effects would be imperceptible or undetectable.
	Minor—Impacts would be detectable but not substantial, and would be localized, potentially affecting a only small number of persons.
	Moderate—Effects would be readily apparent and appreciable, but would not necessitate limits on activities.
	Major— Effects would be very noticeable or would necessitate limits on activities. Effects would be recognizable as clearly introducing a substantial public health or safety hazard.

Evaluation of Impacts

Build Alternatives 1 and 2, All Sites

Effects on Dam and Embankment Safety

As described in Chapter 3, no embankment safety concerns have been identified at Limantour Beach Marsh. There is some concern about the long-term stability of the embankment at Glenbrook Crossing, and the U.S. Bureau of Reclamation (USBR) has assessed the structural condition of the Muddy Hollow dam as "seriously deficient" and has suggested that "consideration should be given to deactivation." Both build alternatives would result in removal of the dam and embankment, and consequently would result in a long-term benefit to public safety. No mitigation is required.

Effects on Mosquito Populations and Mosquito-Borne Disease

At present, the existing culverted embankments at Glenbrook Crossing foster periods of extended ponding. Substantial impoundment is of course also present above the dams at Muddy Hollow and Limantour Beach Pond. Ponded areas may have some potential to support mosquito breeding, and because recreational opportunities are available at and adjacent to each site, there may be some existing risk to public health and safety due to mosquito borne-disease. However, the sites are largely exposed to the wind, and winds are often high throughout the region, probably resulting in wind-driven mixing of the ponded waters, which would limit larval survival and reduce the sites' value for mosquito productivity. The nearby Marin-Sonoma VCD does not consider the area a threat for mosquito-borne disease, and to date NPS has not identified a need for mosquito abatement at any of the sites.

Restoration would reduce ponding on all three sites. In particular, at Limantour Beach Marsh and Muddy Hollow, tidal circulation and natural mixing between salt and fresh water would be greatly improved. As a result, the potential for mosquito breeding at these sites would decrease, representing a long-term benefit to public health. No mitigation is required.

Build Alternatives' Contribution to Cumulative Effects on Public Health and Safety

No cumulative short-term effect related to public health or safety has been identified as a result of the actions listed in Table 4-1. In the long-term, removal of facilities subject to dam safety inspection and hosts to mosquito reproduction would result in beneficial cumulative effects.

Build Alternatives' conclusion on Public Health and Safety

Both Alternative 1 or Alternative 2 would result in the removal of facilities that pond water. Based on the analysis above, the action alternatives would result in short term minor impacts to public health and safety as a result of construction activities and closures, and beneficial long-term effects with the removal of these structures. Alternative 1 or Alternative 2 would not result in impairment of park public health and safety.

Table 4.54 Alternatives 1 and 2: Overall Effects on Public Health and Safety

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Dam safety	Minor adverse	Beneficial
	Mosquito effects	Beneficial	Beneficial
	Cumulative	No effect	Beneficial

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and existing management practices would continue. Although vegetation removal would continue at Muddy Hollow, the dam would remain in place, and would continue to pose a safety hazard. Mosquito breeding habitat would remain unchanged under the No Action Alternative. Consequently, there would be no effect on existing public health and safety levels under the No Action Alternative.

In the long-term, potential catastrophic failure could occur at the Muddy Hollow Pond and Glenbrook Crossing sites, which could result in increased risk to public health and safety as sites are either closed or warnings posted.

Contribution to Cumulative Effects on Public Health and Safety

No cumulative short- or long-term effect related to public health and safety has been identified as a result of the actions listed in Table 4-1. No further analysis is required.

Conclusion on Public Health and Safety

Alternative 3 would result in no effect in the short-term, and the potential for minor adverse effects to public health and safety in the long term. Alternative 3 would not result in impairment of park public health and safety.

Table 4.55 Alternative 3: Overall Effects on Public Health and Safety

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Dam safety	No effect	Minor adverse
	Mosquito effects	No effect	No effect
	Cumulative	No effect	No effect

Effects on Recreational Use

Policies and Regulations

Because the project sites are located within the Point Reyes National Seashore, recreational land uses at and near the proposed sites have been designated by the General Management Plan for the Seashore (National Park Service 1980). Key provisions include the designation of Limantour Beach as a primary beach use and access site. In addition, the Glenbrook Crossing site and the

portions of the Muddy Hollow and Estero Trails planned for realignment are located in designated wilderness areas, where uses are restricted to those considered low-impact.

Assessment Methods

Effects on recreational use and the visitor experience were analyzed qualitatively, based on NPS's understanding of current recreational use at and around the proposed restoration sites. Short- and long-term effects were addressed separately.

Table 4-45 summarizes the descriptors used to evaluate effects on recreational use and the visitor experience effects.

Table 4-56. Descriptors for Recreational Use and Visitor Experience Effects

Type of Effect	Beneficial—The proposed action would enhance visitor participation, the quality of the visitor experience, or service level.
	Adverse—The proposed action would reduce visitor participation; degrade the quality of the visitor experience; or reduce service level.
Duration of Effect	Short-term—Direct effects at any one site (such as closures) would be 90 days or less in duration and would be related to construction activities.
	Long-term—Direct effects could persist for more than 90 days at any one site.
Intensity of Effect	Negligible—The proposed action would result in little or no noticeable change in the visitor experience.
	Minor—The proposed action would result in changes in the visitor experience but would not appreciably limit or enhance critical characteristics.
	Moderate—The proposed action would change the visitor experience appreciably, such as by altering one more critical characteristics, or by appreciably reducing or increasing the number of participants.
	Major—The proposed action would eliminate or would greatly enhance more than one critical characteristic, or would greatly reduce or increase participation.

Evaluation of Impacts

Build Alternatives 1 and 2, All Sites

Short-Term Effects

Recreational opportunities at each site would be temporarily restricted during restoration construction. In particular, the trail network that serves the Muddy Hollow and Glenbrook Crossing sites would not be accessible via these sites, and beach access at Limantour would also be unavailable during the construction period. Proposed trail reroutes would also maintain access to current trails and would actually improve upon existing trail conditions. These closures would short-term and trails would be reopened for continued access to the larger trail network throughout the park following construction. Moreover, the trail network in the central portion of the Seashore would still be accessible from a number of trailheads located off of Sir Francis Drake Boulevard and Mount Vision Road. The remaining beaches throughout the park, including Point Reyes Beaches North and South, Kehoe Beach, and McClure's Beach, as well as the South access to Limantour Beach, would remain open and accessible throughout this period. Therefore, **effects on recreation during construction are considered minor,** and no mitigation is required.

Long-Term Effects

Restoration proposed for the Muddy Hollow and Glenbrook Crossing sites includes rerouting portions of the Estero and Muddy Hollow Trails, respectively. The proposed realignments have been designed to maintain or enhance the current visitor experience. Consequently, trail reroutes in and of themselves are not expected to alter the quality of the visitor experience materially. In addition, the trail reroutes would be located and constructed using recommended, sustainable trail construction techniques, resulting in a better quality trail requiring less maintenance. This is considered a beneficial effect on long-term recreational use. No mitigation is required.

As described in Chapter 2, the bridge or boardwalk proposed to replace the existing paved embankment would become a gateway access to Limantour Beach. The bridge or boardwalk would be ADA-compliant and would include safety railings, while still accommodating equestrian traffic. As such, it has been designed to offer improved safety for users, and better access for handicapped and infirm visitors, including wheelchair users. Because of these improvements in safety and accessibility, either build alternative would improve recreational opportunities and enhance the visitor experience at Limantour Beach Marsh.

Following construction, all trailheads accessed from the Limantour Beach Marsh site would still be available. The existing paved spur trail would be partially or completely removed under both build alternatives. As discussed in Visual Resources above, this would represent an aesthetic benefit to the site. There would be no impact on recreational use or access as a result of removing the spur trail, because it currently terminates at an abrupt dead end and does not provide access to any existing recreational amenities or opportunities.

Under both build alternatives, restoration at Muddy Hollow would remove the existing dam and would substantially alter habitat patterns on and adjacent to the site. The pond area now supports a large stand of riparian and freshwater marsh vegetation that provides habitat for a large variety of birds and offers outstanding opportunities for recreational birdwatching. Following project implementation, the existing impoundment would no longer be present; pond habitat would be replaced over time by stream and tidal channels with associated riparian, wetland, and floodplain habitat. As discussed in *Biological Resources* above, these changes in vegetation are expected to alter the species that may be viewed at this site. Because there are a number of other ponded freshwater bodies within the Seashore, including Laguna Pond and upper and lower Limantour Estero Ponds, where opportunities to view similar bird communities would continue to be available at the Seashore. While alternative viewing locations are present in the Seashore, access, with the exception to sites in the Olema Valley are more remote. In addition, the restored site would be inhabited by different populations of birds that would provide birdwatching opportunities. However, some birders may experience the loss of current birdwatching opportunities as an adverse effect of moderate intensity. To ensure that this concern is mitigated to the extent feasible, NPS is committed to working with the birding community to develop informational signage that explains the reasons for the change and identifies other nearby birding opportunities.

Build Alternatives' Contribution to Cumulative Effects on Recreational Use

Construction of most of the actions listed in Table 4-1 would require restriction or closure of access during all or part of the construction period. Thus, to the extent that construction periods overlap, the listed actions could affect recreational use in the Drake's Bay/Drake's Estero watershed. As identified above, the actions most likely to overlap are the Drake's Estero Road Crossing Improvements and the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. Effects could be moderate relative to the Drake's Bay/Drake's Estero watershed area, but would be minor in the larger context of the park. The proposed action's contribution would represent a substantial portion of the cumulative effect, but would be mitigated to the extent feasible by NPS's commitments to provide noticing and signage to assist park visitors in finding alternate recreational sites, and would be of limited duration. It is thus considered minor on balance, and no further mitigation is required.

As identified above, actions listed in Table 4-1 would have long-term incremental benefits for recreational use at Point Reyes, and their cumulative effect would also be beneficial. Under either build alternative, the proposed action would be a substantial contributor to this net benefit.

Conclusion on Recreational Use

Either Alternative 1 or Alternative 2 would change existing habitat features requiring new trail access corridors and shifts to current recreational uses. In the short-term, minor adverse impacts to recreation would occur as a result of temporary construction closures. In the long-term, changes to the trail network and habitat would result in new and different recreational opportunities and are considered beneficial.

Alternative 1 or Alternative 2 would not result in impairment of park recreational resources.

Table 4.57 Alternatives 1 and 2: Overall Effects on Recreational Use

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Trail Access	Minor adverse	Beneficial
	Wildlife viewing	Minor adverse	Beneficial
Muddy Hollow Pond	Trail Access	Minor adverse	Beneficial
	Wildlife viewing	Moderate adverse	Negligible adverse
Glenbrook Crossing	Trail Access	Minor adverse	Beneficial
	Wildlife viewing	No effect	No effect
All Sites	Cumulative	Minor adverse	Beneficial

Alternative 3: No Action

The No Action Alternative would include no construction activities. The sites would remain in their current condition, and recreational opportunities at all three sites would remain unchanged. There would be no effect on recreational use or the visitor experience under the No Action Alternative.

In the long-term, potential catastrophic failure would result in minor to moderate impacts similar to those discussed in the build alternative scenario. Trail closures would be longer term, with similar reroute scenarios. Wildlife viewing, specifically at Muddy Hollow, would be affected in the same manner as under the build alternatives.

Contribution to Cumulative Effects on Recreational Use

Because no construction-related closures would be necessary, the No Action Alternative would not contribute to short-term cumulative effects on recreational use. Over the long term, the dam at Muddy Hollow and the crossings at Limantour Beach Marsh and Glenbrook would continue to degrade, and would be increasingly difficult and costly to maintain. The same would be true of the trail segments slated for realignment. Consequently, the No Action Alternative could ultimately make a minor adverse contribution to an otherwise beneficial long-term cumulative effect on recreational use and visitor access.

Conclusions on Recreational Use

Alternative 3 would not result in temporary closures and therefore there would be no effect to recreational resources in the short term. In the long-term, potential failure of facilities without plans to repair or replace them would result in minor to moderate adverse impacts to recreational uses, including trail access as well as wildlife viewing.

Alternative 3 would not result in impairment of park recreational uses.

Table 4.58 Alternative 3: Overall Effects on Recreational Use

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Limantour Beach Pond	Trail Access	No effect	Minor adverse
	Wildlife viewing	No effect	Minor adverse
Muddy Hollow Pond	Trail Access	No effect	Minor adverse
	Wildlife viewing	No effect	Moderate adverse
Glenbrook Crossing	Trail Access	No effect	Minor adverse
	Wildlife viewing	No effect	No effect
All Sites	Cumulative	No effect	Minor adverse

Effects on Transportation and Traffic

Policies and Regulations

The transportation element of the Marin County Plan addresses the effect of regionally important recreational uses in West Marin on LOS along key access routes. Specifically, park visitor traffic is identified as producing congestion in excess of that expected from local land uses on Sir Francis Drake Boulevard to Point Reyes.

Assessment Methods

Analysis of effects on traffic and transportation concentrated on road traffic, because Point Reyes National Seashore is not directly served by air, rail, or mass transit. Traffic effects were evaluated qualitatively, based on professional judgment in light of current understanding of likely restoration construction scenarios and visitor use in and around the restoration areas.

Analysis of traffic effects assumed that visitors access the Seashore by car, and that park facilities are primarily used by day visitors, with a small percentage of visitors overnighting at park campgrounds, and larger groups overnighting at other local accommodations. NPS's understanding is that most park users do not plan the trip prior to arrival.

Table 4-59 summarizes the descriptors used to evaluate effects on traffic.

Table 4-59. Descriptors for Traffic Effects

Type of Effect	Beneficial—The proposed action would improve traffic flow in the project area.
	Adverse—The proposed action would contribute to traffic congestion, would degrade level of service at roadways or intersections, or would result in demand for parking in excess of available supply.
Duration of Effect	Short-term—Effects would be limited to the construction period.
	Long-term—Effects would persist following the completion of construction.
Intensity of Effect	Negligible—Effects would be barely perceptible, or would be restricted to a very limited area. No applicable level of service standards would be exceeded.
	Minor—Effects would be noticeable but would be limited in severity and/or areal extent. No applicable level of service standards would be exceeded.

Moderate—Effects would be very noticeable or would affect a wide area. Applicable level of service standards could be exceeded.

Major—Level of service would be substantially degraded, or parking supply would be substantially exceeded. Applicable level of service standards would be exceeded.

Evaluation of Impacts

Alternative 1: Full-Build Approach—All Sites (Preferred Alternative at Limantour Beach Pond and Muddy Hollow Pond sites)

Effects During Construction, Alternative 1

During construction, effects on traffic flow could result from

- delivery and removal of heavy equipment to sites for earthwork,
- delivery of construction materials to the sites,
- removal of demolition debris (e.g., concrete riprap and other imported materials), and
- construction worker commute trips.

NPS has committed to ensuring that construction worker parking is managed such that there is no effect on visitor or emergency vehicle access.

Earthwork equipment (scraper, backhoe, etc.) would be trailered to the construction sites, and would then be staged onsite. Equipment mobilization and demobilization is expected to generate a maximum of about 10 trips per site (5 pieces of heavy equipment, round trip). Additional haul truck trips would be required to delivery construction materials for each site.

Equipment deliveries would use US-101 to Point Reyes-Petaluma Road to access the Point Reyes area, and the presence of large, slow-moving semi-trailers required to haul heavy earthwork equipment would be an annoyance and a potential safety hazard in heavy morning or evening commute traffic. Similar concerns could apply to materials haul trucks. To address this issue NPS intends to require the contractor to schedule equipment mobilization and demobilization during off-peak hours (see *Environmental Commitments* in Chapter 2).

Once within the Seashore, large, slow-moving semi-trailers could continue to temporarily obstruct traffic, creating potential hazards for park visitors. Safety could be a concern at the Bear Valley Road/Limantour Road intersection, where visibility is limited and traffic is controlled by stop sign only. However, the effect would be constrained since equipment would be staged onsite, and equipment haulage would take place over a very limited timeframe. Hazards and frustrations would be further reduced by requiring the restoration contractor to have equipment delivered off-peak hours, when visitor use is at a minimum (see Chapter 2). Similar constraints would reduce concerns related to delivery of construction materials and offhaulage of demolition debris. To allow adaptive management of traffic concerns, NPS would also require the Project Manger to notify NPS's ranger dispatch to inform them of equipment delivery date(s) and time(s), allowing them to monitor effects on traffic. If needed, delivery and demobilization schedules as well as the timing of materials delivery and debris removal can be modified based on feedback received.

With the environmental commitments identified above in place, effects on traffic flow during construction are not expected to exceed a minor level.

Construction workers would likely drive their own vehicles to the sites each day, so worker access would slightly increase traffic on Limantour Road, Bear Valley Road, and the regional access routes. The maximum number of workers expected per site is about 10; if all sites were under construction at the same time, a maximum of 60 additional trips per day (30 round trips per day) would be generated. This is not expected to result in any adverse affect on the quality of the visitor experience, hinder Seashore maintenance activities, or interfere with emergency response.

Construction workers would park their vehicles in the existing Limantour parking lot during restoration at Limantour Beach Marsh and Muddy Hollow. As described in *Recreation* above, this area would be closed during restoration, so construction worker parking is not expected to interfere with visitor use. Similarly, because ample parking is available in the Limantour lot, construction worker parking is not expected to affect Seashore maintenance activities or emergency response in the Limantour Beach/Muddy Hollow area.

During restoration at the Glenbrook Crossing site, construction workers would park their vehicles in the small existing Muddy Hollow Trailhead parking lot off of Limantour Road. This lot has ample capacity to accommodate the small number of workers expected at the site, and as described in *Recreation* above, the trailhead would be closed during restoration, so no effect on visitor use is anticipated as a result of construction worker parking. As described in Chapter 2, NPS would require that the contractor guarantee open access for emergency vehicles via the Muddy Hollow Road trailhead. In addition, NPS would require the contractor to shuttle workers to the active Glenbrook Crossing restoration site in order to minimize vehicle trips through the Wilderness. To ensure that construction access does not adversely affect Muddy Hollow Creek, a temporary construction crossing would be installed where the trail crosses the drainage and would remain in place for the duration of construction at the Glenbrook site.

With these environmental commitments in place, negligible adverse effect on parking availability or visitor access is expected during construction.

Long-term Effects, Alternative 1

Following restoration, visitor use and access would be restored. Visitor use is not expected to change, and maintenance activities in the vicinity of the restoration sites would be reduced at all sites except Limantour Beach Marsh. The principal potential for effects on traffic in the period following restoration would be associated with site monitoring and maintenance visits to the restoration sites themselves. Both monitoring and site maintenance visits would occur regularly but infrequently during the week, and would not increase traffic above existing levels. The restoration activities would not result in long-term effects to traffic.

Alternative 1 Contribution to Cumulative Effects on Transportation & Traffic

As identified above, of the actions listed in Table 4-1, those with construction periods most likely to overlap are the Drake's Estero Road Crossing Improvements, and the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. During the overlap between construction periods, a short-term minor cumulative effect on traffic flow along access routes to the Seashore is possible, as is a minor adverse effect on traffic flow on Seashore roadways. No cumulative effect on visitor parking availability or emergency vehicle access is expected.

Under Alternative 1, the proposed action's contribution any cumulative effect that were to occur would be an important proportion of the net effect. Proposed best management practices to reduce the proposed action's effect on traffic to the extent feasible would be followed. The duration of any such contribution would be very limited, and its intensity would be minor; no additional mitigation is required.

No long-term cumulative effect on traffic has been identified as a result of the actions listed in Table 4-1. No further analysis is required.

Alternative 1 Conclusion on Transportation and Traffic

Alternative 1 would result in short-term minor adverse effects to traffic during the period of construction. However, once construction is completed, the resulting restoration is not expected to change the traffic loading patterns to or within the park, therefore no long-term effects would occur to traffic.

Alternative 1 would not result in impairment to park resources as a result of traffic.

Table 4.60 Alternative 1: Overall Effects on Traffic and Transportation

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Traffic	Minor adverse	No effect
	Parking	Negligible adverse	No effect
	Cumulative	Minor adverse	No effect

Alternative 2: Partial-Build Approach (Preferred Alternative at Glenbrook Crossing)

Effects During Construction, Alternative 2

As with Alternative 1, the greatest potential for effects on traffic flow as a result of Alternative 2 restoration activities at all three sites would be associated with delivery of heavy equipment to sites for earthwork, delivery of construction materials to the sites, removal of demolition debris (e.g., concrete riprap and other imported materials), and construction worker commute trips.

Construction worker parking could also affect visitor and emergency vehicle access.

Equipment mobilization would be the same in Alternative 2, as Alternative 1, however, the phased implementation at Muddy Hollow would require another round of mobilization and demobilization the following construction year.

Trip generation under Alternative 2 would be similar to that expected under Alternative 1, and is not expected to result in any adverse affect on the quality of the visitor experience, hinder Seashore maintenance activities, or interfere with emergency response.

With the environmental commitments identified above in place, effects on traffic flow during construction are not expected to exceed a minor level.

As with Alternative 1, because ample parking is available in the Limantour lot, construction worker parking is not expected to affect Seashore maintenance activities or emergency response in the Limantour Beach/Muddy Hollow area during construction of Alternative 2. With these environmental commitments in place, negligible short-term adverse effects on parking availability or visitor access is expected during construction.

Long-term Effects, Alternative 2

As with Alternative 1, visitor use and access would be restored following construction under Alternative 2. Visitor use is not expected to change postrestoration, and long-term maintenance needs in the vicinity of the restoration sites would be reduced at all sites except Limantour Beach Marsh. The principal potential for effects on traffic in the period following Alternative 2 restoration would be associated with monitoring and maintenance visits to the restoration sites themselves. Both monitoring and site maintenance visits would occur regularly but infrequently during the week, and would not increase traffic above existing levels. The restoration activities would not result in long-term effects to traffic.

Alternative 2 Contribution to Cumulative Effects on Transportation & Traffic

As identified above, of the actions listed in Table 4-1, those with construction periods most likely to overlap are the Drake's Estero Road Crossing Improvements, and the Glenbrook Dam and Quarry Restoration Project, together with the proposed action. During the overlap between construction periods, a short-term minor cumulative effect on traffic flow along access routes to the Seashore is possible, as is a minor adverse effect on traffic flow on Seashore roadways. No cumulative effect on parking availability or emergency vehicle access has been identified.

As described for Alternative 1, the proposed action's contribution any cumulative effect that were to occur would be an important proportion of the net effect. Proposed best management practices to reduce the proposed action's effect on traffic to the extent feasible would be followed. Thus, the duration of any such contribution would be very limited, and its intensity would be minor; no additional mitigation is required.

No long-term cumulative effect on traffic has been identified as a result of the actions listed in Table 4-1. No further analysis is required.

Alternative 2 Conclusion on Transportation and Traffic

Alternative 2 would result in short-term minor adverse effects to traffic during the period of construction, but would include 2 construction years rather than one (Muddy Hollow phasing). However, once construction is completed, the resulting restoration is not expected to change the traffic loading patterns to or within the park, therefore no long-term effects would occur to traffic.

Alternative 2 would not result in impairment to park resources as a result of traffic.

Table 4.61 Alternative 2: Overall Effects on Traffic and Transportation

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Traffic	Minor adverse	No effect
	Parking	Negligible adverse	No effect
	Cumulative	Minor adverse	No effect

Alternative 3: No Action

Under the No Action Alternative, no restoration would take place and existing management practices, including the need for periodic trail and road closures, would continue. Traffic and emergency access in the Point Reyes area would be unaffected.

Alternative 3 Contribution to Cumulative Effects on Transportation & Traffic

Under the No Action Alternative, no construction would take place, and there would be no contribution to short-term cumulative effects on traffic.

No long-term cumulative effect on traffic has been identified. No further analysis is required.

Alternative 3 Conclusion on Transportation and Traffic

Alternative 3 would result in short-term or long-term effects to traffic. Alternative 3 would not result in impairment to park resources as a result of traffic.

Table 4.62 Alternative 3: Overall Effects on Traffic and Transportation

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Traffic	No effect	No effect

Parking	No effect	No effect
Cumulative	No effect	No effect