



Tuolumne Wild and Scenic River

Draft Comprehensive Management Plan
and Environmental Impact Statement

Yosemite National Park

National Park Service
U.S. Department of the Interior



Tuolumne Wild and Scenic River Draft Comprehensive Management Plan and Environmental Impact Statement

Volume One

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Lead Agency: National Park Service

ABSTRACT

This *Tuolumne Wild and Scenic River Draft Comprehensive Management Plan and Environmental Impact Statement* is intended to guide the management of the Tuolumne Wild and Scenic River within the boundaries of Yosemite National Park for the next 20 or more years. The plan and its draft environmental impact statement, which evaluates the potential impacts of the plan and its range of alternatives, are integrated in this document and are referred to collectively as the *Tuolumne River Plan / Draft EIS*.

The *Tuolumne River Plan* directs the protection of the river's free-flowing condition and the values that make it worthy of designation by (1) reviewing and updating river corridor boundaries and segment classifications, (2) prescribing a process for the protection of the river's water quality and free-flowing condition, (3) identifying and documenting the condition of the river's outstandingly remarkable values, (4) identifying management concerns and actions needed to address these concerns, (5) defining visitor use and user capacity for the river corridor, and (6) establishing measurable management standards for river values and a monitoring program for ensuring the standards are met over the life of the plan. The *Yosemite National Park General Management Plan* (NPS 1980b) will be revised to incorporate this direction.

The *Tuolumne River Plan / Draft EIS* presents and analyzes five alternatives. The no-action alternative would continue current management and trends in the condition of river values. Action alternatives 1-4 would protect and enhance river values by restoring ecological conditions at Tuolumne Meadows and by improving conditions that pose risks to water quality, sensitive meadows, archeological sites, scenic vistas, and recreational experiences. The alternatives differ primarily in the kinds of visitor opportunities and use levels at Tuolumne Meadows. Alternative 1 would improve opportunities for self-reliant experiences by closing the Tuolumne Meadows Lodge, reducing use levels, and eliminating all commercial services. Alternative 2 would provide opportunities for a greater diversity of day use and a modest increase in campground capacity. Alternative 3 would focus on retaining the traditional character of the visitor experience in a historic setting that would remain essentially unchanged. Alternative 4 (the preferred alternative) would retain the traditional overnight use and reorient day use to protect river values and improve opportunities for short-term visitors. All alternatives would provide for traditional cultural practices by American Indian tribes.

There will be a 60-day public comment period on the *Tuolumne River Plan/Draft EIS*. Comments are due not later than 60 days after the publication of the EPA notice in the *Federal Register*. Please refer to the project website, www.nps.gov/yose/parkmgmt/trp.htm, for the exact comment end date. Readers are encouraged to submit comments electronically through the National Park Service Planning, Environment and Public Comment system, a link to which can be found on the project website above, or directly at parkplanning.nps.gov/yose_trp. Written comments regarding this document should be postmarked by the end of the review period and directed to: Superintendent, Yosemite National Park, ATTN: Tuolumne River Plan, P.O. Box 577, Yosemite, California 95389. You may also fax your comments to 209-379-1294. Finally, to request a printed copy or CD of this document (available in limited quantity), please email Yose_Planning@nps.gov.

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- Appendix H: Ecological Restoration Planning for the Tuolumne Wild and Scenic River Comprehensive Management Plan
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- Appendix M: Cumulative Plans and Projects List
- Appendix N: Mitigation Measures Applicable to all Action Alternatives
- Appendix O: The Process Used to Develop the Alternatives

[†] Volume Three is in electronic form only, available on the Internet (and on compact disc by request).

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Executive Summary

This draft *Tuolumne Wild and Scenic River Comprehensive Management Plan and Environmental Impact Statement (Tuolumne River Plan/Draft EIS)* addresses all the elements required by the Wild and Scenic Rivers Act (WSRA) for the management of a designated river. It also analyzes these elements by following and documenting planning processes required by the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), and other legal mandates governing decision making by the National Park Service (NPS).

Readers may gain a quick summary of the proposed action by reviewing, at a minimum, the following parts of the document:

- Executive Summary
- Table of Contents (for specific sections of interest)
- Chapter 7. Alternatives for River Management: Actions Common to Alternatives 1-4
- Chapter 7. Alternatives for River Management: Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience

Readers who wish to review the plan in more depth, but who don't have time to review the entire document, will find most details related to decision making in the following chapters:

- Chapter 1. The Tuolumne Wild and Scenic River
- Chapter 2. Purpose and Need for the Tuolumne River Plan
- Chapter 5. River Values and Their Management
- Chapter 7. Alternatives for River Management (this chapter includes site plan maps for the existing conditions and alternatives 1-4)

The Tuolumne Wild and Scenic River

The Tuolumne Wild and Scenic River, designated in 1984, includes 54 miles of the Tuolumne River in Yosemite National Park, excluding the Hetch Hetchy Reservoir. The Tuolumne River originates high in the Sierra Nevada on the eastern side of Yosemite National Park and flows westward across the park for 62 miles before it continues into Stanislaus National Forest (see figure ES-1). The river has two principal sources: the Dana Fork, which drains the west-facing slopes of Mount Dana, and the Lyell Fork, which begins at the base of the glacier on Mount Lyell. The two forks converge at the eastern end of Tuolumne Meadows, one of the largest subalpine meadows in the Sierra Nevada. The Tuolumne River meanders through Tuolumne Meadows, and then cascades through the Grand Canyon of the Tuolumne before it enters the eastern end of Hetch Hetchy Reservoir (still within the park, but not part of the wild and scenic rivers system). Below O’Shaughnessy Dam, the river again is included in the wild and scenic rivers system as it continues through a low-elevation meadow and rocky gorge to the park boundary.



Figure ES-1. Tuolumne Wild and Scenic River and Vicinity.

More than 90 percent of the Tuolumne Wild and Scenic River inside Yosemite National Park flows through congressionally designated wilderness and is managed to protect wilderness qualities. In these areas, natural river-related systems are sustained by natural ecological processes, archeological and American Indian traditional cultural resources characterize the cultural landscape, and recreational opportunities are primitive and unconfined.

Tioga Road, the only park road connecting the eastern and western slopes of the Sierra, and one of only a few trans-Sierra highways, passes through Tuolumne Meadows, then parallels the Dana Fork and one of its tributaries to the top of Tioga Pass. Rustic facilities for visitors have long been located in the Tuolumne Meadows area, which is accessible from Tioga Road, and at the Glen Aulin High Sierra Camp, which is located west of Tuolumne Meadows and is accessible only by trail.

Since the early days of Yosemite National Park, visitors have valued Tuolumne Meadows for its quieter, wilder setting in contrast to the more heavily visited attractions at Yosemite Valley. Tuolumne Meadows is a popular staging area for wilderness travelers and, because of easy access by way of Tioga Road (until the road closes for winter), it is also a destination for river-related recreation that can be readily enjoyed by people of various ages and abilities.



The Tuolumne River as it leaves Tuolumne Meadows and enters the Grand Canyon of the Tuolumne, heading west.



The Tuolumne River in Tuolumne Meadows.

River Values

WSRA requires comprehensive planning for the Tuolumne Wild and Scenic River to provide for the protection of the river's free-flowing condition, water quality, and the outstandingly remarkable values that make it worthy of designation. The outstandingly remarkable values of the Tuolumne River are defined in this plan as follows:

Biological Values

- In Tuolumne Meadows, Dana Meadows, and along the Lyell Fork, the Tuolumne River sustains one of the most extensive Sierra complexes of subalpine meadows and riparian habitats with relatively high biological integrity.
- Poopenaut Valley contains a type of low-elevation riparian and wetland habitat that is rarely found in the Sierra.

Geologic Value

- Between Tuolumne Meadows and Pate Valley, the Tuolumne River demonstrates classic stairstep river morphology, repeatedly transitioning from calm stretches to spectacular cascades.

Cultural Values

- The rich archeological landscape along the Tuolumne River reflects thousands of years of travel, settlement, and trade.
- Parsons Memorial Lodge, a national historic landmark sited near the Tuolumne River, commemorates the significance of this free-flowing segment of the river in inspiring conservation activism and protection of the natural world on a national scale.

Scenic Values

- Lyell Canyon offers remarkable and varied views of lush meadows, a meandering river, a U-shaped glacially carved canyon, and surrounding peaks.
- Dana and Tuolumne Meadows offer dramatic views of a meandering river, adjacent meadows, glacially carved domes, and the Sierra Crest.
- The Grand Canyon of the Tuolumne offers views of a deep, rugged canyon with vast escarpments of granite, hanging valleys, and tall cascades of falling water.

Recreational Values

- The Tioga Road across the Sierra provides rare and easy access to high-elevation sections of the Tuolumne River through Tuolumne and Dana Meadows.
- Wilderness travelers along the Tuolumne River engage in a variety of activities in an iconic High Sierra landscape, where opportunities for primitive and unconfined recreation, self-reliance, and solitude shape the experience.

Purpose of and Need for the Plan

The NPS is considering what long-term, comprehensive guidance will best protect and enhance the 54 miles of the Tuolumne Wild and Scenic River within Yosemite National Park. The purpose of the plan, as defined by WSRA and its implementing guidance is to

- Review, and if necessary revise, the boundaries and segment classifications (as wild, scenic, or recreational) of the Tuolumne Wild and Scenic River.
- Provide a clear process for protection of the river's free-flowing condition in keeping with WSRA section 7.
- Refine descriptions of the river's *outstandingly remarkable values*, which are the unique, rare, or exemplary river-related characteristics that make the river eligible for inclusion in the national wild and scenic rivers system.
- Document the conditions of river values, including water quality, free-flowing condition, and outstandingly remarkable values.
- Identify management objectives for the river, and specific actions and/or programs that will be implemented to achieve the objectives.
- Establish a user capacity program that addresses the kinds and amounts of public use that the river corridor can sustain while protecting and enhancing the river's outstandingly remarkable values.
- Commit to a program of ongoing studies and monitoring to ensure that river values are protected and enhanced over the life of the plan.

This is the first comprehensive management plan for the portion of the Tuolumne Wild and Scenic River inside Yosemite National Park. To address this need, the NPS is issuing this plan, which will make long-term decisions about the range of different interests in and concerns about the Tuolumne River expressed by park managers, culturally associated American Indian tribes and groups, other public agencies, and the public. Since the plan's initiation in 2006, the NPS has engaged in nearly continuous outreach (more than 120 public meetings) and communication with American Indian tribes and groups, gateway communities, organizations, other land management agencies, and the general public.

A thorough, science-based examination of river values informed the actions required to protect and enhance the river as part of this *Tuolumne River Plan*. Programmatic and site-specific actions proposed in the plan will address the management concerns raised during this examination.

A key management concern within the river corridor relates to the susceptibility of the subalpine meadows to impacts associated with historic uses, including stock grazing and road building; ongoing impacts associated with heavy foot traffic and localized stock use; and potential impacts of climate change. Although the meadows remain highly productive and support a great diversity of species, they may be transitioning toward communities that tolerate drier conditions, compared to the communities believed to have existed in prehistoric times. In addition, widespread parking along Tioga Road and associated social trailing in the Tuolumne Meadows area has resulted in effects on meadow and riparian communities, archeological resources, and scenic values. Increasing visitor use in this popular area now requires the NPS to consider alternatives to the current management of allowing generally unrestricted access to the river at Tuolumne Meadows and along wilderness trails with trailheads on Tioga Road.

Overview of the Plan and Alternatives

The *Tuolumne River Plan* focuses on protecting and enhancing river values. Therefore, many of the actions that would be taken to address management concerns about those values are common to all the action alternatives. For example, a comprehensive ecological restoration program for the subalpine meadow and riparian complex is a central component of the plan that is included in all the action alternatives. The alternatives vary primarily in how they would balance the protection of river values with different kinds of visitor use and associated user capacities in the Tuolumne Meadows scenic segment and at the Glen Aulin potential wilderness addition within the Grand Canyon of the Tuolumne wild segment.

Protection and Enhancement of River Values

Free-Flowing Condition

The Tuolumne River above the Hetch Hetchy Reservoir is free flowing, and the NPS will protect its free-flowing condition by implementing a process under section 7 of WSRA to ensure that no potential water resource project within the bed and banks of the river could have a direct and adverse effect on this river value. The natural flow regime below O'Shaughnessy Dam is altered by the dam, as it was at the time of designation. The NPS will continue to work cooperatively with the San Francisco Public Utilities Commission to inform the timing, duration, and magnitude of flows that will reduce the effects of dam operations on downstream habitats. However, the Raker Act is the controlling authority over water releases from the dam. The NPS will apply the section 7 process to evaluate any potential water resource project below the dam.

NPS management concerns include the abutments of one vehicle bridge and one footbridge at Tuolumne Meadows, and a short section of boulder riprap placed along the Lyell Fork to protect the campground A-loop road from flooding. The plan calls for removal of the riprap and mitigation of the effects of the two bridges.

The amount of water withdrawn from the Dana Fork for domestic use in the Tuolumne Meadows area currently amounts to less than 10% of lowest flow. According to recent research, withdrawing this amount of water has a minimal effect on downstream aquatic habitat; however, any increase in water withdrawals could decrease wetted habitat. NPS management is also concerned about the potential for future reductions in low flows associated with climate change, in which case withdrawals at the current rate could decrease habitat. The plan calls for long-term monitoring of river flows and caps water withdrawals at no more than 10% of lowest flows. Water conservation measures, such as replacement of leaking water lines and installation of low-flow fixtures, are included in all the plan alternatives, and some alternatives would achieve additional decreases in water consumption through decreases in user capacity. If long-term monitoring detects a future decrease in river flows associated with natural cycles or climate change, those findings will trigger further decreases in water withdrawals for domestic use at Tuolumne Meadows, including reductions in the types and levels of visitor services, if necessary. The rapid retreat of the Lyell Glacier indicates that a probable loss of meltwater flows in the upper Lyell Fork will pose a challenge for river managers in the foreseeable future.

Water Quality

The Tuolumne River has exceptionally high water quality. All the measured indicators are within the NPS standards, which are considerably more protective than other federal or state standards. Although water quality is fully protected, a few risks are present within the river corridor, including an unstable road cut along Tioga Road, wastewater treatment facilities at Tuolumne Meadows and Glen Aulin, fuel storage tanks at Tuolumne Meadows, and packstock use. The plan includes actions to stabilize the road cut, to upgrade wastewater treatment facilities at Tuolumne Meadows, and to upgrade or eliminate wastewater treatment facilities at

Glen Aulin. The risks to water quality associated with the public fuel station and pack stock use will either be eliminated or reduced and mitigated, depending upon the alternative selected.

An ongoing monitoring program will continue to test for nutrients, *E. coli*, and petroleum hydrocarbons to ensure that the exceptional baseline water quality is sustained over time. Decreasing water quality for any of these indicators will trigger studies to identify the source of the concern. Depending on the source, appropriate action will be taken to address the concern prior to an adverse impact. If the concern is related to visitor use, use will be managed as needed to protect this river value.

Subalpine Meadow and Riparian Complex

At the time of designation, the portion of the subalpine meadow and riparian complex in the Tuolumne Meadows segment was likely experiencing a shift in vegetation associated with historic grazing and disruptions to meadow hydrology caused by historic road-building and drainage projects. Stresses on meadow processes are now being increased by visitor foot traffic, which is creating informal trails across the meadow and causing habitat fragmentation. These management concerns will be addressed by a comprehensive program of ecological restoration and management of visitor use and development. Ecological restoration will include actions to restore riparian vegetation along riverbanks, restore more natural meadow hydrology, and continue research into possible additional restoration of historic vegetation communities. Management of visitor use and development will include the elimination of roadside parking to reduce informal trailing and removal of facilities from riverbanks and wet areas. These actions will be expected to enhance the meadow and riparian complex and allow for its long-term management in a condition equal to or better than the management standards. (Additional management of visitor use and development to further enhance this value is explored through alternative proposals to reduce use levels, reduce development, and/or confine use to resilient areas; these alternatives are explored in chapter 7).

At the time of designation, the portions of the subalpine meadow and riparian complex in the Lyell Fork and Lower Dana Fork segments were in good condition and they remain in that condition today. Stock use has been identified as a management concern for meadow and riparian areas in Lyell Canyon. Streambank stability is a management concern in at least one location on the Lyell Fork. This concern will be addressed under the plan either by eliminating or regulating commercial stock use (both alternatives are under consideration).

An ongoing program of monitoring and continuing study will be implemented to ensure that the subalpine meadow and riparian complex is returned to good condition and remains in good condition over the life of the plan. A suite of three indicators will be used to track the health and potential for impact on this complex river value. An important part of the monitoring program will be management triggers that will identify any decline from good condition under any of the three indicators well before an adverse impact occurs. Any of these triggers would require additional action to protect the subalpine meadow and riparian complex.

Low-Elevation Riparian and Meadow Habitat

Since 1923 O'Shaughnessy Dam has influenced the magnitude, timing, duration, and frequency of river flows below the dam. Because of favorable site conditions, Poopenaut Valley continues to experience seasonal flooding and retains a rare mix of diverse riparian, wetland, and upland meadow plant communities. For reasons that are still the subject of ongoing research, some wetlands appear to be transitioning to drier upland habitat, while riparian areas appear to be expanding. The NPS is working collaboratively with the San Francisco Public Utilities Commission to scientifically inform dam releases to mitigate the impacts on natural ecological processes in Poopenaut Valley to the maximum extent possible; however, this management is constrained by the legal mandates of the commission to deliver water and power. Monitoring is ongoing to support this

collaborative effort; however, because the NPS does not have jurisdiction over the extent to which dam releases affect the ecology in Poopenaut Valley, no management standards or determinations of adverse effect or degradation have been established for this value.

Stairstep River Morphology

Stairstep river morphology is considered impervious to the intended human uses in this wild river segment. No management or monitoring is needed to protect this river value.

Archeological Landscape

At the time of designation, the known archeological resources in the river corridor were characterized as being in a generally fair condition. Since then ongoing documentation, condition assessments, and evaluation projects have expanded the body of knowledge about the importance and condition of this cultural value. Several decades of site condition assessments have found that archeological sites occurring in every river segment either have or appear to have important research potential. Almost all the archeological sites along the river and in meadows have been affected by informal trails, and many of these sites are at risk of losing some of their integrity.

Since the time of designation, the NPS adopted the Archeological Sites Management Information System (ASMIS) to support improved archeological resource protection by providing a systematic, consistent methodology for assessing archeological site condition and impacts. Based on ASMIS evaluation criteria and standards, the collective character and significance of the archeological landscape remains well within the management standard of being fully protected. However, concerns about disturbances to sites caused by foot traffic and/or potential future facility development and maintenance remain.

Under the plan, sites will continue to be monitored through the ASMIS. The potential for effects associated with visitor foot traffic will be greatly reduced by eliminating roadside parking and removing informal trails. The potential for effects associated with future facility development, repair, and maintenance will be addressed by confining actions to nonsensitive areas wherever feasible and by mitigating unavoidable effects in compliance with section 106 of NHPA. Any future downward trend in site conditions associated with human use will trigger a required management response to counteract or minimize the effect before an adverse impact occurs.

Parsons Memorial Lodge

Parson Memorial Lodge National Historic Landmark was in good condition at the time of designation and remains in good condition, with no management concerns identified. The lodge will continue to be preserved in accordance with all applicable standards, guidelines, and agreements. If future monitoring under the NPS List of Classified Structures assessment program detects deterioration or damage, repairs will be undertaken to correct the deficiency while the structure is still in an overall good condition.

Scenery through Lyell Canyon, Dana and Tuolumne Meadows, and the Grand Canyon of the Tuolumne

The scenic values across all segments are found to be within the management standard, although management concerns are present at Glen Aulin (due to the visibility, if limited, of High Sierra Camp structures from the surrounding wilderness) and in Tuolumne Meadows (due to the roadside parking and lodgepole pine encroachment into the meadows). To remedy these concerns, a variety of actions are proposed, from replacement of the Glen Aulin tents to match the surrounding landscape more harmoniously, to the elimination of roadside parking. Lodgepole encroachment will be managed according to the restoration program discussed

under “Subalpine Meadow and Riparian Complex,” above. To prevent concerns from redeveloping, the monitoring program will subject all new proposed structures to a contrast analysis, complemented by periodic monitoring, and a suite of actions to be taken should new concerns be identified.

Tioga Road Access to the River through Tuolumne and Dana Meadows

Tioga Road continues to provide access to a diversity of recreational and educational opportunities in the Tuolumne River corridor that are little changed since the time of designation. Access to the meadows and river within the Tuolumne Meadows area remains largely unrestricted, and visitors report satisfaction with their ability to go “where they want, when they want.” However, visitors also report dissatisfaction with vehicle congestion and with crowding at popular spots along the river and in the meadows. Unrestricted access also contributes to impacts on other river values, as more than a third of all visitors currently park along the road shoulder and create informal trails across the meadows and along the riverbanks to reach popular attractions.

Under the plan the roadside parking along Tioga Road will be eliminated, reducing the traffic congestion, safety hazards, and intrusion of parked cars into the viewing experience of people traveling Tioga Road. Under most alternatives the amount of designated parking would be increased, making it possible for more visitors to find a space in designated parking areas. Also, under all alternatives a visitor capacity will be enforced to protect the quality of the visitor experience from increasing congestion, as well as protecting other river values from visitor use related impacts. The day use capacity will be managed through the availability of day parking and through the capacity of the buses that serve the Tuolumne corridor, while the overnight capacity will be managed by the number of lodging units, campsites, and wilderness permits.

The effectiveness of using the day parking supply at Tuolumne Meadows to manage the day use capacity in all the river segments above Hetch Hetchy Reservoir will be monitored through an indicator that compares the number of vehicles actually parking in the Tuolumne Meadows area with the supply of designated parking provided under the plan. Additional management actions to identify issues and enforce the designated user capacity will be triggered by the exceedance of standards developed for this indicator.

Wilderness Experience along the River

At the time of designation the wild segments of the Tuolumne River offered outstanding opportunities for river-related recreation characterized by self-reliance and solitude, and those opportunities continue today. Since the 1970s an overnight zone capacity and trailhead quota system has helped protect this river value, particularly in more remote portions of the corridor. However, increasing day use on wilderness trails within the first few miles of the Tuolumne Meadows trailheads now threatens to diminish opportunities for solitude on certain trail segments. The plan will address this management concern by managing day use levels in the river corridor and by monitoring the indicator of encounters with other groups on trails, which is a widely used indicator for a quality wilderness experience. Use on wilderness trails will be managed to remain within the management standard established for this indicator, through actions that could include changes to the overnight trailhead quota system and/or the implementation of a day use trailhead quota system if determined necessary.

Overview of the Alternatives

Five alternatives (no action plus four action alternatives) under consideration in the *Tuolumne River Plan/Draft EIS* involve primarily a reasonable range of variations in visitor use and user capacity. A table comparing the user capacities of the alternatives is included at the end of this section.

No-Action Alternative

The no-action alternative would preserve and sustain wilderness character, including natural ecosystem function and opportunities for primitive, unconfined recreation, in the more than 90 percent of the river corridor that is congressionally designated wilderness. In the Tuolumne Meadows area, opportunities for day and overnight use would continue to include a range of recreational activities supported by modest commercial services and overnight camping and lodging. The existing management would perpetuate the current resource conditions and landscape character at Tuolumne Meadows and Glen Aulin.

Wild Segments

Overnight use in wilderness would continue to be managed through established wilderness zone capacities and associated overnight trailhead quotas, which currently accommodate a maximum of 400 people per night (350 in zones above Hetch Hetchy Reservoir and 50 below O'Shaughnessy Dam). The Glen Aulin High Sierra Camp would be retained at the current capacity of 32 guests. Day use in wilderness would remain unrestricted and would be expected to continue to increase. Concessioner stock day rides would continue to serve a maximum of 62 people per day. Commercial use in wilderness would continue under current management; current levels of use for guided stock trips averaged 263 person-nights per season during the years 2005 to 2009, and for guided hiking trips averaged 188 person-nights per season. Commercial users and the general public currently have equal access to backcountry overnight permits.

Scenic Segments

A full range of orientation, interpretation, and education programs would continue to be conducted at the existing visitor center, wilderness center, and Parsons Memorial Lodge, and in the field. Current commercial services (store/grill, public fuel station, mountaineering shop and school, concessioner stock day rides) would be retained at Tuolumne Meadows. The campground and Tuolumne Meadows Lodge would be retained at current capacities.

Current maximum visitor day use in the Tuolumne Meadows area and adjacent wilderness is estimated at 1,762 people at one time. (This number has been calculated from the actual day use parking counts from 2011 and the estimated maximum number of visitors arriving by bus.) Day use would be expected to continue to increase. The visitor overnight capacity at Tuolumne Meadows is 2,310 people per night: 2,034 people are accommodated in the 304 campsites and 7 group campsites in the campground, and 276 people are accommodated in the 69 guest cabins at Tuolumne Meadows Lodge.

Currently 104 NPS employees are housed at Tuolumne Meadows, although this amount of housing is inadequate to accommodate the up to 150 employees who work in the Tuolumne Meadows area on full-time or intermittent work assignments. Currently 103 concessioner employees are housed at Tuolumne Meadow.

Action Alternative 1: Emphasizing a Self-Reliant Experience

Like all alternatives, alternative 1 would preserve and sustain wilderness character, including natural ecosystem function and opportunities for primitive, unconfined recreation, in the more than 90 percent of the river corridor that is congressionally designated wilderness. In the Tuolumne Meadows area and Glen Aulin, alternative 1 would focus on restoring conditions for primitive, unconfined recreation in an undeveloped natural area. Natural river values would be enhanced by greatly reducing the footprint of development, by greatly reducing demands for water supply and wastewater treatment, and by eliminating most potential risks to water quality.

Wild Segments

All commercial use would be discontinued in wild segments of the river corridor. This would include the Glen Aulin High Sierra Camp, all concessioner stock day rides, and all commercial day hikes, overnight hikes, and overnight stock trips. All other existing activities would continue.

The day use levels along popular wilderness trails within reach of day hikes from Tioga Road would be managed to achieve no more than four encounters with other parties per hour, making them more commensurate with use levels in remote wilderness and enhancing opportunities for solitude. This encounter rate would be more protective of solitude than the standard adopted for this river value (which would be no more than 10 encounters with other groups per hour), in keeping with the greater emphasis on solitude and self-reliance under this alternative. The overnight capacity for wild segments would be retained at 400 persons per night (350 persons per night above the reservoir and 50 persons per night below the dam).

Scenic Segments

To achieve a visitor experience characterized by self-reliance and unconfined exploration, all commercial services (including the Tuolumne Meadows Lodge, store, grill, fuel station, and mountaineering shop/school), would be discontinued. The campground would be retained at a reduced capacity, and the NPS would provide minimal camper supplies at the campground office.

The maximum visitor day use above the Hetch Hetchy Reservoir (which could disperse from scenic into wild segments) would be reduced from 1,762 people at one time to a maximum of 1,021 people at one time to reduce the effects of dispersed foot traffic on sensitive resources, including meadow and riparian areas and archeological sites, and to avoid perceptions of crowding along wilderness trails close to Tioga Road trailheads. At Tuolumne Meadows, the visitor overnight capacity would be reduced from 2,310 people per night to a maximum of 1,632 people per night (the reduced capacity of the campground), to reduce demands for water supply and wastewater disposal and to allow for the restoration of the campground A-loop road nearest the river without replacing the sites in another part of the campground.

Commensurate with the reduction in visitor use levels and the discontinuation of commercial services, the number of NPS employees housed in the river corridor would be slightly reduced (from 104 to 100 employees), and almost all the concessioner housing would be removed.

Action Alternative 2: Expanding Recreational Opportunities

Like all alternatives, alternative 2 would preserve and sustain wilderness character, including natural ecosystem function and opportunities for primitive, unconfined recreation, in the more than 90% of the river corridor that is congressionally designated wilderness. In the Tuolumne Meadows area, alternative 2 would focus on facilitating resource enjoyment and stewardship by a broad spectrum of visitors, including visitors with only a short time to spend in the area. All current activities and services would be retained, and some would be expanded.

Wild Segments

All ongoing uses would continue. The Glen Aulin High Sierra Camp would be converted to a seasonal outfitter camp with no permanent facilities except a vault toilet; the camp would continue to accommodate 32 visitors per night. Maximum day use along popular wilderness trails would be limited as necessary to achieve the standard of encounters with no more than ten parties per hour, 80% of the time. The overnight quota for backpacker camping in wilderness management zones that overlap wild segments of the river corridor would be retained at 400 persons per night. Concessioner stock day rides would be reduced to a maximum of 24 people per day. Commercial use would be restricted to no more than 2 groups per wilderness management zone per night and no more than 2 day groups per trail per day (these restrictions are described more fully in chapter 7 and appendix C). Under this alternative only, limited recreational kayaking would be allowed on portions of the river; this use would be limited to 6 trips per year, with a maximum of 8 people/boats per trip, to reduce risks to visitor safety and to protect shoreline river values.

Scenic Segments

To allow for a modest expansion of opportunities for recreational use in the Tuolumne Meadows area, visitor services, facilities, and management strategies would be adjusted to direct visitors to resilient locations where they could enjoy recreational activities without adversely affecting river values. For example, rather than dispersing across the meadows, visitors would be directed from trailheads at designated parking lots to trails and boardwalks, some with fencing or other forms of delineation to discourage dispersed foot traffic through these sensitive environments; rather than picnicking informally on the banks of the river, visitors would have access to new formal picnic areas. A full range of orientation, interpretation, and education programs would be conducted, and all commercial services except the mountaineering shop would be retained. Opportunities for day visitors with only a short time to spend would be enhanced by a new day parking and picnic area near the trailhead for Parsons Memorial Lodge. The campground would be expanded and the lodge would be retained.

The maximum visitor day use above Hetch Hetchy Reservoir (which could disperse from scenic into wild segments) would be increased from an estimated 1,762 to a maximum of 1,901 people at one time. At Tuolumne Meadows, the visitor overnight capacity would be increased to 2,556 people per night: 2,280 people accommodated by the 352 campsites in the campground, and 276 people accommodated by the 69 guest tent cabins at Tuolumne Meadows Lodge.

The number of NPS employees housed in the river corridor would be increased to 174 to meet the staffing needs for visitor and resource protection, interpretive and educational services, resource management and monitoring, and maintenance under this alternative. Concessioner housing needs would remain unchanged at 103 employees.

Action Alternative 3: Celebrating the Tuolumne Cultural Heritage

Like all alternatives, alternative 3 would preserve and sustain wilderness character, including natural ecosystem function and opportunities for primitive, unconfined recreation, in the more than 90% of the river corridor that is congressionally designated wilderness. In the Tuolumne Meadows and Glen Aulin areas, alternative 3 would focus on preserving the opportunity for a classic national park experience in a historic setting. Visitors who have developed deep personal connections with these areas through repeated experiences shared among generations would continue to have these opportunities in a setting that would appear little changed over time.

Wild Segments

All ongoing uses would continue. The overnight quota for wilderness management zones that overlap wild segments of the river corridor would be retained at 400 persons per night. The Glen Aulin High Sierra Camp would be retained at a reduced capacity of 28 persons per night. Concessioner stock day rides and commercial use would be managed the same as in alternative 2, with the following exception: Commercial use would be restricted to no more than 1 group per zone per night and no more than 1 day group per trail per day.

Scenic Segments

To enhance opportunities for visitors to connect with the history and traditional uses of the Tuolumne River, the historic setting would be preserved, and use levels would be reduced to allow for a mix of traditional park programs and relatively unstructured exploration at a level that would be protective of river values. A full range of orientation, interpretation, and education programs would be conducted, and the store and grill and concessioner day rides would be retained. The campground would be retained at its current capacity, and the lodge would be retained, but at half its current capacity.

The maximum visitor day use above the Hetch Hetchy Reservoir (which could disperse from scenic into wild segments) would be reduced from 1,762 people at one time to a maximum of 1,556 people at one time. At Tuolumne Meadows, the visitor overnight capacity would be reduced to 2,170 people per night: 2,034 people accommodated by the 311 campsites in the campground, and 136 people accommodated by the 34 guest tent cabins at Tuolumne Meadows Lodge.

The number of NPS employees housed in the river corridor would be increased to 124 to meet the staffing needs for visitor and resource protection, interpretive and educational services, resource management and monitoring, and maintenance under this alternative. Concessioner housing needs would remain unchanged at 103 employees.

Action Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience

Like all alternatives, alternative 4 would preserve and sustain wilderness character, including natural ecosystem function and opportunities for primitive, unconfined recreation, in the more than 90 percent of the river corridor that is congressionally designated wilderness. In the Tuolumne Meadows area, alternative 4 would seek to balance the retention of a traditional Tuolumne experience with the need to reduce the impacts of development and an opportunity to provide a more meaningful introduction to the Tuolumne River for the growing number of short-term visitors.

Wild Segments

All noncommercial uses would continue; however, concessioner stock day rides into wilderness would be discontinued, and commercial use would be restricted to no more than 2 overnight groups per zone and no more than 2 day groups per trail per day. The overnight quota for wilderness management zones that overlap wild segments of the river corridor would be retained at 400 persons per night. The Glen Aulin High Sierra

Camp would be retained at a reduced capacity of 20 visitors per night. Maximum day use along popular wilderness trails would be limited as necessary to achieve the standard of encounters with no more than ten parties per hour, 80% of the time.

Scenic Segments

Visitor facilities would be reoriented to protect river values while generally maintaining current kinds and levels of use. A full range of orientation, interpretation, and education programs would be provided, and opportunities for day visitors to connect with the river would be improved by providing a visitor contact station, picnic area, and trail connection to the river and Parsons Memorial Lodge. Existing opportunities for traditional overnight use would be retained. In order to accommodate current use levels while protecting and enhancing recovering meadow and riparian habitats, day use would generally be confined to formally maintained trails and specific destinations.

The maximum visitor day use above the Hetch Hetchy Reservoir (which could disperse from scenic into wild segments) would increase slightly, from 1,762 people at one time to a maximum of 1,827 people at one time. At Tuolumne Meadows, the current visitor overnight capacity of 2,310 people per night would be retained: 2,034 people accommodated by the 311 campsites in the campground, and 276 people accommodated by the 69 guest tent cabins at Tuolumne Meadows Lodge.

The number of NPS employees housed in the river corridor would be increased to 163 to meet the staffing needs for visitor and resource protection, interpretive and educational services, resource management and monitoring, and maintenance under this alternative. Concessioner housing needs would remain unchanged at 103 employees.

Environmentally Preferable Alternative

The Council on Environmental Quality (CEQ) regulations implementing NEPA and the National Park Service NEPA guidelines require that “the alternative or alternatives which were considered to be environmentally preferable” be identified (CEQ Regulations, section 1505.2). Environmentally preferable is defined as “the alternative that will promote the national environmental policy as expressed in NEPA’s Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources” (CEQ 1981).

Upon full consideration of the elements of NEPA section 101, alternative 4 was determined to represent the environmentally preferable alternative for the *Tuolumne River Plan/Draft EIS*. This conclusion is analyzed in chapter 7.

Summary Comparison of Alternatives

A comparison of user capacities under all the alternatives is shown in table ES-1.

Table ES-1.
Corridorwide Comparison of Visitor Use Capacities, by Alternative

| Visitor Overnight Capacity | | | | | |
|---|--|--|--|--|--|
| River Segment | Current Overnight Visitors | Maximum Overnight Visitors, Alternative 1 | Maximum Overnight Visitors, Alternative 2 | Maximum Overnight Visitors, Alternative 3 | Maximum Overnight Visitors, Alternative 4 (Preferred) |
| Scenic Segments | | | | | |
| Tuolumne Meadows Lodge | 276 | 0 | 276 | 136 | 276 |
| Tuolumne Meadows Campground | 2,034 | 1,632 | 2,280 | 2,034 | 2,034 |
| Wild Segments | | | | | |
| Glen Aulin HSC | 32 | 0 | 32 | 28 | 20 |
| Wilderness | 400 | 400 | 400 | 400 | 400 |
| Subtotal, Overnight | 2,742 | 2,032 | 2,988 | 2,598 | 2,730 |
| Visitor Day Use Capacity | | | | | |
| River Segment | Maximum People At One Time, Based on 2011 Vehicle Count | Maximum People At One Time, Alternative 1 | Maximum People At One Time, Alternative 2 | Maximum People At One Time, Alternative 3 | Maximum People At One Time, Alternative 4 |
| Scenic Segments | | | | | |
| Access from Tuolumne Meadows (designated parking) | 986 | 796 | 1,676 | 1,331 | 1,467 |
| Access from Tuolumne Meadows (undesignated parking) | 551 | 0 | 0 | 0 | 0 |
| Access from Tuolumne Meadows (arrival by bus) | 225 | 225 | 225 | 225 | 360 |
| Access from below O'Shaughnessy Dam | 12 | 12 | 12 | 12 | 12 |
| Subtotal, Day Use | 1,774 | 1,033 | 1,913 | 1,568 | 1,839 |
| Total Visitor Overnight and Day Use People At One Time | 4,516 | 3,065 | 4,901 | 4,166 | 4,569 |
| Administrative Capacity | | | | | |
| River Segment | Maximum employees (existing) | Maximum employees, Alternative 1 | Maximum employees, Alternative 2 | Maximum employees, Alternative 3 | Maximum employees, Alternative 4 |
| Wild Segments | | | | | |
| Concessioner | 9 | 0 | 9 | 9 | 8 |
| Scenic Segments | | | | | |
| NPS | 150 | 100 | 174 | 124 | 163 |
| Concessioner | 103 | 2 | 103 | 103 | 103 |
| Total Administrative People At One Time | 262 | 102 | 286 | 236 | 274 |
| Total People At One Time | 4,778 (existing) | 3,167 (proposed) | 5,187 (proposed) | 4,402 (proposed) | 4,843 (proposed) |

Organization of this Draft Plan and Environmental Impact Statement

The information in this document is organized as follows:

Chapter 1. The Tuolumne Wild and Scenic River describes the purpose of the nation's wild and scenic rivers system and what the designation of the Tuolumne River as part of that system means in terms of river planning and management.

Chapter 2. Purpose of and Need for the Tuolumne River Plan describes the purpose and organization of the plan, the major planning issues identified during internal and public scoping, and the interrelationships with other plans and projects.

Chapter 3. Wild and Scenic River Corridor Boundaries and Segment Classifications explains the legal requirements for establishing a river corridor boundary and classifying its segments, and describes the boundary and segment classifications for the Tuolumne River in Yosemite National Park.

Chapter 4. Determination Process for Water Resource Projects explains the legal requirements for protecting the river's free-flowing condition and describes the process that will be used to fulfill that requirement.

Chapter 5. River Values and Their Management is the heart of the *Tuolumne River Plan*. The chapter presents detailed discussions of the conditions, management concerns, actions for addressing management concerns, and continuing monitoring and protective actions for each river value. The actions presented in this chapter to ensure protection of river values will be common to all alternatives.

Chapter 6. Visitor Use and User Capacity describes the process used to address the WSRA user capacity requirement. The major differences among the plan alternatives (presented in chapter 7) have to do with the kinds and amounts of use the river corridor could receive in the future. Once an alternative is selected, the decisions about visitor use and user capacity will be incorporated into this chapter.

Chapter 7. Alternatives for River Management presents the five alternatives (no action plus four action alternatives) currently under consideration in the *Tuolumne River Plan/Draft EIS*. The differences among the alternatives revolve primarily around possible differences in visitor use and user capacity. Most of the actions needed to protect and enhance river values are common to all the action alternatives, although some differences exist and are described in this chapter.

Chapter 8. Affected Environment and Environmental Consequences identifies and describes the natural and sociocultural resources and values that could be affected by the alternatives presented in chapter 7, and evaluates and compares the potential effects of the alternatives. This chapter looks comprehensively at the components of the human environment that might be affected by the plan and assesses how they might be affected by actions intended to protect and enhance river values.

Chapter 9. Consultation and Coordination summarizes all consultation and coordination efforts undertaken for the *Tuolumne River Plan/Draft EIS* to date. It outlines the project scoping history and the much broader public involvement history that extended through every step of the development of the plan alternatives. It describes specific consultations with the culturally associated American Indian tribes and the federal, state, and local agencies having jurisdiction or particular interests in the Tuolumne River corridor. This chapter also includes a list of the agencies, organizations, and businesses that received the *Tuolumne River Plan/Draft EIS*.

Chapter 1: The Tuolumne Wild and Scenic River

The upper Tuolumne Valley is the widest, smoothest, most serenely spacious, and in every way the most delightful summer pleasure park in all the high Sierra . . . Down through the open sunny levels of the valley flows the bright Tuolumne River, fresh from many a glacial fountain in the wild recesses of the peaks. . . . There are four capital excursions to be made from here. . . . All of these are glorious, and sure to be crowded with joyful and exciting experiences; but perhaps none of them will be remembered with keener delight than the days spent in sauntering in the broad velvet lawns by the river, sharing the pure air and light with the trees and mountains, and gaining something of the peace of nature in the majestic solitude. (John Muir, 1890)

Since the early days of Yosemite National Park, visitors have valued the Tuolumne River and Tuolumne Meadows for their quieter, wilder setting in contrast to the popular Merced River and iconic Yosemite Valley. The Tuolumne provides park visitors with a place for recreation, rejuvenation, and connecting with nature. Many return year after year, demonstrating its importance in their lives. The river also plays a significant role in maintaining cultural and religious traditions among groups of American Indian people. Artifacts dating back at least 6,000 years attest to the prehistoric importance of the river corridor as a seasonal hunting and gathering ground and a trans-Sierra trade and travel route.



NPS PHOTO BY RANDY FONG.

"Keep it Wild. Keep it Simple. Keep it Natural. Don't spoil the magic of Tuolumne!" (Individual Public Scoping Comment)

The Tuolumne helped inspire a conservation movement that led to the creation of the national park system, and the river was protected early in one of the first national parks. From its alpine headwaters through its steep descent into the Sierra Nevada foothills, the river and its landscape provide an ecologically and scientifically important refuge that sustains a rare diversity of interconnected and largely intact ecosystems. Most of the river corridor is located in designated wilderness, which helps to further protect the ecological integrity of these systems.

What Is a Wild and Scenic River?

Recognizing that the nation's rivers were being dredged, dammed, diverted, and degraded at an alarming rate, the U.S. Congress passed the Wild and Scenic Rivers Act (WSRA) in October 1968. The purpose of the act was to protect some rivers in their free-flowing state, along with the water quality and the outstandingly remarkable values that set these rivers apart from all others in the nation and made them deserving of special protection. Yosemite National Park contains two wild and scenic rivers: the Tuolumne, designated in 1984, and the Merced, designated in 1987. In recognizing such rivers, Congress pronounced the following intention:

It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes. (Wild and Scenic Rivers Act, 16 USC 1271)

While inclusion in the national wild and scenic rivers system increases protection for a river, it does not forbid all use or development. WSRA permits some public use so long as the river values are not harmed. When a river is designated, individual segments are classified as “wild,” “scenic,” or “recreational,” based on the level of development at the time of designation, and this classification determines the level of development, such as roads and buildings, that may be allowed in the segment in the future. In order to determine the permitted levels of use, a river manager must prepare a comprehensive management plan specifying the steps that the agency will take to protect and enhance the river and its immediate environment.



“What happens in Tuolumne is important in so many ways to so many people. And it feels as if it matters especially to us. I suspect many people feel the same way.” (Individual Public Scoping Comment)

Today, more than 12,500 miles of rivers and creeks are protected in the United States as units of the wild and scenic rivers system. Managing agencies include state governments, the National Park Service (NPS), the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), the U.S. Army Corps of Engineers (USACE), and the U.S. Fish and Wildlife Service (USFWS). WSRA protects not only the designated waterways, but also part of the nation's heritage.

Designation of the Tuolumne Wild and Scenic River

The Tuolumne River originates high in the Sierra Nevada on the eastern side of Yosemite National Park. The river has two principal sources: the Dana Fork, which drains the west-facing slopes of Mount Dana, and the Lyell Fork, which begins at the base of the glacier on Mount Lyell. The two forks converge at the eastern end of Tuolumne Meadows, one of the largest subalpine meadows in the Sierra Nevada. The Tuolumne River meanders through Tuolumne Meadows, then cascades through the Grand Canyon of the Tuolumne, and then enters the eastern end of Hetch Hetchy Reservoir (which is within the park, but not part of the national wild and scenic rivers system). Below O’Shaughnessy Dam, the river continues through Poopenaut Valley (a low-elevation meadow) to the park boundary (see figure 1-1).



Figure 1-1. Tuolumne Wild and Scenic River and Vicinity.

Certain segments of the Tuolumne River in both Yosemite National Park and Stanislaus National Forest were designated a national wild and scenic river through a provision of the 1984 California Wilderness Act (98 Stat. 1632) (see figure 1-2). The eligibility of the Tuolumne River for inclusion in the national wild and scenic rivers system had been established by the 1979 *Tuolumne Wild and Scenic River Study: Final Environmental Impact Statement and Study Report* (Tuolumne Final Study), prepared cooperatively by the USFS and NPS (1979b). The designated segments of the river include 54 of the 62 miles of the river within the boundaries of Yosemite National Park (excluding the 8-mile segment through Hetch Hetchy Reservoir) and 29 of the 30 miles of the river on USFS and BLM lands downstream of the park and upstream of Lake Don Pedro. This plan addresses only the segments within the boundaries of Yosemite National Park.

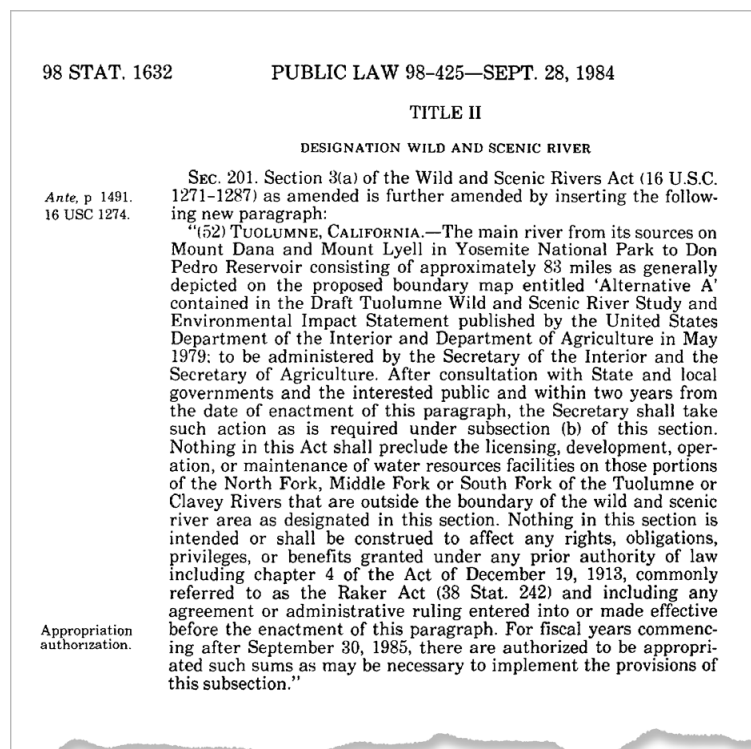


Figure 1-2. 98 Stat. 1632 of the 1984 California Wilderness Act.

‘scenic,’ or ‘recreational’ river segments, based on the condition and level of development of the river corridor at the time of designation. The classification of a river segment indicates the level of development on the shorelines, the level of development in the watershed, and the accessibility by road or trail. The classification of the Tuolumne Wild and Scenic River has been reviewed as part of this planning effort and is described in chapter 3, “Wild and Scenic River Corridor Boundaries and Segment Classifications.”

Section 3: Congressionally Designated Components, Establishment of Boundaries, Classifications, and Management Plans

Section 3 lists the rivers that are congressionally designated as components of the national wild and scenic rivers system. The Tuolumne Wild and Scenic River is listed under section 3(a)(53). Section 3 also requires the administrating agency to identify river corridor boundaries and to prepare a comprehensive management plan to “provide for the protection of the river values.” This plan for the Tuolumne River is being prepared in compliance with that requirement. The Tuolumne River corridor boundaries have been reviewed as part of this plan for the Tuolumne River and are described in chapter 3.

Section 7: Restrictions on Hydro and Water Resource Development Projects

Section 7 (16 USC 1278) directs federal agencies to protect the values of designated rivers from the adverse effects of water resources projects within the bed and banks of the river. Section 7 requires a rigorous process to ensure that proposed water resources projects, implemented or assisted by federal agencies within the bed and banks of designated rivers, do not have a “direct and adverse effect” on the values for which the river was designated. It additionally includes procedures to determine whether projects above or below the designated river or on its tributary streams would invade the area or unreasonably diminish the outstandingly remarkable scenic, recreational, and fish and wildlife values present in the designated corridor. This process for the Tuolumne River has been developed as part of this plan and is described in chapter 4, “Section 7 Determination Process for Water Resources Projects.”

Requirements of the Wild and Scenic Rivers Act

Under WSRA, designated rivers “shall be preserved in free-flowing condition, and . . . their immediate environments shall be protected for the benefit and enjoyment of present and future generations” (16 USC 1271). The following text describes the sections of WSRA most pertinent to this plan for the Tuolumne River.

Section 1: Congressional Declaration of Policy

Section 1 explains the intent of the act, as quoted above.

Section 2: Classifications

Section 2 requires that the river be classified and administered as ‘wild,’

Section 10: Management Direction

Section 10 sets forth the management direction for designated river segments and includes the following:

- (1) WSRA shall be administered to *protect and enhance* a river's outstandingly remarkable values. Insofar as possible, uses that are consistent with this and do not substantially interfere with public enjoyment and use of these values should not be limited (16 USC 1281[a]).
- (2) In administration of a wild and scenic river, "primary emphasis shall be given to protecting its aesthetic, scenic, historic, archaeological, and scientific features. Management plans may establish varying degrees of intensity for its protection and development, based on the special attributes of the area" (16 USC 1281[a]).
- (3) WSRA states that wild and scenic river segments inside congressionally designated wilderness are subject to both WSRA and the Wilderness Act. Where the two conflict, the more restrictive (i.e., protective of resources) regulation will apply (16 USC 1281[b]).
- (4) Any component of the national wild and scenic rivers system that is administered by the National Park Service shall become part of the national park system and be subject to both WSRA and the acts under which the national park system is administered. In the case of conflict among these acts, the more restrictive provisions will apply (16 USC 1281[c]).

Protect has been interpreted by the Interagency Wild and Scenic Rivers Coordinating Council as elimination of adverse impacts. Enhance has been defined as improvement in conditions (IWSRCC 2002).

Section 10(e) enables administering federal agencies to enter into cooperative agreements with state and local governments to allow them to participate in the planning and administration of components of the wild and scenic rivers system that include or adjoin state- or county-owned lands.

Section 12: Management Policies

Section 12 directs the managing agency to take management actions on lands under its jurisdiction adjacent to the designated river corridor that may be necessary to protect the river according to the purposes of WSRA. The managing agency shall also work with other agencies and entities with jurisdictions adjacent to the wild and scenic river corridor to ensure compliance with purposes under the act, particularly in regard to activities, such as timber harvesting and road construction, that might occur outside of the corridor but affect the outstandingly remarkable values of the designated river segments.

Joint Secretarial Final Revised Guidelines

In 1982, at the direction of the President, the Secretaries of Interior and Agriculture jointly promulgated guidelines (hereafter referred to as the Secretaries' Guidelines for River Areas) for implementing WSRA¹. The guidelines interpret the act as stating a "nondegradation and enhancement mandate for all designated river areas, regardless of classification." Based on that interpretation, the guidelines advise agencies to address the kinds and amounts of public recreation, public facilities, and resource uses that the river area can sustain without adverse impact or degradation of river values.²

1 National Wild and Scenic River System; Final Revised Guidelines for Eligibility, Classification and Management of River Areas, 47 *Federal Register* (FR) 39454 (1982).

2 Id. at 39458-9. In order to be located within the river area, major public use facilities such as visitor centers, administrative facilities, and developed campgrounds, must be (1) necessary for public use or resource protection; and (2) infeasible to move outside the river area; and (3) have no adverse effects on river values.

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Chapter 2: Purpose of and Need for the Tuolumne River Plan

How This Document Is Organized

This *Draft Tuolumne Wild and Scenic River Comprehensive Management Plan and Draft Environmental Impact Statement (Tuolumne River Plan/Draft EIS)* addresses all the elements required by the Wild and Scenic Rivers Act (WSRA) for the management of a designated river. It also analyzes these elements by following and documenting the planning processes required by the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), and other legal mandates governing decision making by the National Park Service (NPS).

Because of its length, the *Tuolumne River Plan/DEIS* is presented in two volumes (with a third volume of appendices). All the planning elements required by WSRA are addressed in volume 1. Chapters 1 and 2 introduce the plan and its purpose, and provide an overview of issues and concerns brought forth in the public scoping and plan development process. Chapters 3 through 6 address the basic elements of a wild and scenic river plan. Chapter 7 describes a range of reasonable alternatives for managing river values, visitor use, and user capacity. Chapter 8 describes the environmental impacts of the alternatives. Once an alternative has been selected in a formal *record of decision* (the final step in the decision-making process under NEPA), the actions included in that alternative will be incorporated into chapters 5 and 6 to complete the final *Tuolumne River Plan*.

The required sections of the draft environmental impact statement are split between volumes 1 and 2 as shown in figure 2-1.

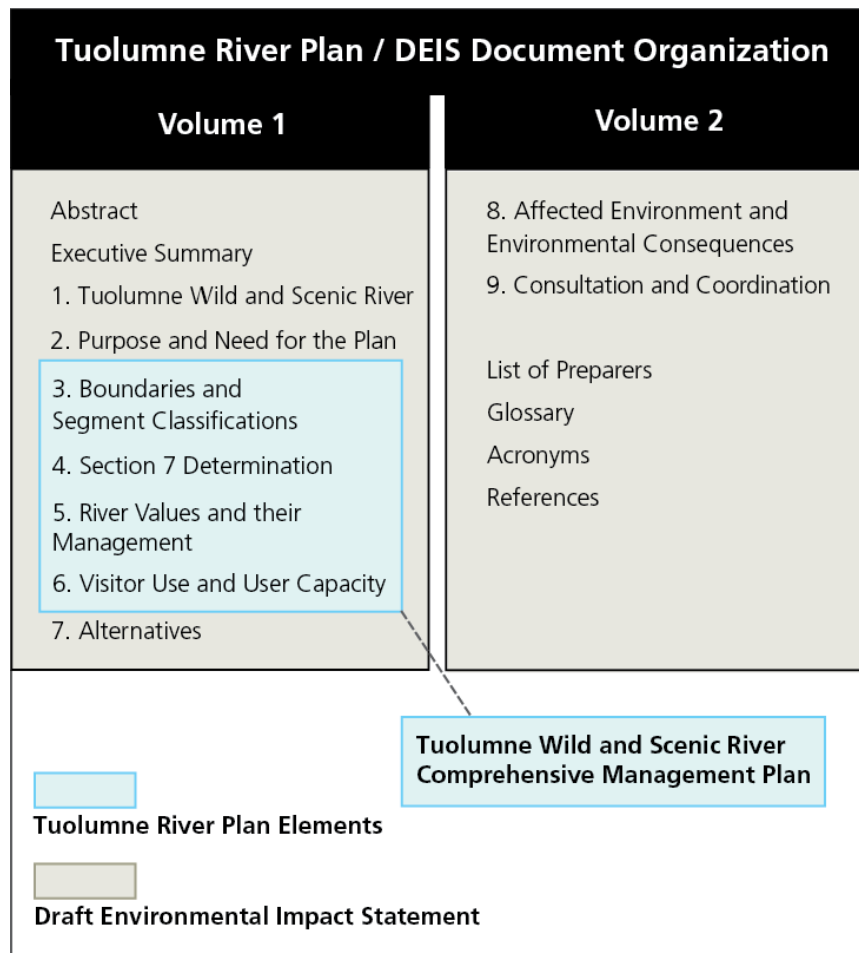


Figure 2-1. Tuolumne River Plan and Draft Environmental Impact Statement Document Organization

Purpose of the Tuolumne River Plan

WSRA requires comprehensive planning for designated rivers to provide for the protection of (1) the river's free-flowing condition, (2) its water quality, and (3) the outstandingly remarkable values that make it worthy of designation (collectively these three categories are referred to as river values). This is the fundamental purpose of the *Tuolumne River Plan*: to develop a plan for the protection of the Tuolumne's river values. The act further directs, in section 3(d), that the comprehensive management plan for each river "shall address resource protection, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purposes of this Act." It also states that "for rivers designated before January 1, 1986, all boundaries, classifications, and [existing] plans shall be reviewed. . . through regular agency planning processes."



"My best advice is to seek out and listen to the people who live and work in Tuolumne." (Individual Public Scoping Comment)

The "Final Revised Guidelines for Eligibility, Classification and Management of River Areas," published by the U.S. Department of the Interior and the U.S. Department of Agriculture in the *Federal Register* in 1982 (hereafter referred to as the Secretaries' Guidelines for River Areas, USDI and USDA 1982) elaborate on the guidance in WSRA by specifying that management plans should state (1) principles for land acquisition (not applicable to the *Tuolumne River Plan*, since all lands in the corridor are federally owned); (2) the kinds and amounts of public use the river can sustain without adversely affecting the

river's outstandingly remarkable values; and (3) specific management measures that will be taken to implement management objectives. Additional guidance about wild and scenic rivers is provided by the Interagency Wild and Scenic Rivers Coordinating Council (IWSRCC or Interagency Council), through which representatives of the federal agencies that administer wild and scenic rivers coordinate the management of designated rivers and the criteria for potential additions to the system. The Interagency Council has issued a series of technical papers, one of which (IWSRCC 2010) addresses the contents of a river management plan.

Consistent with the guidance provided by WSRA, the Secretaries' Guidelines for River Areas, and the technical papers prepared by the Interagency Council, the *Tuolumne River Plan* specifically addresses the elements listed in table 2-1.

**Table 2-1.
 Plan Elements Consistent with the Wild and Scenic Rivers Act and Other Guidance**

| Plan Element | Primary Reference | Location in the Tuolumne River Plan |
|---|---|---|
| Review, and if necessary revise, the boundaries and segment classifications (as wild, scenic, or recreational) of the Tuolumne Wild and Scenic River. | WSRA, section 3 (d), and USDI and USDA 1982, section II | Chapter 3 |
| Provide a clear process for protection of the river's free-flowing condition in keeping with section 7 of WSRA. | WSRA, section 7 | Chapter 4 |
| Refine descriptions of the river's outstandingly remarkable values, which are the unique, rare, or exemplary, river-related characteristics that make the river eligible for inclusion in the national wild and scenic rivers system. | WSRA, section 3(d), and IWSRCC 2010 | Chapter 5 |
| Identify management standards for river values and an ongoing monitoring strategy, specifically related to protecting the river's free-flowing condition, water quality, and outstandingly remarkable values, to ensure that the standards are met and maintained over the long term. | WSRA, section 3(d), USDA and USDI 1982, section III, and IWSRCC 2010 | Chapter 5 |
| Identify management actions that will be taken to protect and enhance river values. Address resource protection, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purposes of WSRA. | WSRA, section 3(d), and USDA and USDI 1982, section III | Chapters 5 and 6 Chapter 7 (Alternatives) Alternatives under consideration at this draft stage of planning are included in chapter 7. The selected alternatives for resource protection, user capacities, and development will be added to chapters 5 and 6 once a decision has been made and documented in the record of decision. |
| Establish a user capacity program that addresses (1) the kinds and amounts of visitor use appropriate to the corridor, (2) the facilities, services, and management strategies needed to support that use, and (3) the management needed to achieve and maintain the that use. | WSRA, section 3(d), and USDA and USDI 1982, section, III, and IWSRCC 2010 | Chapter 6 Chapter 7 (Alternatives) |

As a comprehensive plan for the river corridor, the *Tuolumne River Plan* will make appropriate revisions to the *Yosemite National Park General Management Plan (Yosemite General Management Plan [NPS 1980b])*. While the focus of this river management plan is on the Tuolumne River as a unit of the national wild and scenic rivers system, the plan also provides long-term, comprehensive guidance for protecting the values of the Tuolumne River that support its inclusion in the national park system and the national wilderness preservation system (see “Interrelationships with Other Plans and Projects,” below).

Because it is a comprehensive, long-term plan, the *Tuolumne River Plan* does not address all the details of actions needed to manage resources and visitor use and development in the Tuolumne River corridor; rather, it provides general guidance for actions that will be further developed through a number of program- and project-specific implementation plans. However, this plan includes some implementation planning, including specific proposals for ecological restoration of subalpine meadow and riparian areas at Tuolumne Meadows and Lyell Canyon and specific proposals for site planning at Tuolumne Meadows and Glen Aulin.

Need for the Tuolumne River Plan

This is the first comprehensive management plan for the portion of the Tuolumne Wild and Scenic River inside Yosemite National Park. A 1986 amendment to WSRA required managers of rivers designated before 1986 to complete a comprehensive management plan for the river by 1996, adding that the management plan “may be incorporated into resource management planning for adjacent Federal lands” (WSRA 3(d)(1)). The NPS responded to this directive in a 1986 *Federal Register* notice (51 FR 180) that classified the river segments within the park and declared that the Tuolumne River would be managed through (1) the *Yosemite National Park Wilderness Management Plan* (*Yosemite Wilderness Management Plan* [NPS 1989]) for the segments of the river classified as wild and (2) a forthcoming Tuolumne Meadows comprehensive design plan for the segment of the river in the Tuolumne Meadows area classified as scenic.

The 1989 *Yosemite Wilderness Management Plan* included guidelines for the management of the Tuolumne River; however, it did not fully address the planning requirements of WSRA. A draft *Environmental Assessment for the Tuolumne Meadows Design Concept Plan; Comprehensive Design Plan, NPS Employee Housing Element; and Management of the Tuolumne River Scenic Classified Segments* (*Draft Tuolumne Meadows Plan* [NPS 1995a]) addressed those requirements for the Tuolumne Meadows segment of the river corridor; however, that plan was never approved or adopted.

This *Tuolumne River Plan* considers the corridor as a whole and will make long-term decisions about the resource conditions and opportunities for visitor experiences that will best fulfill the purposes of WSRA. These decisions will be made after considering the full range of concerns about the Tuolumne River, as expressed by park managers, culturally associated American Indian tribes and groups, other public agencies, and the public. This range of concerns is reflected in the alternatives identified and evaluated in the draft environmental impact statement. A summary of the major planning issues identified during internal, tribal, and public scoping is presented below.

The final *Tuolumne River Plan* will be published after the public has the opportunity to comment on this draft. When the plan is final, it will guide management activities in the Tuolumne River corridor for approximately the next 20 years. Whenever park managers consider work and funding priorities, they will look to the *Tuolumne River Plan* and assess what still needs to be done to carry out the decisions and direction specified in the plan. Based on these assessments, they will propose more detailed plans, programs, or projects which, when funded, will become part of the annual work assignments of park resource managers, interpreters, rangers, scientists, facility managers, concession managers, planners, and other staff.

Before any project can proceed within the Tuolumne Wild and Scenic River corridor boundary, it must be determined to be consistent with the *Tuolumne River Plan* directives and shared with the public as part of a transparent process. If future projects require additional site-specific environmental compliance, they will take as their starting point the final environmental impact statement prepared in conjunction with the final version of the *Tuolumne River Plan*.

Identification of Planning Issues: Internal and Public Scoping

Over the course of the past six years, as the planning alternatives were being developed through a step-by-step process, the interests and concerns of a number of groups were solicited and considered through a series of meetings, workshops, and other opportunities to comment. These groups included NPS managers; culturally associated American Indian tribes and groups; other federal, state, and local agencies; and the public.



Site visit at Lembert Dome trail.

Internal scoping, including consultation with culturally associated tribes and other public agencies, began in the summer of 2005 with a comprehensive review of the river's outstandingly remarkable values. The interests and concerns of the tribes and other government agencies continued to be gathered concurrently with the general public scoping process.

The NPS initiated public scoping for the *Tuolumne River Plan* on June 27, 2006. The public scoping period lasted 73 days, closing on September 7, 2006. During the public scoping period, the NPS planning team solicited and compiled ideas, interests, and concerns from members of the public to help determine the future management of the Tuolumne River. People were asked specifically what they loved about the Tuolumne River and Tuolumne Meadows; what they do there; what they would like to see protected; and what kinds of services or facilities they would like to see offered, improved, or removed. People were encouraged to submit comments at one of 13 public scoping meetings held at Tuolumne Meadows, in communities adjacent to the park, and in San Francisco. Park rangers at Tuolumne Meadows incorporated the topic of planning for Tuolumne's future into most of the summer's interpretive programs.

In all, more than 4,000 distinct comments were captured on flip charts at public meetings; submitted on comment forms available at the park; sent via e-mail, fax, or letter; or entered electronically on the park's website. These comments were sorted and synthesized into approximately 1,000 concern statements, each expressing a particular (and sometimes controversial) action the NPS might take in managing the river corridor. This information was compiled into the *Tuolumne Wild and Scenic River Comprehensive Management Plan and Tuolumne Meadows Plan EIS Public Scoping Report (Public Scoping Report [NPS 2006m])*. Hundreds of hours of analysis, a series of workshops for the NPS planning team and other NPS staff members, and one public workshop were devoted to reviewing the Public Scoping Report and discussing the range of public interests and concerns. This report remains a vital reference document, featuring prominently in all team planning deliberations.

Public scoping was only the beginning of public involvement in Tuolumne River planning. The park staff committed to involving the public at many key points in the decision-making process, explaining the rationale for each step leading up to the development of the alternatives and inviting the public to complete the individual exercises within the same time frame as



"Tuolumne is my favorite part of Yosemite and is the main reason I got involved in the planning effort." (Individual Public Scoping Comment)

the park staff. Park staff conducted numerous “planner-for-a-day” workshops in 2007, 2008, and 2009 and distributed workbooks in 2007 and 2008. Both efforts were ways of soliciting public input early in the decision-making process. Throughout the planning process, park staff held meetings in gateway communities to discuss the plan and potential effects on local economies. In 2009 and 2010, park staff shared draft alternatives at numerous public meetings held in Tuolumne Meadows and at public open houses in Yosemite Valley to give the public a preview of the alternatives that would be assessed in the draft environmental impact statement.



Tuolumne River Plan public discussion.

In all, more than 120 public meetings and presentations on the *Tuolumne River Plan* have taken place during the plan’s development. Volume 2, chapter 9, “Consultation and Coordination,” provides a complete listing of all the meetings and additional details about the public involvement during each step of this process.

Major Planning Issues

This plan will make decisions about (1) the best management strategies for protecting and enhancing river values; (2) recreational and other public use and associated user capacity for the river corridor; and (3) the types, sizes, and suitable locations of facilities needed to support public use. The major planning issues that will be addressed by the plan are summarized below and discussed in depth in chapters 5-7. Chapter 5 describes each river value, its condition and management concerns, the actions proposed to address the concerns, and a monitoring program to ensure that the value is protected over the life of the plan. Chapter 6 presents the process used to address user capacity, and chapter 7 describes the action alternatives, which primarily address different approaches to management of visitor use and user capacity.

Protection and Enhancement of River Values

The following discussion of issues related to protection and enhancement of river values is a summary of more detailed information presented in chapter 5. References for statements about resource conditions and concerns are provided in chapter 5.

Free-Flowing Condition

The designated river segments are in a largely free-flowing condition, with no major changes since the time of designation. Natural flow regimes below O’Shaughnessy Dam are altered by the dam; however, dam releases are being managed in an attempt to more closely mimic natural flows.

Recent research has documented that erosion in excess of natural rates, with the potential for channel widening, is occurring on the outside meanders of the river at Tuolumne Meadows. This issue will be addressed as part of the ecological restoration of the Tuolumne Meadows area (see “Subalpine Meadow and Riparian Complex,” below).

Water is withdrawn from the river to provide potable water for visitors and employees at both Tuolumne Meadows and Glen Aulin. While the current withdrawals have been found to have only a minimal impact on downstream habitats, researchers have cautioned that ongoing periods of drought might necessitate reductions in future withdrawals during low-flow periods, which generally coincide with the peak visitor season.

Some structures associated with roads and trails interfere with flow in localized areas. These structures include a section of boulder riprap that was installed to protect the campground A-loop road, abutments for the Tioga Road vehicle bridge, and abutments for the footbridge at Parsons Memorial Lodge. The latter two may be causing the river channel to back up during high-flow periods.



"We would like to see watershed and water quality management improved—keeping water quality consistently high throughout the Tuolumne River corridor." (California Conservation Organization Public Scoping Comment)

Water Quality

While water quality remains exceptionally high throughout the river corridor, localized risks are associated with wastewater treatment systems at Tuolumne Meadows and Glen Aulin, stock use, fuel storage, and sedimentation from an unstable road cut near the Dana Fork. With the exception of the road cut, these risks are currently managed to ensure that there is no adverse impact on water quality.

Wastewater treatment facilities at Tuolumne Meadows include an aging treatment plant on the south side of Tioga Road, from which partially treated wastewater is pumped beneath the road, meadows, and river to two containment ponds and sprayfields above the meadows on the north side of Tioga Road. Risks include potential

seepage from the lines beneath the meadow, overflow from the ponds, and saturation of the sprayfields. At Glen Aulin, the mound septic system and leachfield has failed in the past, thereby prompting restrictions on water use. Water quality is frequently monitored. Since the current restrictions on water use have been in place, no effects on water quality at or below Glen Aulin have been detected. However, as at Tuolumne Meadows, a risk of leakage from the mound into the river remains at Glen Aulin. The water treatment systems at Tuolumne Meadows and Glen Aulin are also aging and need to be upgraded.

Erosion potential at the unstable road cut (the "little blue slide") east of Tuolumne Meadows on Tioga Road continues to pose a risk of increased turbidity in the Dana Fork.

Subalpine Meadow and Riparian Complex

Recent research suggests that Tuolumne Meadows is undergoing a shift in vegetation (Cooper et al. 2006). This shift is believed to have begun in response to historic actions, such as drainage of ponded areas, road building across the meadows, and extensive sheep grazing. More recent activities, including heavy foot traffic and siting of facilities in sensitive areas, are also suspected of influencing this shift. Global climate change may also be a factor.

Restoring more natural hydrologic processes is considered fundamental to the long-term health of Tuolumne Meadows. Localized interruptions to the seasonal sheetflow across the meadows are posed by historic features, such as the remnants of historic roadbeds and drainage projects, as well as by contemporary features, such as inadequate culverts along Tioga Road. These features intercept and channelize surface flows, resulting in incised channels, eroded cuts, and ponded areas. Disruptions to surface flows, which under natural conditions provide both water and nutrients to the meadows, also lower the groundwater levels, which are critical to meadow vegetation during low-flow periods.

Decreasing riparian vegetation along riverbanks, likely influenced by historic and contemporary trampling, as well as heavy browsing by deer, is resulting in channel widening (Cooper et al. 2006), which also affects groundwater levels in the meadows

Understanding the complex influences on meadow vegetation composition, below-ground biomass, and soil-forming processes will require additional research, and mitigation of adverse effects might require additional management actions.

Tuolumne Meadows remains highly susceptible to impacts on vegetation, soils, and soil organisms associated with foot traffic, and especially the foot traffic and informal trails that radiate out from roadside parking.

Meadows along the Lyell Fork are being affected by stock use. Recent studies found significantly higher levels of bare ground in Lyell Fork meadows, compared with meadows with low stock use and no stock use (NPS, Ballenger et al. 2010j) Evidence of hoof-punching suggests that these meadows are receiving stock use when soils are still wet and more susceptible to impacts.

Prehistoric Archeological Sites

Archeological sites in developed areas continue to be at risk for ongoing visitor- and construction-related impacts. Nearly half the sites in the Tuolumne Meadows Archeological District have already sustained development-related impacts. Almost all the sites in the meadows and along the river are affected by informal trails that bring visitors near the sites, and several sites have evidence of camping and campfires. Many sites in Dana and Tuolumne Meadows are at risk of losing some of their integrity from ongoing visitor use impacts.

Scenic Values

Views into and away from Tuolumne Meadows are being encroached upon by roadside parking and by woody vegetation, primarily lodgepole pine. Woody vegetation is encroaching into some traditional vista points within the river corridor.

Recreational and Other Public Use and User Capacity

Wild Segments (Designated Wilderness)

The majority of the designated wilderness provides abundant opportunities for solitude. Wilderness areas that are closer to roads receive a greater proportion of day use and higher use levels than in more remote places.

The issue of the appropriate level of permissible stock use in the river corridor was raised during scoping for this plan. Stock use is an ongoing activity that extends far beyond the river corridor and involves many kinds of activities, including guided trail rides offered by the concessioner, use of pack stock by NPS and concession employees (including trail maintenance and stocking the High Sierra Camps), guided commercial rides into the park, and individual visitors bringing their own private stock into the park. Recent studies show significantly higher levels of bare ground in subalpine meadows with currently high levels of pack stock use, such as meadows along the Lyell Fork. Pack stock use is one of the factors suspected of contributing to changing ecological conditions in these subalpine meadows. Also, signs of stock use were identified as a relatively important negative factor by wilderness overnight users participating in a survey of the quality of their experience. The parkwide management of stock in the Yosemite Wilderness is addressed in the 1989 *Yosemite Wilderness Management Plan*. The management of stock as it relates to the protection and enhancement of river values in the wilderness and nonwilderness portions of the Tuolumne River corridor will be addressed in this *Tuolumne River Plan*.

The issue of allowing kayaking was also raised during and after scoping. It is current park policy to prohibit recreational boating on all park rivers except a short segment of the Merced in Yosemite Valley and a segment of the South Fork of the Merced downstream of the Wawona Swinging Bridge. An alternative that permits kayaking on the Tuolumne River will be assessed for potential impacts on river values as part of this plan.

The historic Glen Aulin High Sierra Camp is located in a wild segment of the river. This area was designated by Congress in the California Wilderness Act of 1984 as a potential wilderness addition. Public scoping raised the concern about the possible effects of the Glen Aulin High Sierra Camp on river values. This plan will ensure that there are no adverse impacts or degradation of river values as a result of the Glen Aulin High Sierra Camp.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)



"Define uses at different areas to better identify parking and use issues." (Individual Public Scoping Comment)



"We need to determine how many people can use the Tuolumne area without damaging its health, and we need to find effective ways to hold visitor use to this level." (Individual Public Scoping Comment)

Use patterns throughout Yosemite National Park are changing, with a smaller percentage of visitors spending the night in the park, and a larger percentage staying for only part of a day, compared to historic use. Although the majority of visitors to Tuolumne Meadows still spend at least one night in the area, the NPS staff has noted an increase in day visitors. Since the Tuolumne River was designated a Wild and Scenic River by Congress in 1984, there has been a 44% increase in visitation to Yosemite National Park. Between 2006 and 2010, visitation in the Tuolumne River corridor increased by about 3% per year, but the rate of increase leveled off in 2011. Vehicle congestion and crowding have begun to change the quality of the visitor experience. Unchecked, this increase in visitation may pose a threat to river values. Because parking demand during peak visitation times exceeds the capacity of the designated parking areas, about a third of all visitors now park in informal, undesignated locations along road shoulders or around the edges of designated parking areas. Of the estimated 870 vehicles parked in the Tuolumne Meadows area during peak use periods in 2011, only 533 parked in designated spaces.

Informal parking not only affects resources at the parking location, but also leads to the creation of informal trails across the meadows. Visitor use is essentially unmanaged at Tuolumne Meadows. Visitors park wherever they can, often along the shoulders of

Tioga Road and other access roads, and from their cars tend to walk directly out into the meadows and along the river banks. People play games, such as soccer, in the meadows, and picnickers spread blankets over meadow vegetation. Recent research has shown that the meadow vegetation, soils, and soil organisms are highly susceptible to impacts from foot traffic and that areas of concentrated visitor use are experiencing disturbance which should be monitored and reduced (Holmquist and Schmidt-Gengenbach 2008).

Identifying the kinds and amounts of use appropriate to and desired for the Tuolumne Wild and Scenic River began at the initial stages of the planning process and has continued throughout—from public scoping, to the

identification of the river's outstandingly remarkable values, to developing alternatives for protecting and enhancing those values. A key difference among the alternatives is the kinds and amount of visitor use that would occur under each alternative. However, each alternative would increase the management of visitor use through some combination of visitor education, site management (such as formal parking areas and trails), and caps on or reductions in total numbers of visitors.

Although most visitors who commented during scoping felt strongly that overnight use, such as camping and staying in the lodge, was most important to their Tuolumne experience, the fact that day use has been increasing as a percentage of total use raises the question of whether the plan should call for an increase in opportunities for day use recreation. The plan alternatives explore various combinations of opportunities for day and overnight use. Some alternatives expand or enhance opportunities for day visitors by providing new picnic areas and short interpretive trails. Although relatively few people requested an increase in levels of service and facilities, the great majority of comments supported either (1) retaining the existing visitor opportunities and levels/types of facilities or (2) providing opportunities that would require less development overall within the river corridor.

Some people would like to see Tioga Road and other facilities remain open during some or all of the winter. However, for compelling reasons (see "Alternatives Dismissed from Further Consideration," in chapter 7) it is Yosemite National Park policy to manage the Tuolumne Meadows area as de facto wilderness during the winter. All the alternatives in this plan would continue this winter management policy. Therefore, the decisions that need to be made by this plan revolve around the most appropriate visitor experiences during the summer and fall seasons and the kinds of facilities needed to support those experiences while protecting and enhancing river values.

Facility Site Planning

Given that WSRA does not allow for "grandfathering" of facilities, all existing development in the river corridor has been evaluated for its effects on water quality, the free flow of the river, and the outstandingly remarkable values (see table A-1 in appendix A). Where it has been determined that river values are being affected by existing development, the *Tuolumne River Plan* will call for removal, redesign, and/or relocation of those facilities. In accordance with the Secretaries' Guidelines for River Areas, the only major public use facilities that may remain in the corridor under this plan are those (1) that are necessary; (2) that would be infeasible to move outside the corridor; and (3) that do not negatively affect river values. The plan will determine the appropriate kinds and levels of facilities needed to support visitor use while protecting and enhancing river values, and it will identify locations for those facilities that are protective of river values.

Issues that Will Not Be Addressed by the Tuolumne River Plan

Management of Resources that Are Not River Values

As a plan to protect and enhance the free-flowing condition, water quality, and outstandingly remarkable values of the Tuolumne Wild and Scenic River, the *Tuolumne River Plan* will address these values in detail, but it will not address the management of natural or cultural resources that do not contribute to these values, except indirectly, as they might be affected by an action targeted at a river value. For example, the management of natural resources and processes in upland areas of Tuolumne Meadows, or of historic landscape elements in the Tuolumne Meadows Historic District (except Parsons Memorial Lodge), will not be directed by this plan. Many actions taken to protect natural and cultural resources are part of the natural resource management, cultural resource management, and wilderness management programs conducted by the park staff. This plan acknowledges the importance of those activities; however, it will not directly address how they should be conducted. It leaves those decisions to the park program managers, who are responsible for ensuring that all

actions in the Tuolumne River corridor are consistent with the broad guidance provided by this comprehensive plan for the Tuolumne Wild and Scenic River.

Management and Use of the Portion of the Tuolumne River through Hetch Hetchy Reservoir

In 1979 the U.S. Forest Service (USFS) and the NPS conducted a joint study to determine how much of the Tuolumne River was eligible for inclusion in the national wild and scenic rivers system. The study determined that the 8-mile portion of the river impounded by O’Shaughnessy Dam at the Hetch Hetchy Reservoir, which is managed by the City and County of San Francisco as part of the city’s water supply, was ineligible for inclusion in the system because it was not free flowing (a fundamental requirement of WSRA). This study was reviewed and accepted by the U.S. Congress, which designated all eligible portions of the Tuolumne Wild and Scenic River in 1984. Based on that decision the Hetch Hetchy Reservoir lies between two of the eligible segments of the Tuolumne Wild and Scenic River within Yosemite National Park, but it is not, itself, included in the designated river corridor. Therefore, the management of the reservoir and O’Shaughnessy Dam is not addressed in the *Tuolumne River Plan*.

While O’Shaughnessy Dam is an impoundment on a wild and scenic river, the issue of possibly removing it and designating an additional wild and scenic river segment is beyond the scope of this plan and environmental impact statement. Any major change in the status of the dam would require an act of Congress. Additional planning and NEPA compliance would be triggered by such congressional action.

Interrelationships with the planning and management of the reservoir are described below under “Hetch Hetchy Reservoir Planning and Management.”

Legal Framework for the Tuolumne River Plan

Management of the Tuolumne River is directed by law, policy, and plans, in that order. Law and policy direct those things that must happen because they have been mandated by Congress or the NPS. Planning is a decision-making process used by managers when they have the discretion to choose among available options.

The Tuolumne Wild and Scenic River is a broadly recognized national treasure, and its management is guided by multiple federal laws and systems. It is included in the national wild and scenic rivers system and thus subject to the requirements of WSRA. It is an integral part of Yosemite National Park, a unit of the national park system. Much of the river corridor is within the national wilderness preservation system. Certain properties within the corridor are listed on the National Register of Historic Places. Each of these designations recognizes particular nationally significant qualities of the Tuolumne River, which it shares in common with the other areas included in these national systems, and each requires particular management and planning. (See “Appendix B: A Brief History of Legislation and Planning” for additional discussion of the legislative and administrative history of the river corridor.)

National Wild and Scenic Rivers Act

See chapter 1 for a detailed discussion of the requirements of WSRA.

National Park System Organic Act and National Parks and Recreation Act

The segments of the Tuolumne River covered by the *Tuolumne River Plan* were part of Yosemite National Park when they were designated as part of wild and scenic river system in 1984. As part of the national park, these

river segments are also managed under the provisions of the laws, policies, and regulations applicable to all units of the national park system. Section 10(c) of WSRA specifies that in case of conflicts between the mandates of the two systems, the more restrictive provisions apply.

The NPS was created by the National Park Service Organic Act of 1916 (USC 2-4) for the purpose of promoting and regulating a system of national parks “to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” This broad mandate has been translated into an extensive set of management policies, which direct all aspects of park management (NPS 2006g).

In addition to contributing to the overarching purpose of the national park system, each national park must achieve its own particular purpose, established in its enabling legislation or the presidential proclamation that created the park area.

Since 1978 the NPS has been required under the National Parks and Recreation Act (16 USC 1a-7) to prepare general management plans for all units of the national park system. The relationship between the *Tuolumne River Plan* and the *Yosemite General Management Plan* is described below under “Interrelationships with Other Plans and Projects.”

Wilderness Act

The Yosemite Wilderness was added to the national wilderness preservation system by the 1984 California Wilderness Act, the same legislation that designated the Tuolumne Wild and Scenic River. More than 90% of the Tuolumne Wild and Scenic River corridor within Yosemite National Park is included within this congressionally designated wilderness. The non-wilderness portions of the river corridor, including Tuolumne Meadows and the segment directly below O’Shaughnessy Dam, are surrounded by lands within the national wilderness preservation system. The California Wilderness Act designated the Glen Aulin High Sierra Camp and an 80-acre inholding in Poopenaut Valley as potential wilderness additions.

WSRA specifies that where a designated wild and scenic river is located in wilderness that both laws will apply:

Any portion of a component of the national wild and scenic rivers system that is within the national wilderness preservation system, as established by or pursuant to the Act of September 3, 1964 (78 Stat. 890; 16 U.S.C., ch. 23), shall be subject to the provisions of both the Wilderness Act and this Act with respect to preservation of such river and its immediate environment, and in case of conflict between the provisions of these Acts the more restrictive provisions shall apply.

The national wilderness preservation system was established by the Wilderness Act of 1964 (PL 88-577, 16 USC 1131-1136) to secure for present and future generations the benefits of an enduring resource of wilderness. The Wilderness Act requires that areas of designated wilderness be managed in ways that preserve their wilderness character. A wilderness area, as defined by the act, is

an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean. . . an area. . . retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable, and (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Congress has delegated the management of the Yosemite Wilderness to the NPS. The *NPS Management Policies 2006* requires the superintendent of each park containing wilderness resources to develop a wilderness management plan or equivalent planning document to guide the preservation, management, and use of these resources. The relationship between the *Tuolumne River Plan* and the *Yosemite Wilderness Management Plan* is described below under “Interrelationships with Other Plans and Projects.”

The NPS is required to consider the effects of commercial use in the Yosemite Wilderness as part of its delegated responsibility to maintain the wilderness character of the lands under its charge. A “Determination of Extent Necessary for Commercial Services in the Wilderness Segments of the Tuolumne Wild and Scenic River Corridor” has been prepared as part of this planning for the Tuolumne River (see appendix C). This determination is addressed in greater detail under “Interrelationships with Other Plans and Projects,” below.

Raker Act

O’Shaughnessy Dam and the Hetch Hetchy Reservoir are authorized under the 1913 Hetch Hetchy Reservoir Site Act, commonly known as the Raker Act, which grants the City and County of San Francisco certain lands and rights-of-way in Yosemite National Park for the purpose of building a reservoir and associated infrastructure, in order to generate a municipal water supply and hydroelectric power for the city. In addition, the act stipulates sanitary regulations for the reservoir’s watershed, which amounts to the Tuolumne River watershed in Yosemite. (See “Hetch Hetchy Reservoir Planning and Management,” below.)

National Environmental Policy Act

Pursuant to section 102(2) (C) of the National Environmental Policy Act of 1969 (NEPA [42 USC 4341 et seq.]), the NPS has prepared a draft environmental impact statement identifying and evaluating five alternatives for the *Tuolumne River Plan*. Regulations governing NEPA compliance are set by the President’s Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508). CEQ regulations establish the requirements and process for agencies to fulfill their obligations under the act. This draft environmental impact statement documents compliance with two fundamental NEPA requirements: One is the requirement to make a careful, complete, and analytical study of the impacts of any proposal, and alternatives to that proposal, if it has the potential to affect the human environment, well before decisions are made. The other is to be diligent in involving any interested or affected members of the public in the planning process.

Compliance with the National Historic Preservation Act (see below) is integrated into the NEPA compliance process, using NHPA criteria for the analysis of impacts on cultural resources. The NEPA process is also used to coordinate compliance with other federal laws and regulations applicable to the decisions to be made as part of the *Tuolumne River Plan*, including but not limited to the following:

- Americans with Disabilities Act (42 USC 12101 et seq.)
- Clean Air Act (as amended, 42 USC 7401 et seq.)
- Clean Water Act (33 USC 1241 et seq.)
- Endangered Species Act (16 USC 1531 et seq.)
- Executive Order 11593: Protection and Enhancement of the Cultural Environment
- Executive Order 11988: Floodplain Management
- Executive Order 11990: Protection of Wetlands
- Wilderness Act

National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA [16 USC 470]) directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties. A 'historic property' is any district, building, structure, site, or object, including resources that are considered by American Indians or other communities to have cultural and religious significance, that is eligible for listing in the National Register of Historic Places (NRHP) because the property is significant at the national, state, or local level in American history, architecture, archeology, engineering, or culture. Section 106 also provides the Advisory Council on Historic Preservation (ACHP) and the state historic preservation officer (SHPO) an opportunity to comment on assessment of effects by the undertaking. The Yosemite National Park section 106 review process is governed by national and park-specific programmatic agreements among the NPS, the Advisory Council for Historic Preservation, and the National Council of Historic Preservation Officers or the California state historic preservation officer (NPS, ACHP, and NCSHPO 2008; NPS, SHPO, and ACHP 1999). Both agreements are included in appendix D. As stated above, compliance with NHPA section 106 is integrated into the NEPA compliance process, using NHPA criteria for the analysis of impacts on cultural resources.

The section 106 review process is also used to coordinate compliance with the following federal laws and regulations applicable to the decisions to be made as part of the *Tuolumne River Plan*.

Archaeological Resources Protection Act

The Archeological Resources Protection Act of 1979 (ARPA [16 USC 470aa- 470ll]) prohibits unauthorized excavation of archeological sites on federal land, as well as other acts involving cultural resources, and implements a permitting process for excavation of archeological sites on federal or Indian lands (see regulations at 43 CFR 7). The act also provides civil and criminal penalties for removal of, or damage to, archeological and cultural resources. Historic properties are addressed in volume 2, chapter 8.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA [25 USC 3001 et seq. and its implementing regulations at 43 CFR 10]) provides for the protection and repatriation of Native American human remains and cultural items and requires notification of the relevant Native American tribe upon accidental discovery of cultural items. Resources covered by NAGPRA are addressed in volume 2, chapter 8, and the process for handling these resources is included in the national and park-specific programmatic agreements included in appendix D.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act of 1979 (AIRFA [42 USC 1996]) preserves for American Indians and other indigenous groups the right to express traditional religious practices, including access to sites under federal jurisdiction. Regulatory AIRFA guidance is lacking, although most land-managing federal agencies have developed internal procedures to comply with the act. Access to American Indian traditional religious practice sites is addressed in the programmatic agreements included in appendix D.

Executive Order No. 13007: Indian Sacred Sites

Executive Order 13007 directs federal agencies with statutory or administrative responsibility for the management of federal lands, to the extent practicable and permitted by law, to accommodate access to and ceremonial use of Indian sacred sites by American Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. Access to and ceremonial use of American Indian sacred sites is addressed in the programmatic agreements included in appendix D.

Interrelationships with Other Plans and Projects

Interrelationships with Other Yosemite National Park Plans and Management Activities

The *Tuolumne River Plan* is a comprehensive, long-term plan for the river corridor that will be implemented over time. Many of the actions included in the plan can be implemented without additional planning and analysis; however, some the actions will require more detailed implementation planning. Any implementation planning and analysis will tier off this plan and its environmental impact statement and will include a transparent public involvement process.

The relationship with other closely related park plans is summarized below.

Yosemite General Management Plan

Similar to the comprehensive management plan required for the Tuolumne Wild and Scenic River, the general management plan required for Yosemite National Park addresses measures for the preservation of resources, types and general intensities of development, visitor carrying capacities, and potential boundary modifications. WSRA states that comprehensive river management plans must be coordinated with, and may be integrated into, the administering agency's planning. The most current *Yosemite General Management Plan* was completed before the Tuolumne River was designated in 1984 and therefore does not consider protection and enhancement of river values in accordance with WSRA. The *Tuolumne River Plan* will amend the *Yosemite General Management Plan* to include those considerations. The specific amendments to the *Yosemite General Management Plan* resulting from the *Tuolumne River Plan* are outlined in appendix E.

Yosemite Wilderness Management Plan and Implementing Management Actions

The *Yosemite Wilderness Management Plan*, approved in 1989 and soon to be revised by an upcoming stewardship plan for the Yosemite Wilderness, tiers off the *Yosemite General Management Plan* and provides guidance for specific management activities and facilities within designated wilderness. The plan provides parkwide guidance for implementing wilderness policies and programs, including the minimum requirement policy and an overnight trailhead quota system, in the Yosemite Wilderness.

The *Yosemite Wilderness Management Plan*, as well as the *Tuolumne River Plan*, addresses management and use within those portions of the Tuolumne River corridor that are also designated wilderness. Section 10(b) of WSRA specifies that in case of conflicts between the mandates of the national wild and scenic rivers system and the national wilderness system, the more restrictive provisions apply. The following actions related to wilderness mandates and policies currently restrict use within the river corridor. Specific actions applicable to the Tuolumne River corridor may be revised as part of the upcoming wilderness stewardship plan so long as they remain protective of river values, as specified in the *Tuolumne River Plan*.

Wilderness Zone Capacities

Overnight zone capacities and associated trailhead quotas have been established to protect wilderness character throughout Yosemite National Park, including zones and trailheads in the Tuolumne River corridor (see table 8-1 in chapter 8). Zone capacities and associated trailhead quotas may be revised as necessary to reflect changing visitor patterns and resource sensitivities under the overall guidance provided by the current *Yosemite Wilderness Management Plan* or upcoming wilderness stewardship plan. However, in the future all capacities within the river corridor must remain within the maximum levels allowed under this *Tuolumne River Plan*.

Extent Necessary for Commercial Services in Wilderness

A “Determination of Extent Necessary for Commercial Services in the Wilderness Segments of the Tuolumne Wild and Scenic River Corridor” has been prepared as part of this planning for the Tuolumne River (see appendix C). As discussed in the determination, both the text of the Wilderness Act and its legislative history indicate that commercial services in wilderness were intended by Congress to be subject to limits. Since the adoption of the Wilderness Act, courts have repeatedly emphasized that the law requires that commercial services may be allowed, but only to the extent necessary to realize the wilderness purposes of the act. The purpose of the “extent necessary determination” for the *Tuolumne River Plan* is to determine limits on commercial use in the wilderness sections of the Tuolumne River corridor in accordance with the requirements of the Wilderness Act, the Concessions Management Improvement Act of 1998, and NPS management policies. When Yosemite completes a new wilderness stewardship plan, that plan will determine the extent necessary for commercial services for the entire Yosemite Wilderness.

No-Camping Zones

The *Yosemite Wilderness Management Plan* currently designates no-camping zones in the watersheds of Parker Pass Creek, the Dana Fork of the Tuolumne, and Gaylor Creek, to protect the Tuolumne Meadows water supply.

Merced Wild and Scenic River Comprehensive Management Plan

The NPS is currently preparing a comprehensive management plan for the 81 miles of the Merced Wild and Scenic River that flow through Yosemite National Park. The *Merced Wild and Scenic River Comprehensive Management Plan* and this *Tuolumne River Plan* will use similar methods and management strategies to the extent practicable.

Scenic Vista Management Plan

The purpose of the *Scenic Vista Management Plan* is to develop a systematic program for protecting and restoring Yosemite's important viewpoints and vistas. The plan does not propose any actions in designated wilderness. While the *Scenic Vista Management Plan* suggests locations for management within the Tuolumne River corridor, the *Tuolumne River Plan* will provide the overall direction and guidance based on an evaluation of all river values. Upon its completion, the *Tuolumne River Plan* will amend the *Scenic Vista Management Plan* for the scenic segments within the Tuolumne River corridor.

Interrelationships with Other Agency Plans and Management Activities

Hetch Hetchy Reservoir Planning and Management

The Hetch Hetchy Reservoir remains a drinking water source for the City and County of San Francisco. The San Francisco Public Utilities Commission (SFPUC) maintains a watershed control program in the Hetch Hetchy watershed to ensure water quality and limit contamination, in accordance with the federal and state requirements for unfiltered water supplies (40 CFR 141(H) and the *California Code of Regulations* 22:64652.5(e)(3)). The Raker Act stipulates sanitary regulations for permanent facilities within the reservoir's watershed, stating that no human excrement, garbage, or refuse may be placed within 300 feet of the reservoir or watercourses that flow into it; all sewage generated from permanent camps or hotels within the watershed must be adequately filtered and purified; and no bathing, washing, watering stock, or other polluting activity may take place in the reservoir or waters within 1 mile of the reservoir. The NPS and the City and County of San Francisco work as partners to protect the Tuolumne River watershed in Yosemite National Park.

In 2006 the SFPUC adopted a policy that establishes a management direction to protect and rehabilitate ecosystems affected by dam operations, within the context of meeting water supply, power generation, water quality, and existing minimum in-stream flow requirements that were first established in 1985. These flow requirements focused primarily on maintaining habitat for trout, a species that is not believed to be native above Preston Falls on the Tuolumne River. The policy adopted in 2006 also directs the nature of SFPUC in-stream flow releases such that they mimic to the extent feasible the variation of the seasonal hydrology in order to sustain the aquatic and riparian ecosystems upon which native wildlife species depend.

The NPS is collaborating with the SFPUC, the USFS, and the U.S. Fish and Wildlife Service (USFWS) on the Upper Tuolumne River Ecosystem Project. This project is conducting research to determine the effects of water temperature and flow regime on ecological conditions below the dam. The ultimate goal of this project is to make informed recommendations for water releases from the dam that would provide maximum ecological benefits to the river-dependent ecosystems between the O'Shaughnessy Dam in Yosemite National Park and the Early Intake in the Stanislaus National Forest. Draft recommendations have been reviewed by stakeholders, but the final recommendations have not yet been completed, nor have they been adopted by the SFPUC.

Planning and Management for the Tuolumne River Segments Administered by the U.S. Forest Service and Bureau of Land Management

The current comprehensive plan for the 29 miles of the Tuolumne Wild and Scenic River outside Yosemite National Park (see figure 1-1) was prepared by the USFS (1988). That plan, similarly titled *Tuolumne Wild and Scenic River Management Plan*, covers river segments administered by both the USFS and the Bureau of Land Management (BLM), which cedes its management authority to the USFS through a cooperative agreement.

Similar to the NPS *Tuolumne River Plan/Draft EIS*, the overall objective of the USFS plan is to provide recreational opportunities within the capability of the resource, protect the free-flowing condition of the river, and preserve and enhance the values for which the river was designated. The Yosemite National Park staff works cooperatively with Stanislaus National Forest staff to protect the river values of the entire Tuolumne Wild and Scenic River.

Nonfederal Lands

The 54 miles of the Tuolumne Wild and Scenic River in Yosemite National Park is solely under the jurisdiction of the NPS, with the exception of a single parcel below Hetch Hetchy Reservoir and an 80-acre inholding partially within the Poopenaut Valley segment, both of which are owned by the City and County of San Francisco. There is no private landownership within the Tuolumne River corridor in Yosemite National Park.

Federal, State, Local, Tribal, and other Partnership Responsibilities

As the NPS moves forward with various management actions approved through this plan, consultation will continue with a number of federal, state, and local agencies, as well with culturally-associated American Indian tribes and others. The nature of those relationships and responsibilities are summarized below.

Federal Agencies

U.S. Army Corps of Engineers

Under section 404 of the Clean Water Act (33 USC 1344), permit approval is required for projects which may result in the discharge of dredged or fill material into waters of the United States. This includes all navigable

waters, their tributaries, impoundments of these waters, and adjacent wetlands. Section 404 permits are administered by the U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service

The Endangered Species Act of 1973, as amended (16 USC 1531 et seq.), requires all federal agencies to consult with the USFWS to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitat. Consultation with the USFWS will be ongoing as the *Tuolumne River Plan* is completed and implementation continues.

U.S. Forest Service

The NPS shares management responsibility for the Tuolumne Wild and Scenic River with the USFS, which manages the segments west (downstream) of the Yosemite National Park boundary.

Culturally Associated Tribes and Groups

Yosemite National Park currently maintains consultation relationships with seven American Indian tribes and groups that claim ancestral cultural association with park lands and resources, including five federally recognized American Indian tribes (Bridgeport Paiute Indian Colony of California, Bishop Paiute Tribe, North Fork Rancheria of Mono Indians of California, Picayune Rancheria of Chukchansi Indians, and the Tuolumne Band of Me-Wuk Indians) and two federally non-recognized American Indian groups (American Indian Council of Mariposa County [also known as the Southern Sierra Miwuk Nation] and the Mono Lake Kutzadikaa).

Consultation with federally recognized tribes is on a government-to-government basis, which means that Yosemite National Park officials work directly with appropriate tribal government officials whenever plans or activities might directly or indirectly affect tribal interests, practices, and/or traditional use areas such as sacred sites. The Yosemite National Park American Indian Consultation Program facilitates regulatory compliance with the NHPA, NEPA, NAGPRA, and other statutes, policy, and guidance related to American Indian resources, issues, and concerns. Formal and informal consultations are conducted with culturally associated American Indian tribes and groups about proposed NPS plans and actions that might affect the treatment and use of, and access to, cultural and natural resources with documented or potential cultural meaning for the groups.

State Agencies

California State Historic Preservation Officer

A programmatic agreement among the NPS at Yosemite, the California SHPO, and the ACHP regarding planning, design, construction, operation, and maintenance was developed in consultation with American Indian tribes and groups having cultural association with Yosemite National Park, and was executed in October 1999 (NPS, ACHP, and SHPO 1999). Consultation with the SHPO will continue throughout implementation of this *Tuolumne River Plan*.

State and Regional Water Quality Control Board

The NPS works with state and local government agencies to maintain the highest possible water quality standards and to take action to restore substandard waters, as directed by NPS Management Policies 2006 and Directors Order 84, Public Health (2004).

Yosemite National Park is under the jurisdiction of Regional Board 5, Central Valley, of the California Environmental Protection Agency and therefore consults with and obtains any necessary permits and/or certifications for construction activities from that board. The board derives its authority from section 401 of the Clean Water Act and section 13020 of the California Water Code. The U.S. Environmental Protection Agency sets water quality standards for all contaminants in surface waters and implements pollution control programs such as the National Pollution Discharge Elimination System permit program, which regulates point source water pollution (EPA 1972). The state board allocates rights to the use of surface water and, along with nine regional boards, is charged with protecting surface, ground, and coastal waters throughout the state. The regional boards issue permits that govern and restrict the amount of pollutants that can be discharged into the ground or surface water, which includes regulating stormwater during construction activities.

Local Governments

Gateway Communities

Yosemite National Park is bordered by four primary gateway communities: Lee Vining, Groveland, Oakhurst, and Mariposa. While the park contributes to the cultural, environmental, and economic well-being of the region, the local communities play an important role in the preservation of the park and its resources. In recognition of this interdependent relationship, the NPS cofounded with gateway community members and organizations the Yosemite Gateway Partners in 2003. Through quarterly meetings, the Yosemite Gateway Partners facilitate dialogue between the gateway communities and the NPS. In addition to Yosemite Gateway Partners, NPS representatives regularly attend and participate in gateway community tourism boards, chambers of commerce, boards of supervisors, and other community agencies, councils, and organizations.

City of San Francisco and Tuolumne River Watershed Agreement

The relationship between Yosemite National Park and the City and County of San Francisco began with passage of the Raker Act on December 6, 1913. Over the years, the NPS and the city have worked together to ensure that the provisions of the Raker Act are followed to preserve park resources in the Tuolumne River and Eleanor Creek watersheds.

The primary city agencies involved in the Hetch Hetchy partnership are the SFPUC and its subsidiary, Hetch Hetchy Water and Power. At present, six of Yosemite's nine administrative divisions contribute directly to watershed protection, under the guiding leadership of the Yosemite management team. The most current Memorandum of Agreement for the Comprehensive Management of Watersheds Supplying the San Francisco Regional Water System within Yosemite National Park was signed on November 2, 2010. The agreement formalizes the commitment from Yosemite and the SFPUC to work in concert to protect the watershed for a five-year planning horizon.

The agreement serves as the mechanism for the SFPUC to fund the following NPS activities:

- Provide watershed controls to preserve the watershed as a high-quality drinking water source, including source water protection and Raker Act water quality provisions.
- Improve environmental stewardship of the Tuolumne River ecosystem.
- Provide security for facilities that are essential to the SFPUC within Yosemite National Park.

Other Partnerships

Yosemite Conservancy

Yosemite Conservancy is the nonprofit philanthropic partner formed by a merger of the Yosemite Association and The Yosemite Fund. Their mission is to inspire people to support projects and programs that preserve and protect Yosemite National Park's resources and enrich the visitor experience. The Yosemite Conservancy has funded more than 380 projects through \$71 million in grants to help preserve and protect the park. The Yosemite Conservancy restores trails, provides bear-proof lockers, issues wilderness permits, conducts wildlife preservation and outdoor education programs, and more. Annually the Yosemite Conservancy recruits over 400 volunteers to work in the park to repair trails, remove invasive species, and provide visitor information.

NatureBridge

Since 1971 thousands of school-aged children have benefited from learning in “nature’s classroom” through the residential field science programs offered by NatureBridge. NatureBridge also offers professional development for teachers, summer youth programs, backpacking adventures, community outreach programs, and service learning projects.

Concessioners

Consistent with law (36 CFR 51.23) and agency policies (Directors Orders 48A and 48B), the NPS contracts with private businesses that offer a range of commercial services to park visitors. Currently, the primary hospitality contract is held by Delaware North Companies Parks and Resorts at Yosemite. Delaware North Companies operates lodging, restaurants, sightseeing tours, recreational activities, interpretive programs, stores, shuttles, and fuel stations in the park under a contract with the U.S. Department of the Interior. Under the terms of the concession contract, it also engages in an agreement with the U. S. Postal Service to provide incoming/outgoing mail service at the Tuolumne Meadows store. Future concession contracts will be written to incorporate the terms and conditions of approved plans, including the Tuolumne River Plan.

Commercial Use Authorizations

As authorized by law (36 CFR 5.3) and NPS Management Policies 2006 and Directors Order 53, the NPS issues commercial use authorizations to business entities that offer services to visitors that are not typically provided by the concessioner. Commercial bus operators, wilderness outfitters and guides, and other small businesses operate in the park under the terms of commercial use authorizations. Commercial use in designated wilderness is limited in accordance with the requirements of the Wilderness Act, the Concessions Management Improvement Act of 1998, and NPS management policies (see the “Determination of Extent Necessary for Commercial Services in the Wilderness Segments of the Tuolumne Wild and Scenic River Corridor” in appendix C).

Yosemite Area Regional Transportation System

Under a formal agreement between the NPS and the Yosemite Area Regional Transportation System (YARTS) Joint Powers Authority, YARTS administers a contract for transportation services to and through Yosemite National Park, including along the Tioga Road in the Tuolumne River corridor.

Chapter 3: Wild and Scenic River Corridor Boundaries and Segment Classifications

The Wild and Scenic Rivers Act (WSRA) allows for the review and revision of river corridor boundaries and segment classifications as part of the comprehensive management planning process. Accordingly, the river corridor boundary and classifications have been reviewed as part of this planning effort. The review process considered the definitions included in WSRA and the further interpretations of these definitions provided by the Secretaries' Guidelines for River Areas (USDI and USDA 1982).

River Corridor Boundaries

Section 3 of WSRA calls for the establishment of river corridor boundaries to define the area to be protected. The act allows for river corridor boundaries that average no more than 320 acres of land per river mile, measured from the ordinary high-water mark on both sides of the river. (The ordinary high-water mark is defined by the U.S. Army Corps of Engineers as “that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.”)

The 1984 designation of the Tuolumne Wild and Scenic River established a boundary extending 0.25 mile on either side of the river (which equates to 320 acres per river mile), the maximum allowed WSRA. The National Park Service (NPS) has been managing the river corridor pursuant to this boundary, pending a review as part of this *Tuolumne River Plan*.

This plan makes one technical correction to the river corridor boundaries. In the 1979 study, the NPS and the U.S. Forest Service (USFS) identified two tributaries as the primary headwaters of the Tuolumne River: the Lyell Fork and the Dana Fork. The map accompanying the verbal description of the headwaters incorrectly illustrated the Dana Fork as descending from the area near the Tioga Pass entrance station. The Dana Fork actually originates between Mount Dana and Mount Gibbs. When Congress designated the Tuolumne as a wild and scenic river in 1984, the enabling legislation referred to the 1979 eligibility study description and map for the location of the headwaters. The map error resulted in an unnamed tributary descending from Tioga Pass being incorrectly labeled the headwaters of the Tuolumne River.

Based on consultation with park hydrologists and members of the planning team from the original 1979 study, the *Tuolumne River Plan* corrects the 1979 map error and incorporates the proper Dana Fork headwaters into the wild and scenic river boundary. This headwaters section of the river corridor will be assigned a wild classification, as the portion of the Dana Fork between Mount Dana and Mount Gibbs flows through congressionally designated wilderness. Based on this correction, the river will be divided into seven segments (see below).

The original and corrected Tuolumne Wild and Scenic River corridor boundaries are shown in figure 3-1.

The river corridor boundaries are based on the existing river channel. Although the river is a dynamic natural system, boundaries depicted in the *Tuolumne River Plan* maps will not be changed to account for every future fluctuation in the river channel. However, in the interests of allowing natural processes to prevail, the NPS will consider changing the delineation of river corridor boundaries if there is a major shift in the river channel.

Boundaries may also be redrawn if significant new information regarding the river channel becomes available and the ability of the NPS to protect and enhance outstandingly remarkable values is inhibited. If changes are deemed necessary, an environmental compliance process will be initiated (including opportunities for additional public involvement), and the plan will be amended or updated as appropriate.



"The Dana Fork is shown incorrectly starting at Tioga Pass instead of between Mt. Dana and Mt. Gibbs." (Individual Public Scoping Comment)

Segment Classifications

The classification of each segment of the Tuolumne River is based on the level of development at the time of designation (1984) using the following criteria from section 2(b) of WSR and its implementing regulations:

- **Wild river areas:** Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- **Scenic river areas:** Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational river areas:** Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

All actions within the river corridor must be consistent with these classifications.

In 1979, the Tuolumne Final Study proposed that all segments of the Tuolumne Wild and Scenic River within Yosemite National Park were either wild or scenic. The 1984 designation specified that segment classifications for the Tuolumne River must be established within two years of the designation. In a 1986 *Federal Register*

notice, the park adopted the river segments and classifications that had been proposed in the 1979 Tuolumne Final Study with one exception: the 6-mile segment below the dam identified as scenic in the Tuolumne Final Study was split into two segments, a 1-mile scenic segment directly below the dam and a 5-mile wild segment beginning at the wilderness boundary and extending to the park boundary. With this change, the length of the river within Yosemite National Park was divided into six segments. The subsequent technical correction to the river corridor boundaries as part of this plan, described above, will result in the river being divided into seven segments.

As part of the review process, the NPS and the USFS noted that the Glen Aulin High Sierra Camp was too minor a presence within the 24-mile segment extending from Tuolumne Meadows to the headwaters of the Hetch Hetchy Reservoir for that segment to be classified as anything other than wild. Specifically, the agencies wrote, “The only man-made developments along this stretch of the river, with the exception of several foot bridges, are the facilities of the High Sierra Camp at Glen Aulin. Any detracting caused by the camp is minor when compared with the over-all primitive character of this section of the river. This segment of the river meets criteria for a ‘wild’ classification” (USFS and NPS 1979a: 30).

Revised Segment Classifications

The seven river segments and classifications are identified in figure 3-1 and are listed in table 3-1.

Table 3-1.
Tuolumne Wild and Scenic River Segments and Classifications

| Segment | Classification | Name | Description | Approximate Length |
|----------------------------------|-----------------------|-------------------------|---|---------------------------|
| Segment 1 | Wild | Lyell Fork | From the headwaters of the Lyell Fork to the confluence of the Dana and Lyell Forks | 13 miles |
| Segment 2 (technical correction) | Wild | Upper Dana Fork | From the headwaters of the Dana Fork to Dana Meadows | 3 miles |
| Segment 3 | Scenic | Lower Dana Fork | From Dana Meadows to the confluence of the Dana and Lyell Forks | 6 miles |
| Segment 4 | Scenic | Tuolumne Meadows | From the confluence of the Dana and Lyell Forks to the downstream wilderness boundary | 3 miles |
| Segment 5 | Wild | Grand Canyon | From the western end of Tuolumne Meadows (the downstream wilderness boundary of segment 4) to Hetch Hetchy Reservoir | 24 miles |
| Segment 6 | Scenic | Below O’Shaughnessy Dam | From the wild and scenic river boundary 500 feet below O’Shaughnessy Dam to the wilderness boundary approximately 1 mile downstream | 1 mile |
| Segment 7 | Wild | Poopenaut Valley | From the wilderness boundary to the western park boundary | 5 miles |

Relationship between Wilderness and the Wild and Scenic River Segments

The river segment classifications approximate, but do not exactly follow, the boundaries of the Yosemite Wilderness (see table 3-2). Based on federal policies established for the management of congressionally designated wilderness (NPS 2006f), the *Tuolumne River Plan* addresses future management of the river corridor according to three broad management overlays that apply to (1) congressionally designated wilderness, (2) Glen Aulin (a potential wilderness addition), and (3) Tuolumne Meadows and the Tioga Road corridor to the east (non-wilderness).

Table 3-2.
Relationship between Tuolumne River Segment Classifications and Yosemite Wilderness

| Segment | Classification | Name | Relationship to Congressionally Designed Yosemite Wilderness |
|-------------------------------------|-----------------------|-------------------------|---|
| Segment 1 | Wild | Lyell Fork | The entire segment is included in the Yosemite Wilderness. |
| Segment 2 (technical correction) | Wild | Upper Dana Fork | The entire segment is included in the Yosemite Wilderness. |
| Segment 3 | Scenic | Lower Dana Fork | The Tioga Road corridor east of Tuolumne Meadows (extending 200 feet from the centerline on both sides of the road) is excluded from the Yosemite Wilderness. The remainder of the segment, extending 0.25 mile from the center on both sides of the river, is included in the Yosemite Wilderness. |
| Segment 4 | Scenic | Tuolumne Meadows | Some portions of the segment, mostly north of Tioga Road, are included in the Yosemite Wilderness. |
| Segment 5 | Wild | Grand Canyon | Almost all the segment is included in the Yosemite Wilderness. The Glen Aulin High Sierra Camp is a potential wilderness addition. |
| Segment 6 | Scenic | Below O'Shaughnessy Dam | The Hetch Hetchy Road corridor and administrative area are excluded from the Yosemite Wilderness. The remainder of the segment is included in the Yosemite Wilderness. |
| Segment 7 | Wild | Poopenaut Valley | Almost all the segment is included in the Yosemite Wilderness. An 80-acre inholding owned by the City and County of San Francisco that lies partially within this segment is a potential wilderness addition. |

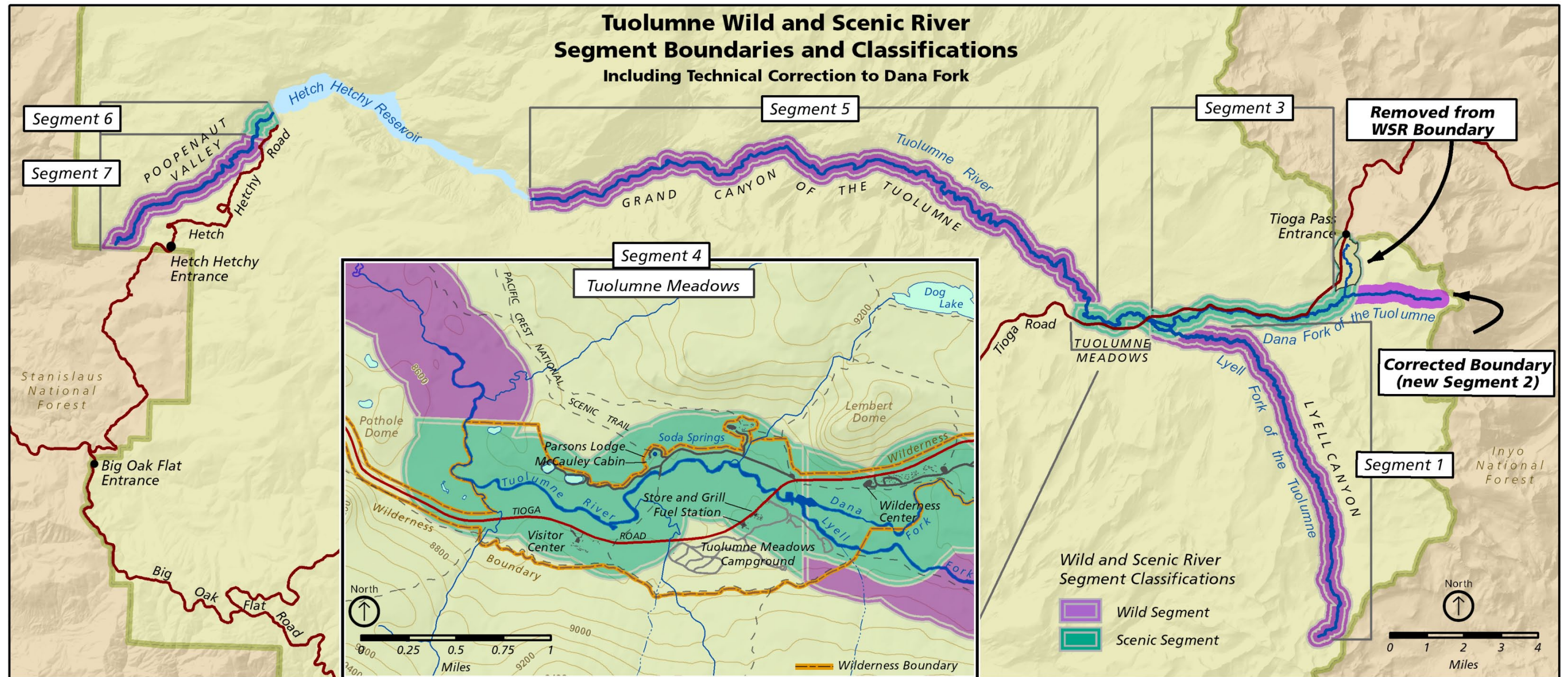


Figure 3-1. Tuolumne Wild and Scenic River Boundary and Segment Classifications.

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Chapter 4: Section 7 Determination Process for Water Resources Projects

Background

When Congress enacted the Wild and Scenic Rivers Act (WSRA) in 1968, it sought to prevent decades of damming, dredging, and diversion from spreading to some of the nation’s most spectacular waterways. Section 7 of the act specifies restrictions on hydro and water resource development projects and directs the managing agency to specify a process that will be followed in determining whether or not a proposed water resources project is appropriate.

Water resources projects include, but are not limited to, dams, water diversion projects, fisheries habitat and watershed restoration/enhancement projects, bridge and other roadway construction/reconstruction projects, bank stabilization projects, channelization projects, levee construction, recreation facilities such as boat ramps and fishing piers, and activities that require a section 404 permit from the U.S. Army Corps of Engineers (USACE). While no new dams will be proposed on the Tuolumne River, other potential water resources projects along the Tuolumne Wild and Scenic River could come up for decision, including projects with the purpose of improving the free-flowing condition of the river or enhancing a particular outstandingly remarkable value.

| |
|---|
| <p>WHY IS FREE FLOW IMPORTANT TO A RIVER SYSTEM?</p> <ul style="list-style-type: none"> Free-flowing rivers disperse valuable nutrients in adjacent meadows and stream habitats during flood events. Aquatic species require varied habitat created by a dynamic river system. Constriction and hardening of river channels, as caused by levees, riprap, and bridges, can alter the river’s energy and natural course, causing it to erode its banks and damage valuable habitat, particularly during flood events. |
|---|

Standards

The need for a section 7 review is determined based on the standards shown in figure 4-1.

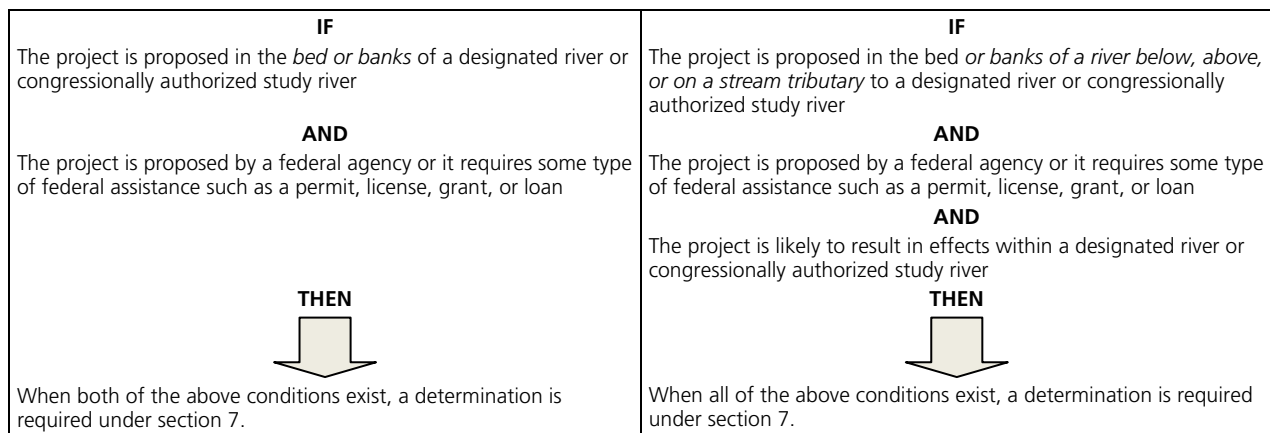


Figure 4-1. Determining the Need for a Section 7 Review under the Wild and Scenic Rivers Act.

Federally Assisted Projects on the Wild and Scenic River

The law prohibits any federally assisted water resources project that would have a “direct and adverse effect” on the values for which a river was added to the wild and scenic rivers system. For the portion of the Tuolumne River within Yosemite National Park, the National Park Service (NPS) is responsible for making the final determination as to whether a proposed water resources project will have a direct and adverse impact on river values. The agency coordinates its evaluation process with other agencies that are required to review and comment on the project. Depending on the type and location of the project, such agencies might include the U.S. Fish and Wildlife Service (USFWS), the U.S. Environmental Protection Agency, the U.S. Forest Service, the Bureau of Land Management, and the USACE. Review of WSRA section 7 projects are also coordinated with other environmental review processes, such as those required by the National Environmental Policy Act (NEPA) and the National Historic Preservation Act, as appropriate. Potential water resources projects that are found to have a direct and adverse effect on the values of a designated river must be either redesigned and resubmitted for a subsequent section 7 determination, abandoned, or reported to the Secretary of the Interior and the United States Congress, in accordance with the act.

Federally Assisted Projects Below, Above, or on Tributaries of a Wild and Scenic River

For federally assisted projects below, above, or on tributaries of a wild and scenic river, the river-administering agency evaluates non-hydroelectric project proposals under an ‘invade the area or unreasonably diminish’ standard. Typical projects that meet this definition are water resources projects visible from the designated river, dams, and upstream diversion structures because they have the potential to affect scenic, recreational, and fish and wildlife values in the designated river.

Compliance and Agency Responsibilities

The Interagency Wild and Scenic Rivers Coordinating Council’s (Interagency Council) technical paper on section 7 (IWSRCC 2004) provides the following guidance for compliance:

A separate environmental document is not required for a Section 7 determination. Rather, the federal official proposing or permitting the project [in Yosemite, this would only be the National Park Service] typically includes analysis of what, if any, impact the proposal would have on a designated or potential wild and scenic river in their respective environmental and/or permitting processes. The river-administering agency is responsible for conducting the Section 7 analysis and making a determination under the statute. This responsibility does not preclude utilizing staff expertise of the proposing/permitting agency in the evaluation process. The Section 7 determination is signed and transmitted to the proposing/permitting agency via respective river-administering agency processes.

For proposed water resources projects “assisted” by other federal agencies, the Section 7 determination would be conducted in response to draft and final environmental documents, respectively (i.e., when sufficient alternative detail and discussion of environmental consequences is available in a NEPA document). The river-administering agency should identify wild and scenic river concerns early in the scoping process and should cooperate with the proposing agency to the greatest extent possible. Section 7 creates a requirement for consultation between the river-administering agency and the federal agency assisting the construction of the project. Project proponents, if not federal agencies, are not required to consult directly with the federal river-administering agency, and no new permits are required under Section 7. However, project proponents should be encouraged to consult informally with the river-administering agency early

in the siting and project design process, in order to avoid delays or costs associated with projects that are unacceptable under Section 7.

The river-administering agency should, as appropriate, coordinate its evaluation process with other agencies that are required to review and comment on the project. Depending on the type of proposed project, this may include: USFWS (Fish and Wildlife Coordination Act, Endangered Species Act, and other statutes); Environmental Protection Agency (Clean Water Act, Clean Air Act); and state fish, wildlife, water quality, and other agencies. Coordination with these other agencies should begin as early as possible in the process, preferably in the first stages of project planning. For a water resources project proposed by a river-administering agency, the Section 7 analysis should be documented in, or appended to, the environmental analysis.

Draft Determination Process

The description of the WSRA section 7 determination process contained in this section is adapted from a technical report by the Interagency Council (IWSRCC 2004). In conformance with the guidance contained in that report, the NPS will undertake the following steps as part of its section 7 determination process for nonemergency projects:

- Describe the purpose and need of the proposed project and its location, duration, magnitude, and relationship to past and future management activities.
- Analyze the potential impacts of the proposed project on the values for which the river was designated wild and scenic. This analysis will follow the guidelines provided by the *Wild and Scenic Rivers Act, Section 7 Technical Report* of the Interagency Council (2004), and other applicable guidance.
- Define the likely duration of the projected impacts.
- Assess the effects of the projected impacts on the achievement or timing of achievement of the management objectives of the *Tuolumne River Plan* (based on WSRA).
- Use this analysis to make a WSRA section 7 determination. This determination will document the effects of the proposed activity, including any direct and adverse effects on the values for which the river was designated as wild and scenic.
- Redesign and resubmit any water resources projects found to have a direct and adverse effect on the values of this designated river for a subsequent section 7 determination. In the event that a project cannot be redesigned to avoid direct and adverse effects on the values for which the river was designated, the NPS will either abandon the project or advise the Secretary of the Interior in writing and report to Congress in writing in accordance with section 7(a) of the act.
- Follow WSRA section 7 procedures to determine if projects above or below the designated river or on its tributary streams would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated corridor.

Emergency projects (such as repairing a broken sewer line in or near the river) may temporarily proceed without a section 7 determination. However, a section 7 determination must be completed in a timely manner upon completion of the project. Emergency water resource projects that are later determined to have a direct and adverse effect on the river values shall be mitigated based on the findings of the section 7 determination.

This process is based on the guidance provided by the Interagency Council, which has developed three flowcharts to illustrate the process. The first is a “Process” flowchart, which provides a general guide to determine if a proposal is subject to review under section 7(a) and, if so, which standard and evaluative procedure applies. Users follow either the track for water resources projects *within* a wild and scenic river or *outside* (upstream, downstream or on a tributary) of a wild and scenic river. This page may be used

independently because it provides all the necessary information from which to analyze a project proposal. “Within” and “Outside” flowcharts are also provided to give more detail about the standards and evaluative procedures for water resources projects.

Footnotes to WSRA Section 7(a) Flowcharts:

¹ **A wild and scenic river (WSR)** means a river and the adjacent area within the boundaries of a component of the National Wild and Scenic Rivers System pursuant to section 3(a) or 2(a)(ii) of the Wild and Scenic Rivers Act (WSRA).

² **Water resources project (FERC-Hydropower)** means construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the hydropower provisions (license and exemption) of the Federal Power Act (FPA, Part I), as amended (41 Stat. 1063; 16 U.S.C. 791a et seq.). Other facilities licensed under the FPA by FERC (e.g., interstate power transmission lines or natural gas pipelines) are not prohibited outright. They are subject to review under Section 7(a) only if they include construction as described in footnote 6.

³ **Water resources project** means any federally assisted construction that would affect free-flowing characteristics, as defined in Section 16(b) of the WSRA (see footnote 6). Examples of water resources projects include, but are not limited to: fisheries habitat and watershed restoration/enhancement projects; water diversion projects; transmission lines and pipelines; bridge and other roadway construction/reconstruction projects; dams; water conduits; bank stabilization projects; channelization projects; powerhouses; levee construction; reservoirs; recreation facilities, such as boat ramps or fishing piers; or dredge and fill projects that require a Federal permit, such as from the U.S. Army Corps of Engineers as required by Section 404 of the Clean Water Act (33 U.S.C. 1344).

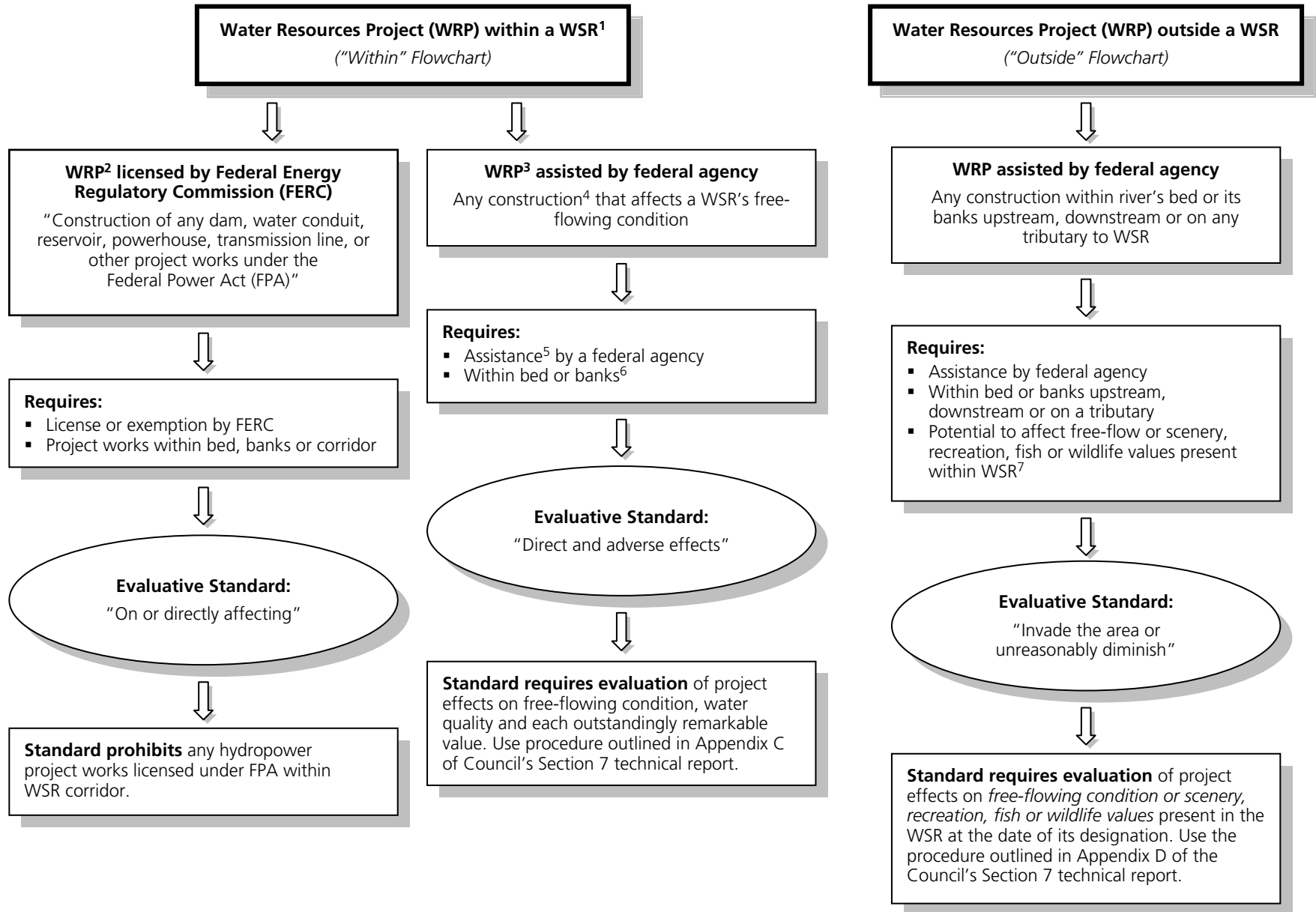
⁴ **Construction** means any action carried on with Federal assistance affecting the free-flowing characteristics of a WSR.

⁵ **Assistance** is defined as a loan, grant, license, or other assistance in the construction of any water resources project.

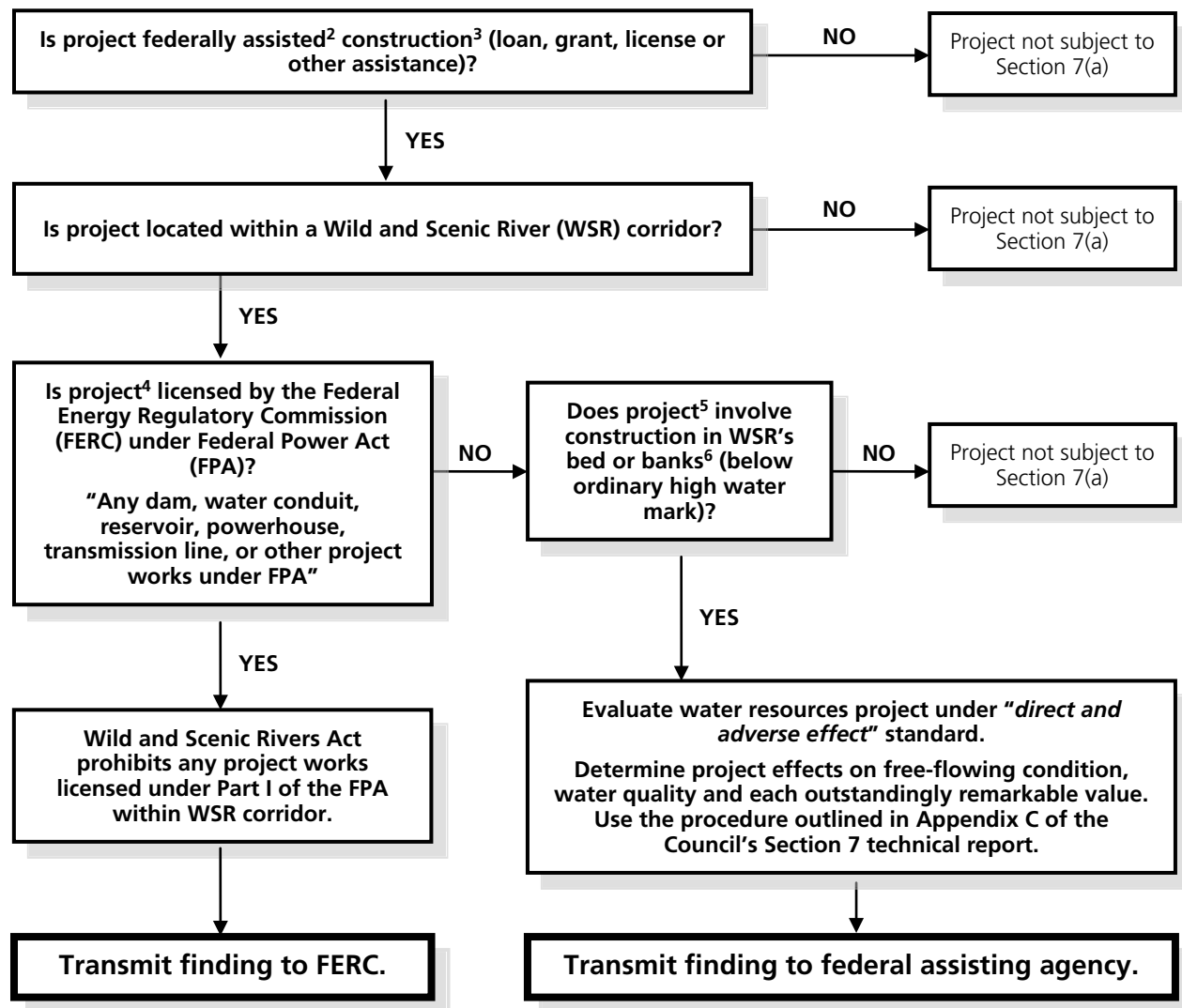
⁶ **Bed or banks** is an interpretation of Section 16(b) of the WSRA, which defines free-flowing, in part, as “existing or flowing in natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway.” Generally the applicability of Section 7(a) is limited to the area within the ordinary high water mark (OHWM) of the river. OHWM is defined in 33 CFR Part 328.3(e) as “. . .that line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.”

⁷ Requires a **nexus** between the proposed upstream, downstream or tributary project and the WSR or such project is not a water resources project for purposes of a Section 7(a) determination. Projects that have the potential to affect *free-flow, or scenery, recreation, fish or wildlife values* of the WSR are dams, upstream diversion structures and projects that can be seen from the WSR as they have the potential to affect these characteristics and values in the WSR.

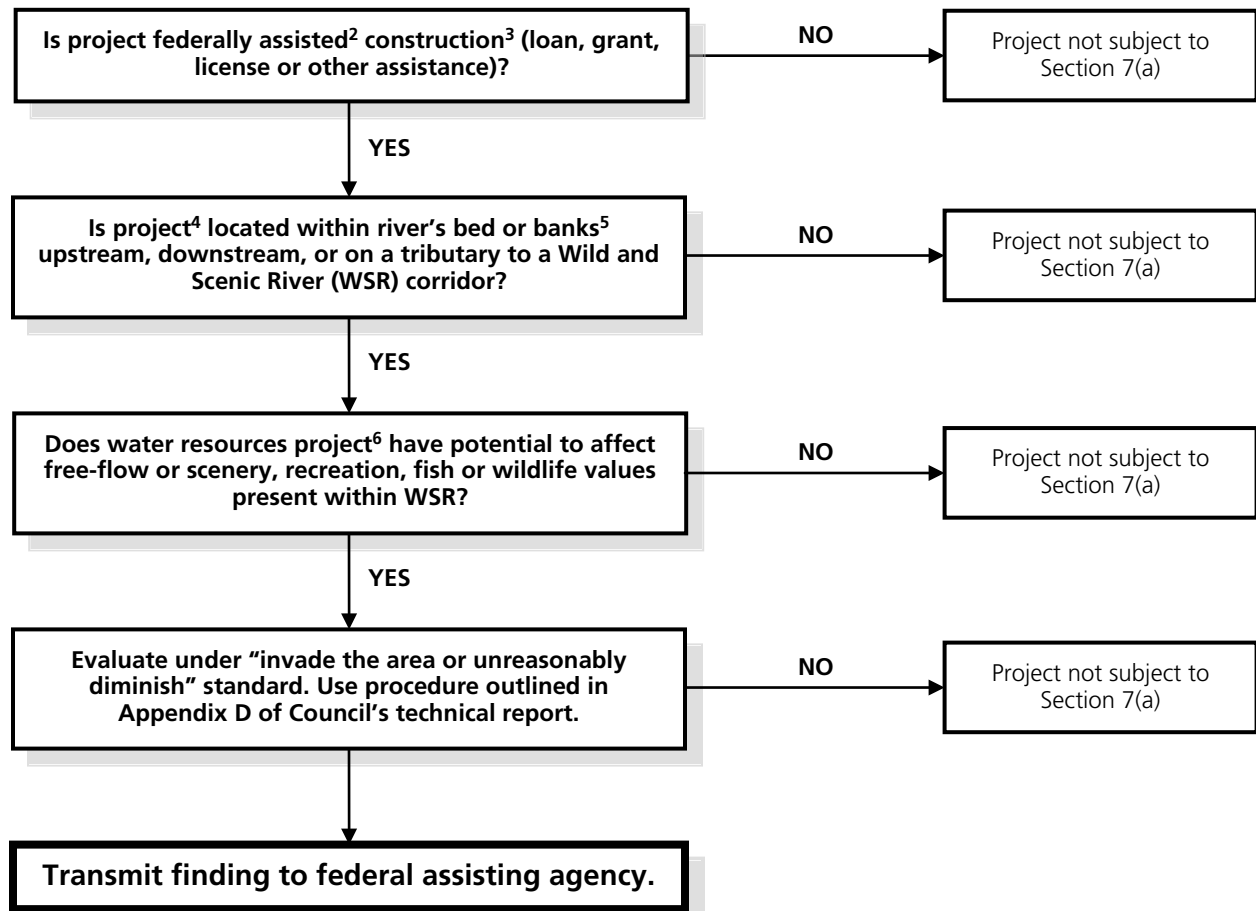
WSRA Section 7(a) "Process" Flowchart



Section 7(a) Flowchart for a Water Resources Project “Within” a Wild and Scenic River Corridor¹



Section 7(a) Flowchart for a Water Resources Project "Outside" a Wild and Scenic River Corridor¹



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Chapter 5: River Values and Their Management

Mandate to Protect and Enhance River Values

The Tuolumne River was added to the national wild and scenic rivers system based on three categories of values: (1) its free-flowing condition, (2) its water quality, and (3) its outstandingly remarkable values. Collectively and hereafter, these are referred to as *river values*. Section 10(a) of the Wild and Scenic Rivers Act (WSRA) provides the following broad direction related to river management:

Each component of the national wild and scenic rivers system shall be administered in such manner as to protect and enhance the values which caused it to be included in said system without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its aesthetic, scenic, historic, archaeological, and scientific features. Management plans for any such component may establish varying degrees of intensity for its protection and development, based on the special attributes of the area.

Under the *Tuolumne River Plan*, protection and enhancement of river values will be achieved by (1) identifying and defining the river values; (2) establishing the baseline conditions of river values; (3) identifying management concerns about each river value; (4) listing the actions the National Park Service (NPS) will take to correct these concerns; and (5) establishing measurable indicators and standards, including the management standard for each river value, and a monitoring program to ensure that these values are fully protected and enhanced over time.

After presenting a brief overview of river values and introducing the concepts of *management standard*, *adverse impact*, and *degradation*, this chapter will present detailed discussions of the river's condition, management concerns, actions for addressing management concerns, and continuing monitoring and protective action for each river value. The actions presented in this chapter to ensure protection of river values are common to all alternatives. A range of further actions for enhancing the conditions of river values are presented in the alternatives in "Chapter 7: Alternatives for River Management."

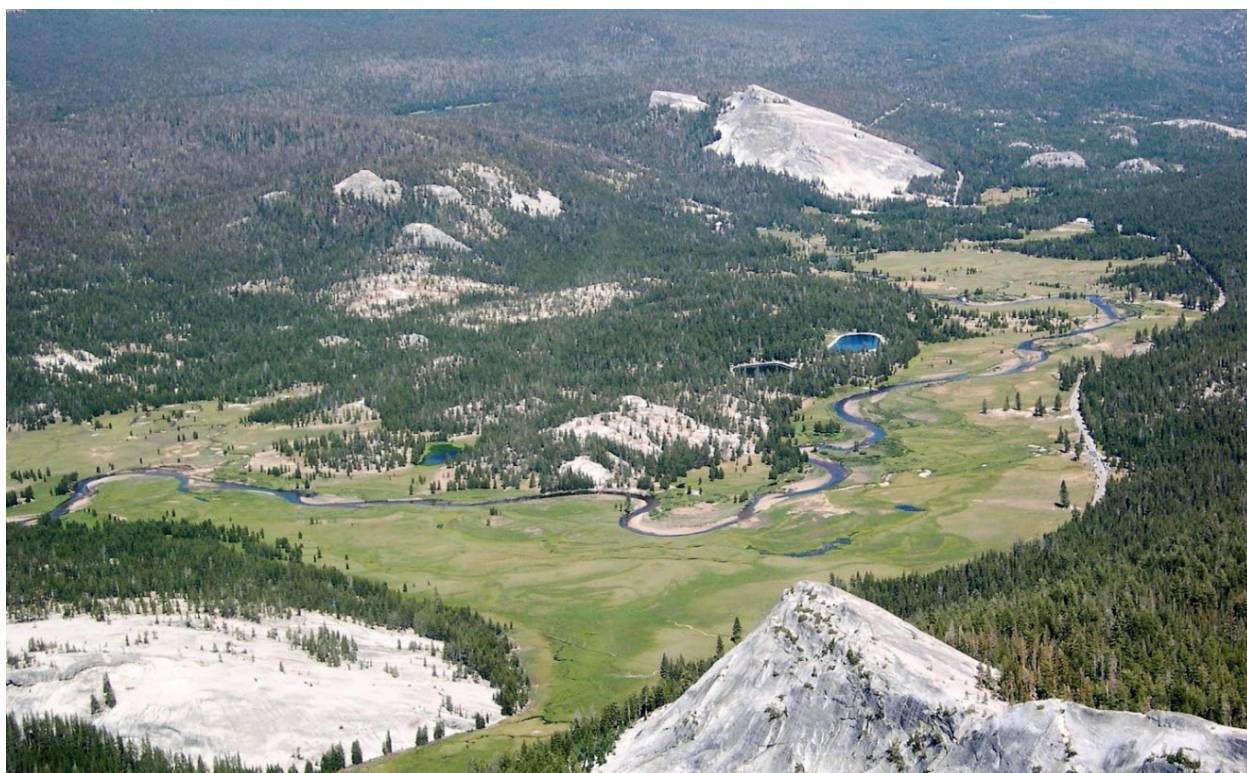
Overview of River Values

Free-Flowing Condition

As discussed in "Chapter 1: The Tuolumne Wild and Scenic River," a river must be in a free-flowing state to be eligible for inclusion in the national wild and scenic rivers system. Preserving the free-flowing condition of rivers is central to the purpose of WSRA. Once a river is designated, the managing agency is required to preserve it in its free-flowing condition for the benefit and enjoyment of present and future generations.

Water Quality

Another purpose of WSRA is to protect the water quality of designated rivers. Water quality in the Tuolumne River is exceptionally high, and far superior to federal and state standards.



NPS PHOTO BY GREG LAWLER

The Tuolumne River winds through Tuolumne Meadows (viewed from Medlicott Dome).

Outstandingly Remarkable Values

Outstandingly remarkable values were first considered for the Tuolumne River as part of the development of the 1979 *Tuolumne Final Study*, which established the eligibility of the Tuolumne River for inclusion in the national wild and scenic rivers system. Since the completion of that study, the Interagency Wild and Scenic Rivers Coordinating Council (Interagency Council, or IWSRCC) has issued specific guidance and criteria for identifying outstandingly remarkable values (IWSRCC 1999), which can be summarized as follows:

- The value must be river-related or river-dependent. To be considered river-related or river-dependent, a value must be located in the river or on its immediate shorelands (generally within 0.25 mile on either side of the river); contribute substantially to the functioning of the river ecosystem; and/ or owe its location or existence to the presence of the river.
- The value must be rare, unique, or exemplary in a regional or national context. To be considered rare, unique, or exemplary, a value should be a conspicuous example from among a number of similar values that are themselves uncommon or extraordinary.

The Interagency Council provides additional criteria for assessing each category of outstandingly remarkable values listed in WSRA, noting that these criteria may be modified to make them more meaningful to a particular river. The Interagency Council also notes that while no specific national evaluation guidelines have been developed for the “other similar values” mentioned in WSRA, agencies may assess additional river-related values, including but not limited to hydrology, paleontology, and botany resources, consistent with the guidance provided (IWSRCC 1999).

With input from other agencies, tribes, and members of the public, the Yosemite park staff used the best available science along with their best professional judgment to articulate river-related values, with the Sierra Nevada forming the primary region of comparison. Using these criteria, 10 outstandingly remarkable values have been identified for the Tuolumne Wild and Scenic River, as presented here in brief and discussed in

more detail later in this chapter. A discussion of how descriptions of river values evolved over the planning process is documented in appendix F.



NPS PHOTO BY RANDY FONG

Meadow and riparian vegetation in Tuolumne Meadows.



NPS PHOTO BY KRISTINA RYLANDS

Wetlands in Poopenaut Valley.

Biological Values

In Tuolumne Meadows, Dana Meadows, and along the Lyell Fork, the Tuolumne River sustains one of the most extensive Sierra complexes of subalpine meadows and riparian habitats with relatively high biological integrity.

Explanation: The unusual extent and influence of glaciations in the Tuolumne River corridor created extensive areas of low relief that alternate with steep river reaches flowing over bedrock. The long, low-gradient reaches along the Lyell Fork, the lower Dana Fork, and below their confluence through Tuolumne Meadows were conducive to the accumulation of sand, silts, and organic debris. The resulting meadow/riparian complex is the largest in Yosemite National Park and one of the most extensive in the Sierra Nevada (see figure 5-1, following this overview of river values).

Poopenaut Valley contains a type of low-elevation riparian and wetland habitat that is rarely found in the Sierra.

Explanation: Poopenaut Valley, located about 3 miles below the Hetch Hetchy Reservoir and O'Shaughnessy Dam, is one of the few undeveloped and largely undisturbed low-elevation riparian/meadow/wetland complexes in the region. Aquatic/riparian systems are the most altered and impaired habitats of the Sierra Nevada (UC Davis 1996), and loss of these habitats may be the most important cause of population decline among land bird species in western North America (DeSante and George 1994). The wet meadow habitats at Poopenaut Valley are some of the most productive in the park.

Geologic Value

Between Tuolumne Meadows and Pate Valley, the Tuolumne River demonstrates classic stairstep river morphology, repeatedly transitioning from calm stretches to spectacular cascades.

Explanation: The Tuolumne River corridor between Tuolumne Meadows and Pate Valley represents one of the finest examples of stairstep river morphology in the Sierra Nevada. This glacially carved morphology extends over an unusually long gradient. A series of broad basins interspersed with steep dropoffs help define the river's overall character. The spectacular cascades and waterfalls within this segment include Tuolumne Fall; White Cascade; and California, LeConte, and Waterwheel Falls.



NPS PHOTO BY RANDY FONG

Stairstep river morphology along the trail to Glen Aulin.



NPS PHOTO BY RANDY FONG

Waterwheel Falls.

Cultural Values

The rich archeological landscape along the Tuolumne River reflects thousands of years of travel, settlement, and trade.

Explanation: The nearly continuous archeological landscape along the Tuolumne River contains dense concentrations of archeological resources reflecting thousands of years of travel, settlement, and trade. The record of cultural continuity at specific locations is longest along the Dana Fork, where it extends back at least



NPS PHOTO BY KRISTINA RYLANDS

Obsidian flake.

6,000 years (NPS 2007d and 2007s). Some of these sites individually hold exceptional data potential, and Dana and Tuolumne Meadows have the potential to provide data about how and why prehistoric people occupied these riparian/meadow areas and the relationships between ecological and cultural change over millennia. In addition to this regionally significant scientific and interpretive value, the sites have value to American Indian tribes and groups as a connection to their history and their ancestors.

Parsons Memorial Lodge, a national historic landmark sited near the Tuolumne River, uniquely commemorates the significance of this free-flowing segment of the river in inspiring conservation activism and protection of the natural world on a national scale.

Explanation: Beginning at the end of the 19th century, the Sierra Club played a major role in instilling appreciation of and support for the preservation of wild rivers and natural areas for the benefit of all Americans. The Soda Springs area was a historic center of activity for these efforts. Parsons Memorial Lodge continues to fulfill its historic role as a meeting place where people learn, share ideas, and champion a greater understanding and appreciation of rivers and other wild places (NPS 1975a, NPS 1985g, NPS 1987b, NPS 2007u).



NPS PHOTO BY MIKE YOCHIM

Parsons Memorial Lodge.

Scenic Values

Lyell Canyon offers remarkable and varied views of lush meadows, a meandering river, a U-shaped glacially carved canyon, and surrounding peaks.

Explanation. The scenery throughout Lyell Canyon includes spectacular views of a U-shaped river valley, mountain peaks, ridgelines, and the largest glacier on the western flank of the Sierra Nevada. Specific views from the bed and banks of the Lyell Fork include Mount Lyell, Lyell Glacier, Lyell Canyon, Kuna Crest, the cascades at Kuna Creek, and the meandering Lyell Fork through extensive alpine and subalpine meadows.



NPS PHOTO BY MIKE YOCHIM

Sweeping views of Lyell Canyon and a distant Mount Lyell.

Dana and Tuolumne Meadows offer dramatic views of a meandering river, adjacent meadows, glacially carved domes, and the Sierra Crest.



NPS PHOTO BY RANDY FONG

The scenic interface of meadow, river, forest, and granite peaks in Tuolumne Meadows.

Explanation. Tuolumne Meadows offers scenic views of the large, low-lying river valley, adjacent meadows, glacially carved domes, rugged mountain peaks, and expansive skies. Specific views from the bed and banks of the river include Lembert, Pothole, and Fairview Domes; the Kuna Crest; Mounts Dana and Gibbs; Cathedral and Unicorn Peaks; Juniper Ridge; and the river meandering through subalpine meadows. Dramatic views from the Dana Fork include glacially carved mountains and ridgelines, and alpine and subalpine meadows. Specific views from the bed and banks of the Dana Fork include the Kuna Crest, Mount Dana, Mount Gibbs, and the meandering Dana Fork through Dana Meadows.

The Grand Canyon of the Tuolumne offers views of a deep, rugged canyon with vast escarpments of granite, hanging valleys, and long cascades of falling water.

Explanation. Spectacular views from the trail leading from Tuolumne Meadows to Glen Aulin and through the Grand Canyon of the Tuolumne include steep canyon walls, the untrailed Muir Gorge, hanging valleys, and cascades of falling water.



FROM THE COLLECTION OF KRISTINA RYLANDS.

The Tioga Road provides unusual access to the High Sierra, enabling people to take part in many recreational activities, like this family camping around 1925.



NPS PHOTO BY KRISTINA RYLANDS

Meadow along the John Muir Trail in Lyell Canyon.

Recreational Values

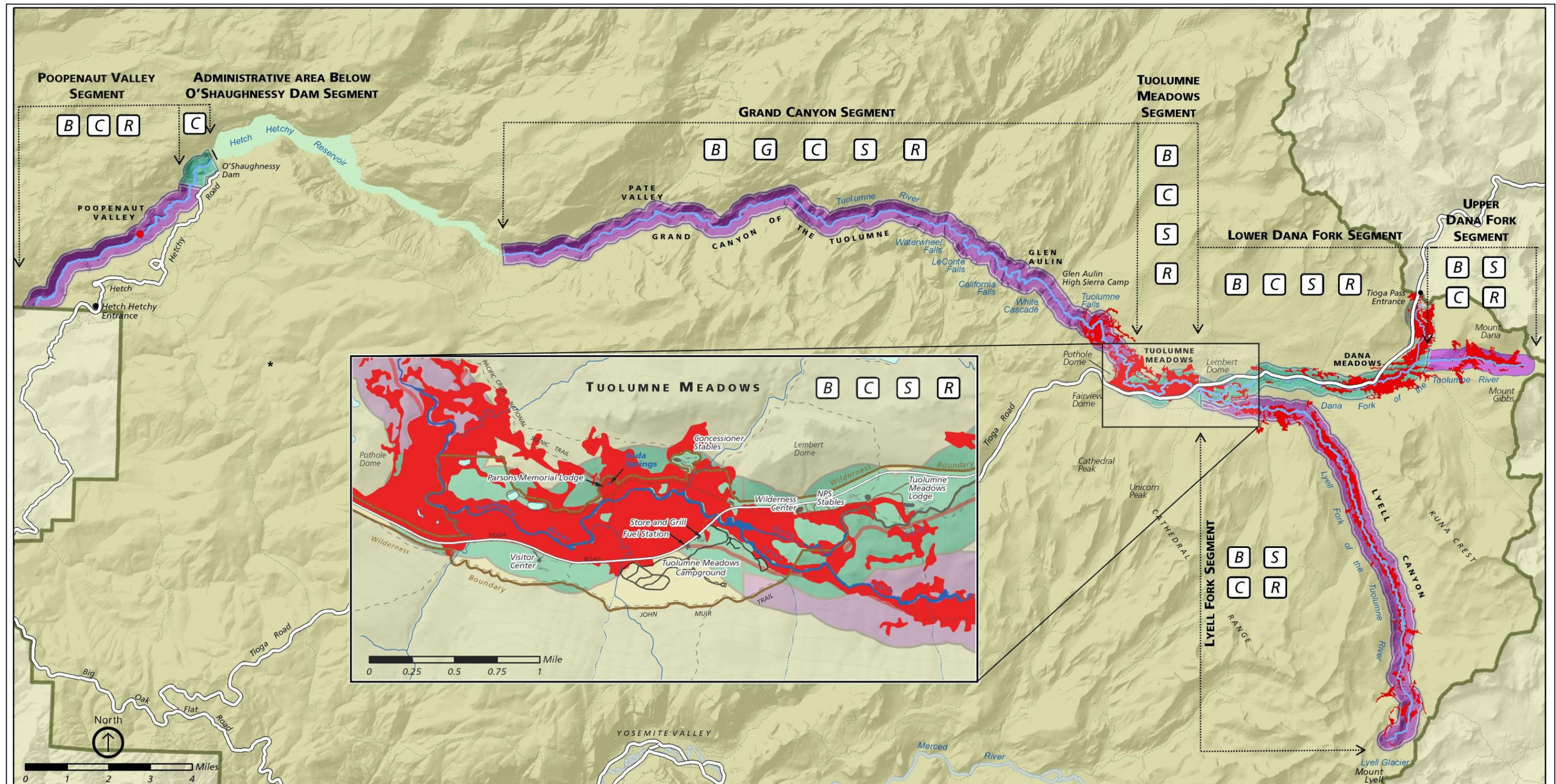
The Tioga Road across the Sierra provides rare and easy access to high-elevation sections of the Tuolumne River through Tuolumne and Dana Meadows.

Explanation. The Tioga Road is the highest continuous paved road in California and one of just a few trans-Sierra highways. As such, it provides ready access to Tuolumne Meadows, enabling visitors to easily connect with the Tuolumne River and engage in a variety of outdoor recreational activities. Such ready access is rare in California and the primary feature of this outstandingly remarkable recreational value of the Tuolumne River.

Wilderness travelers along the Tuolumne River engage in a variety of activities in an iconic High Sierra landscape, where opportunities for primitive and unconfined recreation, self-reliance, and solitude shape the experience.

Explanation. The Tuolumne River provides outstanding opportunities for visitors to engage in a variety of river-related recreational activities in a wilderness setting characterized by dramatic natural scenery. Remote areas in the Lyell Fork and Grand Canyon of the Tuolumne enable solitude; an intimacy with the river and natural sights and sounds shape the visitor experience.

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Wild and Scenic River Classifications

- Wild river area:** Per the Wild and Scenic Rivers Act, the sections of the river that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.
- Scenic river area:** Per the Wild and Scenic Rivers Act, the sections of the river that are free of impoundments, with shorelines or watersheds still largely primitive.

Outstandingly Remarkable Values of the Tuolumne River

Outstandingly Remarkable Values

- | | | |
|---|--|--|
| B Biological Value* | C Cultural Value | S Scenic Value |
| G Geologic Value | R Recreational Value | |

*Location of a river-related biological values are shown in red. Geologic, scenic, and recreational values are not illustrated because they are not tied to specific locations within river segments. The locations of cultural values (archeological sites) are not shown in accordance with federal law.

Figure 5-1. Outstandingly Remarkable Values of the Tuolumne River.

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Concepts Applied in the Context of River Management

In 1968, Congress passed the Wild and Scenic Rivers Act to “preserve . . . selected rivers or sections thereof in their free-flowing condition[,] to protect the water quality of such rivers[,] and to fulfill other vital national conservation purposes.” Congress went on to direct that “Each component of the national wild and scenic rivers system shall be administered in such manner as to protect and enhance the values which caused it to be included in said system without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values.”¹

In 1982, at the direction of the President, the Secretaries of Interior and Agriculture jointly promulgated regulations (hereafter referred to as the Secretaries’ Guidelines for River Areas, or the guidelines) implementing the WSRA.² The guidelines interpret the act as stating a “nondegradation and enhancement mandate for all designated river areas, regardless of classification.” Under the guidelines, rivers must be “managed to protect and enhance the values for which the river was designated, while providing for public recreation and resources uses which do not adversely impact or degrade those values.” The guidelines require agencies to address the kinds and amounts of public use that the river area can sustain without adverse impact to river values. The guidelines also place limits on major public use facilities in the river area, and require that any such developments have no adverse effect on river values.³

The U.S. Court of Appeals for the Ninth Circuit (the Ninth Circuit) has interpreted WSRA and its implementing guidelines to mean that a comprehensive river management plan must contain provisions designed to prevent any adverse impacts or degradation from occurring. Specific thresholds must be stated for mandatory management action that will occur ahead of any such impacts or degradation. In addition, a comprehensive river management must address “both past and ongoing degradation.”⁴

The Interagency Council was formed in 1995 to assist those federal and state agencies charged with administering designated wild and scenic rivers.⁵ The Interagency Council’s mission is to make recommendations that will foster consistency in the interpretation and implementation of WSRA. In its technical report on managing wild and scenic rivers, the council recommends that managers should document and eliminate adverse impacts on outstandingly remarkable values, free flow, and water quality, “including activities that were occurring on the date of designation.”⁶ According to the Interagency Council, any past degradation or adverse impacts in existence as of the date of designation should be carefully assessed, and the managing agency should establish “a positive trajectory for any value that was in a degraded condition.”⁷

1 16 USC 28: 1271-1287.

2 National Wild and Scenic River System; Final Revised Guidelines for Eligibility, Classification and Management of River Areas, 47 *Federal Register* 39454 (1982).

3 *Id.* at 39458-9. In order to be located within the river area, major public use facilities such as visitor centers, administrative facilities, and developed campgrounds, must be (1) necessary for public use or resource protection; and (2) infeasible to move outside the river area; and (3) have no adverse effects on river values.

4 *Friends of Yosemite v. Kempthorne*, 520 *F.3d* 1024, 1035-36 (Ninth Circuit, 2008) [hereafter *FYVIII*].

5 See <http://rivers.gov/council.html>.

6 IWSRCC, “Wild and Scenic River Management Responsibilities,” page 26 (2002), available at <http://www.rivers.gov/publications/management.pdf>.

7 IWSRCC, “A Compendium of Questions and Answers Relating to Wild & Scenic Rivers,” page 69 (2011), available at <http://rivers.gov/publications/q-a.pdf>.

In order to assess the health of river values at the date of designation, and to ensure that no further degradation or adverse impact occurs, in 2002 the Interagency Council recommended that “the river administering agency should document baseline resource conditions and monitor changes to these conditions.”⁸ According to the council, this baseline

serves as the basis from which the degree/intensity of existing and future impacts can be measured. All future activities are to be measured from this baseline to ensure continued high quality conditions and to eliminate adverse impacts (protect) or improve conditions (enhance) within the river corridor. If a thorough resource assessment that includes a baseline description of the ORVs [outstandingly remarkable values] is not completed at the time of designation, this assessment should be included in the river management plan [for the Tuolumne, that assessment is included in this chapter]. The river management plan then establishes the baseline conditions at the time of designation—including a description of any degradation—and proposes management actions [presented in this chapter, along with additional actions presented in chapter 7] that will be taken to improve conditions until they meet the requirement to protect and enhance the river’s values.

This chapter presents the following means by which the NPS will ensure future protection of river values:

- identification of river values⁹
- definitions of management standard, adverse impact, and degradation, as used in the assessment of conditions
- assessment of baseline conditions, both current and at the time of the 1984 designation
- identification of management concerns
- commitment to actions to correct management concerns, adverse impacts, and degradation and prevent them from recurring
- selection of one to three measurable indicators of condition for each river value, with specific metrics for the management standard, adverse impact, and degradation
- ongoing monitoring with trigger points for additional corrective actions that would be taken to protect or enhance river values over the life of the plan

By assessing baseline conditions, past adverse impacts or degradation can be identified and corrected.¹⁰ In addition, any downward trends that could lead to adverse impacts or degradation can be identified and addressed at an early stage. The baseline condition assessment will guide future actions to ensure that river values are fully protected and enhanced. The monitoring program will fulfill the WSRG guideline requirement that “studies will be made during preparation of the management plan and periodically thereafter to determine the quantity and mixture of recreation and other public use which can be permitted without adverse impact on the resource values.”¹¹ The conditions assessments for each river value; the statements of management concerns; the corrective actions to be taken; the indicators; the definitions of management standards, adverse

8 IWSRCC, “Wild and Scenic River Management Responsibilities,” page 22 (2002), available at <http://rivers.gov/publications/management.pdf>.

9 Statements of river values have been extensively reviewed and revised during the development of this *Tuolumne River Plan*. See Appendix F: Revisions to Outstandingly Remarkable Value Statements, 1984-2012,” which documents how the statements have evolved through this planning process and provides the rationale for the revisions.

10 According to the Interagency Council, adverse effects to river values “must be identified in development of the CRMP, with appropriate strategies detailed for their resolution.” IWSRCC, “Wild and Scenic River Management Responsibilities,” page 22 (2002), available at <http://rivers.gov/publications/management.pdf>.

11 National Wild and Scenic River System; Final Revised Guidelines for Eligibility, Classification and Management of River Areas, 47 *Federal Register* 39454, at 39459 (1982). In addition, by clearly stating the baseline conditions, management concerns, actions to correct those, indicators, standards, and triggers for corrective action, the plan “will state . . . the specific management measures which will be used to implement the management objectives for each of the various river segments and protect aesthetic, scenic, historic, archeologic and scientific features” 47 FR 39454, at 39458 (1982).

impact, and degradation; and the triggers for future action are all based on the best professional judgment of subject matter experts. This judgment was informed by the best available science (e.g., existing scientific literature, scientific protocols for data collection and analysis, existing monitoring information, and peer review), which is cited throughout this chapter.

Before assessing the condition of each river value, it is important to set forth the definitions of management standard, management concern, adverse impact, and degradation as used in this plan.

As noted above, the definitions of protection and enhancement used in this plan are provided by the Interagency Council, which has defined protection as “elimination of adverse impacts” and has defined enhancement as “improvement in conditions.”¹² The definitions of adverse impact and degradation presented below have been developed within the context of this guidance and are not intended to be the same definitions of these terms that are used in the National Environmental Policy Act (NEPA) analysis presented in “Chapter 8: Affected Environment and Environmental Consequences.” The *Tuolumne River Plan* will be evaluated in terms of three legal requirements: (1) the WSRA requirement that it protect and enhance river values (addressed in volume 1); (2) the NEPA requirement that it fully consider the effects, including the intensity of beneficial and adverse impacts, on the human environment (addressed in volume 2); and (3) the National Historic Preservation Act (NHPA) requirement that it consider effects on historic properties (also addressed in volume 2). Guidelines that exist for each of these requirements describe the criteria to be used in defining terms and determining the effects of the plan. This chapter focuses directly on how the plan will meet the WSRA requirement to protect and enhance river values, and it defines terms based on the guidelines for implementing WSRA. Evaluations of whether or not a value is in a protected condition, the identification of specific management concerns, and determinations of adverse impact or degradation are described first in qualitative terms, then in terms of specific, measureable indicators and numeric standards.

Enhancement

Enhancement is defined as actions taken to improve the condition of a river value. This definition is based upon guidance provided by the Interagency Council, which states “Enhance rivers by seeking opportunities to improve conditions.”¹³ Such actions would improve the conditions of a river value to the point where the river value’s condition meets or exceeds the management standard (defined below). These actions would, where possible, correct past and present degradation. The state of enhancement is the best possible condition for a river value; in some cases, this state would be unattainable (perhaps due to past degradation that irreversibly alters a value’s condition); in other cases, a river value’s condition is already at the state of enhancement. In all cases, the management standard would be at the lower end of the enhanced state.

Management Standard

Management standard is defined as the desired condition for a river value.

Under this plan, all river values will be protected and enhanced in accordance with WSRA and the Secretaries’ Guidelines for River Areas. The management standard is the desired condition of a river value attainable under current trends and influences beyond NPS control, given implementation of all the actions discussed in this chapter (which are actions common to all alternatives) and those additional actions identified in “Chapter 7: Alternatives for River Management.” For those river values that have management concerns present or are

12 IWSRCC, “Wild and Scenic River Management Responsibilities,” page 26 (2002), available at <http://rivers.gov/publications/management.pdf>.

13 IWSRCC, “Wild and Scenic River Management Responsibilities,” page 26 (2002), available at <http://rivers.gov/publications/management.pdf>.

adversely affected or degraded, the management standard is an aspirational state, the condition to which park managers aspire to bring the value. If a river value is within its management standard, it is considered to be both protected and enhanced.

Management Concern

Management concern is defined as an impact identified in the condition assessment discussions below, or in future monitoring, that may bring the condition of a value below that described by the management standard, but that does not bring it down to the adverse impact state.

Management concerns might be quite localized (such as erosion occurring in a 20-foot-long section of riverbank) or may be as large as segmentwide (such as informal trails fragmenting a meadow complex that dominates a river segment), but are correctable and do not bring the river value condition to the level of adverse impact or degradation. Another form of management concern is a downward trend in river condition that is occurring so slowly that the river condition has not yet been adversely affected but would if given adequate time and continued decline. With the *Tuolumne River Plan* being a 20–30 year plan, if a downward trend is visible for 10 years or more, the trend will be considered a management concern even if the river value condition has not yet fallen to the level of adverse impact. In such an instance, the NPS will take the actions identified for each river value (presented later in this chapter) when a management trigger occurs. A river value that has management concerns present is considered to be protected but with need for enhancement.

Adverse Impact

Adverse impact is defined as a substantial reduction in the condition of a river value in relation to baseline conditions as a result of public use, development, and/or administrative use. An adverse impact is a segmentwide effect and requires immediate attention by the agency. It may be detected by periodic monitoring or by other means. When more than one indicator is monitored for any river value, an adverse impact associated with any one of the indicators constitutes an adverse impact on the value as a whole.

Under WSRA, the NPS must protect the river area against those impacts that “substantially interfere” with river values.¹⁴ Like degradation, “adverse impact” is not defined in the act or guidelines. In this plan, the NPS has defined the term in accordance with its plain, ordinary meaning, and best professional judgment. An adverse impact is not simply a mere decline in the condition of a river value but is a substantial reduction in the condition of that value throughout a given river segment. Such an impact may be sudden and unforeseeable, or it may have been sustained over a specified period of time, as reflected through results from repeated condition assessments.¹⁵ As shown in this chapter, each river value has a specific set of conditions that constitute an adverse impact to that value that has been established in reliance on the best available scientific information and expertise, and reasoned professional judgment.

14 *Hell’s Canyon Alliance v. U.S. Forest Service (USFS)*, 227 F.3d 1170, at 1177-78 (Ninth Circuit 2000). As one court has observed, the act requires managers to exercise discretion and judgment in order to strike a balance between use and preservation. *Sierra Club v. Babbitt*, 69 F. Supp. 2d 1202, 1254 (E.D. Cal. 1999). (“If anything, the WSRA seems deliberately ambiguous as to how an agency is supposed to balance the recognized tension between use and preservation.”)

15 The requirement that in order to be an adverse impact, a decline must be substantial and sustained over time is intended to exclude limited, transitory, or natural fluctuations in condition from the definition. Many river values may experience temporary downward trends that are not indicative of any threat to the segmentwide condition of the river value as a whole. For example, a deer may drown while crossing the Tuolumne River, thereby temporarily increasing nearby coliform bacteria counts. In another example, some downward trends may be the result of natural variations in function over time. Drought years, for example, may negatively influence the diversity and productivity of grasses in Tuolumne Meadows for several years in a row. For these reasons, the trends leading to adverse impacts must be reflective of something more than inconsequential changes or short-term fluctuations. More rarely, sudden unforeseeable impacts may occur that require immediate action to mitigate. For example, a chemical or fuel spill into the meadow from a truck traveling over Tioga Road would create such an adverse impact.

Degradation

Degradation is defined as the state in which a river value has been fundamentally altered by public use or development to the point that its value is lost for at least a decade. Degradation is a long-term, segmentwide condition. A river value has been degraded when recovery would only be possible through a sustained change in park management and a significant investment of financial and natural capital. Degradation may be detected by the baseline condition assessment, by periodic monitoring, or by other means.

The Ninth Circuit has held that under WSRA, a comprehensive management plan must “trigger management action before degradation occurs.”¹⁶ Neither WSRA nor the Interagency Council guidelines interpreting the act specifically define degradation. The Ninth Circuit has held in the context of the WSRA that in the absence of guidance, such terms should be given their ordinary meaning.¹⁷ This plan therefore relies on the common, ordinary meaning of the term. Merriam Webster’s *Collegiate Dictionary, Tenth Edition*, defines *degradation* as a “decline to a low, destitute, or demoralized state,” while *degrade* is defined as “to lower or impair in respect to some physical property,” or “to lower in grade, rank, or status.” Similarly, Webster’s *Third New International Dictionary Unabridged* uses both of the above definitions of degrade, as well as “to lower from a superior to an inferior level.” Thus, the common, ordinary meaning of degradation is consistent with that given above: a substantial reduction in the condition of a river value to a clearly defined, low state of functioning.

As presented in this chapter, each river value has a specific set of conditions constituting degradation. The NPS relied on the best available science and reasoned professional judgment in determining these conditions.

¹⁶ *FYVIII*, 520 *F.3d* 1024, 1034-35 (Ninth Circuit 2008).

¹⁷ *Friends of Yosemite Valley v. Norton*, 348 *F.3d* 789, 796 (Ninth Circuit 2003) (citing *Hell’s Canyon Alliance v. USFS*, 227 *F.3d* 1170, at 1177 (Ninth Circuit 2000)). “Degradation” is not a term from the act, but from the Secretaries’ Guidelines for River Areas. The Supreme Court has recently reaffirmed that where an agency’s regulations construing a statute are ambiguous, the agency’s own interpretation of those terms are entitled to substantial weight. *Chase Bank USA, N.A. v. McCoy*, 131 S. Ct. 871, 880 (2011). In this case NPS has determined that the ordinary meaning of the term “degradation” is the most reasoned reading of the text of the guidelines because it will enable the agency to use the best available science to establish clear and specific thresholds for degradation of each outstandingly remarkable value, as well as a monitoring program that triggers action intended to prevent degradation prior to its incidence. See *FYVIII*, 348 *F.3d* at 1034.

Biological Value: Subalpine Meadow and Riparian Complex

Wild Segments: Lyell Fork, Upper Dana Fork

Scenic Segments: Lower Dana Fork, Tuolumne Meadows

Condition Assessment

Condition at the Time of Designation

At the time of the 1984 designation, the subalpine meadow and riparian complex in the Tuolumne River corridor was largely undeveloped and retained a relatively high level of biodiversity and productivity. The diversity of plants and animals currently present (see “Current Conditions,” below) was probably also present in 1984. Managers were generally unaware of any serious problems, and no major research or resource management initiatives were underway. However, historic activities along the river and other anthropogenic (human-induced) influences over the previous 100 years had probably disrupted biological and hydrologic processes, which were affecting meadow stability at Tuolumne Meadows, as described below. The primary sources for the following discussion are Cooper et al. 2006; NPS, Babalis et al. 2006k; and Smith 2009.

Effects of Historic Sheep Grazing

Significant and lasting vegetation changes, driven by the overgrazing of sheep, occurred in Tuolumne Meadows from the 1860s through to the early years of the 20th century (Dull 1999).

The damage is cited by many sources. John Muir (1911), who first came to the Sierra Nevada as a shepherd, famously called sheep “hoofed locusts.” In the 1870s Joseph LeConte (1875) observed that “some twelve to fifteen thousand sheep are now pastured here (in Tuolumne Meadows). They are divided into flocks of about twenty-five hundred to three thousand.” Visitors to Tuolumne Meadows observed a variety of impacts resulting from overgrazing. Meadow plants were grazed to the ground or trampled, especially around bedding areas. Sheep hooves punched into the wet ground, cutting the soil and destroying the underground network of rhizomes that supports sod-forming plants. Bare earth was loosened and eroded by rain into gullies.

Long-lived clonal and densely tufted plant communities were replaced by communities dominated by annual species. Damage was especially severe along repeatedly used trails. Streambanks were denuded of protective willow and other plant cover, resulting in extensive erosion. Studies conducted in Tuolumne Meadows and other regions show that overgrazing along streams has been linked to channel downcutting or widening, which in turn leads to lowered water tables in adjacent meadows (Kaufman and Krueger 1984; Hall and Bryant 1995; Sierra Nevada Ecosystem Project 1996).

The restoration of natural hydrological conditions to Tuolumne Meadows, which is discussed in detail below, may help to protect meadows from conifer encroachment. The causes of conifer encroachment will be researched as part of the comprehensive program to restore subalpine meadow habitat. If this research indicates a need for the resumption of conifer removal, it will be incorporated into the ecological restoration program. The role of fire is managed according to the park’s Operational Fire Management Plan, which seeks to perpetuate as natural a role for fire in Yosemite wildland ecosystems as is possible. Fire management will also be informed by the research supporting ecological restoration at Tuolumne Meadows.

An 1897 National Academy of Sciences report on the impacts of grazing in the Oregon Cascades shows that, in the last years of the 19th century, the issue was receiving national attention. In 1889, John Muir and Robert Underwood Johnson, appalled by the damage done by overgrazing, lobbied for national park status for the Yosemite area. This was granted by Congress in 1890. The U.S. Army administered the park from 1891 to 1913. The army’s primary management challenge was protecting the park from illicit grazing, logging, and poaching. It took over a decade to bring these practices under control. An 1898 report from the park’s first acting

superintendent shows just how extensive grazing was in Yosemite: “From June 25 until September 1, we expelled from the park 189,550 head of sheep, 350 head of horses, 1,000 head of cattle, and captured 27 firearms” (USDI 1899: 85).

Altered Fire Regimes and Conifer Encroachment

Natural and Native American fire regimes have been absent from Tuolumne Meadows since at least the early 1900s but may have been relatively frequent prior to the mid 1800s (Cooper et al. 2006). The relative effect of natural versus Native American fires is not well known. Fires may have historically promoted meadow stability by limiting conifer encroachment. However, it is not known if fires burned across Tuolumne Meadows or stopped at the forest-meadow margin. Periods of conifer encroachment into the meadows appear to be the result of a warmer, drier climate and lower moisture correlated with low interannual climate variability (Millar et al. 2004). Manual control of conifers in the meadows likely began with Native Americans; the practice was adopted by the Civilian Conservation Corps in the 1930s and continued until recently.

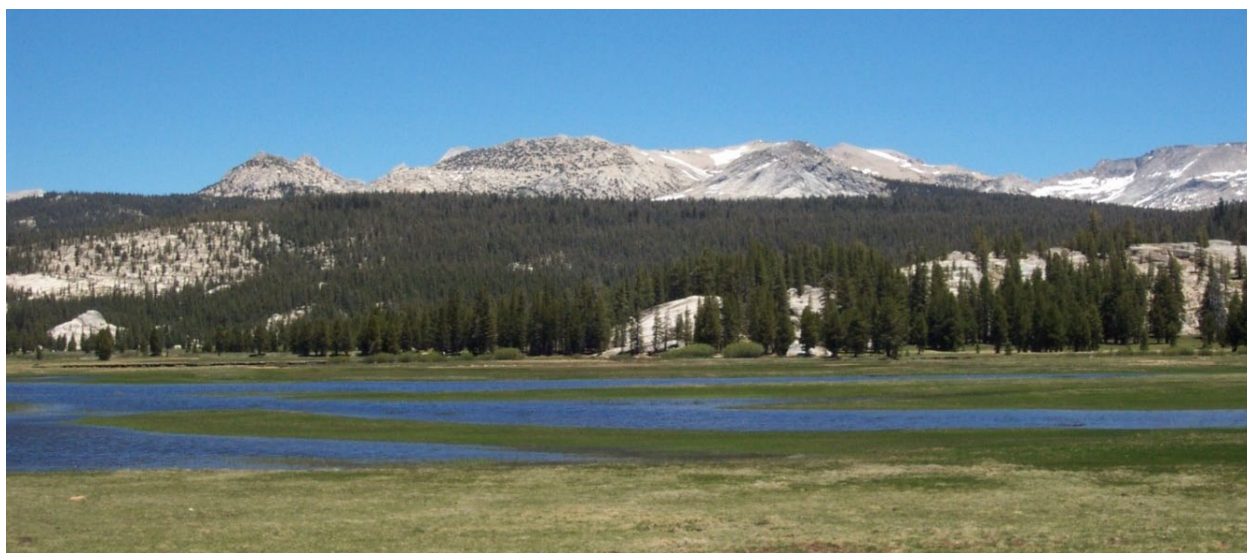
As discussed under “Actions NPS Will Take to Address Management Concerns,” below, the *Tuolumne River Plan* will address the effects of historic sheep grazing as part of a comprehensive ecological restoration program for subalpine meadow and riparian habitats (see appendix H). Two of the closely related objectives of this program are (1) to restore natural hydrologic function to the river and its floodplain and (2) to restore native riparian and meadow plant communities. The latter will include planting of riparian vegetation along riverbanks. Additional research is underway to identify feasible and appropriate techniques for restoring native meadow vegetation in areas where historic grazing has led to shifts in vegetative composition.

Effects of Historic Trails, Roads, and Camping

The chronology described in this and the following paragraphs comes from the park’s historic resources study (NPS, Greene 1987a). Many of the travel routes through Tuolumne Meadows originated as Native American trails. In 1883 the Great Sierra Wagon Road was completed across the meadows to the silver mines on Mount Hoffman. This route was reopened to automobiles as the Tioga Road in 1915. The current trail system through the meadows was established between 1891 and 1913 during the period of U.S. Army administration. Portions of the Tioga Road were realigned in 1934. Some data suggest that the presence of the Great Sierra Wagon Road and Tioga Road has caused local damming of surface and subsurface flow along the roads (Cooper et al. 2006). Culverts have forced previously dispersed runoff into localized channels and resulted in downcutting and lower water tables in adjacent meadows.

The Sierra Club purchased the homestead at Soda Springs in 1912, and camping occurred there until 1974. Parsons Memorial Lodge was constructed at Soda Springs in 1915. Tuolumne Meadows Lodge was opened in 1916. Visitation flourished following the opening of the Tioga Road, and this in turn led to concerns about impacts on the meadows. Visitors drove automobiles through the meadows and camped where they liked. Soil compaction and resulting damage to park forests and meadows were documented by Meinicke in 1927, who recommended confining campers to designated sites (NPS 2006k). Rock barriers were placed and ditches dug along roads in 1927 to prevent people from driving autos onto the meadows. The NPS began restricting camping in the meadows in 1933, and the Tuolumne Meadows campground was completed in forest adjacent to the meadows in 1936.

Mitigating the effects of historic roads on meadow hydrology is a central component of the ecological restoration program for Tuolumne Meadows, as described under “Actions NPS Will Take to Address Management Concerns,” below.



NPS PHOTO BY KRISTINA RYLANDS

Seasonal high water in the Tuolumne River, Tuolumne Meadows.

Effects of Development and Management Practices in Place at the Time of Designation

By 1984 most facilities, with the exception of roads and trails, were concentrated in upland areas around Tuolumne Meadows. Seasonal facilities (open May to October) that supported basic visitor services included a small store, a large campground, rustic tent lodging, employee tents and cabins, administrative and concessioner stables, a visitor contact station, a gas station, and water and wastewater treatment systems. The Tioga Road skirted the southern edge of Tuolumne Meadows and ran just north of Dana Meadows. Roadside ditches and culverts allowed movement of water from upland areas into the meadows. The ditches intercepted natural surface sheet flow and shallow groundwater, moving it rapidly to culverts, where the flow was passed under the road and released as channelized flow on the other side. From November to April, the roads were closed and visitor use was limited to hearty travelers who snowshoed or skied into the snow-covered meadows.

Impacts associated with foot traffic in areas of concentrated visitor use, such as Soda Springs, occurred at the time of designation, as evidenced by restoration projects conducted in the 1980s. Other historic actions that may have contributed to conditions at the time of designation in Tuolumne Meadows include adding oil to ponded areas for mosquito abatement, extensive aerial spraying of malathion/diesel mix in an effort to kill needle leaf miner, the free-form camping that allowed people to drive across the meadow to their campsites, and the installation and repair of sewer lines between the old Sierra Club campground and the current Tioga Road.

Lodgepole pine encroachment into subalpine meadows was ongoing in 1984.



NPS PHOTO BY KRISTINA RYLANDS

Meadow and riparian vegetation along an ephemeral stream in Dana Meadows.

Current Condition

Since the 1984 designation, a wilderness center has been added; parking has been expanded at Dog Lake and the visitor center; the number of campsites in the campground has been reduced by about half; shower houses have been added or replaced in employee housing areas; and underground gas tanks have been removed. Facilities remain concentrated in uplands. Restoration projects to repair impacts on meadow/riparian areas have been implemented across Tioga Road from the store/grill, near the Cathedral Lakes trailhead, at Pothole Dome, at Soda Springs, at Lembert Dome, along the trail to Glen Aulin, and along the lower Lyell Fork (NPS 2009f).

In spite of historical disruptions to biological and hydrologic processes, the meadow and riparian complex still provide habitat for a diversity of plant and animal species, including special status species such as slender lupine (*Lupinus gracilentis*), Yosemite bulrush (*Trichophorum clementis*), Yosemite toad (*Anaxyrus canorus*), and several species of bats and migratory birds (NPS, Buhler et al. 2010e). Meadow invertebrate assemblages at Tuolumne Meadows are also remarkably diverse, with relatively low dominance of any one form (Holmquist and Schmidt-Gengenbach 2003). These indicators suggest a relatively high degree of meadow and riparian health and functioning.

However, several recent studies have documented changes in meadow ecological integrity, exemplified by expanding areas of bare ground, atypical plant species, conifer encroachment, and diminished willow vegetation along riverbanks, summarized below (NPS, Buhler et al. 2010e; Cooper et al. 2006). Researchers suspect that the disruption of ecological processes resulting from historic sheep grazing, coupled with the emerging stress of global climate change and more frequent periods of low precipitation, is being exacerbated by heavy foot and stock traffic in sensitive meadow habitats, heavy browsing by deer of the few remaining willows, and a high level of ground disturbance by gophers and voles (Cooper et al. 2006; NPS, Ballenger et al. 2010j). While studies continue, currently there are no simple explanations for these findings of instability in particular meadows and riparian areas. However, the cumulative effects of these past, present, and emerging stresses have the potential to change the long-term productivity of the meadows. These management concerns are described in detail below, and are addressed by actions included in this chapter, in the alternatives in chapter 7, and in the restoration plan in appendix H.

Management Concerns

Meadow Fragmentation Due to Informal Trails

Areas of concentrated visitor use along the Dana and Lyell Forks and at Tuolumne Meadows are being disturbed by increasingly heavy foot traffic (NPS, Buhler et al. 2010e). These areas have been found to be highly susceptible to impacts on vegetation, soils, and soil organisms associated with foot traffic (Holmquist and Schmidt-Gengenbach 2008).

NPS monitored four areas from 2009 to 2011: (1) the main meadow at Tuolumne Meadows, (2) the small meadow near the ranger station, (3) the upper meadow in Lyell Canyon, and (4) Dana Meadows. The following maps (figures 5-2 through 5-8) and table 5-1 document locations and conditions of informal trails in Tuolumne and Dana Meadows and the upper Lyell meadows (NPS 2009k). Informal trails were classified, as illustrated on the maps, as having one of three levels of visible impact: (1) stunted vegetation (stunted by trampling), (2) some bare ground (areas of visible soil interspersed with trampled vegetation), or (3) barren (a linear path denuded of vegetation). The maps also show a 5-meter zone centered on the trails to graphically depict the associated disturbance to vegetation and soils that occurs from the presence of the trail and the use it receives.

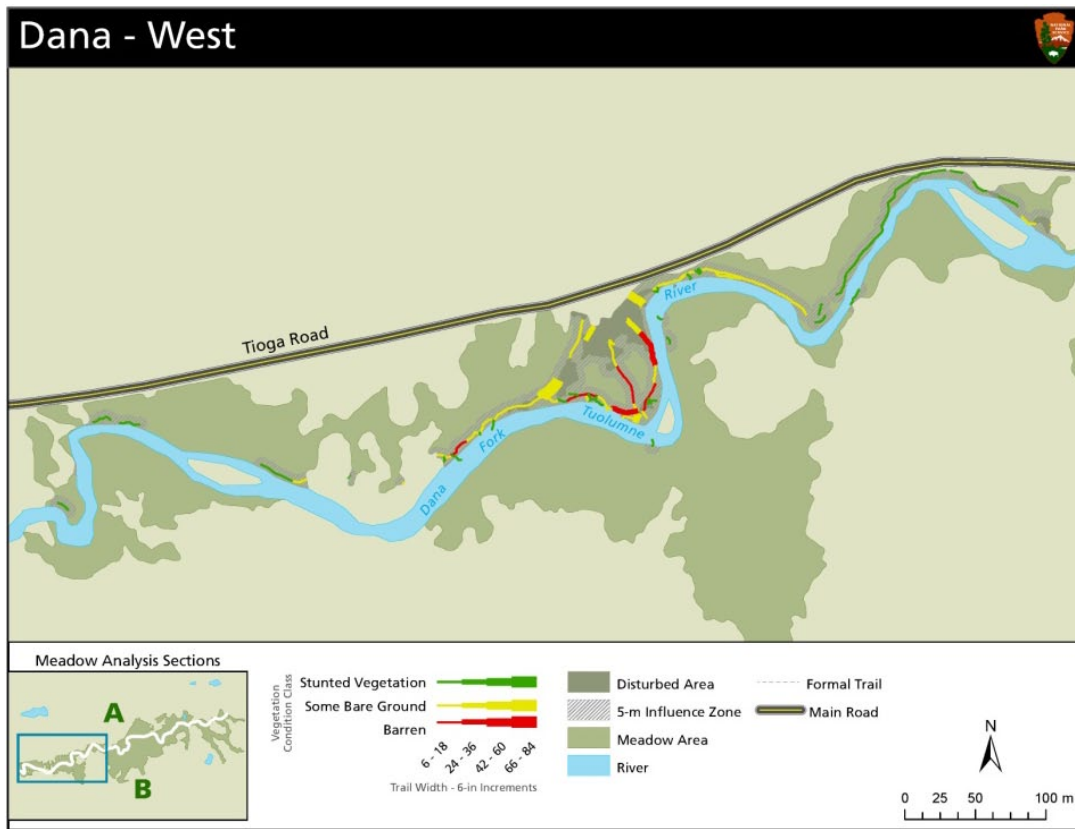


Figure 5-2. Location and Condition of Informal Trails, West Dana Fork.

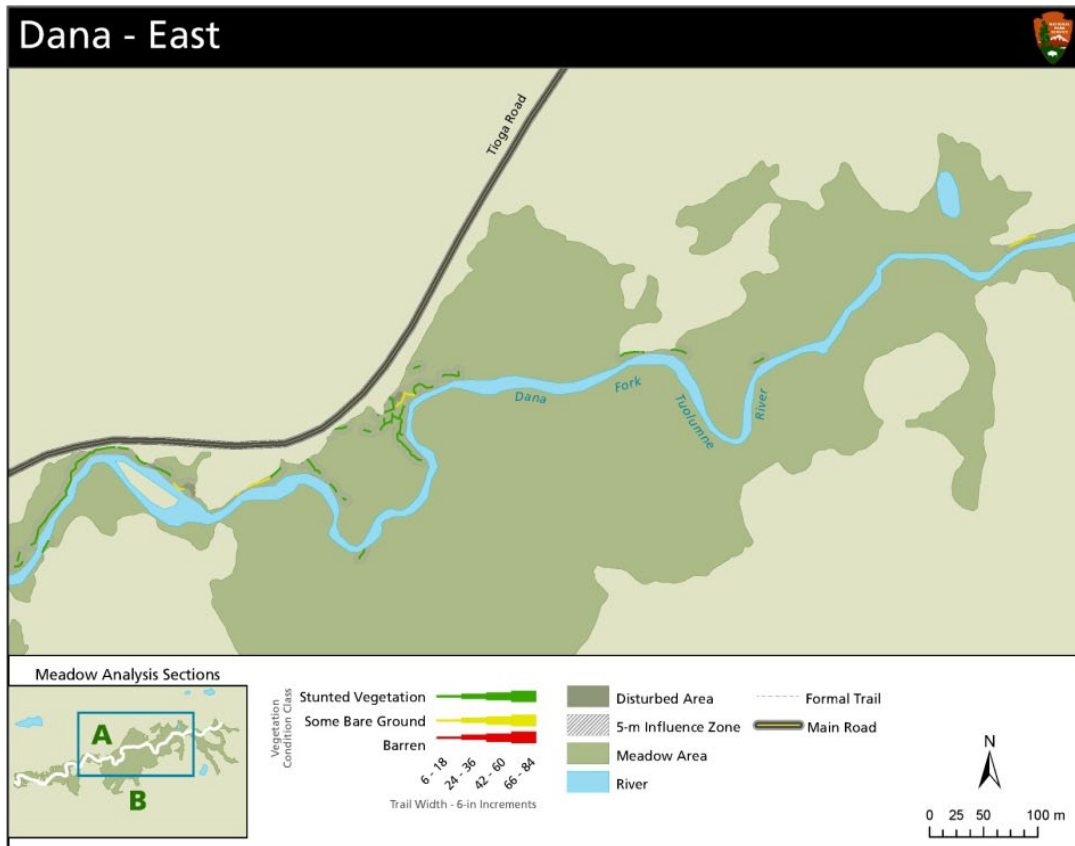


Figure 5-3. Location and Condition of Informal Trails, East Dana Fork.

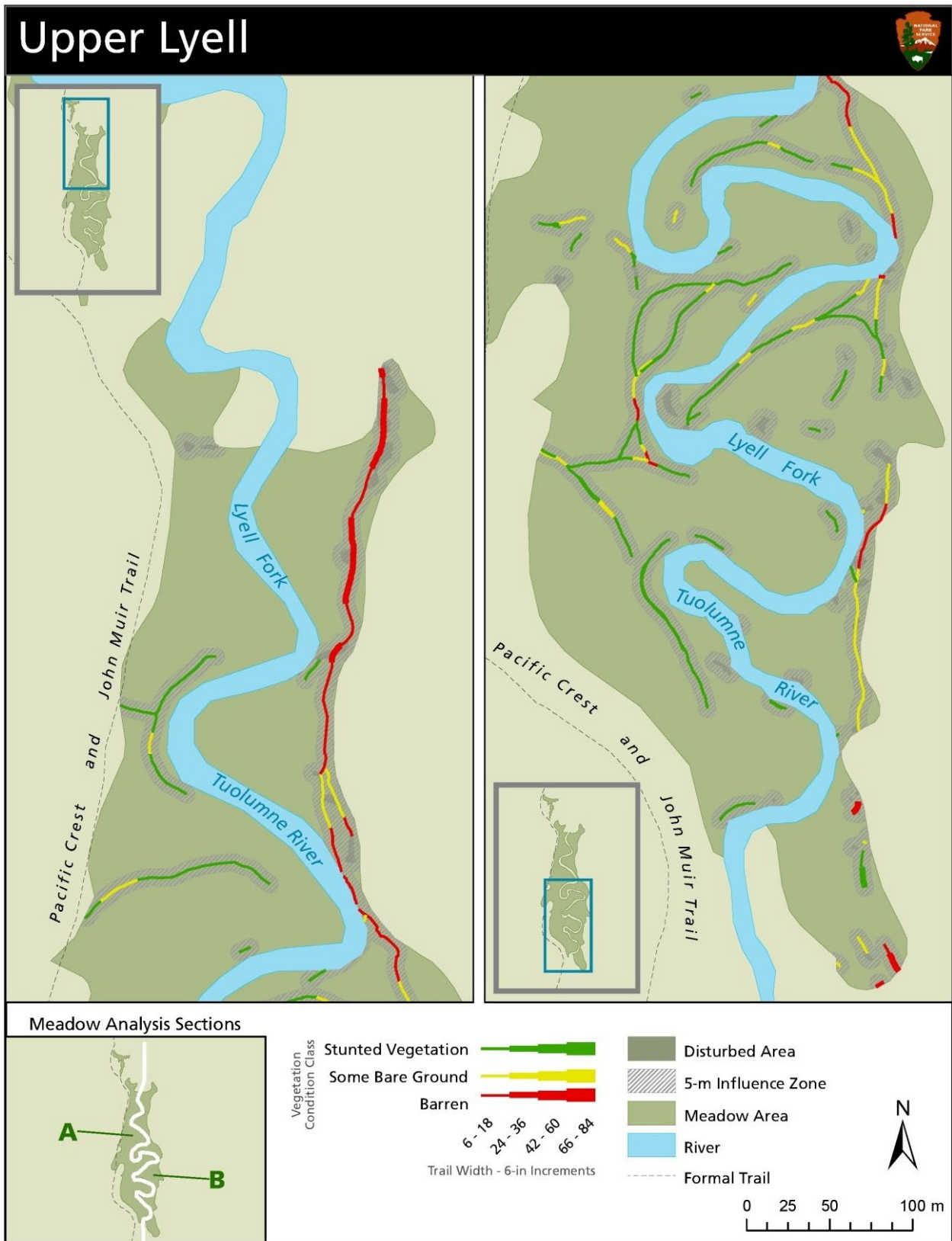


Figure 5-4. Location and Condition of Informal Trails, Upper Lyell Fork.

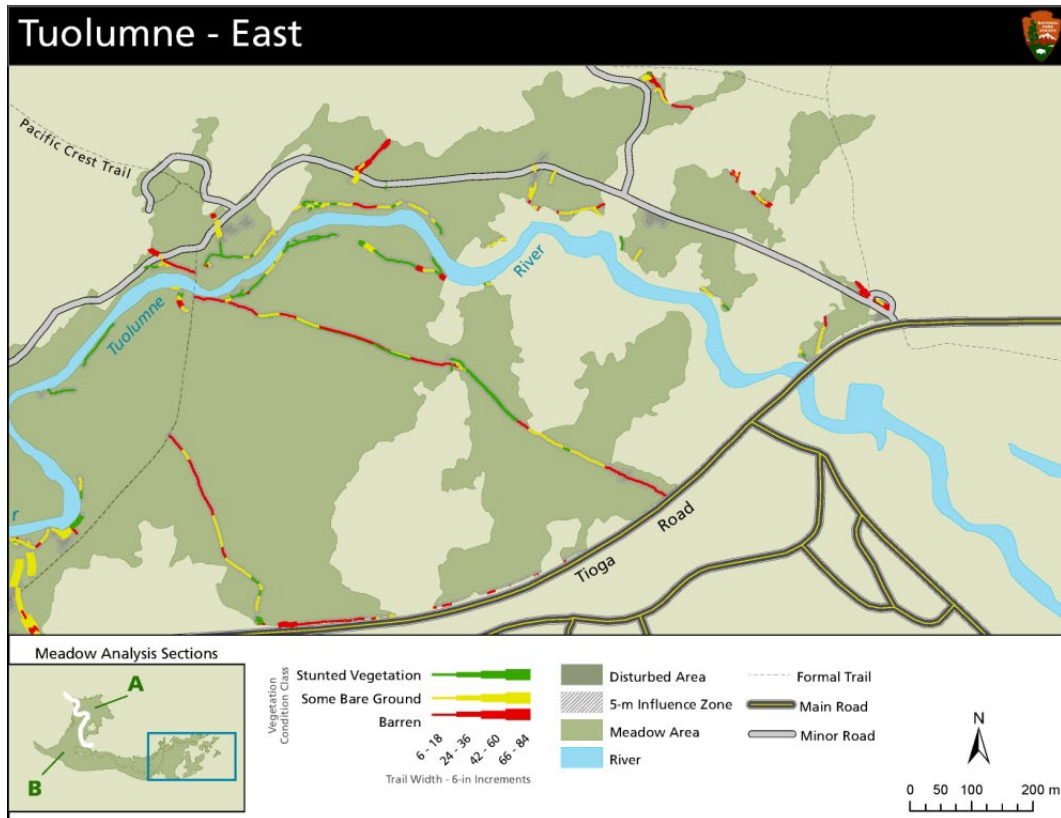


Figure 5-5. Location and Condition of Informal Trails, East Tuolumne Meadows.

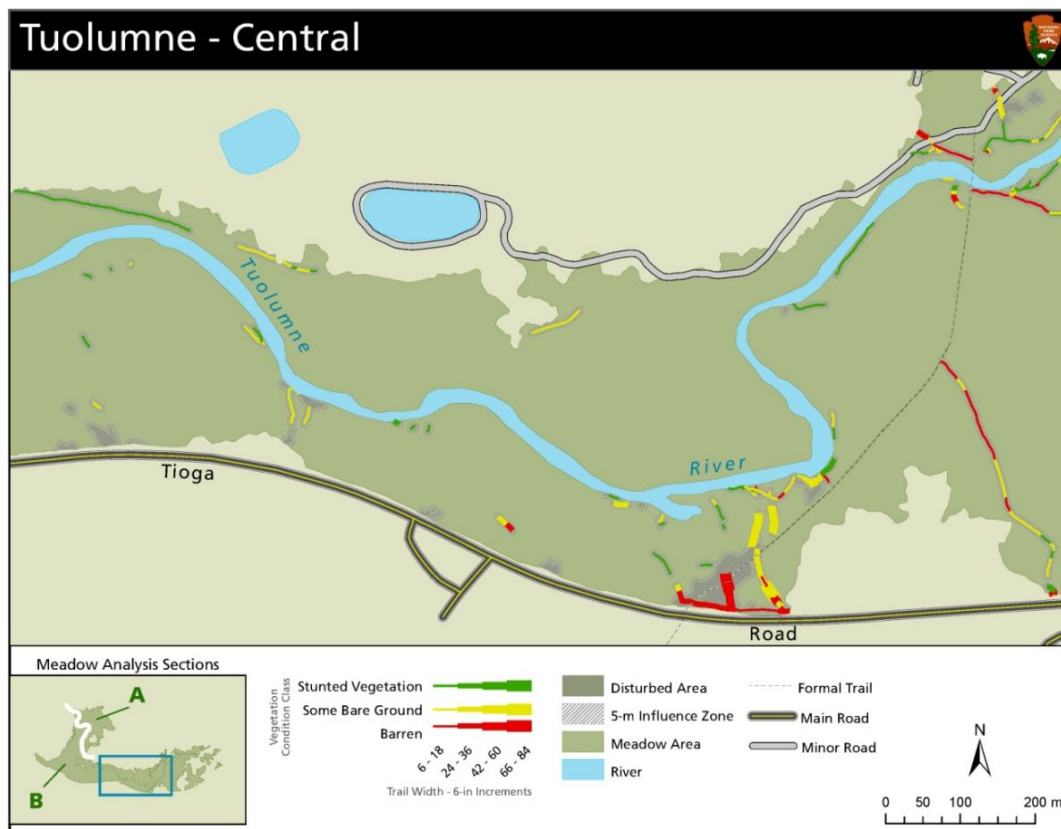


Figure 5-6. Location and Condition of Informal Trails, Central Tuolumne Meadows. The two visible ponds are the wastewater containment ponds.

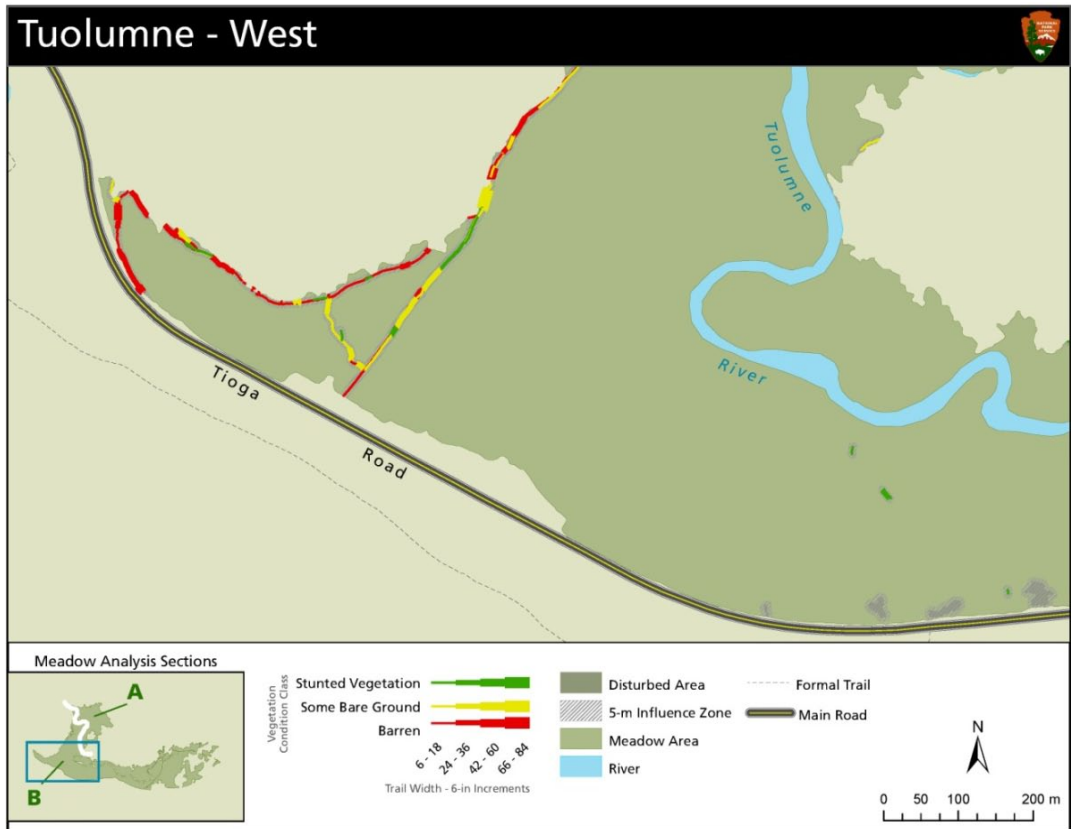


Figure 5-7. Location and Condition of Informal Trails, West Tuolumne Meadows.

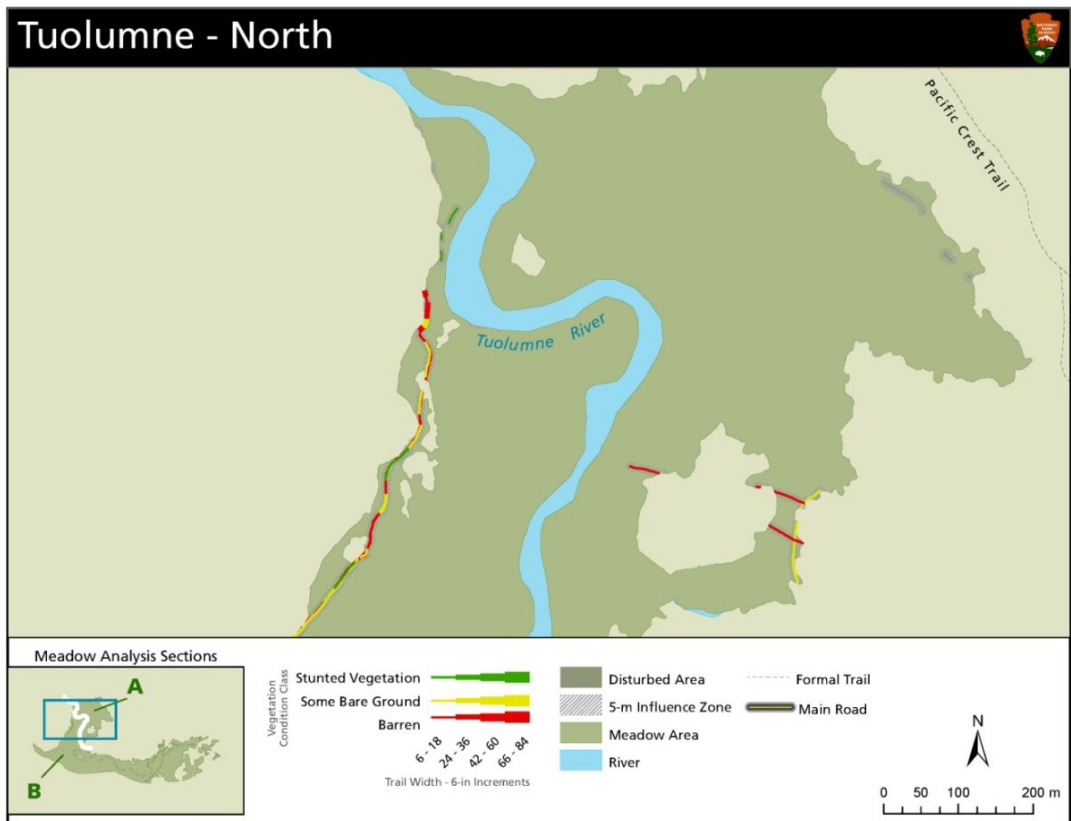


Figure 5-8. Location and Condition of Informal Trails, North Tuolumne Meadows.

Diminished Streambank Stability and Channel Widening

Based on a preliminary condition assessment (developed by Pritchard et al. 1998) of the Tuolumne River in Tuolumne Meadows, a team of hydrologists and river managers determined that several reaches of the Tuolumne River appear to be “functioning at risk” with an undetermined trend. Cooper and others (2006) found that the banks of the Tuolumne River are eroding on outside meanders without accompanying riparian vegetation (primarily willow) recruitment on the complementary point bar, likely resulting in channel widening. Riverside willows, abundant along the river in Tuolumne Meadows in 1867 (Cooper et al. 2006), appear to have diminished greatly. As part of the assessment of historical and contemporary influences on vegetation, Cooper and others found that the decrease in willows might be associated with extensive sheep grazing during the late 1800s, exacerbated by deer heavily browsing the few remaining willows.



An example of channel widening on an outer river bend in Tuolumne Meadows.

The riverbanks on the Tuolumne River (particularly on the west end of Tuolumne Meadows) have little to no vegetation, particularly willows, and are characterized by extensive erosion and riverbank loss (NPS, Buhler et al. 2010e). Vegetation loss and the subsequent riverbank erosion could be exacerbated by human trampling (NPS, Buhler et al. 2010e). Certain reaches of the Tuolumne River that experience high levels of visitor use are devoid of riverbank vegetation.

Willows along the riverbank serve an important role in preventing river widening. The lack of willows on sandbars and riverbanks allows water to flow unimpeded, thus increasing the river flow velocity and altering scour and deposition relationships (NPS, Buhler et al. 2010e). Channel widening produces a shallower channel with a lower river stage for any given flow

volume and a concurrent drop of the water table associated with the river (Cooper et al. 2006, Loheide and Booth 2010). Because wet meadows form where a shallow water table during the summer fulfills the water requirements of this groundwater-dependent ecosystem (Loheide et al. 2009), a drop in the water table could adversely affect wet meadow vegetation. A wider, shallower channel also influences the magnitude and frequency of overbank flow and associated sheet flow processes (NPS, Buhler et al. 2010e).

Changes in Meadow Hydrology at Tuolumne Meadows

Soil moisture and hydroperiod (length of time soil remains saturated) are the most important determinants of the presence and integrity of meadows (Heady and Zinke 1979, Allen-Diaz 1991). Stream channelization and straightening, drainage efforts, and culverts have lowered water tables in northern Sierra Nevada meadows, triggered a succession to xeric (drought-tolerant) plant species, and diminished ecosystem function (Loheide and Gorelick 2007).

Tioga Road runs east-west along the southern edge of Tuolumne Meadows. Direct precipitation runoff from roads and surface sheet flow from the adjacent slopes is collected in roadside ditches and then channeled through 35 culverts. Roadside ditches can act as drainage ditches by intercepting surface sheet flow and shallow soil water and moving it more quickly out of wetland systems than would normally occur (Repath 2011). Road culverts are intended to move water from one side of a road to the other; however, in 2006 Cooper and others observed that culverts were clogged with vegetation and sediment in 12 locations, and signs of ponding water south of the road were visible in 23 locations. Ponding is much more frequent near the eastern end of the



Headcut associated with Budd Creek.



Partially blocked culvert.



Culvert set too low in meadow.

meadow, where culverts are spaced farther apart. This is also where the campground, gas station, store, and other infrastructure, coupled with lower gradient surface slopes, further interrupt water flow.

Culverts force previously dispersed runoff into local channels, and downcutting of these channels has occurred on the downside of many culverts, particularly in the west end of the meadow. Headcuts (see Budd Creek photo above) occur when sheet flow is concentrated and channeled at higher than natural velocity, thus increasing scour and altering sedimentation dynamics. Like downcut channels, headcuts lower the adjacent water table and limit sheet flow across meadows (Cooper et al. 2006). Many Tioga Road culverts were installed lower or higher than the meadow surface, which exacerbates downcutting, headcutting, and ponding. These changes in meadow hydrology can result in changes to meadow community species composition (NPS, Buhler et al. 2010e).

The sections of the Great Sierra Wagon Road from the visitor center to Parsons Memorial Lodge (now a trail) and from Parsons Memorial Lodge to Lembert Dome (currently used by maintenance vehicles) include segments of raised roadbed edged with ditches that empty into culverts. The damming action of the roadbed, combined with headcuts, vegetation loss, and incised channels associated with the ditches and culverts, alters the natural near-surface and surface flow of water throughout the meadow (NPS, Buhler et al. 2010e).

The other stretch of the Great Sierra Wagon Road, between Tuolumne Meadows Lodge and Lembert Dome (now a trail), is deeply rutted, a situation that also affects the meadow hydrology. Its proximity to the Tioga Road and the Tuolumne River, combined with the sandy substrate, has led to deep channeling, heavy erosion, headcuts, and sediment transport into the river. Sheet flow coming off Lembert Dome is channeled through culverts and along the deeply rutted trail toward the river. This diverts water from the meadow and exacerbates erosion in the deep ruts (NPS, Buhler et al. 2010e). The lateral headcuts and informal trails leading to the main trail exacerbate and expand the channeling effects through the local terrain. Sections of the historic roadway are deep, sandy, and difficult to walk on. Visitors and pack stock walk on the edge of the trail, which leads to further vegetation loss and widening of the incised trail. If this condition was allowed to persist, continued erosion and alteration of the natural and cultural terrain would likely occur (NPS, Noon and Martin 2010d).

Enhancing river hydrology, while critical, may not be sufficient to reverse the disturbance to the meadow, as described below.

Bare Soil and Changes in Meadow Vegetation

Existing studies show that Tuolumne Meadows has higher bare soil cover than would be expected for an intact wet meadow (NPS, Ballenger and Acree 2009m). The high organic content of Tuolumne Meadows soils and the currently low belowground plant production suggest that the existing vegetation could not have formed these soils (Cooper et al. 2006). Recent studies suggest several possible causes. As reported by Cooper and others (2006), historic grazing may have created an alternative stable state that would require more than just mitigating disruptions to hydrologic processes to reverse. Intense grazing and hoof punching can destroy the underground network of rhizomes that supports sod-forming plants, and their reestablishment is an extremely slow process. When a rhizomatous sod layer is broken apart, the loose, bare ground is susceptible to erosion and invasion by non-meadow plants. Shallow-rooted annuals dominate these disturbance patches, and lodgepole pine seedlings are common. The low density of belowground roots and rhizomes allows pocket gophers and voles to maintain plant communities in a perpetual state of disturbance. It also affects the water retention capacity of meadow soils, thus exacerbating the drying effects of the previously described impacts on hydrologic processes (Lowry and Loheide 2010).

Recent studies also show higher levels of bare ground in subalpine meadows with high levels of current pack stock use (such as meadows along the Lyell Fork), when compared with those with lower pack stock use (NPS, Ballenger et al. 2010j). Hoof punching was highest in meadows with more area dominated by wetland species, suggesting that meadows are receiving stock use while soils are still wet and more susceptible to impacts. Recent studies document lodgepole pine encroachment into subalpine meadows along the Lyell Fork (Cooper et al. 2006).

Actions NPS Will Take to Address Management Concerns

The previous sections speak to the loss of ecological resistance of subalpine meadow ecosystems (the amount of disturbance that a system can take before key ecosystem elements change), and the capacity of these ecosystems to adapt (the ability to deal with unpredictable change). This section presents actions the NPS will take to protect and enhance the Tuolumne River's subalpine meadow and riparian system. Anthropogenic threats that can be managed by the NPS, such as residual effects of historic uses and effects of current visitor and administrative use, will be addressed. Some influences, such as global environmental change, which might result in long-term changes to the riparian and meadow system, cannot be prevented by the NPS. The meadows are being monitored for the effects of global environmental change in efforts unrelated to this plan, and management practices may be adjusted to protect and enhance river values in response to climate change.

Detailed restoration planning was originally conducted and documented in *Ecological Restoration Planning for the Tuolumne Wild and Scenic River Comprehensive Management Plan (Ecological Restoration Plan)*; NPS, Buhler et al. 2010e). Proposals from that report are summarized here, and the full report is attached as appendix H. Referenced locations are shown on the *Ecological Restoration Plan* map (figure 5-9). Unless noted otherwise, all actions discussed herein are actions common to all alternatives.

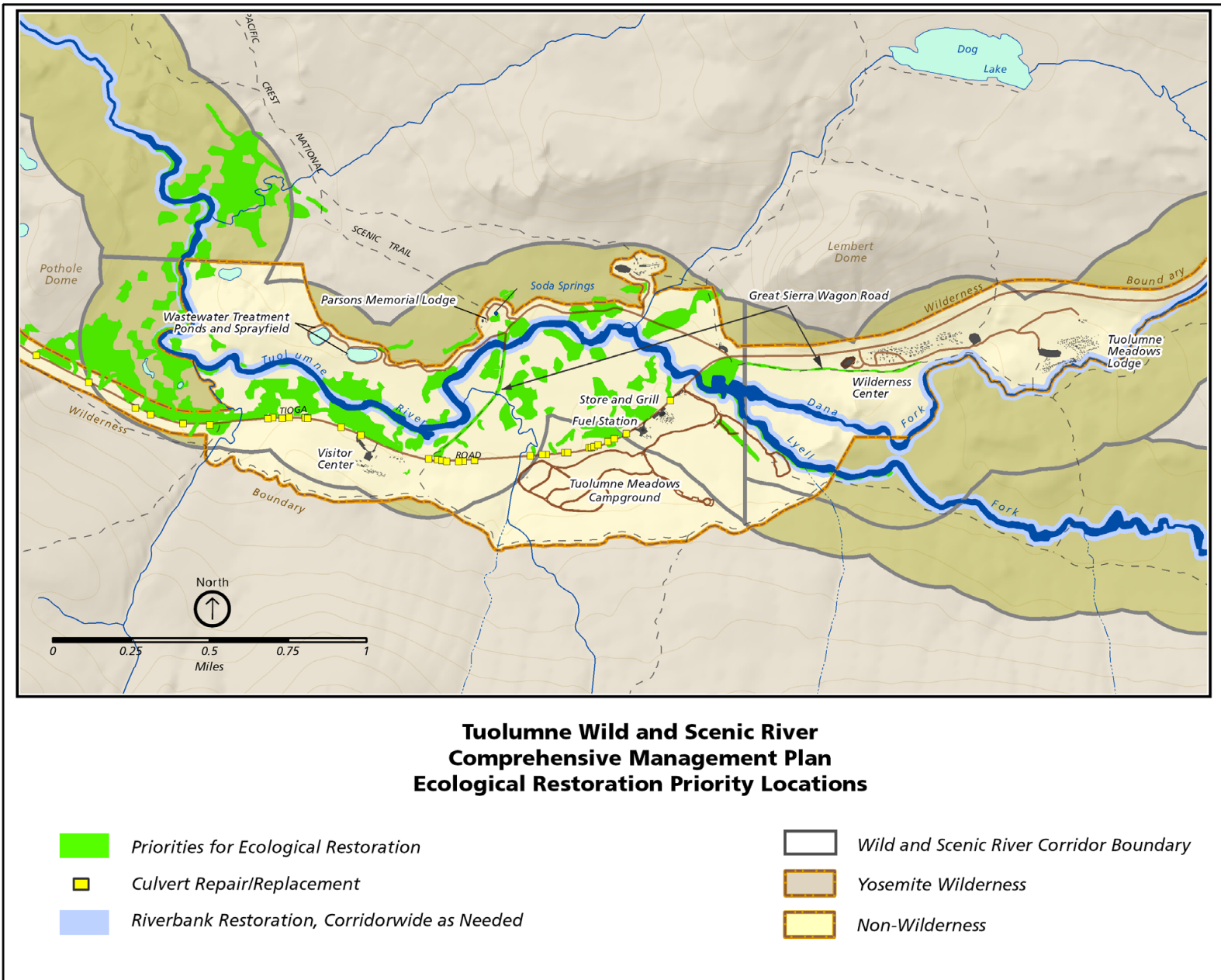


Figure 5-9. Tuolumne Meadows Ecological Restoration Priority Locations.

The *Ecological Restoration Plan* focuses on protecting or restoring primary hydrologic and biological processes. The goals and objectives of the plan are as follows:

- Protect, maintain, and restore natural hydrologic function of the Tuolumne River and tributaries.
 - Protect, maintain, and restore the hydrologic connectivity between the main river channel and the floodplain (which includes meadows, ponds, wetlands, cutoff channels, oxbows) during regular high water flows.
 - Protect, maintain, and restore naturally high groundwater levels and sheet flow processes to support biotic communities in riparian and meadow plant communities.
 - Protect, maintain, and restore the ability for the Tuolumne River channel to migrate and change course.
 - Improve and protect the ecological integrity of Soda Springs.
- Protect, maintain, and restore the function, structure, diversity and productivity of native riparian and meadow plant communities and wildlife habitat.
- Restore areas impacted by the removal or relocation of facilities to natural conditions.

The above goals and objectives will be achieved through the actions described below. The *Ecological Restoration Plan* is intended to address all the management concerns identified above (meadow fragmentation, streambank stability, changes in meadow hydrology, bare soil, and changes in vegetation). These issues cannot be addressed in isolation; management action to address one issue will often also address others.

Eliminate Roadside Parking and Associated Informal Trails

Roadside parking is a major cause of informal trails across the meadow. To eliminate such informal trails, roadside parking will be eliminated along Tioga Road and the road to Tuolumne Meadows Lodge by installing curbing or naturalistic barriers and by directing visitors to formal parking areas and trailheads. The locations and sizes of the new parking areas would vary by alternative. Informal trails will be removed throughout Tuolumne Meadows. Actions to remove informal trails will include decompacting soils, recontouring unnatural landforms, and revegetation (through seeding and transplanting with native seeds/plants), all of which will contribute to the restoration of more natural conditions in the meadows. Priority areas identified for restoration are listed below:

- roadsides, particularly near the Cathedral Lakes and Parsons Memorial Lodge trailheads
- along the Dana Fork from the former Tuolumne Meadows Lodge to the campground
- along riverbanks
- at Soda Springs
- at Pothole and Lumbert Domes

Remove Structures Inappropriately Sited Near the Riverbank or in Wet Areas

Abandoned utility lines will be removed, crushed, filled, or plugged to prevent their altering underground water transport. For example, old sewer lines likely exist along the Great Sierra Wagon Road between Tioga Road and Parsons Memorial Lodge. The method of pipe removal will depend on the habitat type; those in meadows may be filled with slurry, while in other areas it may be more appropriate to remove the pipe.

The following facilities that are inappropriately sited near the riverbank or in wet areas will be removed under all alternatives:

- the concessioner employee housing in a wet area behind the store and grill
- the concessioner employee tents nearest the river at the Tuolumne Meadows Lodge
- three visitor tent cabins near the river at the Tuolumne Meadows Lodge
- the A-loop campsites closest to the river

Additional facilities not in meadow and riparian areas may also be removed and restored, depending on the alternative and associated site development. They are identified in the site planning sections of each alternative in chapter 7.

The following actions will be taken to restore previously disturbed sites:

- Decompact, mulch, and revegetate impacted areas.
- Recontour unnatural landforms.
- Restore primary ecosystem processes (primarily hydrologic).
- Protect restoration areas from further impacts with fencing or appropriate deterrents.
- Remove above- and belowground infrastructure that affect hydrologic conditions (such as pipes, asphalt, and water diversion).
- Salvage any soil or vegetation impacted by removal for replanting/reuse.

Restore Riparian Vegetation along Riverbanks

Channel widening is believed to be associated with loss of riparian vegetation along riverbanks. Such widening affects the hydrologic connectivity between the river and the adjacent meadow/riparian complex. It also lowers the river stage for any given flow volume, decreases the magnitude and frequency of overbank flow during flood periods, and drops the groundwater table associated with the river. The primary action to address channel widening will be the reestablishment of this riparian vegetation. The following actions are included in every alternative to restore riparian vegetation along riverbanks where vegetation loss can be attributed to past and current human activities:

- Apply brush-layering techniques (see appendix H) to stabilize riverbanks, promote sediment accretion, and minimize further riverbank loss.
- Establish willows (using hydrodrilling techniques) along riverbanks.
- Protect affected riverbanks from further trampling by temporary fencing or other deterrents so that vegetation can establish.
- Install temporary exclosures to protect willow regeneration from deer browsing.
- Decompact, seed, mulch, and plant to encourage vegetation establishment on denuded riverbanks.

Mitigate Effects of Tioga Road Culverts

To enhance meadows and hydrologic function, culverts along Tioga Road will be improved to facilitate water flow to the river and adjacent meadows. Existing culverts will be repaired or replaced with larger, better-placed culverts. Additional larger culverts are needed in some locations, such as Budd Creek and Unicorn Creek, to accommodate peak spring runoff, some channel migration, and flash floods from summer thunderstorms. A section 7 determination (see appendix I) showed that this work will not unreasonably diminish river values. That determination has been guided by the process described in “Chapter 4: Section 7 Determination Process for Water Resources Projects.”

Culverts will be aligned with the surface level of the adjacent meadows to minimize downcutting, headcutting, ponding, and clogging. Tioga Road is a historic property listed on the National Register of Historic Places, and the historic culverts contributing to the eligibility of that property to the national register will require special treatment to address impacts on the cultural landscape.

When culverts are replaced and enhanced, the following actions will be taken to restore the contours adjacent to existing culverts to help reduce further impacts to natural hydrologic processes:

- Fill ditches associated with culverts with native soil.
- Apply woody debris and plant material to divert and disperse runoff, promote deposition, and limit scour.
- Recontour slope and landform to natural condition to encourage sheet flow.
- Revegetate areas downslope of culverts with native species to slow velocity of water flowing into the meadow and encourage sheet flow and sediment deposition.

Mitigate Effects of the Great Sierra Wagon Road

The hydrologic effects of the section of the Great Sierra Wagon Road from Tuolumne Meadows Lodge to Lembert Dome will be mitigated through the following actions:

- Bring trail ruts up to the same elevation as the adjacent meadow (fill with native soil, rocks, and/or gravel).
- Apply woody debris, plant material, and erosion control structures, such as wattles or blankets, to divert and disperse runoff, promote deposition, and limit scour.
- Establish vegetation (seeding, planting, mulching) to slow water velocity.
- Improve culverts that convey runoff from Lembert Dome (north of the road) to reduce channeling, downcutting, and velocity, thus encouraging sheet flow.
- Stabilize existing headcuts and encourage sediment accumulation by filling and planting or by installing check-dam structures.
- Where the trail diverges from the historic road in front of the ranger station, relocate the trail at the edge of the road and restore the meadow to natural conditions.

The effects of the sections of the Great Sierra Wagon Road from Lembert Dome to Parsons Memorial Lodge and from the lodge to the visitor center will be mitigated through the following actions:

- Lower trail sections that act as dams.
- Fill ditches on either side of the trail section from Parsons Memorial Lodge to the visitor center.
- Apply woody debris, plant material, and erosion control structures, such as wattles or blankets, to divert and disperse runoff, promote deposition, and limit scour.
- Narrow the roadbed to a width that retains its historic character.
- Remove nonnative fill.
- Install additional and larger culverts to accommodate flows from Unicorn Creek.
- Install sections of boardwalk or other surface types through wet and saturated areas to maintain sheet flow and protect vegetation from trampling.

The historic character of the Great Sierra Wagon Road and the John Muir Trail (which follows the historic roadbed in this location) will be protected by the following mitigating measures:

- Maintain the current alignment and a minimum width of 10 feet in order to convey the historic use as a wagon road.
- If modifications are necessary to historic culverts and their associated headwalls, ensure that the modifications match their historic character; similarly, ensure that any new culverts match the historic character of the culverts.

Mitigate Impacts From Stock Use in Lyell Canyon

Actions to mitigate stock-related impacts in Lyell Canyon would vary by alternative and involve either eliminating all commercial and some administrative stock use or increasing its regulation. When an alternative has been selected in a formal record of decision, it will be incorporated here as part of the final *Tuolumne River Plan*. All alternatives call for the following regulation of stock use (which at a minimum would include administrative stock use):

- Campsites and access routes will be specified. Factors such as avoidance of rare plants and other resources of special concern will be considered in designating these areas.
- Pack stock opening dates (or “range readiness” dates for mountain meadows) will be set by managers. Researchers and park staff are collecting data to develop models that predict range readiness dates for meadows frequently used by pack stock. These data will include extent of saturated soil for each meadow as well as soil drying and plant maturation rates for key meadow communities. Data from multiple years over a range of early season conditions will be correlated with snowpack and/or runoff rates to develop a model to predict meadow opening dates prior to stock use season. In areas of stock use, conditions will be monitored to provide feedback for adjusting opening dates. This information will allow managers to determine the best dates for early season stock use while protecting meadow soils and vegetation.
- A grazing capacity for meadows in the Lyell Fork has been identified based on recent meadow condition assessments and past research (Cole et al. 2004). The grazing capacity is an estimate of the grazing level that could be sustained without undesirable effects on meadow habitat (NPS, Ballenger 2010h). Meadows receiving high use will be monitored annually to ensure that the grazing capacity was protective of river values (NPS, Ballenger et al. 2010j).

Localized areas previously disturbed by stock use or other human activities in Lyell Canyon will be restored using techniques that meet the minimum-requirement criteria established under the Wilderness Act.

Conduct Additional Research

More research is necessary to examine evidence of the historic vegetation communities in areas of concern, the most efficient and effective techniques for restoration, and the feasibility, as well as the appropriateness, of potential ecological restoration activities. Research into the composition of historic vegetation is likely to entail analyses of soil seed banks, plant macrofossils, and phytoliths (microscopic pieces of plants that are resistant to decay and can identify historic plant species). Analyses of organic matter content, soil carbon, and plant productivity may also be included. Ecological restoration techniques, if determined feasible and appropriate, would likely involve planting, seeding, and mulching, with temporary closure to foot traffic as vegetation reestablished. Research might also provide information on the relationship between past land uses, such as intensive grazing, and the rate and extent of conifer seedling establishment. All of these studies will address the potential influence of climatic conditions and consider those interactions.

Cooper and others (2006) recommended a detailed study of willows to understand the factors that limit willow establishment and persistence in the area and the relationship between willow growth and bank stability. This research was initiated in 2011 and is ongoing. Research into the effects of pocket gophers, voles, and deer on the establishment and growth of perennial plants typical of wet meadows also began in 2011. The effects of deer browsing is being studied by placing small enclosures around individual willows to protect them from grazing, then assessing any changes in willow height, productivity, and catkin/seed production. These research plots are located outside of designated wilderness.

Fire also played a role in shaping the vegetation communities and landscape of Tuolumne Meadows, but the frequency and types of ignition (lightning or anthropogenic) of fire are largely unknown. Ongoing studies of fire history in subalpine forests may shed some light on the role that fire may have played in shaping Tuolumne Meadows and point to using fire as an additional restoration tool.

Management Indicators and Monitoring Program

The NPS has developed a suite of three indicators to protect and enhance the subalpine meadow and riparian complex: (1) fragmentation of meadow habitats by visitor-created informal trails; (2) physical streambank stability; and (3) the amount of bare soil in meadows. This combination of metrics represents the most efficient method available for representing the scope of this value and the complexities of the system protected. Each indicator reflects a different aspect of the meadow and riparian complex and different potential impacts on the greater biological value. All meadows within the three segments in which portions of the subalpine meadow and riparian complex occur will be evaluated every three to five years for evidence of use, and all meadows with high potential for visitor-created impacts will be monitored, also every three to five years.

The three indicators are discussed individually below.

Indicator #1: Meadow Fragmentation from Informal Trails

Indicator Description

Informal trails are defined as visitor-created tracks that are noticeable to observers and generally not managed directly by park staff, as opposed to formal trails, which are mapped, periodically assessed, and maintained (Leung et al. 2002; Leung et al. 2011b). Various informal trail metrics have been commonly used as indicators of visitor-caused impacts by federal land management agencies and selected as indicators in other national parks, such as Mount Rainier and Acadia (Kim and Daigle 2011; Rochefort and Swinney 2000) because of their representation of impacts on both social and ecological conditions (Leung et al. 2011b; Monz and Leung 2006).

Informal trail management has been found to be more difficult in subalpine environments, where recovery rates are slow (Eagan et al. 2004; Kim and Daigle 2011). The NPS selected habitat fragmentation from visitor-created trails in meadows as an indicator because of its sensitivity in detecting spatial changes and thus protecting the pristine quality of large areas of intact meadow. In studies of trail impacts outside of meadow environments, researchers have identified disturbance to vegetation and soils within 1 to 3 meters of the trail's edge (Dawson et al. 1974; Dale and Weaver 1974; Leung et al. 2011c). Research within meadow environments has demonstrated that impacts from trails can extend beyond the direct impacts on trails and can have significant impacts radiating from the trail's edge into the meadow (Holmquist and Schmidt-Gengenbach 2004). The degree of fragmentation reflects the potential for impacts on meadow hydrology, habitat quality, soil moisture, and the introduction of nonnative species (Forman 1995; Leung et al. 2011c; Lindenmayer and Fischer 2006). Trail corridors have also been shown to pose barriers for small mammals and other wildlife (Knight 2000; Gaines et al. 2003). Investigations of trampling impacts in Tuolumne Meadows demonstrate that meadow condition is poorer in heavily used areas; larger areas are more prone to recovery than smaller areas; and visitor-created trampling has a significantly negative impact on vegetation and macroinvertebrate structure and diversity (Holmquist and Schmidt-Gengenbach 2004 and 2008; Leung et al. 2011a; Foin et al. 1977).

To measure meadow fragmentation, a Largest Patches Index – Five (LPI₅) has been adapted from the concept of Largest Patch Index (McGarigal and Marks 1995). This index is derived from the sum of areas of the five largest patches without informal trails divided by total landscape (meadow) area and then multiplied by 100. The resulting percentage indicates the extent to which the meadow area is divided (fragmented) due to the existence of visitor-created trails. If zero trails were present, the total index value would be 100%. The main

purpose of including the largest patches as a group of five, rather than merely the single largest patch, is to reduce the index's oversensitivity to changes in one single patch. Although parks such as Mount Rainier have found variations of this metric best suited to their meadow system (Moskal and Halabisky 2010), Yosemite park staff and collaborators also considered the three largest and ten largest patches (LPI₃, LPI₁₀), ultimately determining that five best achieved a balance between simplicity and representativeness for Yosemite's meadows (Leung et al. 2011b).

Definitions of Management Standard, Adverse Impact, and Degradation

Management Standard

The fragmentation management standard for the subalpine meadow complex within the Tuolumne River corridor is an LPI₅ (sum of the five largest intact patches as a percentage of the total meadow area) of 90%. This is interpreted to mean that the LPI₅ for all the selected meadows within any given segment must be greater than or equal to 90%, calculated as a weighted mean of the indexes for each of the selected individual meadows in the segment. The weighted mean value for each segment factors in the relative size of each of the selected meadows in the segment when calculating the index for the segment as a whole. As the overall size of the meadow complex is a key component of the meadow value, this ensures protection of the integrity and overall extent of individual meadows and the full meadow complex within each segment. Although the standard applies to a river segment as a whole, meadows will be monitored individually, and action will be taken if the standard is exceeded at the meadow level (see "Management Triggers and Responses," below).

The fragmentation standard adopted for the *Tuolumne River Plan* was developed using several years of data showing the recent levels of impacts at individual meadows within the main Tuolumne River corridor. Data from several meadows within Yosemite Valley in the Merced River corridor were also considered in selecting numerical standards. A group of subject matter experts determined this threshold based on data from meadows that experienced elevated visitation levels, reduced vegetation cover, and an increased occurrence of invasive species. To select an appropriate standard, all meadow values were considered, and an appropriate value selected from a range of meadow condition over several years. Managers have used best professional judgment in selecting a weighted mean to evaluate the management standard at the segment level. In making this consideration, a suite of other informal trail metrics were considered to ensure that the chosen indicator accurately reflects the degree of trampling-related impacts.

Adverse Impact

An adverse impact will occur if the weighted mean of all meadows within a given segment has dropped below an LPI₅ threshold of 81% for three consecutive years of annual assessments despite management actions to improve the connectivity and overall health of the meadow. Specific precipitation patterns will be evaluated to ensure that the sampling interval reflects impacts caused by visitors as opposed to other natural causes.

Patch size in some meadows has been shown to be associated with reduced total vegetation, increased bare ground cover, and an increased presence of nonnative plants (Leung et al. 2011b). The value chosen to represent adverse impacts reflects conditions found in individual meadows identified by park staff, managers, and subject matter experts as needing significant restoration actions. This value relates to low values for the main meadow in Tuolumne and meadows within Yosemite Valley, both of which have been identified for comprehensive restoration action. These meadows should demonstrate accelerated recovery rates and good response to restoration after actions are taken. A conservative number has been chosen from existing data, with 2 percentage points added for increased sensitivity to impacts (NPS 2009k).

If the LPI is between 89% and 81% for the weighted mean of all meadows within a river segment, management concerns will trigger management actions to ensure that adverse impacts are avoided (see the monitoring program for this indicator, below).

Degradation

The degradation standard for individual meadows monitored for fragmentation resulting from informal trails is a weighted mean LPI₅ value of 40% for meadows within the subalpine meadow complex in the Tuolumne corridor.

Archival aerial photographs make it possible to simulate the fragmentation that previously existed in certain Yosemite Valley meadows. Through spatial analysis using a 1978 image of Stoneman Meadow, park staff determined that an LPI₅ of 40% existed prior to intensive restoration efforts in that meadow (see figure 5-10). The 1978 depiction of this meadow and its associated impacts represents what Yosemite meadow ecologists point to consistently as an example of a meadow in a degraded state. Although this meadow has shown evidence of recovery in recent years, it was made possible through intensive restoration efforts involving several years of planning and significant financial investment.

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

The fragmentation indicator has been monitored by Yosemite biologists at highly visited meadows within the Tuolumne River corridor since 2008. All meadows selected for monitoring are evaluated for a complete set of measures reflecting extent, proliferation, and condition of trails and disturbed areas (Leung et al. 2011b). Meadows of concern are identified for increased monitoring based on other trends found in other metrics that are collected alongside fragmentation data.

Table 5-1 displays current LPI values for the meadows in all three river segments in which portions of the subalpine meadow and riparian complex occur.

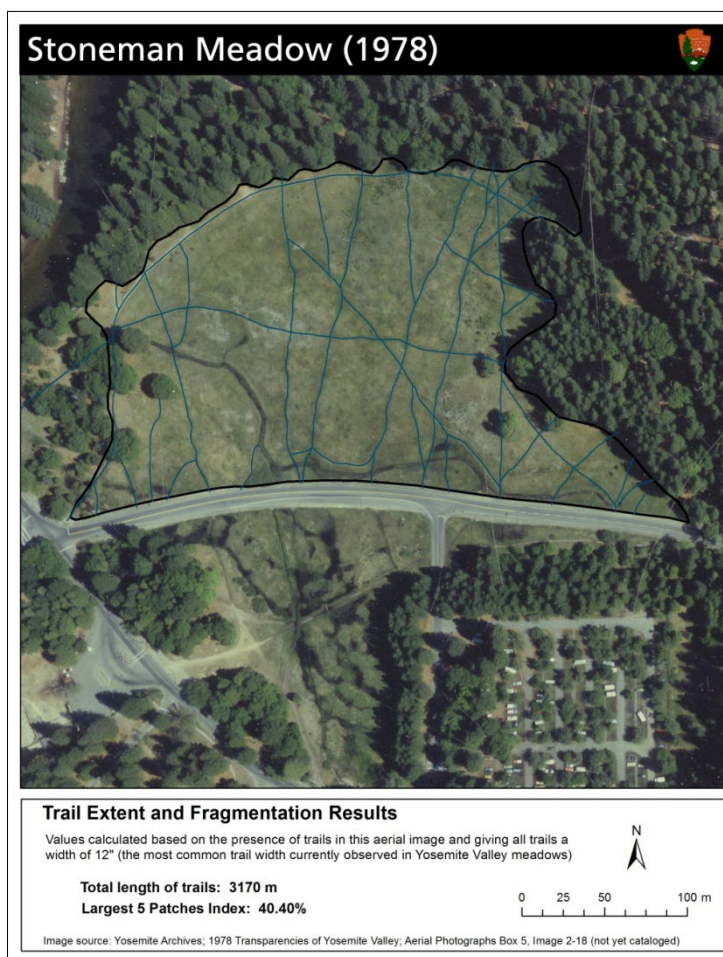


Figure 5-10. 1978 Aerial Image of Stoneman Meadow with LPI Calculations. (Today a boardwalk crosses the meadow north-to-south and the northern edge of the meadow is fenced. Due to these actions, no informal trails are present.)

Table 5-1.
Current Condition of Meadow and Riparian Complex Based on Monitoring of Largest Patches Index (LPI)

| Standards | River Segment /Meadows | Current Conditions by Year ^a | | | |
|---|--|---|-------|------|-------|
| | | 2008 | 2009 | 2010 | 2011 |
| Management Standard: LPI is greater than 90% of weighted mean value of the meadows in a river segment | Lyell Fork Segment | | | | |
| | Ranger Station A | | 99.49 | | |
| | Ranger Station B | | 99.94 | | |
| | Upper Lyell A (see figure 5-4) | 99.7 | 99.3 | | 99.3 |
| | Upper Lyell B (see figure 5-4) | 98.9 | 93.9 | | 96.9 |
| | <i>Weighted mean</i> | | | | 98.71 |
| | Lower Dana Fork Segment | | | | |
| | Dana A (see figure 5-2) | 96.3 | 95.6 | | |
| | Dana B (see figure 5-3) | 100.0 | 100.0 | | |
| | <i>Weighted mean</i> | | | | 98.4 |
| Management Concern: LPI is between 81% and 89% of weighted mean value of the meadows in a river segment | Tuolumne Meadows Segment | | | | |
| | Tuolumne A (see figure 5-8) | 100 | 99.9 | 99.8 | 100.0 |
| | Tuolumne B (see figures 5-5, 5-6, and 5-7) | 80.0 | 78.4 | 78.2 | 78.7 |
| | <i>Weighted mean</i> | | | | 82.3 |
| Adverse Impact: LPI is below 81% of weighted mean value of the meadows in a river segment | | | | | |
| Degradation: LPI is below 40% of weighted mean value of the meadows in a river segment | | | | | |

a LPIs as a percentage of the weighted mean value of all the meadows in a river segment.

Table 5-1 shows that three years of consecutive data have not yet been collected for the Lyell Fork and Lower Dana Fork segments. Based on the available data, if current trends continue, both segments will be within the management standard. The meadows in the Tuolumne Meadows segment do not meet the management standard, as the weighted average falls within the management concern range. This concern will be addressed by actions included in the *Ecological Restoration Plan*, described above, and through long-term monitoring to ensure the proposed management is effective, as described below.

Monitoring Program

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the *Tuolumne River Plan* to ensure that river values are protected and enhanced throughout the life of the plan. A key part of this program will be “management triggers” intended to ensure that any substantial downward trend in conditions will be identified and arrested well before any adverse impact occurs. These triggers will identify management concerns prior to the occurrence of any adverse impact or degradation and will require that specific kinds of management action be taken. Management actions will become more comprehensive if the value continues to decline despite intervention.

Monitoring Protocols

Monitoring of informal trails in meadows within the Tuolumne River corridor will occur during the growing season before plant senescence (final stage in the life cycle of a plant). Meadows with high potential for visitor-created impacts will be monitored every three to five years. Meadows with specific management concerns will be monitored annually. Meadows without evidence of visitor impacts, as reflected in the baseline conditions report, will be periodically evaluated until evidence suggests more intensive monitoring is necessary.

Triggers and Management Responses

To ensure that a downward trend in conditions can be arrested well before an adverse impact occurs, trigger levels for management actions have been developed to address increasing departures from the management standard (an LPI greater than or equal to 90% as a weighted average of the meadows in a particular river segment). Management actions will be triggered when the LPI falls below this level for an individual meadow and become more comprehensive and intensive at lower LPIs, as described in table 5-2.

Table 5-2.
Triggers and Management Responses for Preventing Meadow Fragmentation

| Trigger | Management Response | Rationale |
|---|--|---|
| Decrease in LPI ₅ threshold below 90% for an individual meadow (as opposed to the weighted mean for all the meadows in the segment). | Increase meadow monitoring assessments to one-year interval at each individual meadow that surpasses this value. Largest patches in meadow will be analyzed for trail condition and emergence of new trails. Increase enforcement and education of best management practices in meadows. Manage visitor use through visitor messaging, restoration signs, delineation of trails determined to be less disturbing to meadow ecology, and closure of selected informal trails. | This action allows increased sensitivity to changes in trails, and would allow managers better opportunities to identify meadows of concern and take actions well before adverse impacts are incurred. With more frequent assessment, emerging trails and particularly problematic trails will be identified and restoration actions taken. |
| Data analyses from annual monitoring of fragmentation yields results less than or equal to LPI ₅ value of 90% for three consecutive years for an individual meadow (as opposed to the weighted mean for all the meadows in the segment). | Remove informal trails and restore disturbed areas in specific meadows that exceed the threshold. Restoration activities could include the following: <ul style="list-style-type: none"> ▪ Decompact soils. ▪ Salvage any plants growing in the ruts or on the edges of the trail/ruts for later replanting. ▪ Recontour topography. ▪ Scatter locally gathered seed and organic materials to facilitate new plant growth. ▪ Fill (with native soil) any deep headcuts caused by informal trails and recontour to more natural meadow topography. Management of visitor use could include the following: <ul style="list-style-type: none"> ▪ Install boardwalks or hardened surfaces to allow access to sensitive areas. ▪ Temporarily close sites to use to facilitate restoration. ▪ Fence meadow perimeters. ▪ Institute “hard closures” of specific affected meadows, which involves law enforcement and increased visitor education about the rationale for closures as a means of protecting meadows. Meadow closure regulations would be included within the superintendent’s compendium in order to allow law enforcement. ▪ Reduce or redirect use. Any management action in designated wilderness would require a minimum-requirement analysis. | This value represents the level at which a group of subject matter experts determined that the effects of visitor use would threaten resource protection and quality of the visitor experience. |

Indicator #2: Physical Streambank Stability Rating

Indicator Description

Streambank stability ratings consist of a combination of vegetative cover and the presence/absence of erosion features (Frazier et al. 2005; Burton et al. 2011). Results of quality control tests conducted by Archer and others (2004) demonstrated that streambank stability ratings had generally low coefficients of variation, were repeatable, and were consistent among different observers (especially when ratings were dichotomous—either stable or unstable). Streambank stability has been widely identified as a factor affecting the geomorphic function of stream channels (Kondolf et al. 1996; Kattelman and Embury 1996; Madej et al. 1994; Kauffman et al. 1997).

Impacts on streambank stability can result from multiple causal mechanisms, including both anthropogenic (human-related) and natural sources that alter sediment-discharge balance (Kondolf et al. 1996) or cumulative impacts from both source types (Allen-Diaz et al. 1999). Examples of anthropogenic activities and their impacts that contribute to destabilization of streambanks (hereafter, streambank alteration) include the following:

- human foot traffic (bank shear, compaction, vegetation trampling)
- stock use (hoofpunching, bank shear, soil compaction, vegetation trampling, vegetation removal from grazing)
- road/trail construction and/or informal trailing (soil compaction, decreased sheet flow, reduced infiltration/percolation, increased surface routing and flow velocities, vegetation composition changes)

Streambank stability is a long-term indicator of system function over time; therefore, monitoring data on stability conditions can be used to verify whether and how well objectives are being achieved. Low ratings for streambank stability could be indicative of reduced system function and diminished biological integrity of riparian areas.

Definitions of Management Standard, Adverse Impact, and Degradation

Standards for streambank stability have been reported in published literature from various survey protocols, including the Pfankuch-Rosgen *channel stability assessment* (Rosgen 2001), the *stream condition inventory* (Frazier et al. 2005), and *multiple indicator monitoring* (Burton et al. 2011). Each protocol and corresponding optimal value for streambank stability ratings was considered in determining the management standard, adverse impact, and degradation standard for this indicator.

The following delineations are described hierarchically—in terms of increasing spatial and/or temporal scale. The management standard is determined at the monitoring site (or designated monitoring area) scale. Adverse impact and degradation are determined at the scale of each river segment. This hierarchical distinction is consistent with the river discontinuum and continuum concepts, which infer that each river segment is comprised of individual components (Poole 2002) that collectively function as an interconnected riverine system (Vannote et al. 1980; Rosgen 1996). In addition, the degradation standard incorporates temporal scale, where this standard is met if streambank stability conditions have not recovered to above the management standard over two monitoring years.

Management Standard

The management standard for the maintenance of stable streambanks is a streambank stability rating of 50% or greater for the mean observed value at any individual monitoring site. Monitoring sites are specific, established places, chosen according to accepted criteria, within the three river segments in which portions of the subalpine meadow and riparian complex occur. The monitoring sites are regularly monitored pursuant to the schedule specified in the “Monitoring Protocols” section below, which also lists the specific sites in the Tuolumne River corridor.

Preliminary assessment of multiple indicator monitoring data from sites categorically separated by use levels, indicated a mean percent of stable plots as 55 percent for the highest use sites without adjustment for statistical confidence (n = 3; all are located within the upper Lyell Fork of the Tuolumne River and surveyed between 2009 and 2011). This value is consistent with the findings for nonreference (managed) sites by Frazier and others (2005). Furthermore, this management standard allows for a portion of streambank instability due to either anthropogenic causes and/or dynamic processes (channel migration, erosion, and deposition) fundamental to hydrologic function of fluvial river systems.

Despite a reportedly low coefficient of variation (Archer et al. 2004), an inherent level of uncertainty exists in efforts to quantifiably measure changes in streambank stability conditions, based on variability in observers, as well as variation within, and between, sites. Confidence limits developed from monitoring data would facilitate a given level of certainty (i.e., 95% or 90% confidence) for comparison of the mean of the observed values with the management standard. Burton and others (2011) reported the width of confidence intervals as 5.2 percent at 95% confidence from repeat surveys of streambank stability at 89 sites. Therefore, breach of the management standard will be determined by comparing the management standard to the value of the upper confidence limit for the mean of the observed data.¹⁸

Adverse Impact

Based on available scientific knowledge and professional judgment, an adverse impact would occur when streambank stability ratings are less than 50% stable averaged across all monitoring plots within a river segment for any single monitoring year, after restoration or use restrictions have been implemented. Potential adverse impacts may also be realized when a statistical trend is observed where streambank stability ratings less than 50% stable are likely to occur in subsequent monitoring years without intervening management action.

As with the management standard, the decline of streambank stability conditions below adverse impact will be determined by comparing the adverse impact to the value of the upper confidence limit for the mean of the observed data across the river segment.

Degradation

Based on available scientific knowledge and professional judgment, degradation would occur when streambank stability ratings are less than 50% stable averaged across all monitoring plots within a river segment for at least two consecutive monitoring years, after restoration or use restrictions have been implemented.

Degradation of riparian zones and stream channels diminishes their capacity to provide critical functions, including chemical and nutrient cycling, water purification, flood attenuation, maintenance of stream flows and temperatures, groundwater recharge, and habitats for fish and wildlife (Kauffman et al. 1997). Ultimately, adverse consequences of channel instability (or disequilibrium) would be associated with land productivity change, land loss, aquatic habitat deterioration, changes in both short- and long-term channel evolution, and loss of physical and biological function (Rosgen 2001). Extensive or severely degraded streambank stability conditions, manifested from either anthropogenic or natural sources, would likely propagate the loss of functional integrity of the stream channel on site and downstream. Realization of the degradation standard would be indicative of the need for substantial restoration investment.

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

Current conditions for streambank stability in the Tuolumne Meadows and Lower Dana Fork segments are currently unknown. As noted below under “Monitoring Protocols,” baseline conditions will be established through data collection the first year of plan implementation.

The upper Lyell Canyon north site is within the management standard; however, the upper Lyell Canyon south site falls slightly below the standard (see table 5-3). Management concerns will be addressed by actions to restore riparian vegetation along riverbanks, described above, and through long-term monitoring to ensure the proposed management is effective, as described below.

¹⁸ The upper confidence limit is the upper value for a given mean's confidence interval (i.e., if the confidence interval is 45 to 55, then it's compared to 55).

**Table 5-3.
 Streambank Stability Ratings by Monitoring Site and Segment Averages**

| Standards | River Segment | Current Conditions, 2011 |
|--|--|---------------------------------|
| Management Standard: Average streambank stability rating greater than 50% at any individual monitoring site | Lyell Fork Segment (average stability rating of all plots at the monitoring site) | |
| | Upper Lyell Canyon, north | 63 |
| | Upper Lyell Canyon, south | 49 |
| | <i>Segment Average</i> | 56 |
| Management Concerns Present (condition does not meet management standard but is better than adverse impact): | Lyell Fork Segment | |
| | Upper Lyell Canyon, south A stability rating at the south upper Lyell Canyon site of 49% does not meet the management standard and will trigger a management response (see "Actions to Be Taken to Avoid Adverse Impacts or Degradation," below). | 49 |
| Adverse Impact: Average streambank stability rating below 50% averaged across all monitoring sites within a river segment for any single monitoring year | | |
| Degradation: Average streambank stability rating below 50% across all river segments for at least two consecutive monitoring years | | |

Monitoring Program

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the plan to ensure that river values are enhanced where necessary and protected throughout the life of the plan. A key part of this program will be management triggers intended to ensure that any downward trend in conditions can be identified and arrested well before adverse impact occurs. For streambank stability, action will be triggered when the condition is still within the management standard (if the stability rating falls below 75% at any monitoring site, see table 5-4).

Monitoring Protocols

Streambank stability monitoring is a long-term indicator and can be effectively monitored on a three- to five-year interval (see Kershner et al. 2004; Burton et al. 2011); whereas, streambank alteration is a short-term indicator that should be monitored annually (see Burton et al. 2011). Streambank stability and streambank alteration will be assessed by trained personnel after the majority of use has occurred for that year, typically September or October. Monitoring locations will be selected according to the site selection criteria of the chosen protocol. Monitoring sites have been established within the Lyell Fork of the Tuolumne River segment and include middle Lyell; upper Lyell, north; and upper Lyell, south. In addition, one or more monitoring sites will be established within the Lower Dana Fork and Tuolumne river segments in accordance with site selection criteria of the protocol.

Baseline conditions for streambank stability will be established through data collection the first year of plan implementation; subsequent evaluation of streambank stability conditions will be conducted on a three- to five-year monitoring interval, thereafter. If less than 75% of plots at a given monitoring site are rated as stable, the NPS will undertake detailed annual assessments to evaluate the level of streambank alteration at that site. Annual assessments of alteration will provide data on the level, location, and distribution of use, and will facilitate inference on the degree to which use is affecting streambank stability. Concurrently, the NPS will assess hydrologic conditions within the contributing source area for that monitoring site to identify potential anomalies (i.e., excessive alteration at areas upstream of the monitoring site, or the occurrence of natural

events, such as landslides or wildfires) as sources of site instability. In combination, these two management actions will help prioritize subsequent actions necessary for site recovery.

Triggers and Management Responses

Management actions to facilitate site recovery could restrict the use of riparian habitats by a combination of exclusions (access restriction), rest (temporary restriction of specific use types), and/or site restoration. The duration of use-restriction will be dependent on the rates of recovery of streambank stability and could be short or long term. Effectiveness monitoring will be initiated if management actions to restrict use levels are implemented.

Table 5-4. Triggers and Management Responses for Protecting Streambank Stability

| Trigger | Management Response | Rationale |
|--|--|--|
| The percent of stable plots observed at any monitoring site declines to less than 75%. OR A statistical trend indicating the likelihood for a monitoring site to have less than 75% stable plots in subsequent monitoring years, without intervening management action, is observed. | Assess streambank alteration at impacted sites. Conduct hydrologic assessments of the contributing source area for that site. Implement actions to facilitate site recovery through restoration and/or use restriction (i.e., resource exclusions, site rest, and so on). Implement use-restriction actions if streambank alteration or other anthropogenic activities are identified as causal mechanisms of instability. Increase monitoring frequency to evaluate effectiveness and recovery to the management standard, and compare to reference site conditions as available. | Assessments will refine understanding of baseline conditions and the causes (streambank alteration, natural processes, or cumulative effects) affecting streambank stability, on-site and within the greater contributing source area for that monitoring site. Identifying land use practices that are the most damaging to ecosystems or that prevent recovery is essential for restoration (National Research Council 1992). Comparison of site conditions to reference sites will validate observed conditions and recovery. |

Indicator #3: Meadow Bare Soil

Indicator Description

The amount and distribution of bare soil is considered an important indicator of meadow integrity because it directly relates to site stability and susceptibility to wind and water erosion (Smith and Wischmeier 1962; Morgan 1986; Benkobi et al. 1993; Blackburn and Pierson 1994). Grazing activities have been linked to increases in bare soil as well as decreased plant cover, decreased primary productivity, and shifts in species composition (Miller and Donart 1981; Trimble and Mendel 1995; Olson-Rutz et al. 1996; Fahnestock and Detling 2000; Cole et al. 2004). Trampling, by either humans or stock, can produce similar results (Cole 1995; Liddle 1975, 1991) with the added effect of soil compaction that compromises root growth and water infiltration (Gilman et al. 1987; Unger and Kaspar 1994; Pietola et al. 2005).

Candidate metrics for monitoring ecological conditions in meadows subject to grazing and/or trampling pressures include vegetative cover, bare soil, species composition, and meadow productivity. Bare soil and basal vegetative cover are more sensitive indicators of meadow condition than species composition (Cole et al. 2004). For instance, bare soil increases at lower levels of disturbance compared with shifts in species composition in a variety of montane vegetation types of North America (including alpine meadow) (Cole 1993). Plant productivity may be more sensitive to grazing pressure than bare soil (Cole et al. 2004), but it may be impractical to monitor in wilderness meadow settings. Furthermore, plant productivity is subject to high interannual variability due to climatic factors such as precipitation (Walker et al. 1994), snowpack, or snowmelt (Walker et al. 1995). In addition to its relevance for monitoring meadow condition, bare soil measured from point data is efficient, objective, easily obtained, and repeatable across time and observers. Therefore, bare soil may be one of the most robust indicators of changes in meadow ecological condition.

The adopted standards for bare soil are based on monitoring data from Sierra Nevada meadows (Weixelman and Zamudio 2003). Additional data may be collected from meadows where there is no human use to further refine these standards and provide reference plots to discern changes in condition unrelated to human use or management actions. The monitoring approach may also include collecting additional information on meadow characteristics and human use to have an empirical basis for assessing the causes of bare soil. The specific approach will be determined during monitoring design.

Definitions of Management Standard, Adverse Impact, and Degradation

Management Standard

The management standard for the meadow bare soil indicator is that at least 75% of monitoring plots in a river segment have bare soil amounts within the range of high ecological condition, and no more than 15% of plots have bare soil amounts with the range of low ecological condition (Weixelman and Zamudio 2003). The numeric standard for bare soil will vary according to meadow type and elevation (table 5-5). For example, a moist meadow within the range of high ecological condition will not have bare soil cover exceeding 6%, and a wet montane meadow (at an elevation of 5,000–8,000 feet) will not have bare soil exceeding 4%. Temporarily flooded meadows may have greater variability in bare soil cover than other wet meadows (NPS unpublished data). This variability may necessitate the development of bare soil standards for temporarily flooded meadows during the early portion of the monitoring program.

No standards for bare soil are reported in published literature. The management standard is based on data and recommendations from the U.S. Forest Service (USFS) Region 5 (California) Range Monitoring Project. This project has been monitoring bare soil in Sierra Nevada meadows for 12 years in relation to livestock use (Weixelman 2009). Ecological condition classes for bare soil values are based on point-intercept data collected from 363 meadows across a broad disturbance gradient (Weixelman and Zamudio 2003). Based on point-intercept data collected from these meadows, the USFS derived ecological condition classes for bare soil values.

Table 5-5.
Bare Soil Cover Values for Ecological Condition Classes among Sierra Nevada Meadow Types

| Meadow Type /Elevation Zone | High Condition | Moderate Condition | Low Condition |
|------------------------------------|------------------|--------------------|---------------|
| Wet meadow/ subalpine ^a | 0–4% | 5–8% | >8% |
| Wet meadow/ montane ^b | 0–4% | 5–9% | >9% |
| Moist meadow/all zones | 0–6% | 7–13% | >13% |
| Dry meadow/ subalpine | TBD ^c | TBD | TBD |
| Dry meadow/ montane | 0–8% | 9–13% | >13% |
| Temporarily flooded/all zones | TBD | TBD | TBD |

Source: Data from Weixelman et al. 2003.

a The subalpine zone is 8,000 – 9,500 feet in elevation.

b The montane zone is 4,000 – 8,000 feet in elevation.

c Cover values for condition classes within the dry subalpine meadow requested from the USFS on 12/15/2011.

TBD = to be determined.

Adverse Impact

An adverse impact on meadow condition will occur if more than 20% of monitoring plots in a river segment have bare soil amounts within the range of low ecological condition as described by Weixelman and Zamudio (2003). For example, if the river segment has 100% wet subalpine meadow, an adverse impact will occur if more than 20% of the plots have 8% or greater bare soil cover.

The condition ratings in Weixelman and Zamudio (2003) provide ecologically meaningful ranges for bare soil values that were derived from analyzing meadow data from the Sierra Nevada. This condition class approach provides a way to distinguish adverse impact from minor fluctuations in the amount of bare soil. Increases in

bare soil that result in a low ecological condition rating for more than 20% of meadow plots in a river segment would signify a more significant decline than a minor, short-term fluctuation in one meadow.

Degradation

Degradation will occur if at least 80% of monitoring plots in a river segment have twice the bare soil value for the low ecological condition as defined by Weixelman and Zamudio (2003). For example, if the river segment has 100 percent wet subalpine meadow, degradation will occur if 80% of the plots have 16% or greater bare soil cover.

The ecological processes that sustain meadows are integrally tied to plant composition, vegetative structure, and soil stability. A meadow in low ecological condition would have a predominance of shallow- and tap-rooted species, lower vegetative cover, and a greater extent of bare soil. High amounts of bare soil indicate low meadow productivity and greater susceptibility to erosion. Bare soil amounts of the magnitude described above, widespread across meadows in a river segment, would likely indicate that the processes sustaining meadow function were in jeopardy within that segment of the Tuolumne River corridor.

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

Detailed monitoring of the meadows in Dana, Lyell, and Tuolumne Meadows has not been done for bare soil. Consequently, a definitive finding of adverse impacts or degradation is currently impossible. As noted above, though, Tuolumne Meadows has higher bare soil cover than would be expected for an intact wet meadow (NPS, Ballenger and Acree 2009m). More monitoring is needed before the bare soil condition of the meadows in Dana, Lyell, and Tuolumne Meadows can be determined. However, existing studies show that management concerns are clearly present. These concerns will be addressed by actions included in the ecological restoration plan, described above, and through long-term monitoring to ensure the proposed management is effective, as described below.

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the plan to ensure that river values are enhanced where necessary and protected throughout the life of the plan. A key part of this program will be management triggers intended to ensure that any downward trend in conditions can be identified and arrested well before an adverse impact occurs. These triggers will identify management concerns prior to the occurrence of any adverse impact or degradation. Triggers will require that specific kinds of management action be taken. Management actions will become more comprehensive if the value continues to decline despite intervention.

Monitoring Protocols

Monitoring will be conducted in subalpine meadows with grazing and/or trampling concerns. These currently include two meadows in upper Lyell Canyon and one meadow at Tuolumne Meadows. The frequency and timing of such monitoring will be every five years unless the amount of bare soil exceeds the management standard. If that occurs, a subset of sites may receive annual monitoring to obtain estimates of interannual variation. Monitoring may occur any time between meadow flowering and first snowfall.

Triggers and Management Responses

The NPS has developed two triggers for management action to ensure that a downward trend in conditions can be reversed well before an adverse impact occurs (see table 5-6). Both triggers would require additional management action if a downward trend was detected even though the condition was still within the management standard. For meadows with pack stock or human use, management responses will include

reducing the intensity or timing of use. In addition, when a trigger point is reached, there will be additional assessments to help identify factors associated with decline and to assess the meadow complex as a whole.

Table 5-6.
Triggers and Management Responses for Preventing Bare Soil

| Trigger | Management Response | Rationale |
|--|---|---|
| Trigger point 1: There is a statistically significant increase in bare soil at any monitoring site over one monitoring period. OR Fewer than 90% of monitoring plots within a river segment are rated as having a high ecological condition for bare soil. | Apply a meadowwide rapid assessment method (e.g., California Rapid Assessment Method [CRAM, CWMW 2009]) for a qualitative evaluation of meadow condition. | Rapid assessments are diagnostic tools that provide standardized, rapid, field-based assessments of the overall condition or functional capacity of wetlands. Assessing meadow condition at a greater scale than the monitoring plot will aid in identifying key stressors that may be affecting meadow condition. Assessment results will assist with interpretation of monitoring results. CRAM, for example, has undergone extensive peer review, and it performs well when compared with fine-scale quantitative condition assessments (Stein et al. 2009). A version of CRAM tailored to wet meadows is in development; it is best used in combination with quantitative measures. |
| | Increase education in best management practices for meadows. | Education in maintaining meadow condition will help prevent further increases in bare soil associated with human use. |
| | Develop strategies for reducing use and/or the timing of use to minimize impacts. | Determining effective strategies for managing meadow use is a necessary step in the process to protect and enhance meadow condition, positioning the park for rapid response in the advent of additional increases in bare soil. |
| | Implement actions such as placing signage, placing naturalistic barriers (such as rocks and logs), slightly rerouting trails to discourage off-trail travel, increasing ranger patrols, and other actions to encourage the public to tread where they will not do undue resource damage but at the same time, can enjoy the resource. | Physical barriers will prevent further increases in bare soil by preventing trampling of protected areas. |
| Trigger point 2: Fewer than 80% of monitoring plots within a river segment are rated as having high ecological condition. | Apply a meadowwide rapid assessment method (e.g., CRAM [CWMW 2009]) for a qualitative evaluation of meadow condition. | Rationale above for rapid assessment also applies at this trigger point. |
| | Implement strategies to reduce intensity of use and /or modify timing of use (i.e., move use to later in the season) by pack stock or people. Evaluate the possibility of meadow rest. | Reducing stresses from herbivory (animals eating plants) and/or trampling effects (either total for the entire season or when meadow soils are wet) will help facilitate meadow recovery. Effects of trampling that are expected to decline with reduced use or avoidance of early-season use include soil compaction, bare ground exposure, and plant disturbance. |
| | Increase monitoring frequency. | Frequent monitoring will help facilitate more rapid detection of, and management response to, changes in ecological condition. It will be useful in evaluating the effectiveness of changes in the intensity and/or timing of use on meadow condition. |

Conclusions: Protecting and Enhancing the Subalpine Meadow and Riparian Complex

At the time of designation, the portion of the subalpine meadow and riparian complex in the Tuolumne Meadows segment was likely experiencing a shift in vegetation associated with historic grazing and disruptions to meadow hydrology caused by historic roadbuilding and drainage projects. Stresses on meadow processes are now being increased by visitor foot traffic, which is creating informal trails across the meadow and causing habitat fragmentation. These management concerns will be addressed under the *Tuolumne River Plan* by a comprehensive program of ecological restoration and management of visitor use and development. Ecological restoration will include actions to restore riparian vegetation along riverbanks, restore more natural meadow hydrology, and continue research into possible additional restoration of historic vegetation communities. Management of visitor use and development will include the elimination of roadside parking to reduce informal trailing and removal of facilities from riverbanks and wet areas. These actions will be expected to enhance the meadow and riparian complex and allow for its long-term management in a condition equal to or better than the management standards. (Additional management of visitor use and development to further enhance this value is explored through alternative proposals to reduce use levels, reduce development, and/or confine use to resilient areas; these alternatives are explored in chapter 7).

At the time of designation, the portions of the subalpine meadow and riparian complex in the Lyell Fork and Lower Dana Fork segments were in good condition, and they remain in that condition today. Stock use has been identified as a management concern for meadow and riparian areas in Lyell Canyon. Streambank stability is a management concern in at least one location on the Lyell Fork. This concern will be addressed under the plan either by eliminating or regulating commercial stock use (both alternatives are under consideration in this Draft EIS).

The NPS will implement an ongoing program of monitoring and continuing study to ensure that the subalpine meadow and riparian complex is returned to good condition and remains in good condition over the life of the plan. A suite of three indicators will be used to track the health and potential for impact on this complex river value. An important part of the monitoring program will be the management triggers used to identify any decline from good condition under any of the three indicators well before an adverse impact occurs. Any of these triggers would require additional action to protect the subalpine meadow and riparian complex.

Biological Value: Low-Elevation Riparian and Meadow Habitat

Wild Segment: Poopenaut Valley



NPS PHOTO BY KRISTINA RYLANDS

Poopenaut Valley, meadow, river, and seasonal pond.

Condition Assessment

Condition at the Time of Designation

The ecological health of the Poopenaut Valley's unique, low-elevation meadow, wetland, and riparian habitats, which provide important habitat for many wildlife species, depends upon a river whose flows have been controlled since 1923. No condition assessments were conducted at or near the time of designation. However, no major changes in development or use have occurred in this area since designation, making it likely that conditions then were similar to current conditions. Research conducted since designation (NPS, Stock et al. 2007k)(discussed below) indicates that, despite alterations to the hydrologic regime caused by dam operations, a diverse mix of low-elevation, riparian, wetland, meadow upland, and forested communities continues to provide essential habitat for wildlife.

Current Condition

In the Tuolumne River corridor below Hetch Hetchy Reservoir, the O'Shaughnessy Dam has influenced the magnitude, timing, duration, and frequency of river flow. However, Poopenaut Valley and its ecosystems have largely been spared the severe impacts seen downstream of other dams. This is because of several factors unique to this setting, such as a low overall gradient and a downstream bedrock constriction that promotes floodplain inundation at Poopenaut Valley (NPS, Stock et al. 2007k). Despite a reduction in available water

during the growing season, a diverse mix of riparian, wetland, and upland plant communities remain in Poopenaut Valley. These are some of the most diverse communities in the park.

Wetland and upland meadows cover most of the Poopenaut Valley floor. Riparian vegetation adjacent to the river and tributary streams is relatively extensive as compared to other riverbank areas below the dam. Several Poopenaut Valley wetlands contain an unusual assemblage of plants, and hydric soils and hydrophytic vegetation are present in some upland areas. This suggests that valley wetlands were more extensive in the past (NPS, Stock et al. 2007k). A 2007 wetland delineation in the valley indicates that there may be riparian encroachment associated with low, regulated flows (NPS, Buhler and Santina 2007n). Some conifer encroachment has occurred in these meadows, similar to conditions seen in Tuolumne Meadows.

Management Concerns

Research conducted by Stock and others suggests that some areas of wetland below O'Shaughnessy Dam might be transitioning to drier upland habitat, the result of lowering groundwater levels. Riparian areas below the dam appear to have expanded. The degree to which these changes have been influenced by dam operations is being studied (NPS, Stock et al. 2007k).

Actions NPS Will Take to Address these Concerns

The Raker Act authorizes the San Francisco Public Utilities Commission (SFPUC) to manage water releases according to its needs and mission. The NPS will continue to work with the SFPUC regarding recommended science-based release rates from the dam. The overall goals of this collaboration are to better understand the complex ecology of Poopenaut Valley and to design water release strategies to protect meadows, wetlands, and riparian zones in Poopenaut Valley; a specific goal is to mimic a natural snowmelt. While the SFPUC attempts to cooperate with the NPS, it can be limited in its ability to provide the recommended flows. For example, naturally occurring drought years may not produce adequate runoff to simulate a spring flood. Given these constraints, low-elevation riparian and meadow habitat in Poopenaut Valley will continue to be sustained by natural ecological processes to the maximum extent possible, supplemented when possible by scientifically informed releases from O'Shaughnessy Dam that would provide maximum ecological benefits to the river-dependent ecosystems below the dam.

Management Indicator and Monitoring Program

Indicator Description

Definitions of Management Standard, Adverse Impact, and Degradation

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

These terms are not defined for the Poopenaut Valley because the river flows that sustain this river value are subject to the provisions of the Raker Act and beyond NPS control.

Monitoring Program

Collaborative ecological studies conducted since 2006 by the NPS and SFPUC have focused on connections between the hydrology, geomorphology, and plant and wildlife ecology of the Poopenaut Valley. Extensive monitoring protocols, including river and groundwater levels, surveys of plant communities, and surveys of birds and aquatic invertebrates, have been established to evaluate the effects of water release strategies. A baseline conditions report was developed in 2007. Annual monitoring is expected to continue into the foreseeable future, and every five years a periodic condition assessment will be conducted and compared to

baseline conditions to ensure that, within the bounds of the Raker Act and NPS authority, public use and management actions do not adversely affect this outstandingly remarkable biological value.

Conclusions: Protecting and Enhancing Low-Elevation Riparian and Meadow Habitat

Since 1923 O'Shaughnessy Dam has influenced the magnitude, timing, duration, and frequency of river flows below the dam. Because of favorable site conditions, Poopenaut Valley continues to experience seasonal flooding and retains a rare mix of diverse riparian, wetland, and upland meadow plant communities. For reasons that are still the subject of ongoing research, some wetlands appear to be transitioning to drier upland habitat, while riparian areas appear to be expanding. The NPS is working collaboratively with the SFPUC to scientifically inform dam releases to mitigate the impacts on natural ecological processes in Poopenaut Valley to the maximum extent possible; however, this management is constrained by the legal mandates of the SFPUC to deliver water and power. Monitoring is ongoing to support this collaborative effort; however, because the NPS does not have jurisdiction over the extent to which dam releases affect the ecology in Poopenaut Valley, no management standards or determinations of adverse effect or degradation have been established for this value.

Geologic Value: Stairstep River Morphology

Wild Segment: Grand Canyon

Condition Assessment

Condition at the Time of Designation

The unique landforms comprising this outstandingly remarkable geologic value are predominantly the result of geologic uplift and glacial erosion that occurred over millions of years. Since retreat of the most recent glaciers about 15,000 years ago, these landforms have changed remarkably little because of the very strong granitic rock of which they are composed. At the time the Tuolumne River was included in the wild and scenic river system, the extensive stairstep river morphology was unaltered by human intervention.

Current Condition

No natural event or human intervention has perceptibly changed the morphology of the Tuolumne River corridor since the time of designation. Low-impact recreational uses, such as hiking and camping, have had negligible impacts on these durable landforms.

Management Concerns

Natural processes will continue to shape the landscape and the geologic value of the Tuolumne River corridor. No present or foreseeable management concern exists regarding the condition of stairstep river morphology in the river corridor.

Actions NPS Will Take to Manage this Value

Because there are no concerns regarding the condition of this value, no actions other than continued protection under the Wild and Scenic Rivers Act are necessary.

Management Indicator and Monitoring Program

Indicator Description

Definitions of Management Standard, Adverse Impact, and Degradation

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

These terms are not defined for stairstep river morphology because this geologic value is essentially impervious to intended human activities.

Monitoring Program

No existing or future human uses allowed in this segment are expected to have adverse impacts on these landforms. Therefore, active monitoring is not required to ensure that actions taken to manage public use, and other management actions, protect and enhance this outstandingly remarkable geologic value.

Conclusions: Protecting and Enhancing Stairstep River Morphology

Stairstep river morphology is considered impervious to the intended human uses in this wild river segment. No management or monitoring is needed to protect this river value.

Cultural Value: Archeological Landscape

All Wild and All Scenic Segments

Condition Assessment

Condition at the Time of Designation

Information about the extent and significance of the archeological landscape was limited in 1984. Archeological surveys along the Lyell Fork (up to Ireland Creek), Tuolumne Meadows, Dana Meadows, and Upper Dana Fork in the 1950s (Bennyhoff 1956) noted numerous sites with significant research potential. Some prehistoric archeological sites along the Dana Fork were affected by road and trail construction prior to enactment of legislation protecting archeological resources. Impacts on sites in less developed locations were limited to visitor use and natural processes.

Of the known sites on the Dana Fork, only nine (along Tioga Road where it follows the Dana Fork) had been formally evaluated for their eligibility for listing on the National Register of Historic Places (NRHP or national register). Seven of these sites were found eligible and two were found ineligible. One of the eligible sites had undergone data recovery excavation, which was conducted to mitigate the impacts of highway construction. None of the sites along the Lyell Fork (with the exception of those near the confluence with the Dana Fork, which were included in the NRHP-nominated Tuolumne Meadows Archeological District, see below) had been evaluated for eligibility. Based on studies conducted in the 1950s and 1970s (Bennyhoff 1956; Napton and Greathouse 1976b), the Tuolumne Meadows Archeological District was nominated for inclusion on the NRHP in 1978. At that time, the Tuolumne Meadows Archeological District was altered but considered to be in fair condition overall (NPS, Anderson and Hammack 1977b).

While there were additional recorded archeological sites in the Grand Canyon, none had been evaluated for eligibility on the NRHP at the time of designation. One site that has since been determined to be eligible for listing on the NRHP had been affected by flooding, erosion, illegal collection of artifacts, and scientific study.

The Hetch Hetchy Archeological District (NPS 1979), like the Tuolumne Meadows Archeological District, had been determined eligible for the NRHP based on surveys conducted in the 1950s and 1970s (Bennyhoff 1956; Napton and Greathouse 1976b). Two sites comprised the Hetch Hetchy Archeological District at that time, one of which was located within the wild and scenic river corridor in the Below O'Shaughnessy Dam segment (NPS, Montague 2006n). This site was in fair condition.

Current Condition

Documentation, condition assessments, and the few evaluation projects since designation (NPS, various authors 1985a–f; NPS, Montague 1996; NPS, Montague 2000 a–f; NPS, Gavette 2004b and 2005d; NPS, Shive 2007d; and others) have expanded the body of knowledge about the archeological importance of the river corridor. Many sites have been documented, and previously unknown sites continue to be discovered. Sites that have not yet been evaluated are considered potentially contributing resources to the outstandingly remarkable archeological values of the Tuolumne River until determined otherwise through formal evaluation (NPS, Montague 2006n).

Although few of the sites along the Lyell and Dana Forks have been formally evaluated for their NRHP eligibility, many of the sites along both forks appear to have important research potential that might make them significant (NPS, DePascale and Curtis 2006e, among others). Almost all the sites along these forks are affected indirectly by informal trails that bring visitors to the site area (NPS, Shive 2007d). Other commonly observed impacts were caused by erosion, camping, informal trails, and park operations (NPS 2009k).

The Tuolumne Meadows Archeological District contains a significant concentration of sites with a diversity of materials and important research potential. A few of these sites (located in the campground, at the wastewater containment ponds, and along road or trail corridors) are severely disturbed. The most common impact on the integrity of archeological sites is from the displacement of artifacts or archeological features, caused either by natural forces (evident at 78% of the sites visited in 2009) and/or visitor use (evident at 42% of the sites visited in 2009) (NPS 2009k).

Sites located in the Grand Canyon of the Tuolumne provide distinct evidence of trade and travel routes, tool caching, food and medicine procurement and processing, and related settlement. These sites may also contribute to the understanding of human demography and cultural occupation in recent prehistory. Three sites that are located in the Grand Canyon and also within the Tuolumne Meadows Archeological District have been evaluated for their NHRP eligibility. The condition of other prehistoric sites in this river segment is, in general, fair to good. The most common causes of site disturbance in the river corridor below Tuolumne Meadows are erosion and use by hikers and/or pack stock. Less common sources of disturbance include camping, trail construction, unauthorized collecting or looting, rodent activity, fire, and grazing or trampling.

At Glen Aulin High Sierra Camp specifically, the large site in the camp's immediate vicinity has been affected by development, use, and ongoing utilities work at the camp (NPS, Montague 2006b).

Sites in the lower elevations of the Sierra Nevada (2,000–4,000 feet) had the potential to be occupied year-round, and could provide substantial data about settlement and subsistence to the archeological record. These sites are more likely to have architectural features, such as house pits and dance houses, to be associated with burial areas, and to have food storage and cooking features, in contrast to the higher-elevation sites.

Furthermore, obsidian obtained from Bodie Hills may signify certain cultural affiliation and trade networks, particularly in the most recent prehistoric past.

Because many archeological sites in the Tuolumne River corridor are estimated to contain subsurface materials, their scientific data potential and the integrity of the deposits cannot be fully documented and evaluated without some form of excavation or scientific analysis. Few of the sites in the Tuolumne River corridor have had such excavation or analysis, so the data potential and condition of the majority of sites in these segments is interpreted from surface observations only (NPS, Montague 2006b).

Management Concerns

Management concerns are largely due to one of two causes: (1) visitor use or (2) construction-related impacts (including impacts of facility maintenance and repair). Almost all the sites in the meadows and along the river are affected by informal trails, many of which emanate from roadside parking and bring visitors close to sensitive sites. Several sites have evidence of camping and campfires. Many sites in Dana and Tuolumne Meadows are at risk of losing some of their integrity from ongoing visitor use impacts associated with informal trails near the sites (NPS, Montague 2006b and 2007s; NPS, Shive 2007d). Many locations of archeological sites in the greater Tuolumne Meadows area, especially adjacent to the Tuolumne River, receive high levels of use in the summer.

The potential for future development, repair, and maintenance of facilities and underground utilities to support visitor use is also a management concern at both Tuolumne Meadows and Glen Aulin. A 2005 site evaluation at Glen Aulin concluded that continued use of the High Sierra Camp and backpacker camp has the potential to further affect the integrity of the site, and that consideration should be given to limiting future ground-disturbing activities within the boundaries of the camp, particularly within the high lithic (stone tool) concentration area (NPS, Kreshak 2006s).

Actions NPS Will Take to Address these Concerns

Wild Segments (Lyell Fork, Upper Dana Fork, Grand Canyon of the Tuolumne, Poopenaut Valley)

Prehistoric archeological sites will continue to be documented and monitored through the NPS Archeological Sites Management Information System (ASMIS) adopted in 2007 to support improved archeological resource protection by tracking the visitor use impacts on archeological sites. Sites will be protected by managing use levels, using natural features to conceal and divert foot traffic around sites, mitigating potential impacts of ecological restoration practices by using noninvasive techniques wherever possible, evaluating sites where appropriate, and undertaking site-specific treatment actions, such as data recovery, where necessary to avoid resource loss through park actions or natural forces.

Scenic Segments (Tuolumne Meadows, Lower Dana Fork, Below O'Shaughnessy Dam)

All the management actions described for archeological resources in wild segments, above, will also apply to archeological resources in scenic segments. In addition, many of the actions related to ecological restoration at Tuolumne Meadows, such as eliminating roadside parking and removing informal trails, will also help protect archeological sites in the Tuolumne Meadows and Lower Dana Fork segments by diverting foot traffic away from sites and into less sensitive areas.

Management concerns about potential impacts on archeological sites caused by ground disturbance associated with future development, repair, and maintenance of facilities and underground utilities will be addressed by

confining actions to nonsensitive areas wherever feasible and by mitigating unavoidable effects in compliance with section 106 of NHPA. Specific actions related to use levels, ecological restoration, and site development would vary among the alternatives and are presented in chapter 7 and evaluated against the NHPA criteria of effect in chapter 8.

Associated American Indian tribes and groups will be consulted to ensure that management of archeological sites considers their concerns, issues, and perspectives.

Management Indicator and Monitoring Program

Indicator Description: Aggregate Condition of Archeological Sites

Within the Tuolumne River corridor, individual prehistoric sites combine to form the collective character and significance of the archeological landscape. The indicator is the aggregate condition of the collection of archeological sites within the landscape. The condition of individual sites includes the general physical state of the site and associated material remains. Other key components of site condition are site stability (the potential for physical deterioration over time) and site integrity (of location, design, setting, materials, workmanship, feeling, and association).

Archeological site condition was chosen as an indicator because this characteristic is sensitive to human disturbance (an observable harmful effect on the integrity or data potential of a site resulting from human activity). There is a direct relationship between the degree of site disturbance and the current site condition (NPS 2007e). Site disturbances, or impacts, can lead to the irretrievable loss of archeological resources at the individual site level (NPS 2007f). The cumulative loss of individual site resources within an archeological district can ultimately result in degradation of the district as a whole, because “the majority of components that add to the district’s historic character. . . must possess integrity, as must the district as a whole” (NPS 1997a).

The site monitoring protocol uses the NPS ASMIS format (NPS 2007e, 2007f), supplemented with data collection specific to human impacts. ASMIS, which is a management database developed by the NPS, tracks a broad range of information about documented archeological sites: site components, disturbances, current condition, cumulative disturbance effects, and management actions. ASMIS functions as a “tool to support improved archeological resources preservation, protection, planning, and decision-making by parks, regional offices, and the national program offices” (NPS 2007f). Archeological site condition has been assessed in Yosemite National Park for several decades, but prior data collection does not always meet current professional standards. The site monitoring protocol was designed to assess site condition and impacts using a systematic, consistent methodology.

ASMIS quantifies impacts (disturbances) in two ways: (1) the effect on site condition and (2) site damage severity levels. Condition effects are ranked on an ascending scale: negligible, partial loss repairable, partial loss irretrievable, and total loss irretrievable. Impacts with negligible effects can cause minor damage to the physical condition of the site, with little to no loss of data potential or site integrity. Partial loss repairable effects result in minor damage to the site that can be reversed or ameliorated through treatment or repair, such as careful removal of campfire rings or hand removal of fire fuel buildup. Partial loss irretrievable effects result in more serious damages that are not repairable, such as the partial collapse of a prehistoric rock feature from human alteration, or artifact movement from its original context. Total loss irretrievable effects result in complete loss of the resource, as in site destruction from major earthmoving associated with construction (NPS 2007e).

Site damage from a disturbance is measured as low, moderate, or severe, based on areal extent or the amount of site integrity compromised (NPS 2007e; NPS, Bane 2011b). These measurements take into consideration site type, data potential, and impact on site integrity. Destruction of a pictograph, for example, is highly damaging

to site data potential even if the pictograph represents only a small physical area of site. Loss of the densest portion of a lithic scatter may be small in areal extent, but critically large for research potential if temporally diagnostic tools had been present in that locus (place). Previous data recovery at the site may mean some impacts are less damaging for data potential at the excavated locations.

ASMIS includes fields that assign causes of disturbances: natural, park operations, visitor, or unknown. Both park operation and visitor disturbances are included in total site counts of human impacts. Typical park operation disturbances include road construction and maintenance, trail construction and use, utilities installation, building construction, controlled fire, or scientific research. Unlike natural and visitor impacts, many park operation impacts are considered “undertakings,” and are addressed before or during disturbance through a regulated process (NHPA, section 106, and NEPA) involving consultation with tribal partners, evaluation, and treatment. The most common types of visitor disturbances include camping impacts, informal trails, climbing, and use by hikers and/or horses. Other, less common visitor disturbances include vegetation damage, structure modification, stock use (picketing or corralling), soil compaction, dumping, off-road vehicle use, vandalism, and unauthorized collection of artifacts (looting or collection piles).

Definition of Management Standard, Adverse Impact, and Degradation

Management Standard

For the Tuolumne River archeological landscape, the management standard is at least 85% of sites free from serious unmitigated human impacts for sites with high data potential, and at least 80% for sites with low data potential. *Serious unmitigated human impacts* are single disturbances with partial or total loss irretrievable disturbance effects at moderate to severe site damage levels, or a series of three or more disturbances with partial or total loss irretrievable disturbance effects at low site damage levels. Unmitigated impacts are disturbances uncorrected by management action under a regulatory context such as section 106 of NHPA. Sites with low data potential are valuable and justifiable inclusions into the management standard: While they may individually be considered less important for their individual information potential, they are tangible elements on the landscape that contribute to understanding of the settlement patterns, land use, and other aspects of the prehistory; they are also important in terms of their cultural value to contemporary traditionally associated peoples.

In balancing visitor use and site preservation, some disturbances to resources can be acceptable if the site retains context and integrity (NRHP 1990). For archeological sites with estimated low data potential (i.e., small sites with few materials and no diagnostic artifacts; sites with a single feature, such as a bedrock mortar; sparse lithic scatters; or heavily deteriorated sites), some amount of irretrievable damage may be allowable. This is particularly true for common site types in the river corridor, such as small lithic scatters. The management standard allowance for numbers of low data sites with human impacts (20%, or 80% of sites free of serious unmitigated human impacts) represents a realistic management threshold for protection of the largest portion of sites (Donnermeyer 2005).

For sites with estimated high data potential (i.e., sites with multiple features, sites with diagnostic artifacts or dense artifact concentrations, documented historical sites, or sites with uncommon or unique attributes), the potential resource loss is greater, as is the impact to an archeological district. A serious human impact or series of minor impacts resulting in irretrievable damage and loss at high data sites is less acceptable (Donnermeyer 2005). The management standard allowance for numbers of high data sites with human impacts for these effects (15%, or 85% of sites free of serious unmitigated human impacts) is therefore less.

Adverse Impact

Adverse impact occurs when the number of sites free from serious unmitigated human impacts falls to 60% or fewer for sites with low data potential, and 70% or fewer for sites with high data potential in a 10-year monitoring interval.

The adverse impact represents a higher level of serious impact for both low and high data potential sites over a 10-year interval of representative site sampling within an archeological district. The 20% increase serves as a warning of long-term downward trends in site condition, thus requiring stronger protective management actions before widespread individual site damages threaten the essential character of the aggregate archeological district (Donnermeyer 2005).

Degradation

Degradation occurs when the majority of sites ($\geq 50\%$) comprising the archeological landscape exhibit severe disturbance severity levels and poor site conditions as a result of human impacts.

Severe disturbance severity levels indicate a prior history of disturbances that caused major site damage. Sites or major portions of sites will likely be lost if actions to protect and/or preserve are not taken within two years (NPS 2007f). Poor site conditions indicate current loss of site features or key areas that define primary site function and are critical to site data potential for historical or scientific research. Such losses make it difficult to use any remaining site data (NPS 2007f). The combination of prior and current damage causes a near total loss of site significance (data potential) and integrity.

The archeological landscape value for the Tuolumne River corridor is comparable to an archeological district as defined by the National Register of Historic Places as “a grouping of sites, buildings, structures, or objects that are linked historically by function, theme, or physical development or aesthetically by plan” (Little et al. 2000). When the majority of sites within the aggregate landscape lose significance and integrity, as indicated by severe disturbance levels and poor site conditions, the significance and integrity of the archeological landscape as a whole degrades (NPS 1991).

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

Current human impact values for a sample of relevant Tuolumne River corridor sites are shown in table 5-7. Results are drawn from site monitoring conducted in 2007–2011 of a sample set of 128 sites (54%) from a total of 235 sites in the archeological landscape of the Tuolumne River corridor as of May 2011. Over that five-year interval (2007–2011), 98% of high data potential sites and 96% of low data potential sites in the sample were considered free of serious human impacts, thus meeting the management standards for the indicator. Based on recent site condition assessments, the archeological landscape is well within the management standard.

Table 5-7.
Current Condition of Archeological Sites Based on Monitoring of Aggregate Condition of Sites

| Standards | Current Conditions, 2007–11 | | |
|---|---|---------------------------|--------------------------|
| | Sites free of current serious unmitigated human impacts ^a | High data potential sites | Low data potential sites |
| Management Standard: Sites with low data potential: 80% of sites free from serious unmitigated human impacts ^a Sites with high data potential: 85% of sites free from serious unmitigated human impacts | Sample set of 128 sites (54% of 235 sites relevant to the Tuolumne River archeological value) | 98% | 96% |
| Management Concern: Sites with low data potential: 61–84% of sites free from serious unmitigated human impacts Sites with high data potential: 71–84% of sites free from serious unmitigated human impacts | | | |
| Adverse Impact: Sites with low data potential: 60% of sites free from serious unmitigated human impacts Sites with high data potential: 70% of sites free from serious unmitigated human impacts | | | |
| Degradation: All sites: The majority of sites (≥ 50%) exhibit severe disturbance severity levels and poor site conditions due to human impacts | | | |

a Impacts with partial loss irretrievable effects with moderate to severe damage levels or multiple (≥3) impacts with low damage levels.

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the *Tuolumne River Plan* to ensure that the archeological river value is protected throughout the life of the plan. Impacts on archeological resources are irreversible, and their condition can never be enhanced. Even if all human impacts could be eliminated, a downward trend in the condition of archeological resources over time would be inevitable due to the effects of natural weathering. The management triggers for protecting archeological resources are considerably higher than the management standard so that downward trends can be identified and arrested to the extent possible while the resources are still in a protected state and well before any adverse impacts occur (see “Triggers and Management Responses,” below).

Monitoring Protocols

The NPS will assess site conditions for a representative sample of archeological sites within the landscape at 5–15 year monitoring intervals, following the assigned ASMIS site inspection schedule (NPS 2007f). The following criteria generally guide the frequency of site condition assessments:

- assessment every 5 years: sites likely to be affected by humans, animals, or natural forces or sites with structural components covered by the Park Facilities Management Software System
- assessment every 10 years: sites with a currently good or fair condition that are not likely to be affected and already have good or fair documentation or have low data potential
- assessment every 15 years or longer: sites that would meet the criteria for assessment every 10 years except that they are very remote and/or logistically expensive to access

The key source of feedback for adaptive archeological site management is the periodic, systematic analysis of collected site data, focused on management objectives (Kintigh et al. 2007). To support management, site monitoring results will be compiled and analyzed at 5-year intervals (for the individual sites that were assessed over the past five years) and aggregated and analyzed at 30-year intervals (for the entire archeological landscape). (The 5-year interval for summary reporting and analysis of site data is the minimum reporting

period necessary for accurate capture of human impacts over longer time spans [NPS, Bane 2011b]; a 30-year interval for aggregate summary reporting for the entire landscape is necessitated by the large number of archeological sites within the corridor.) Analysis of these data, which may report on 10–50 sites at every 5-year interval and approximately 250 sites at the 30-year interval, will identify trigger points for management actions to ensure that this value remains within the management standard.

Triggers and Management Responses

For the archeological landscape, a management response will be triggered if the number of individual sites free from serious unmitigated human impacts is 90% for sites with low data potential, and 95% for sites with high data potential in a monitoring interval. At this level of impact, the landscape is still within the management standard, but management concerns are present. Management actions will become more comprehensive and intensive if the condition moves farther from the management standard, as described in table 5-8.

Table 5-8.
Triggers and Management Responses to Protect the Archeological Landscape

| Trigger | Management Response | Rationale |
|--|---|--|
| The number of individual sites free from serious unmitigated human impacts falls to 90% or less for sites with low data potential, and falls to 95% or less for sites with high data potential in a monitoring interval. | Increased monitoring frequency for affected sites. Increased management protection designed to counteract or minimize impacts, crafted to individual site specifications. Examples include: <ul style="list-style-type: none"> ▪ consultation with tribal partners. ▪ site documentation, research, testing, or NRHP evaluation. ▪ site stabilization, revegetation, trail reroutes, or trail removal. ▪ increased public interpretation and education. ▪ increased education for local user communities, such as backpackers and climbers. ▪ NRHP reevaluations and/or data recovery at affected sites. ▪ development of comprehensive site management plans for large, complex sites in developed areas. ▪ hard closures of individual affected sites, using law enforcement monitoring and increased visitor education about human impacts and the necessity for closures. Site closure regulations will be represented within the superintendent’s compendium in order to allow legal enforcement. | The trigger range is set at 10% above the management standard, thus allowing identification of individual problem sites and localized areas and timely prescriptive actions before the management standard levels are violated. The trigger range was selected from sampling results for five years of site impact monitoring within the district, and is based on best professional judgment of thresholds necessary to retain the desired management standard. |

NRHP = National Register of Historic Places

Conclusions: Protecting and Enhancing the Archeological Landscape

At the time of designation, the known archeological resources in the river corridor were characterized as being in a generally fair condition. Since then, ongoing documentation, condition assessments, and evaluation projects have expanded the body of knowledge about the importance and condition of this outstandingly remarkable cultural value. Several decades of site condition assessments have found that archeological sites occurring in every river segment either have or appear to have important research potential. Almost all the archeological sites along the river and in meadows have been affected by informal trails, and many of these sites are at risk of losing some of their integrity.

Since the time of designation, the NPS adopted the ASMIS to support improved archeological resource protection by providing a systematic, consistent methodology for assessing archeological site condition and impacts. Based on ASMIS evaluation criteria and standards, the collective character and significance of the archeological landscape remains well within the management standard of being fully protected. However, concerns about disturbances to sites caused by foot traffic and/or potential future facility development and maintenance remain.

Under the plan, sites will continue to be monitored through the ASMIS. The potential for effects associated with visitor foot traffic will be greatly reduced by eliminating roadside parking and removing informal trails. The potential for effects associated with future facility development, repair, and maintenance will be addressed by confining actions to nonsensitive areas wherever feasible and by mitigating unavoidable effects in compliance with section 106 of NHPA. Any future downward trend in site conditions associated with human use will trigger a required management response to counteract or minimize the effect before an adverse impact occurs.

Cultural Value: Parsons Memorial Lodge

Scenic Segment: Tuolumne Meadows

Condition Assessment

Conditions at the Time of Designation

Parsons Memorial Lodge, a national historic landmark, was designed in the office of the renowned Berkeley architect Bernard Maybeck with a thorough understanding of the harsh environmental conditions encountered at its location at 8,640 feet. The national historic landmark nomination for Parsons Memorial Lodge, prepared in 1985, states that the building had undergone a few minor changes over the years but none that marred its historic integrity. Its condition at that time was rated as good (NPS, Harrison 1985g). It is assumed that the building was in the same condition at the time of designation in 1984.

Current Condition

The lodge receives scheduled preservation and maintenance treatment, as defined by the Secretary of Interior's Standards for the Treatment of Historic Properties (Secretary's Standards for Historic Properties), and is in good condition (NPS 2007u). The structure continues to be used as a gathering place, as it was historically.

Management Concerns

Parsons Memorial Lodge is in good condition, with no management concerns present.

Actions NPS Will Take to Manage this Value

The Parsons Memorial Lodge will continue to be preserved in accordance with the Secretary's Guidelines for Historic Properties, NPS cultural resource management guidelines, and the park's programmatic agreement with the Advisory Council on Historic Preservation (ACHP) and the California state historic preservation officer (SHPO) (see appendix D).

The Yosemite National Park Maintenance Division has a trained and experienced historic preservation crew that performs regular annual maintenance on Parsons Memorial Lodge, such as applying preservative to exposed logs. The crew also inspects the condition of the structure each year during annual maintenance. The rangers who staff Parsons Memorial Lodge also inspect the lodge each year at the beginning of the season. They submit work orders to have small and large problems fixed as problems arise so that the condition of the structure never falls below good.

Management Indicator and Monitoring Program

Indicator Description: List of Classified Structures Condition Assessment

The NPS List of Classified Structures is the primary computerized database for registration and long-term management of park historic and prehistoric structures. The NPS is required by NPS Director's Order (DO) 28 and the Secretary's Guidelines for Historic Properties to preserve and protect the Parsons Memorial Lodge in good condition as defined in the List of Classified Structures guidance. This standard will also ensure protection required by the Wild and Scenic Rivers Act.

List of Classified Structures conditions are defined as follows:

- *Good*: The structure and significant features are intact, structurally sound, and performing their intended purpose. The structure and significant features need no repair or rehabilitation but only routine or preventative maintenance.
- *Fair*: The structure is generally structurally sound and performing its intended purpose; however, one of the following conditions is present:
 - There are early signs of wear, failure, or deterioration affecting 15% to 25% of the structure.
 - There is failure of a significant feature of the structure.
- *Poor*: The structure is in poor condition if any of the following conditions is present:
 - The significant features are no longer performing their intended purpose.
 - Significant features are missing.
 - Deterioration or damage affects more than 25% of the structure.
 - The structure or significant features show signs of imminent failure or breakdown.

Definitions of Management Standard, Adverse Impact, and Degradation

Management Standard

The management standard is to protect Parsons Memorial Lodge in good condition as defined in the List of Classified Structures guidance.

Adverse Impact

Parsons Memorial Lodge will be considered adversely impacted if the condition of the building is diminished from good to fair as defined in the List of Classified Structures guidance.

Degradation

Parsons Memorial Lodge will be considered degraded if the condition of the building is diminished from good to poor as defined in the List of Classified Structures guidance, or if critical building failures are allowed to continue without repair for a period of longer than six months.

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

Parsons Memorial Lodge is within the management standard of good condition based on the most current List of Classified Structures assessment, conducted in 2007 (see table 5-9).

**Table 5-9.
 Current Condition of Parsons Memorial Lodge**

| Standards | Current Conditions, 2012 |
|--|--|
| Management Standard: Parsons Memorial Lodge is protected in good condition as defined in the List of Classified Structures guidance. | According to the 2007 assessment, Parsons Memorial Lodge is in good condition. |
| Adverse Impact: The condition of the lodge is downgraded to fair as defined in the List of Classified Structures guidance. | |
| Degradation: The condition of the lodge is downgraded to poor as defined in the List of Classified Structures guidance. | |

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the *Tuolumne River Plan* to ensure that river values are enhanced where necessary and protected throughout the life of the plan. A key part of this program will be management triggers intended to ensure that any downward trend in conditions can be identified and arrested well before adverse impact occurs.

Monitoring Protocols

The Yosemite National Park historical architect, in concert with the park historic preservation specialist, will assess the condition of Parsons Memorial Lodge at least once every five years and identify any critical building system failures or weather impacts. Preservation and cultural resource specialists who assess the structure must meet the qualifications outlined within NPS DO 28. Additionally, in the performance of routine patrols of the Parsons Memorial Lodge area, the district ranger will report any observed threats or changes in condition.

The following are specific components of the structure that will be monitored by park preservation and cultural resource specialists responsible for ensuring that the Parsons Memorial Lodge remains in good condition:

- failing fasteners of the corrugated metal roofing
- damaged or missing corrugated metal roofing
- failing chimney to roof flashing
- failing mortar joints of the stone masonry: interior walls, exterior walls, and chimney
- loose or missing stones of the stone masonry: interior walls, exterior walls, and chimney
- damaged or deteriorated log roof structure, mainly the exposed log rafter tails and braces
- damaged or deteriorated wood sash windows, jambs, hardware, or wooden shutters
- damaged or deteriorated front door, jamb, or hardware

Triggers and Management Responses

Because 15% or more damage to, or deterioration of, the structure would place the lodge into fair condition, the need for repairs will be triggered if 10% of the structure is experiencing damage or deterioration, as shown in table 5-10. The rationale for taking action at this threshold is to ensure that repairs needed to mitigate damage or deterioration are made while the condition of the structure is still good.

**Table 5-10.
 Trigger and Management Responses to Protect Parsons Memorial Lodge**

| Trigger | Management Response | Rationale |
|---|--|--|
| Detection of deterioration or damage affecting 10% of the structure | Increase monitoring. Increase frequency of condition assessment. Make repairs to mitigate damage or deterioration. | Repairs are made to mitigate damage or deterioration while the structure is still in good condition. |

Conclusions: Protecting and Enhancing Parsons Memorial Lodge

Parson Memorial Lodge was in good condition at the time of designation and remains in good condition, with no management concerns identified. The lodge will continue to be preserved in accordance with all applicable standards, guidelines, and agreements. If future monitoring under the List of Classified Structures assessment program detects deterioration or damage, repairs will be undertaken to correct the deficiency while the structure is still in an overall good condition.

Scenic Values: Scenery through Lyell Canyon, Dana and Tuolumne Meadows, and the Grand Canyon of the Tuolumne

Wild Segments: Lyell Fork, Grand Canyon of the Tuolumne

Scenic Segments: Tuolumne Meadows, Lower Dana Fork

The three outstandingly remarkable scenic values of the corridor are addressed collectively because the same management indicators and monitoring program will be used for each.

Condition Assessment

Condition at the Time of Designation

Wild Segments: Lyell Canyon and Grand Canyon of the Tuolumne

The *Tuolumne Final Study* (USFS and NPS 1979b) found that the area's unspoiled condition, its variety of landscape types, its vegetation, and its backcountry values ranked that portion of the river at least as high as the national forest portion (which had been studied and given a high aesthetic rating compared with other rivers).

Scenic Segments: Dana and Tuolumne Meadows

Expansive views were afforded by the natural vegetation patterns at Tuolumne Meadows. Views into and away from the meadows were maintained and occasionally expanded by the mechanical removal of encroaching lodgepole pines. After 1930, the siting of all development was guided by the principle of not obstructing or competing with the naturally occurring views and vistas. Reducing human visual impacts was a key reason for realigning the Tioga Road and eliminating all camping inside the meadow. Building locations and circulation patterns were designed to take advantage of the scenic opportunities of this landscape, while remaining as unobtrusive as possible (NPS 2007t).

Current Condition

Wild Segments: Lyell Canyon and Grand Canyon of the Tuolumne

Views from the river and trails in Lyell Canyon continue to have high aesthetic value. The Glen Aulin High Sierra Camp is the only developed structure within these segments. Infrastructure associated with the camp is visible from a few locations in the river corridor. Visible facilities include about a dozen off-white-colored tents, a dining hall, two restroom buildings, several sheds, a large fire ring, a utility shed with a small solar panel and water pipes, and other camp equipment and structures. The camp is fairly well screened from most parts of the trail in its vicinity and has a very limited geographic extent.

Scenic Segments: Dana and Tuolumne Meadows

Views from trails and vista points through Dana and Tuolumne Meadows continue to have high aesthetic value. The predominantly open meadows provide for a remarkable variety of visual experiences, including unobstructed views of the craggy Sierra Nevada and dramatic, changing weather formations. Even from the periphery of the meadows, where denser vegetation obstructs the panoramic views, a sense of openness is provided by glimpses of the meadows and distant peaks between the trees.

The built environment at Tuolumne Meadows has remained relatively unchanged since the river was designated. Most development remains sited just within the surrounding forest to take advantage of views into and across the meadows while avoiding any obstructions to views (NPS 2007t). Most existing structures are in low- to moderate-visibility zones. Sources of artificial light at Tuolumne Meadows are minimal (NPS, Duriscoe 2005c), and outdoor lighting guidelines are being developed to protect nighttime views (NPS 2008k). The important visual relationships between the natural features of Tuolumne Meadows and its adjacent developed areas remain largely intact (NPS 2007t).

Management Concerns

Wild Segments: Lyell Fork and Grand Canyon of the Tuolumne

Scenic values in these two wild segments will generally continue to be shaped by natural processes. The only exception will be at Glen Aulin, where structures are visible from short segments of the trails through this area. At Glen Aulin any new structures will be subject to the Visual Resource Management (VRM) contrast analysis explained below (under the “Management Indicators and Monitoring Program” discussion for this value).

Scenic Segments: Lower Dana Fork and Tuolumne Meadows

Views into and away from Tuolumne Meadows are being affected by roadside parking, which has increased since the 1997 flood destroyed the Cathedral Lakes parking area. Conifers are also encroaching into views. This encroachment may be a response to changes in average precipitation and other factors (see “Subalpine Meadow and Riparian Complex,” above).

Actions NPS Will Take to Address Management Concerns

Wild Segments: Lyell Canyon and Grand Canyon of the Tuolumne

With no concerns present in Lyell Canyon, no actions are necessary. At Glen Aulin, the NPS will continue to ensure that the High Sierra Camp is kept in an overall clean and tidy condition. When the tents are next replaced, the NPS will seek replacement fabric colors that blend with the landscape, thereby reducing their contrast. Other actions to enhance the scenic value in the vicinity of the camp would vary among the alternatives and are presented in chapter 7.

Scenic Segments: Lower Dana Fork and Tuolumne Meadows

Views into and away from Tuolumne Meadows will be enhanced under all the action alternatives by eliminating roadside parking, which currently affects those views, and by requiring visitors to park in formal parking areas, which will be located away from highly visible areas (shown in figure 5-12). Roadside curbing or naturalistic barriers and signs to prevent roadside parking will intrude into views, but they will be considerably less obtrusive than parked vehicles. The removal of informal trails and the revegetation of riverbanks will also enhance views in the Tuolumne Meadows area under all alternatives. These actions are described in detail earlier in this chapter under “Subalpine Meadow and Riparian Complex.” When the canvas siding on the

structure housing the store and grill needs replacing, NPS will consider using tan, green, or gray fabric if a contrast analysis indicates such a color would blend more harmoniously with the surrounding landscape.

The outstandingly remarkable scenic values throughout Tuolumne and Dana Meadows will continue to evolve in response to natural ecological processes. The mechanical removal of conifers from meadows was discontinued in 2010, pending further study as part of the ecological restoration program. If conifer removal proves to be beneficial for restoring meadow and riparian habitats, it could be included in that program. However, mechanical removal of conifers for the purpose of enhancing scenery is not included in any of the alternatives of this *Tuolumne River Plan/Draft EIS*, with the exception of managing the eight scenic vista points identified below. Management of scenic vista points would vary among the alternatives and is addressed in chapter 7.

The eight scenic vista points in or near the Tuolumne River corridor that would be maintained under some alternatives are listed below. All these vista points are in or near scenic segments and outside designated wilderness; no vista management would occur in designated wilderness. Appendix J contains work plans for each of the viewpoints that would be consistent with protecting and enhancing the scenic values of the Tuolumne Meadows and Lower Dana Fork segments, if vista management was adopted under the selected alternative.

- Tioga Road: Mount Dana and Mount Gibbs view facing east, overlooking a pond and meandering Tuolumne River. (This viewpoint is outside of the Tuolumne River corridor.)
- Tioga Road, Mount Dana viewpoint: view looking east at the river meandering through Dana Meadows, with the Sierra Nevada crest in the background
- Tioga Road, Dana Fork interpretive viewpoint: view looking west down through the glaciated river valley along the Dana Fork, with distant views of the granite peaks
- Tioga Road, near the “little blue slide” road cut: view overlooking Lyell Canyon and the Kuna Crest
- Lumbert Dome, near the parking area: view looking west toward Unicorn Peak
- Tioga Road, Parsons Memorial Lodge trailhead: view looking west toward Pothole Dome and the river, with Fairview Dome in the background
- Tioga Road, near the Pothole Dome parking area: view looking east over Tuolumne Meadows to Lumbert Dome. (This viewpoint is outside of the Tuolumne River corridor.)
- Parsons Memorial Lodge doorway: view looking south across the meadow and river toward Unicorn Peak

These vista points differ from the vista points identified for the Tuolumne River area in the 2010 environmental assessment for the park’s *Scenic Vista Management Plan* (NPS 2010k). The Finding of No Significant Impact (FONSI) for that plan stipulates that the identification of vista points for the Tuolumne and Merced river corridors will be deferred to the comprehensive river management plans.

Actions included in the parkwide Yosemite Exterior Lighting Guidelines (NPS 2008k) are protective of the outstandingly remarkable skyward views through Dana and Tuolumne Meadows. Exterior lighting in the river corridor will comply with the most current guidelines.

When the NPS selects an alternative in a formal record of decision, the management actions included in that alternative will be incorporated into this chapter of the *Tuolumne River Plan* to guide the future management of scenic values in the Tuolumne River corridor. This guidance will also amend the park’s *Scenic Vista Management Plan*.

Management Indicators and Monitoring Program

Indicator Description: Visual Resource Management Classification

The definitions of management standard, adverse impact, and degradation for the scenic values are based on application of the VRM system within the Tuolumne River corridor. Developed by the USFS (1995) and further refined by the Bureau of Land Management (BLM 2007a-c), the VRM system is a widely accepted system for assessing the scenic character of a landscape and of predicting the effects of a management action upon that landscape. The VRM system has been in use for over three decades and has proven to be a process that can consistently document what people consider to be incongruous with a predominately natural environment (Galliano 2000). Under this system, landscapes are classified into one of four classes, with class I being most protective/most wild and class IV being most accommodating to a variety of human change.

There are typically two steps for the VRM system: an inventory of the existing landscape and a contrast analysis. The inventory is done to ensure that existing conditions are acceptable and to develop a baseline for future comparison. In the contrast analysis, the degree of contrast of a management action as compared to the native landscape is quantitatively assessed (the contrast analysis is part of the monitoring program for this indicator and is described more fully in that section, below).¹⁹

Definitions of Management Standard, Adverse Impact, and Degradation

Management Standard

Segments classified as wild shall meet the definitions of VRM class I areas, with scenic segments meeting the definitions of VRM class II areas. As presented in table 5-11, there is a natural parallel between wild and scenic river classifications and VRM classes.

Table 5-11.
WSRA Classification Definitions and VRM Class Definitions

| WSRA Classification Definitions | VRM Class Definitions^a |
|---|---|
| Wild segments: Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America. | Class I objectives: Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention (BLM 2007b). |
| Scenic segments: Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. | Class II objectives: Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape (BLM 2007b). |
| Recreational segments (no designated segments in the Tuolumne Wild and Scenic River corridor): Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past. | Class III objectives: Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape (BLM 2007b). |

a Class IV is not included in this table because it would accommodate more human change in a landscape than is acceptable in the Tuolumne River wild and scenic river corridor.

¹⁹ While scores have some subjectivity, variations in scoring between scorers decline with user training and experience (NPS 2009). For example, in the Blue Ridge Parkway the NPS has used this system using large numbers of volunteers to assess scenic value and monitor change over time. Using those results, park managers have been able to successfully communicate the need of adjacent land owners to modify developments to reduce the possible contrasts with the native landscape. Results were also introduced in a 2008 lawsuit case against the Tennessee Valley Authority and cited by the judge in the ruling to justify requirements for three coal plants to operate above Clean Air Act standards (NPS 2009).

Adverse Impact

Wild river segments managed as VRM class I would be adversely affected if they fell into the VRM class II management class evaluation. Scenic river segments managed as VRM class II would be adversely affected if they fell into VRM class III management class evaluation.

Degradation

Wild river segments managed as VRM class I would be degraded if they fell into the VRM class III management class evaluation. The scenic segments managed as VRM class II would be considered degraded if they fell into the class IV management class evaluation (which is not included in table 5-11 because it would accommodate more human change in a landscape than is acceptable in the Tuolumne River corridor).

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

The scenic values in the Lyell Fork and Lower Dana Fork segments are within the management standards for wild and scenic segments, respectively. However, the scenic values in the Grand Canyon and the Tuolumne Meadows segments have management concerns present (see table 5-12). These concerns will be addressed by actions to eliminate intrusions into views, as described above, and through long-term monitoring to ensure the proposed management is effective, described below.

Table 5-12.
Current Condition of Scenic Values Based on Visual Resource Management System

| Standards | Current Conditions, 2010 | |
|---|--|--|
| | Wild Segments | Scenic Segments |
| Management Standard: Wild Segments shall fit within VRM class I. Scenic Segments shall fit within VRM class II. | The Lyell Fork segment meets the VRM objectives for class I areas. | The Lower Dana Fork segment meets the VRM objectives for class II areas |
| Management Concerns: | Grand Canyon (due to views being affected by structures at Glen Aulin) | Tuolumne Meadows (due to views being affected by roadside parking and conifers encroaching into the meadows) |
| Adverse Impact: Wild segments would be adversely impacted if they fell into VRM class II. Scenic segments would be adversely impacted if they fell into VRM class III. | | |
| Degradation: Wild Segments would be degraded if they fell into VRM class III. Scenic segments would be degraded if they fell into VRM class IV | | |

Monitoring Program to Prevent Future Adverse Impacts or Degradation

Using the VRM system described above, the monitoring program will consist of (1) a contrast analysis for any new proposed structures and/or modifications of existing structures, (2) periodic on-the-ground monitoring, and (3) actions taken when specific management triggers are reached. These components are explained in more detail below.

Contrast Analysis

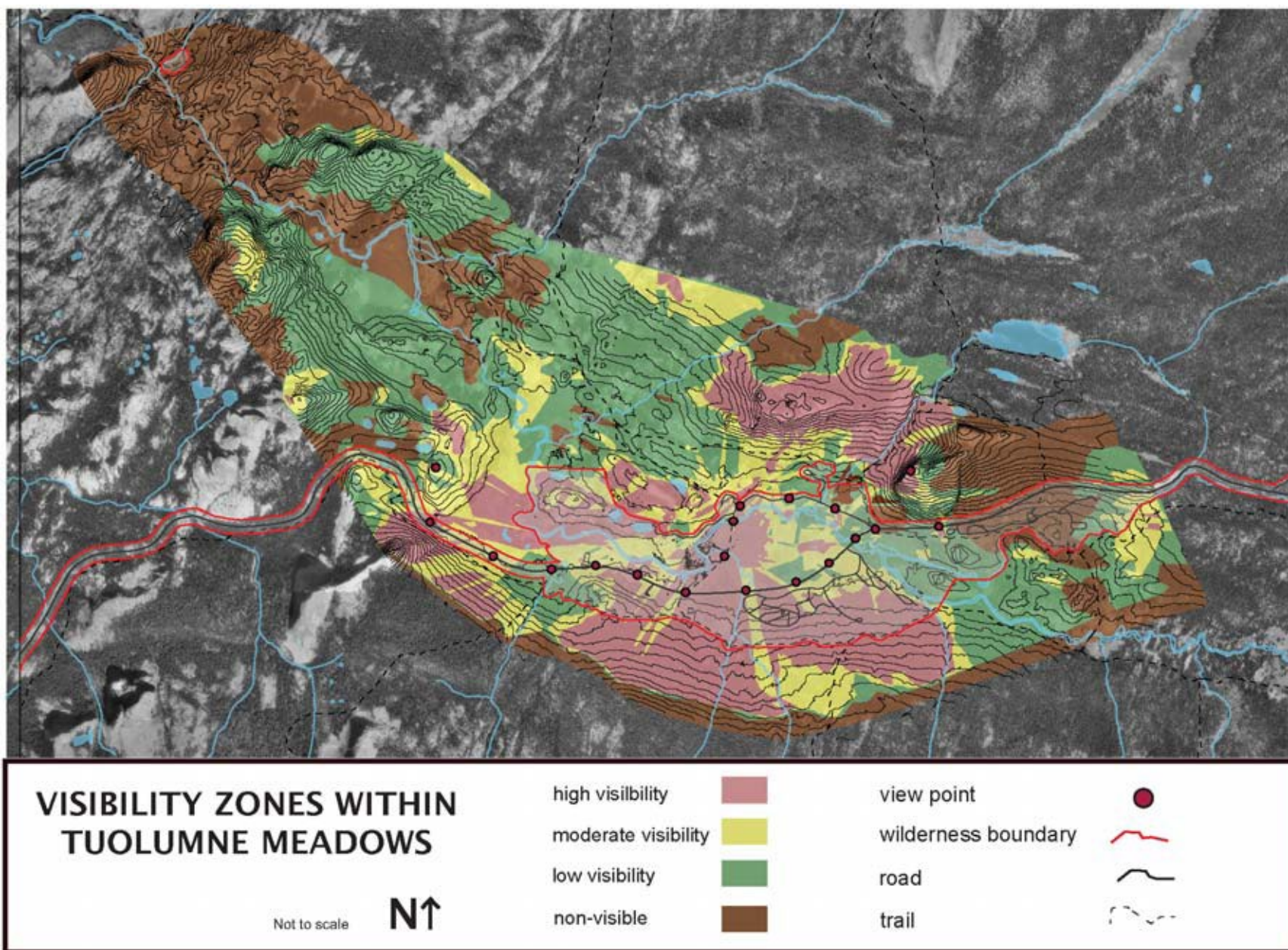
“Contrast” refers to the difference between the 12 key components of a landscape (form, line, texture, and color of the landscape’s vegetation, of its land and water, and of its existing structures) and the same components of the proposed structure. The lower the contrast between the existing landscape and a proposed structure, the more the structure can be said to blend into (not distract from) and therefore preserve the surrounding landscape and its VRM landscape class rating.

The NPS will perform a contrast analysis for all new structures and/or modifications of existing structures proposed for the Tuolumne River corridor (see figure 5-11, below). The contrast analysis will analyze whether the proposed structure or modification will harmonize with the class I or class II landscapes in which they will be located. For each of the 12 key components, contrast will be rated from high (3 points) to none (0 points). This could result in a contrast rating as high as 36, if the structure is rated as having a strong contrast in all categories. Within the wild segments (Lyell Fork and Grand Canyon), contrast ratings must not exceed a total value of 4, with no strong contrasts evident. For scenic segments (Lower Dana Fork and Tuolumne Meadows), contrast ratings must not exceed a total value of 12, again with no strong contrasts evident. If a structure with an excessive contrast rating was constructed, it would cause the VRM class rating for that segment to fall to the next lower level (i.e., from class II to class III), representing an adverse impact. To prevent this from occurring, if a proposed structure is found to exceed the specified contrast rating for that segment, it will be revised to fall within that contrast rating.

| | | FEATURES | | |
|----------|---------|--|--|--|
| | | Land and Water Body | Vegetation | Other Structures |
| | | Strong (3 pt.) Moderate (2 pt.) Weak (1 pt.) None (0 pt.) | Strong (3 pt.) Moderate (2 pt.) Weak (1 pt.) None (0 pt.) | Strong (3 pt.) Moderate (2 pt.) Weak (1 pt.) None (0 pt.) |
| ELEMENTS | Form | | | |
| | Line | | | |
| | Color | | | |
| | Texture | | | |

Figure 5-11. Sample Contrast Analysis Rating Sheet. The 12 cells at the bottom would all be completed, providing a comprehensive and quantitative analysis of the proposed structure's contrast with the existing landscape.

The contrast rating for proposed structures or structure modifications within the landscape units that contribute to the outstandingly remarkable scenic values of the river corridor would be assessed from a randomized selection of the eight scenic vista points and other vista points commonly used by park visitors today. Additional considerations for protecting scenic values in the Tuolumne Meadows area are included in the *Scenic Analysis of Tuolumne Meadows* (NPS, Torgerson and Schaible 2007o). This analysis was conducted to support the *Tuolumne River Plan* by identifying visually sensitive areas within the Tuolumne Meadows landscape and to recommend planning and design guidelines for the potential addition of new development to the meadows in the future. This information will be used in conjunction with the contrast analysis (explained above) and has informed the site planning component of the plan, as described in chapter 7. The analysis is summarized below as figure 5-12.



Source: NPS, Torgerson and Schaible 2007m

Figure 5-12. Visibility Zones within Tuolumne Meadows.

Monitoring Protocols

Monitoring of scenic segments will take place every four years to ensure that any recommended mitigations and actions are within the management class rating. Monitoring will include site visits to a random selection of the eight scenic vista points and five other notable scenic views. The monitoring will assess the landscape using the VRM initial inventory. Monitoring of wild segments will occur only when needed. Impacts in these segments are unlikely because of Wilderness Act restrictions on facility construction.

Triggers and Management Responses

Table 5-13 shows actions that will be taken to avoid adverse impacts or degradation on outstandingly remarkable scenic values.

Table 5-13.
Triggers and Management Responses for Protecting Scenic Values

| Trigger | Management Response | Rationale |
|---|--|--|
| Planned construction of any new structure or exterior modifications to any existing structure | Contrast analysis. | The contrast analysis is intended to reveal effects on the outstandingly remarkable scenic value before a new structure is built. |
| Within a wild river segment, a contrast rating of moderate in any category. | Mitigation such as changing color of structures to blend with native landscapes. | Actions or structures within this segment should attempt to minimize the contrast to the surrounding landscape to the extent possible. |
| Within a scenic river segment, an overall contrast rating greater than 12, or a strong contrast in any category | Mitigations to reduce the contrast rating to 12 or below, or to avoid any strong contrast rating. (If such mitigation is not practical, an alternative location must be found.) | A contrast rating above a 12 would attract more attention than is acceptable from the casual observer. |
| Within the scenic river segment, an overall contrast rating greater than 21, or a strong contrast in any two categories | Mitigations to reduce the contrast rating to 21 or below, or to avoid two strong contrast ratings. (If such mitigation is not practical, an alternative location must be found.) | A contrast rating above a 21 is beginning to dominate the surrounding landscape. |

Conclusions: Protecting and Enhancing the Scenic Values of the River Corridor

The outstandingly remarkable scenic values across all segments are found to be within the management standard, although management concerns are present at Glen Aulin (due to the visibility, if limited, of High Sierra Camp structures from the surrounding wilderness) and in Tuolumne Meadows (due to the roadside parking and lodgepole pine encroachment into the meadows). To remedy these concerns, a variety of actions are proposed, such as replacing the Glen Aulin tents to match the surrounding landscape more harmoniously, and eliminating roadside parking. The NPS will manage lodgepole encroachment according to the restoration program discussed under “Subalpine Meadow and Riparian Complex,” above. To prevent concerns from redeveloping, the monitoring program will subject all new proposed structures to a contrast analysis, complemented by periodic monitoring and a suite of actions to be taken if new concerns are identified.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

Scenic Segment: Tuolumne Meadows and Lower Dana Fork



NPS PHOTO BY KRISTINA RYLANDS

Tioga Road bridge on Tioga Road in Tuolumne Meadows.

Condition Assessment

Conditions at the Time of Designation

At the time of designation, visitors traveling the Tioga Road within the Tuolumne Wild and Scenic River corridor could travel across the Sierra Nevada and enjoy recreational opportunities such as auto touring, sightseeing, trailhead access, and car-based camping. The *Tuolumne Final Study* (USFS and NPS 1979b) noted that Tuolumne Meadows contained one of the largest campgrounds in the national park system and served as a major point of access to the Yosemite backcountry. The study also noted that the number of visitors in the Tuolumne Meadows area reached 3,000 per day during the peak summer season (which included both day and overnight visitors).

Current Conditions

The Tioga Road continues to provide access to a diversity of recreational and educational opportunities in the Tuolumne River corridor that are easily accessible to people of various ages and abilities. These opportunities have not changed since the time of designation, with the exception that the number of campsites in the Tuolumne Meadows campground has been reduced from about 600 (USFWS and NPS 1979a) to 304 regular sites plus 7 group campsites, as part of redesign to accommodate larger modern recreational vehicles, provide better site separation, and better protect natural features. The most popular activities in the Tuolumne area are

sightseeing/scenic driving, visiting the visitor center, nature study, and day hiking (Littlejohn et al. 2005). In 2009, 64% of summer park visitors reported taking a scenic drive as an activity in which they participated and 11% considered it their primary activity while in the park (Littlejohn et al. 2010).

Access to the meadows and river within the Tuolumne Meadows area remains largely unrestricted. Visitors park wherever they can (often along the shoulders of Tioga Road and other access roads) and walk out into the meadows and along the river shoreline at will, thus creating many informal trails. Although visitors are satisfied with this level of accessibility (see below), the cumulative impacts of current patterns and levels of use are contributing to changes in meadow habitats, as described under “Subalpine Meadows and Riparian Complex,” earlier in this chapter. According to comments received throughout the Tuolumne River planning process, visitors have easy access to important park attractions and vistas, they connect with the natural environment, they experience a sense of freedom, they find it easy to access scenic overlooks/vistas, and they can go “where they want, when they want” (NPS 2006m; White 2011).

The NPS estimates that 4,072 people visit Tuolumne Meadows during peak hours on peak days (see maximum amount of use for the no-action alternative in chapter 7). No comparative data for maximum people at one time are available from the time of designation; however, visitation parkwide has increased by 44% since the Tuolumne was designated (2.74 million in 1984 compared with 3.95 million in 2011 [NPS Public Use Statistics Office]).

Length of stay data from the 2010 visitor surveys in Tuolumne Meadows indicate that approximately 60% of visitors stay more than 24 hours and 40% of visitors stay less than 24 hours. For visitors staying more than 24 hours, the average length of stay was 3.9 days, with a median stay of 3 days. For visitors staying less than 24 hours, the average length of stay was 7.4 hours, with a median stay of 8 hours.

Management Concerns

Internal, tribal, and public scoping produced more comments about the nature of the visitor experience than any other general topic (NPS 2006m). Most of the concerns related to recreational values focus on the Tuolumne Meadows area. As the popularity of the area has increased, crowding and congestion—particularly vehicle congestion and crowding at popular spots along the river and in the meadows—have begun to change the quality of the visitor experience and to adversely affect resources. Many respondents expressed some dissatisfaction with vehicle congestion and crowding at popular spots along the river and in the meadow (NPS 2006m; White 2011). More than a third of all visitors now park in undesignated locations along road shoulders or around the edges of designated parking areas. Parking data collected in 2011 indicate that, of the 870 vehicles found parked in the Tuolumne Meadows area during peak use periods (including both day and overnight parking), only 533 of these vehicles were parked in designated spaces. Parking is essentially unmanaged at Tuolumne Meadows, in that visitors park wherever they can (all visitors do keep their cars on road shoulders, however). Roadside parking creates traffic congestion as cars slow or wait for a parking space to open up, creates safety hazards associated with erratic traffic and pedestrians on the road, and allows the intrusion of parked cars into the views of people taking a scenic drive along Tioga Road. If management action is not taken to protect the visitor experience, future increases in visitation can be expected to increase visitor dissatisfaction and traffic safety hazards, as well as impacts on resources.

Actions NPS Will Take to Address these Concerns

All the action alternatives would eliminate roadside parking along Tioga Road, thereby reducing traffic congestion, safety hazards, and the intrusion of parked cars into the viewing experience of people traveling Tioga Road. With the exception of alternative 1 (which would reduce visitor use to a level that would allow

visitors to have a self-reliant experience), the action alternatives would increase the amount of designated parking, thus making it possible for more visitors to find a space in a designated parking area. All designated parking would be in locations that were protective of all the outstandingly remarkable river values. Formal trail connectors and shuttle bus stops would provide easy access from the designated parking to trailheads and other visitor facilities. Thus, people wishing to park and get out of their cars would have easier access to these destinations than is currently available, up until the time that the designated parking became full. Because the amount of designated day parking would be used to manage the day visitor capacity (established for each alternative), whenever the designated parking was full during peak times, some visitors wishing to park and get out of their cars would no longer be able to do so.

Traffic management would seek to balance the potential for adverse impacts on the visitor experience associated with the frustrations of trying to find a parking space in relatively heavy traffic, with the potential for adverse impacts associated with more intrusive traffic control techniques, such as requiring a parking permit and issuing tickets for illegally parked vehicles (see the discussions of the monitoring program for this value, below, and also the direction provided for management of user capacity under all the action alternatives, in chapter 7). In exchange for these unavoidable adverse effects (which are analyzed in chapter 8), enforcing the user capacity would improve the recreational experience for those visitors who were able to park and get out of their cars by decreasing congestion on trails and at other destinations and by protecting other river values from visitor use-related impacts (as described in the discussions specific to those values).

Management Indicator and Monitoring Program

Indicator Description: Vehicles Parked Compared to Designated Parking Supply

The number of vehicles parked at any one time in the Tuolumne Meadows area can now be extrapolated from data produced by vehicle volume counters, using a coefficient derived from comparing vehicle volumes to actual counts of parked cars conducted in 2006 and 2011. Through these extrapolations and direct observation, the total vehicles parked at one time in the Tuolumne Meadows area can be compared to the designated parking supply to evaluate compliance with designated parking regulations.

The indicator will document any parking shortages during the busiest days of the year and guide management in determining the most appropriate traffic management actions for minimizing impacts on the experience of visitors accessing the river corridor via Tioga Road. Because the availability of day parking will be used to enforce the day visitor capacity, some visitors will unavoidably be displaced to other locations; the intent of this indicator will be to help managers manage traffic to minimize the adverse impact on all visitors.

Definitions of Management Standard, Adverse Impact, and Degradation

The definitions of management standard, adverse impact, and degradation compare cars parked with the number of designated parking spaces. Peak volumes between Tuolumne Meadows and Tioga Pass vary from 140 to 150 vehicles per hour for westbound traffic, and 155 to 170 vehicles per hour for eastbound traffic. Travel patterns could change, resulting in consistent peak hourly volumes but increased daily volumes. During the 2006 data collection, peak daily volumes were 1,450 vehicles westbound and 1,715 eastbound (DEA 2007). The NPS 2011 study collected parking data on eight days, capturing both early morning (overnight parking) and peak hour parking data. Excluding the campgrounds, peak hour parking counts in the 2011 study ranged from 589 to 870 at Tuolumne Meadows.

Management Standard

Parking design has typically sought to accommodate parking demand on the seventh to tenth busiest day of the year (NPS 2008b). Adapting this practice to this standard and translating the tenth busiest day to a percent (10%), the management standard is defined as vehicles parked do not exceed parking supply more than 10% of the time at peak hour.

Adverse Impact

An adverse impact is defined as parked vehicles exceeding the parking supply 50% of the time at peak hour, or an increase of 30% or more in exceeding parking supply within a three-year sample.

Degradation

Degradation is defined as parked vehicles exceeding the parking supply 80% of the time at peak hour.

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

Parking supply is currently elastic, in that the lack of restrictions allows visitors to seek and use additional undesignated parking during periods of high demand; however, if parking supply is defined as designated parking (as it needs to be to protect river values), then parked cars exceed the parking supply by 39% at peak hour. This impact will be addressed by actions to manage the visitor user capacity, described above, and through long-term monitoring to ensure the proposed management is effective, as described below.

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the *Tuolumne River Plan* to ensure that river values are enhanced where necessary and protected throughout the life of the plan. For this outstandingly remarkable recreational value (Tioga Road access to the river through Tuolumne and Dana Meadows), monitoring will be conducted to ensure that management of day parking is effectively protecting river values, including the quality of the visitor experience. A key part of this program will be management triggers intended to identify and address management problems before adverse impact occurs.

Monitoring Protocols

NPS will use automated counters to monitor inbound and outbound travel in the Lower Dana Fork and Tuolumne Meadows segments to determine whether relationships across use levels remain similar over time. Parking in unauthorized locations (where parked vehicles and associated informal trails could affect vegetation and soil, cause traffic congestion and visitor safety issues, and affect scenic values) will be monitored by direct observation.

Baseline monitoring will occur annually for the first three years of implementation to account for the change in infrastructure resulting from implementation of the selected *Tuolumne Wild and Scenic River Plan/Draft EIS* alternative. Thereafter, monitoring to detect change is expected to take place one out of every three years. This monitoring schedule will ensure that both segmentwide and site-specific information is understood.

Unauthorized parking locations that are curbed or barricaded with natural features will be evaluated for their effectiveness in protecting river values, particularly during busier times of the peak visitor season.

Triggers and Management Responses

Table 5-14 shows triggers at which action will be taken to address management concerns that arise.

Table 5-14.
Triggers and Management Responses to Protect River Values by Managing Tioga Road Access to the River through Tuolumne and Dana Meadows

| Trigger | Management Response | Rationale |
|--|---|---|
| Parked vehicles exceed parking supply 10% of the time for three consecutive years. | Increase monitoring of vehicle volumes, parking, and travel time conditions. Increase educational efforts within the park. Increase pre-trip planning educational efforts for prospective visitors. Redouble efforts to enforce parking restrictions. Escalate parking enforcement. | Exceeding the management standard routinely warrants further identification of the issue. Exceeding the management standard routinely warrants assurances that visitors are not parking in locations not specifically designated for day or overnight parking. |
| Approaching Adverse Impact: Parked vehicles exceed parking supply 40% of the time during peak hour, or a change of 25% or more in exceeding parking supply over a three-year sample. | Implement parking reservation system; provide alternative transportation on shuttle system subject to that system's limitations. | Given the legal ramifications of reaching adverse impacts in accordance with the WSRA, aggressive visitor use management measures will be put in place to reduce parking demand on the finite supply of parking in the Tuolumne River corridor. |

WSRA = Wild and Scenic Rivers Act

Conclusions: Protecting and Enhancing Tioga Road Access to the River through Tuolumne and Dana Meadows

The Tioga Road continues to provide access to a diversity of recreational and educational opportunities in the Tuolumne River corridor that are little changed since the time of designation. Access to the meadows and river within the Tuolumne Meadows area remains largely unrestricted, and visitors report satisfaction with their ability to go “where they want, when they want.” However, visitors also report dissatisfaction with vehicle congestion and with crowding at popular spots along the river and in the meadows. Unrestricted access also contributes to impacts on other outstandingly remarkable river values, as more than a third of all visitors currently park along the road shoulder and create informal trails across the meadows and along the riverbanks to reach popular attractions.

Under the *Tuolumne River Plan*, the roadside parking along Tioga Road will be eliminated, thus reducing the traffic congestion, safety hazards, and intrusion of parked cars into the viewing experience of people traveling on Tioga Road. Under most alternatives presented in chapter 7, the amount of designated parking would be increased to make it possible for more visitors to find a space in designated parking areas. Also, under all the action alternatives, a visitor capacity will be enforced to protect the quality of the visitor experience from increasing congestion and to protect other river values from visitor use-related impacts. The day use capacity will be managed through the availability of day parking and the capacity of the buses that serve the Tuolumne River corridor, while the overnight capacity will be managed by the number of lodging units, campsites, and wilderness permits.

The effectiveness of using the day parking supply at Tuolumne Meadows to manage the day use capacity in all the river segments above Hetch Hetchy Reservoir will be monitored through an indicator that compares the number of vehicles actually parking in the Tuolumne Meadows area with the supply of designated parking provided under the plan. Additional management actions to identify issues and enforce the designated user capacity will be triggered by the exceedance of standards developed for this indicator.

Recreational Value: Wilderness Experience along the River

Wild Segments: Lyell Fork, Upper Dana Fork, Grand Canyon of the Tuolumne, and Poopenaut Valley



NPS PHOTO BY KRISTINA RYLANDS

Backpackers along the Grand Canyon of the Tuolumne.

Condition Assessment

Condition at the Time of Designation

Wilderness along the Tuolumne River offered outstanding opportunities for recreation characterized by self-reliance and solitude. This experience was being protected by an overnight zone capacity and associated trailhead quota system, which had been implemented in response to concerns about increasing visitor use in the Yosemite backcountry, as described below.

As the popularity of backpacking increased in the late 1960s and 1970s, campsites proliferated throughout Yosemite's backcountry. Some areas had hundreds of campsites, and documented impacts included vegetation loss, soil compaction, firewood depletion, and informal trail formation. In response, the Yosemite wilderness zoning and trailhead quota system was developed in the 1970s (van Wagtenonk and Coho 1980 and 1986). The backcountry was divided into travel zones. The capacity within each zone was based on its size, miles of trails, and desired sociological densities for campsites and trails. These values were then adjusted downward to account for ecological factors. Capacities were reduced in zones that contained rare or vulnerable ecosystems (such as the subalpine meadows in the Tuolumne River corridor) or ecosystems that had a low potential for

recuperation and repair (such as alpine meadows). While this research took place more than 30 years ago, the ecological and social factors that the capacities are based on are little changed (NPS, Fincher 2010m).

By the time the river was designated (the same time that the Yosemite Wilderness was designated), the zone capacities and associated trailhead quotas were limiting the number of overnight visitors in the wilderness, thus limiting the number of campsites and encounters with other parties. Requiring a wilderness permit also allowed NPS staff to have a face-to-face educational contact with every party spending the night in the wilderness. Leave-No-Trace education and low-impact camping practices helped protect wilderness and river values. Campers learned how to minimize or avoid impacts on water quality, sensitive resources, and wildlife by, for example, camping in existing sites, minimizing trips to water to avoid using or forming informal trails, properly disposing of human waste and dishwater, leaving artifacts where found, and storing food to prevent feeding wildlife.

The zoning and quota system was not designed to work by itself in limiting these impacts. Monitoring and restoration of backcountry campsites started in the 1960s. Campsites close to water were restored to natural conditions, and camping was encouraged in more resilient locations already used for camping. By the time of the Tuolumne River's designation, these efforts had started to improve ecological conditions in the backcountry and the associated wilderness experience.

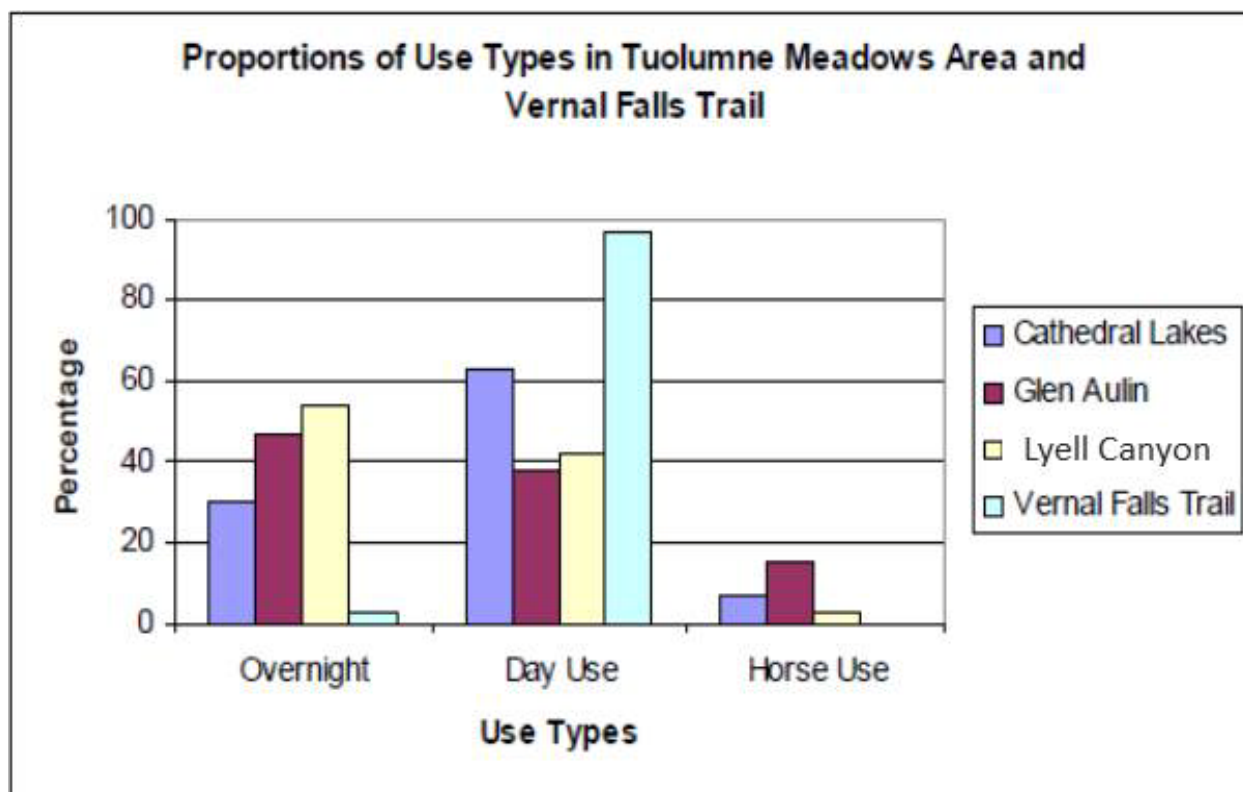
Current Conditions

The wild segments of the Tuolumne River corridor continue to offer a variety of opportunities for solitude and self-sufficient recreation, with visitors enjoying the same activities they did in 1984. Use in designated wilderness remains largely unconfined. River values are protected by the wilderness zoning and overnight trailhead quota system, restrictions on camping in sensitive areas, and group size limitations.

Variables monitored to determine the effectiveness of the zone capacities and trailhead quotas include water quality, meadow health, formal trail conditions, informal trails, day use levels, encounters with others on trails, and campsite numbers and condition. Monitoring of wilderness campsites provides a good example of observed trends. Campsite numbers and conditions were inventoried in 1972 (NPS, Holmes 1972) and then in the 1980s (this time using the Wilderness Inventory and Monitoring System (WIMS) (NPS, Sydoriak 1986b). In the 1990s and again in the 2000s, NPS assessed a representative sample of wilderness campsites (WIMS 2 and WIMS 3). Analysis of these four data sets (spread over 35 years) shows a positive trend and steady improvement over time. The total number of campsites is decreasing, sites with large impacts are being restored, and overall impacts continue to show a significant decrease with each round of monitoring. As an example of this trend at a specific location, when Pate Valley was surveyed in 1984 (the year the Tuolumne Wild and Scenic River was designated), 18 campsites were recorded, while a 2006 survey recorded only 9 campsites. In 1984, five of the sites were within 25 feet of water; in 2006 only one site was that close (NPS, Fincher 2010m).

Monitoring of resource conditions has led to adjustments in the wilderness trailhead quotas, and by extension, the zone capacities themselves. In 1984, for example, the trailhead quota for Lyell Canyon was 50 people per day. The quota has since been lowered to 40 people per day to further enhance the wilderness recreational experience. In contrast, at Glen Aulin, the management response was to establish a designated backpacker campground. As a result, more people could be accommodated with less physical impact, and the trailhead quota was raised from 25 to 35 people per day. Other management responses to undesirable impacts discovered through this monitoring have included site-specific regulations (such as prohibiting fires), increased ranger patrols, and major restoration efforts. Lyell Canyon, in particular, has seen extensive restoration of campsites since 1984 (NPS, Fincher 2010m).

The monitoring data indicate that with the quota system in place, visitors' overnight wilderness experiences are protected from crowding and perceptions of human disturbance. However, this quota system can temporarily deny some individuals access to a particular location on a particular date if the quota is already filled. Overnight wilderness visitors' attitudes about their wilderness experience were studied from 2001–2002 (Newman 2002). Respondents were asked to trace their daily route of travel and make evaluative judgments concerning qualities that contributed to a positive wilderness experience. Factors found to be important included (1) signs of human use at camping sites, (2) numbers of people encountered per day when hiking, (3) encountering stock or signs of stock use, (4) regulation of camping, (5) the chance of obtaining a wilderness permit, and (6) the opportunity to camp out of sight and sound of other groups. The study suggested that Yosemite Wilderness visitors are willing to trade some freedoms, such as camping regulation and some degree of access, in order to obtain a high quality recreational experience (Newman 2002).



Source: Pettebone et al. 2008. Vernal Falls, which is not in the Tuolumne River corridor, is included for comparison.

Figure 5-13. Mean Hourly Visitation at Three Primary Tuolumne Meadows Trailheads.

While overnight visitation to the Yosemite Wilderness has decreased substantially since the zone capacity and trailhead quota system was instituted, demand for wilderness permits in the Tuolumne River corridor remains well above the quotas. Thus the quota system is still vital in protecting river values from the potential threats listed above.

By 2008, one-third to over one-half of use on the three major trailheads originating in Tuolumne Meadows (Glen Aulin, Cathedral Lakes, and Twin Bridges along the Lyell Fork) was day use (see figure 5-13) (Pettebone et al. 2008). Increasing day use levels have contributed to increased perceptions of crowding on trails within a day hike of Tuolumne Meadows trailheads, particularly on the trail following the river from Tuolumne Meadows to Glen Aulin.

Management Concerns

The number of people encountered per day when hiking in the Yosemite Wilderness was identified as a concern of overnight wilderness users in the Newman study (2002). Increasing day use on wilderness trails within the first few miles of Tuolumne Meadows trailheads is not addressed by the wilderness overnight zone capacities and associated trailhead quota system. Another identified concern was encountering stock or signs of stock use. Wilderness overnight users also identified concerns about signs of human use at camping sites, regulation of camping, the chance of obtaining a wilderness permit, and the opportunity to camp out of sight and sound of other groups.

Actions NPS Will Take to Address these Concerns

Designated wilderness within the wild segments of the Tuolumne River corridor will continue to be managed in accordance with the Wilderness Act and its implementing regulations and NPS policies. The impacts of the *Tuolumne River Plan* on wilderness character are addressed in chapter 8.

In addition to the guidance provided by the current *Wilderness Management Plan* and the upcoming *Wilderness Stewardship Plan*, the *Tuolumne River Plan* will guide management of wild segments within the river corridor to protect and enhance river values. Specifically, the *Tuolumne River Plan* will address concerns about encounters with other groups and potential conflicts between hikers/backpackers and stock users. The plan will establish an indicator and management standard for wilderness trails that are within a day's hike of Tuolumne Meadows to protect the river-related wilderness experience in wild segments of the Tuolumne River corridor. For any trail segment on which the management standard is not being met, the NPS will increase monitoring, inform visitors about alternative trails within the corridor, and encourage visitors to hike during days and times of day at which lower encounter rates occur. If encounter rates increase despite these efforts, the NPS will establish a day use permitting system and make necessary changes in the backcountry quota system to better manage for opportunities for solitude.

Stock use will be reduced under all the alternatives to enhance the opportunity for a wilderness experience along the river with a reduced potential for conflicts between hikers/backpackers and stock users. Commercial stock use would be eliminated under some, but not all, the alternatives.

The NPS has found the wilderness overnight zone capacities to be an effective tool for keeping use within the standards to be adopted under the *Tuolumne River Plan*. Monitoring of impacts on river values from wilderness camping under the existing capacities will be sufficient to ensure that river values are being protected and enhanced.

Management Indicator and Monitoring Program

Indicator Description: Number of Encounters with Other Hiking Parties per Hour

One of the components of this outstandingly remarkable recreational value (wilderness experience along the river) of the Tuolumne River is the opportunity for solitude, which is an enduring characteristic of a wilderness experience (Lucas 1964). Expectations for solitude and actual numbers and types of groups encountered have been shown to have a significant effect on the quality of visitor experiences (Newman and Manning, 2002; Patterson and Hammitt 1990; Vaske et al. 1986). Although some studies have shown a weak relationship between encounters and visitor perceptions of solitude and crowding (Graefe et al. 1984; Lee 1977; Stewart and Cole 2001), there exists a substantial body of literature to support the use of encounters as an indicator of solitude opportunities in wilderness (Broom and Hall 2009; Graefe et al. 1984; Lee 1977; Manning et al. 2000; Stewart and Cole 2001; Vaske and Donnelly 2002).

The number of encounters has been chosen by many wilderness managers as an indicator for the social setting, not only because encounters among groups have an effect on solitude but also because field measurements are easy to accomplish (Watson et al. 1998). Researchers and managers have at times chosen to monitor the number of individuals encountered, rather than the number of groups, due to difficulties distinguishing individuals' affiliations to others, especially in busy areas (Shelby and Heberlein 1986). However, where possible, documenting each group encountered as well as the number of people in the group will provide the most flexibility for subsequent analysis (Broom and Hall 2010).

Encounters are also an excellent way to assess use levels and density, which can affect other outstandingly remarkable values, such as the biological and cultural values identified for the Tuolumne River Wild and Scenic River.

Definitions of Management Standard, Adverse Impact, and Degradation

Management Standard

The management standard is defined as a mean encounter rate (across all designated trail sections sampled within a river segment) of no more than 10 encounters with other groups per hour, 80% of the sampled time (or more), exceeded no more than two out of three consecutive years.

The standard has been derived from several years of data collection on trails located throughout Yosemite National Park and representing varying levels of use (Broom and Hall 2010; Pettebone et al. 2010). Several studies have examined visitor preferences toward encounters in wilderness areas that support the chosen thresholds (Broom and Hall 2009; Cole and Hall 2008). The numerical threshold takes into account a sampling strategy that includes a high-use destination and a low- to moderate-use destination in each segment.

Adverse Impact

Adverse impact is defined as a mean encounter rate (across all designated trail sections sampled within a river segment) exceeding 12 encounters with other groups per hour more than 20% of the sampled time, in both the Lyell Fork and Grand Canyon segments, for three consecutive years.

Monitoring for a downward trend toward the adverse impacts threshold of 12 encounters with other parties per hour 80% of the time allows for fluctuation in visitor use and offers management the ability to take measures to reduce the impact in a timely manner. This threshold is also consistent with management guidelines at Mount Rainier National Park for the standard for high- use climbing zones (Lah 2000). The level of adverse impact in the Tuolumne River corridor was determined through multiple years of indirect and direct sampling, looking at use in other areas of the park, the high use of adjacent trails (Pettebone et al. 2010), and visitor preferences expressed in studies of high-use destinations in wilderness (Cole and Hall 2008).

Degradation

Degradation is defined as a mean encounter rate (across all designated trail sections in a river segment) exceeding 20 encounters with other groups per hour more than 20% of the sampled time, in both the Lyell Fork and Grand Canyon segments combined, for three consecutive years.

Degradation for wilderness encounters is defined at the level at which visitors perceive crowding is beyond an acceptable level. Encounter rates above this level cause displacement of visitors and detract from the visitor's experience (Cole and Hall 2008). This standard is based on observations from several years of encounter data in the Tuolumne River corridor as well as preferences from hikers in studies of wilderness use in the Pacific Northwest (Broom and Hall 2010; Cole et al. 1997). Although the literature offers insight into visitor

preferences regarding encounter rates and there are sufficient data on Yosemite trail encounters, managers must consider management objectives to set standards (Cole et al. 1997).

Current Findings Regarding Management Standard, Adverse Impacts, and Degradation

The encounter rate on the trail to Glen Aulin occasionally reached 8 encounters with other groups per hour in 2010 (Broom and Hall 2010). Encounter rates on other trails were below that number. For all wild segments, the management standard for this recreational value was being met in 2010 (see table 5-15). Data from 2011 are still being analyzed.

Table 5-15.
Current Condition of Wilderness Experience Based on Mean Encounter Rate

| Standards | Current Conditions, 2010 (All Wilderness Trail Segments) |
|--|--|
| Management Standard: Mean encounter rate ≤ 10 per hour, 80% of sampled time | All trails have a mean encounter rate of less than 8 per hour, with the trail to Glen Aulin approaching this rate. |
| Management Concern Mean encounter rate 10–12 per hour, 80% of sampled time | |
| Adverse Impact: Mean encounter rate > 12 per hour, 80% of sampled time | |
| Degradation: Mean encounter rate 20 per hour $> 20\%$ of sampled time | |

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the *Tuolumne River Plan* to ensure that river values are enhanced where necessary and protected throughout the life of the plan. A key part of this program will be management triggers intended to ensure that any downward trend in conditions can be identified and arrested well before adverse impact occurs.

Monitoring Protocols

Automated counts of visitor trail use will occur annually along high-use trail segments. A recent study demonstrated that when based on direct counts, accurate encounter rates can be generated using automated trail counters (Pettebone et al. 2010). Prior sampling showed a relationship between indirect and direct counts (Broom and Hall 2010). Monitoring annually by indirect counts will reduce the burden on managers and provide reliable data on encounter levels on the trail segments. An annual analysis of these counts will provide management the best available data to make decisions.

Four locations have been selected to represent varying levels of use along trails within the Tuolumne Wild and Scenic River corridor: (1) the section of the Glen Aulin trail from the Young Lakes junction to Glen Aulin, (2) the trail from Glen Aulin to Waterwheel Falls, (3) the Grand Canyon of the Tuolumne trail from Pate Valley to the Rogers Creek bridge, and (4) the section of the Lyell Canyon trail from Rafferty Creek to the Ireland Lake junction. High-use trail sections will be monitored annually during the high-use season using automated counters. Actual encounters or direct counts will be collected at low-use and moderate-use sites every five years. Monitoring may occur with more frequency, depending on trends or trigger points being reached. Direct counts will be conducted along high-use trails as necessary to ensure that there is no significant downward trend towards an adverse impact. The status of this outstandingly remarkable recreational value will be evaluated by examining the mean encounter rates for all designated trail sections in the Tuolumne River corridor, as well as encounter rates for each individual sampling location. Mean encounter rates along individual trails and across the corridor will be used to inform management actions.

Triggers and Management Responses

Table 5-16 summarizes the management triggers and responses to protect a wilderness experience along the Tuolumne River.

Table 5-16.
Triggers and Management Responses to Protect a Wilderness Experience along the River

| Trigger | Management Response | Rationale |
|--|--|--|
| Encounter rate exceeds 10 encounters with other groups per hour more than 20% of the time on an individual trail section in a single monitoring year. (This trigger would require action while the condition was still within the standard because the standard would not be exceeded until encounter rates reached this level across all the trail sections sampled within the river segment and for two of three consecutive years.) | Increase sampling intervals at low-use and moderate-use sites for direct observation. Increase direct observation sampling interval at high-use trail sections. Disseminate information to visitors regarding alternative trails within corridor. Encourage visitors to hike during days and times of day at which lower encounter rates occur. | Additional information is needed to determine that conditions are not trending toward adverse impacts. |
| Encounter rate exceeds 10 encounters with other groups per hour more than 20% of the time for three consecutive years on an individual trail section. | Make necessary changes in the overnight trailhead quota system to better manage for opportunities for solitude. Establish day use parking permits and institute changes to shuttle system to manage the number of people arriving at trailheads feeding trail sections that have exceeded the trigger point. | Trailhead quotas control the amount of overnight use in the wilderness segments of the Tuolumne River corridor. This standard will assist in determining whether the existing quotas and associated zone capacities sufficiently provide opportunities for solitude. |
| Encounter rate exceeds 10 encounters with other groups per hour more than 20% of the time for three consecutive years across all trail sections within the segment. | Establish a trailhead day use quota and permit system for trail sections that have exceeded the trigger point. Make necessary changes in backcountry quota system to better manage for opportunities for solitude. Institute hard closures of trailheads or parking as necessary to regulate use of wilderness corridor. | If the management standard is exceeded for the segment level, and an opportunity for solitude is not provided, aggressive actions are necessary to regulate the flow of individuals into wilderness. |

Conclusions: Protecting and Enhancing the Wilderness Experience along the River

At the time of designation, the wild segments of the Tuolumne River offered outstanding opportunities for river-related recreation characterized by self-reliance and solitude, and those opportunities continue today. Since the 1970s, an overnight zone capacity and trailhead quota system has helped protect this river value, particularly in more remote portions of the corridor. However, increasing day use on wilderness trails within the first few miles of the Tuolumne Meadows trailheads now threatens to diminish opportunities for solitude on certain trail segments. The *Tuolumne River Plan* will address this management concern by managing day use levels in the river corridor and by monitoring the indicator of encounters with other groups on trails, which is a widely used indicator for a quality wilderness experience. Use on wilderness trails will be managed to remain within the management standard established for this indicator through actions that could include changes to the overnight trailhead quota system and/or the implementation of a day use trailhead quota system if determined necessary.

Water Quality

Condition Assessment

Conditions at the Time of Designation

At the time of designation, the Tuolumne River corridor was characterized as having generally high-quality water that was low in dissolved nutrients, had low conductance, adequate dissolved oxygen, and pH in the range expected for granitic watersheds. In 1979, prior to designation, a portion of the river at Tuolumne Meadows had elevated coliform and biological oxygen demand levels that were associated with large numbers of recreational users and the proximity of a wastewater treatment plant to the river (USFS and NPS 1979b). Shortly thereafter, the NPS rebuilt the wastewater treatment plant, thus solving the elevated coliform and associated problems.

Previous impacts on water quality at Glen Aulin were addressed in 1983, prior to designation, by replacing the septic tank and leach mound at the High Sierra Camp and by installing a composting toilet facility at the backpacker camp. Manure at the stock corral, which was relatively close to the river at that time, may have affected water quality.

Current Conditions

Water quality in the Tuolumne River is exceptionally high and superior to state standards (NPS 2009k; SFPUC 2009; NPS 2011d). Levels of coliform and biological oxygen demand, which had been elevated in Tuolumne Meadows prior to designation, are now within established NPS standards throughout the river corridor. No samples collected between 2006 and 2010 fell below NPS water quality standards. Data from several of these years were used to establish the management standard, which requires water quality far superior to existing state and U.S. Environmental Protection Agency (USEPA) standards.

Because water quality in the Hetch Hetchy Reservoir is critical to the water supply for the City of San Francisco, the 1913 Raker Act grants the city the authority to protect the Hetch Hetchy watershed. The city has implemented requirements for the treatment or disposal of sewage and garbage, and restrictions on bathing, washing clothes or cooking utensils, watering stock, or any other activity that could pollute the watershed (SFPUC 2008). Water quality data collected by the NPS and the SFPUC in 2006–2009 show that the water quality of the Hetch Hetchy water supply remains exceptional.

Numerous actions have been taken over the past two decades to reduce risks to water quality. In the Tuolumne Meadows area, actions have included relining wastewater containment ponds, removing underground tanks at the public fuel station, repairing and installing new sewer lines, and removing manure from stables and trails. At the Glen Aulin High Sierra Camp, actions have included enforcing water use restrictions, moving the corral for the concessioners' stock farther from the river, and removing manure. In 1993, the NPS constructed a backpacker campground with about 32 sites to relocate campers and their associated potential effects on water quality (such as soil erosion and human waste) away from Conness Creek. Regulations protective of water quality and other river values are enforced by rangers hired specifically for that purpose.

The “little blue slide” is a road cut along the Tioga Road just east of Tuolumne Meadows and immediately adjacent to the Dana Fork. Continuous sloughing of material including silt and sand from the cut affects water turbidity, as described in greater detail immediately below.

Management Concerns

The primary concern for water quality in the Tuolumne River corridor is caused by the “little blue slide.”

Impacts on river values from this road cut include reduced water quality and impacts on river habitat. Under-snow winter runoff, spring runoff, summer storms, and emerging groundwater are continually depositing silt into the Dana Fork at this location and undermining larger boulders that fall onto Tioga Road. Silt washed from the fill slope below the road sinks to the bottom of the river. According to NPS specialists in Yosemite and in the agency’s Water Resources Division in Fort Collins, Colorado, the cut has destabilized the slope both above and below the road and it will not stabilize without intervention (NPS, Noon and Martin 2010d). While sediments do indeed enter the Dana Fork, water quality in the fork remains excellent, and state turbidity standards are not exceeded.



NPS PHOTO BY KRISTINA RYLANDS

Fine soils along a portion of Tioga Road can contribute to river turbidity during storm events.

Other management concerns regarding water quality are present in the corridor. While the NPS operates in compliance with Central Valley Regional Water Quality Control Board permits, changes to the wastewater treatment facilities at Tuolumne Meadows would require upgrades to meet current standards. Potential wastewater leaks from the containment ponds in Tuolumne Meadows pose a risk to water quality, as does the potential for saturation of the sprayfield (SFPUC 2009). Past impacts associated with leakage from the wastewater line that runs beneath the river and meadow from the wastewater treatment plant to the wastewater ponds have been corrected by the installation of a new line. However, the risk of future impacts cannot be totally eliminated so long as the line remains in place.

Impacts from the fuel facilities at Tuolumne Meadows have been corrected and were mitigated between 1997 and 2005 (SFPUC 2009). However, the potential for future impacts cannot be totally eliminated as long as fuel facilities remain. Two vapor-extraction cleanup projects associated with older buried tanks are ongoing. In addition, the fuel station is required to operate according to all applicable state laws and best management practices, including having a spill prevention plan. The concern that water quality could be affected remains, even though water quality is excellent.

The leach mound associated with the High Sierra Camp septic system at Glen Aulin was found to be over capacity in 1997. The system was unable to adequately treat previous levels of wastewater, prompting restrictions in 2002 that capped water use at a maximum 700 gallons per day to protect water quality. In 2010 water use was further restricted to 600 gallons per day. Because of these measures, leach mound failure has been avoided. However, the risk to water quality from failure of the minimally sized leach mound remains.

A microbial water quality study in the Tuolumne River watershed considered the potential risk of surface water contamination by pack stock (Atwill et al. 2008). This study focused on *giardia* and *cryptosporidium* shedding by pack stock. While the study suggests that pack stock-associated waterborne contamination was of low concern, the study's authors made several recommendations to protect water quality. For example, since most manure occurs within the first 0.25 mile of trails from stable operations, the study authors recommended that trails be patrolled and manure removed from watercourses in these areas. These management practices are now ongoing.

Actions NPS Will Take to Address these Concerns

Under all alternatives, the “little blue slide” east of Tuolumne Meadows along Tioga Road will be stabilized to reduce the erosion of silt into the Dana Fork. Stabilization of the site will require development of an engineering and revegetation strategy, followed by extensive manipulation of the cut slope above the road and the fill slope below the road. The stabilization strategy will be protective of the scenic values within the lower Dana Fork and Lyell Fork segments of the river.

All alternatives call for the Tuolumne Meadows wastewater treatment plant to be upgraded at its current location (the possibility of relocating the plant was considered but dismissed for reasons discussed at the end of chapter 7 under “Alternatives Dismissed from Further Consideration”). The design capacity of the new plant will depend on the visitor use alternative selected. The wastewater containment ponds and sprayfield on the north side of Tioga Road will either be improved to mitigate risks to water quality or replaced with facilities on the south side of Tioga Road. Site-specific planning for the plant, the containment ponds, and the sprayfield will be conducted after the NPS selects an alternative in a formal record of decision. This site-specific planning must ensure that risks to water quality are reduced and that meadow/riparian and scenic values remain protected.

The risk to water quality associated with stable operations will continue to be mitigated by best management practices, including manure removal from corrals and water courses within the first 0.25 mile of trails leading from stable operations. These practices have been successful in protecting water quality. The sizes and specific locations of the NPS and concessioner stable operations vary among the alternatives.

Risks from fuel storage tanks have been mitigated by secondary containment and periodic testing, as required by California regulations. The retention or removal of commercial fuel storage tanks, and the location of administrative fuel storage tanks, vary among the alternatives. After the NPS has selected an alternative in a formal record of decision, any additional implementing actions for protecting river values will be incorporated into the final *Tuolumne River Plan*.

The risk to water quality at the Glen Aulin High Sierra Camp would be addressed differently among the various alternatives (see chapter 7). After the NPS has selected an alternative in a formal record of decision, it will be incorporated here as part of the final *Tuolumne River Plan*.

Management Indicators and Monitoring Program

Indicator Description: Nutrient Levels, *E. Coli*, and Hydrocarbons

Nutrient levels (total dissolved nitrogen, total phosphorus, nitrate plus nitrite, and total dissolved phosphorous), *Escherichia coli* (*E. coli*), and hydrocarbons are appropriate indicators for monitoring water quality because their levels can be tied to human activities and human contact with water. The State of California has proposed replacing the more general fecal coliform indicator with *E. coli* as a more direct indicator of human disease potential. Adoption of this indicator is on hold until the USEPA finishes a court-

mandated review of bacteriological criteria, due in October 2012. Given the likelihood that state standards will change, coupled with the need to establish baseline conditions, the NPS herein is adopting *E. coli* rather than fecal coliform as an indicator of water quality, along with nutrient levels and hydrocarbons.

Definitions of Management Standard, Adverse Impact, and Degradation

Management Standard

The management standard for water quality is defined as the baseline established in the 2005–2008 period, with nutrients, *E. coli*, and petroleum hydrocarbons all measured. The management standard for nutrients is exceeded when the 75th percentile of annual sampling exceeds the 95% upper confidence limit of the baseline condition in more than one in five years at any sample location. The management standard for *E. coli* is exceeded when the 50th percentile of annual sampling exceeds the 95% upper confidence limit of the baseline condition in more than one in five years at any sampling location. The standard for petroleum hydrocarbons is exceeded when they are detected (at current detection limits) in more than one in five years.

Water quality criteria for the Tuolumne River above Lake Don Pedro were established by the California Water Control Board through the *Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins*. The *Basin Plan* adheres to the Federal Anti-degradation Policy (40 *Code of Federal Regulations* [CFR] 131.12) as follows:

Chief among the State Water policies for water quality control is State Water Board Resolution No. 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California). It requires that wherever the existing quality of surface or ground waters is better than the objectives established for those waters in a basin plan, the existing quality will be maintained unless as otherwise provided by Resolution No. 68-16 or any revisions thereto.

Adverse Impact

Adverse impacts on water quality are defined as the occurrence of either or both of the following: (1) exceedance of the draft USEPA bacteriological criteria for water contact recreation *E. coli* one-day standard of 235 most probable number of bacterial colonies (MPN, the standard unit used to measure *E. coli* bacteria in water) per 100 milliliter (ml) and subsequent exceedance of the 90-day geometric mean standard of 126 MPN/100ml, or (2) exceedance of USEPA maximum contamination level for nitrate+nitrite of 10 milligrams per liter (milligrams of nitrate and nitrite expressed as the weight of elemental nitrogen). Exceedance of this bacteriological standard indicates a persistent contamination problem beyond normal flushing summer or fall rainstorms and would likely result in a violation of state water quality standards (protecting the designated beneficial use of Tuolumne River waters for recreational contact) when they are established after October 2012. Exceeding the nitrate+nitrite criteria would violate state water quality standards as they are applied to municipal water sources. The *Basin Plan* specifies that waters designated for municipal use must also adhere to California drinking water regulations (title 22), which include the USEPA maximum contaminant limit for nitrate+nitrite. It should be noted that current levels of nitrate+nitrite are only 1% to 10% of this maximum contaminant limit.

Degradation

The degradation standard is defined as the inclusion of any Tuolumne River segment on the state listing under section 303d of the Clean Water Act of waters not attaining minimum water quality objectives. For the Tuolumne River and the chosen water quality indicators, this would occur when there were 10 or more violations (exceedances) of the USEPA water quality standards over the course of the 303d reporting period of three years. States are mandated by section 303(d)(1) of the Clean Water Act [40 CFR 130.7(b)] “to identify waters that do not meet applicable water quality standards with technology-based controls alone and prioritize such waters for the purposes of developing Total Maximum Daily Loads (TMDLs)” (CWRCB 2004).

Current Findings Regarding Management Standard, Adverse Impact, and Degradation

In the summer of 2010, the NPS sampled water monthly in five locations on the Tuolumne River. All sites were sampled for total dissolved nitrogen, nitrate+nitrite, total phosphorous, and total dissolved phosphorous. *E. coli* was only sampled at frontcountry sites because of the maximum six-hour hold time for these samples. The river was also sampled for total petroleum hydrocarbons at four locations downstream of developed areas. Field staff also measured water temperature, specific conductivity, pH, and dissolved oxygen at all sites, and noted river stage where possible (NPS 2009k). Nutrient and *E. coli* concentrations were not significantly different (at the 95% confidence level) from conditions during 2005–2008, the period of baseline data used to establish the management standard (NPS 2009k). Samples were of very high quality and had low levels of dissolved nutrients, low conductance, adequate dissolved oxygen, and pH in the range expected for granitic watersheds. The current condition of water quality in the Tuolumne River corridor is presented in table 5-17.

Table 5-17.
Current Condition of Water Quality

| Standards | Current Conditions |
|---|---|
| Management Standard: The management standard for water quality is defined as the baseline established in 2005-2008, with nutrients, <i>E. coli</i> , and petroleum hydrocarbons all measured. ^a | Samples taken between 2005 and 2010 were of very high quality, and within the management standard. |
| Management Concern: | The primary concern for water quality in the Tuolumne River is caused by the “little blue slide” (though no violations of state turbidity standards are present), potential wastewater leaks from the containment ponds, and the leach mound at Glen Aulin. |
| Adverse Impact: Exceedance of USEPA bacteriological criteria for water contact recreation: <i>E.coli</i> and nitrates. ^b | |
| Degradation: The degradation standard is defined as the inclusion of any Tuolumne River segment on the state listing under section 303d of the Clean Water Act of waters not attaining minimum water quality objectives. ^c | |

a The management standard for nutrients is exceeded when the 75th percentile of annual sampling exceeds the 95% upper confidence limit of the baseline condition in more than one in five years at any sample location. The management standard for *E. coli* is exceeded when the 50th percentile of annual sampling exceeds the 95% upper confidence limit of the baseline condition in more than one in five years at any sampling location. The standard for petroleum hydrocarbons is exceeded when they are detected (at current detection limits) in more than one in five years.

b (1) *E.coli* exceeds one-day standard of 235 MPN/100 ml and subsequent exceedance of the 90-day geometric mean standard of 126 MPN/100 ml for water contact recreation, or (2) exceedance of USEPA maximum contamination level for nitrate + nitrite of 10 milligrams per liter.

c For the Tuolumne River and the chosen water quality indicators, this would occur when there were 10 or more violations (exceedances) of the USEPA water quality standards over the course of the 303d reporting period of three years.

Abbreviations: *E. coli* = *Escherichia coli*; ml = milliliter; MPN = most probable number of bacterial colonies; USEPA = U.S. Environmental Protection Agency

The primary exception to Yosemite's generally outstanding water quality parkwide occurs during the first fall storms following the long dry season. In three out of seven years of intense monitoring of the Merced River, the proposed state single day *E. coli* standard of 235 MPN/100 ml has been exceeded. High values are common in all locations, both upstream and downstream of developed areas, indicating that natural sources of contamination may be dominating the signal during these storms. This is thought to result from the accumulation of animal waste across the entire watershed during the prior four to seven months, when few or no storms occur. Fall storms may have less impact on water quality in the Tuolumne Meadows area. Storms at that elevation are generally colder, with less rain and more snow, thus resulting in a smaller watershed response. Episodic summer thunderstorms may produce more of an impact. Capturing the effects of these storms is challenging, given their limited spatial and temporal nature and the logistical challenges of responding to these less predictable events.

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the plan to ensure that river values are enhanced where necessary and protected throughout the life of the plan.

Monitoring Protocols

Water quality monitoring is ongoing. The monitoring protocol is available as a part of the overall *Visitor Use and Impacts Monitoring Program* field guide (NPS, 2011d). The initial sampling regime has been designed to inventory spatial and temporal water quality conditions on the Tuolumne River, with an emphasis on areas of the river adjacent to the heaviest development. Sampling sites were selected based on location, co-location with other sampling efforts, and existing water quality data. In general, locations were selected to be upstream and downstream of developed areas in order to better isolate impacts. To understand seasonal variations in water quality, monthly sampling is conducted on the Tuolumne River during the summer at all sites and bimonthly during the winter.

For Poopenaut Valley, water quality monitoring will be done as part of the ongoing program of continuous USEPA-mandated water quality monitoring in Hetch Hetchy Reservoir by the SFPUC. The SFPUC monitoring indicates that water quality at the dam is very good. Water quality sampling at Poopenaut Valley (only three miles downstream of the dam) by the NPS in 2007 indicates that water quality there is also very good. Given the proximity of Poopenaut Valley to the dam and the fact that SFPUC water quality monitoring is ongoing, the SFPUC's monitoring is an excellent proxy for water quality in Poopenaut Valley. Additionally, new water release strategies being implemented by the SFPUC at O'Shaughnessy Dam include reduced ramping rates (rates at which flows are increased and decreased) that are similar to unregulated river flow fluctuations. This action will reduce the potential for excessive erosion potential to background rates.

Actions to Be Taken to Avoid Adverse Impacts or Degradation

A key part of the monitoring program will be management triggers intended to ensure that any downward trend in conditions can be identified and arrested well before adverse impact occurs. These triggers will identify departures from the management standard and require that specific kinds of management action be taken, as shown in table 5-18.

Table 5-18.
Actions Identified by the NPS to Prevent Adverse Impacts on or Degradation of Water Quality

| Trigger | Action ^a | Rationale for Using this Action at this Threshold |
|---|--|--|
| Statistically significant trend toward decreasing water quality condition in any of the indicators at any one monitoring site. or Exceedance of any of the management standards. (In the case of water quality, the NPS standards are so far above the state standards that it is not feasible to strengthen this trigger.) | Initiate investigation of water quality conditions in the area of concern to identify potential point source. | These standards indicate possible deterioration of water quality. Steps taken based on these triggers are focused on determining the persistence and source of the problem and whether more serious investigation and action are required to resolve the issue. |
| Approaching Adverse Impact: Exceedance of proposed USEPA bacteriological criteria for water contact recreation (E. coli one-day standard of 235 MPN/100 ml at any one monitoring site) in two consecutive monthly samples or Exceedance of a maximum contamination level for nitrate+nitrite of 8 mg/l (as N) or Detection of petroleum hydrocarbons | Initiate weekly sampling of E. coli at sites exceeding the limit until sample concentration falls below single sample limit (235 MPN/100 ml). Ensure at least five samples are taken over the course of the 90 days following the first exceedance to determine 90-day geometric mean, which determines adherence to proposed E. coli standard. Establish a coordinated investigation of water quality, including more frequent sampling at more sites, inspection of sewage systems and stock operations, and closing the river to all contact recreation until issue is resolved. | This threshold indicates potential violation of a state (and USEPA) water quality standard. Subsequent prescribed sampling would determine whether the event was one time only or more persistent (more serious) in nature. Also, approaching these state and federal standards may indicate serious water quality problems that are likely the direct result of human use. Immediate and substantial action is required to resolve these issues to minimize impacts on river and human health and prevent an adverse impact from occurring. |

a Depending on findings at each level above, NPS could also take the following management actions:

- Increase educational messaging regarding water quality.
- If impacts are related to human waste (and where allowed by management objectives), provide toilet facilities.
- If impacts are due to erosion, improve conditions through restoration, trail rerouting, etc.
- If impacts are due to stock use, redirect/reduce/limit stock use in certain areas.
- If hydrocarbons are detected, test the integrity of the fuel storage tanks and try to determine the source.
- Increase enforcement of permit requirements.
- Increase ranger patrols and visitor education efforts.
- Close some areas temporarily or permanently.

Abbreviations: ml = milliliter; MPN = most probable number of bacterial colonies; USEPA = U.S. Environmental Protection Agency

Conclusions: Protecting and Enhancing Water Quality

The Tuolumne River has exceptionally high water quality. All the measured indicators are within the NPS standards, which are considerably more protective than other federal or state standards. Although water quality is fully protected, a few risks are present within the river corridor, including an unstable road cut along Tioga Road, wastewater treatment facilities at Tuolumne Meadows and Glen Aulin, fuel storage tanks at Tuolumne Meadows, and pack stock use. The plan includes actions to stabilize the road cut, to upgrade wastewater treatment facilities at Tuolumne Meadows, and to upgrade or eliminate wastewater treatment facilities at Glen Aulin. The risks to water quality associated with the public fuel station and pack stock use will either be eliminated or reduced and mitigated, depending on the alternative selected.

An ongoing monitoring program will continue to test for nutrients, *E. coli*, and petroleum hydrocarbons to ensure that the exceptional baseline water quality is sustained over time. Decreasing water quality for any of these indicators will trigger studies to identify the source of the concern. Depending on the source, appropriate action will be taken to address the concern prior to an adverse impact. If the concern is related to visitor use, use will be managed as needed to protect this river value.

Free-Flowing Condition

All Segments



NPS PHOTO BY KRISTINA RYLANDS

Dana Fork water intake.

Condition Assessment

Condition at the Time of Designation

At the time of the 1984 designation, the Tuolumne River above the Hetch Hetchy Reservoir was largely free of structures that impeded flow or otherwise altered the free-flowing condition of the river. Flows varied seasonally. Snowmelt runoff caused high-velocity, high-volume flows during spring and early summer, while much lower flows occurred at most other times of the year. The natural flow regime below O’Shaughnessy Dam was altered by the dam.

Between late May and late October, water was taken from the Dana Fork by a low cement diversion to support seasonal visitor and operational uses in Tuolumne Meadows. The quantity of the water that was withdrawn is unknown. An intake hose was used to take water from the river at the Glen Aulin High Sierra Camp to serve the needs of guests and staff.

One vehicle bridge crossed the river at Tuolumne Meadows, and approximately seven footbridges crossed the river at various locations. The vehicle bridge and the footbridge near Parsons Memorial Lodge both contained abutments that may have caused the river channel to back up during periods of high flows.

Current Condition

Flow levels remains largely the same as they were at the time of designation. Stream flows are typically between 25.3 million and 110 million gallons per day on the Lyell Fork and between 9.7 million and 57 million gallons per day on the Dana Fork, with the highest stream flows occurring during early summer snowmelt. In early summer, the Lyell and Dana Forks contribute about 60 percent and 40 percent, respectively, of the flow beneath the Tioga Road bridge in Tuolumne Meadows, proportions comparable to their relative drainage areas. The contribution of snowmelt to stream flow decreases by mid-summer. Then, the Lyell Fork contributes a greater percentage (66–75%) of the total flow into Tuolumne Meadows (Lundquist et al. 2005).

Data that record Tuolumne River flows into Hetch Hetchy Reservoir from the fall of 1982 to 2002 show considerable variability from one year to the next. During the 1982–2002 period, the greatest water year (in California, a “water year” extends from July 1 to June 30 of the following year) annual discharge into Hetch Hetchy was about 539 billion gallons in 1983 (the water year ending on June 30, 1983), while the least annual discharge was about 108 billion gallons in 1987. The periods from 1983–86 and 1995–98 were relatively wet (averaging 354 billion and 379 billion gallons), while the periods of 1987–94 and 2000–02 were relatively dry (averaging 160 and 187 billion gallons). These data indicate that wet and dry conditions can occur over multiyear spells (Lundquist et al. 2005).

Several attempts in the mid-1990s to develop a groundwater source as a viable water supply for the Tuolumne Meadows area were not successful (HRS Water Consultants 1994). Water continues to be taken from the Dana Fork of the Tuolumne River to support seasonal visitor and operational uses in Tuolumne Meadows. The Dana Fork water intake extends across a portion of the river. During high flows, water moves around and over the cement structure. However, during periods of lower flows in the fall, the structure impounds a portion of the river. Because the structure is on a steep and rocky section of the river, it does not affect riparian integrity.

Water withdrawals from the Dana Fork from late May to late October average about 65,000 gallons per day. As is typical for surface water diversions in the Sierra Nevada, maximum withdrawal coincides with annual minimum flows. Waddle and Holmquist (2011) found that flows of less than 3 cubic feet per second occurred on 47 or more days in at least 25% of years, flows of less than 1 cubic foot per second occurred on 9 or more days in at least 25% of years, and flows less than 1 cubic foot per second occurred for one day or more per year in 48 of the past 95 years. The study also showed that when flows are less than 3 cubic feet per second, wetted habitat losses are substantial and invertebrate production decreases. At the current withdrawal rates, when the amount of water withdrawn for use at Tuolumne Meadows amounts to less than 10% of the lowest flow rates, wetted habitat is considered to be only minimally affected by these withdrawals (Waddle and Holmquist 2011). Withdrawals of 65,000 gallons per day would approximate 10% of flow at 1 cubic foot per second, and average demands of no more than 60,000–70,000 gallons per day would fall within the margin of error of meeting a standard of no more than 10% of low flow when low flow equals 1 cubic foot per second. However, an increase in the abstraction rate could increase the number of days when flows reach extreme low levels, which would further decrease aquatic habitat during periods of low flow. For example, increasing domestic water withdrawals by 50% would decrease aquatic habitat by 44%, a decrease that could jeopardize the microorganisms (*ephemeroptera*, *plecoptera*, *trichopterta*) dependent on that habitat (Waddle and Holmquist 2011). Furthermore, if climate change results in an increase in the duration of summer low flows, current rates of water withdrawal could exceed 10% of future low flows.

An unknown amount of the water withdrawn from the river leaks from underground pipes (part of the aging water delivery system in Tuolumne Meadows) before it can be used. These losses will be assessed as part of future utilities improvement work and water conservation planning.

At Glen Aulin High Sierra Camp, water diversion from the main stem of the river has been limited to 600 gallons per day to address concerns about the leach mound capacity (see “Water Quality,” earlier in this chapter). Since designation, the NPS has made upgrades and improvements to the water purification system, and the water intake hose has been moved to a deeper collection pool located within designated wilderness.

The bridges crossing the Tuolumne River that existed in 1984 remain. They include the Tioga Road bridge at Tuolumne Meadows, a single-vehicle bridge below O’Shaughnessy Dam, and seven footbridges: one crossing the upper Lyell Fork near the middle base camp, Twin Bridges near Tuolumne Meadows, a Dana Fork bridge, a footbridge at Parsons Memorial Lodge, another “twin bridges” above Glen Aulin, a footbridge at Glen Aulin, and two bridges in Pate Valley. Three tributary bridges are very near the river corridor on Rafferty Creek just outside of Tuolumne Meadows, and along Conness and Return Creeks in the Grand Canyon reach. With the exception of the footbridge at Parsons Memorial Lodge, the trail bridges have very minor impacts on free flow, if any, generally because the river flows around them at high flows. The Tioga Road bridge in Tuolumne Meadows and the historic footbridge at Parsons Memorial Lodge have abutments that might cause the river channel to back up during periods of high flows and might contribute to accelerated flows downstream (NPS, Noon and Martin 2010d).

After the 1997 flood (a 90-year flood event, which included high flows on the Tuolumne River), a short section of boulder riprap was placed along the Lyell Fork to harden the riverbank and protect the campground A-loop road (NPS, Buhler et al. 2010e).

Management Concerns

The need to withdraw water for domestic use from the Tuolumne River is among the factors that limit overall use and development at Tuolumne Meadows. An aging water supply system that lacks adequate storage capacity, loses water through leaking supply lines, and does not take full advantage of available water conservation technologies poses a management concern because it makes water use less efficient than it could be.

Ongoing periods of drought and the resulting effect on water availability is another growing management concern. The Waddle and Holmquist study (2011) concluded that withdrawals at or less than current levels and durations are likely to have a minimal impact on downstream habitat. However, the study notes that climate change might lead to longer low-flow periods that begin earlier in the summer. Continuous river flow monitoring is warranted to determine whether reevaluation of withdrawal levels might become necessary in the future. Currently, water withdrawals are maintained at a level that preserves sufficient flows in the Dana Fork to protect aquatic habitat.

While the Lyell Glacier itself is not a part of the Tuolumne River corridor, it is an important hydrologic feature contributing to flows in the Tuolumne River. Yosemite’s remaining glaciers are rapidly retreating, with consequences for ecosystem health and visitor experience. As with other glacial systems around the world, the retreat of the Lyell Glacier and probable loss of meltwater flows in the upper Lyell Fork poses a challenge for land managers. Due to forces external to the park, there is little direct action that can be taken aside from monitoring changes and trying to predict the downstream impacts of declining glaciers. The monitoring program detailed below is intended to assess the effects of the gradual reduction and probable elimination of the glacier.

The abutments for the bridge along the Tioga Road in Tuolumne Meadows and the historic footbridge at Parsons Memorial Lodge may cause the river channel to back up during periods of high flows and may contribute to accelerated flows downstream (NPS, Noon and Martin 2010d).

The short section of boulder riprap along the Lyell Fork near the campground A-loop road interferes with the free flow of the river.

The natural flow regime below O'Shaughnessy Dam is altered by the dam. The NPS, in collaboration with the SFPUC and others, is conducting research below the dam to inform the timing, duration, and magnitude of flows that will reduce the effects of dam operations on downstream habitats. This was discussed in greater detail under "Low-Elevation Riparian and Wetland Habitat at Poopenaut Valley," earlier in this chapter. Ultimately, the Raker Act is the controlling authority for the river below Hetch Hetchy Reservoir. Flows in the river are subject to the needs of the SFPUC, which does its best to consider NPS needs.

Actions NPS Will Take to Address these Concerns

To avoid any future action that would adversely affect the free-flowing character of the Tuolumne River, the NPS has specified a process, required by section 7 of WSR, that it will use to evaluate all potential water resource projects within the bed and banks of the river (see chapter 4). Before it could be approved and implemented, any proposed project would have to be evaluated using the process outlined in chapter 4 and found to have no potential for direct or adverse effect on the values for which the river was added to the wild and scenic rivers system.

Existing facilities with the potential to affect river flows have been identified and will be mitigated. The Tioga Road bridge in Tuolumne Meadows and the historic footbridge at Parsons Memorial Lodge will both be improved under whichever of the action alternatives is selected to mitigate the ponding effect that these bridges' abutments cause on the river during high flows. Improvements to both bridges will be compatible with their historic character and will require additional site-specific planning and compliance. Both projects will be subject to section 7 determinations as part of future planning and assessment. Under all the action alternatives, the riprap at the Tuolumne Meadows campground will be removed and the riverbank will be restored to natural conditions.

Regarding river flows in the Poopenaut Valley segment, the NPS will continue to work cooperatively with a consortium of individuals, including scientists from Yosemite National Park, the SFPUC, Stanislaus National Forest, and contractors, to inform releases from O'Shaughnessy Dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems below the dam.

Regarding the effect of water withdrawals at Tuolumne Meadows, the Waddle and Holmquist study (2011) found that current abstraction (withdrawal) rates only minimally affect aquatic habitat but that an increase in the abstraction rate could increase the number of days when flows reach extreme low levels, which would further decrease aquatic habitat during periods of low flow. Based on this study, the NPS developed all alternatives in this plan such that water use would not comprise more than 10% of the Dana Fork's flows when such flows reach their critical low of 1 cubic foot per second. If climate change results in longer periods of low flow that begin earlier in the summer, current and proposed rates of water withdrawals could exceed 10% of future low flows. To avoid future potential impacts on downstream habitats, water conservation measures are part of all the action alternatives presented in chapter 7.

The NPS will update the water supply system in its current location to meet existing standards and to ensure that storage is adequate for demand. The current water treatment facility site is suitable for protecting river values (see the facilities analysis in appendix A). Water supply lines will be repaired or replaced to eliminate leakage. Additional planning will identify opportunities for conserving water in the Tuolumne Meadows area. In the interim, water meters will be installed and known conservation measures will be further improved,

including use of low-flow fixtures and the education of visitors and employees about the importance of water conservation and how they can contribute.

Additional reductions in water use based on user capacity would vary among the alternatives. When the NPS selects an alternative in a formal record of decision, it will be incorporated into this volume as part of the final *Tuolumne River Plan*. A program of long-term monitoring and protective action could trigger yet additional reductions in water use, as described under “Monitoring Program to Prevent Future Adverse Impacts or Degradation,” below.

Management Indicator and Monitoring Program

Indicator: Water Withdrawals as a Percentage of Low Flow

As described above, the domestic water supply for the Tuolumne Meadows facilities is taken from the Dana Fork. In late summer, the Dana Fork drops to very low flows, a common occurrence on Sierra Nevada rivers, given California’s Mediterranean climate. Withdrawals for domestic water often reach their peak at this same time, a situation that can be particularly problematic in drought years. This indicator will ensure that water withdrawals do not reduce low flows to the extent that they would result in a reduction in downstream aquatic habitat.

Definitions of Management Standard, Adverse Impact, and Degradation

The NPS will monitor streamflows and withdrawals to ensure that withdrawals never exceed 10% of low flows.

Because all alternatives were developed to stay within the abstraction limits and because the water monitoring and conservation program would be mandatory under all alternatives (even no action), definitions of management standard, adverse impact, and degradation were not developed.

Water withdrawals at Glen Aulin are limited to 600 gallons per day, an amount that is negligible in comparison to the river’s flow at this location. No other water withdrawals are present on the river, nor would any withdrawals be permitted. Consequently, the discussion of low flows focuses on the Dana Fork withdrawals.

Monitoring Program to Prevent Future Adverse Impacts or Degradation

As required by the guidelines implementing WSRA, the NPS will conduct a program of monitoring and ongoing study during and following the implementation of the *Tuolumne River Plan* to ensure that river values are enhanced where necessary and protected throughout the life of the plan. A key part of this program will be management triggers intended to ensure that any downward trend in conditions can be identified and arrested well before adverse impact occurs.

Monitoring Protocols

River flow monitoring will occur on the Dana Fork at and downstream of the diversion structure. Flow monitoring will be sufficient to determine the daily average flow magnitude and annual low-flow frequency (return interval) for flow less than 10 cubic feet per second, as well as the amount of water being withdrawn from the river.

Triggers and Management Responses

As shown in table 5-19, additional mandatory water conservation measures will be triggered when water withdrawals exceed 10% of flow whenever flow drops below 3 cubic feet per second, similar to those implemented at Wawona, where critically low flows also occur in drought years. Such additional conservation

measures at Tuolumne would begin with mandatory closure of shower facilities and use of paper plates in the lodge, and proceed to partial or complete closures of the lodge or campground, depending on the severity of the drought and the average water consumption of the different facilities.

Table 5-19.
Actions Identified by the NPS to Prevent Adverse Impacts on or Degradation of Free-Flowing Condition

| Trigger | Management Response | Rationale |
|--|--|---|
| Water withdrawals exceed 10% of the river's flow for one day when total flow drops below 3 cubic feet per second | Additional water conservation measures, such as shower restrictions and use of paper plates, go into effect at Tuolumne Meadows. | Water conservation measures would reduce human water withdrawals from the Dana Fork. |
| Approaching 1 cubic foot per second total river volume | Parts or all of Tuolumne Meadows Lodge and/or the campground are closed to protect water flows. | Water withdrawals when low flow drops to 1 cubic foot per second have greater potential to adversely affect aquatic habitat; therefore, emergency measures would be implemented to reduce water use during these periods. |

Conclusions: Protecting and Enhancing the River's Free-Flowing Condition

The Tuolumne River above the Hetch Hetchy Reservoir is free flowing, and the NPS will protect its free-flowing condition by implementing a process under section 7 of WSRA to ensure that no potential water resource project within the bed and banks of the river could have a direct and adverse effect on this river value. The natural flow regime below O'Shaughnessy Dam is altered by the dam, as it was at the time of designation. The NPS will continue to work cooperatively with the SFPUC to inform the timing, duration, and magnitude of flows that will reduce the effects of dam operations on downstream habitats. However, the Raker Act is the controlling authority over water releases from the dam. The NPS will apply the section 7 process to evaluate any potential water resource project below the dam.

Management concerns include the abutments of one vehicle bridge and one footbridge at Tuolumne Meadows, and a short section of boulder riprap placed along the Lyell Fork to protect the campground A-loop road from flooding. The *Tuolumne River Plan* calls for removal of the riprap and mitigation of the effects of these two bridges.

The amount of water withdrawn from the Dana Fork for domestic use in the Tuolumne Meadows area currently amounts to less than 10% of lowest flow. According to recent research, withdrawing this amount of water has a minimal effect on downstream aquatic habitat; however, any increase in water withdrawals could decrease wetted habitat. Management is also concerned about the potential for future reductions in low flows associated with climate change, in which case withdrawals at the current rate could decrease habitat. The plan calls for long-term monitoring of river flows and caps water withdrawals at no more than 10% of lowest flows. Water conservation measures, such as replacement of leaking water lines and installation of low-flow fixtures, are included in all the plan alternatives, and some alternatives would achieve additional decreases in water consumption through decreases in user capacity. If long-term monitoring detects a future decrease in river flows associated with natural cycles or climate change, those findings will trigger further decreases in water withdrawals for domestic use at Tuolumne Meadows, including reductions in the types and levels of visitor services, if necessary. The rapid retreat of the Lyell Glacier indicates that a probable loss of meltwater flows in the upper Lyell Fork will pose a challenge for river managers in the foreseeable future.

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Chapter 6: Visitor Use and User Capacity

This chapter addresses the user capacity requirement of the Wild and Scenic Rivers Act (WSRA). Consistent with the direction in the “Final Revised Guidelines for Eligibility, Classification and Management of River Areas” (Secretaries’ Guidelines for River Areas), this chapter outlines how the *Tuolumne River Plan* “determined the quantity and mixture of recreation and other public use which can be permitted without adverse impact on the resource values of the river area.”¹

The alternatives presented in “Chapter 7: Alternatives for River Management” differ with regard to the kinds and amounts of use the Tuolumne River corridor would receive in the future and the infrastructure needed to support that use. The alternatives address management of visitor use and user capacity for each river segment by specifying the kinds and maximum amounts of use that would occur in each segment under each alternative. The kinds and amounts of use allowed under each alternative would protect and enhance river values.

A brief discussion of user capacity is provided below, along with a description of how user capacity was calculated for each of the management alternatives described in chapter 7. Additionally, this chapter summarizes the actions that would be taken with each alternative to ensure that river values are protected and enhanced based on the kinds and amounts of use proposed. Chapter 7 provides a full list of these actions as well as actions common to all alternatives. Appendix G contains additional information on visitor use and the methods used to quantify use.

Under each alternative, all river values would be fully protected from any adverse impact or degradation and enhanced. Some alternatives may provide greater enhancement of certain river values and other resources, as described below. In addition, some alternatives would provide for public visitation and use at levels lower than the maximum capacity in order to provide the public with options regarding visitation levels and related user experience.

Requirements of the Wild and Scenic Rivers Act and Implementing Guidelines

The WSRA requires the National Park Service (NPS) to protect river values while allowing for recreational and other public use that does not “substantially interfere” with the enjoyment of river values. The WSRA gives “primary emphasis to protecting the river area’s esthetic, scenic, historic, archeological and scientific features.” To achieve this goal, the WSRA requires all comprehensive river management plans to address user capacity. The Secretaries’ Guidelines for River Areas define carrying capacity in the context of a management plan to mean “the quantity and mixture of recreation and other public use which can be permitted without adverse impact on the resource values of the river area.”² Under these guidelines, public use should be regulated and distributed where necessary to protect and enhance river values. Public use may be controlled by limiting public access to the river, by issuing permits, or by other means available to the managing agency through its general statutory authorities.

¹ National Wild and Scenic Rivers System; Final Revised Guidelines for Eligibility, Classification, and Management of River Areas, 47 *Federal Register* 39454 (1982).

² Secretaries Guidelines for River Areas, at 39459. WSRA and the Secretaries’ Guidelines for River Areas use the terms “carrying capacity” and “user capacity” interchangeably.

The U.S. Court of Appeals for the Ninth Circuit (Ninth Circuit) has interpreted these mandates to mean that a comprehensive river management plan “must deal with or discuss the maximum number of people that can be received” in the river area, and that the NPS must “adopt specific limits on user capacity” that “describe an actual level of visitor use that will not adversely impact” river values.³ The *Tuolumne River Plan* has been developed to be consistent with WSRA and the Secretaries’ Guidelines for River Areas, as interpreted by judicial opinions.

Process to Address User Capacity

Addressing user capacity is an integral part of the overall comprehensive river planning process (Haas 2002). Development of the *Tuolumne River Plan* included several steps to determine the kinds and amounts of visitor and other public use that the Tuolumne River could sustain without adverse impact on river values. Figure 6-1 presents a summary of the planning process as it relates to addressing user capacity. A more detailed explanation of each step in the process follows.

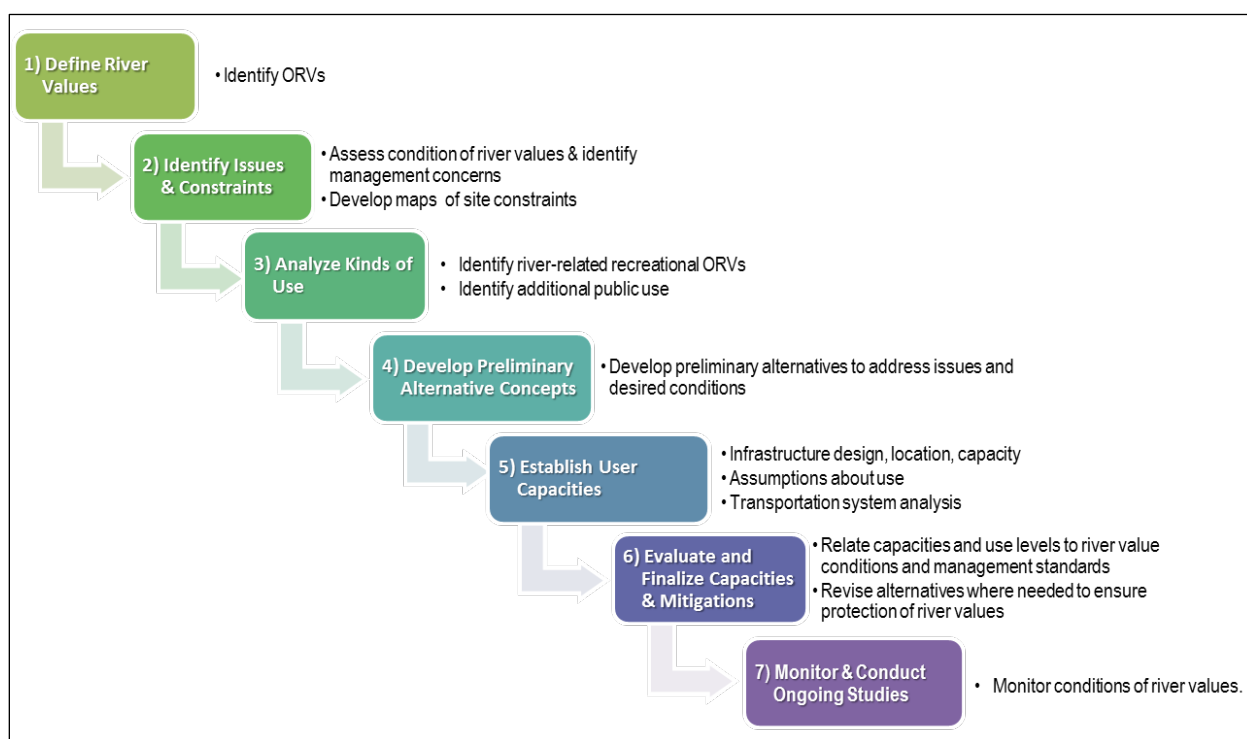


Figure 6-1. Planning Process and Addressing User Capacity.

Step 1. Define River Values

The first step in the overall river planning process is identifying the river’s outstandingly remarkable values. These values, along with preserving water quality and the river’s free-flowing condition, are the foundational elements of the *Tuolumne River Plan*. Public use, and the facilities to support that use, must not adversely affect these values. This step in the process includes developing detailed maps to illustrate the location and extent of the river values to be protected. This information is provided in “Chapter 5: River Values and Their Management” (see figure 5-1).

³ *Friends of Yosemite Valley v. Kempthorne*, 520 F.3d 1024 (Ninth Circuit 2008).

Step 2. Identify Issues and Constraints

For the second step, the NPS documented the baseline condition of the river values to be protected. This included a comprehensive review of existing research and monitoring information, as well as a targeted investment in additional research needed to provide a comprehensive assessment. An important component of this assessment, presented in chapter 5, is identifying the extent to which visitor use is affecting river values. Existing data were also used to develop maps of physical site constraints (see chapter 7, figure 7-3) to guide the next steps of the planning process. Choices on facility locations and infrastructure design were guided by the location of outstandingly remarkable values, wetlands, floodplains, archeological sites, rare plants, and other important resource and financial considerations, such as water quantity and quality, costs, and operational logistics. The baseline assessment, understanding of visitor use impacts, and overlays of important resource considerations were used by the planning team to generate a comprehensive list of management issues that needed to be addressed by the plan to improve conditions in the Tuolumne River corridor and ensure the protection of river values. These issues are summarized in chapter 5 and in appendix A.

Step 3. Analyze Kinds of Use

Under WSRA, the NPS is to provide for public use and enjoyment of river areas in a manner that is consistent with the protection and enhancement of river values. The NPS may also provide for other types of uses if such uses are protective of river values and do not substantially interfere with public use and enjoyment of river values.⁴

Recreational use is the most significant subset of public use that occurs in the Tuolumne River corridor (administrative use to support recreational use and resource protection is another use, also addressed below). The Secretaries' Guidelines for River Areas further divide recreational use into the categories of "primary" and "secondary." Primary recreational activities are those that involve direct contact with the water, while secondary activities occur on the shore. Outstandingly remarkable recreational values may include both primary and secondary uses but must also be rare, unique, or exemplary at a regional or national scale. Recreational and other public uses that do not meet the definition of an outstandingly remarkable value are permitted under the WSRA and Secretaries' Guidelines for River Areas so long as those uses do not substantially interfere with the use and enjoyment of outstandingly remarkable values and other river values. Thus, depending on the setting, the public use associated with the recreational outstandingly remarkable value may only be a small component of overall recreational and other public use in the river corridor.

During plan initiation and scoping, NPS planners asked the public to describe what they liked to do in the Tuolumne River corridor and which facilities and services these activities would require. The resulting public scoping report (NPS 2006m) provided important feedback to the NPS regarding the level of public interest in different activities. This information gave planners a better sense of the uses that members of the public would like to preserve as well as uses that the public preferred to see be reduced or restricted. Planners also conducted visitor surveys and studies to understand use patterns and reviewed the findings of social research completed for similar settings for its relevance to the Tuolumne River (Littlejohn et al. 2005; Le et al. 2008). This effort provided additional insight into the types of activities and experiences visitors preferred. Finally, NPS planners compiled information on the historic, current, and projected levels of visitor use at Tuolumne Meadows and along the Tuolumne River (DEA 2007; NPS 2008d; NPS 2008e; NPS 2009c; and NPS 2009e). Appendix G (and to some extent, chapter 7) provide more detail on the existing kinds and amounts of visitor use occurring in Tuolumne Meadows.

⁴ Secretaries Guidelines for River Areas, at 39456.

Step 4. Develop Preliminary Alternative Concepts

Based upon legal requirements, management issues, resource constraints, and public comments identified during the previous steps, NPS planners developed a set of preliminary alternative concepts. These concepts were designed to protect and enhance river values by specifying the kinds and amounts of use that could occur while meeting the established management standards for each outstandingly remarkable value (which are discussed in more detail in chapter 5):

A) Indicators and Management Standards

For each river value, Yosemite National Park scientists identified at least one, and as many as three, indicators and management standards. As explained in chapter 5, an indicator is a quantifiable measure of resource conditions that the NPS will periodically measure and monitor as representative of the condition of the river value. A management standard is the desired condition of the river value. If the indicator measurement falls below the level of the management standard, then specific management actions (including, where appropriate, adjustments to user capacity) will be taken to address the situation to ensure that the river value is protected and enhanced and any deterioration of condition is arrested before the river value experiences any adverse impact or degradation. In addition, for each river value, specific quantifiable definitions of adverse impact and degradation have been established, and triggers for management action have been set at points well before such conditions are reached to ensure that all river values are protected and enhanced. (For definitions of adverse impact and degradation in the context of the *Tuolumne River Plan*, please see chapter 5, pages 5-14 and 5-15.)

B) Management Actions to Protect and Enhance River Values

For each outstandingly remarkable value (see chapter 5, pages 5-2 through 5-7), the NPS specified a series of management actions to ensure that the river values were protected and enhanced, as well as a set of triggers to compel management action if the condition of a river value begins to decline.

As the Ninth Circuit has noted, the WSRA “does not mandate one particular approach to user capacity.”⁵ In a river environment as diverse and dynamic as the Tuolumne, no single approach can be used to successfully address all issues. Rather, a suite of management strategies and tools is the most effective approach. These include actions such as providing visitors with information and education; establishing and enforcing regulations on visitor activities such as group size limits; manipulating sites and designing infrastructure to accommodate use, such as trails or boardwalks; implementing restrictions on use levels and access, such as trailhead quotas for backcountry use; and many other management activities. The management strategies and tools employed to protect and enhance river values differ among the alternatives presented in chapter 7.

Step 5. Establish User Capacities

The next step in the process involved the establishment of user capacities for each alternative. These calculations varied depending on the type of use considered: overnight visitor, day visitor, and administrative use.

- **Overnight use.** This category includes people who stay in a campsite in the Tuolumne Meadows campground, in a guest tent cabin at the Tuolumne Meadows Lodge or the Glen Aulin High Sierra Camp, or who backpack in the Yosemite Wilderness.

⁵ *Friends of Yosemite Valley, Mariposans for Environmentally Responsible Growth v. Dirk Kempthorne et al.*, Opinion, March 27, 2008, 520 F.3d 1024 (Ninth Circuit 2008).

Overnight use levels are expressed in terms of the maximum occupancy of all camping, lodging, and wilderness zones for a given night. This represents the total number of people per night.

Based on past use rates, overnight lodging, campsites, and wilderness trailhead quotas will not generally be used to full capacity. Only the maximum capacities are presented in chapter 7 and analyzed in “Chapter 8: Affected Environment and Environmental Consequences.”

- **Day use.** This category includes people who come for the day to sightsee, hike, or pursue other activities and spend the night outside the river corridor. Much of this use is concentrated in the Tuolumne Meadows and Lower Dana Fork segments, although day visitors also hike into wilderness segments that can be reached on a day hike from Tuolumne Meadows or below O’Shaughnessy Dam. This category also includes people passing through on the Tioga Road who make a brief stop at Tuolumne Meadows or at the roadside pullouts between Tuolumne Meadows and Tioga Pass.

Day use capacities are expressed in terms of parking spaces and the corresponding number of “people at one time,” which refers to the total number of people at a single point in time within a specified area. For parking, this would be the total number of cars parked at any given point in time multiplied by the estimated average number of people per vehicle.

The calculation of day use capacity is based on people at one time and represents the number of people who can be received in the corridor at one time without adverse impact on river values and without substantial interference with public use and enjoyment of those values.⁶

- **Administrative use.** This category includes NPS, park concessioner, park partner, and volunteer personnel. Specific examples of NPS, park partner, and volunteer administrative uses include the trail crews, maintenance, resource protection, university research activities, commercial delivery, and visitor service personnel. Specific examples of concessioner uses include the employees who staff the lodge, campground, visitor center, store, grill, and stables at Tuolumne Meadows.

In the alternatives presented in chapter 7, administrative use levels are expressed in terms of the number of employees housed in the river corridor because this use has the highest per capita water demand and the most extensive footprint on the land. (Most of the other administrative uses are minimal and would not have a measureable effect on other public use).

Step 6. Evaluate and Finalize Capacities and Mitigations

After deriving the maximum user capacities for each alternative, NPS planners evaluated these capacities against the management standards for all river values to be sure the levels of use proposed would be consistent with protecting river values. Where capacities posed concerns, adjustments were made to the alternatives to ensure that the use permitted under each alternative would allow NPS to meet the management standards established for the outstandingly remarkable values. Planners then drafted the alternatives, specifying in each the final maximum capacities along with related management actions. The user capacity elements of each alternative are summarized later in this chapter.

⁶ The calculations do not take account of the turnover of parking spaces because some day visitors leave and are replaced by other day visitors. Thus, it does not provide an estimate of the total number of unique daily visitors who can be received in the river corridor. No data are currently available from which a reliable estimate could be calculated.

Step 7. Monitor and Conduct Ongoing Studies of River Values

The final step in the process to address user capacity includes measuring and monitoring the condition of river values. While NPS planners designed each alternative to protect and enhance river values (for example, moving parking away from the meadow, restoring informal trails, and relocating some infrastructure outside of the river's 100-year floodplain), it is impossible to predict every possible impact from visitor use. Regardless of the kinds and amounts of use and related management actions specified in a plan, some degree of impact might still occur over time (Cole 1990; Cole and Stankey 1997; Marion 1998; Hammit and Cole 1998; Cole et al. 2005, Manning 2007, McCool et al. 2007). It is therefore important to monitor conditions to ensure that any impacts associated with visitor and other public use do not cause any adverse impacts or degradation of river values and that river values are protected and enhanced.

This step resulted in various adjustments in management to protect river values, including changes to infrastructure to reduce capacity or additional mitigation measures that will ensure river values are protected and enhanced under any given capacity. For more information on the monitoring and study of river conditions refer to chapter 5, which contains a comprehensive discussion of the monitoring program for the Tuolumne Wild and Scenic River.

Factors Limiting User Capacity

This section discusses the factors used to establish the overall maximum amounts of use that may be provided in the Tuolumne River corridor without adverse impact on river values. In determining maximum user capacity for each alternative, planners must take into account existing constraints that could affect such use. For example, visitor services and employee housing require water withdrawals from the river, and the amount of water that can be withdrawn from the river is limited by the need to ensure free-flowing conditions and the health of downstream ecosystems. Therefore, potential limitations on the water supply must be taken into account. Under the WSRA and its implementing Secretaries' Guidelines for River Areas, the NPS must specify the number of people who can be received in the river corridor consistent with the protection and enhancement of outstandingly remarkable values. This is the "maximum user capacity" for the river corridor.

Some alternatives would allow more people to visit the area, and some would allow fewer. These differing use levels reflect differing visions of providing a visitor experience in the Tuolumne River corridor; these visions are based in large part on public comment received in the scoping phase of this process. Some of these visions introduce other restrictions on user capacity that reduce the use levels under an alternative. For example, alternative 1 envisions a visitor experience characterized by self-reliance and close experience with the river and the wilderness. As a result, the total number of people allowed in the meadows at any one time would be low to allow visitors opportunities for solitude and quiet reflection envisioned with alternative 1. The level of visitor use under alternative 1 would be substantially less than that allowed under the no-action alternative or the other action alternatives (see table 6-2, below).

Depending on the alternative, the maximum user capacity of the Tuolumne River corridor will be limited by the following several factors:

- **Constraints on the level of development.** The level of development and related facilities that can be provided in the Tuolumne River corridor is constrained by wilderness designation and by river segment classifications under WSRA. More than 90% of the Tuolumne flows through federally designated wilderness, which is described by the Wilderness Act as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation" (16 *United States Code* [USC] 1131-1136, section 2c). Similarly, the river classifications contained in WSRA pose

restrictions on the level of development appropriate in river segments. The majority of the Tuolumne River corridor is classified as wild (generally coinciding with the areas also protected by wilderness designation). Only the Tuolumne Meadows area and the area below O'Shaughnessy Dam are classified as scenic (see river classifications in "Chapter 3: Wild and Scenic River Corridor Boundaries and Segment Classifications"). According to the WSRRA, a scenic river segment contains shorelines largely undeveloped but accessible in places by roads. Collectively, these designations pose constraints on the level of development and infrastructure that may be provided in the river corridor and thus have a direct effect on the kinds and amounts of use that may be accommodated.

- **Resource constraints and site suitability.** These constraints include topography, meadow and riparian areas, rare and sensitive plant and animal populations, scenic vista points, and cultural resource sites (see figure 7-3 in chapter 7 for a map of these constraints). Generally, planning for visitor use and access to the river corridor seeks to avoid these sensitive resource areas to prevent unacceptable impacts. For instance, the parking associated with Cathedral Lakes trailhead along Tioga Road is constrained by several factors, including its effect on the edge of the meadow, runoff from Budd Creek, high scenic visibility, cultural resources, and safety concerns associated with passing traffic and pedestrians. Considering these factors, the *Tuolumne River Plan* proposes various alternatives to provide this parking in a less sensitive location. Alternative locations for this parking are further constrained by topography and the various site constraints found within the Tuolumne Meadows area.
- **Water consumption.** A key limiting factor to user capacity in the scenic segment of the river in Tuolumne Meadows is the availability of water. Water for Tuolumne Meadows is drawn directly from the Dana Fork of the Tuolumne upstream from Tuolumne Meadows Lodge. A minimum flows study (Waddle and Holmquist 2011) found that 60,000 gallons to 70,000 gallons of water per day can be withdrawn before negative impacts on aquatic species occur. Water demand is primarily associated with overnight accommodations, camping, and employee housing (see water demand calculations below and in chapter 7). Alternative 2 provides for the highest use levels of the action alternatives, which correspond to water withdrawals of approximately 70,000 gallons of water per day. The capacity associated with this alternative is a maximum of 4,325 day and overnight people at one time in Tuolumne Meadows.
- **Wilderness experience.** As described by the recreational outstandingly remarkable values, outdoor recreation opportunities in the Tuolumne River corridor are primarily oriented toward wilderness, where solitude and closeness to nature shape the experience. Too many other visitors can potentially reduce a visitor's ability to obtain these wilderness experiences along the river corridor and, therefore, might have a limiting effect on the amount of use that could be provided. Therefore, for the wilderness segments of the Tuolumne, the key constraint for user capacity is the recreational outstandingly remarkable value where wilderness-related recreation and opportunities for solitude experiences are emphasized. In these segments, use levels will be maintained at levels where encounters with other hiking groups would be at or below 10 groups per hour 80% of the time sampled.

The capacities proposed in the plan are within the constraints discussed above because all site constraints were factored into the development of each alternative. No alternative would remove more water from the Dana Fork than the minimum flows allow, and the anticipated wilderness encounter rates in every alternative would allow many opportunities to obtain solitary experiences.

Determining Alternative User Capacities

To address user capacity, all aspects of use and the effects of use on river values must be considered, including seasonal variation in conditions and the construction of infrastructure such as boardwalks to prevent resource damage. For example, alternative 2 provides for an increase over current use. Alternative 2 therefore requires additional of infrastructure and river protection measures (like boardwalks in parts of the meadows), whereas alternative 1 provides for a decrease from current use and includes much less infrastructure. Accordingly, each alternative emphasizes different factors, depending on the mix of use and related management actions proposed. However, each of the alternatives is protective of river values. A summary of each alternative's proposed user capacity is described in the Alternative User Capacities section below.

Alternative User Capacities

This section provides a summary of the proposed user capacities for each alternative analyzed in this environmental impact statement, including a description of the kinds and amounts of use each alternative would provide as well as the actions necessary to protect river values from these uses over time. The implications of the proposed capacities and related management actions are also discussed. Readers can refer to chapter 7 for a more detailed description of the user capacities and associated management actions contained in each plan alternative, including actions common to all alternatives to protect river values.

No-Action Alternative

As described in chapter 7, the no-action alternative provides a baseline from which to compare the environmental and other impacts of the action alternatives proposed in this environmental impact statement. For user capacity, this includes the current kinds and amounts of use available in the Tuolumne River corridor. These are summarized briefly below, while a more complete discussion of the kinds and amounts of use can be found in the Affected Environment section of chapter 8.

Summary of the Kinds and Amounts of Use

Current use of the Tuolumne River is oriented toward the wilderness values that are prevalent in significant portions of the river corridor. Recreational activities include day hiking, backpacking, camping, swimming, fishing, stock trips and day rides, interpretive and educational programs, rock climbing, and other similar activities. Current capacities are presented in table 6-1, below.

Table 6-1.
Maximum User Capacity, No-Action Alternative

| Overnight Capacity | | |
|---|---------------------------------------|--|
| Location | Overnight Capacities | Maximum Number of People per Night |
| Tuolumne Meadows Lodge | 69 units | 69 units × 4 people/unit = 276 people per night |
| Tuolumne Meadows campground | 304 campsites, plus 7 groups sites | 304 campsites × 6 people/site = 1,824; plus 7 group sites × 30 people/site = 210; for a combined total of 2,034 people per night |
| Glen Aulin High Sierra Camp | 8 tent cabins | 8 cabins × 4 people per cabin = 32 people per night |
| Wilderness above Hetch Hetchy Reservoir | 350 person capacity | # of people per wilderness zone (350) |
| Wilderness below O'Shaughnessy Dam | 50 person capacity | # of people per wilderness zone (50) |
| Subtotal, Overnight | | 2,742 people |
| Day Use Capacity | | |
| Location | Day Use Capacities | Maximum Number of People at One Time |
| Private vehicle access at Tuolumne Meadows ^a | 530 parking spaces | 530 parking spaces × 2.9 people/vehicle = 1,537 people |
| Bus riders to Tuolumne Meadows | 5 buses | 5 buses × 45 people/bus = 225 people |
| Access from below O'Shaughnessy Dam | 4 spaces | 4 parking spaces × 2.9 people/vehicle = 12 people |
| Subtotal, Day Use | | 1,774 people |
| Administrative Capacity | | |
| Existing Use Calculation | Maximum Number of Employees | |
| Approximately 9 concessioner employees based at Glen Aulin High Sierra Camp | 9 | |
| Approximately 150 NPS employees based at Tuolumne Meadows | 150 | |
| Approximately 103 concessioner employees based at Tuolumne Meadows | 103 | |
| Subtotal, Administrative Use | | 262 people |
| GRAND TOTAL | | 4,778 people |

a The peak number of vehicles observed during vehicle counts in 2011 (observed on August 13, 2011).
Abbreviation: NPS = National Park Service

Alternative 1: Emphasizing a Self-Reliant Experience

As explained in detail in chapter 7, alternative 1 would significantly reduce the kinds and amounts of use that would be allowed in the Tuolumne River corridor in an attempt to increase opportunities for self-reliant recreational experiences. The emphasis on self-reliance means that visitors would need to come prepared for their wilderness excursion and not have additional facilities and services readily available in Tuolumne Meadows to support their activities. For example, the store and grill, gas station, and Tuolumne Meadows Lodge would all be removed under this alternative.

Summary of the Kinds and Amounts of Use

The kinds of use under alternative 1 would include hiking, camping, backpacking, fishing, swimming, and rock climbing, and other similar activities. Under this alternative, all commercial visitor services, including lodging at Glen Aulin High Sierra Camp and the Tuolumne Meadows Lodge, would be removed along with concessioner stock day rides for visitors and commercial outfitter hiking and stock trips.

Based on the existing constraints in the Tuolumne River corridor and the kinds and amounts of use prescribed for this alternative, the maximum user capacity for alternative 1 is calculated at 3,167 people (table 6-2).

**Table 6-2.
Maximum User Capacity, Alternative 1**

| Visitor Overnight Capacity | | |
|--|--------------------------------------|--|
| Location | Overnight Capacities | Maximum Number of People per Night |
| Tuolumne Meadows Lodge | 0 units | 0 units × 4 people/unit = 0 people per night |
| Tuolumne Meadows campground | 237 campsites, plus 7 group sites | 237 campsites × 6 people/site = 1,422, plus 7 group sites × 30 people/site = 210, for a combined total of 1,632 people per night |
| Glen Aulin High Sierra Camp | 0 tent cabins | 0 cabins × 4 people per cabin = 0 people per night |
| Wilderness above Hetch Hetchy Reservoir | 350 person capacity | # of people per wilderness zone (350) |
| Wilderness below O'Shaughnessy Dam | 50 person capacity | # of people per wilderness zone (50) |
| Subtotal, Overnight | | 2,032 people |
| Visitor Day Use Capacity | | |
| Type of Access | Day Use Capacities | Maximum Number of People at One Time |
| Private vehicle access from Tuolumne Meadows | 305 spaces | 305 parking spaces @ 90% occupancy ^a × 2.9 people/vehicle = 796 people |
| Bus riders to Tuolumne Meadows | 5 buses | 5 buses × 45 people/bus = 225 people |
| Private vehicle access from below O'Shaughnessy Dam | 4 spaces | 4 parking spaces × 2.9 people/vehicle = 12 people ^b |
| Subtotal, Day Use | | 1,033 people |
| Administrative Capacity | | |
| Proposed Action | Units (Beds) | Maximum Number of Employees |
| Remove concessioner employees at Glen Aulin | 0 beds | 0 |
| Meet NPS staffing need with 100 employees at Tuolumne Meadows | 100 beds | 100 |
| Meet concessioner staffing need with 2 employees at Tuolumne Meadows | 2 beds | 2 |
| Subtotal, Administrative Use | | 102 people |
| GRAND TOTAL | | 3,167 people |

a The 90% factor is applied to account for the vacancy of a percentage of parking spaces after visitors leave and before new visitors find the empty spaces.

This is applied as the maximum capacity because no single parking area is feasibly used to 100% efficiency.

b Because the parking lot at Poopenaut Valley is so small, using the 90% figure is inappropriate because all empty stalls can be seen by a typical driver. Abbreviation: NPS = National Park Service

Management of User Capacity

Visitor Overnight Use. Levels of overnight use in wild segments would continue to be managed through a system of zone capacities and related overnight trailhead quotas under alternative 1. The NPS would retain oversight of these and other concessioner activities. Overnight use levels in the scenic segment at Tuolumne Meadows would be managed by the facility capacity of the campground. Some campsites would continue to be available through a reservation system and some on a first-come, first-served basis.

Visitor Day Use. Day use levels would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. Service levels of public transportation systems serving the Tuolumne Meadows area (the regional transit bus service, Yosemite Area Regional Transit Service [YARTS]) would remain under NPS control, with the number of visitors delivered into the corridor by such services managed according to the user capacity limits established for alternative 1. NPS may use any combination of limits on the numbers of buses, the stops they make, the number of passengers they accept, and/or the numbers of routes they run per day.

Administrative Use. Commensurate with the discontinuation of commercial services, the number of NPS and concessioner employees would be reduced. The levels of administrative use would be managed through the

allocation of housing in the Tuolumne Meadows area. Housing would be maintained at the levels specified in alternative 1.

Actions to Protect River Values given the Kinds and Amounts of Use in Alternative 1

Under alternative 1, river values would be protected based on the kind and amounts of use proposed because the associated capacities would be within the constraints for water consumption. Further, the following describes the actions that would ensure use would not adversely affect river values over time (see chapter 5 for a comprehensive listing of river protection measures; see chapter 7 for specific management actions associated with alternative 1).

Free-Flowing Condition of the River

As noted in chapter 5, the existing average water withdrawals of 60,000 to 70,000 gallons per day meet the standard of being at or below 10% of low flow (1 cubic foot per second). As shown in table 6-3, alternative 1 would reduce the estimated average water demand by approximately 44% due to reduced amounts and types of use, particularly overnight visitor use and employee housing. The average estimated water demand for alternative 1 is calculated as about 36,000 gallons per day, as shown in table 6-3. Based on these calculations, alternative 1 would be protective of river flow and downstream habitat. Even in years where low-flow durations occurred earlier in the summer, withdrawal levels would be well within the standard of no more than 10% of low flows presented in chapter 5.

Table 6-3.
Summary of Average Estimated Water Demand at Tuolumne Meadows, Alternative 1

| Location | Current consumption per unit | Current consumption (gpd) | Alternative 1 consumption (gpd) |
|---|------------------------------|-------------------------------|---------------------------------|
| Campsites | 100 gallons/site/day | 30,400 gpd (304 sites) | 23,700 gpd (237 sites) |
| Group Campsites | 500/gallons/site/day | 3,500 gpd (7 sites) | 3,500 gpd (7 sites) |
| RV dump | 50 gallons/use/day | 1,600 gpd (32 dumps) | 1,600 gpd (32 dumps) |
| Tuolumne Meadows Lodge | 30 gallons/person/day | 8,280 gpd (276 guests) | 0 |
| NPS housing | 50 gallons/employee/day | 5,200 gpd (104 employees) | 5,000 gpd (100 employees) |
| Concessioner housing | 50 gallons/employee/day | 5,150 gpd (103 employees) | 100 gpd (2 employees) |
| Cafeteria meals (two per concessioner employee) | 6 gallons/person/day | 1,236 gpd (206 meals) | 0 |
| Store/grill/fuel station | 5 gallons/person/day | 5,740 gpd (1,148 visitors) | 0 |
| Visitor center | 5 gallons/visitor/day | 3,035 gpd (607 visitors) | 2,064 gpd (413 visitors) |
| Total | | 64,141 gpd | 35,964 gpd |

Abbreviations: gpd = gallons per day; NPS = National Park Service; RV = recreational vehicle

Management to Protect Water Quality

Reducing water withdrawals would reduce the amount of wastewater to be treated and disposed by nearly half, which would allow for the elimination of the wastewater ponds and sprayfields on the north side of Tioga Road and the crushing or removing of the wastewater line that runs beneath the river and the meadow. Further reductions in risks to water quality would be achieved by eliminating the fuel storage associated with the public fuel station and greatly reducing the size of the concessioner stable operation. Monitoring (detailed in chapter 5) would be ongoing to ensure that water quality remained excellent.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 1 would additionally reduce the maximum people at one time in the Tuolumne Meadows area by an estimated 34% (from a current maximum capacity of 4,778 users to a maximum capacity of 3,167 users) to reduce the effects of foot traffic. Although visitors would be allowed relatively unconfined access to the meadows and the river, the reduction in visitor numbers would be expected to keep impacts the associated with visitor use within the protective standard.

These actions would be expected to reduce the stresses on the subalpine meadow and riparian system and increase their ecological resistance to the kinds and levels of use that would continue. Conditions would be monitored to ensure that the protective management standards for meadow and riparian habitat would be achieved and maintained over time. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as identified in chapter 5.

Management to Protect Archeological Sites

Management of visitor use for alternative 1 would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. The NPS would conduct monitoring to ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced by managing unnatural features related to visitor and administrative use, such as facilities and parked cars, to minimize their intrusion into remarkable views.

Management to Protect and Enhance the Wilderness Experience along the River

Day use levels along trails in wild segments of the river corridor but within reach of a day hike from Tuolumne Meadows would be restricted to levels that resulted in encounters with no more than four other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends. If required to achieve this standard, a day use trailhead quota system would be implemented for some trails under alternative 1. This management would protect visitors' opportunity to experience solitude throughout the wild segments of the river corridor, even on a day hike from Tuolumne Meadows. The wilderness experience would be enhanced by eliminating commercial stock use in the river corridor.

Alternative 2: Expanding Recreational Opportunities

As explained in greater detail in chapter 7, alternative 2 would expand the kinds and amounts of use within the constraints described above and using the measures to protect river values listed below. This alternative presents the highest use levels that may be accommodated across the range of action alternatives. The primary constraint to capacity with alternative 2 would be the consumption and treatment of water (as described below).

Summary of the Kinds and Amounts of Use

The various kinds of use proposed under alternative 2 would remain the same as are currently provided, with the addition of allowing limited private boating down the Grand Canyon of the Tuolumne. Additional opportunities for walk-in camping at the Tuolumne Meadows campground and picnic areas would be

expanded for day visitors with this alternative. Designated day parking would be increased and consolidated in resource appropriate areas that are protective of river values.

Based on the kinds and amounts of used prescribed for this alternative and consideration of the constraints described earlier in this chapter, the maximum user capacity for alternative 2 is calculated at 5,187 people (see table 6-4).

**Table 6-4.
Maximum User Capacity, Alternative 2**

| Overnight Capacity | | |
|--|------------------------------------|--|
| Location | Overnight Capacities | Maximum Number of People per Night |
| Tuolumne Meadows Lodge | 69 units | 69 units × 4 people/unit = 276 people per night |
| Tuolumne Meadows campground | 345 campsites, plus 7 groups sites | 345 campsites × 6 people/site = 2,070, plus 7 group sites × 30 people/site = 210, for a combined total of 2,280 people per night |
| Glen Aulin High Sierra Camp | 8 tent cabins | 8 cabins × 4 people per cabin = 32 people per night |
| Wilderness above Hetch Hetchy Reservoir | 350 person capacity | # of people per wilderness zone (350) |
| Wilderness below O'Shaughnessy Dam | 50 person capacity | # of people per wilderness zone (50) |
| Subtotal, Overnight | | 2,988 people |
| Day Use Capacity | | |
| Type of Access | Day Use Capacities | Maximum Number of People at One Time |
| Private vehicle access from Tuolumne Meadows | 642 spaces | 642 parking spaces @ 90% occupancy ^a × 2.9 people/vehicle = 1,676 people |
| Bus riders to Tuolumne Meadows | 5 buses | 5 buses × 45 people/bus = 225 people |
| Private vehicle access from below O'Shaughnessy Dam | 4 spaces | 4 parking spaces × 2.9 people/vehicle = 12 people ^b |
| Subtotal, Day Use | | 1,913 people |
| Administrative Capacity | | |
| Proposed Action | Units (Beds) | Maximum Number of Employees |
| Meet concessioner staffing need at Glen Aulin High Sierra Camp | 9 beds | 9 |
| Meet NPS staffing need at Tuolumne Meadows | 174 beds | 174 |
| Meet concessioner staffing need at Tuolumne Meadows | 103 beds | 103 |
| Subtotal, Administrative Use | | 286 people |
| GRAND TOTAL | | 5,187 people |

a The 90% factor is applied to account for the vacancy of a percentage of parking spaces after visitors leave and before new visitors find the empty spaces.

This is applied as the maximum capacity because no single parking area is feasibly used to 100% of its capacity.

b Because the parking lot at Poopenaut Valley is so small, using the 90% figure is inappropriate, as all empty stalls can easily be seen by a typical driver.

Abbreviation: NPS = National Park Service

Management of User Capacity

Visitor Overnight Use. Levels of overnight use in wild segments of the Tuolumne River corridor would continue to be managed through a system of zone capacities and related overnight trailhead quotas. In the wild segment below Tuolumne Meadows, recreational whitewater boating would be allowed and regulated through a permit system. The Glen Aulin High Sierra Camp would continue to be managed by a concession contract, with spaces allocated on an advanced reservation system. The NPS would retain oversight of these and other concessioner activities. Overnight use levels in the scenic segment of the river corridor under alternative 2 would be managed by the facility capacities of the Tuolumne Meadows campground and Tuolumne Meadows Lodge. These facilities would continue to be available through a reservation system, with some campsites also available on a first-come, first-served basis.

Visitor Day Use. Day use levels would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the

Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. Service levels of public transportation systems serving the Tuolumne Meadows area (YARTS, the hiker bus operated by the concessioner, and other transit services) would remain under NPS control, with the number of visitors delivered into the corridor by such services managed according to the user capacity limits established for alternative 2. The NPS may use any combination of limits on the numbers of buses, the stops they make, the number of passengers they accept, and/or the numbers of routes they run per day.

Administrative Use. NPS staffing would be increased to provide for increased visitor and resource protection needs (including management of the user capacity program, below), additional interpretive and educational services, resource management and monitoring, and maintenance. NPS employee housing or campsites would be increased to accommodate this staffing level; campsites would meet the need for incidental housing for employees on temporary duty in the Tuolumne Meadows area. Concessioner employee staffing and housing necessary to support commercial services would remain the same as under the no-action alternative. All housing would be maintained at the levels specified in alternative 2.

Actions to Protect River Values given the Kinds and Amounts of Use in Alternative 2

Alternative 2 would expand the kinds and amounts of use in the Tuolumne River corridor but would maintain uses within the constraints and management actions to protect river values described below. See chapter 5 for a comprehensive list of river protection measures, and see chapter 7 for a complete list of all management actions associated with alternative 2.

Free-Flowing Condition of the River

So long as Tuolumne River low flows remained around 1 cubic foot per second, and assuming the current timing and duration of low flows, average water withdrawals of 60,000 to 70,000 gallons per day would fall within the margin of error for meeting the standard of being at or below 10% of low flow. The average estimated water demand for alternative 2 is calculated as about 70,000 gallons per day, as shown in table 6-5. Intensive management effort, including water metering, replacing inefficient fixtures, and implementing educational programs, would be required to ensure that water use remained within the standard. If low-flow durations occurred earlier in the summer, alternative 2 would have the greatest potential for requiring reductions in service, including reducing the capacities at the Tuolumne Meadows Lodge and/or campground, to ensure that the level of water consumptions remained protective of river flows.

Table 6-5.
Summary of Average Estimated Water Demand at Tuolumne Meadows, Alternative 2

| Location | Current consumption per unit | Current consumption (gpd) | Alternative 2 estimated consumption (gpd) |
|---|--------------------------------------|-------------------------------|---|
| Campsites (drive-in) | 100 gallons/site/day | 30,400 gpd (304 sites) | 30,400 (304 sites) |
| Campsites (walk-in) | 50 gallons/site/day | 0 | 2,050 gpd (41 sites) |
| Campsites (group) | 500 gallons/site/day | 3,500 gpd (7 sites) | 3,500 gpd (7 sites) |
| RV dump | 50 gallons/use/day | 1,600 gpd (32 dumps) | 1,600 gpd (32 dumps) |
| Tuolumne Meadows Lodge | 30 gallons/person/day | 8,280 gpd (276 guests) | 8,280 gpd (276 guests) |
| Shower house | 10 gallons/person/shower | 0 gpd | 350 gpd (35 showers) |
| NPS housing | 50 gallons/employee/ day | 5,200 gpd (104 employees) | 7,200 gpd (144 employees) |
| | 25 gallons/employee/day in campsites | 0 gpd | 500 gpd (30 employees in campsites) |
| Concessioner housing | 50 gallons/employee/day | 5,150 gpd (103 employees) | 5,150 gpd (103 employees) |
| Cafeteria meals (two per concessioner employee) | 6 gallons/person/day | 1,236 gpd (206 meals) | 1,236 gpd (206 meals) |
| Store/grill/ fuel station | 5 gallons/person/day | 5,740 gpd (1,148 visitors) | 6,257 gpd (1,251 visitors) |
| Visitor center | 5 gallons/visitor/day | 3,035 gpd (607 visitors) | 3,308 gpd (662 visitors) |
| Total | | 64,141 gpd | 70,081 gpd |

Abbreviation: gpd = gallons per day; NPS = National Park Service; RV = recreational vehicle

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area under alternative 2 would be mitigated by upgrading the wastewater treatment plant, wastewater ponds, and sprayfields. The improved utilities would be designed for loads commensurate with the estimate of domestic water use noted in table 6-5. Risks to water quality at Glen Aulin would be reduced by removing the current wastewater treatment system and leach mound and replacing it with a new composting toilet. Water used for meal preparation and sanitation would be screened before disposal in a wastewater sump. Monitoring would be ongoing (as described in chapter 5) to ensure that water quality remained excellent at both Tuolumne Meadows and Glen Aulin.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Although use levels could be higher, alternative 2 would direct visitors to designated trails and delineate or fence certain trail segments to facilitate ecological recovery of adjacent vegetation.

Management to Protect Archeological Sites

The same management of visitor use described above would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. Monitoring would be ongoing to ensure that site disturbance did not exceed the protective standard established for these sites.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced under alternative 2 by managing unnatural features related to visitor and administrative use, such as facilities and parked cars, to minimize their intrusion into remarkable views.

Management to Protect and Enhance the Wilderness Experience along the River

Day use levels along trails in wild segments of the river corridor but within reach of a day hike from Tuolumne Meadows would be restricted to levels that would result in encounters with no more than 10 other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced under alternative 2 by eliminating roadside parking and the congestion currently caused by vehicles slowing to park and pedestrians crossing the road. Opportunities for people wishing to park and get out of their cars would be enhanced by increasing the number of designated parking spaces.

Alternative 3: Celebrating the Tuolumne Cultural Heritage

As explained in greater detail in chapter 7, alternative 3 would celebrate the cultural heritage of the Tuolumne experience by maintaining historic opportunities for recreation while providing for needed improvements to protect river values. Some restrictions on the levels of visitor services and reductions in overnight and day use capacities are proposed, although the overall traditional experience of the Tuolumne as expressed in public comments would be preserved.

Summary of the Kinds and Amounts of Use

The majority of the current kinds of use in the Tuolumne River corridor would be retained with alternative 3. However, some proposed changes could affect the kinds of use in specific areas. For example, meals-only service, wood stoves, and flush toilets would be discontinued or removed at the Glen Aulin High Sierra Camp. Similarly, concessioner day rides would be reduced.

The overnight and day use capacities would be lowered slightly with alternative 3. In particular, the overnight capacity of the Glen Aulin High Sierra Camp and Tuolumne Meadows Lodge would be reduced. Designated day parking would be increased and consolidated in resource appropriate areas that are protective of river values. Additional shuttle bus service would provide visitors with more opportunity to access their desired recreational activities in the Tuolumne Meadows area without the use of their private vehicle.

Based on the kinds and amounts of used prescribed for this alternative and consideration of the constraints described earlier in this chapter, the maximum user capacity for alternative 3 is calculated at 4,402 people (table 6-6).

**Table 6-6.
Maximum User Capacity, Alternative 3**

| Overnight Capacity | | |
|--|------------------------------------|--|
| Location | Overnight Capacities | Maximum Number of People per Night |
| Tuolumne Meadows Lodge | 34 units | 34 units × 4 people/unit = 136 people per night |
| Tuolumne Meadows campground | 304 campsites, plus 7 groups sites | 304 campsites × 6 people/site = 1,824, plus 7 group sites × 30 people/site = 210, for a combined total of 2,034 people per night |
| Glen Aulin High Sierra Camp | 7 tent cabins | 7 cabins × 4 people per cabin = 28 people per night |
| Wilderness above Hetch Hetchy Reservoir | 350 person capacity | # of people per wilderness zone (350) |
| Wilderness below O'Shaughnessy Dam | 50 person capacity | # of people per wilderness zone (50) |
| Subtotal, Overnight | | 2,598 people |
| Day Use Capacity | | |
| Type of Access | Day Use Capacities | Maximum Number of People at One Time |
| Private vehicle access from Tuolumne Meadows | 510 spaces | 510 parking spaces @ 90% occupancy ^a × 2.9 people/vehicle = 1,331 people |
| Bus riders to Tuolumne Meadows | 5 buses | 5 buses × 45 people/bus = 225 people |
| Private vehicle access from below O'Shaughnessy Dam | 4 spaces | 4 parking spaces × 2.9 people/vehicle = 12 people ^b |
| Subtotal, Day Use | | 1,568 people |
| Administrative Capacity | | |
| Proposed Action | Units (Beds) | Maximum Number of Employees |
| Retain all concessioner employees at Glen Aulin High Sierra Camp | 9 beds | 9 |
| Meet NPS staffing need with 124 employees at Tuolumne Meadows | 124 beds | 124 |
| Meet concessioner staffing need with 103 employees at Tuolumne Meadows | 103 beds | 103 |
| Subtotal, Administrative Use | | 236 people |
| GRAND TOTAL | | 4,402 people |

a The 90% factor is applied to account for the vacancy of a percentage of parking spaces after visitors leave and before new visitors find the empty spaces. This is applied as the maximum capacity because no single parking area is feasibly used to 100% efficiency.

b Because the parking lot at Poopenaut Valley is so small, using the 90% figure is inappropriate because all empty stalls can easily be seen by a typical driver.

Abbreviation: NPS = National Park Service

Management of User Capacity

Visitor Overnight Use. Levels of overnight use in wild segments of the Tuolumne River corridor would continue to be managed through a system of zone capacities and related overnight trailhead quotas. The Glen Aulin High Sierra Camp would continue to be managed by concession contract, with spaces allocated on an advanced reservation system. The NPS would retain oversight of these and other concessioner activities. Overnight use levels in the scenic segments of the river corridor would be managed by the facility capacities of the Tuolumne Meadows campground and Tuolumne Meadows Lodge. These facilities would continue to be available through a reservation system, with some campsites also available on a first-come, first-served basis.

Visitor Day Use. Day use levels under alternative 3 would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. Service levels of public transportation systems serving the Tuolumne Meadows area (YARTS, the hiker bus operated by the concessioner, and other transit services) would remain under NPS control, with the number of visitors delivered into the river corridor by such services managed according to the user capacity limits established for alternative 3. The NPS may use any combination of limits on the numbers of buses, the stops they make, the number of passengers they accept, and/or the numbers of routes they run per day.

Administrative Use. NPS staffing would be reduced under alternative 3. In addition to current housing, employee campsites would be provided to meet the need for incidental housing for employees on temporary duty in the Tuolumne Meadows area. Concessioner employee staffing and housing necessary to support commercial services would remain the same as under the no-action alternative. All housing would be maintained at the levels specified in alternative 3.

Actions to Protect River Values given the Kinds and Amounts of Use in Alternative 3

Under alternative 3, the NPS would reduce capacities while providing for traditional kinds of use in the Tuolumne River corridor. See chapter 5 for a more comprehensive list of river protection measures, and see chapter 7 for a complete list of all management actions associated with alternative 3.

Free-Flowing Condition of the River

So long as low flows remained around 1 cubic foot per second, and assuming the current timing and duration of low flows, average water withdrawals of 60,000 to 70,000 gallons per day would fall within the margin of error for meeting the standard of being at or below 10% of low flow. The average estimated water demand for alternative 3 is calculated as about 60,000 gallons per day, as shown in table 6-7. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow.

Table 6-7.
Summary of Average Estimated Water Demand at Tuolumne Meadows, Alternative 3

| Location | Current consumption per unit | Current consumption (gpd) | Alternative 3 estimated consumption (gpd) |
|---|--------------------------------------|----------------------------------|--|
| Campsites (drive-in) | 100 gallons/site/day | 30,400 gpd (304 sites) | 30,400 gpd (304 sites) |
| Campsites (group) | 500 gallons/site/day | 3,500 gpd (7 sites) | 3,500 gpd (7 sites) |
| RV dump | 50 gallons/use/day | 1,600 gpd (32 dumps) | 1,600 gpd (32 dumps) |
| Tuolumne Meadows Lodge | 30 gallons/person/day | 8,280 gpd (276 guests) | 4,080 gpd (136 guests) |
| NPS housing | 50 gallons/employee/day | 5,200 gpd (104 employees) | 5,200 gpd (104 employees) |
| | 25 gallons/employee/day in campsites | 0 employees in campsites | 500 gpd (20 employees in campsites) |
| Concessioner housing | 50 gallons/employee/day | 5,150 gpd (103 employees) | 5,150 gpd (103 employees) |
| Cafeteria meals (two per concessioner employee) | 6 gallons/person/day | 1,236 gpd (206 meals) | 1,236 gpd (206 meals) |
| Store/grill/ fuel station | 5 gallons/person/day | 5,740 gpd (1,148 visitors) | 5,281 gpd (1,056 visitors) |
| Visitor center | 5 gallons/visitor/day | 3,035 gpd (607 visitors) | 2,792 gpd (558 visitors) |
| Total | | 64,141 gpd | 59,739 gpd |

Abbreviations: gpd = gallons per day; NPS = National Park Service; RV = recreational vehicle

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area would be mitigated by upgrading the wastewater treatment plant, wastewater ponds, and sprayfield. The improved utilities would be designed for loads commensurate with estimates of domestic water use. The risk to water quality at Tuolumne Meadows would be reduced by eliminating the fuel storage associated with the public fuel station. Risks to water quality at Glen Aulin would be reduced by removing the current wastewater treatment system and leach mound and replacing it with a new composting toilet. Monitoring (as described in chapter 5) would be ongoing to ensure that water quality remained excellent at both Tuolumne Meadows and Glen Aulin.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 3 would additionally reduce the maximum people at one time in the Tuolumne Meadows area by an estimated 9% (from an estimated maximum capacity of 4,778 visitors to a maximum capacity of 4,402 visitors). Although visitor access to the meadows and the river would not be as restricted as under alternative 2, the reduction in numbers of visitors would be expected to keep the impacts associated with visitor use within the protective standard.

Management to Protect Archeological Sites

The same management of visitor use described above would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments under alternative 3. Monitoring would be ongoing to ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced by managing unnatural features associated with visitor and administrative use, such as facilities and parked cars, to minimize their intrusion into remarkable views.

Management to Protect and Enhance the Wilderness Experience along the River

Day use levels along trails in wild segments of the river corridor but within reach of a day hike from Tuolumne Meadows would be protected by restricting use to levels that resulted in encounters with no more than 10 other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced under alternative 3 by eliminating roadside parking and the associated congestion currently caused by vehicles slowing to park and pedestrians crossing the road. Opportunities for people wishing to park and get out of their cars would be enhanced by increasing the number of formally designated parking spaces.

Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience

As explained in greater detail in chapter 7, alternative 4 would maintain the traditional Tuolumne experience while making marked improvements to infrastructure to further connect visitors to the river while protecting its resources. The range of visitor and administrative activities would be similar to the no-action alternative.

Summary of the Kinds and Amounts of Use

Except for some services at the Glen Aulin High Sierra Camp, the kinds of use that currently exist in the Tuolumne River corridor would continue. The overnight and day capacity with alternative 4 would also be similar to existing conditions but reduced somewhat, especially at Glen Aulin, as shown in table 6-8.

Based on the kinds and amounts of used prescribed for this alternative and consideration of the constraints described earlier in this chapter, the maximum user capacity for alternative 4 is calculated at 4,843 people (see table 6-8).

Table 6-8.
Maximum User Capacity, Alternative 4

| Overnight Capacity | | |
|--|------------------------------------|--|
| Location | Overnight Capacities | Maximum Number of People per Night |
| Tuolumne Meadows Lodge | 69 units | 69 units × 4 people/unit = 276 people per night |
| Tuolumne Meadows campground | 304 campsites, plus 7 groups sites | 304 campsites × 6 people/site = 1,824, plus 7 group sites × 30 people/site = 210, for a combined total of 2,034 people per night |
| Glen Aulin High Sierra Camp | 5 tent cabins | 5 cabins × 4 people per cabin = 20 people per night |
| Wilderness above Hetch Hetchy Reservoir | 350 person capacity | # of people per wilderness zone (350) |
| Wilderness below O'Shaughnessy Dam | 50 person capacity | # of people per wilderness zone (50) |
| Subtotal, Overnight | | 2,730 people |
| Day Use Capacity | | |
| Location | Day Use Capacities | Maximum Number of People at One Time |
| Private vehicle access from Tuolumne Meadows | 562 spaces | 562 parking spaces @ 90% occupancy ^a × 2.9 people/vehicle = 1,467 people |
| Bus riders to Tuolumne Meadows | 2 buses | 8 buses × 45 people/bus = 360 people |
| Access from below O'Shaughnessy Dam | 4 spaces | 4 parking spaces × 2.9 people/vehicle = 12 people ^b |
| Subtotal, Day Use | | 1,839 people |
| Administrative Capacity | | |
| Proposed Action | Units (Beds) | Maximum Number of Employees |
| Reduce concessioner staffing at Glen Aulin High Sierra Camp to 8 employees | 8 beds | 8 |
| Meet NPS staffing need with 163 employees at Tuolumne Meadows | 163 beds | 163 |
| Meet concessioner staffing need with 103 employees at Tuolumne Meadows | 103 beds | 103 |
| Subtotal, Administrative Use | | 274 people |
| GRAND TOTAL | | 4,843 people |

a The 90% factor is applied to account for the vacancy of a percentage of parking spaces after visitors leave and before new visitors find the empty spaces. This is applied as the maximum capacity because no single parking area is feasibly used to 100% efficiency.

b Because the parking lot at Poopenaut Valley is so small, using the 90% figure is inappropriate because all empty stalls can easily be seen by a typical driver.

Abbreviation: NPS = National Park Service

Management of User Capacity

Visitor Overnight Use. Levels of overnight use in wild segments of the Tuolumne River corridor would continue to be managed through a system of zone capacities and related overnight trailhead quotas. The Glen Aulin High Sierra Camp would continue to be managed by concession contract, with spaces allocated on an

advanced reservation system. The NPS would retain oversight of these and other concessioner activities. Overnight use levels in the scenic segments of the river corridor would be managed by the facility capacities of the Tuolumne Meadows campground and Tuolumne Meadows Lodge. These facilities would continue to be available through a reservation system, with some campsites also available on a first-come, first-served basis.

Visitor Day Use. Day use levels would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area under alternative 4. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. In addition, regional transit capacity would be increased by 135 people, the equivalent of three 45-passenger shuttle buses, to encourage use of regional transit and relieve traffic congestion at Tuolumne Meadows on peak days. These regional transit service levels (YARTS, the hiker bus operated by the concessioner, and other transit services) would remain under NPS control, with the number of visitors delivered into the river corridor by such services managed according to the user capacity limits established for alternative 4. The NPS may use any combination of limits on the numbers of buses, the stops they make, the number of passengers they accept, and/or the numbers of routes they run per day.

Administrative Use. NPS staffing would be increased for more resource protection needs (including management of the user capacity program), resource management, and monitoring. NPS employee housing or campsites would be increased. Campsites would meet the need for incidental housing for employees on temporary duty in the Tuolumne Meadows area, with a bunkhouse to be constructed as funds become available for these employees. Concessioner employee staffing and housing necessary to support commercial services would remain the same as under the no-action alternative. All housing would be maintained at the levels specified under alternative 4.

Actions to Protect River Values given the Kinds and Amounts of Use in Alternative 4

The kinds and amounts of use proposed with alternative 4 would be protective of river values because of the variety of management actions as listed below. For a more comprehensive list of river protection measures, see chapter 5. For the full list of management actions associated with alternative 4, see chapter 7.

Free-Flowing Condition of the River

So long as low flows remained around 1 cubic foot per second, and assuming the current timing and duration of low flows, average water withdrawals of 60,000 to 70,000 gallons per day would fall within the margin of error for meeting the standard of being at or below 10% of low flow. The average estimated water demand for alternative 4 is calculated as about 67,000 gallons per day; this amount would be due primarily to an increase in employee housing, as shown in table 6-9. This slightly increased level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow unless climate change led to longer low-flow durations occurring earlier in the summer, in which case further reductions in water use would be required.

Table 6-9.
Summary of Average Estimated Water Demand at Tuolumne Meadows, Alternative 4

| Location | Current consumption per unit | Current consumption (gpd) | Alternative 4 estimated consumption day (gpd) |
|---|--------------------------------------|-------------------------------|---|
| Campsites (drive-in) | 100 gallons/site/day | 30,400 gpd (304 sites) | 30,400 gpd (304 sites) |
| Campsites (group) | 500 gallons/site/day | 3,500 gpd (7 sites) | 3,500 gpd (7 sites) |
| RV dump | 50 gallons/use/day | 1,600 gpd (32 dumps) | 1,600 gpd (32 dumps) |
| Tuolumne Meadows Lodge | 30 gallons/person/day | 8,280 gpd (276 guests) | 8,280 gpd (276 guests) |
| Shower house at Tuolumne Meadows Lodge | 10 gallons/person/shower | closed | 350 gpd (35 showers) |
| NPS housing | 50 gallons/ employee/ day | 5,200 gpd (104 employees) | 6,650 gpd (133 employees) |
| | 25 gallons/employee/day in campsites | 0 employees in campsites | 750 gpd (30 employees in campsites) |
| Concessioner housing | 50 gallons/employee/day | 5,150 gpd (103 employees) | 5,150 gpd (103 employees) |
| Cafeteria meals (two per concessioner employee) | 6 gallons/person/day | 1,236 gpd (206 meals) | 1,236 gpd (206 meals) |
| Store/grill/ fuel station | 5 gallons/ person/ day | 5,740 gpd (1,148 visitors) | 5,797 gpd (1,159 visitors) |
| Visitor center | 5 gallons/ visitor/ day | 3,035 gpd (607 visitors) | 3,065 gpd (613 visitors) |
| Total | | 64,141 gpd | 66,778 gpd |

Abbreviations: gpd = gallons per day; NPS = National Park Service; RV = recreational vehicle

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area would be mitigated by upgrading the wastewater treatment plant, treatment ponds, and sprayfields. The improved utilities would be designed for loads commensurate with estimates of domestic water use presented in table 6-9. Further reductions in risks to water quality would be achieved by eliminating the fuel storage associated with the public fuel station and by greatly reducing the size of the concessioner stable operation. Risks to water quality at Glen Aulin would be mitigated by replacing flush toilets with vault toilets. Monitoring would ensure that water quality remained excellent at Tuolumne Meadows and Glen Aulin.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 4 would additionally restrict visitor access to meadow and riparian areas and allow use only on designated trails and paths.

Management to Protect Archeological Sites

The same management of visitor use described above would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. Monitoring would ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced under all the action alternatives by managing unnatural features associated with visitor and administrative use, such as facilities and parked cars, to minimize their intrusion into remarkable views.

Management to Protect and Enhance the Wilderness Experience along the River

Day use levels along trails in wild segments of the river corridor but within reach of a day hike from Tuolumne Meadows would be protected by restricting use to levels that resulted in encounters with no more than 10 other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced under alternative 4 by eliminating roadside parking and the associated congestion caused by vehicles slowing to park and pedestrians crossing the road. Opportunities for people wishing to park and get out of their cars would be enhanced by increasing the number of designated parking spaces.

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Chapter 7: Alternatives for River Management

Following the guidance in section 10(a) of the Wild and Scenic Rivers Act (WSRA) to “protect and enhance the values which caused [the river] to be included in the [wild and scenic rivers] system,” and giving primary emphasis to protecting the river’s “aesthetic, scenic, historic, archeologic and scientific [including biologic and geologic] features,” this *Tuolumne River Plan/Draft EIS* focuses on management to protect and enhance these values. As described in chapter 5, a number of actions have been identified to address management concerns about the river’s free-flowing condition, water quality, and outstandingly remarkable biological, geologic, cultural, recreational, and scenic values. Most of these actions would be common to all the action alternatives under consideration.

The alternatives presented in this chapter differ primarily in the kinds of visitor experiences that might be available at Tuolumne Meadows and Glen Aulin High Sierra Camp in the future, including different levels of services and facilities at those locations, and associated implications for user capacity. In earlier stages of planning, five distinctive action alternatives were developed based on public comments submitted during scoping for this *Tuolumne River Plan/Draft EIS*. Based on further analysis and review, some of the elements that had differed among the original five action alternatives were determined to be so important for protecting river values that they were included in all the action alternatives. Other elements were determined to be infeasible or inappropriate and were dismissed from further consideration (see “Alternatives Dismissed from Further Consideration” at the end of this chapter). The remaining elements of the original five action alternatives were consolidated into four action alternatives. A more complete description of the *Tuolumne River Plan/Draft EIS* alternatives development process is provided in appendix O.

The four action alternatives are compared in this chapter, and are contrasted with a fifth alternative (the no-action alternative), which retains current conditions with no change in management, use, or development. These five alternatives constitute a reasonable range of alternatives that reflects the consideration and integration of (1) applicable laws and policies, including the WSRA, the Secretaries’ Guidelines for River Areas implementing WSRA, the National Park Service (NPS) Organic Act, the Wilderness Act, the National Historic Preservation Act (NHPA), and the National Environmental Policy Act (NEPA); (2) the various, sometimes contradictory interests and concerns raised during internal and public scoping; (3) scientific and scholarly data and analyses; and (4) an evaluation of the current facilities and infrastructure in the river corridor.

The five draft alternatives are characterized as follows:

- no- action alternative
- alternative 1: Emphasizing a Self-Reliant Experience
- alternative 2: Expanding Recreational Opportunities
- alternative 3: Celebrating the Tuolumne Cultural Heritage
- alternative 4 (Preferred): Improving the Traditional Tuolumne Experience

Actions necessary to protect river values are common to all the action alternatives. Additional actions to enhance some river values are included in some, but not all, alternatives. A comprehensive evaluation of how river values would be protected and enhanced under each alternative is provided at the end of each alternative description. This evaluation, which addresses a management requirement under WSRA, is provided in addition to the evaluations required by NEPA and NHPA. The NEPA and NHPA evaluations are included in volume 2, chapter 8. Based on the evaluations required by NEPA, the preferred alternative is the environmentally preferable alternative (see “Environmentally Preferable Alternative,” near the end of this chapter).

How the Alternatives Are Organized

By River Segment and Classification

The management actions are organized by river segment and classification (see table 3-1 and figure 3-1 in chapter 3) because the management guidance under the WSRA differs for wild segments and scenic segments. (No recreational segments were designated.)

Wild Segments

The discussion of the wild segments (segments 1, 2, 5, and 7, see table 3-1) encompasses the Lyell Fork, Upper Dana Fork, Grand Canyon, and Poopenaut Valley segments. Almost all lands and waters in these segments are also designated wilderness. The one exception is the Glen Aulin High Sierra Camp in the Grand Canyon segment, which is a potential wilderness addition and is addressed in its own subsection.

Scenic Segments

The discussion of the scenic segments (segments 3, 4, and 6, see table 3-1) includes the Tioga Road corridor in the Lower Dana Fork segment, Tuolumne Meadows in the Tuolumne Meadows segment, and the dam administrative site in the Below O'Shaughnessy Dam segment. All these segments contain some lands that are included in designated wilderness, and those areas will be managed the same as the wild segments.

By Type of Action

The management actions for wild segments and scenic segments are further subdivided into the following categories:

- *resource management actions* to protect and enhance river values, organized by value
- actions to protect and enhance river values by *managing visitor use and user capacity*
- *site plans* (including site restoration) for the Glen Aulin High Sierra Camp (under “Wild Segments” subheadings) and for the Tuolumne Meadows area (under “Scenic Segments” subheadings)

Actions Common to Alternatives 1–4

Many of the actions intended to protect and enhance river values would be common to all the action alternatives. These actions are presented first, before alternative 1, and are referenced, but not repeated, in the descriptions of the action alternatives.

No-Action Alternative

The no-action alternative is required by NEPA to provide the baseline from which to compare the action alternatives. This alternative assumes that current trends in the conditions of natural and cultural resources and visitor experiences would continue, consistent with the management activities that are ongoing under currently approved plans. Future actions that would require additional planning and environmental compliance could still occur, independent of the *Tuolumne River Plan/Draft EIS*, but they are not considered part of the no-action alternative for the purposes of conducting environmental compliance for the *Tuolumne River Plan*.

The description of the no-action alternative does not attempt to list the many activities that are ongoing in the river corridor to manage natural and cultural resources and to provide opportunities for visitor use. These activities range from fire management to maintenance work on historic structures, from wilderness patrols to enforcing traffic regulations, from field research to interpretive talks, and everything else that contributes to the conditions that currently exist in the river corridor. Most of these activities will continue, regardless of which alternative is eventually selected for the *Tuolumne River Plan*. Rather, the no-action alternative focuses on the main differences between the new actions that might occur under alternatives 1–4 and the management that is occurring now.

The future management actions to protect or enhance river values that might occur under alternatives 1–4 are not considered part of the no-action alternative. Therefore, the no-action alternative does *not* include the technical correction to the river corridor boundary presented in chapter 3, the section 7 determination process for evaluating water resources projects presented in chapter 4, or the management actions to protect and enhance river values presented in chapter 5.

Concept

More than 90% of the Tuolumne River corridor inside Yosemite National Park flows through congressionally designated wilderness and is managed to protect wilderness qualities. In these areas (primarily river segments classified as wild, although scenic segments also include some lands in designated wilderness, as shown in table 3-2), natural river-related systems are sustained by natural ecological processes, archeological and American Indian traditional cultural resources characterize the cultural landscape, and recreational opportunities are primitive and unconfined.

Visitor services are consolidated at Tuolumne Meadows (within the scenic classification), which is easily accessible along the Tioga Road. This expansive, highly productive yet fragile subalpine meadow and riparian area has sustained American Indian traditional uses, was the location of nationally important historic events, and now supports abundant opportunities for distinctive high-country recreational experiences.

Tuolumne Meadows is a popular staging area for wilderness travelers. A segment of the Pacific Crest Trail, one of the country's 11 national scenic trails, passes through the river corridor, as does the John Muir Trail. Because the Tioga Road provides easy access (until it closes for winter), Tuolumne Meadows is also a destination for recreation that can be readily enjoyed by people of various ages and physical abilities. Visitors to Tuolumne Meadows can enjoy a wide variety of river-related outdoor recreational activities. Many visitors are through-travelers on the Tioga Road—one of only a handful of trans-Sierra highways—who enjoy motor touring and stop briefly to take advantage of the visitor services at Tuolumne Meadows. In winter, when Tioga Road is closed due to snow, a small number of visitors access the area by cross-country skiing and snowshoeing. There are no visitor services in the winter, although the campground office is available as a ski hut for the few skiers who make it all the way to the meadows area.

Visitor use patterns are changing, as more day visitors visit the park, and people with only a short time to spend in the area now comprise almost half of the visitor population at Tuolumne Meadows.

The Glen Aulin High Sierra Camp, 6 miles downriver from Tuolumne Meadows in the Grand Canyon segment, provides visitors, including those who are unable to carry a heavy pack or are mobility impaired, an opportunity to experience and enjoy the river in a remote, wilderness setting.

In summary, the no-action alternative would:

- Preserve and sustain wilderness character, including natural ecosystem function and opportunities for primitive, unconfined recreation, in the wild segments of the river.
- Retain existing opportunities for day and overnight use at Tuolumne Meadows and the Glen Aulin High Sierra Camp.
- Perpetuate the current resource conditions and management concerns for river values throughout the river corridor.
- Manage for a continuing upward trend in day use.

Wild Segments (Designated Wilderness and Glen Aulin)

Resource Management

As noted in the introduction to the no-action alternative, this section is not intended to summarize all the current management of resources in the river corridor. Rather, it focuses on the actions currently underway to address the management concerns identified in chapter 5. This provides a baseline for comparing the additional actions that might be taken under the action alternatives to further protect and enhance river values.

Free Flowing Condition

Management concerns about free flow in wild segments of the river relate to altered flow levels below O'Shaughnessy Dam. Under the no-action alternative, the NPS would continue to work cooperatively with the San Francisco Public Utilities Commission (SFPUC), Stanislaus National Forest, and others to inform releases from O'Shaughnessy Dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems below the dam.

Water Quality

Management concerns about water quality in wild segments of the river relate to wastewater disposal at the Glen Aulin High Sierra Camp and risks associated with stock use. Throughout the wild segments water quality would continue to be monitored and managed to meet NPS standards (which are higher than state water quality standards), through ongoing practices, including manure removal and other provisions outlined by the SFPUC to protect the Hetch Hetchy watershed. Water use at the Glen Aulin High Sierra Camp would continue to be restricted to 600 gallons per day to avoid saturation of the camp's leach mound (see "Glen Aulin," below).

Biological Value: Subalpine Meadow and Riparian Complex

Subalpine meadow and riparian areas would continue to be sustained by natural ecological processes. The management concern about subalpine meadows in wild segments of the river relates to localized impacts on meadow/riparian areas in Lyell Canyon, associated primarily with stock use. These impacts include high levels of bare ground in meadows with stock use when compared with meadows receiving low or no stock use (NPS, Ballenger et al. 2010j). Under the no-action alternative, commercial pack stock use would continue to be allowed by the concessioner under the concessions contract and by private pack stations under the provisions of current commercial use authorizations, the latter of which are renewed annually.

The majority of concessioner pack stock use in the river corridor is associated with the supply of the High Sierra Camps (see table 7-1). The concessioner generally operates one, sometimes two, strings of mules from Tuolumne Meadows to Vogelsang and Sunrise High Sierra Camps three times a week, and to May Lake and Glen Aulin High Sierra Camps two times a week (Boyers 2012). These concessioner stock trips do not involve any grazing because stock is kept in the corrals at Glen Aulin.

Currently three different pack stations operate in the river corridor under commercial use authorizations for overnight guided pack trips. Free-range grazing is allowed in wilderness where stock travel is permitted, with the exception of no-camping zones and areas near the High Sierra Camps. Between 2004 and 2010, commercial overnight stock use from these pack stations in Lyell Canyon ranged from 193 (2010) to 564 (2007) grazing-nights per year (1 grazing-night equals 1 animal grazing for 1 night; 2 grazing-nights could equal 2 animals grazing for 1 night or 1 animal grazing for 2 nights, and so on). There has been little private overnight stock use in the river corridor. (Additional discussion of commercial use in wilderness, including commercial stock overnight use, is included below, under “Recreational Value: Wilderness Experience along the River.”)

NPS administrative stock use occurs in wild segments in support of trail maintenance and utility operations at Glen Aulin. The level of use depends on where trail crews are working. In a busy summer, with two trail crews supplied from Tuolumne Meadows, an average of 15 head (and up to 30 head) of stock work out of the NPS corral, primarily supporting trail crew operations. Backcountry Utilities Division staff generally hike into Glen Aulin unless they have a project or need to pack compost. Their stock use averages 36 stock passes on the Glen Aulin trail over the course of an entire season (Boyers 2012); similar to the concessioner stock trips to Glen Aulin, this stock use does not involve any grazing because stock is kept in the corral at Glen Aulin.

Biological Value: Low-Elevation Riparian and Meadow Habitat

The management concern about low-elevation meadow and riparian habitat is that it might be transitioning in response to unnatural changes in the river’s hydrologic regime. Disruptions to natural flows caused by O’Shaughnessy Dam would be mitigated by science-based releases intended to more closely mimic natural flows and to provide maximum ecological benefits to the low-elevation riparian and meadow habitat in Poopenaut Valley.

Geologic Value: Stairstep River Morphology

No present or foreseeable management concerns are associated with the condition of stairstep river morphology in the river corridor. This river value is not affected by any ongoing or foreseeable use and does not require management or monitoring. Therefore, this river value is not considered further in the action alternatives.

Cultural Value: Archeological Landscape

Park staff would continue to identify, document, monitor, evaluate, and protect significant archeological sites in consultation with culturally associated American Indian tribes and groups through monitoring for changing site conditions, developing and implementing treatment measures, implementing visitor and employee education, and conducting research.

The primary management concern about prehistoric archeological sites in wilderness is the need to protect them from disturbance caused by visitor use. Under the no-action alternative, sites in the Lyell Fork, Upper Dana Fork, Grand Canyon, and Poopenaut segments would continue to be documented, monitored, and evaluated (where appropriate). Sites would continue to be protected by managing overnight use and campsites and by using natural features to conceal and divert foot traffic around sites.

Scenic Value: Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne

Natural scenery would continue to evolve in response to natural ecological processes, with no management of scenic vistas. The primary management concerns are the visibility of the Glen Aulin High Sierra Camp structures from a few locations along the trail through this area, and the manure and other signs of stock use on trails, which are offensive to some hikers. Both of these management concerns would continue under the no-action alternative. Additional information about the amount of stock use on trails is provided under “Recreational Value: Wilderness Experience along the River,” below.

Recreational Value: Wilderness Experience along the River

The primary management concerns about the wilderness experience along the river is the increasing day use on wilderness trails within the first few miles of Tuolumne Meadows trailheads and the potential for conflicts between hikers and stock users traveling the same wilderness trails. Because day use in wilderness is not covered by the existing overnight trailhead quota system, this use would remain unrestricted under the no-action alternative. Commercial use (guided stock and hiking trips) would continue under current management, and the potential for conflict between stock users and other visitors would remain unchanged. The amount of pack stock on trail segments within the river corridor is shown in table 7-1.

Table 7-1.
2011 Total Stock Use per Trail, Tuolumne River Corridor

| Trail | River Segment | Total Passes/ Stock Nights | Concessioner | NPS Administrative | Commercial Outfitter | Private Use |
|--|---|-------------------------------|--|--|-------------------------|---|
| Cathedral Lakes | Tuolumne Meadows (500-foot segment in WSR corridor) | ~340 passes | 186 passes (~1–2 mule strings/week to service Sunrise HSC) | 8 passes (sawyers and ranger patrols) | 52 passes | 94 passes |
| Glen Aulin | Tuolumne Meadows and Grand Canyon | ~1,127 passes | 801 passes (~ 768 passes to set up, take down, and service Glen Aulin HSC, 33 passes for half- and full-day rides) | 50 passes (backcountry utilities, sawyers, trail crew, ranger patrols) | 116 passes | 160 passes |
| Lyell Canyon | Tuolumne Meadows and Lyell Canyon | ~600 passes | 208 passes (~6 mule strings/week to service Vogelsang HSC) | 62 passes (backcountry utilities, sawyers, ranger patrols) | 214 passes | 116 passes |
| Parker/Mono Pass | Dana Fork | ~8 passes | 0 passes | 8 passes (sawyers, ranger patrols) | 0 passes | Few passes |
| Pate Valley within WSR | Grand Canyon | Unknown | 0 passes | No data for 2011 | 0 passes | 0 passes |
| Poopenaut (foot traffic only) | Poopenaut Valley | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |
| Tuolumne Meadows Campground and Miscellaneous Trails | Tuolumne Meadows | Unknown (at least 44) | 0 passes | 44 passes for ranger patrols | 0 passes | Unknown number of passes dispersed throughout Tuolumne Meadows trails |
| Unicorn Creek/Elizabeth Lake | Trailhead in Tuolumne Meadows | Unknown passes (at least 10) | 0 passes | 10 passes for ranger patrols | 0 passes | Occasional passes expected as trailhead near stock campsites. |
| Young Lakes | Tuolumne Meadows | ~1,232 passes | 1,214 passes (three 2-hour trail rides per day) | 18 passes (sawyers, ranger patrols) | 0 passes | Unknown passes |

Abbreviations: HSC = High Sierra Camp; WSR = wild and scenic river

Management of Visitor Use and User Capacity

Kinds of Visitor Use

Wild segments would continue to provide excellent opportunities for primitive, unconfined recreation. Management concerns about the quality of the visitor experience in wild segments relate to the increasing number of encounters with other parties on trails within a day hike of Tuolumne Meadows, and the potential for conflicts between hikers and stock users on trails.

Maximum Amounts of Visitor Use

Under the no-action alternative, visitor use capacity in wild segments would continue to be managed through an existing system of zone capacities and related overnight trailhead quotas, accommodating a total of 350 people per night in the Lyell Fork and Grand Canyon segments above Hetch Hetchy Reservoir (camping is prohibited along the Dana Fork). The zone capacity for the Poopenaut Valley segment below the reservoir would remain at 50 people per night. The capacity for each wilderness management zone in the river corridor is listed in table 7-2.

Table 7-2.
Existing Wilderness Management Zone Capacities

| Wilderness Management Zone (Tuolumne River Segment) | Maximum Overnight Use per Zone |
|---|--------------------------------|
| Lyell Canyon (Lyell Fork) | 125 |
| Glen Aulin (Grand Canyon) | 50 |
| Glen Aulin to Cold Canyon/Waterwheel Falls (Grand Canyon) | 75 |
| Pate Valley (Grand Canyon) | 100 |
| Miguel Meadow (Poopenaut Valley) | 50 |
| Total | 400 |

The only restrictions on day use in wilderness would be restrictions on group size (8 people per group off trail and 35 people per group on trail). The encounter rate on the trail to Glen Aulin occasionally reached 8 encounters with other groups per hour in 2010 (Broom and Hall 2010). Encounter rates on other trails in the corridor were lower; below Glen Aulin hikers rarely encountered more than four other groups per hour. Based on past trends, the current levels of use would be expected to continue or increase. Concessioner stock day rides into wilderness would continue at current levels of service (3 two-hour rides per day, 2 four-hour rides, and occasional all-day rides). Generally, the two-hour rides quickly exit the river corridor from the stable at the north edge of the Tuolumne Meadows segment and follow the Dog Lake trail. A maximum of 12 visitors and 2 wranglers per ride take the two-hour rides, and all three rides are often booked during July and August, which is when most of this use occurs. The four-hour rides, which can accommodate 10 visitors per ride, follow the Glen Aulin Trail through the Tuolumne Meadows and Grand Canyon segments; these rides are less popular. The full-day rides, which can accommodate six visitors, follow the Glen Aulin trail beyond Glen Aulin to Waterwheel Falls; these rides are rare. The maximum daily capacity of all rides is 62 people per day.

Overnight commercial use in the wilderness portions of the Tuolumne River corridor averaged approximately 451 person-nights per year from 2005 to 2009. Of those nights, 263 (58%) were on stock trips and 188 (42%) were on hiking trips. Commercial day use was negligible, averaging only 65 use days for the whole season, most of which occurred on the Mono/Parker Pass trail. Commercial use in 2009 (475 person-nights) was slightly higher than the five-year average, while the percentage of stock use (240 person-nights or 51%) was slightly lower than the five-year average (NPS, Fincher 2009n).

Administrative Use

Administrative users in wild segments of the river corridor include NPS and concessioner staff, park partners, and volunteers. These individuals engage in a variety of functions, including resource protection and stewardship; trail and bridge maintenance; visitor protection; maintaining the utilities and foodservice at the Glen Aulin High Sierra Camp; and providing visitor recreation, interpretive, and educational opportunities. Administrative users engage in a variety of travel modes, including stock, helicopter, or foot travel to carry out their work. Nine concessioner employees are housed at the Glen Aulin High Sierra Camp.

Glen Aulin (Potential Wilderness Addition)

Glen Aulin High Sierra Camp

The Glen Aulin High Sierra Camp is a concessioner-operated camp that provides rustic lodging and meal service for up to 32 overnight guests. The High Sierra Camp was designated a potential wilderness addition within the Yosemite Wilderness by the 1984 California Wilderness Act. Under the no-action alternative, the Glen Aulin High Sierra Camp would be retained at the current capacity of 32 guests. Day use at Glen Aulin would remain at current levels of approximately 45 people per day, and limited meal service would remain available for hikers and backpackers who are not staying at the camp.

Management concerns about river values at Glen Aulin focus on a risk to water quality associated with wastewater treatment at the camp, a risk to water quality associated with the use of stock to transport guests and supplies to the camp, localized impacts on scenic quality associated with the visibility of camp structures and signs of stock use along the Glen Aulin trail, an impact on the wilderness experience of some visitors caused by conflicts between hikers and stock users, and a risk to archeological sites associated with potential future development or maintenance of camp facilities.

To mitigate the risk of leach-mound failure, water use is restricted to 600 gallons per day. A number of water conservation measures have already been implemented to achieve this reduction in water use, including installation of low-flow toilets, elimination of guest showers, elimination of towel and linen service, conversion to disposable tableware, and menu revisions to conserve water.

Measures have also been taken to reduce stock trips, including menu revisions to reduce required supplies. These measures would continue under the no-action alternative.

The risk to individual sites contributing to the outstandingly remarkable archeological value of the Tuolumne River would be reduced by evaluating the sites to determine their eligibility for the National Register of Historic Places (NRHP); reducing, minimizing, or mitigating ongoing site impacts; and avoiding new impacts to the greatest extent possible. Where it is not feasible to avoid, minimize, or eliminate impacts, the NPS would conduct data recovery excavations and perform other mitigative actions in consultation with culturally associated American Indian tribes.

The historic character of the Glen Aulin High Sierra Camp would be retained with no change in the layout or design of facilities. Utilities would remain limited to water and wastewater systems powered by solar energy and gas-powered generators; propane would continue to be used for cooking. Guest tent cabins have wood stoves, and wood would continue to be packed in by the concessioner; however, there is no electric power to the guest tent cabins. The following facilities would be retained (see figure 7-1):

- three permanent structures (cookhouse, toilet building with flush toilets, and storage shed)
- dining tent with concrete and stone foundation and footings
- storage tent with concrete and stone foundation and footings

- shower tent (for employees only) with concrete foundation
- guest tent cabins (eight units) with concrete foundations
- employee tent cabins (four units) with concrete foundations
- water and wastewater treatment facilities (including a water storage tank, a chlorinator located in a small permanent building, a filter tank, surge tanks, a belowground septic tank, a wastewater leach mound, and solar panels), many with concrete foundations

Backpacker Campground

The backpacker campground would be retained. The aging composting toilet at the campground would not be replaced under the no-action alternative. Overnight use at the backpacker camp would continue to be managed through the wilderness zone capacity for Glen Aulin, which is currently set at 50 people per night. Dispersed backpack camping is not allowed in the Glen Aulin vicinity, to mitigate impacts of overnight use at this popular destination.

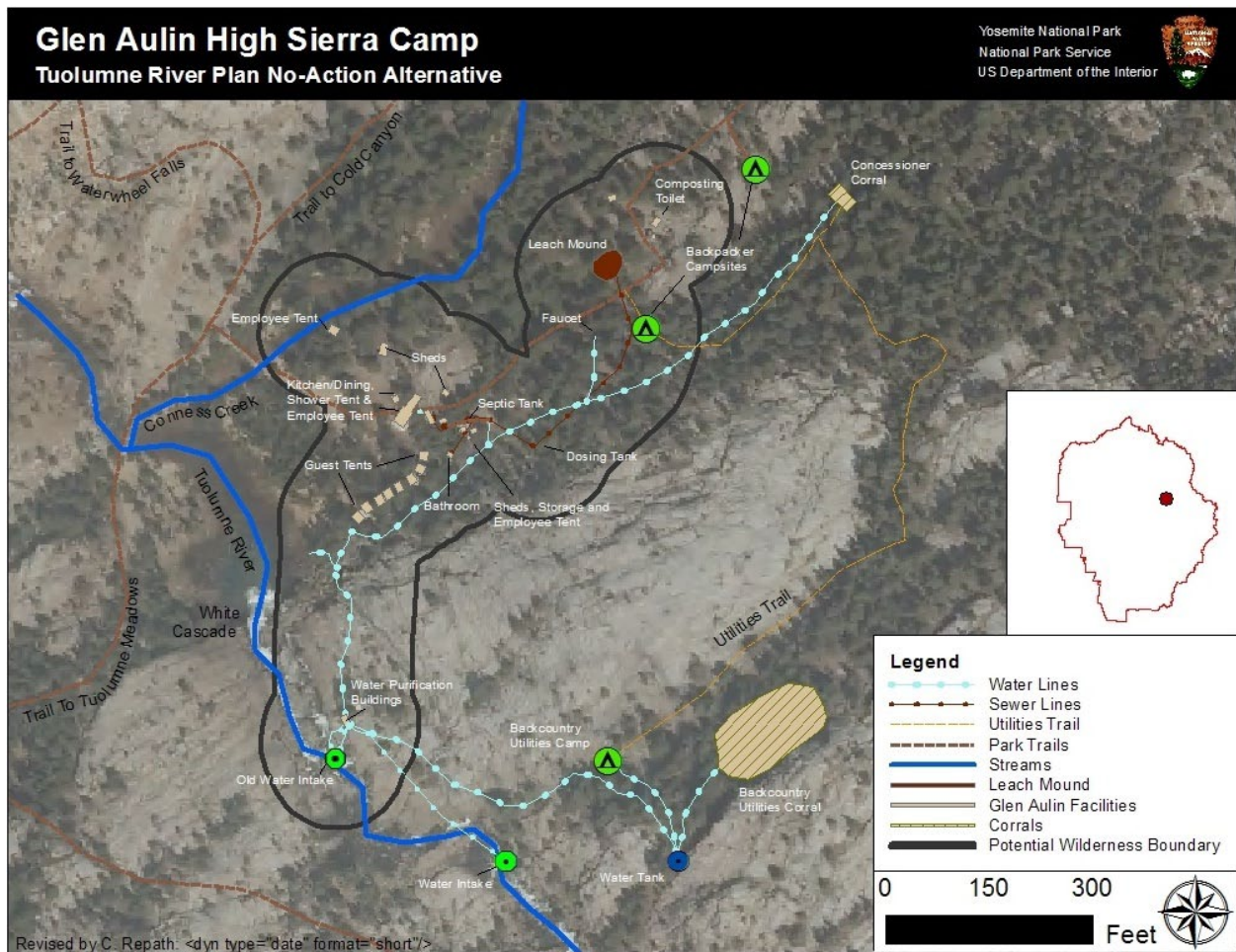


Figure 7-1. Glen Aulin Site Plan, No-Action Alternative.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)

This discussion pertains only to the nonwilderness portions of the Tuolumne Meadows and Lower Dana Fork segments. Portions of these segments within designated wilderness would be managed the same as the wild segments. The discussion focuses on the actions currently underway to address the management concerns identified in chapter 5.

Resource Management

Free Flow

Management concerns about free flow in the Tuolumne Meadows/Tioga Road area relate to water withdrawals to support visitor and administrative use; an aging water intake, treatment, and distribution system; interference with high flows caused by bridge abutments; and interference with river flow caused by the short section (approximately 150 feet) of riprap placed to protect the campground A-loop road. The no-action alternative would continue existing management regarding these issues, as follows:

- Continue withdrawals averaging about 64,000 gallons per day to support visitor and administrative use (see table 7-6 later in this chapter, which compares current water consumption with consumption under alternative 1). If increasing use or prolonged periods of drought made withdrawals unsustainable in terms of impacts on downstream habitat, further water restrictions would be imposed through mandatory rationing or closures.
- Maintain existing domestic water and wastewater systems.
- Retain existing bridges with no action to mitigate impacts on river hydrology during high flow periods.
- Retain the boulder riprap along an approximately 150-foot-long section of riverbank, installed to protect the campground A-loop road.

Water Quality

Concerns about water quality in the Tuolumne Meadows/Tioga Road area relate to an unstable road cut (the “little blue slide”) along Tioga Road near the Dana Fork; an aging wastewater treatment and disposal system; stock use impacts; and underground fuel storage tanks. The no-action alternative would continue existing management regarding these issues, as follows:

- Maintain existing utilities.
- Take no action to stabilize the road cut along Tioga Road near the Dana Fork.
- Continue best management practices, including daily removal of manure from corrals and water courses within the first 0.25 mile of trails leading from stable operations, to mitigate the potential for impacts on water quality associated with stock use.
- Mitigate risks associated with aging utilities, stock use, and fuel tanks through water quality monitoring and continued compliance with state water quality regulations.

Biological Value: Subalpine Meadow and Riparian Complex

Management concerns for the subalpine meadow and riparian complex in the Tuolumne Meadows/Tioga Road area relate to

- informal trails across meadows, along riverbanks, and at popular attractions, associated primarily with undesignated roadside parking and facilities sited in meadow and riparian areas
- disruptions to sheet flow across meadows, associated with inadequate Tioga Road culverts and the historic Great Sierra Wagon Road
- diminishing riparian vegetation along riverbanks

- changes in meadow vegetation, suspected of being associated with historical sheep grazing, past and current visitor use and development, and climate change

The mechanical removal of lodgepole pine seedlings to inhibit their encroachment into open meadows was practiced from at least as early as 1933 (Cooper et al. 2006) through 2010. No management to mechanically remove lodgepole from the meadows has occurred since 2010, and it would not be resumed unless ongoing research indicated that it should be part of a comprehensive ecological restoration program for the meadows.

By definition, the no-action alternative would not include any new management actions to address concerns about changing meadow and riparian vegetation. However, actions to address these issues might still be taken as part of other planning and management projects, independent of the *Tuolumne River Plan*. The NPS continuously responds to resource management issues and has already initiated some projects that directly respond to the current issues summarized above. For example, trampled areas and informal trails at Tuolumne Meadows are being restored to natural conditions during the summer of 2012. Because these actions are being conducted independently of the *Tuolumne River Plan*, they are not considered part of the no-action alternative for the *Tuolumne River Plan/Draft EIS*, and they require separate compliance (such as NEPA analysis or consultations with other federal or state agencies or tribes).

For purposes of providing a baseline for comparison of action alternatives, the no-action alternative would continue the following ongoing management:

- Continue to allow undesignated roadside parking along Tioga Road and the road to the Tuolumne Meadows Lodge, which would continue to encourage informal trailing across meadows.
- Retain the following facilities in meadow and riparian areas: concessioner employee housing behind the store and grill, some concessioner and visitor tent cabins at Tuolumne Meadows Lodge, and several campsites near the river.
- Take no action to improve the Tioga Road culverts to mitigate effects on surface flow into Tuolumne Meadows.
- Continue to protect the remaining segments of the historic Great Sierra Wagon Road and use them for trails, with no management action to mitigate impacts on meadow hydrology.
- Take no action to reestablish riparian vegetation along riverbanks.
- Take no action to improve the Tioga Road bridge or the footbridge at Parsons Memorial Lodge to mitigate adverse impacts on river hydrology during periods of high flows.
- Continue research to determine the conditions necessary for the ecological recovery and long-term integrity of river-related habitats in Tuolumne Meadows.

Cultural Value: Archeological Landscape

Although the park staff would continue to identify, document, monitor, and evaluate significant archeological sites in consultation with culturally associated American Indian tribes, no new actions to protect sites would be initiated as part of the *Tuolumne River Plan*.

The primary management concern about archeological sites is ongoing disturbance associated with visitor use, primarily informal trails. Action to resolve this issue will require a comprehensive approach to address the causes of impacts on archeological sites. The no-action alternative would not include any new management actions to address these issues (although they might be addressed through other resource planning and management). For purposes of providing a baseline for comparison with action alternatives, management under the no-action alternative would strive to mitigate the impacts of informal trails through placement of logs or other natural objects to disguise the sites and divert foot traffic.

No new development is proposed under the no-action alternative. Effects on archeological sites from potential future actions (independent of the *Tuolumne River Plan*) would be addressed through procedures outlined in the park's programmatic agreement for section 106 of NHPA, potential new agreement(s), or by following the implementing regulations for NHPA section 106.

Cultural Value: Parsons Memorial Lodge

Parsons Memorial Lodge would continue to be preserved through periodic assessments and appropriate treatments. No management concerns have been identified for this value.

Scenic Value: Scenery through Dana and Tuolumne Meadows

The management concern identified for outstandingly remarkable scenic values in the Tuolumne Meadows/Tioga Road area are associated with the encroachment of undesignated roadside parking and conifers. These concerns would be addressed under the no-action alternative by continuing ongoing actions:

- Continue to allow the mechanical removal of conifers for scenic vista management.
- Take no action to manage scenic vista points.
- Take no action to eliminate undesignated roadside parking and the associated impact on scenic views.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

The major management concern regarding this outstandingly remarkable recreational value is the potential for crowding and congestion—particularly vehicle congestion—to change the quality of the experience for visitors accessing the Tuolumne River through Tuolumne and Dana Meadows by way of Tioga Road. Under the no-action alternative, parking would not be restricted by any additional barriers to protect sensitive resources; however, no additional designated parking would be provided to reduce vehicle congestion and competition for parking spaces. It is estimated that the designated parking at Tuolumne Meadows currently can accommodate only about 60% of the maximum demand for day and overnight parking, so that almost 40% of all visitors must park along roadsides or squeeze into other undesignated spaces. Although most visitors who were recently surveyed responded that they were satisfied with their ability to find parking (White 2010), some were dissatisfied with the traffic congestion, the pedestrian/vehicle conflicts, and the intrusions into scenic views caused by undesignated roadside parking.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

A full range of orientation, interpretation, and education programs would continue to be conducted at the existing visitor center, wilderness center, and Parsons Memorial Lodge, and in the field. These programs would continue to help visitors understand, appreciate, and connect with the Tuolumne River and encourage visitor behaviors that are protective of resources.

Current commercial services (store/grill, public fuel station, mountaineering shop and school, concessioner stock day rides) would be retained. The U.S. Postal Service (USPS) would continue to contract with the park concessioner to provide incoming and outgoing mail service, including packages for through-hikers on the Pacific Crest and John Muir Trails. (This service would remain subject to future USPS level-of-service decisions beyond NPS control.)

Opportunities for overnight use would include camping and lodging at current capacities (2,034 people at the campground and 276 people at Tuolumne Meadows Lodge).

Shuttle bus service between destinations within the Tuolumne Meadows area would continue to operate at the current level of service (see “Tuolumne Meadows Shuttle Bus Service” under “Transportation” in chapter 8; existing shuttle bus stops are shown on the site plan map, figure 7-2). The Tuolumne Meadows shuttle bus currently runs from the Tuolumne Meadows Lodge west to Olmsted Point and back, making 12 stops and with departures every 30 minutes during the day. The Tioga Pass shuttle runs from the lodge east to Tioga Pass and back, with four departures in each direction daily).

Maximum Amounts of Visitor Use

Day Use

Current maximum day use in the Tuolumne Meadows area and adjacent wilderness is estimated at 1,762 people at one time. This number is reached only during peak periods (e.g., some weekends in July and August); at other times day use is less. This estimate of maximum day use is the sum of two factors:

- (1) the most current (2011) observed maximum number of parked cars counted on a peak day, presumed to belong to day visitors (530 total vehicles parked at the peak of the summer season) multiplied by an average of 2.9¹ persons per car, for 1,537 maximum people at one time, plus
- (2) the maximum number of day visitors who can arrive by in-park shuttles, tour bus, and regional public transportation (225 people per day)

Because only 340 designated parking spaces were available for day visitors in 2011, more than a third of these day visitors (an estimated 551 people in 190 vehicles on the day in 2011 with the highest parking counts) were parking along roadsides and crowding into the existing parking areas. A comparison of designated and undesignated parking is provided under “Site Development,” below.)

Overnight Use

The overnight capacity at Tuolumne Meadows is 2,310 people per night: 2,034 people are accommodated in the 304 sites (6 people per site) plus 7 group sites (30 people per site) in the campground, and 276 people are accommodated in the 69 guest tent cabins at Tuolumne Meadows Lodge. Actual overnight use levels are lower than these capacities because individual campsites and lodging units are not always occupied by the maximum number of people allowable. Some campsites are available through a reservation system, while the rest of the campsites are available on a first-come/first-served basis.

Administrative Use

Administrative uses are most concentrated in the river corridor at Tuolumne Meadows. Administrative activities in these segments include scientific study and resource monitoring, maintenance and facility operations functions, food service and hospitality, education and interpretation, and visitor protection, including emergency services. Staffing levels in the Tuolumne River corridor change annually, depending on operational needs.

Currently, housing is provided for 104 NPS employees at Tuolumne Meadows. However, up to 150 NPS employees currently work at Tuolumne Meadows in the summer, including NPS research and restoration crews, trail crews, and volunteers who work out of Tuolumne Meadows on an intermittent basis. The actual number of employees at Tuolumne Meadows at any one time fluctuates due to the different nature and

¹ The vehicle occupancy rate is 2.9 persons per vehicle, based on visitor studies conducted over the past 20 years that found an average vehicle occupancy ranging from 2.6 to 3.4 (Van Wagendonk and Coho 1980; FHWA 1982; ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). Based on this range, an average of 2.9 persons per vehicle is used for estimating visitor numbers for planning purposes in this document.

duration of employee assignments. However, even allowing for this fluctuation, the amount of housing is never sufficient to accommodate all of the NPS employees who are working in the area at any one time, resulting in some employees having to commute, double up, or camp in the campground.

Approximately 103 concessioner employees are housed at Tuolumne Meadows to support visitor services such as the store and grill, lodge, concessioner stable, and the mountaineering shop/school. Most employees park their personal vehicles near their residences, or occasionally, at the wilderness lot near Bug Camp or at Tuolumne Meadows Lodge.

Site Development at Tuolumne Meadows

Most development in the river corridor is situated south of Tioga Road at the edge of the lodgepole pine forest that surrounds Tuolumne Meadows. Most of the development at Tuolumne Meadows is inside the wild and scenic river corridor, with the exception of the western half of the campground, which is outside the corridor boundary. The development pattern is the result of a plan that was completed by the NPS in 1929 (NPS 2007t). Its purpose was to minimize impacts on the natural and scenic resources of Tuolumne Meadows by confining physical development to well-defined clusters along the meadow's southern margins in a way that avoided the need for cross-meadow traffic by vehicles, stock, and pedestrians. Circulation patterns were aligned according to similar principles. Much of the construction was implemented by the Civilian Conservation Corps (CCC), and the site retains some excellent examples of CCC design and handiwork.

In the 1930s the Tioga Road was reconstructed to mitigate its impact on the meadow and to take greater advantage of the panoramic views available to motorists traveling along the meadow's edge. Attention to views and vistas was identified as an important guiding principle, with vantage points carefully selected to maximize the aesthetic effect of varying views of broad open meadows, dark forests, and surrounding peaks.

Although the principles guiding the 1929 plan have clearly characterized ongoing development throughout the Tuolumne Meadows Historic District, the plan was never fully realized, and vestiges of earlier development patterns still exist. These include a cluster of structures that once formed the core of the Sierra Club's inholding at Soda Springs; the original NPS administrative area at Ranger Camp, which was supposed to be demolished when the development plan was fully realized; and the old Insect Research Station (Bug Camp), which was designed to be temporary but has remained a center for resource management and employee housing to the present (NPS 2007t). Furthermore, over the past decades aging utilities and increasing demand for parking and other facilities have resulted in a piecing together of historic and nonhistoric elements and localized impacts on the meadows.

Under the no-action alternative, all the existing facilities would be retained and the Tuolumne Meadows area would generally retain the character of a rustic, temporary outpost at the edge of the Sierra wilderness. The structures, mostly tent cabins that are taken down each fall and erected each summer, and their dispersed (rather than consolidated) placement would continue to reinforce a sense of minimal amenities and deference to the natural setting. Table 7-3 contains a summary of existing facilities for comparison with the facilities included in alternative site plans.

A comprehensive site plan to guide the future repair or replacement of aging utilities and infrastructure and the provision of appropriate visitor and administrative facilities is proposed and addressed as part of this *Tuolumne River Plan/Draft EIS*, but it is not included in this no-action alternative.

**Table 7-3.
Current Facilities, Tuolumne Meadows**

| Facility Type | Description |
|---|--|
| Visitor Services | <ul style="list-style-type: none"> ▪ visitor center, restrooms ▪ wilderness center ▪ store and grill ▪ lodge (69 guest tent cabins [276 guests], hard-sided kitchen, hard-sided shower house, canvas-sided dining hall) ▪ public fuel station ▪ mountaineering shop/school ▪ post office ▪ recreational vehicle dump station |
| Campgrounds | <ul style="list-style-type: none"> ▪ 304 campsites (1,824 people) in seven loops, A–G, plus 7 group campsites (210 people) ▪ campground office |
| Picnic Areas | <ul style="list-style-type: none"> ▪ picnic area near Lembert Dome |
| Trails | <ul style="list-style-type: none"> ▪ Pothole Dome trail (hiking) ▪ Cathedral Lakes trail (hiking and stock use) ▪ Segments of the historic Great Sierra Wagon Road bed through the Tuolumne Meadows area (Now part of the Pacific Crest Trail): <ul style="list-style-type: none"> ▫ Segment from Tioga Road to Parsons Memorial Lodge and on to Glen Aulin (hiking and stock use) ▫ Segment from Parsons Memorial Lodge to Lembert Dome; hiking and stock use and administrative road) ▫ Segment from Lembert Dome to Tuolumne Meadows Lodge (hiking and stock use) ▪ Elizabeth Lakes trail (hiking) ▪ Lembert Dome trail (hiking) ▪ Dog Lake trail (hiking and stock use) ▪ John Muir Trail (merges with the Pacific Crest Trail through Lyell Canyon; hiking and stock use) |
| Stables | <ul style="list-style-type: none"> ▪ NPS stable (capacity up to 60 head of stock) ▪ concessioner stable (capacity up to 100 head of stock) |
| Park Operations | <ul style="list-style-type: none"> ▪ ranger station ▪ maintenance yard and offices ▪ aboveground diesel fuel tank for administrative use (currently used only by the concessioner) ▪ search-and-rescue cache ▪ helipad at Gaylor Pit |
| Housing (NPS Employees) | <ul style="list-style-type: none"> ▪ Road Camp (17 employees) ▪ Ranger Camp (54 employees), restrooms, shower house, laundry room ▪ Bug Camp (33 employees), restrooms, shower house |
| Housing (Concessioner Employees) | <ul style="list-style-type: none"> ▪ Tuolumne Meadows Lodge (48 employees) ▪ behind the store/grill and fuel station (42 employees) ▪ concessioner stable (13 employees) |
| Utility Systems | <ul style="list-style-type: none"> ▪ wastewater treatment plant and recreational vehicle dump station ▪ wastewater containment ponds and sprayfields ▪ domestic water intake, treatment, and storage tanks |

Table 7-3.
Current Facilities, Tuolumne Meadows (continued)

| Facility Type | Number of spaces | Description |
|---|--|---|
| Day Parking (Number of designated parking spaces in the Tuolumne Meadows area allotted to day visitors) | 16 | parking area at Pothole Dome |
| | 50 | parking area at the visitor center |
| | 11 | parking area at the campground office |
| | 11 | parking in the campground for the Elizabeth Lakes trailhead |
| | 15 | parking at the fuel station |
| | 51 | parking area at the store and grill |
| | 58 | parking area at the concessioner stable |
| | 29 | parking area at the base of Lembert Dome |
| | 7 | parking area at the ranger station |
| | 25 | parking area at the Dog Lake/John Muir Trail trailhead |
| | 67 | parking areas in the road corridor east of Tuolumne Meadows, including the Mono Pass and Gaylor Peak trailheads and the Dana Meadows and other pullouts |
| 340 | total designated day parking space ^a | |
| +190 | additional cars parked in undesignated spots during peak demand ^b | |
| Overnight Parking | 102 | Tuolumne Meadows Lodge |
| | 58 | parking area at the wilderness office |
| | 33 | parking area at the Dog Lakes/John Muir Trail trailhead |
| | 0 | parking at the Cathedral Lakes trailhead |
| | 0 | parking along the road to the concessioner stable |
| | 193 | total designated overnight parking spaces |
| | +147 | additional cars parked in undesignated spots during peak demand ^b |

a Parking for people who might ride the Tioga Pass shuttle to access Tuolumne Meadows from one of the parking areas to the east along Tioga Road are included in the parking figures for Tuolumne Meadows (67 spaces accommodating 194 people). Parking for people who might ride the Tuolumne Meadows shuttle from one of the parking areas west of Tuolumne Meadows (notably Tenaya Lake and Olmsted Point) are not included in the parking figures for Tuolumne Meadows, primarily because most of the parking in these areas is used by Tenaya Lake and Olmsted Point visitors who do not ride the shuttle. Only a small number of visitors ride the shuttle between Tenaya Lake and Tuolumne Meadows.

b More cars currently park in the Tuolumne Meadows area than can be accommodated in the available designated parking spaces. Parking counts conducted in 2011 indicate that a maximum of 870 cars were parked at Tuolumne Meadows at the peak of the summer season. This includes cars parking in the 533 designated day and overnight parking spaces listed above and an additional 337 cars that were crowding into established parking areas and along roadsides. It is assumed that 340 spaces are needed to accommodate existing overnight users; because only 193 spaces are currently designated for overnight users, it is estimated that 147 vehicles belonging to overnight users are currently parking in undesignated areas. The remainder of the cars parked in undesignated areas is assumed to belong to day visitors.

Scenic Segment (Below O’Shaughnessy Dam)

The Below O’Shaughnessy Dam segment is a 1-mile-long segment that begins approximately 500 feet below the dam and ends where the wilderness boundary crosses the river (see figure 3-1). It includes a portion of an administrative road and some structures associated with the operation of the dam. There are no public facilities, and visitor use is not encouraged for reasons of public safety and dam security. There is no employee housing in this segment. Beyond the road and developed site, the remainder of the segment is in designated wilderness. There would be no change in management or use of this segment under the no-action alternative.

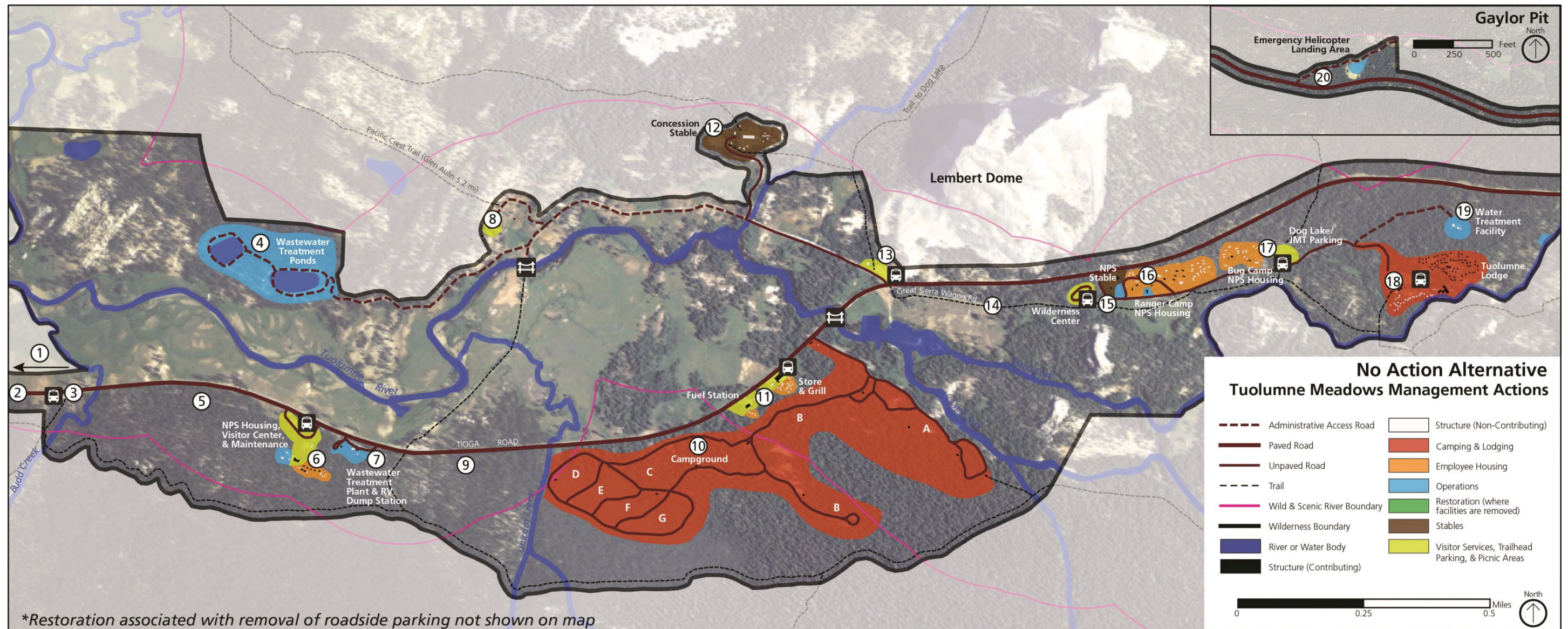


Figure 7-2. Tuolumne Meadows Site Plan, No-Action Alternative.

Key to figure 7-2 and List of Facilities Management Actions:

| | | | |
|--|--|--|---|
| <p>1. Pothole Dome scenic pullout/ parking areas</p> <ul style="list-style-type: none"> Retain roadside pullout/day parking and trailhead on north side of road. Retain roadside pullout/day parking on south side of road. Retain trail to Pothole Dome. | <p>6. Existing visitor center and Road Camp</p> <ul style="list-style-type: none"> Retain visitor center and day parking. Retain NPS employee housing. Retain maintenance yard and office. | <p>11. Existing commercial services core</p> <ul style="list-style-type: none"> Retain store, grill, mountaineering shop/school, public fuel station, and day parking. Retain concessioner employee housing. | <p>16. Existing ranger station and Ranger Camp</p> <ul style="list-style-type: none"> Retain ranger station and day parking. Retain aboveground diesel fuel tank. Retain NPS employee housing. |
| <p>2. Tioga Road through the Tuolumne Meadows area</p> <ul style="list-style-type: none"> Retain Tioga Road in its current alignment. Allow undesignated roadside parking. Retain vehicle bridge. | <p>7. Wastewater treatment plant</p> <ul style="list-style-type: none"> Retain wastewater treatment plant. Retain recreational vehicle dump station. | <p>12. Existing concessioner stable</p> <ul style="list-style-type: none"> Retain concessioner stable and day parking. Retain concessioner employee housing. | <p>17. Bug Camp, Dog Lake/John Muir Trail parking</p> <ul style="list-style-type: none"> Retain NPS employee housing. Retain day and overnight parking. |
| <p>3. Existing Cathedral Lakes trailhead</p> <ul style="list-style-type: none"> Allow undesignated roadside parking; retain trailhead. | <p>8. Parsons Memorial Lodge</p> <ul style="list-style-type: none"> Preserve Parsons Memorial Lodge and retain vehicle access. Retain footbridge. | <p>13. Lumbert Dome</p> <ul style="list-style-type: none"> Retain day parking and trailheads for Lumbert Dome and Parsons Memorial Lodge. Retain picnic area. | <p>18. Tuolumne Meadows Lodge</p> <ul style="list-style-type: none"> Retain lodge and overnight parking. Retain roadside parking along access road. Retain concessioner employee housing. |
| <p>4. Existing wastewater ponds and sprayfields</p> <ul style="list-style-type: none"> Retain ponds, sprayfields, and service road. | <p>9. Area west of Unicorn Creek</p> <ul style="list-style-type: none"> Retain as undeveloped natural area. | <p>14. Old Tioga Road/Great Sierra Wagon Road</p> <ul style="list-style-type: none"> Preserve as trails. | <p>19. Water treatment facility</p> <ul style="list-style-type: none"> Retain water treatment facility. |
| <p>5. Area east of Budd Creek and west of existing visitor center</p> <ul style="list-style-type: none"> Retain as undeveloped natural area. | <p>10. Tuolumne Meadows campground</p> <ul style="list-style-type: none"> Retain campground in current loop configuration (304 sites plus 7 group sites). Retain campground office and day parking. Retain Elizabeth Lakes trailhead and day parking. | <p>15. Existing wilderness center and NPS stable</p> <ul style="list-style-type: none"> Retain wilderness center and overnight parking. Retain NPS stable. | <p>20. Gaylor Pit</p> <ul style="list-style-type: none"> Retain helipad. Allow undesignated day parking. Retain day and overnight parking along access road. |

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Actions Common to Alternatives 1–4

Many of the actions for protecting and enhancing river values would be common to all the action alternatives. These actions respond to the management concerns about river values, which are outlined in chapter 5. Since these actions would be common to all of the action alternatives, they are already incorporated into the body of the *Tuolumne River Plan*. They are described in detail in chapter 5, “River Values and Their Management.” They are also summarized here to emphasize that they would be integral parts of any of the action alternatives, although they are not repeated under each alternative.

Wild Segments (Designated Wilderness and Glen Aulin)

Resource Protection and Enhancement

Free Flow

- Continue to work cooperatively with the SFPUC and others to inform releases from O’Shaughnessy Dam intended to more closely mimic natural flows.

Water Quality

- Replace the composting toilet at the backpacker campground at Glen Aulin High Sierra Camp.

Biological Value: Subalpine Meadow and Riparian Complex

- Reduce the potential for stock-related impacts in Lyell Canyon by regulating stock use as follows:
 - Establish an opening date for stock to enter the high country that protects meadow and riparian areas during the wettest portions of the spring and early summer.
 - Manage stock use to not exceed 192 grazing-nights per year. This target grazing capacity for meadows in the Lyell Fork was based on recent meadow condition assessments and past research (Cole et al. 2004) to estimate the grazing levels that can be sustained without undesirable effects on meadow habitat (NPS, Ballenger 2010h). Meadows receiving high use would be monitored annually to ensure that the target grazing capacity was protective of river values (NPS, Ballenger et al. 2010j). This management action would apply only to stock grazing-nights; additional stock use nights could be accommodated and still be protective of river values if users packed in their own feed. (Additional limitations on commercial use in wilderness, including commercial overnight stock use, are described under “Management of Visitor Use and User Capacity,” below.)
 - Allow camping with stock only in two designated campsites that are located away from sensitive resources.
 - Restrict campsite access to only approved routes found suitable to protect natural and cultural resources.
 - Restrict grazing to certain locations found suitable to protect natural and cultural resources.
- Restore localized areas previously disturbed by human and pack stock use in Lyell Canyon, using techniques that meet the minimum-requirement criteria established under the Wilderness Act.

Biological Value: Low-Elevation Riparian and Meadow Habitat

- Make informed recommendations for water releases from the dam that would provide maximum ecological benefits to the river-dependent ecosystems below the dam.

Cultural Value: Archeological Landscape

- Protect prehistoric archeological sites by diverting use away from sensitive areas.
- Mitigate ecological restoration practices by using noninvasive techniques wherever possible, and undertake site-specific treatment actions, such as data recovery, where necessary to avoid resource loss through park actions or, where possible and practicable, through natural forces.

Scenic Value: Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne

- Continue to allow the natural scenery to evolve in response to natural ecological processes, with no management of scenic vistas.

Recreational Value: Wilderness Experience along the River

- Continue to manage overnight use in wilderness through an overnight trailhead quota system (see “Maximum Amounts of Use,” below) to protect opportunities for solitude.
- Continue to maintain the formal trails through Lyell Canyon, the Grand Canyon of the Tuolumne, and Poopenaut Valley.

Management of Visitor Use and User Capacity

User capacity for the river corridor has two components: visitor use and administrative use. The corridor must be able to accommodate both capacities within the management standards for river values presented in chapter 5. In the discussion that follows, visitor use and associated visitor capacity is described first, followed by administrative use and associated employee capacity.

Kinds of Visitor Use

Individuals would continue to have opportunities for all the kinds of recreational activities that currently occur in wild segments of the corridor. (Commercial support for recreational activities, including guided day hikes, overnight hikes, and overnight stock trips, and concessioner stock day rides would vary among the alternatives.)

Maximum Amounts of Visitor Use and Management of Visitor Use Capacity

The day use capacity in wild segments of the river corridor would vary among the alternatives. Day visitors in the wild segments above Hetch Hetchy Reservoir access these segments from parking in the Tuolumne Meadows area; therefore, changes in use levels in the Tuolumne Meadows and Lower Dana Fork segments have the potential to affect use levels in the wild segments. Under all alternatives, the amount of day use in wild segments would be managed to stay within a management standard established to protect a wilderness experience along the river; the suite of potential management actions could include additional management of day parking or implementation of a day trailhead quota system (see chapter 5).

Overnight user capacity would continue to be managed through a system of zone capacities and related overnight trailhead quotas that currently accommodate a maximum of 350 backpackers per night above Hetch Hetchy Reservoir and a maximum of 50 backpackers per night below the reservoir (see table 7-2). Under any of the action alternatives, the zone capacities might be reduced in the future if it was determined that reductions were needed to protect wilderness character; however, they would not be increased above the current levels, which have been determined to be protective of river values.

The kinds and amounts of overnight use associated with the Glen Aulin High Sierra Camp would vary among the alternatives.

Administrative Use

Administrative use is a separate user capacity issue that primarily relates to employee housing and associated implications for water consumption and wastewater treatment within the corridor. The only employee housing in wild segments would be at the Glen Aulin High Sierra Camp. The number of employees housed at Glen Aulin would vary by alternative, depending on the levels of visitor use and water consumption prescribed by each alternative.

Glen Aulin (Potential Wilderness Addition)

The Glen Aulin High Sierra Camp would be managed differently under alternatives 1–4; however, whether the camp remained, was reduced in size, or was completely removed (these are the management options considered in the alternatives), ecological restoration would be undertaken to mitigate current impacts on wetlands and riverbanks. Although the habitats at Glen Aulin have not been identified as an outstandingly remarkable value of the river, all federal land managers are directed to protect wetlands under Executive Order 11990. In addition, riverbank restoration would help to enhance the free-flowing character of the river. Detailed direction for this work is provided in the *Ecological Restoration Planning Report*, which is summarized in chapter 5 and appended to this document as appendix H. The actions that would occur under any of the action alternatives are summarized below:

- Remove any impacts on wetlands and restore currently affected areas to natural conditions.
- Reroute the heavily used trail out of the fragmented wetland to a less-sensitive upland area.
- Revegetate the historic corral on the granite bench that once was an extension of a delineated wetland.
- Revegetate, stabilize, and protect denuded riverbanks on the Tuolumne River.

The following management of the backpacker campground would be common to all the action alternatives:

- Retain the backpacker campground to accommodate no more than 50 people per night (based on the capacity of the Glen Aulin wilderness zone).¹ This zone capacity, which would be protective of river values, would be managed through the trailhead quota system. The capacity might be reduced (but not increased) in the future if it was determined that a reduction was needed to protect wilderness character.
- Replace the aging composting toilet at the campground to adequately handle waste loads and reduce the risk to water quality.

¹ Because Yosemite restricts backcountry use by trailhead, not by site, it is difficult to estimate the capacity of this campground. However, because the majority of Glen Aulin zone users stay at the campground, while few who enter the river corridor from other trailheads pass through the Glen Aulin area, the Glen Aulin zone capacity suffices for a reasonable estimate of this campground's capacity.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)

Note that this discussion pertains only to the nonwilderness portions of the Tuolumne Meadows and Lower Dana Fork segments. The portions of these segments within designated wilderness would be managed the same as the wild segments.

Resource Protection and Enhancement

Free Flow

- Continue to improve water conservation and sustainability practices, including installation of water meters, use of low-flow fixtures, and visitor and employee education, and identify and implement additional long-term water conservation measures.
- Improve the Tioga Road bridge at Tuolumne Meadows and the footbridge at Parsons Memorial Lodge to mitigate impacts on river hydrology during periods of high flows. Improvements to both bridges would be compatible with their historic character, and would require additional planning and compliance.
- Remove approximately 150 feet of boulder riprap from the riverbank near the campground A-loop road to allow the river to flow more freely.

Water Quality

- Upgrade utility systems to conserve water and protect water quality.
- Stabilize the road cut east of Tuolumne Meadows along Tioga Road to reduce erosion into the Dana Fork.
- Continue best management practices to mitigate the potential for impacts on water quality associated with administrative and private stock use.

Biological Value: Subalpine Meadow and Riparian Complex

Alternatives 1–4 would protect subalpine meadow and riparian areas from visitor-related impacts by removing informal trails; mitigating the hydrologic impacts caused by historic trail segments; and eliminating all facilities except roads, trails, and some underground utilities from meadow and riparian areas. Detailed direction for this work is provided in the *Ecological Restoration Planning Report*, which is summarized in chapter 5 and included as appendix H. Referenced locations are shown on the Ecological Restoration map (figure 5-11) in chapter 5. Meadow and riparian areas would be further enhanced by ecological restoration projects designed to restore riparian vegetation to riverbanks; direction for this work is also provided in the *Ecological Restoration Planning Report*. Research would continue to identify and protect or reestablish the conditions necessary for the ecological recovery and long-term integrity of river-related habitats suspected of disruption by historic and contemporary human use, climate change, and other disturbances. Actions common to alternatives 1–4 are summarized below and described in greater detail in chapter 5 and appendix H:

- Eliminate undesignated roadside parking and associated informal trails at Tuolumne Meadows.
- Remove structures inappropriately sited near the riverbank or in wet areas.
- Restore riparian vegetation along riverbanks.
- Mitigate effects of Tioga Road culverts.
- Mitigate effects of the Great Sierra Wagon Road.
- Conduct additional research to determine causes of altered riparian and meadow condition in Tuolumne Meadows.
- Increase interpretive programming to educate visitors about the fragility of meadow/riparian areas.

Cultural Value: Archeological Landscape

- Protect prehistoric archeological sites by removing informal trails and managing visitor use to avoid sensitive areas.
- Avoid, reduce, or mitigate the potential effects of ecological restoration by using noninvasive techniques wherever possible, and undertake site-specific treatments and data recovery where necessary to avoid resource loss through park actions, or where possible and practicable to avoid resource loss through natural forces.

Cultural Value: Parsons Memorial Lodge

- Preserve Parsons Memorial Lodge through periodic assessments and appropriate treatments directed by the guidance for properties included on the List of Classified Structures.

Scenic Value: Scenery through Dana and Tuolumne Meadows

- Continue to allow the natural scenery to evolve in response to natural ecological processes. Vegetation removal for scenic vista management at specific vista points (see appendix J) would occur under some, but not all, of the action alternatives. However, the general mechanical removal of conifers to enhance meadow scenery would not occur under any alternative. (Mechanical removal of conifers to protect the meadows has recently been suspended and would not be resumed unless called for in ongoing studies in support of ecological restoration.)
- Mitigate human intrusions into views by eliminating undesignated roadside parking, removing informal trails, and restoring more natural conditions to many currently disturbed sites.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

- Retain seasonal (generally late May or early June through October) recreational access to the river through Tuolumne and Dana Meadows by way of Tioga Road. Recreational opportunities afforded by this access include both scenic driving along the river and the opportunity to park and get out of cars to enjoy recreational experiences in a river-related landscape.
- Retain Tioga Road on its current alignment.
- Enhance the scenic driving experience by eliminating undesignated roadside parking.

(The alternatives of maintaining Tioga Road for year-round access and/or realigning Tioga Road through the Tuolumne Meadows area were considered but dismissed. See “Alternatives Dismissed from Further Consideration” at the end of this chapter for a discussion of these decisions.)

Management of Visitor Use and User Capacity

The following paragraphs discuss the management of visitor use and user capacity, which were introduced in chapter 5 (as part of the discussion of management standards for river values) and chapter 6 (as part of the discussion of visitor use and user capacity).

Kinds of Visitor Use

The primary differences among the alternatives involve the kinds and amounts of visitor use. These are discussed for each alternative and followed by a discussion of how that particular alternative would protect each river value.

Facilities and services are integral components of different kinds of visitor use and critical to managing user capacities because they can influence the way that public access to the river affects river values. The following examples illustrate how the character of visitor use is shaped by facilities and services, and how facilities and services in turn affect the protection of river values: Domestic water is a basic campground and lodging service; however, withdrawing too much water from the river to support these visitor services has the potential to

adversely affect river flows. Providing designated parking lots and prohibiting undesignated roadside parking can protect subalpine meadows from damage associated with indiscriminate parking and informal trails; however, the ability to provide designated parking spaces is constrained by the limited land area outside the boundary of the Yosemite Wilderness and the requirement to avoid adversely affecting natural, archeological, and scenic values through site development. Providing boardwalks can prevent visitors from creating informal trails in riparian areas; however, such facilities may change the character of the visitor experience. The availability of concessioner stock day rides may enhance the recreational experience for some visitors but detract from the experience of others.

The alternatives under consideration for the *Tuolumne River Plan* explore a reasonable range of services and facilities and associated visitor capacities for the Tuolumne Meadows and Lower Dana Fork segments, related primarily to balancing the following considerations in ways that would be protective of river values:

- amount of water withdrawal from the Dana Fork
- number of day parking spaces
- number of campsites at the Tuolumne Meadows campground
- number of tent lodging units at Tuolumne Meadows Lodge
- number of concessioner stock day rides

Winter Use

Regardless of which alternative is selected, visitor use of the river corridor during the winter will remain unchanged. It is Yosemite National Park policy to close the Tioga Road each winter after the first major snowfall and to manage the Tuolumne Meadows area and Glen Aulin as de facto wilderness. The alternative of keeping the Tioga Road open during the winter, or of extending the use season, has been dismissed as infeasible (see “Alternatives Dismissed from Further Consideration,” at the end of this chapter). In the winter, the recreational value of the Tuolumne Meadows and Lower Dana Forks segments shifts from river access via Tioga Road to a wilderness experience along the river. The snow season, which in the Yosemite high country usually extends from November to late May or early June, is a quiet time to enjoy solitude in the raw elements of winter. Visitor access to the high country in the winter is limited to cross-country skiing and snowshoeing. Snowmobiling as a mode of visitor access is not consistent with wilderness management and is prohibited by Yosemite National Park policy. Winter camping is regulated according to the wilderness overnight permit system.

Maximum Amounts of Visitor Use

The maximum number of people at one time in the river corridor would depend largely on the number of people entering the corridor in the Tuolumne Meadows and Lower Dana Fork segments via Tioga Road. As noted above, day visitors in the wild segments above Hetch Hetchy Reservoir access these segments from parking in the Tuolumne Meadows area. The number of visitors below the dam is minimal compared to the number of visitors above the reservoir. This section addresses the elements of user capacity that are common to alternatives 1-4 as they relate to the Tuolumne Meadows and Lower Dana Fork segments. A corridorwide user capacity for each alternative, which combines both the maximum day use and the maximum overnight use for both the scenic and the wild segments, is presented as part of the detailed description of each alternative (see tables 7-5, 7-7, 7-9, and 7-11 later in this chapter). A comparison summary of all the alternative user capacities is presented at the end of this chapter (table 7-14).

The maximum number of people at one time in the river corridor would vary among the alternatives. However, the method for calculating the maximum number of people at one time would be the same under all the alternatives and is summarized below.

Maximum Visitor Day Use

The NPS selected a vehicle-based measure of the maximum number of people at one time who could be parked and out of their vehicles to express the standard for the maximum number of day visitors in the Tuolumne River corridor. Vehicle-based measures are widely accepted in scientific literature as an efficient and effective method for documenting and managing visitor use levels (Gramman 1992; ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). They are particularly applicable to the Tuolumne Meadows area because (1) the primary means of access is by automobile and (2) the vast majority of visitors arrive in personal vehicles.

As a baseline for comparison with the action alternatives, the NPS estimated the maximum day use for the no-action alternative by starting with an actual vehicle count on a peak day during the peak season in 2011 and multiplying the number of parked cars attributed to day visitors by 2.9 persons per vehicle. The maximum number of visitors who currently arrive by tour bus, in-park shuttle, or regional transit was added to this number to reflect the current maximum day use. Maximum day use for alternatives 1–4 was computed by multiplying the number of day parking spaces that would be provided under each alternative by 90%, then multiplying that number of spaces by 2.9 persons per vehicle. The 90% factor is applied to account for the vacancy of a percentage of parking spaces after visitors leave and before new visitors find the empty spaces. The numbers of visitors who arrive by tour bus, in-park shuttle, or regional transit were also included in the total maximum day use for each alternative.

The maximum visitor day use is a capacity figure; the actual day use levels at any one time could be lower, depending on other factors, including time of day or day of the week.

Maximum Visitor Overnight Use

The overnight capacity of the Tuolumne Meadows and Lower Dana Fork segments is based on the combined capacities of the campground and the Tuolumne Meadows Lodge. These capacities would vary among the alternatives. Actual overnight use levels would be lower than these capacities because not all individual campsites and lodging units would be occupied by the maximum number of people allowable.

Management of Visitor Use Capacity

Under all the action alternatives, maximum day use capacity would be managed by restricting day parking to designated parking spaces and by managing the service levels of public transportation that delivers day visitors to the river corridor. The number of day parking spaces would differ among the alternatives, consistent with the differences in the proposed user capacity among the alternatives. Overnight user capacity in the Tuolumne Meadows area would be managed by controlling the number of campsites/people per site in the campground, and the number of lodge units at Tuolumne Meadows Lodge. The amount of parking made available for overnight users would *not* be a mechanism for enforcing overnight user capacity, and the number of spaces related to the number of overnight visitors would be computed using a different set of criteria and assumptions from those used to compute the number of day parking spaces.

General information about parking and traffic conditions would be provided to visitors via the forthcoming parkwide traffic management and information system (see “Appendix M: Cumulative Projects”). Parking areas would be designed to separate day and overnight visitors (either in separate or shared lots). Signs, discussions with staff at entrance stations and visitor contact stations, and notices in park literature would explain the rationale for changes in visitor use management and direct day and overnight visitors to appropriate parking. If no day parking spots were available, day visitors would be directed to another day use location outside the corridor.

If park visitation continued to increase, a parking reservation system would likely be needed at some point in the future. However, because such a system would have to be implemented on a parkwide basis, planning and compliance for this management action would be deferred until comprehensive management planning has been completed for the Tuolumne and Merced Wild and Scenic Rivers. If needed, more detailed planning for a reservation system would occur after the capacities had been established for the Tuolumne and Merced River corridors and the park staff had gained some experience with managing for the user capacities established through those plans. In the meantime, park staff would monitor how well the designated parking at Tuolumne Meadows was serving to manage the day visitor capacity in the Tuolumne River corridor.

In enforcing the visitor use capacities established under the *Tuolumne River Plan*, tactics that were least intrusive on the visitor experience (site design, orientation, education) would be implemented first; however, more intrusive tactics, including issuing and checking parking permits and ticketing illegally parked vehicles, would be implemented if determined necessary to ensure that visitor use remained within the established capacity.

Service levels of public transportation systems serving the Tuolumne Meadows area (the regional transit bus [YARTS], the hiker bus operated by the concessioner, and other transit services) would remain under NPS control, with the number of visitors delivered into the corridor by such services managed according to the user capacity limits established for each alternative. NPS may use any combination of limits on the numbers of buses, the stops they make, the number of passengers they accept, and/or the numbers of routes they run per day.

Kinds and Maximum Amounts of Administrative Use

Total maximum administrative use is expressed in terms of the number of employees (and related administrative personnel, such as partners and volunteers) who would be housed in the Tuolumne River corridor. Housing would vary by alternative, based on the level of visitor services to be provided and on-site development constraints. Before constructing new housing, park managers would examine the efficiency of using existing housing stock. Employees with temporary assignments at Tuolumne Meadows, but who had permanent housing assigned at White Wolf, Crane Flat, or Hodgdon Meadow, would be required to commute or be assigned to the Tuolumne Meadows housing designed for temporary, high-turnover occupancy. In some alternatives, campsites would meet the need for incidental “housing” for employees on temporary duty in the Tuolumne Meadows area.

The amount of employee parking for each alternative would be directly proportionate to the amount of housing provided, with about one parking space provided for each employee. Employees would be expected to park in their designated locations, within the housing areas shown for each alternative. Whenever employees were recreational visitors to the Tuolumne corridor, they and their vehicles would be subject to the overall visitor user capacity and parking restrictions.

Tuolumne Meadows Site Plan

The *Tuolumne River Plan* addresses site planning for Tuolumne Meadows by (1) identifying what facilities would be necessary to provide for public use or to protect river values under each alternative; (2) determining the feasibility of locating those facilities outside the river corridor; (3) for those facilities that must be located inside the corridor, identifying suitable locations that would be protective of river values; (4) establishing the allowable facility capacities (for example, the number of parking spaces, number of employee beds, or amount of water or wastewater to be treated); and (5) providing direction for site design based on protection of river values and desired visitor experiences.

The feasibility of locating the facilities necessary for visitor use and resource protection of the Tuolumne River in areas outside the river corridor boundary is severely constrained by the boundaries of the Yosemite Wilderness, which generally overlaps into the scenic segments of the river corridor. The only locations within the Tuolumne Meadows area that are outside both the river corridor and the designated wilderness are shown on the Site Analysis map (see figure 7-3); the most suitable (for development) of these sites is currently occupied by the B–G loops of the campground.

All visitor facilities would comply with NPS and Yosemite policies and design guidelines governing protection of natural and cultural resources, functionality, energy and water efficiency, and accessibility. The following additional general direction about facilities and site design would be common to all the action alternatives.

Visitor Facilities

The following visitor facilities have been determined to be necessary under all the alternatives (except as noted):

- Visitor contact facilities (whether a visitor center or a visitor contact station) are necessary to help visitors plan their visit and to educate visitors about resource protection.
- A wilderness center is necessary to more specifically support wilderness use and protection.
- A campground is necessary because Tuolumne Meadows is a major visitor destination that is far enough from most visitors' homes to necessitate an overnight stay in the vicinity. Camping is an integral part of a national park experience for many visitors, and the Tuolumne Meadows campground is an integral part of the campground system of Yosemite National Park.
- A campground office near the entrance to the campground is necessary to support campground management (camper check-in, fee collection, basic orientation).
- The Tuolumne Meadows Lodge is necessary to provide affordable accommodations for visitors who choose not to camp or who are unable to camp (for lack of equipment or experience). (As an exception to this determination, the lodge would be removed under alternative 1 to allow for a particular kind of visitor experience characterized by self-reliance and solitude. User capacities under alternative 1 would be substantially lower than the other alternatives, and no commercial services would be available.)
- The Glen Aulin High Sierra Camp is necessary to allow visitors with a broader range of physical abilities to enjoy a wilderness experience along the river. (As an exception to this determination, the camp would be removed under alternative 1 to allow for a particular kind of visitor experience characterized by self-reliance and solitude.)

Campground

The campground would be rehabilitated under all the action alternatives. Campground Design Guidelines have been developed to guide campground improvements needed to enhance the recreational camping experience. These guidelines, included in appendix K, address campground circulation, campsite delineation, and restoration of a more natural setting within the campground. Such improvements would occur regardless of which alternative for campground capacity or general configuration was selected.

Trails and Trailheads

Trails and trailheads are necessary to provide access while protecting resources. The following management of trails and trailheads would be common to alternatives 1–4:

- Retain Pothole Dome parking and trailhead on north side of Tioga Road, with no overnight parking at the trailhead. Designate a trail from the trailhead to the top of the cascade (where the river leaves the meadow); restrict trail use to foot traffic by small groups.

- Restore the Cathedral Lakes trailhead to natural conditions and reroute the trail to a new trailhead near the parking at the location of the existing visitor center.
- Maintain the following sections of the Great Sierra Wagon Road bed through the Tuolumne Meadows area for trail use (now part of the Pacific Crest Trail); manage the trails to restore more natural meadow hydrology while protecting the historic character of the road bed:
 - Section from Tioga Road to Parsons Memorial Lodge
 - Section between Parsons Memorial Lodge and Lembert Dome
 - Section from Lembert Dome to Tuolumne Meadows Lodge
- Maintain the trailhead at the base of Lembert Dome, which provides access to both the Lembert Dome trail and the trail to Parsons Memorial Lodge.
- Retain the trailhead for the Dog Lake and John Muir Trail and expand parking.
- Retain the Elizabeth Lakes trailhead.
- Provide a new trail connecting the campground with the area currently occupied by the store and grill (although the use of this location varies among the alternatives, it remains a visitor service area warranting trail access from the campground).
- Formalize the trail connecting the campground with the John Muir Trail.
- Maintain the formal trails radiating from Tuolumne Meadows trailheads through the Tuolumne Meadows, Upper and Lower Dana Forks, Lyell Fork, and Grand Canyon segments.

Parking

Day Parking

Day parking is necessary to provide access to trailheads and visitor facilities.

All day parking in the Tuolumne Meadows area would be confined to designated parking areas under alternatives 1–4. Curbing or other physical barriers that are consistent with the historic cultural landscape would be installed along the shoulders of Tioga Road through Tuolumne Meadows to prevent undesigned roadside parking and associated informal trails across the meadows.

Formal parking to replace some of the eliminated undesigned roadside parking would be consolidated in locations determined to be protective of river values, primarily in upland areas away from the river and meadows, out of primary viewsheds, and without known archeological sites. In general, the amount of designated parking areas would be expanded to replace some of the shoulder parking being eliminated from Tioga Road and the road to Tuolumne Meadows Lodge.

In addition to formal parking areas, four additional parking pullouts would be delineated along Tioga Road within the Tuolumne Meadows area to accommodate scenic viewing and traffic safety operations. The pullouts would be well-delineated to prevent encroachment of vehicles or foot traffic into the adjacent meadows. These pullouts would be posted for brief stops only and would not be counted as part of the day parking for Tuolumne Meadows. The pullouts would be on both the north and south sides of Tioga Road at locations west of the existing visitor center and near the campground D-loop road, in locations that have historically been used for this purpose.

Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows.

Overnight Parking

Overnight parking is necessary to support overnight camping, lodging, and wilderness permit holders. Parking for people staying in the Tuolumne Meadows campground would be provided at the campground; parking for guests at the Tuolumne Meadows Lodge would be provided at the lodge. Overnight parking for the Glen Aulin High Sierra Camp and for wilderness backpackers with overnight permits for trailheads above Hetch Hetchy Reservoir would be provided in designated parking areas at various locations in the Tuolumne Meadows area.

Employee Parking

Employee parking is necessary to support visitor and administrative use. Under all alternatives, employee parking would be restricted to spaces designated for employees in housing and administrative/maintenance areas, and these spaces would be counted and managed separately from visitor parking. Employee parking would be sized to accommodate the small number of employees (5–10) on temporary duty at Tuolumne Meadows.

Stables

An NPS stable is necessary to support wilderness patrol and trail maintenance. A concessioner stable is necessary to support the High Sierra Camps. Even if the Glen Aulin High Sierra Camp was closed (as proposed in alternative 1), other High Sierra Camps outside the corridor would continue to be supplied from the Tuolumne Meadows stable.

Park Operations

At this relatively remote location, administrative offices and maintenance facilities are necessary to support basic park operations, and the helipad at Gaylor Pit is necessary to support visitor protection operations.

Employee Housing

NPS employee housing is necessary to provide essential personnel for visitor and resource protection, interpretive and educational services, administration, and maintenance. Concessioner employee housing is necessary to support commercial services. The amount of housing needed would vary among the alternatives, depending upon the management of visitor use and user capacity.

For reasons described earlier, it would not be feasible to place the housing determined to be necessary in the Tuolumne Meadows area in a location outside the river corridor; however, housing retained would be limited to no more than the amounts specified in each alternative. Any additional housing for employees working in the Tuolumne Meadows area would have to be located elsewhere, either inside or outside the park. Decisions about any additional housing would require separate planning and NEPA/NHPA compliance.

To be consistent with the scenic river segment classification, new housing in the river corridor would be modest in scale and consistent with the Tuolumne Meadows Employee Housing Design Guidelines (see appendix K). New employee housing units would meet Occupational Safety and Health Administration (OSHA) regulations and NPS standards for being “safe, sanitary, sited to avoid natural hazards, integrated into the park environment, and, to the best extent possible, energy efficient and cost-effective to maintain.”

Utility Systems

Domestic water and wastewater treatment systems are necessary to support visitor use at Tuolumne Meadows. The required capacity of the systems would vary, depending upon the management of visitor use and user capacity.

Future site-specific planning would be required for a new water collection, treatment, and distribution system and new wastewater collection, treatment, and disposal system. Future facility design and capacity would adhere to the land use assignments and capacity decisions outlined in the *Tuolumne River Plan*. The following actions would be common to alternatives 1–4.

Tuolumne Meadows Wastewater Collection, Treatment, and Disposal

- Upgrade the wastewater treatment plant to modern treatment codes, on the south side of Tioga Road in the area currently used for wastewater collection and treatment, which has been determined to be protective of river values. Even though the location is not within the 100-year floodplain, design the plant to resist damage from flooding.

Tuolumne Meadows Water Collection, Treatment, and Distribution

- Upgrade the water treatment facility in the existing location, which has been determined to be protective of river values.
- Upgrade water distribution system to eliminate leaks and conserve water.
- If a suitable alternate source of water were to be determined in the future, remove the Dana Fork collection diversion and restore the river to natural conditions at that location.

Site Restoration

Under all alternatives, all facilities except roads, trails, and some underground utilities would be removed from meadow and riparian areas, and the sites would be restored to natural conditions, following the applicable recommendations in the *Ecological Restoration Planning Report* (described in greater detail in chapter 5 and appendix H). Specific sites that would be restored under all the action alternatives are listed below:

- sites disturbed by undesignated roadside parking and informal trails
- the site of the concessioner employee housing behind the store and grill
- the site of the concessioner employee housing near the river at Tuolumne Meadows Lodge
- the sites of three visitor tent cabins closest to the river at the Tuolumne Meadows Lodge

Scenic Segment (Below O’Shaughnessy Dam)

Except for the effect of the dam on the river’s free flow, no management concerns related to river values have been identified for this segment of the river. The effect of the dam is addressed under the Poopenaut Valley segment as it relates to the outstandingly remarkable biological values below the dam. No outstandingly remarkable biological, geologic, scenic, or recreational values have been identified in the Below O’Shaughnessy Dam segment. One archeological site that might contribute to outstandingly remarkable cultural values of the river corridor is within the segment boundary. The site has been affected by road construction and is potentially at risk from impacts related to construction or maintenance projects, which would be subject to compliance with the 1999 programmatic agreement between Yosemite National Park, the Advisory Council on Historic Preservation (ACHP), and the California state historic preservation officer (SHPO) (included in appendix D) or other consultation procedures consistent with NHPA section 106, as agreed to through consultation with the SHPO and other interested parties. Because no change in the management of this segment is anticipated, it is not included in any further discussion of the alternatives.

Site Suitability: Tuolumne Meadows

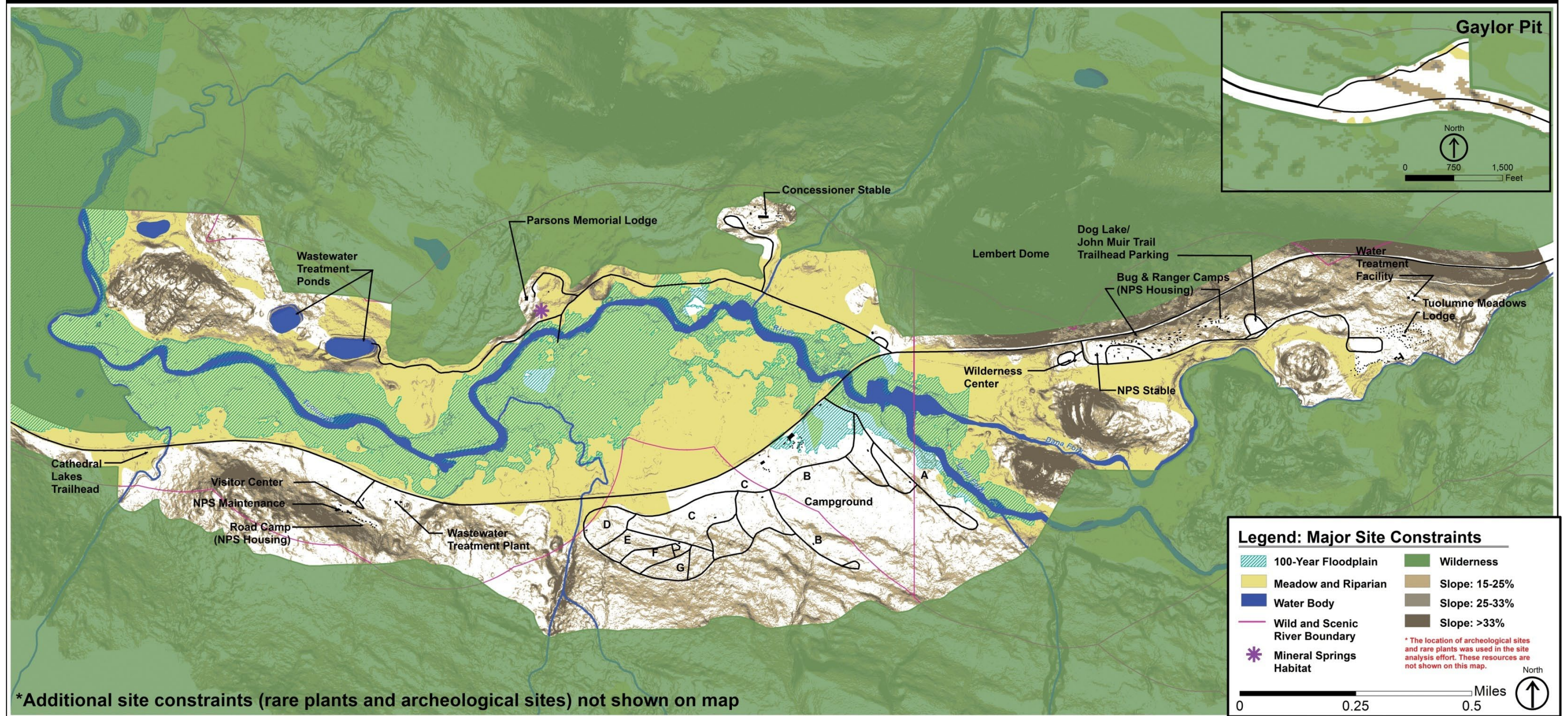


Figure 7-3. Site Analysis: Tuolumne Meadows.

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Summary of Protection and Enhancement of River Values under All Action Alternatives

Section 10(a) of WSRA requires managers to “protect and enhance the values which caused [the river] to be included in [the wild and scenic rivers] system.” The 1982 Secretaries’ Guidelines for River Areas (USDI and USDA 1982) indicate that the nondegradation and enhancement standard for the outstandingly remarkable values of a wild and scenic river is initiated at time of designation. If the value was protected at the time of designation and the trend associated with the impacts of the alternative would maintain or improve a high-quality condition, the value would be protected or enhanced. If the condition at the time of designation was threatened, then the value would be protected or enhanced if the alternative would result in an upward trend in quality that would eventually result in a high-quality condition being achieved.

Consistent with section 10(a) of the Wild and Scenic Rivers Act, the alternatives give primary emphasis to protecting the river’s “aesthetic, scenic, historic, archeological and scientific [biological, geologic, and hydrologic] features” by proposing actions that would be taken to address the management concerns identified for these values and to meet the management objectives established for them. Such actions would include both management of natural and cultural resources and management of visitor use and development to protect river values. Generally, the resource management actions are common to all alternatives, while the management of visitor use and development differs among the alternatives.

Major constraints on kinds and amounts of visitor use in the Tuolumne River corridor are (1) the protection of the free-flowing condition of the river, which constrains the amount of water that can be withdrawn for domestic use at Tuolumne Meadows; (2) protection of water quality, which constrains the disposal of wastewater and other risks to water quality at Tuolumne Meadows and Glen Aulin; (3) protection of subalpine meadow and riparian habitat, which constrains facility development, foot traffic, and stock use in these sensitive habitats; (4) protection of archeological sites, which constrains facility development and foot traffic in areas where sites are located; and (5) protection of river-related recreational experiences, which constrains the character of services and facilities and the amount of use that can be accommodated before crowding is perceived.

Resource management actions that would be taken under all of the action alternatives to protect or enhance river values are summarized below and in table 7-4 at the end of this section. See also table 7-13 at the end of this chapter, which compares and contrasts all of the actions that would be taken under each alternative to protect and enhance river values.

Free-Flowing Condition of the River

Tuolumne River flows below O’Shaughnessy Dam were altered by the dam at the time of designation and would remain altered by dam operations under all the alternatives. However, the NPS is working with the SPPUC and others to make informed recommendations for water releases from the dam that would more closely mimic natural flows while meeting the City of San Francisco’s mandates for water supply and power generation. Draft recommendations for water releases from the dam have been reviewed by stakeholders, but the final recommendations have not yet been completed, nor have they been adopted by the SFPUC. When recommendations are approved, this action is expected to result in an upward trend in, and enhancement of, the currently altered free-flowing condition of the river below O’Shaughnessy Dam. Monitoring of river and groundwater levels and river-associated habitats would continue to inform this management.

The recent study of the effect of water withdrawals in the Tuolumne Meadows area on low flows and downstream habitat concludes that withdrawals of no more than 10% of low flow would have only a minimal

impact on downstream habitat (Waddle and Holmquist 2011). Based on the conclusions of this study, the standard for protecting river flows has been set at withdrawals of no more than 10% of minimum flows. Withdrawals of 65,000 gallons per day would approximate 10% of flow at 1 cubic foot per second, and average demands of no more than 60,000–70,000 gallons per day would fall within the margin of error of meeting a standard of no more than 10% of low flow when low flow equals 1 cubic foot per second (see chapter 5). All the action alternatives would be required to meet this standard. Long-term monitoring of river flows would identify whether flows were declining from current levels as a result of natural cycles or climate change, in which case water withdrawals would be adjusted as necessary, with associated adjustments in visitor services, to ensure that they stayed below 10% of minimum flows.

The impediments caused by the abutments for the Tuolumne Road bridge and the footbridge at Parsons Memorial Lodge would be removed to allow the river to flow freely through these sections, even during periods of high flows. This action would result in an upward trend in, and protection of, the currently high-quality free-flowing condition of the river above Hetch Hetchy Reservoir. Additional site-specific planning and compliance would be required to implement this action.

The boulder riprap would be removed from an approximately 150-foot length of riverbank near the campground A-loop road to allow the river to flow more freely.

Water Quality

Risks to water quality in the Tuolumne Meadows area would be reduced under all the action alternatives by upgrading the utility systems, including upgrading the wastewater treatment plant to modern treatment codes; the amount of wastewater treated and the associated facility design would vary by alternative. The road cut east of Tuolumne Meadows along Tioga Road would be stabilized to reduce erosion into the river, which creates high levels of turbidity at the Dana Fork intake. Best management practices to mitigate the potential for impacts on water quality associated with stock use, including manure removal, would be continued under any alternative; the kinds and levels of stock use would vary by alternative. Long-term monitoring would continue to test for nutrients, *E. coli*, and petroleum hydrocarbons, and any decrease in water quality associated with any of these indicators would trigger action to address the concern before an adverse impact occurred.

Biological Value: Subalpine Meadow and Riparian Complex

The subalpine meadow and riparian complex was undergoing changes in ecological integrity at the time of designation that continue today. As described in chapter 5, the impacts of historical sheep grazing, coupled with the emerging stress of global climate change and more frequent periods of low precipitation, and exacerbated by foot traffic and pack stock use in sensitive meadow habitats, appear to be resulting in diminished ecosystem function in the subalpine meadow and riparian habitats in the Tuolumne Meadows area.

Resource management activities in the subalpine meadow and riparian complex under all the action alternatives would focus on improving the ecological resistance and adaptive capacity of the meadows by mitigating past and ongoing disturbances to hydrology, vegetation, geomorphology, and soils:

- Establishing willows along the riverbanks would help stabilize the banks and reduce unnatural shoreline erosion, which is likely causing widening of the river channel. A more natural, narrower, and deeper channel would maintain a higher river stage for any given flow volume and sustain the relatively high water table critical to meadow vegetation.
- Improving Tioga Road culverts and restoring more natural contours to the trails that follow the roadbed of the historic Great Sierra Wagon Road would allow more natural sheet flows across the meadows, thus improving the distribution of nutrients and increasing soil moisture and groundwater levels.

- Removing, crushing, or filling old, unused underground utility lines would mitigate or eliminate their potential impact on subsurface water flow beneath the meadows.
- Continuing research to support possible additional restoration of vegetative communities disrupted by historic uses, if determined to be feasible and appropriate, would address issues such as potential restoration techniques to restore belowground biomass, soil-forming processes, and stability of the prehistoric meadow vegetation.

The intent of this management would be to facilitate the recovery of more natural hydrologic and biological processes needed to sustain the subalpine meadow and riparian complex within the river corridor. These actions would result in an upward trend in, and enhancement of, the meadow and riparian habitats in the Tuolumne Meadows area.

In addition to the above resource management actions, visitor use would be managed under all the action alternatives to reduce the stress on the meadow and riparian complex. Visitor use accommodated in portions of the Tuolumne River corridor that have subalpine meadow and riparian habitats currently reaches a maximum of about 4,000 people at one time during the peak use period. This use is concentrated in the Tuolumne Meadows area, from which visitors disperse to the Lyell Fork, the Dana Fork, and the Grand Canyon segments. Subalpine habitats in less heavily used portions of the corridor, principally along the Lyell and Dana Forks, are experiencing some localized, minor impacts associated with foot traffic and stock use in Lyell Canyon. In the Tuolumne Meadows area, the current kinds and amounts of use are causing numerous informal trails, which result in vegetation trampling, soil compaction, and fragmentation of subalpine meadow and riparian habitat. These impacts likely contribute to the unusually high levels of bare ground, changes in vegetation, and loss of willows along riverbanks.

Foot traffic in sensitive meadow and riparian areas would be greatly reduced under all the action alternatives by prohibiting undesignated roadside parking, removing informal trails and restoring disturbed areas to natural conditions, directing visitors to formal trailheads and trails adjacent to designated parking areas, and prohibiting high-impact activities in meadows and along riverbanks. All facilities except roads, trails, and some underground utilities would be removed from sensitive meadow/riparian areas, and all retained or new facilities would be located in upland areas to reduce the trampling pressure on sensitive wet soils and associated vegetation.

Reducing informal trails and achieving and maintaining a protective standard for unfragmented expanses of meadow habitat (as measured through a *largest patches index*) is considered critical to achieving the management objectives for the subalpine meadow and riparian complex. Therefore, this measure has been chosen as a key indicator of whether user capacity is protective of this river value (see chapter 5).

In Lyell Canyon, the amount and locations of stock use would be regulated under all the action alternatives to protect meadow and riparian vegetation. Resource managers have used meadow condition assessments and past research to identify a grazing capacity of no more than 192 grazing-nights per year for meadows along the Lyell Fork. Meadows receiving high stock use would continue to be monitored, and the capacity would be adjusted if necessary to ensure meadow protection.

These actions would be expected to reduce the stresses on the subalpine meadow and riparian system and, in conjunction with the resource management activities that would be common to all the action alternatives, to mitigate most of the ongoing disturbances to the subalpine meadow and riparian habitats at Tuolumne Meadows, thereby increasing their ecological resistance to the kinds and levels of use that would continue.

Monitoring would be ongoing to ensure that the protective standards for meadow and riparian habitat would be achieved and maintained over time. A suite of three indicators would be used to monitor the health and potential for impact on this complex river value. If conditions were declining for any one of these indicators, additional actions would be taken, including possible further management of visitor use, as described in chapter 5.

Biological Value: Low-Elevation Riparian and Meadow Habitat

At the time of designation, river-dependent riparian and meadow habitat in Poopenaut Valley had been largely spared the severe impacts seen downstream of other dams because of several factors unique to this setting, and they remain some of the most diverse and productive communities in the park. These high-quality communities would be protected over the long term by mitigating the ongoing disturbance to hydrology caused by O’Shaughnessy Dam. The intent of this management would be to provide maximum ecological benefits to the river-dependent ecosystems downstream of the dam, within the bounds of the Raker Act and NPS authority. Long-term monitoring of river and groundwater levels and river-associated habitats would continue to inform this management.

Cultural Value: Archeological Landscape

More comprehensive information is now available about the current condition of archeological sites than was available at the time of designation. Because the condition of archeological sites cannot be enhanced, they would have been in the same or better condition at the time of designation compared to the current condition. As described in chapter 5, archeological sites in developed areas continue to be at high risk for ongoing visitor- and construction-related impacts (including impacts from facility maintenance and repair). Almost all the sites in the meadows and along the river are affected by informal trails, many of which emanate from undesignated roadside parking and bring visitors close to sensitive archeological sites. Several sites have evidence of camping and campfires. Many sites in Dana and Tuolumne Meadows are at risk of losing some of their integrity from ongoing visitor use impacts associated with nearby informal trails.

Under all the action alternatives, the potential for impacts related to informal trails would be reduced by eliminating undesignated roadside parking in the Tuolumne Meadows area and directing use to designated trailheads and trails. These actions would be expected to result in the protection of archeological sites at their current levels of integrity, which for most sites has been evaluated as being in good or fair condition. As stated above, the condition of an archeological site cannot be enhanced (an upward trend in condition is not possible; only an upward trend in the level of protection). Periodic site condition assessments would be conducted as part of long-term monitoring and protective management. Any future downward trend in site conditions associated with human use would trigger a required management response to counteract or minimize the effect before an adverse impact occurred, as described in chapter 5.

Any sites that would be disturbed by construction activities would undergo archeological survey, data recovery, and/or mitigations (see the discussions of the archeological landscape in chapter 5 and impacts on archeological resources in chapter 8).

Cultural Value: Parsons Memorial Lodge

Parsons Memorial Lodge had a high level of historic integrity at the time of designation, as it continues to have today. This national historic landmark would continue to be managed through periodic assessments and appropriate treatments directed by the List of Classified Structures. This management would protect its high-quality condition. If future monitoring under the List of Classified Structures assessment program detected

deterioration or damage, repairs would be undertaken to correct the deficiency while the structure was still in an overall good condition.

Scenic Values

Scenic views were of high quality at the time of designation, and they retain a high quality today, although some views in the Tuolumne Meadows and Lower Dana Fork scenic segments are being intruded upon by cars parked along Tioga Road and by encroaching vegetation. The outstandingly remarkable scenic values of the river corridor would be protected under all alternatives by protecting or enhancing the natural processes that have created them and by ensuring that development and undesignated roadside parking would not intrude into highly visible areas. The NPS would conduct a contrast analysis for all new structures and/or modifications of existing structures proposed for the Tuolumne River corridor to ensure that they remained within the established standards for protecting scenic values, as described in chapter 5.

Recreational Value: Wilderness Experience along the River

The wilderness overnight trailhead quota system would continue to help protect this outstandingly remarkable value, particularly on trail segments out of reach of day hikers entering the wilderness from Tuolumne Meadows. Encounter rates would be monitored over the life of the plan, and trailhead quotas would be modified or expanded to cover day use if necessary to protect the wilderness experience on popular day hiking and backpacking trails in wild river segments.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced by eliminating undesignated roadside parking and the congestion currently caused by vehicles slowing to park and pedestrians crossing the road. The effectiveness of using the day parking supply at Tuolumne Meadows to manage the day use capacity in all the river segments above Hetch Hetchy Reservoir would be monitored over time, and additional management action would be triggered if needed to enforce designated parking, as described in chapter 5.

Table 7-4.
Summary of Actions to Protect and Enhance River Values Common to Alternatives 1–4

| WILD SEGMENTS | |
|---------------------------|---|
| Value | Action |
| Free Flow | <ul style="list-style-type: none"> Continue to work cooperatively with the San Francisco Public Utilities Commission and others to inform releases from O'Shaughnessy Dam intended to more closely mimic natural flows. |
| Water Quality | <ul style="list-style-type: none"> Eliminate or mitigate the risk associated with wastewater disposal at the Glen Aulin High Sierra Camp. Replace the composting toilet at the backpacker campground at Glen Aulin. |
| Biological Values | <p>Subalpine Meadow and Riparian Complex:</p> <ul style="list-style-type: none"> Discontinue or reduce commercial pack stock use to reduce impacts on subalpine meadow/riparian areas. Restore localized areas previously disturbed by human use in Lyell Canyon using techniques that meet the minimum-requirement criteria established under the Wilderness Act. |
| | <p>Low-Elevation Riparian and Meadow Habitat:</p> <ul style="list-style-type: none"> Make informed recommendations for water releases from O'Shaughnessy Dam that would provide maximum ecological benefits to the river-dependent ecosystems below the dam. |
| Cultural Values | <p>Archeological Landscape:</p> <ul style="list-style-type: none"> Protect prehistoric archeological sites by diverting use away from sensitive areas. Mitigate ecological restoration practices by using noninvasive techniques wherever possible, and undertake site-specific treatment actions, such as data recovery, where necessary to avoid resource loss through park actions or natural forces. |
| Scenic Values | <p>Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne:</p> <ul style="list-style-type: none"> Continue to allow the natural scenery to evolve in response to natural ecological processes, with no management of scenic vistas. |
| Recreational Value | <p>Wilderness Experience Along the River:</p> <ul style="list-style-type: none"> Continue to manage overnight use in wilderness through an overnight trailhead quota system (see "Maximum Amounts of Use," below) to protect opportunities for solitude. Manage day use levels along wilderness trails within reach of day hikes from Tioga Road to achieve an encounter rate that is protective of a wilderness experience along the river (the maximum encounter rate would vary among the alternatives). |
| SCENIC SEGMENTS | |
| Value | Action |
| Free Flow | <ul style="list-style-type: none"> Continue to improve water conservation and sustainability practices, including installation of water meters, use of low-flow fixtures, and visitor and employee education and identify and implement additional long-term water conservation measures. Improve the Tioga Road bridge at Tuolumne Meadows and the footbridge at Parsons Memorial Lodge to mitigate impacts on river hydrology during periods of high flows. Improvements to the footbridge would be compatible with its historic character. Remove the boulder riprap from approximately 150 feet of riverbank near the campground A-loop road to allow the river to flow more freely. |
| Water Quality | <ul style="list-style-type: none"> Upgrade utility systems to conserve water and protect water quality. Stabilize the road cut east of Tuolumne Meadows along Tioga Road to reduce erosion into the Dana Fork. Continue best management practices to mitigate the potential for impacts on water quality associated with stock use. |
| Biological Values | <p>Subalpine Meadow and Riparian Complex:</p> <ul style="list-style-type: none"> Eliminate undesignated roadside parking and associated informal trails. Remove structures inappropriately sited near the riverbank or in wet areas. Restore riparian vegetation along riverbanks. Mitigate effects of Tioga Road culverts on surface flows into Tuolumne Meadows. Mitigate the effects of the Great Sierra Wagon Road bed on sheet flow across Tuolumne Meadows. Conduct additional research to determine causes of altered riparian and meadow condition in Tuolumne Meadows. Increase interpretive programming to educate visitors about the fragility of meadow/riparian areas. |
| | <p>Archeological Landscape:</p> <ul style="list-style-type: none"> Protect prehistoric archeological sites by removing informal trails and managing visitor use to avoid sensitive areas. Avoid, reduce, or mitigate the potential effects of ecological restoration by using noninvasive techniques wherever possible, and undertake site-specific treatment actions, such as data recovery, where necessary to avoid resource loss through park actions or, where possible and practicable, through natural forces. <p>Parsons Memorial Lodge:</p> <ul style="list-style-type: none"> Continue to preserve Parsons Memorial Lodge through periodic assessments and appropriate treatments directed by the List of Classified Structures. |
| Scenic Value | <p>Scenery through Dana and Tuolumne Meadows:</p> <ul style="list-style-type: none"> Mitigate human intrusions into views by eliminating undesignated roadside parking, removing informal trails, and restoring more natural conditions to many currently disturbed sites. |
| Recreational Value | <p>Tioga Road Access to the River through Tuolumne and Dana Meadows:</p> <ul style="list-style-type: none"> Retain seasonal (generally late May or early June through October) recreational access to the river through Tuolumne and Dana Meadows by way of Tioga Road. Recreational opportunities afforded by this access include both scenic driving along the river and the opportunity to park and get out of cars to enjoy recreational experiences in a river-related landscape. Retain Tioga Road on its current alignment. Enhance the scenic driving experiences by eliminating undesignated roadside parking. |

Alternative 1: Emphasizing a Self-Reliant Experience

Alternative 1 builds upon all the major elements included in the *Tuolumne River Plan* to identify a set of management actions that would work together to protect river values while providing for a self-reliant visitor experience in a more natural setting.

Alternative 1 includes the technical correction to the river corridor boundary (presented in chapter 3), the section 7 determination process for evaluating water resources projects (presented in chapter 4), the management standards and actions for protecting and enhancing river values (presented in chapter 5), and the guidance for identifying an appropriate visitor experience and associated user capacity (presented in chapter 6).

Concept

Alternative 1 responds to those members of the public who expressed a desire for more wilderness-like management throughout the river corridor. It would restore conditions for primitive, unconfined recreation in an undeveloped natural area to much of Tuolumne Meadows and Glen Aulin.

The Tuolumne Meadows area would be the largely undeveloped gateway to a diversity of wilderness experiences characterized by self-reliance and unconfined exploration. Visitors could enjoy the unspoiled scenery from the roadside; participate in an interpretive program; go for a stroll along the river; have an informal picnic on a granite slab; go rock climbing, fishing, wading, or swimming; enjoy a day hike to a subalpine lake; camp in the campground; or embark on a multiday backpacking or stock packing trip. Parking, trailheads for staging wilderness trips, and the facilities needed to support a variety of interpretive and educational programs would be provided in upland areas beyond the periphery of the meadows; however, most commercial services, including the Tuolumne Meadows Lodge, grill, mountaineering shop, and public fuel station, would no longer be available, thus requiring visitors to be self-reliant and prepared in advance for a trip to Tuolumne Meadows. The meadows themselves would remain wild, providing opportunities for primitive, unconfined enjoyment of the river and its surroundings.

The Glen Aulin High Sierra Camp (a potential wilderness addition) would be removed; the area would be restored to natural conditions and would be eligible for inclusion in the Yosemite Wilderness. The backpacker camp would remain.

River values would be protected and enhanced by greatly reducing the footprint of development, by restoring ecological conditions to meadow and riparian areas at Tuolumne Meadows, by greatly reducing demands for water supply and wastewater treatment, and by eliminating most risks to water quality (see “Summary of Protection and Enhancement of River Values under Alternative 1” at the end of this alternative section).

The visitor use capacity under alternative 1 would be reduced to a maximum of 3,065 people at one time, as shown in table 7-5. Actual day use levels would be lower during nonpeak periods, and actual overnight use levels would be lower even during peak periods because not all individual campsites and lodging units would be occupied by the maximum number of people allowable. Administrative use capacity under alternative 1 would be reduced to a maximum of 102 employees at one time (table 7-5).

In comparison to no action, alternative 1 would include the following actions:

- Restore previously disturbed ecological conditions to subalpine meadow and riparian areas.
- Reduce risks to stream flow and water quality.
- Increase protection of archeological sites and resources important to American Indians.
- Retain all current recreation opportunities except concessioner day rides and commercial use.
- Remove all lodging and commercial services and reduce the size of the Tuolumne Meadows campground.
- Remove the Glen Aulin High Sierra Camp.

**Table 7-5.
 Corridorwide Visitor and Administrative Use Capacity, Alternative 1**

| Visitor Overnight Capacity | | | | | |
|--|---|--|---|--|---|
| River Segment | Existing Use Calculation | Current Maximum Overnight Visitors | Proposed Action | Units | Maximum Overnight Visitors, Alternative 1 |
| Scenic Segments | | | | | |
| Tuolumne Meadows Lodge | # of lodging units (69) × max of 4 people per unit | 276 | Remove lodge (minus 69 guest tent cabins) | 0 guest cabins | 0 |
| Tuolumne Meadows Campground | # of campsites (304 sites × max of 6 people per site, 7 group sites × max 30 people per site) | 2,034 | Remove A-loop campsites (minus 67 campsites) | 237 sites, 7 group sites | 1,632 |
| Wild Segments | | | | | |
| Glen Aulin HSC | # of lodging units (8) × max of 4 people per unit | 32 | Remove Glen Aulin HSC (minus 8 guest tent cabins) | 0 guest cabins | 0 |
| Wilderness | Maximum capacity of wilderness zones (400) | 400 | Retain current wilderness zone capacities | – | 400 |
| Subtotal, Visitor Overnight Capacity | | 2,742 | | | 2,032 |
| Visitor Day Use Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum Observed People At One Time, 2011 ^a | Proposed Action | Proposed Units | Maximum People At One Time, Alt. 1 |
| Scenic Segments | | | | | |
| Access from Tuolumne Meadows | # of cars parking in designated parking spaces (340) × 2.9 ^b | 986 | Reduce designated day parking (minus 35 spaces) | 305 spaces at 90% occupancy × 2.9 ^b | 796 |
| | # cars parking in undesignated spaces (190) × 2.9 ^b | 551 | Eliminate undesignated roadside parking | – | 0 |
| | Maximum people arriving by in-park shuttles, tour buses, and regional public transit | 225 | Maintain current level of arrivals via tour bus and regional public transit | – | 225 |
| Access from Below O’Shaughnessy Dam | # of cars parking in designated spaces (4) × 2.9 ^b | 12 | Retain existing parking | 4 spaces × 2.9 ^b | 12 |
| Subtotal, Visitor Day Use Capacity | | 1,774 | | | 1,033 |
| Total Visitor People At One Time | | 4,516 | | | 3,065 |
| Administrative Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum Employees (existing) | Proposed Action | Units | Maximum Employees, Alt. 1 |
| Wild Segments | | | | | |
| Concessioner | Approximately 9 employees at Glen Aulin HSC | 9 | Remove Glen Aulin HSC | 0 | 0 |
| Scenic Segments | | | | | |
| NPS | Approximately 150 employees based at Tuolumne Meadows | 150 | Meet staffing need with 100 employees at Tuolumne Meadows | 100 employees | 100 |
| Concessioner | Approximately 103 employees based at Tuolumne Meadows | 103 | Meet staffing need with 2 employees at Tuolumne Meadows | 2 employees | 2 |
| Total Administrative People At One Time | | 262 | | | 102 |
| Total People at One Time | | 4,778 (existing) | | | 3,167 (proposed) |

a The peak number of vehicles observed during vehicle counts in 2011 (observed on August 13, 2011).

b The vehicle occupancy rate is 2.9 people per vehicle, based on visitor studies conducted over the past 20 years that found an average vehicle occupancy ranging from 2.6 to 3.4 (Van Wagtenonk and Coho 1980; FHWA 1982; ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). Based on this range, an average of 2.9 persons per vehicle is used for estimating visitor numbers for planning purposes in this document.

Abbreviations: HSC = High Sierra Camp; max = maximum; # = number.

Wild Segments (Designated Wilderness and Glen Aulin)

Resource Protection and Enhancement

Free Flow

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Water Quality

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Close the Glen Aulin High Sierra Camp and restore the site to natural conditions, thereby eliminating the risk to water quality associated with the wastewater leach mound (see “Glen Aulin,” below).

Biological Value: Subalpine Meadow and Riparian Complex

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Discontinue all commercial use (except as needed for the concessioner to supply the High Sierra Camps outside the river corridor, see table 7-1) to reduce impacts on subalpine meadow/riparian areas. (Additional limitations on commercial use in wilderness are described under “Management of Visitor Use and User Capacity,” below).

Biological Value: Low-Elevation Riparian and Meadow Habitat

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Protect the archeological site at Glen Aulin from impacts associated with the removal of the High Sierra Camp by conducting an NRHP site evaluation and data recovery if deemed necessary.

Scenic Value: Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Greatly reduce the signs of stock use on trails in wild segments by removing Glen Aulin High Sierra Camp (which would eliminate the need for stock to set up, take down, transport visitors to, and resupply the camp), eliminating concessioner stock day rides, and eliminating commercial outfitter stock trips in the river corridor. The concessioner would still be able to use stock on the Cathedral Lakes and Lyell Canyon trails to supply the High Sierra Camps outside the river corridor (see table 7-1).

Recreational Value: Wilderness Experience along the River

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Reduce the day use levels along popular wilderness trails within reach of day hikes from Tioga Road so that visitors encounter no more than four other groups per hour (80% of the time, sampled over the entire season, including weekdays and weekends). This encounter rate would be more protective of solitude than the standard adopted for this river value (which would be no more than 10 encounters with other groups per hour, as described in chapter 5) in keeping with the greater emphasis on solitude and self-reliance under this alternative. If monitoring determined that this level of use was being exceeded on some trails, day use wilderness trailhead quotas would be implemented for major trail segments, including Lyell

Fork, Glen Aulin, Cathedral Lakes, and Dog Lake, using a mixed first-come/first-served and advanced reservation system.

- Discontinue all commercial use in wilderness. Under this alternative, all concessioner stock day rides and all commercial outfitter day hikes, overnight hikes, and overnight stock trips would be eliminated to enhance opportunities for self-reliance and solitude in a wilderness setting and to reduce the rate of contacts between parties and with stock on trails.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

All commercial use would be discontinued in wild segments of the river corridor. This would include the Glen Aulin High Sierra Camp (see below), all concessioner stock day rides, and all commercial day hikes, overnight hikes, and overnight stock trips. All other existing activities would continue.

Maximum Amounts of Visitor Use

The overnight capacity for wild segments would be retained at 400 persons per night (350 persons per night above the reservoir and 50 persons per night below the reservoir). This capacity might be reduced in the future if determined necessary to protect wilderness values; however, it would not be increased above this amount, which has been determined to be protective of river values. Overnight use at the Glen Aulin High Sierra Camp would be eliminated.

Management of Visitor Use Capacity

The current overnight trailhead quota system would be retained to regulate overnight use in wild segments. If monitoring determined that the new standard for day use was not being met, a day trailhead quota system would be implemented for some trails.

Administrative Use

There would be no employees housed at Glen Aulin High Sierra Camp because the camp would be removed.

Glen Aulin (Potential Wilderness Addition)

The Glen Aulin High Sierra Camp and all infrastructure associated with it would be removed, and its site would be restored to natural conditions, following the direction for removal of facilities provided in the *Ecological Restoration Planning Report* (see figure 7-4 and appendix H). Water would no longer be diverted from the Tuolumne River to support the camp, and no wastewater treatment or disposal facilities would be needed. The NPS would recommend to the Secretary of the Interior that the Glen Aulin potential wilderness addition be declared part of the Yosemite Wilderness, as provided for in section 108 of the 1984 California Wilderness Act.

The wilderness character of the area would be protected as required by the Wilderness Act. The visitor experience in the Glen Aulin area would be like that in the rest of the Yosemite Wilderness, characterized by self-reliance and primitive and unconfined recreation. Day use would be expected to decrease commensurate with an overall reduction in day use in the Tuolumne Meadows area. Overnight use would be limited to camping in the backpacker campground and managed through the wilderness trailhead quota system, as described under “Actions Common to Alternatives 1-4.”

The estimated net construction costs for Glen Aulin under alternative 1 (including camp removal and replacement of the composting toilet at the backpacker campground) would be approximately \$0.9 million (see appendix L).

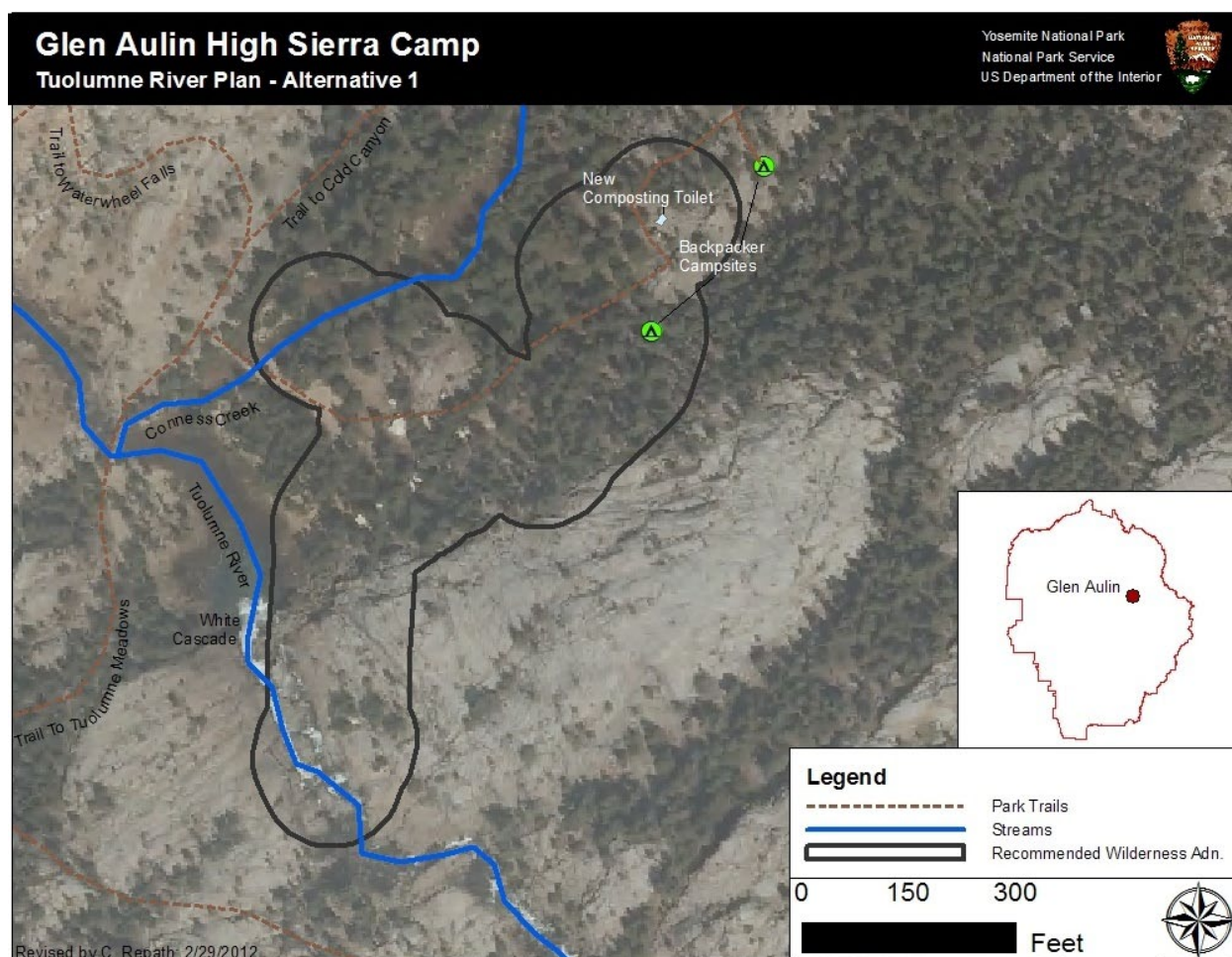


Figure 7-4. Glen Aulin Site Plan, Alternative 1.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)

Note that this discussion pertains only to the nonwilderness portions of the Tuolumne Meadows and Lower Dana Fork segments. The portions of these segments within designated wilderness would be managed the same as the wild segments.

Resource Protection and Enhancement

Free Flow

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Eliminate or reduce visitor services and related employee housing (notably the Tuolumne Meadows Lodge, concessioner employee housing, and some campsites) that would otherwise require water consumption, thus reducing the estimated average water demand to approximately 36,000 gallons per day. As discussed in chapter 5, this level of water withdrawal would be expected to remain well within the standard of no more than 10% of low flow, even if climate change led to longer low-flow durations occurring earlier in the summer.

Water Quality

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Remove the wastewater containment ponds and sprayfields and replace them with new facilities (for serving the campground and the reduced employee housing) on the south side of Tioga Road to eliminate risk to water quality posed by these facilities. Eliminate the need to pump wastewater beneath the meadow from the treatment plant to the ponds and sprayfields.
- Discontinue concessioner stock day rides to reduce risks to water quality associated with stock use. Compared to current service levels, the amount of stock use on trails could be reduced by 3 two-hour and 2 four-hour rides per day, which might otherwise involve up to 14 head of stock per ride on the trails. Full-day rides, which occur only occasionally, would also be eliminated.
- Remove the public fuel station to eliminate the risk to water quality posed by this facility.

Biological Value: Subalpine Meadow and Riparian Complex

In addition to ‘Actions Common to Alternatives 1–4,’ beginning on page 7-19:

- Crush or remove the existing wastewater line that runs beneath the meadow from the treatment plant to the containment ponds.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Cultural Value: Parsons Memorial Lodge

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Scenic Value: Scenery through Dana and Tuolumne Meadows

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

Some kinds of use, particularly those supported by commercial services (including the Tuolumne Meadows Lodge), would be discontinued. The level of use would be reduced to enhance opportunities for solitude and to allow for unconfined travel in meadow and riparian areas that are easily accessible from Tioga Road, while being protective of river values. Educational messages would focus on the importance of protecting river values and Leave-No-Trace practices.

Visitor services would be managed as follows:

- Conduct orientation, interpretation, and education programs, with increased emphasis on education about the need to protect river values, at a combined visitor contact station and wilderness center, at Parsons Memorial Lodge, and in the field.
- Eliminate commercial services (lodge, store, grill, public fuel station, mountaineering shop and school, concessioner stock day rides) to enhance a visitor experience characterized by self-reliance. The post office function would be discontinued. Vending machines for ice and firewood would be provided at the campground office.

- Limit opportunities for overnight use to camping only (no lodging). Remove the A-loop of the campground, thereby reducing the size of the campground to 237 sites plus 7 group campsites, to allow for the restoration of the campground A-loop road nearest the river and to reduce demands for water supply and wastewater disposal.
- Discontinue shuttle bus service between destinations within the Tuolumne Meadows area to enhance an experience characterized by self-reliance.

Maximum Amounts of Visitor Use

- Reduce maximum day use above the Hetch Hetchy Reservoir from 1,762 people at one time to a maximum of 1,021 people at one time to reduce the effects of dispersed foot traffic on sensitive resources, including meadow and riparian areas and archeological sites, and to avoid perceptions of crowding along wilderness trails close to Tioga Road trailheads (see table 7-5; in this table, the total maximum day use number includes the maximum day use below O’Shaughnessy Dam, which would remain at 12 people at one time).
- Reduce the overnight capacity from 2,310 people per night to a maximum of 1,632 people per night (the reduced capacity of the campground) to allow for the restoration of the campground A-loop road nearest the river and to reduce demands for water supply and wastewater disposal (see table 7-5). Actual overnight use levels would be lower than these capacities because individual campsites would not always be occupied by the maximum number of people allowable.

Management of Visitor Use Capacity

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

Day Use

Day use levels would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. The amount of designated day parking in the Tuolumne Meadows area would be reduced from 340 to 305 spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. (See parking details under “Site Planning,” below.)

Overnight Use

Overnight use levels would be managed by the facility capacity of the campground. Some campsites would continue to be available through a reservation system and some on a first-come, first-served basis.

Administrative Use

Commensurate with the discontinuation of commercial services, the number of NPS employees in the Tuolumne Meadows area would be reduced to a maximum of 100 people at one time, and the number of concessioner employees would be reduced to 2 people at one time (see table 7-5).

Tuolumne Meadows Site Plan

The locations identified below are illustrated on the site plan map (figure 7-5) at the end of this section. The estimated net construction costs for Tuolumne Meadows under alternative 1 would be approximately \$46 million, based on calculations included in appendix L.

Visitor Facilities

- Combine a new visitor contact station (to replace the existing visitor center) with the existing wilderness center. The facility analysis conducted for this plan (see appendix A) determined that there is no feasible location for the wilderness center outside the river corridor. Consolidating a small visitor contact station with the wilderness center would make it possible for visitors to access NPS services at a single location and provide better separation between visitor services and operational functions.
- Remove all commercial facilities.
- Retain only those shuttle stops needed to serve passengers arriving on the regional transit bus [YARTS], the hiker bus operated by the concessioner, and other transit services.

Campground

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Design for a capacity of 237 sites (6 people per site) plus 7 group sites (30 people per site) for a maximum of 1,632 people.
- Remove the campground A-loop road and restore the area to natural conditions for day use.
- Retain the campground office and add vending machines for ice and firewood. Vending machines would not operate during quiet hours.
- Relocate the existing campground entrance road out of the floodplain.
- Formalize a trail connection between the campground and the John Muir Trail.

Trails and Trailheads

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Eliminate vehicle access to Parsons Memorial Lodge, and convert the administrative access road to a trail for stock and hiking use only, to enhance the recreational experience characterized by self-reliance and to enhance meadow conditions.

Picnic Areas

- Retain the picnic area at Lembert Dome.
- Provide a small picnic area in association with the day parking at the site of the former store and grill.

Parking

The total number of designated parking spaces in the Tuolumne Meadows area (day and overnight) would be decreased from 533 to 481 spaces.

Table 7-5a.
Number of Parking Spaces in Designated Parking Areas, Alternative 1

| Type of Parking | Current | Alternative 1 | Description |
|--|------------|---------------|--|
| Day Parking | 16 | 16 | existing parking area at Pothole Dome |
| | 0 | 4 | existing roadside pullout south of Pothole Dome |
| | 50 | 50 | existing parking area at the current visitor center (new Cathedral Lakes trailhead) |
| | 11 | 13 | existing parking area at the campground office |
| | 0 | 10 | A-loop day use parking |
| | 11 | 11 | existing parking in the campground for the Elizabeth Lakes trailhead |
| | 15 | 0 | existing parking area at the fuel station |
| | 51 | 50 | existing parking area at the store and grill |
| | 58 | 0 | existing parking area at the concessioner stable |
| | 29 | 25 | existing parking area at the base of Lember Dome |
| | 7 | 7 | existing parking area at the ranger station |
| | 25 | 52 | existing parking area at the Dog Lake/John Muir Trail trailhead |
| | 67 | 67 | existing parking areas in the road corridor east of Tuolumne Meadows, including the Mono Pass and Gaylor Peak trailheads and the Dana Meadows and other pullouts |
| | 340 | 305 | Total day parking |
| Overnight Parking (excluding cars parked in the Tuolumne Meadows campground) | 58 | 89 | existing parking area at the wilderness office |
| | 33 | 68 | existing parking area at the Dog Lakes/John Muir Trail trailhead |
| | 0 | 19 | relocated parking area for the Cathedral Lakes trailhead |
| | 102 | 0 | Tuolumne Meadows Lodge |
| | 193 | 176 | Total overnight parking |

NPS and Concessioner Stables

- Co-locate the NPS and concessioner stables at the current site of the concessioner stable. Because day rides would be discontinued, concessioner use of the facilities would be limited to pack stock needed to supply the Vogelsang, May Lake, and Sunrise High Sierra Camps. Although the amount of concessioner stock would be greatly reduced, concessioner use of the stable would remain necessary to avoid a safety hazard associated with frequently trucking the animals. Housing for all but two stable employees would be removed under this alternative.
- Reserve the current site of the NPS stable for NPS employee housing.

Park Operations

In addition to "Actions Common to Alternatives 1–4," beginning on page 7-19:

- Adapt the CCC mess hall building (current site of the visitor center) for park operations, to provide the administrative facilities determined to be necessary to support visitor use and resource protection, but which would be infeasible to locate outside the river corridor.
- Retain the ranger station.
- Retain the aboveground diesel fuel tank at the ranger station for concessioner and NPS use.
- Adapt the current site of the NPS stable for expansion of NPS employee housing at Ranger Camp.

Employee Housing

- Reduce NPS employee housing to accommodate 100 employees, which is the number determined to be necessary in the Tuolumne Meadows area to support the kinds and levels of visitor use included in this alternative. It would be infeasible to locate this housing outside the river corridor due to site constraints; therefore, it must be inside the corridor. To protect river values, the housing would be provided at the following locations determined not to contain river-related or sensitive resources:
 - Road Camp (30 employees)
 - Ranger Camp (70 employees)
- Eliminate all concessioner services and most concessioner employee housing; provide hard-sided cabin for two concessioner stable employees at the stable.

Utility Systems

The general direction for site-specific planning for utility systems under alternative 1, intended to protect and enhance the river's free flowing condition, water quality, and outstandingly remarkable values, is outlined below. Pending additional site-specific planning, it is currently projected that with known technology, the amount of wastewater to be treated under this alternative could be treated and disposed through new facilities on the south side of Tioga Road, thereby allowing the removal of the ponds and sprayfields on the north side of the road. This would eliminate the need to pump wastewater beneath the river and meadow to treatment and disposal facilities on the north side of Tioga Road.

Tuolumne Meadows Wastewater Collection, Treatment, and Disposal

- Design for an average water demand of 36,000 gallons per day.
- Remove the wastewater containment ponds and sprayfields from the north side of Tioga Road and replace with facilities on the south side of the road, to be designed in conjunction with the new wastewater treatment plant. If additional space was needed, site analysis of the location east of the existing facility has determined that this would be a suitable location.
- Remove the administrative access road to the containment ponds and restore the site to natural conditions.
- Crush or remove the wastewater line that runs beneath the river and meadow between the existing wastewater treatment plant and the containment ponds.

Tuolumne Meadows Water Collection, Treatment, and Distribution

In addition to "Actions Common to Alternatives 1–4," beginning on page 7-19:

- Design for an average water demand of 36,000 gallons per day.

Site Restoration

In addition to "Actions Common to Alternatives 1–4," beginning on page 7-19:

- Restore the following additional sites to natural conditions:
 - the site of the entire Tuolumne Meadows Lodge, including the entrance road
 - the sites of all eliminated or relocated concessioner employee housing
 - A portion of Bug Camp not needed for parking expansion
 - the site of the public fuel station and mountaineering shop
 - the sites of the wastewater containment ponds, sprayfields, and access road

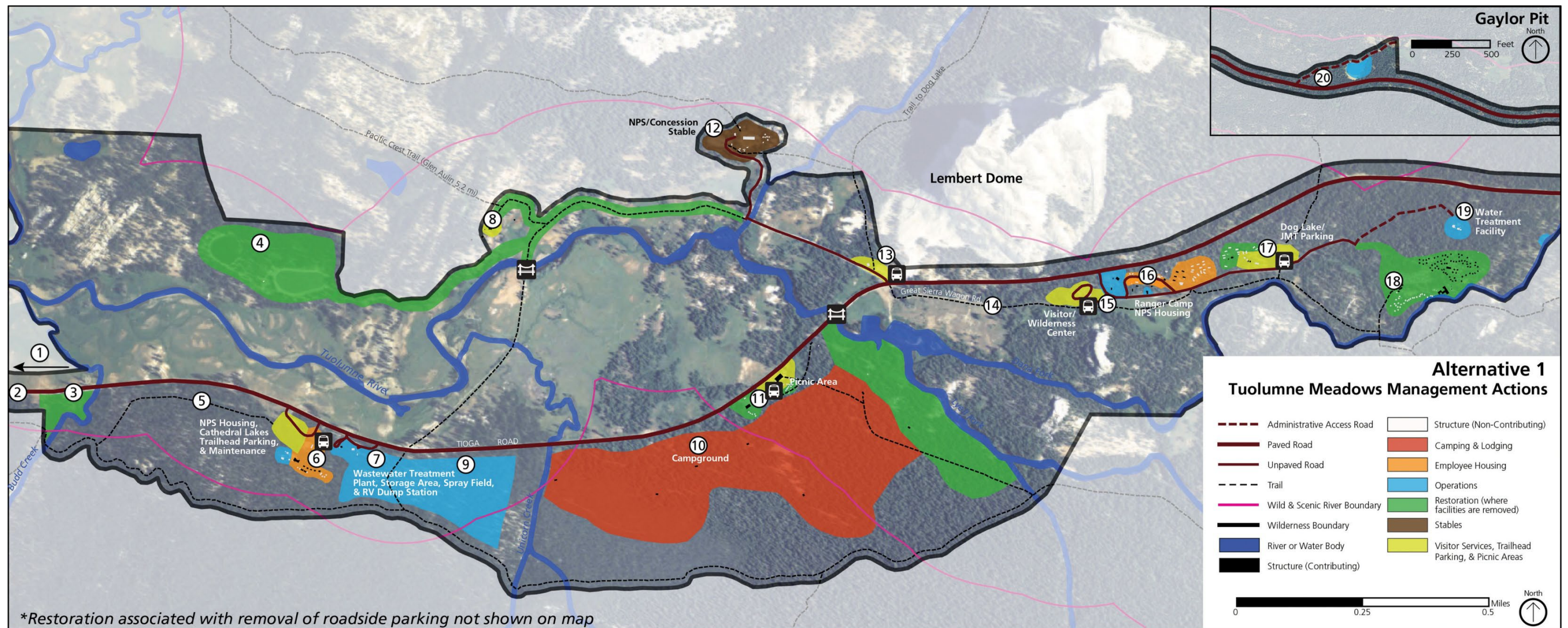


Figure 7-5. Tuolumne Meadows Site Plan, Alternative 1.

Key to figure 7-5 and List of Facilities Management Actions (actions marked with an asterisk (*) are specific to this alternative. All other actions are common to alternatives 1-4):

| | | | | | | | |
|--|---|--|--|--|---|--|---|
| 1. Pothole Dome scenic pullout/ parking areas | <ul style="list-style-type: none"> Designate day parking with trailhead on north side of road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of road. | 6. Existing visitor center and Road Camp | <ul style="list-style-type: none"> Relocate visitor contact station to location #15; convert building to park operations. Construct new Cathedral Lakes trailhead with day and overnight parking. Retain maintenance yard and office. Increase NPS employee housing. | 11. Existing commercial services core | <ul style="list-style-type: none"> Remove store, grill, mountaineering shop/school, public fuel station, and post office. Convert area to day use parking and picnic area. Add new public restroom. Add trail connector to campground. Remove concessioner employee housing. | 15. Existing wilderness center and NPS stable | <ul style="list-style-type: none"> Combine new, small visitor contact station with existing wilderness center; expand parking. Relocate NPS stable to location #12; use site for expansion of NPS employee housing. |
| 2. Tioga Road through the Tuolumne Meadows area | <ul style="list-style-type: none"> Retain the Tioga Road in its current alignment. Add roadside curbing to eliminate undesigned roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. | 7. Wastewater treatment plant | <ul style="list-style-type: none"> Upgrade wastewater treatment plant. Retain recreational vehicle dump station. | 12. Existing concessioner stable | <ul style="list-style-type: none"> Co-locate NPS stable with existing concessioner stable (for administrative use only). Remove most concessioner employee housing except for one hard-sided cabin for two stable employees; restore to natural conditions. Eliminate parking along access road. | 16. Existing ranger station and Ranger Camp | <ul style="list-style-type: none"> Retain ranger station and day parking. Retain diesel fuel tank. Replace NPS employee housing with hard-sided cabins. |
| 3. Existing Cathedral Lakes trailhead | <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | 8. Parsons Memorial Lodge | <ul style="list-style-type: none"> Preserve lodge; eliminate vehicle access. Upgrade footbridge to improve free flow of river. | 13. Lembert Dome | <ul style="list-style-type: none"> Retain picnic area. Retain day parking and trailheads for Lembert Dome and Parsons Memorial Lodge. Add shuttle stop. | 17. Bug Camp, Dog Lake/John Muir Trail parking | <ul style="list-style-type: none"> Increase day and overnight parking. Remove NPS housing. |
| 4. Existing wastewater ponds and sprayfields | <ul style="list-style-type: none"> Pending additional planning, replace with upgraded wastewater treatment plant at locations #7 and #9; restore to natural conditions. | 9. Area west of Unicorn Creek | <ul style="list-style-type: none"> Retain as undeveloped natural area; if needed, use area for future wastewater treatment facilities. | 14. Old Tioga Road/Great Sierra Wagon Road | <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of historic roads to meadow hydrology while protecting historic character. | 18. Tuolumne Meadows Lodge | <ul style="list-style-type: none"> Remove Tuolumne Meadows Lodge, parking, and employee housing; restore area to natural conditions. |
| 5. Area east of Budd Creek and west of existing visitor center | <ul style="list-style-type: none"> Construct new Cathedral Lakes trailhead connector. Retain as undeveloped natural area except for trail segment. | 10. Tuolumne Meadows campground | <ul style="list-style-type: none"> Retain smaller campground; remove the A-loop road and all 67 A-loop campsites. Retain campground office and day parking. Add vending machine for ice and firewood. Relocate entrance road outside of floodplain. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | | | 19. Water treatment facility | <ul style="list-style-type: none"> Upgrade water treatment facility. |
| | | | | | | 20. Gaylor Pit | <ul style="list-style-type: none"> Retain helipad. |

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Summary of Protection and Enhancement of River Values under Alternative 1

The *Tuolumne River Plan* will be evaluated in terms of four legal requirements: (1) the WSRA requirement that it protect and enhance river values; (2) the NEPA requirement that it fully consider the effects on the human environment; (3) the NHPA requirement that it consider effects on historic properties; and (4) the requirement of the Wilderness Act that it consider the effects on wilderness character. Guidelines for each of these requirements describe the criteria to be used in determining the effects of the plan. This section focuses directly on how the plan would meet the WSRA requirement to protect and enhance river values if alternative 1 was selected. The NEPA, NHPA, and Wilderness Act analyses are presented in chapter 8.

All the action alternatives, including alternative 1, would protect and enhance river values as described in detail in chapter 5 and summarized in this chapter under “Summary of Protection and Enhancement of River Values under All Action Alternatives,” earlier in this chapter. In addition, alternative 1 would take the following additional actions, primarily related to management of visitor use, user capacity, and development, to further protect or enhance river values.

Free-Flowing Condition of the River

So long as low flows remained around or above 1.0 cubic foot per second, average water withdrawals of 60,000 to 70,000 gallons per day would ensure that management could maintain consumption at no more than 10% of flow during low-flow periods and impose additional temporary conservation measures if necessary, as discussed in chapter 5. The average estimated water demand for alternative 1 has been calculated as shown in table 7-6.

Table 7-6.
Summary of Average Estimated Water Demand, Alternative 1

| Facility | Current consumption per unit | No-Action | | Alternative 1 | |
|---|---------------------------------------|--------------------------|-----------------|---------------------------------------|-----------------|
| | | Number of units | Gallons per day | Number of units | Gallons per day |
| Campsites | 100 gallons/site/day | 304 sites | 30,400 | 237 sites | 23,700 |
| | 500 gallons/group site/day | 7 group sites | 3,500 | 7 group sites | 3,500 |
| Recreational vehicle dump station | 50 gallons/use/day | 32 dumps | 1,600 | 32 dumps | 1,600 |
| Tuolumne Meadows Lodge | 30 gallons/person/day | 276 guests | 8,280 | Removed | 0 |
| Camper showers | 10 gallons/person/shower | 0 | 0 | 0 | 0 |
| NPS housing | 50 gallons/employee/ day in housing | 104 employees in housing | 5,200 | 100 employees in housing | 5,000 |
| | 25/gallons/employee/ day in campsites | 0 employees in campsites | 0 | 0 employees in campsites | 0 |
| Concessioner employee housing | 50 gallons/employee/ day | 103 employees | 5,150 | 2 employees | 100 |
| Cafeteria meals (2 per concessioner employee) | 6 gallons/person/day | 206 meals | 1,236 | 0 meals | 0 |
| Store/grill | 5 gallons/person/day | 1,148 visitors | 5,740 | Removed | 0 |
| Visitor center /visitor contact station | 5 gallons/visitor/day | 607 visitors | 3,035 | Total visitor capacity reduced by 32% | 2,064 |
| Total consumption | | | 64,141 | | 35,964 |

Based on the calculations in table 7-6, alternative 1 would be protective of river flow and downstream habitat under the current flow conditions. Decreases in all kinds of use, but particularly overnight visitor use and employee housing, would decrease the demand for domestic water in the Tuolumne Meadows area by approximately 44% to about 36,000 gallons per day. Even if climate change led to longer low-flow durations starting earlier in the summer, withdrawal levels would be expected to remain well within the limits of no more than 10% of low flows. If withdrawals ever did approach 10% of low flows, additional water conservation measures, including possible changes in levels of service, would be implemented.

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area would be reduced by reducing the amount of wastewater to be treated and disposed by about a third, which would allow for the elimination of the wastewater ponds and sprayfields on the north side of Tioga Road and the crushing or removing of the wastewater line that runs beneath the river and the meadow. The risk to water quality from fuel storage at the public fuel station would be eliminated. A further reduction in risks to water quality would be achieved by greatly reducing the size of the concessioner stable operation. Monitoring would be ongoing to ensure that water quality remained excellent. Risks to water quality at Glen Aulin would be eliminated by eliminating the High Sierra Camp and commercial stock use.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 1 would additionally reduce the maximum people at one time in the river corridor (almost all of whom would access through the Tuolumne Meadows area) by an estimated 34% (from a current estimated maximum user capacity of 4,778 people, including both visitors and employees, to a maximum capacity of 3,167 people). Most of this reduction would be attributed to a reduction in visitor use to allow for relatively unconfined access to the meadows and the river, while keeping meadow fragmentation associated with foot traffic within the protective standard discussed in chapter 5.

Subalpine meadows in Lyell Canyon would be further protected by eliminating commercial stock use (grazing and camping).

These actions would be expected to reduce the stresses on the subalpine meadow and riparian system and, in conjunction with the resource management activities that would be common to all the action alternatives, to mitigate most of the ongoing disturbances to the subalpine meadow and riparian habitats at Tuolumne Meadows, thereby increasing their ecological resistance to the kinds and levels of use that would continue. Monitoring would be ongoing to ensure that the protective standards for meadow and riparian habitat would be achieved and maintained over time. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as identified in chapter 5.

Management to Protect Archeological Sites

The same management of visitor use described above would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. Monitoring would be ongoing to ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced by managing unnatural features, such as facilities and parked cars, to minimize their intrusion into remarkable views.

Scenic values in wilderness would be enhanced by removing the Glen Aulin High Sierra Camp and by eliminating commercial stock use in wilderness, both of which currently caused localized adverse effects on scenic values along the Glen Aulin trail.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced by eliminating roadside parking and the resulting congestion currently caused by vehicles slowing to park and pedestrians crossing the road.

Management to Protect and Enhance the Wilderness Experience along the River

The wilderness experience for hikers along trails in wild segments within reach of a day hike from Tuolumne Meadows would be enhanced by restricting use to levels that resulted in encounters with no more than four other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends. If required to achieve this encounter rate, a day use trailhead quota system would be implemented for some trails. This management would protect the opportunity to experience solitude throughout the wild segments of the river corridor, even on a day hike from Tuolumne Meadows. This benefit would be offset by an infringement on unconfined use if a quota system was imposed.

The wilderness experience for some hikers would be enhanced by eliminating commercial stock use in the corridor.

Alternative 2: Expanding Recreational Opportunities

Alternative 2 builds upon all the major elements included in the *Tuolumne River Plan* to identify a set of management actions that would work together to protect river values while expanding opportunities for day and overnight visitors.

Alternative 2 includes the technical correction to the river corridor boundary (presented in chapter 3), the section 7 determination process for evaluating water resources projects (presented in chapter 4), the management standards and actions for protecting and enhancing river values (presented in chapter 5), and the guidance for identifying an appropriate visitor experience and associated user capacity (presented in chapter 6).

Concept

Alternative 2 would respond to those members of the public who expressed a desire for more recreational opportunities. It would facilitate resource enjoyment and stewardship by a broad spectrum of visitors.

As in all alternatives, most of the river corridor would be managed as wilderness. In these areas, natural river-related systems would be sustained by natural ecological processes, archeological and American Indian traditional cultural resources would characterize the cultural landscape, and recreational opportunities would be primitive and unconfined. Consistent with the concept of expanding recreational opportunities to connect with the river, a limited portion of the river (west of Tuolumne Meadows and into the Grand Canyon of the Tuolumne) would be opened to recreational whitewater boating.

In comparison to no action, alternative 2 would include the following actions:

- Restore previously disturbed ecological conditions to subalpine meadow and riparian areas.
- Reduce risks to stream flow and water quality.
- Increase protection of archeological sites and resources important to American Indians.
- Allow a moderate increase in overall use levels.
- Allow whitewater boating on limited portions of the river.
- Increase opportunities for camping at Tuolumne Meadows.

At Tuolumne Meadows, visitors would be encouraged to get out of their cars and take walks or short hikes to sites of natural and cultural interest or to places along the river, where they could enjoy activities such as sightseeing and participation in interpretive and educational programs, fishing, swimming, and picnicking. Such opportunities would encourage people to forge connections with the Tuolumne River and to appreciate the importance of protecting its natural, cultural, and recreational values. Potential parking locations would be fully used to maximize opportunities for day use. Opportunities for overnight camping would be slightly increased, and the current lodging at Tuolumne Meadows Lodge would be retained at its current capacity, along with modest commercial services. Although this alternative would provide the greatest range of recreational opportunities, Tuolumne Meadows would still retain its distinctive character as a threshold to the wilderness, and staging for wilderness trips would remain a major visitor activity at Tuolumne Meadows.

The Glen Aulin High Sierra Camp would remain open at its current capacity but would be converted to a seasonal outfitter camp with no permanent structures. Managed in this way, the Glen Aulin High Sierra Camp would be eligible for inclusion in the Yosemite Wilderness.

River values would be protected and enhanced by restoring ecological conditions to meadow and riparian areas, by directing use in scenic segments to resilient areas, and by restricting access to meadows and the river in the Tuolumne Meadows area to formally maintained trails (see “Summary of Protection and Enhancement of River Values under Alternative 2” at the end of this section).

**Table 7-7.
Corridorwide Visitor and Administrative Use Capacity, Alternative 2**

| Visitor Overnight Capacity | | | | | |
|--|---|--|---|--|---|
| River Segment | Existing Use Calculation | Current Overnight Visitors | Proposed Action | Units | Maximum Overnight Visitors, Alt. 2 |
| Scenic Segments | | | | | |
| Tuolumne Meadows Lodge | # of lodging units (69) × max of 4 people per unit | 276 | Retain lodge capacity | 69 guest tent cabins | 276 |
| Tuolumne Meadows Campground | # of campsites (304 sites × max of 6 people per site, 7 group sites × max 30 people per site) | 2,034 | Add walk-in loop (plus 41 campsites) | 345 sites, 7 group sites | 2,280 |
| Wild Segments | | | | | |
| Glen Aulin HSC | # of lodging units (8) × max of 4 people per unit | 32 | Convert HSC to seasonal camp; no capacity change | 8 guest tent cabins | 32 |
| Wilderness | Maximum capacity of wilderness zones (400) | 400 | Retain current wilderness zone capacities | – | 400 |
| Subtotal, Overnight | | 2,742 | | | 2,988 |
| Visitor Day Use Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum Observed People At One Time, 2011^a | Proposed Action | Proposed Units | Maximum People At One Time, Alt. 2 |
| Scenic Segments | | | | | |
| Access from Tuolumne Meadows | # of cars parking in designated parking spaces (340) × 2.9 ^b | 986 | Increase designated day parking (plus 302 spaces) | 642 spaces at 90% occupancy × 2.9 ^b | 1,676 |
| | # cars parking in undesignated spaces (190) × 2.9 ^b | 551 | Eliminate undesignated roadside parking | – | 0 |
| | Maximum people arriving by in-park shuttles, tour buses, and regional public transit | 225 | Maintain current level of arrivals via by in-park shuttles, tour buses, and regional public transit | – | 225 |
| Access from below O'Shaughnessy Dam | # of cars parking in designated spaces (4) × 2.9 ^b | 12 | Retain existing parking | 4 spaces × 2.9 ^b | 12 |
| Subtotal, Day Use | | 1,774 | | | 1,913 |
| Total Visitor People At One Time | | 4,516 | | | 4,901 |
| Administrative Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum employees (existing) | Proposed Action | Units | Maximum employees |
| Wild Segments | | | | | |
| Concessioner | Approximately 9 employees at Glen Aulin HSC | 9 | Retain all employees at Glen Aulin HSC | 9 | 9 |
| Scenic Segments | | | | | |
| NPS | Approximately 150 employees based at Tuolumne Meadows | 150 | Meet staffing need with 174 employees at Tuolumne Meadows | 174 employees | 174 |
| Concessioner | 103 employees based at Tuolumne Meadows | 103 | Meet staffing need with 103 employees at Tuolumne Meadows | 103 employees | 103 |
| Total Administrative People At One Time | | 262 | | | 286 |
| Total Capacity Corridorwide | | 4,778 (existing) | | | 5,187 (proposed) |

a The peak number of vehicles observed during vehicle counts in 2011 (observed on August 13, 2011).

b The vehicle occupancy rate is 2.9 people per vehicle, based on visitor studies conducted over the past 20 years that found an average vehicle occupancy ranging from 2.6 to 3.4 (Van Wagtenonk and Coho 1980; FHWA 1982; ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). Based on this range, an average of 2.9 persons per vehicle is used for estimating visitor numbers for planning purposes in this document.

Abbreviations: HSC = High Sierra Camp; max = maximum; # = number

The visitor use capacity under alternative 2 would be increased to a maximum of 4,901 people at one time, as shown in table 7-7. Actual day use levels would be lower during nonpeak periods, and actual overnight use levels would be lower even during peak periods because not all individual campsites and lodging units would be occupied by the maximum number of people allowable. The administrative use capacity under alternative 2 would be increased to a maximum of 286 employees at one time (table 7-7).

Wild Segments (Designated Wilderness and Glen Aulin)

Resource Protection and Enhancement

Free Flow

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Water Quality

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Greatly reduce water use at the Glen Aulin High Sierra Camp to reduce the risk to water quality (see “Glen Aulin,” below).

Biological Value: Subalpine Meadow and Riparian Complex

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Biological Value: Low-Elevation Riparian and Meadow Habitat

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Scenic Value: Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Recreational Value: Wilderness Experience along the River

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Manage day use levels along wilderness trails within reach of day hikes from Tioga Road to achieve a standard of no more than 10 encounters with other parties per hour (80% of the time, sampled over the entire season, including weekdays and weekends). As described in chapter 5, this standard would be consistent with studies of wilderness user preferences (Broom and Hall 2009; Cole and Hall 2008).
- Continue concessioner stock day rides into wilderness but at a lowered capacity to reduce conflicts on trails (four-hour and all-day rides eliminated; two-hour rides reduced from 3 to 2 per day, accommodating a maximum of 24 people per day).
- Allow commercial use in wilderness, with restrictions on types and levels of use based on a determination of extent necessary (see appendix C) that gives priority to noncommercial use and restricts commercial use to no more than two overnight groups per zone per night and no more than two day groups per trail per day. Additional restrictions would include the following:
 - *Restrictions on types of use, Glen Aulin zone, peak months only:* During the peak use months of July and August, commercial groups having only a recreational purpose would no longer have access to the Glen Aulin zone; groups having an educational or scenic, as well as recreational, purpose (as defined in

appendix C) would continue to have access consistent with limitations on total use levels, described above.

- *Restrictions on types of use, Lyell Canyon zone, peak months only:* During the peak use months of July and August, commercial use in the Lyell Canyon zone by groups with only a recreational purpose would be restricted to Monday–Thursday only; groups having an educational or scenic, as well as a recreational, purpose would continue to have access to the Lyell Canyon zone on weekends, as well as weekdays, consistent with limitations on total use levels, described above.
- Allow limited recreational whitewater boating on portions of the river to provide opportunities for people with expert paddling skills to experience and connect with the Tuolumne in an adventurous pursuit. To prevent resource impacts and address visitor safety concerns, this use would be regulated by a permit system to eight trips per year (and a maximum of six people/boats per trip). Boaters would pack in their boats and put in just below Tuolumne Meadows. All paddlers would be required to take out at Pate Valley because the Raker Act prohibits water contact within 1 mile of the Hetch Hetchy Reservoir. Additional permit conditions would be developed to protect park resources and provide for visitor safety.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

All ongoing uses would continue. In addition, limited recreational whitewater boating would be allowed on portions of the river from below Tuolumne Meadows to Poopenaut Valley.

Maximum Amounts of Visitor Use

Maximum day use along popular wilderness trails would be limited as necessary to achieve the standard of encounters with no more than ten parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

The overnight capacity for backpacker camping in wild segments would be retained at 400 persons per night (350 persons per night above the reservoir and 50 persons per night below the reservoir). This capacity might be reduced in the future if determined necessary to protect wilderness values; however, it would not be increased above this amount, which has been determined to be protective of river values. The Glen Aulin High Sierra Camp (converted to an outfitter camp) would continue to have an overnight capacity of 32 guests.

Because of the extreme skills required, the high potential for search and rescue, and concerns about environmental impacts along the shore, recreational whitewater boating would be limited to eight trips per year, with a maximum of six people/boats per trip.

Management of Visitor Use Capacity

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Recreational whitewater boating would be regulated through a permit system.

Administrative Use

The types and levels of administrative use in wild segments would remain the same as existing conditions. Nine concessioner employees would be housed at the Glen Aulin High Sierra Camp.

Glen Aulin (Potential Wilderness Addition)

Glen Aulin High Sierra Camp

The Glen Aulin High Sierra Camp would be converted to a seasonal outfitter camp, with a capacity accommodating 32 guests (the same number as at present) (see figure 7-6). All permanent structures and infrastructure would be removed, and all remaining structures would be temporary in nature, to be taken down and removed from the area in the fall and packed in and reassembled in the spring. Guest tents would be provided, as would cots in the tents and some services, listed below. The sole permanent structure would be a composting toilet. Trash receptacles and bear lockers would be available. Overall, the camp would look and function much like a seasonal outfitter camp allowed under commercial use authorizations for designated wilderness areas, except that this one would remain in place at Glen Aulin for the summer season.

Specifically, the level of service at the High Sierra Camp under this alternative would be as follows:

- Eliminate all permanent structures, including three stone buildings, concrete floors in the tent cabins, all components of the water treatment system, and the wastewater treatment system and leach mound.
- Provide unheated tents (up to eight) with cots and simple camp chairs for up to 32 guests.
- Provide four unheated tents for nine concessioner employees.
- Require domestic water used for sanitation and meal preparation to be filtered and/or treated in compliance with NPS Director's Order (DO)-83, "NPS Public Health Guidelines." The operators would collect and screen wastewater and dispose of it in a wastewater sump.
- Construct a new composting toilet for guests between the granite slab behind the existing kitchen and septic tank. Also, improve the composting toilet in the nearby backpacker campground to adequately handle demand.
- Provide hot suppers but cold breakfasts and lunches (except for hot drinks). A separate dining tent—still temporary in nature—could be provided as desired, along with a fire pit for evening use. Camp operators would be required to submit plans to the Park Public Health Officer for review and approval.
- Discontinue overnight saddle trips and concessioner day rides to the camp.
- Require all tents and camp structures to be packed out at the end of the season in fall, with the camp area cleaned to an appearance similar to that of the nearby backpacker campground. No overwinter storage would be provided.

The NPS would recommend to the Secretary of the Interior that the Glen Aulin potential wilderness addition be declared part of the Yosemite Wilderness, as provided for in section 108 of the 1984 California Wilderness Act.

The determination of how the components of the permanent buildings would be removed to frontcountry dump areas would be based on the minimum-requirement criteria established under the Wilderness Act. The estimated net construction/demolition costs for Glen Aulin under alternative 2 would be approximately \$1.1 million (see appendix L).

Backpacker Campground

See "Actions Common to Alternatives 1–4," earlier in this chapter.

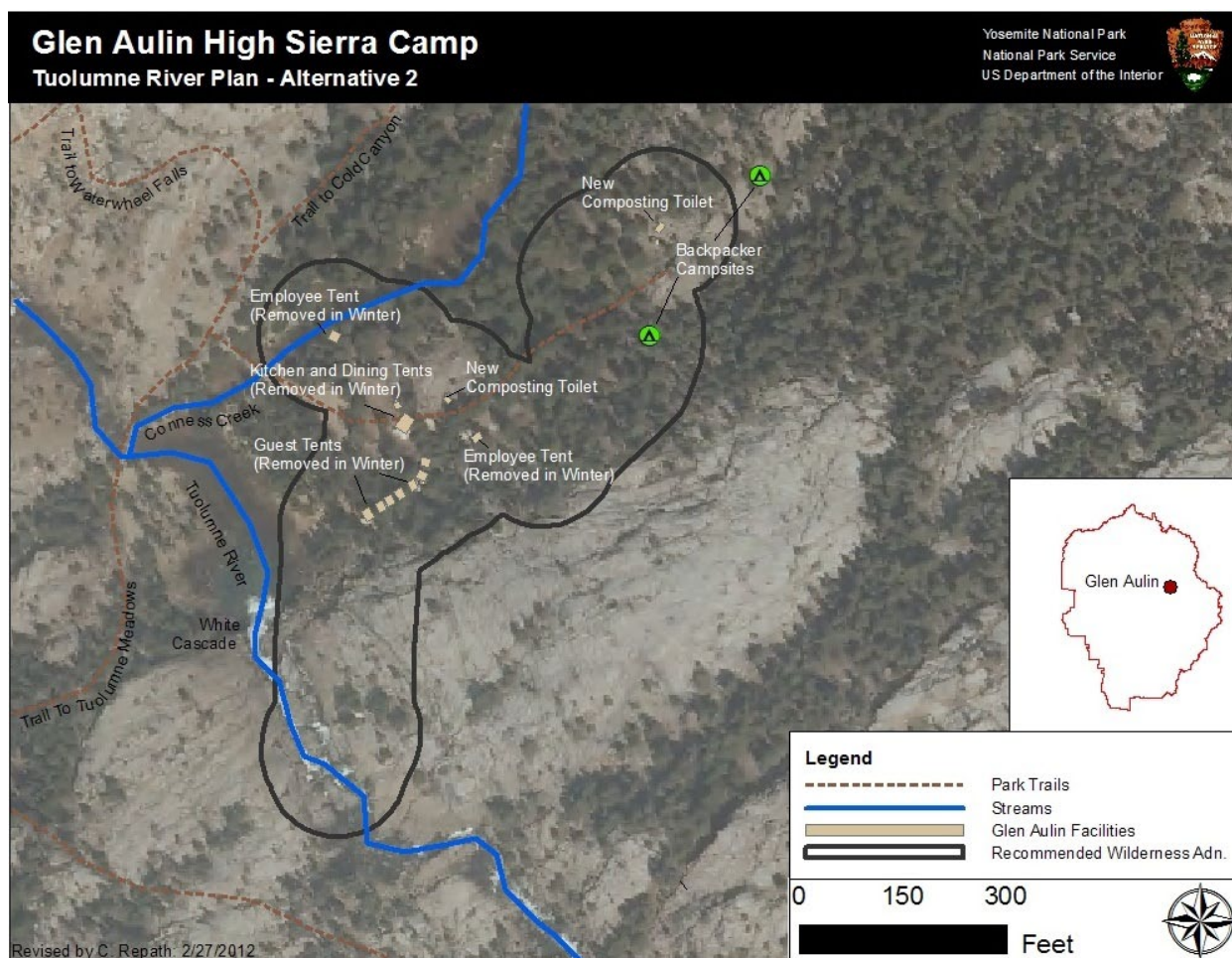


Figure 7-6. Glen Aulin Site Plan, Alternative 2.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)

Note that this discussion pertains only to the nonwilderness portions of the Tuolumne Meadows and Lower Dana Fork segments. The portions of these segments within designated wilderness would be managed the same as the wild segments.

Resource Protection and Enhancement

Free Flow

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Immediately implement water metering, ensure that all fixtures are as water-efficient as possible, and emphasize to visitors and employees the importance of conserving water. Because increases in camping and employee housing under this alternative would increase the estimated average water demand to approximately 70,000 gallons per day, intensive effort would be required to ensure that water use remained within the standard of no more than 10% of low flow. Because water consumption would be at the upper limit of the range determined to be protective of river flow at current levels, the potential for having to reduce services if climate changes resulted in lower flow levels would be greater under this alternative than under any of the other alternatives.

Water Quality

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Reduce concessioner stock day rides to reduce stock use and risks to water quality. Compared to current service levels, the amount of stock use on trails would be reduced by 1 two-hour and 2 four-hour rides per day, which might otherwise involve up to 14 head of stock per ride on the trails. Full-day rides, which occur only occasionally, would also be eliminated.

Biological Value: Subalpine Meadow and Riparian Complex

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Cultural Value: Parsons Memorial Lodge

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

Scenic Value: Scenery through Dana and Tuolumne Meadows

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Maintain views from eight scenic vista points (identified in chapter 5) by controlling the encroachment of vegetation in a manner that was protective of ecological conditions and archeological values at each vista point. Each particular vista point would be managed in accordance with an individual work plan based on evaluations of river values and other resources at that specific location. The work plans are included in appendix J. No other vegetation management would be conducted to enhance scenery or viewing opportunities.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Increase the amount of designated parking available to visitors wishing to get out of cars to enjoy recreational experiences in a river-related landscape.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

To allow for a modest expansion of opportunities for recreational use in the Tuolumne Meadows area, visitor services, facilities, and management strategies would be adjusted to direct visitors to resilient locations where they could enjoy recreational activities without adversely affecting river values. For example, rather than dispersing across the meadows, visitors would be directed from trailheads at designated parking lots to trails and boardwalks, some with fencing or other forms of delineation to discourage dispersed foot traffic through these sensitive environments; rather than picnicking informally on the banks of the river, visitors would have access to new formal picnic areas. With this management strategy, the social interaction at Tuolumne Meadows would be greater than at present; however, congestion would be mitigated with improved parking and trailhead conditions and better visitor information and orientation. Opportunities for day visitors with only a short time to spend would be enhanced by a new day parking and picnic area near the trailhead for Parsons Memorial Lodge, where visitors could connect with the river, the meadows, and the historic significance of the area during a brief visit.

Visitor services would be managed as follows:

- Conduct a full range of orientation, interpretation, and education programs, with increased emphasis on education about the need to protect river values, at a visitor contact station, wilderness center, and Parsons Memorial Lodge, and in the field.
- Retain most existing commercial services (store/grill, public fuel station, concessioner stock day rides) and the postal service (subject to future USPS level of service decisions beyond NPS control). Although the public fuel station was not identified as a necessary facility in the other alternatives, retaining it would be consistent with the higher level of visitor use and service that characterizes this alternative, and allow for a full evaluation in that context. The mountaineering shop and school would be eliminated.
- Add a public shower/restroom facility in the commercial service area.
- Reduce concessioner stock day rides to 2 two-hour rides per day (maximum of 24 people per day); eliminate the four-hour and full-day rides.
- Expand the capacity of the campground to 345 sites plus 7 group campsites.
- Retain the Tuolumne Meadows Lodge at its current capacity.
- Continue the current level of shuttle bus service among destinations within the Tuolumne Meadows area.

Maximum Amounts of Visitor Use

- Increase the maximum day use capacity above the Hetch Hetchy Reservoir from an estimated 1,762 to a maximum of 1,901 people at one time (see table 7-7; in this table, the total maximum day use number includes the maximum day use below O’Shaughnessy Dam, which would remain at 12 people at one time).
- Increase the overnight capacity at Tuolumne Meadows to 2,556 people per night: 2,280 people accommodated by the expanded campground, and 276 people accommodated by the 69 guest tent cabins at Tuolumne Meadows Lodge (see table 7-7). Actual overnight use levels would be lower than these capacities because individual campsites and lodging units would not always be occupied by the maximum number of people allowable.

Management of Visitor Use Capacity

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

Day Use

Day use capacity would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. The amount of formal, designated day parking in the Tuolumne Meadows area would be increased from 340 to 642 spaces. (See parking details under “Tuolumne Meadows Site Plan,” below.)

Overnight Use

Overnight user capacity would be managed by the facility capacities of the campground and lodge. These facilities would continue to be available through a reservation system, with some campsites also available on a first-come, first-served basis.

Administrative Use

NPS staffing would be increased to a maximum of 174 employees to provide for increased visitor and resource protection needs (including management of the user capacity program, below), additional interpretive and educational services, resource management and monitoring, and maintenance (see table 7-7). NPS Employee housing or campsites would be increased by 70 additional units to accommodate this staffing level; campsites would meet the need for incidental “housing” for employees on temporary duty in the Tuolumne Meadows

area. Concessioner employee staffing and housing necessary to support commercial services would remain the same as under the no-action alternative (103 employee employees). (See “Tuolumne Meadows Site Plan,” below for the locations of proposed employee housing.)

Tuolumne Meadows Site Plan

The locations identified below are illustrated on the site plan map (figure 7-7) at the end of this section. The estimated net construction costs for Tuolumne Meadows under alternative 2 would be approximately \$70 million, based on calculations included in appendix L.

Visitor Facilities

- Retain the store, grill, post office, and public fuel station in their current locations. No feasible location exists for relocating the fuel station outside the river corridor; it would remain at its current location where the existing underground fuel tanks have been upgraded to mitigate risk to water quality. Provide a new visitor contact station, picnic area, and public shower/restroom facility in this commercial service area. Consolidating NPS and commercial visitor services would provide better separation between visitor services and operational functions than what exists at the current visitor center location, facilitate visitor access to services, and improve operational efficiency.
- Expand the campground (see below).
- Retain the Tuolumne Meadows Lodge at its current capacity, while relocating the three guest tent cabins nearest the river to protect adjacent riparian habitat.
- Readjust the shuttle bus stops to reflect site-development changes. (Shuttle buses would no longer stop at location 3 on the site plan map [figure 7-7] once the trailhead for the Cathedral Lakes trail was relocated. A new stop would be provided at location 12 to serve the new picnic area.)

Campground

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Design for a capacity of 345 sites, including 41 additional walk-in sites (6 people per site), plus 7 group sites (30 people per site) for a maximum of 2,280 people). All walk-in sites would be on the same loop, located west of loop A, and served by composting toilets, to minimize additional water consumption.
- Retain the campground office.
- Retain the existing entrance road alignment.
- Retain the campground A-loop road. Relocate the A-loop sites that are closest to the Lyell Fork away from the river.
- Formalize a trail connection between the campground and the John Muir Trail.

Trails and Trailheads

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Delineate or fence the Cathedral Lakes trail to facilitate ecological restoration while allowing for use by pack stock and hikers.
- Move the Tioga Road trailhead for Parsons Memorial Lodge to the new day parking area south of Tioga Road and provide a trail connection to the existing trail; install protective fencing on either side of the trail from Tioga Road to Parsons Memorial Lodge to facilitate meadow recovery.
- Install protective fencing on either side of the trail/access road between Lembert Dome and Tuolumne Meadows Lodge to facilitate recovery.
- Provide a new formal trail connecting the visitor services core with the existing Parsons Memorial Lodge footbridge and trail.

- Provide a new hiking trail connecting facilities along Tioga Road; tie into the section of the Great Sierra Wagon Road east of Lembert Dome.

Picnic Areas

- Retain the picnic area at Lembert Dome.
- Provide new picnic areas
 - east of Pothole Dome
 - in the consolidated visitor services area
 - in association with the new day parking area near the Parsons Memorial Lodge trailhead
 - at the site overlooking the meadow that is currently occupied by the concessioner stable

Parking

The total number of designated parking spaces in the Tuolumne Meadows area (day and overnight) would be increased from 533 to 982 spaces.

Table 7-7a.
Number of Parking Spaces in Designated Parking Areas, Alternative 2

| Type of Parking | Current | Alternative 2 | Description |
|--|------------|--|--|
| Day Parking | 16 | 16 | existing parking area at Pothole Dome |
| | 0 | 20 | new parking/viewing area east of Pothole Dome |
| | 0 | 4 | existing roadside pullout south of Pothole Dome |
| | 0 | 58 | new parking area associated with the relocated stables |
| | 50 | 126 | existing parking area at the visitor center (expanded to also include Cathedral Lakes trailhead parking) |
| | 0 | 80 | new day parking area west of Unicorn Creek and across Tioga Road from the Parsons Memorial Lodge trailhead |
| | 11 | 13 | existing parking area at the campground office |
| | 11 | 11 | existing parking in the campground for the Elizabeth Lakes trailhead |
| | 15 | 15 | existing parking area at the fuel station |
| | 51 | 55 | existing parking area at the current site of the store and grill |
| | 58 | 0 | existing parking area at the concessioner stable |
| | 0 | 30 | new parking area in conjunction with picnic area at the existing concessioner stable |
| | 0 | 34 | roadside parking along the road to the concessioner stable |
| | 29 | 50 | existing parking area at the base of Lembert Dome |
| | 7 | 7 | existing parking area at the ranger station (relocated in this alternative) |
| 25 | 52 | existing parking area at the Dog Lake/John Muir Trail trailhead | |
| 67 | 71 | existing parking areas in the road corridor east of Tuolumne Meadows, including the Mono Pass and Gaylor Peak trailheads and the Dana Meadows and other pullouts | |
| | 340 | 642 | Total day parking |
| Overnight Parking (excluding cars parked in the Tuolumne Meadows campground) | 58 | 86 | existing parking area at the wilderness office |
| | 33 | 59 | existing parking area at the Dog Lakes/John Muir Trail trailhead |
| | 0 | 35 | relocated parking area for the Cathedral Lakes trailhead |
| | 0 | 58 | roadside parking along the road to the concessioner stable |
| | 102 | 102 | Tuolumne Meadows Lodge |
| | 193 | 340 | Total overnight parking |

NPS and Concessioner Stables

- Co-locate the NPS and concessioner stables in a new location near the wastewater treatment plant, as proposed in the *Yosemite General Management Plan*.
- Reserve the current site of the NPS stable for NPS employee housing, if needed.

Park Operations

In addition to “Actions Common to Alternatives 1–4,” earlier in this chapter:

- Adapt the CCC mess hall building (current site of the visitor center) for park operations to provide the administrative facilities determined to be necessary to support visitor use and resource protection, but which would be infeasible to locate outside the river corridor.
- Retain the ranger station.
- Retain the aboveground diesel fuel tank at the ranger station for concessioner and NPS use.

Employee Housing

- Provide NPS employee housing for no more than 144 employees, plus campsites for an additional 30 employees. This would accommodate a total of 174 NPS employees, which is the number determined to be necessary in the Tuolumne Meadows area to support the kinds and levels of visitor use included in this alternative. It would be infeasible to locate this housing outside the river corridor due to site constraints; therefore, it must be inside the corridor. To protect river values, the housing would be provided at the following locations determined not to contain river-related or sensitive resources:
 - Road Camp (30 employees)
 - Ranger Camp (70 employees)
 - Gaylor Pit (44 employees, plus 30 additional employee campsites). The area currently does not contain water, wastewater, or communication infrastructure. Additional planning and environmental compliance for employee housing at this site would be required in order to address utilities.
- Provide concessioner employee housing for 101 concessioner employees at a new housing area at Gaylor Pit, immediately west of the helipad. As stated above, the area currently does not contain water, wastewater, or communication infrastructure. Future planning for this site for employee housing would need to address utilities. Provide hard-sided cabin for two stable employees at the concessioner stable at a location that would comply with relevant OSHA and NPS housing regulations regarding the proximity of housing and stock corrals, and relocate all other stable employees to Gaylor Pit.

Utility Systems

The general direction for site-specific planning for utility systems under alternative 2, intended to protect and enhance the river’s free flow, water quality, and outstandingly remarkable values, is outlined below.

Tuolumne Meadows Wastewater Collection, Treatment, and Disposal

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Design for an average water demand of 70,000 gallons per day.
- Seek technology to allow removal of the wastewater containment ponds and sprayfields from the north side of Tioga Road and replace with facilities on the south side of the road, to be designed in conjunction with the new wastewater treatment plant. If technology is not available, redesign the ponds and sprayfields to minimize risks of overflow from containment ponds or saturation of the sprayfields.

Tuolumne Meadows Water Collection, Treatment, and Distribution

In addition to “Actions Common to Alternatives 1–4,” beginning on page 7-19:

- Design for an average water demand of 70,000 gallons per day.

Site Restoration

See “Actions Common to Alternatives 1–4,” beginning on page 7-19.

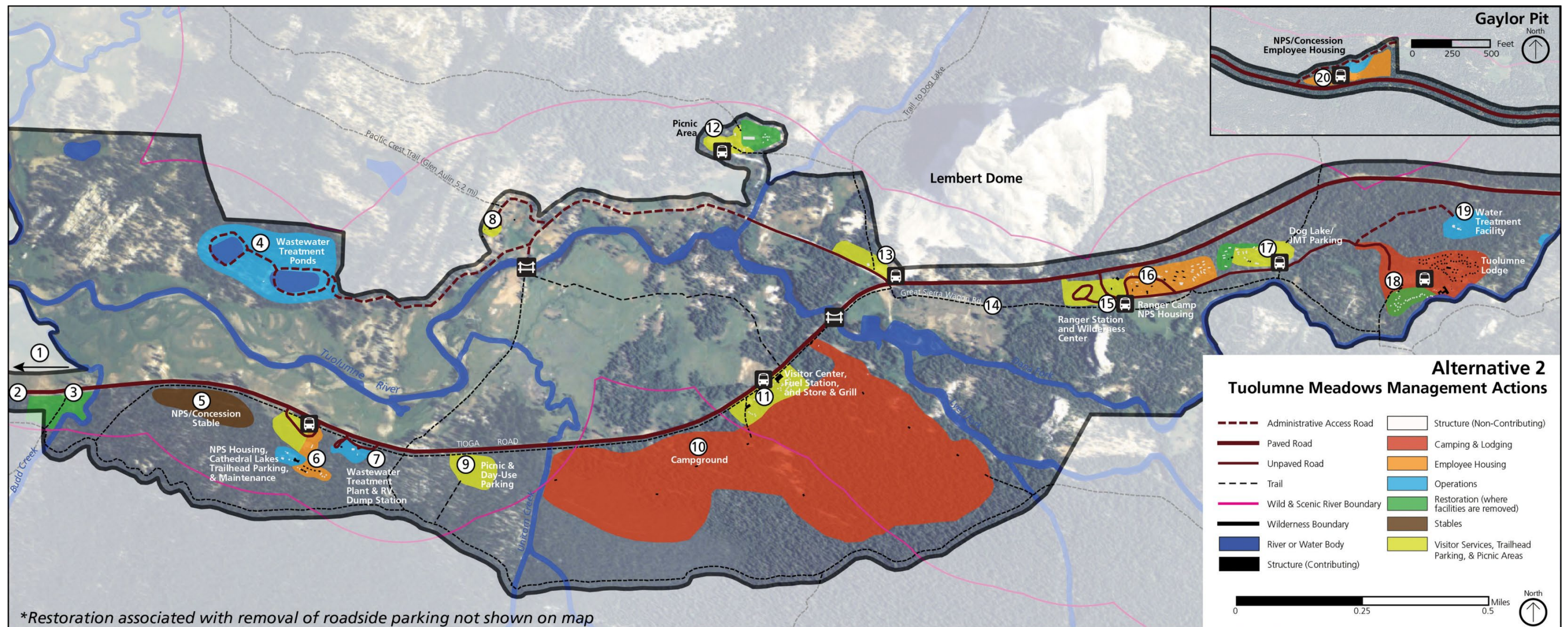


Figure 7-7. Tuolumne Meadows Site Plan, Alternative 2.

Key to figure 7-7 and List of Facilities Management Actions (actions marked with an asterisk (*) are specific to this alternative. All other actions are common to alternatives 1–4):

| | | | |
|--|---|--|--|
| <p>1. Pothole Dome scenic pullout/ parking areas</p> <ul style="list-style-type: none"> Designate day parking with trailhead on north side of Tioga Road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of Tioga Road near Pothole Dome. Add parking, viewing, picnicking area east of Pothole Dome. | <p>6. Existing visitor center and Road Camp</p> <ul style="list-style-type: none"> Relocate visitor center to location #11; convert building to park operations. Construct new Cathedral Lakes trailhead with day and overnight parking. Retain maintenance yard and office. Increase NPS employee housing. | <p>11. Existing commercial services core</p> <ul style="list-style-type: none"> Retain store, grill, public fuel station, and post office. Remove mountaineering shop/school. Add visitor contact station, shower/restroom facility, picnic area, and day parking. Add trail connector to campground. Relocate concessioner employee housing to location #20. | <p>16. Existing ranger station and Ranger Camp</p> <ul style="list-style-type: none"> Replace NPS employee housing with hard-sided cabins. Relocate ranger station function to location #15. Retain aboveground diesel fuel tank. |
| <p>2. Tioga Road through the Tuolumne Meadows area</p> <ul style="list-style-type: none"> Retain the Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Tioga Road bridge to improve free flow of river. Add hiking trail paralleling the road. | <p>7. Wastewater treatment plant</p> <ul style="list-style-type: none"> Upgrade wastewater treatment plant. Retain recreational vehicle dump station. | <p>12. Existing concessioner stable</p> <ul style="list-style-type: none"> Relocate existing concessioner stable and concessioner employee housing to location #5. Add meadow overlook picnic area and day parking. Retain day and overnight parking along access road. | <p>17. Bug Camp, Dog Lake/John Muir Trail parking</p> <ul style="list-style-type: none"> Increase day and overnight parking. Remove NPS housing. |
| <p>3. Existing Cathedral Lakes trailhead</p> <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | <p>8. Parsons Memorial Lodge</p> <ul style="list-style-type: none"> Preserve lodge and retain vehicle access. Upgrade footbridge to improve free flow of river. | <p>13. Lembert Dome</p> <ul style="list-style-type: none"> Retain picnic area. Expand day parking and retain trailheads for Lembert Dome and Parsons Memorial Lodge. Add shuttle stop. | <p>18. Tuolumne Meadows Lodge</p> <ul style="list-style-type: none"> Retain Lodge at current capacity. Eliminate roadside parking. Relocate concessioner employee housing to location #20. |
| <p>4. Existing wastewater ponds and sprayfields</p> <ul style="list-style-type: none"> Retain and upgrade (or relocate if feasible). | <p>9. Area west of Unicorn Creek</p> <ul style="list-style-type: none"> Add day parking and picnic area. Add trailhead for Parsons Memorial Lodge. | <p>14. Old Tioga Road/Great Sierra Wagon Road</p> <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of historic roads to meadow hydrology. | <p>19. Water treatment facility</p> <ul style="list-style-type: none"> Upgrade water treatment facility. |
| <p>5. Area east of Budd Creek and west of existing visitor center</p> <ul style="list-style-type: none"> Construct new Cathedral Lakes trail connector. Co-locate new NPS and concessioner stables and day parking. Build new hard-sided cabin for two stable employees. | <p>10. Tuolumne Meadows campground</p> <ul style="list-style-type: none"> Expand campground in current configuration, adding 41 additional walk-in campsites; relocate the A-loop sites closest to the Lyell Fork. Retain campground office and day parking. Retain the existing entrance road. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | <p>15. Existing wilderness center and NPS stable</p> <ul style="list-style-type: none"> Combine ranger station with existing wilderness center; expand parking. Relocate NPS stable to location #5; use site for expansion of NPS employee housing. | <p>20. Gaylor Pit</p> <ul style="list-style-type: none"> Retain helipad. Add NPS and concessioner employee housing. |

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Summary of Protection and Enhancement of River Values under Alternative 2

The *Tuolumne River Plan* will be evaluated in terms of four legal requirements: (1) the WSRA requirement that it protect and enhance river values; (2) the NEPA requirement that it fully consider the effects on the human environment; (3) the NHPA requirement that it consider effects on historic properties; and (4) the requirement of the Wilderness Act that it consider the effects on wilderness character. Guidelines for each of these requirements describe the criteria to be used in determining the effects of the plan. This section focuses directly on how the plan would meet the WSRA requirement to protect and enhance river values if alternative 2 were to be selected. The NEPA, NHPA, and Wilderness Act analyses are presented in chapter 8.

All the action alternatives, including alternative 2, would protect and enhance river values as described in detail in chapter 5 and summarized in this chapter under “Summary of Protection and Enhancement of River Values under All Action Alternatives,” earlier in this chapter. In addition, alternative 2 would take the following additional actions, primarily related to management of visitor use, user capacity, and development, to further protect or enhance river values.

Free-Flowing Condition of the River

So long as low flows remained around or above 1.0 cubic foot per second, average water withdrawals of 60,000 to 70,000 gallons per day would ensure that management could maintain consumption at no more than 10% of flow during low-flow periods and impose additional temporary conservation measures if necessary, as discussed in chapter 5.

The average estimated water demand for alternative 2 has been calculated as shown in table 7-8.

Table 7-8.
Summary of Average Estimated Water Demand, Alternative 2

| Facility | Current consumption per unit | No-Action | | Alternative 2 | |
|---|---------------------------------------|--------------------------|-----------------|--|-----------------|
| | | Number of units | Gallons per day | Number of units | Gallons per day |
| Campsites | 100 gallons/standard site/day | 304 standard sites | 30,400 | 304 standard sites | 30,400 |
| | 50 gallons/walk-in site/day | 0 walk-in sites | 0 | 41 walk-in sites | 2,050 |
| | 500 gallons/group site/day | 7 group sites | 3,500 | 7 group sites | 3,500 |
| Recreational vehicle dump station | 50 gallons/use/day | 32 dumps | 1,600 | 32 dumps | 1,600 |
| Tuolumne Meadows Lodge | 30 gallons/person/ day | 276 guests | 8,280 | 276 guests | 8,280 |
| Camper showers | 10 gallons/person/shower | 0 | 0 | 35 showers | 350 |
| NPS housing | 50 gallons/employee/ day in housing | 104 employees in housing | 5,200 | 144 employees in housing | 7,200 |
| | 25/gallons/employee/ day in campsites | 0 employees in campsites | 0 | 30 employees in campsites | 750 |
| Concessioner employee housing | 50 gallons/employee/ day | 103 employees | 5,150 | 103 employees | 5,150 |
| Cafeteria meals (2 per concessioner employee) | 6 gallons/person/ day | 206 meals | 1,236 | 206 meals | 1,236 |
| Store/grill | 5 gallons/person/ day | 1,148 visitors | 5,740 | Total visitor capacity increased by 9% | 6,257 |
| Visitor center /visitor contact station | 5 gallons/visitor/ day | 607 visitors | 3,035 | Total visitor capacity increased by 9% | 3,308 |
| Total consumption | | | 64,141 | | 70,081 |

Based on the calculations in table 7-8, the increase in overnight visitor use and employee housing under alternative 2 would increase the demand for domestic water in the Tuolumne Meadows area by 10%, to an average of about 70,000 gallons per day. Intensive management effort, including water metering, replacing inefficient fixtures, and implementing educational programs, would be required to ensure that water use remained within the standard. If climate change should lead to longer low-flow durations occurring earlier in the summer, this alternative would have the greatest potential for requiring reductions in service, including reducing the capacities at the lodge and/or campground, to ensure that the level of water consumptions remained protective of river flows.

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area would be mitigated by upgrading the wastewater treatment plant, wastewater ponds, and sprayfields. The improved utilities would be designed for loads commensurate with the estimate of domestic water use. The risk to water quality from fuel storage at the public fuel station would be mitigated, but not eliminated, by continued monitoring. Risks to water quality at Glen Aulin would be reduced by removing the wastewater treatment system and leach mound, to be replaced by a new composting toilet. Water use would be greatly reduced there. Water used for meal preparation and sanitation would be screened before disposal in a wastewater sump. Monitoring would be ongoing to ensure that water quality remained excellent at both Tuolumne Meadows and Glen Aulin.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 2 would additionally enhance this river value by directing visitors to designated trails and delineating or fencing certain trail segments to facilitate the ecological recovery of adjacent vegetation.

Management to Protect Archeological Sites

The management of visitor use common to all the action alternatives would reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. Monitoring would be ongoing to ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced by managing unnatural features, such as facilities and parked cars, to minimize their intrusion into remarkable views. The eight scenic vista points identified by the *Tuolumne River Plan* would be protected and enhanced, if necessary, by removing encroaching vegetation, primarily conifers.

Management to Protect and Enhance the Wilderness Experience along the River

The wilderness experience along trails in wild segments but within reach of a day hike from Tuolumne Meadows would be protected by restricting use to levels that resulted in encounters with no more than 10 other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced by eliminating undesignated roadside parking and congestion caused by vehicles slowing to park and pedestrians crossing the road. Opportunities for people wishing to park their cars would be enhanced by increasing the number of designated parking spaces.

Alternative 3: Celebrating the Tuolumne Cultural Heritage

Alternative 3 builds upon all the major elements included in the *Tuolumne River Plan* to identify a set of management actions that would work together to protect river values while accommodating day and overnight visitors in a historic setting.

Alternative 3 includes the technical correction to the river corridor boundary (presented in chapter 3), the section 7 determination process for evaluating water resources projects (presented in chapter 4), the management standards and actions for protecting and enhancing river values (presented in chapter 5), and the guidance for identifying an appropriate visitor experience and associated user capacity (presented in chapter 6).

Concept

Alternative 3 responds to those members of the public who have strong traditional ties to the Tuolumne River corridor and who expressed a desire to see the area remain unchanged. It would preserve many aspects of Tuolumne Meadows' historic setting.

As with all alternatives, most of the river corridor would be managed as wilderness. In these areas, natural river-related systems would be sustained by natural ecological processes, archeological and American Indian traditional cultural resources would characterize the cultural landscape, and recreational opportunities would be primitive and unconfined.

Tuolumne Meadows and Glen Aulin would serve as platforms for celebrating the relationships people have had with the Tuolumne River over decades. Many of the historic visitor facilities at Tuolumne Meadows and Glen Aulin date from a time when a trip to the Tuolumne River was a rigorous journey and amenities were few. Visitors would continue to have the opportunity for a classic national park experience, characterized by ranger-guided walks and interpretive programs, independent exploration along the river (including opportunities to disperse away from formal trails), horseback riding, camping, and rustic lodging, in a high-country setting retaining historic structures and buildings. Visitors who have developed deep personal connections with these areas through repeated experiences shared among generations would continue to have these opportunities in a setting that would appear little changed over time.

In giving primacy to the cultural landscape, this alternative would not endorse perpetuating past patterns of use that proved to be unsustainable, like unmanaged camping in the meadows. The desire to maintain strong, tangible ties with the past would be balanced with lessons from the past and present so that the experience could be perpetuated for future generations.

In comparison to no action, alternative 3 would include the following actions:

- Restore previously disturbed ecological conditions to subalpine meadow and riparian areas.
- Reduce risks to stream flow and water quality.
- Increase protection of archeological sites and resources important to American Indians.
- Reduce the capacity of the Tuolumne Meadows Lodge by half.
- Slightly reduce lodging and the level of service at Glen Aulin.

**Table 7-9.
 Corridorwide Visitor and Administrative Use Capacity, Alternative 3**

| Visitor Overnight Capacity | | | | | |
|--|--|--|---|--|------------------------------------|
| River Segment | Existing Use Calculation | Current Overnight Visitors | Proposed Action | Units | Maximum Overnight Visitors, Alt. 3 |
| Scenic Segments | | | | | |
| Tuolumne Meadows Lodge | # of lodging units (69) × max of 4 people per unit | 276 | Reduce lodge capacity (minus 35 guest tent cabins) | 34 guest tent cabins | 136 |
| Tuolumne Meadows Campground | # of campsites (304 sites × max 6 people per site, 7 group sites × max 30 people per site) | 2,034 | Retain campground capacity | 304 sites, 7 groups sites | 2,034 |
| Wild Segments | | | | | |
| Glen Aulin HSC | # of lodging units (8) × max of 4 people per unit | 32 | Reduce Glen Aulin HSC capacity (minus 1 guest tent cabin) | 7 guest tent cabins | 28 |
| Wilderness | Maximum capacity of wilderness zones (400) | 400 | Retain current wilderness zone capacities | – | 400 |
| Subtotal, Overnight | | 2,742 | | | 2,598 |
| Visitor Day Use Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum Observed People At One Time, 2011 ^a | Proposed Action | Proposed Units | Maximum People At One Time, Alt. 3 |
| Scenic Segments | | | | | |
| Access from Tuolumne Meadows | # of cars parking in designated parking spaces (340) × 2.9 ^b | 986 | Increase designated day parking (plus 170 spaces) | 510 spaces at 90% occupancy × 2.9 ^b | 1,331 |
| | # cars parking in undesignated spaces (190) × 2.9 ^b | 551 | Eliminate undesignated roadside parking | – | 0 |
| | Maximum people arriving by in-park shuttles, tour buses, and regional public transit | 225 | Maintain current level of arrivals by in-park shuttles, tour buses, and regional public transit | – | 225 |
| Access from below O'Shaughnessy Dam | # of cars parking in designated spaces (4) × 2.9 ^b | 12 | Retain existing parking. | 4 spaces × 2.9 ^b | 12 |
| Subtotal, Day Use | | 1,774 | | | 1,568 |
| Total Visitor People At One Time | | 4,516 | | | 4,166 |
| Administrative Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum employees (existing) | Proposed Action | Units | Maximum employees, Alt. 3 |
| Wild Segments | | | | | |
| Concessioner | Approximately 9 employees at Glen Aulin HSC | 9 | Retain all employees at Glen Aulin HSC | 9 | 9 |
| Scenic Segments | | | | | |
| NPS | Approximately 150 employees assigned to Tuolumne Meadows | 150 | Meet staffing need with 124 employees at Tuolumne Meadows | 124 employees | 124 |
| Concessioner | 103 employees based at Tuolumne Meadows | 103 | Meet staffing need with 103 employees at Tuolumne Meadows | 103 employees | 103 |
| Total Administrative People At One Time | | 262 | | | 236 |
| Total Capacity Corridorwide | | 4,778 (existing) | | | 4,402 (proposed) |

a The peak number of vehicles observed during vehicle counts in 2011 (observed on August 13, 2011).

b The vehicle occupancy rate is 2.9 people per vehicle, based on visitor studies conducted over the past 20 years that found an average vehicle occupancy ranging from 2.6 to 3.4 (Van Wagtenonk and Coho 1980; FHWA 1982; Corridor ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). Based on this range, an average of 2.9 persons per vehicle is used for estimating visitor numbers for planning purposes in this document.

Abbreviations: Alt. = alternative; HSC = High Sierra Camp; max = maximum; # = number

River values would be protected and enhanced by restoring ecological conditions to meadow and riparian areas, and by directing use in scenic segments to resilient areas (see “Summary of Protection and Enhancement of River Values under Alternative 3” at the end of this alternative).

The visitor use capacity under alternative 3 would be reduced to a maximum of 4,166 people at one time, as shown in table 7-9. Actual day use levels would be lower during nonpeak periods, and actual overnight use levels would be lower even during peak periods because not all individual campsites and lodging units would be occupied by the maximum number of people allowable. The administrative use capacity under alternative 3 would be reduced to a maximum of 236 employees at one time (table 7-9).

Wild Segments (Designated Wilderness and Glen Aulin)

Resource Protection and Enhancement

Free Flow

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Water Quality

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Continue to restrict water use at the Glen Aulin High Sierra Camp to 600 gallons per day to mitigate the risk to water quality (see “Glen Aulin,” below).

Biological Value: Subalpine Meadow and Riparian Complex

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Biological Value: Low-Elevation Riparian and Meadow Habitat

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Scenic Value: Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Recreational Value: Wilderness Experience along the River

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Manage day use levels along wilderness trails within reach of day hikes from Tioga Road to achieve a standard of no more than 10 encounters with other parties per hour (80% of the time, sampled over the entire season, including weekdays and weekends).
- Continue concessioner stock day rides into wilderness, but at a reduced capacity to reduce conflicts on trails (four-hour and all-day rides eliminated; two-hour rides reduced from 3 to 2 per day, accommodating a maximum of 24 people per day).
- Allow commercial use in wilderness, with restrictions on types and levels of use based on a determination of extent necessary (see appendix C) that gives priority to noncommercial use and restricts commercial use to no more than one overnight group per zone per night and no more than one day group per trail per day. Additional restrictions would include the following:

- *Restrictions on types of use, Glen Aulin zone, peak months only:* During the peak use months of July and August, commercial groups having only a recreational purpose would no longer have access to the Glen Aulin zone; groups having an educational or scenic, as well as recreational, purpose (as defined in appendix C) would continue to have access consistent with limitations on total use levels, described above.
- *Restrictions on types of use, Lyell Canyon zone, peak months only:* During the peak use months of July and August, commercial use in the Lyell Canyon zone by groups with only a recreational purpose would be restricted to Monday–Thursday only. Groups having an educational or scenic, as well as a recreational, purpose would continue to have access to the Lyell Canyon zone on weekends, as well as weekdays, consistent with limitations on total use levels, described above.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

All ongoing uses would continue.

Maximum Amounts of Visitor Use

Maximum day use along popular wilderness trails would be limited as necessary to achieve the standard of encounters with no more than ten parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

The overnight capacity for backpacker camping in wild segments would be retained at 400 persons per night (350 persons per night above the reservoir and 50 persons per night below the reservoir). This capacity might be reduced in the future if determined necessary to protect wilderness values; however, it would not be increased above this amount, which has been determined to be protective of river values. The overnight capacity at the Glen Aulin High Sierra Camp would be reduced to 28 guests.

Management of Visitor Use Capacity

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- The current overnight trailhead quota system would be retained to regulate overnight use in wild segments.

Administrative Use

The types and levels of administrative use in wild segments would remain the same as existing conditions. Nine concessioner employees would be housed at the Glen Aulin High Sierra Camp.

Glen Aulin (Potential Wilderness Addition)

Glen Aulin High Sierra Camp

The Glen Aulin High Sierra Camp would be retained at a reduced capacity of 28 guests to facilitate opportunities for visitors with a broader range of physical abilities to connect with the river in a remote setting, while increasing protection of river values. Day use at Glen Aulin would decrease commensurate with an overall reduction in day use in the river corridor. The level of service at the camp would be reduced:

- Eliminate flush toilets for guests to reduce demands for water use and waste disposal. Provide composting toilets for guests. Retain flush toilets for employees living at Glen Aulin.
- Discontinue wood for heat stoves in visitor tent cabins to reduce the need for stock use to supply wood to the camp.

- Discontinue “meals-only” service for people who are not lodge guests to reduce demands for water use and waste disposal.
- Continue overnight saddle trips to the camp.

Utility improvements at the camp would include the following (see figure 7-8):

- Design for a capacity of 600 gallons per day.
- Construct a new composting toilet facility between the granite slab behind the kitchen and the septic tank. To the extent possible, facility design would be compatible with the historic character.
- Install one water treatment tank (1,200 gallons) and one water storage tank (1,200 gallons) north of the existing water tank; remove the existing tank. Replace the existing chlorinator, filter tank, and surge tanks.
- Retain the existing septic tank and leach mound.

The replacement storage tanks, filter tank, and surge tanks would be flown in by helicopter. The rest of the materials would be either flown in by helicopter or packed in with stock. The determination as to which mode of transport to use would be based on the minimum-requirement criteria established under the Wilderness Act. The estimated net construction costs for Glen Aulin under alternative 3 would be approximately \$1.1 million (see appendix L).

Backpacker Campground

See "Actions Common to Alternatives 1-4," beginning on page 7-19.

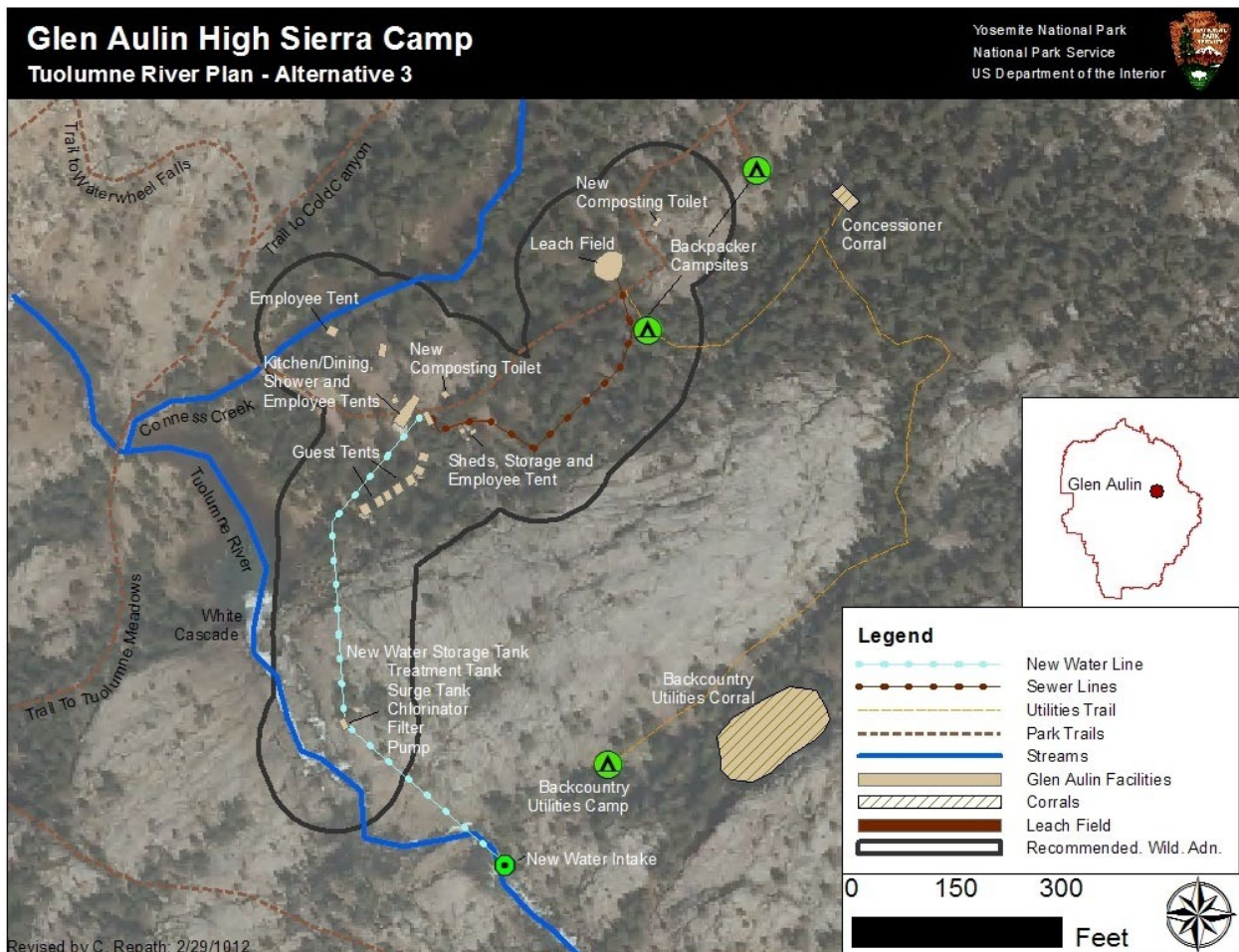


Figure 7-8. Glen Aulin Site Plan, Alternative 3.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)

Note that this discussion pertains only to the nonwilderness portions of the Tuolumne Meadows and Lower Dana Fork segments. The portions of these segments within designated wilderness would be managed the same as the wild segments.

Resource Protection and Enhancement

Free Flow

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Reduce uses, primarily overnight lodging, that would otherwise require water consumption, thus reducing the estimated average water demand to approximately 60,000 gallons per day. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow unless climate change led to longer low-flow durations occurring earlier in the summer, in which case further reductions in water use would be required as discussed in chapter 5.

Water Quality

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Reduce concessioner stock day rides to reduce stock use and risks to water quality. Compared to current service levels, the amount of stock use on trails would be reduced by 1 two-hour and 2 four-hour rides per day, which might otherwise involve up to 14 head of stock per ride on the trails. Full-day rides, which occur only occasionally, would also be eliminated.
- Remove the public fuel station to eliminate the risk to water quality.

Biological Value: Subalpine Meadow and Riparian Complex

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Cultural Value: Parsons Memorial Lodge

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Tuolumne Meadows, Soda Springs, and Tioga Road Historic Districts

The Tuolumne Meadows, Soda Springs, and Tioga Road Historic Districts did not meet the outstandingly remarkable value criteria (see the criteria in the “Background” section of chapter 5). However, these historic districts are considered critical to the implementation of alternative 3 and therefore are addressed under this alternative. Under alternative 3, the three historic districts would be managed as follows to preserve their historic character and to protect and enhance opportunities for visitors to connect with the history and traditional uses of the Tuolumne River:

- Keep all visitor and administrative functions that are to be retained under alternative 3 in their current structures and current locations, most of which are historic and contributing elements of the Tuolumne Meadows Historic District. (Half the Tuolumne Meadows Lodge guest tent cabins and the fuel station/mountaineering shop would be removed under this alternative.) All of the functions to be retained under alternative 3 have been determined to be necessary, and no feasible locations exist outside the river

corridor to relocate these functions; therefore, it would be consistent with the intent of the WSRA and the concept of this alternative to retain them in their historic structures and locations.

- Upgrade exterior of wilderness center to be compatible with the historic landscape.
- Retain the Tioga Road on its current alignment. Impacts of culvert improvements on the district would be minimized or avoided by salvaging and reusing materials of the original historic culverts and ensuring that new or modified structures (e.g., headwalls) were compatible with the materials, size, and scale of the originals.

Scenic Value: Scenery through Dana and Tuolumne Meadows

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Maintain views from eight scenic vista points (identified in chapter 5) by controlling the encroachment of vegetation in a manner that was protective of ecological conditions and archeological values at each vista point. Each particular vista point would be managed in accordance with an individual work plan based on evaluations of river values and other resources at that specific location. The work plans are included in appendix J. No other vegetation management would be conducted to enhance scenery or viewing opportunities.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Increase the amount of designated parking available to visitors wishing to get out of cars to enjoy recreational experiences in a river-related landscape.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

To enhance opportunities for visitors to connect with the history and traditional uses of the Tuolumne River, the historic setting would be preserved under alternative 3, and the day use capacity would be somewhat reduced to allow for a mix of traditional park programs and relatively unstructured exploration at a level that would be protective of river values. As with alternatives 2 and 4, visitors would be directed from trailheads at designated parking lots to trails; however, unlike alternatives 2 and 4, they would not be discouraged from dispersing into the meadow or along the riverbank. Congestion would be reduced by reducing use levels, improving parking and trailhead conditions, increasing shuttle bus service between destinations within the Tuolumne Meadows area, and expanding visitor information and orientation services to advise visitors about less used destinations and trail segments.

Visitor services would be managed as follows:

- Conduct a full range of orientation, interpretation, and education programs, with increased emphasis on education about the need to protect river values, at the visitor center, wilderness center, Parsons Memorial Lodge, and in the field.
- Retain some commercial services (store/grill, concessioner stock day rides) and the postal service (subject to future USPS level of service decisions beyond NPS control). The public fuel station and mountaineering shop and school would be eliminated.
- Reduce concessioner stock day rides to 2 two-hour rides per day (maximum of 24 people per day); eliminate the four-hour and full-day rides.
- Retain the campground at its current capacity of 304 sites plus 7 group campsites.
- Retain the Tuolumne Meadows Lodge, but at half its current capacity. Such a reduced capacity would preserve the historic setting while reducing use levels to allow for a mix of traditional park programs and

relatively unstructured exploration at a level that would be protective of river values. The reduced capacity would also decrease demands for water use and disposal.

- Increase the frequency of shuttle bus service among destinations within the Tuolumne Meadows area, and add stops at visitor service areas, thereby making it easier for visitors to use public transportation to circulate within the Tuolumne Meadows area.

Maximum Amounts of Visitor Use

- Reduce the maximum day use capacity above Hetch Hetchy Reservoir from 1,762 people at one time to a maximum of 1,556 people at one time (see table 7-9; in this table, the total maximum day use number includes the maximum day use below O’Shaughnessy Dam, which would remain at 12 people at one time).
- Reduce the overnight capacity at Tuolumne Meadows to 2,170 people per night: 2,034 people accommodated by the 304 sites and 7 group sites in the campground, and 136 people accommodated by the 34 guest tent cabins at Tuolumne Meadows Lodge (see table 7-9). Actual overnight use levels would be lower than these capacities because individual campsites and lodging units would not always be occupied by the maximum number of people allowable.

Management of Visitor Use Capacity

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

Day Use

Day use capacity would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. The amount of formal, designated day parking in the Tuolumne Meadows area would be increased from 340 to 510 spaces. (See parking details under “Tuolumne Meadows Site Plan,” below.)

Overnight Use

Overnight user capacity under alternative 3 would be managed by the facility capacities of the campground and Tuolumne Meadows Lodge. These facilities would continue to be available through a reservation system, with some campsites also available on a first-come, first-served basis.

Administrative Use

NPS staffing would be reduced to a maximum of 124 employees (see table 7-9). In addition to current housing, 20 employee campsites would be provided to meet the need for incidental “housing” for employees on temporary duty in the Tuolumne Meadows area (see “Employee Housing,” below). Concessioner employee staffing and housing necessary to support commercial services would remain the same as under the no-action alternative (103 employees). (See “Tuolumne Meadows Site Plan,” below for the location of proposed employee housing.)

Tuolumne Meadows Site Plan

The locations identified below are illustrated on the site plan map (figure 7-9) at the end of this section on alternative 3. The estimated net construction costs for Tuolumne Meadows under alternative 3 would be approximately \$48.5 million, based on calculations included in appendix L.

Visitor Facilities

- Retain the visitor center, wilderness center, and store and grill in their existing locations and arrangement to maintain the historic character of the river corridor. Upgrade exterior of the wilderness center to be compatible with the historic landscape. The public fuel station and the mountaineering shop/school would be removed.
- Retain the campground at its current capacity (see the next subhead below).
- Retain the Tuolumne Meadows Lodge but at half its current capacity. The 35 tent cabins on the north side of the lodge complex would be removed. The three guest tent cabins nearest the river would be relocated to protect adjacent riparian habitat.
- Increase shuttle bus stops. (Shuttle buses would no longer stop at location 3 on the site plan after a new trailhead was provided for the Cathedral Lakes trailhead.)

Campground

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Design for a capacity of 304 sites (6 people per site) plus 7 group sites (30 people per site) for a maximum of 2,034 people).
- Retain the campground A-loop road and campsites.
- Retain the campground office.
- Retain the existing entrance road alignment.
- Formalize a trail connection between the campground and the John Muir Trail.

Trails and Trailheads

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Picnic Areas

- Retain the picnic area near Lembert Dome (replace the waterless toilets in kind).
- Provide new picnic area east of Pothole Dome.
- Provide new picnic area near the new Cathedral Lakes trailhead.

Parking

The total number of designated parking spaces in the Tuolumne Meadows area (day and overnight) would be increased from 533 to 813 spaces.

**Table 7-9a.
 Number of Parking Spaces in Designated Parking Areas, Alternative 3**

| Type of Parking | Current | Alternative 3 | Description |
|--|------------|---------------|--|
| Day Parking | 16 | 16 | existing parking area at Pothole Dome |
| | 0 | 4 | existing roadside pullout south of Pothole Dome |
| | | 20 | new parking/viewing area east of Pothole Dome |
| | 50 | 113 | existing parking area at the visitor center, including additional parking for the Cathedral Lakes trailhead |
| | 11 | 13 | existing parking area at the campground office |
| | 11 | 11 | existing parking in the campground for the Elizabeth Lakes trailhead |
| | 15 | 15 | existing parking area at the fuel station |
| | 51 | 55 | existing parking area at the current site of the store and grill |
| | 58 | 58 | existing parking area at the concessioner stable |
| | 0 | 34 | roadside parking along the road to the concessioner stable |
| | 29 | 37 | existing parking area at the base of Lember Dome |
| | 7 | 7 | existing parking area at the ranger station |
| | 25 | 45 | existing parking area at the Dog Lake/John Muir Trail trailhead |
| | 0 | 15 | existing parking area at Gaylor pit |
| | 67 | 67 | existing parking areas in the road corridor east of Tuolumne Meadows, including the Mono Pass and Gaylor Peak trailheads and the Dana Meadows and other pullouts |
| | 340 | 510 | Total day parking |
| Overnight Parking (excluding cars parked in the Tuolumne Meadows campground) | 58 | 86 | existing parking area at the wilderness office |
| | 33 | 59 | existing parking area at the Dog Lakes/John Muir Trail trailhead |
| | 0 | 32 | relocated parking area for the Cathedral Lakes trailhead |
| | 0 | 56 | roadside parking along the road to the concessioner stable |
| | 102 | 70 | Tuolumne Meadows Lodge |
| | 193 | 303 | Total overnight parking |

NPS and Concessioner Stables

- Retain the NPS and concessioner stables in their current locations. Housing for all but two employees would be removed from the stable area and replaced at the consolidated concessioner employee housing area near Tuolumne Meadows Lodge (see “Employee Housing,” below).

Park Operations

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Add a new maintenance yard and office and consolidate operational facilities related to roads, trails, buildings, and grounds at the wastewater treatment site.
- Relocate the aboveground diesel fuel tank to the new maintenance yard for concessioner and NPS use.

Employee Housing

- Provide NPS employee housing for no more than 104 employees, plus campsites for an additional 20 employees to be added behind Tuolumne Meadows Lodge. This would accommodate a total of 124 employees, which is the amount of housing determined to be necessary in the Tuolumne Meadows area to support the kinds and levels of visitor use included in alternative 3. It would be infeasible to locate this housing outside the river corridor due to site constraints; therefore, it must be inside the corridor.
 - Road Camp (17 employees)
 - Ranger Camp (54 employees)
 - Bug Camp (33 employees)
 - campsites behind Tuolumne Meadow Lodge (20 employees)

- Provide concessioner employee housing for 101 employees north of the existing Tuolumne Meadows Lodge parking area (at a density equal to that of the existing lodge employee area plus kitchen, dining, toilet, and shower house facilities). Provide a hard-sided cabin for two stable employees at the concessioner stable at a location that would comply with relevant OSHA and NPS housing regulations regarding the proximity of housing and stock corrals, and relocate all other stable employees to the lodge area.

Utility Systems

The general direction for site-specific planning for utility systems under alternative 3, intended to protect and enhance the river's free flow, water quality, and outstandingly remarkable values, is outlined below.

Tuolumne Meadows Wastewater Collection, Treatment, and Disposal

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Design for an average water demand of 60,000 gallons per day.
- Seek technology to allow removal of the wastewater containment ponds and sprayfields from the north side of Tioga Road and replace with facilities on the south side of the road, to be designed in conjunction with the new wastewater treatment plant. If technology is not available, redesign the ponds and sprayfields to minimize risks of overflow from containment ponds or saturation of the sprayfields.

Tuolumne Meadows Water Collection, Treatment, and Distribution

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Design for an average water demand of 60,000 gallons per day.

Site Restoration

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

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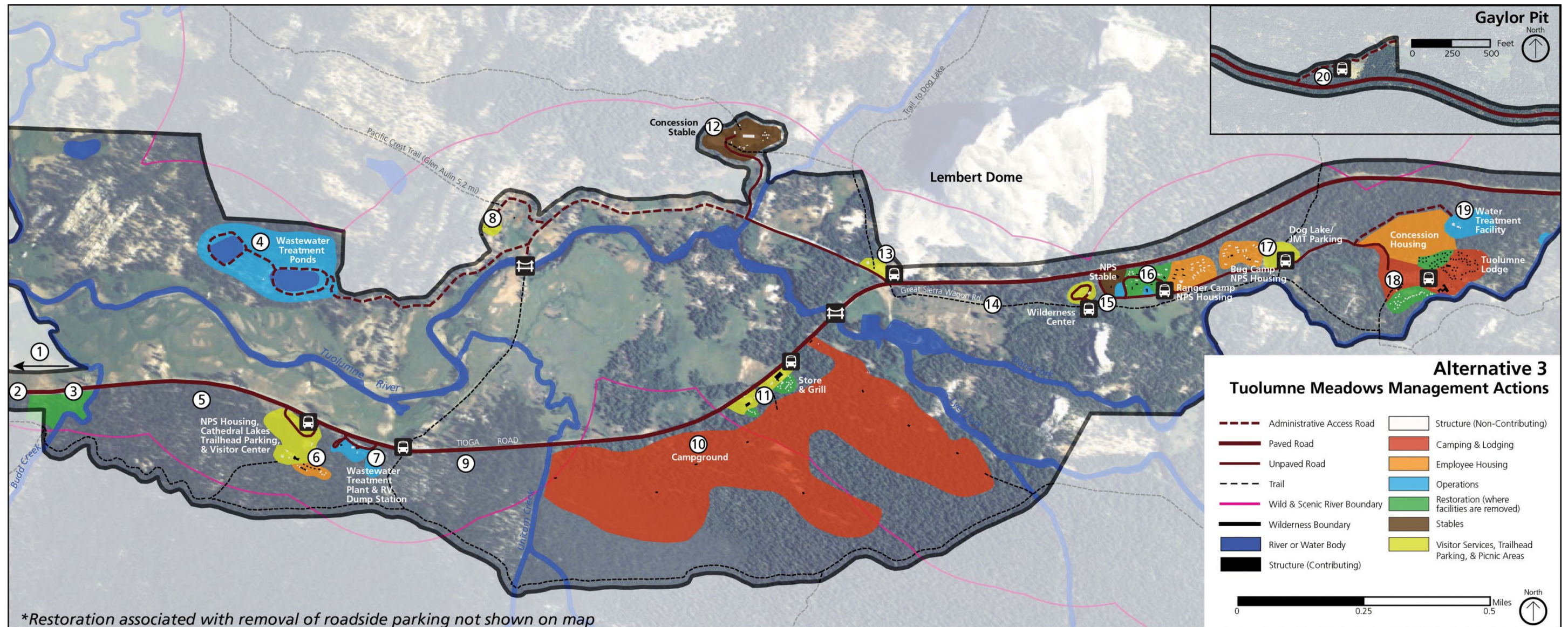


Figure 7-9. Tuolumne Meadows Site Plan, Alternative 3.

Key to figure 7-9 and List of Facilities Management Actions (actions marked with an asterisk (*) are specific to this alternative. All other actions are common to alternatives 1-4):

| | | | | | | | |
|--|---|--|---|---------------------------------------|---|---|---|
| 1. Pothole Dome scenic pullout/ parking areas | <ul style="list-style-type: none"> Designate day parking with trailhead on north side of Tioga Road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of Tioga Road near Pothole Dome. * Add parking, viewing, and picnicking area east of Pothole Dome. | 6. Existing visitor center and Road Camp | <ul style="list-style-type: none"> * Retain visitor center in current location. Construct new cathedral lakes trailhead and picnic area, day and overnight parking. * Relocate maintenance yard and office to location #7. * Retain NPS employee housing. | 10. Tuolumne Meadows campground | <ul style="list-style-type: none"> * Retain campground in current configuration at current capacity. Retain campground office and day parking. * Retain existing entrance road. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | 14. Old Tioga Road/Great Sierra Wagon Road | <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of historic roads to meadow hydrology. |
| 2. Tioga Road through the Tuolumne Meadows area | <ul style="list-style-type: none"> Retain the Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. | 7. Wastewater treatment plant | <ul style="list-style-type: none"> Upgrade wastewater treatment plant. Retain recreational vehicle dump station. Add new modest operational facilities related to roads, trails, buildings, and grounds. Add NPS maintenance yard and office, including aboveground diesel fuel tank. Diesel fuel tank for NPS and concessioner use relocated from location #16. | 11. Existing commercial services core | <ul style="list-style-type: none"> * Retain store, grill, post office, and day parking. Remove mountaineering shop/school and public fuel station; retain day parking at fuel station site. Upgrade restroom. Add trail connector to campground. Relocate concessioner employee housing to location #18. | 15. Existing wilderness center and NPS stable | <ul style="list-style-type: none"> * Retain wilderness center; expand parking. Retain NPS stable. |
| 3. Existing Cathedral Lakes trailhead | <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | 8. Parsons Memorial Lodge | <ul style="list-style-type: none"> Preserve lodge and retain vehicle access. Upgrade footbridge to improve free flow of river. | 12. Existing concessioner stable | <ul style="list-style-type: none"> * Retain concessioner stable and day parking. Retain one hard-sided cabin for two stable employees (most employee housing relocated to location #18). * Retain day and overnight parking along access road. | 16. Existing ranger station and Ranger Camp | <ul style="list-style-type: none"> * Retain ranger station and day parking. Relocate aboveground diesel fuel tank to location #7. Replace NPS employee housing with hard-sided cabins. |
| 4. Existing wastewater ponds and sprayfields | <ul style="list-style-type: none"> * Retain and upgrade (or relocate if feasible). | 9. Area west of Unicorn Creek | <ul style="list-style-type: none"> * Retain as undeveloped natural area. | 13. Lembert Dome | <ul style="list-style-type: none"> Retain picnic area. Expand day parking and retain trailheads for Lembert Dome and Parsons Memorial Lodge. Add shuttle stop. | 17. Bug Camp, Dog Lake/ John Muir Trail parking | <ul style="list-style-type: none"> * Increase day and overnight parking. Retain NPS employee housing. |
| 5. Area east of Budd Creek and west of existing visitor center | <ul style="list-style-type: none"> Construct new cathedral lakes trailhead connector. * Retain as undeveloped natural area except for trail segment. | | | | | 18. Tuolumne Meadows Lodge | <ul style="list-style-type: none"> * Retain Lodge with reduced capacity. Eliminate roadside parking. Expand concessioner employee housing. |
| | | | | | | 19. Water treatment facility | <ul style="list-style-type: none"> Upgrade water treatment facility. |
| | | | | | | 20. Gaylor Pit | <ul style="list-style-type: none"> Retain helipad. * Add day parking. |

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Summary of Protection and Enhancement of River Values under Alternative 3

The *Tuolumne River Plan* will be evaluated in terms of four legal requirements: (1) the WSRA requirement that it protect and enhance river values; (2) the NEPA requirement that it fully consider the effects on the human environment; (3) the NHPA requirement that it consider effects on historic properties; and (4) the requirement of the Wilderness Act that it consider the effects on wilderness character. Guidelines for each of these requirements describe the criteria to be used in determining the effects of the plan. This section focuses directly on how the plan would meet the WSRA requirement to protect and enhance river values if alternative 3 were to be selected. The NEPA, NHPA, and Wilderness Act analyses are presented in chapter 8.

All the action alternatives, including alternative 3, would protect and enhance river values as described in detail in chapter 5 and summarized in this chapter under “Summary of Protection and Enhancement of River Values under All Action Alternatives,” beginning on page 7-28. In addition, alternative 3 would take the following additional actions, primarily related to management of visitor use, user capacity, and development, to further protect or enhance river values.

Free-Flowing Condition of the River

So long as low flows remained around or above 1.0 cubic foot per second, average water withdrawals of 60,000 to 70,000 gallons per day would ensure that management could maintain consumption at no more than 10% of flow during low-flow periods and impose additional temporary conservation measures if necessary, as discussed in chapter 5. The average estimated water demand for alternative 3 is shown in table 7-10.

Table 7-10.
Summary of Average Estimated Water Demand, Alternative 3

| Facility | Current consumption per unit | No-Action | | Alternative 3 | |
|---|---------------------------------------|--------------------------|-----------------|--|-----------------|
| | | Number of units | Gallons per day | Number of units | Gallons per day |
| Campsites | 100 gallons/site/day | 304 sites | 30,400 | 304 sites | 30,400 |
| | 500 gallons/group site/day | 7 group sites | 3,500 | 7 group sites | 3,500 |
| Recreational vehicle dump station | 50 gallons/use/day | 32 dumps | 1,600 | 32 dumps | 1,600 |
| Tuolumne Meadows Lodge | 30 gallons/person/ day | 276 guests | 8,280 | 136 guests | 4,080 |
| Camper showers | 10 gallons/person/shower | 0 | 0 | 0 | 0 |
| NPS housing | 50 gallons/employee/ day in housing | 104 employees in housing | 5,200 | 104 employees in housing | 5,200 |
| | 25/gallons/employee/ day in campsites | 0 employees in campsites | 0 | 20 employees in campsites | 500 |
| Concessioner employee housing | 50 gallons/employee/ day | 103 employees | 5,150 | 103 employees | 5,150 |
| Cafeteria meals (2 per concessioner employee) | 6 gallons/person/day | 206 meals | 1,236 | 206 meals | 1,236 |
| Store/grill | 5 gallons/person/day | 1,148 visitors | 5,740 | Total visitor capacity decreased by 8% | 5,281 |
| Visitor center / visitor contact station | 5 gallons/visitor/day | 607 visitors | 3,035 | Total visitor capacity decreased by 8% | 2,792 |
| Total consumption | | | 64,141 | | 59,739 |

As shown by the calculations in table 7-10, a reduction in levels of use, particularly overnight use, would reduce the average estimated water demand by about 6% to about 60,000 gallons per day. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow.

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area would be mitigated by upgrading the wastewater treatment plant, wastewater ponds, and sprayfields. The improved utilities would be designed for loads commensurate with estimates of domestic water use. The risk to water quality from fuel storage at the public fuel station would be eliminated. Risks to water quality at Glen Aulin would be mitigated by replacing flush toilets with composting toilets and slightly decreasing use levels, which would keep the demand for water at no more than 600 gallons per day. Monitoring would be ongoing to ensure that water quality remained excellent at both Tuolumne Meadows and Glen Aulin.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 3 would additionally reduce the maximum people at one time in the river corridor (almost all of whom would access through the Tuolumne Meadows area) by an estimated 8% (from an estimated maximum user capacity of 4,778 visitors and employees to a maximum user capacity of 4,402 visitors and employees). The reduction in numbers of people would be expected to keep meadow fragmentation associated with foot traffic within the protective standard discussed in chapter 5.

Management to Protect Archeological Sites

The same management of visitor use described above would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. Monitoring would be ongoing to ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced by managing unnatural features, such as facilities and parked cars, to minimize their intrusion into remarkable views.

The eight scenic vista points identified by the *Tuolumne River Plan* would be protected and enhanced if necessary by removing encroaching vegetation, primarily conifers.

Management to Protect and Enhance the Wilderness Experience along the River

The wilderness experience along trails in wild segments but within reach of a day hike from Tuolumne Meadows would be protected by restricting use to levels that resulted in encounters with no more than 10 other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced by eliminating undesignated roadside parking and the congestion currently caused by vehicles slowing to park and pedestrians crossing the road. Opportunities for people wishing to park and get out of their cars would be enhanced by increasing the number of designated parking spaces.

Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience

Alternative 4 builds upon all the major elements in the *Tuolumne River Plan* to identify a set of management actions that would work together to protect river values, while accommodating existing day and overnight use and providing improved, but more highly structured, opportunities for day visitors at Tuolumne Meadows.

Alternative 4 includes the technical correction to the river corridor boundary (presented in chapter 3), the section 7 determination process for evaluating water resources projects (presented in chapter 4), the management standards and actions for protecting and enhancing river values (presented in chapter 5), and the guidance for identifying an appropriate visitor experience and associated user capacity (presented in chapter 6).

Concept

Alternative 4 responds to a range of public concerns by balancing desires to retain a traditional Tuolumne experience with desires to reduce development and make visitor use more sustainable. It also addresses the need to provide a meaningful introduction to the Tuolumne River for the growing number of short-term visitors.

As with all alternatives, most of the river corridor would be managed as wilderness. In these areas, natural river-related systems would be sustained by natural ecological processes, archeological and American Indian traditional cultural resources would characterize the cultural landscape, and recreational opportunities would be primitive and unconfined.

At Tuolumne Meadows, day visitors would be encouraged to get out of their cars and take walks or short hikes to sites of natural and cultural interest, where they could enjoy activities such as sightseeing and participation in interpretive and educational programs, fishing, swimming, and picnicking. Visitors would be directed to formally maintained trails and specific destinations to protect and enhance recovering meadow and riparian habitats while accommodating existing levels of day use. Current levels of camping and lodging would be retained, as would a small store and grill. The potential for traffic congestion on peak days would be reduced by increasing public transit as an option for arriving at Tuolumne Meadows.

The Glen Aulin High Sierra Camp would remain open, but at a reduced level of service, to decrease risks to water quality while still allowing visitors with a broader range of physical abilities the opportunity to experience a wild segment of the river.

River values would be protected and enhanced by restoring ecological conditions to meadow and riparian areas, by directing visitors to designated trails, and by eliminating most risks to water quality (see “Summary of Protection and Enhancement of River Values under Alternative 4” at the end of this alternative).

The visitor use capacity under alternative 4 would remain relatively unchanged at a maximum of 4,569 people at one time, as shown in table 7-11. Actual day use levels would be lower during nonpeak periods, and actual overnight use levels would be lower even during peak periods because not all individual campsites and lodging units would be occupied by the maximum number of people allowable. The administrative use capacity under alternative 4 would be increased to 274 employees at one time (table 7-11).

In comparison to no action, alternative 4 would include the following actions:

- Restore previously disturbed ecological conditions to subalpine meadow and riparian areas.
- Reduce risks to stream flow and water quality.
- Increase protection of archeological sites and resources important to American Indians.
- Retain all current recreation opportunities except concessioner day rides.
- Reduce lodging and the level of service at Glen Aulin.

**Table 7-11.
 Corridorwide Visitor and Administrative Use Capacity, Alternative 4**

| Visitor Overnight Capacity | | | | | |
|--|---|--|--|--|---|
| River Segment | Existing Use Calculation | Current # Overnight Visitors | Proposed Action | Units | Maximum Overnight Visitors, Alt. 4 |
| Scenic Segments | | | | | |
| Tuolumne Meadows Lodge | # of lodging units (69) × max of 4 people per unit | 276 | Retain lodge capacity | 69 guest tent cabins | 276 |
| Tuolumne Meadows Campground | # of campsites (304 sites × max of 6 people per site, 7 group sites × max 30 people per site) | 2,034 | Retain campground capacity | 304 sites, 7 group sites | 2,034 |
| Wild Segments | | | | | |
| Glen Aulin HSC | # of lodging units (8) × max of 4 people per unit | 32 | Reduce Glen Aulin HSC capacity (minus 3 guest tent cabins) | 5 guest tent cabins | 20 |
| Wilderness | Maximum capacity of wilderness zones (400) | 400 | Retain current wilderness zone capacities | – | 400 |
| Subtotal, Overnight | | 2,742 | | | 2,730 |
| Visitor Day Use Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum Observed People At One Time, 2011^a | Proposed Action | Proposed Units | Maximum People At One Time, Alt. 4 |
| Scenic Segments | | | | | |
| Access from Tuolumne Meadows | # of cars parking in designated parking spaces (340) × 2.9 ^b | 986 | Increase designated day parking (plus 222 spaces) | 562 spaces at 90% occupancy × 2.9 ^b | 1,467 |
| | # cars parking in undesignated spaces (190) × 2.9 ^b | 551 | Eliminate undesignated roadside parking | – | 0 |
| | Maximum people arriving by in-park shuttles, tour buses, and regional public transit (YARTS) | 225 | Maintain current level of arrivals by in-park shuttles and tour buses; increase capacity for regional public transit | – | 360 |
| Access from below O'Shaughnessy Dam | # of cars parking in designated spaces (4) × 2.9 ^b | 12 | Retain existing parking | 4 spaces × 2.9 ^b | 12 |
| Subtotal, Day Use | | 1,774 | | | 1,839 |
| Total Visitor People At One Time | | 4,516 | | | 4,569 |
| Administrative Capacity | | | | | |
| River Segment | Existing Use Calculation | Maximum employees (existing) | Proposed Action | Units | Maximum employees, Alt. 4 |
| Wild Segments | | | | | |
| Concessioner | Approximately 9 employees at Glen Aulin HSC | 9 | Reduce staffing at Glen Aulin HSC to 8 employees. | 8 employees | 8 |
| Scenic Segments | | | | | |
| NPS | Approximately 150 employees assigned to Tuolumne Meadows | 150 | Meet staffing need with 163 employees at Tuolumne Meadows. | 163 employees | 163 |
| Concessioner | 103 employees based at Tuolumne Meadows | 103 | Meet staffing need with 103 employees at Tuolumne Meadows. | 103 employees | 103 |
| Total Administrative People at One Time | | 262 | | | 274 |
| Total Corridorwide Capacity | | 4,778 (existing) | | | 4,843 (proposed) |

a The peak number of vehicles observed during vehicle counts in 2011 (observed on August 13, 2011).

b The vehicle occupancy rate is 2.9 people per vehicle, based on visitor studies conducted over the past 20 years that found an average vehicle occupancy ranging from 2.6 to 3.4 (Van Wagtenonk and Coho 1980; FHWA 1982; ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). Based on this range, an average of 2.9 persons per vehicle is used for estimating visitor numbers for planning purposes in this document.

Abbreviations: HSC = High Sierra Camp; max = maximum; # = number.

Wild Segments (Designated Wilderness and Glen Aulin)

Resource Protection and Enhancement

Free Flow

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Water Quality

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Reduce water use at the Glen Aulin High Sierra Camp to 500 gallons per day to mitigate the risk to water quality (see “Glen Aulin,” below).

Biological Value: Subalpine Meadow and Riparian Complex

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Biological Value: Low-Elevation Riparian and Meadow Habitat

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Scenic Value: Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Recreational Value: Wilderness Experience along the River

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Manage day use levels along wilderness trails within reach of day hikes from Tioga Road to achieve a standard of no more than 10 encounters with other parties per hour (80% of the time, sampled over the entire season, including weekdays and weekends). If necessary for maintaining use levels within this standard, day use wilderness trailhead quotas would be implemented for major trail segments, including Lyell Canyon, Glen Aulin, Cathedral Lakes, and Dog Lake, using a mixed first-come/first-served and advanced reservation system.
- Discontinue concessioner stock day rides into wilderness to eliminate conflicts on trails and enhance opportunities for self-reliance.
- Allow commercial use in wilderness, with restrictions on types and levels of use based on a determination of extent necessary (see appendix C) that gives priority to noncommercial use and restricts commercial use to no more than 2 overnight groups per zone per night and no more than 2 day groups per trail per day. Additional restrictions would include the following:
 - *Restrictions on types of use, Glen Aulin zone, peak months only:* During the peak use months of July and August, commercial groups having only a recreational purpose would no longer have access to the Glen Aulin zone; groups having an educational or scenic, as well as recreational, purpose (as defined in appendix C) would continue to have access consistent with limitations on total use levels, described above.
 - *Restrictions on types of use, Lyell Canyon zone, peak months only:* During the peak use months of July and August, commercial use in the Lyell Canyon zone by groups with only a recreational purpose would be restricted to Monday–Thursday only; groups having an educational or scenic, as well as a recreational,

purpose would continue to have access to the Lyell Canyon zone on weekends, as well as weekdays, consistent with limitations on total use levels, described above.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

All ongoing uses would continue.

Maximum Amounts of Visitor Use

Maximum day use along popular wilderness trails would be limited as necessary to achieve the standard of encounters with no more than 10 parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

The overnight capacity in wild segments would be retained at 400 persons per night (350 persons per night above the reservoir and 50 persons per night below the reservoir). This capacity might be reduced in the future if determined necessary to protect wilderness values; however, it would not be increased above this amount, which has been determined to be protective of river values. The overnight visitor capacity at the Glen Aulin High Sierra Camp would be reduced to 20 guests.

Management of Visitor Use Capacity

The current overnight trailhead quota system would be retained to regulate overnight use in wild segments.

Administrative Use

The types and levels of administrative use in wild segments would remain the same as existing conditions. Eight concessioner employees would be housed at the Glen Aulin High Sierra Camp.

Glen Aulin (Potential Wilderness Addition)

Glen Aulin High Sierra Camp

The Glen Aulin High Sierra Camp would be retained at a significantly reduced capacity of 20 guests to continue to offer the opportunity for visitors with a broader range of physical abilities to connect with the river in a remote setting, while decreasing the risk to water quality. Day use at Glen Aulin would decrease commensurate with an overall reduction in day use in the river corridor.

The level of service at the camp would be reduced:

- Eliminate flush toilets for guests to reduce demands for water use and waste disposal. Provide composting toilets for guests. Retain flush toilets for employees living at Glen Aulin.
- Discontinue wood for heat stoves in visitor tent cabins to reduce the need for stock use to supply wood to the camp.
- Discontinue “meals-only” service for people who are not lodge guests to reduce demands for water use and waste disposal.
- Continue overnight saddle trips but discontinue concessioner day rides to the camp.

Utility improvements at the camp would include the following (see figure 7-10):

- Design for a capacity of 500 gallons per day.
- Construct a new composting toilet facility between the granite slab behind the kitchen and the septic tank. To the extent possible, facility design would be compatible with the historic character.

- Install one water treatment tank (1,000 gallons) and one water storage tank (1,000 gallons) north of the existing water tank; remove the existing tank. Replace the existing chlorinator, filter tank, and surge tanks.
- Retain the existing septic tank and leach mound.
- Pull the water intake line back to its former location, entirely within the boundaries of the Glen Aulin potential wilderness addition. In years where the flow from this location is not adequate (dry years), the line would be extended as necessary, but only temporarily, upstream (into wilderness) to maintain sufficient flow for water treatment. As soon as the camp closed for the season or upon restoration of adequate flows, the line would be pulled back inside the Glen Aulin boundaries.

The replacement storage tanks, filter tank, and surge tanks would be flown in by helicopter. The rest of the materials for the project would be either flown in by helicopter or packed in with stock. The determination would be based on the minimum-requirement criteria established under the Wilderness Act.

The estimated net construction costs for Glen Aulin under alternative 4 would be approximately \$1.1million (see appendix L).

Backpacker Campground

See "Actions Common to Alternatives 1-4," beginning on page 7-19.

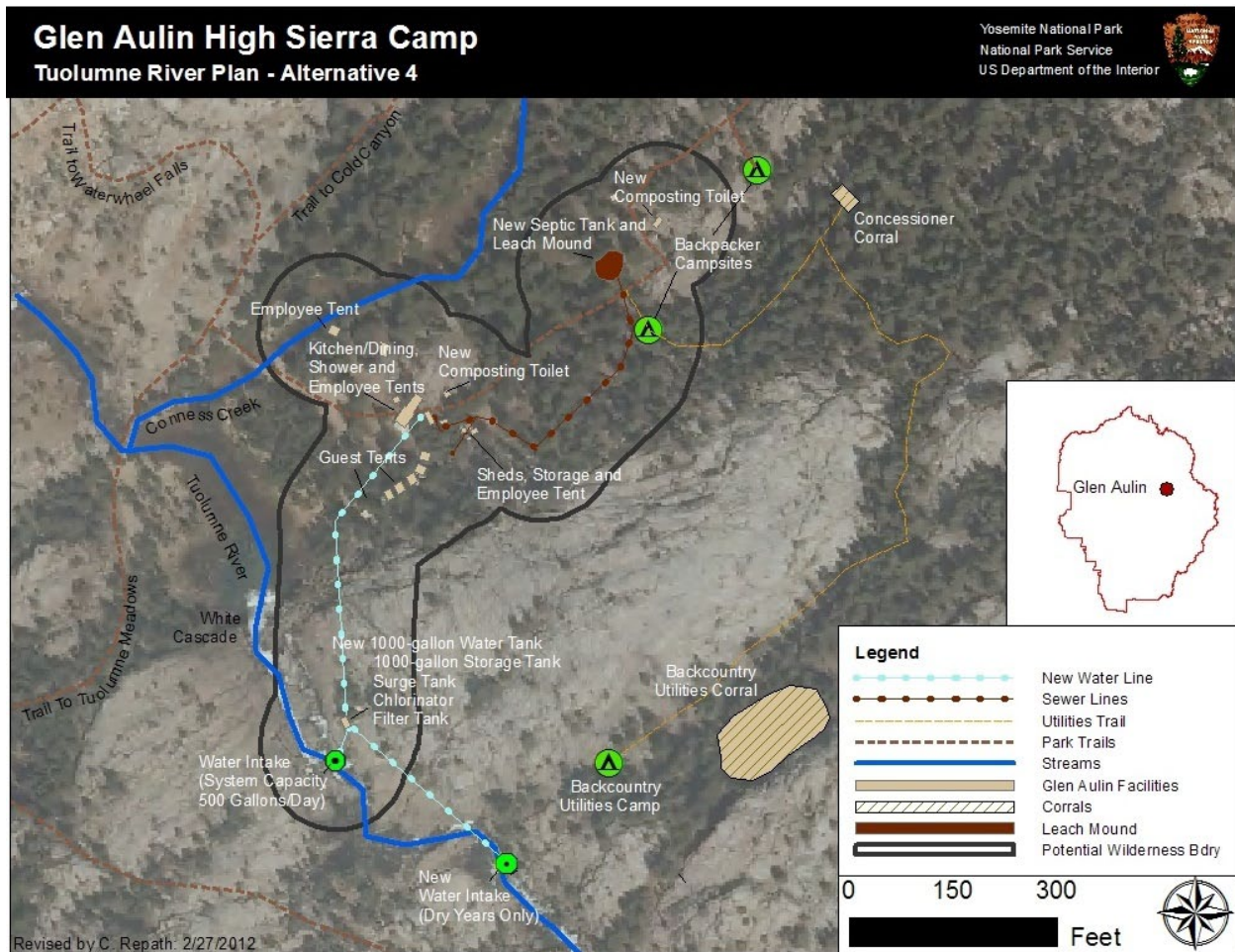


Figure 7-10. Glen Aulin Site Plan, Alternative 4.

Scenic Segments (Tuolumne Meadows and Tioga Road Corridor)

Note that this discussion pertains only to the nonwilderness portions of the Tuolumne Meadows and Lower Dana Fork segments. Portions of these segments within designated wilderness would be managed the same as the wild segments.

Resource Protection and Enhancement

Free Flow

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Increase uses, primarily employee housing, that would require water consumption, thus increasing the estimated average water demand to about 67,000 gallons per day. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow unless climate change led to longer low-flow durations occurring earlier in the summer, in which case further reductions in water use would be required as discussed in chapter 5.

Water Quality

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Discontinue concessioner stock day rides to reduce risks to water quality associated with stock use. Compared to current service levels, the amount of stock use on trails could be reduced by 3 two-hour and 2 four-hour rides per day, which might otherwise involve up to 14 head of stock per ride on the trails. Full-day rides, which occur only occasionally, would also be eliminated.
- Remove the public fuel station to eliminate the risk to water quality.

Biological Value: Subalpine Meadow and Riparian Complex

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Cultural Value: Archeological Landscape

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Cultural Value: Parsons Memorial Lodge

See “Actions Common to Alternatives 1-4,” beginning on page 7-19.

Scenic Value: Scenery through Dana and Tuolumne Meadows

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Maintain views from eight scenic vista points (identified in chapter 5) by controlling the encroachment of vegetation in a manner that was protective of ecological conditions and archeological values at each vista point. Each particular vista point would be managed in accordance with an individual work plan based on evaluations of river values and other resources at that specific location. The work plans are included in appendix J. No other vegetation management would be conducted to enhance scenery or viewing opportunities.

Recreational Value: Tioga Road Access to the River through Tuolumne and Dana Meadows

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Increase the amount of designated parking available to visitors wishing to get out of cars to enjoy recreational experiences in a river-related landscape.

Management of Visitor Use and User Capacity

Kinds of Visitor Use

Visitor services, facilities, and management strategies would be reoriented to improve opportunities for day visitors to connect with the river in a way that is protective of river values, while retaining existing opportunities for traditional overnight use. The day use capacity would be slightly increased, thus allowing for a slight increase in use compared to existing conditions. As in alternative 2, visitors would be directed from trailheads at designated parking lots onto trails and boardwalks, some with fencing or other forms of delineation to discourage dispersed foot traffic through these sensitive environments, and to formal picnic areas. Visitor services would be managed as follows:

- Conduct a full range of orientation, interpretation, and education programs, with increased emphasis on education about the need to protect river values, at a small visitor contact station, wilderness center, Parsons Memorial Lodge, and in the field.
- Reduce commercial services to the store/grill. The public fuel station, mountaineering shop/school, and concessioner stock day rides would be eliminated. The postal service would be retained (subject to future USPS level of service decisions beyond NPS control).
- Retain the campground at its current capacity.
- Retain the Tuolumne Meadows Lodge at its current capacity, while relocating the tent cabins nearest the river to protect adjacent riparian habitat. Upgrade the shower house at the lodge for improved service to lodge guests and campers.
- Increase the capacity of regional transit as an option for arriving at Tuolumne Meadows.
- Increase the frequency of shuttle bus service among destinations within the Tuolumne Meadows area, and add stops at visitor service areas, making it easier for visitors to use public transportation to circulate within the Tuolumne Meadows area.

Maximum Amounts of Visitor Use

- Slightly increase the maximum day use capacity above the Hetch Hetchy Reservoir from 1,762 people at one time to a maximum of 1,827 people at one time (see table 7-11; in this table, the total maximum day use number includes the maximum day use below O'Shaughnessy Dam, which would remain at 12 people at one time).
- Retain the current overnight capacity of 2,310 people per night at Tuolumne Meadows: 2,034 people accommodated by the 304 sites plus 7 group sites in the campground, and 276 people accommodated by the 69 guest tent cabins at Tuolumne Meadows Lodge (see table 7-11). Actual overnight use levels would be lower than these capacities because individual campsites and lodging units would not always be occupied by the maximum number of people allowable.

Management of Visitor Use Capacity

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

Day Use

Day use capacity would be managed by controlling day parking, which would be restricted to paved or otherwise authorized spaces. No undesignated roadside parking would be allowed through the Tuolumne Meadows area. Undesignated roadside parking would continue to be allowed along Tioga Road west and east of Tuolumne Meadows. The amount of formal, designated day parking in the Tuolumne Meadows area would be increased from 340 to 562 spaces. In addition, regional transit capacity would be increased by 135 people, the equivalent of three 45-passenger shuttle buses, to encourage use of regional transit and relieve traffic congestion at Tuolumne Meadows on peak days.

Overnight Use

Overnight use capacity would be managed by the facility capacities of the campground and lodge. These facilities would continue to be available through a reservation system, with some campsites also available on a first-come, first-served basis.

Administrative Use

NPS staffing would be increased to a maximum of 163 employees to provide for increased resource protection needs (including management of the user capacity program, below), resource management, and monitoring (see table 7-11). NPS employee housing or campsites would be increased by 59 additional units. Campsites would meet the need for incidental “housing” for employees on temporary duty in the Tuolumne Meadows area, with a bunkhouse for these employees to be constructed as funds become available. Concessioner employee staffing and housing necessary to support commercial services would remain the same as under the no-action alternative (103 employees). (See “Tuolumne Meadows Site Plan,” below for the location of proposed employee housing.)

Tuolumne Meadows Site Plan

The locations identified below are illustrated on the site plan map (figure 7-11) at the end of this section. The estimated net construction costs for Tuolumne Meadows under alternative 4 would be approximately \$64.5 million, based on calculations included in appendix L.

Visitor Facilities

- Provide a new visitor contact station south of Tioga Road, across from the Parsons Memorial Lodge trailhead. Enhance opportunities for day visitors to experience the river, meadows, and historic setting by providing a new trail along Tioga Road that connects the new visitor contact station with the existing trail across the meadow to Parsons Memorial Lodge, allowing short-term visitors to receive information and take a short stroll across the meadow to the river and the lodge before continuing on their way. A visitor contact station at this location would also provide improved separation between this visitor function, commercial services, and park operations.
- Retain the store and grill, post office, wilderness center, and ranger station in their current locations.
- Retain the campground at its current capacity (see below).
- Retain the Tuolumne Meadows Lodge at its current capacity, while relocating the three guest tent cabins nearest the river to protect adjacent riparian habitat. Upgrade the shower house at the lodge.
- Increase shuttle bus stops. (Shuttle buses would no longer stop at location 3 on the site plan after a new trailhead was provided for the Cathedral Lakes trail.)

Campground

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Design for a capacity of 304 sites (6 people per site) plus 7 group sites (people per site) for a maximum of 2,034 people).
- Realign the campground A-loop road and relocate the campsites closest to the Lyell Fork farther away from the river.
- Retain the campground office.
- Relocate the existing entrance road out of the floodplain.
- Formalize a trail connection between the campground and the John Muir Trail.

Picnic Areas

- Expand the picnic area near Lembert Dome.
- Provide a new picnic area in association with the new visitor contact station and day parking.
- Accommodate picnicking at the new parking/viewing area near Pothole Dome.

Trails and Trailheads

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Delineate or fence the Cathedral Lakes trail to facilitate ecological restoration while allowing for use by stock and hikers.
- Move the Tioga Road trailhead for Parsons Memorial Lodge to the new day parking area south of Tioga Road and provide a trail connection to the existing trail; install protective fencing on either side of the trail from Tioga Road to Parsons Memorial Lodge to facilitate meadow recovery.
- Install protective fencing on either side of the trail/access road between Lembert Dome and Tuolumne Meadows Lodge, to facilitate meadow recovery.
- Provide a new hiking trail connecting facilities along Tioga Road; tie into the section of the Great Sierra Wagon Road east of Lembert Dome.

Parking

The total number of designated parking spaces in the Tuolumne Meadows area (day and overnight) would be increased from 533 to 914 spaces.

Table 7-11a.
Number of Parking Spaces in Designated Parking Areas, Alternative 4

| Type of Parking | Current | Alternative 4 | Description |
|--|------------|--|--|
| Day Parking | 16 | 16 | existing parking area at Pothole Dome |
| | 0 | 20 | new parking/viewing area east of Pothole Dome |
| | 0 | 4 | existing roadside pullout south of Pothole Dome |
| | 50 | 76 | existing parking area at the visitor center, for Cathedral Lakes trailhead parking |
| | 0 | 80 | new parking area for visitor contact station and picnic area |
| | 11 | 13 | existing parking area at the campground office |
| | 11 | 11 | existing parking in the campground for the Elizabeth Lakes trailhead |
| | 15 | 30 | existing parking area at the fuel station |
| | 51 | 55 | existing parking area at the store and grill |
| | 58 | 38 | existing parking area at the concessioner stable |
| | 0 | 34 | roadside parking along the road to the concessioner stable |
| | 29 | 50 | existing parking area at the base of Lembert Dome |
| | 7 | 7 | existing parking area at the ranger station (relocated in this alternative) |
| | 25 | 52 | existing parking area at the Dog Lake/John Muir Trail trailhead |
| | 0 | 5 | existing parking area at Gaylor pit |
| 67 | 71 | existing parking areas in the road corridor east of Tuolumne Meadows, including the Mono Pass and Gaylor Peak trailheads and the Dana Meadows and other pullouts | |
| | 340 | 562 | Total day parking |
| Overnight Parking (excluding cars parked in the Tuolumne Meadows campground) | 58 | 89 | existing parking area at the wilderness office |
| | 33 | 68 | existing parking area at the Dog Lakes/John Muir Trail trailhead |
| | 0 | 35 | relocated parking area for the Cathedral Lakes trailhead |
| | 0 | 58 | road to concessioner stable |
| | 102 | 102 | Tuolumne Meadows Lodge |
| | 193 | 352 | Total overnight parking |

The number of visitors delivered by public transit to the corridor would be managed according to the overall user capacity in this alternative and would be higher than the no-action alternative.

NPS and Concessioner Stables

- Co-locate the NPS and concessioner stables at the current site of the concessioner stable. This facility would support stock operations associated with High Sierra Camps and NPS administrative uses. Housing for all but two employees would be relocated to the concessioner employee housing area north of the Tuolumne Meadows Lodge. The current site of the NPS stable would be reserved for additional NPS employee housing.

Park Operations

In addition to "Actions Common to Alternatives 1-4," beginning on page 7-19:

- Adapt the CCC mess hall building (current site of the visitor center) for park operations to provide the administrative facilities determined necessary to support visitor use and resource protection but which would be infeasible to locate outside the river corridor.
- Relocate maintenance to a new maintenance yard near the wastewater treatment facility.
- Relocate the aboveground diesel fuel tank to the new maintenance yard for concessioner and NPS use.

Employee Housing

- Provide NPS housing for no more than 133 employees, plus campsites for an additional 30 employees. This would accommodate a total of 163 employees, which is the number determined to be necessary in the Tuolumne Meadows area to support the kinds and levels of visitor use included in this alternative. It would be infeasible to locate this housing outside the river corridor; therefore, it must be inside the corridor. In addition to the existing housing, which currently accommodates 104 employees, the following options for additional housing for 29 employees would be considered:
 - Use existing housing structures more efficiently. For example, conduct an efficiency analysis to determine where infill of beds within existing structures is possible.
 - Provide a new bunkhouse(s), with bathrooms and communal kitchen at the current NPS stable site.
 - If options 1 and 2 proved insufficient to provide the additional 29 beds needed under this alternative, construct up to five new double-capacity units at Road Camp, designed to be similar to existing units, with current code compliance.
- Dry campsites for 30 NPS employees would be provided at Gaylor Pit. The employee campground at Gaylor Pit would be configured to temporarily accommodate up to 60 employees while additional permanent housing was under construction.
- Provide concessioner employee housing for 101 employees north of the existing Tuolumne Meadows Lodge parking area (at a density equal to that of the existing lodge employee area plus kitchen, dining, toilet, and shower house facilities; all new facilities would be hard-sided and compliant with all current NPS standards and OSHA codes). Provide hard-sided cabin for two stable employees at the concessioner stable at a location that would comply with relevant OSHA and NPS housing regulations regarding the proximity of housing and stock corrals, and relocate all other stable employees to the lodge area.

Utility Systems

The general direction for site-specific planning for utility systems under alternative 4, intended to protect and enhance the river's free-flowing condition, water quality, and outstandingly remarkable values, is outlined below.

Tuolumne Meadows Wastewater Collection, Treatment, and Disposal

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Design for an estimated water demand of 67,000 gallons per day.
- Seek technology to allow removal of the wastewater containment ponds and sprayfields from the north side of Tioga Road and replace with facilities on the south side of the road, to be designed in conjunction with the new wastewater treatment plant. If technology is not available, redesign the ponds and sprayfield to minimize risks of overflow from containment ponds or saturation of the sprayfields.

Tuolumne Meadows Potable Water Collection, Treatment, and Distribution

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Design for an estimated water demand of 67,000 gallons per day.

Site Restoration

In addition to “Actions Common to Alternatives 1-4,” beginning on page 7-19:

- Restore the site of the public fuel station and mountaineering shop to natural conditions.

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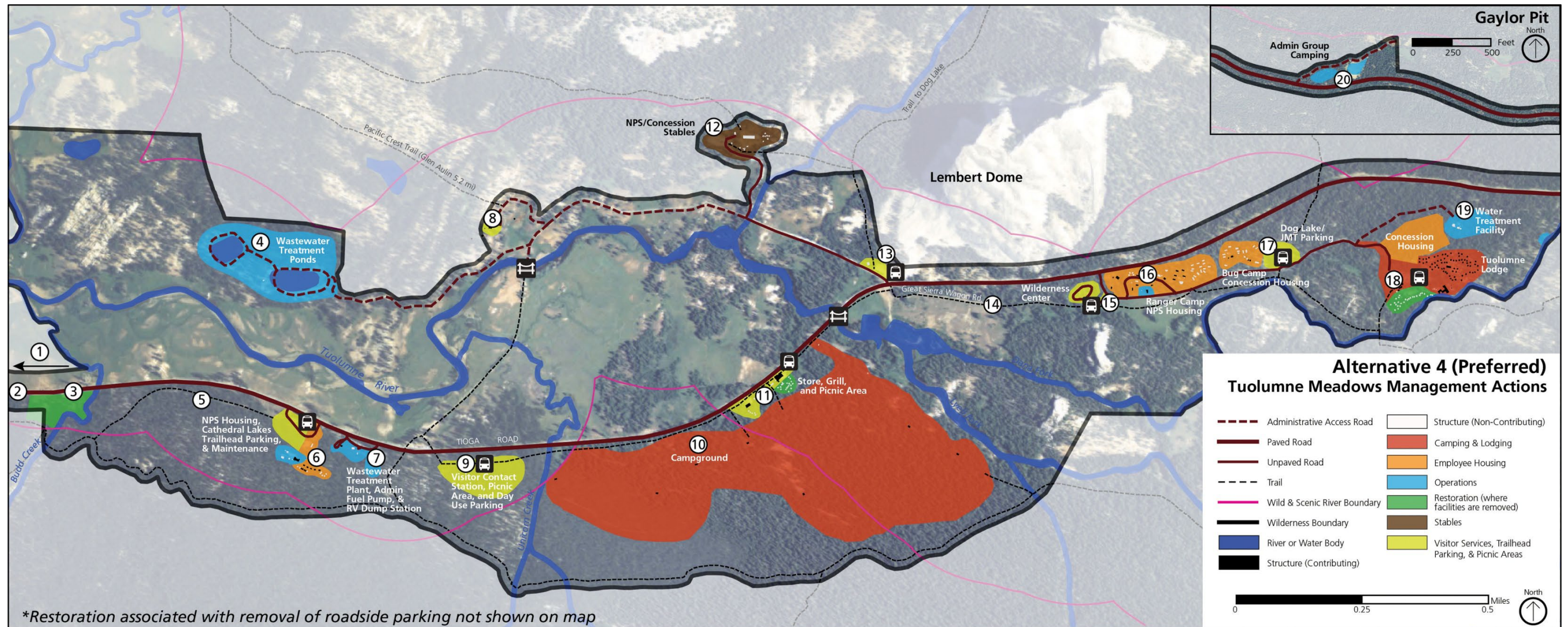


Figure 7-11. Tuolumne Meadows Site Plan, Alternative 4.

Key to figure 7-11 and List of Facilities Management Actions (actions marked with an asterisk (*) are specific to this alternative. All other actions are common to alternatives 1-4):

| | | | |
|--|---|---|---|
| <p>1. Pothole Dome scenic pullout/ parking areas</p> <ul style="list-style-type: none"> Designate parking with trailhead on north side of Tioga Road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of Tioga Road near Pothole Dome. * Add parking/viewing/picnicking area east of Pothole Dome. | <p>6. Existing visitor center and Road Camp</p> <ul style="list-style-type: none"> * Relocate visitor center to location #9; convert building for park operations. Construct new Cathedral Lakes trailhead with day and overnight parking. * Relocate maintenance yard and office to location #7. * Increase NPS employee housing. | <p>11. Existing commercial services core</p> <ul style="list-style-type: none"> * Retain store, grill, and post office; expand day parking. * Remove mountaineering shop/school and public fuel station, add parking. * Upgrade restroom. Add trail connector to campground. * Relocate concessioner employee housing to location #18. | <p>16. Existing ranger station and Ranger Camp</p> <ul style="list-style-type: none"> * Relocate ranger station to location #6. * Relocate aboveground diesel fuel tank to location #7. * Replace NPS employee housing with hard-sided cabins. |
| <p>2. Tioga Road through the Tuolumne Meadows area</p> <ul style="list-style-type: none"> Retain the Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. Add hiking trail parallel to the road. | <p>7. Wastewater treatment plant</p> <ul style="list-style-type: none"> Upgrade wastewater treatment plant. Retain recreational vehicle dump station. * Add NPS maintenance yard and office, including aboveground diesel fuel tank. | <p>12. Existing concessioner stable</p> <ul style="list-style-type: none"> * Co-locate NPS and small concessioner stable (for administrative use only). Retain one hard-sided cabin for two stable employees (relocate most concessioner employee housing to location #18). Retain day and overnight parking along access road. | <p>17. Bug Camp, Dog Lake/ John Muir Trail parking</p> <ul style="list-style-type: none"> Increase day and overnight parking. * Retain NPS employee housing. |
| <p>3. Existing Cathedral Lakes trailhead</p> <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | <p>8. Parsons Memorial Lodge</p> <ul style="list-style-type: none"> Preserve lodge and retain vehicle access. Upgrade footbridge to improve free flow of river. | <p>13. Lembert Dome</p> <ul style="list-style-type: none"> Retain picnic area. Expand day parking and retain trailheads for Lembert Dome and Parsons Memorial Lodge. Add shuttle stop. | <p>18. Tuolumne Meadows Lodge</p> <ul style="list-style-type: none"> * Retain Lodge at current capacity. * Upgrade shower house. Eliminate roadside parking. * Expand concessioner employee housing. |
| <p>4. Existing wastewater ponds and sprayfields</p> <ul style="list-style-type: none"> Retain and upgrade (or relocate if feasible). | <p>9. Area west of Unicorn Creek</p> <ul style="list-style-type: none"> * Add new small visitor contact station, picnic area, trailhead for Parsons Memorial Lodge, and day parking. | <p>14. Old Tioga Road/Great Sierra Wagon Road</p> <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of old roads to meadow hydrology. | <p>19. Water treatment facility</p> <ul style="list-style-type: none"> Upgrade water treatment facility. |
| <p>5. Area east of Budd Creek and west of existing visitor center</p> <ul style="list-style-type: none"> Construct new Cathedral Lakes trailhead connector. * Retain as undeveloped natural area except for trail segment. | <p>10. Tuolumne Meadows campground</p> <ul style="list-style-type: none"> * Retain campground at current capacity; realign the A-loop road and relocate campsites closest to Lyell Fork Retain campground office and day parking. * Relocate entrance road outside of floodplain. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | <p>15. Existing wilderness center and NPS stable</p> <ul style="list-style-type: none"> Retain wilderness center; expand parking. * Move NPS stable to location #12; use site for expansion of NPS employee housing. | <p>20. Gaylor Pit</p> <ul style="list-style-type: none"> Retain helipad. * Add NPS employee campsites, vault toilets, and potable water tank. |

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Summary of Protection and Enhancement of River Values under Alternative 4 (Preferred)

The *Tuolumne River Plan* will be evaluated in terms of four legal requirements: (1) the WSRA requirement that it protect and enhance river values; (2) the NEPA requirement that it fully consider the effects on the human environment; (3) the NHPA requirement that it consider effects on historic properties; and (4) the requirement of the Wilderness Act that it consider the effects on wilderness character. Guidelines that describe the criteria to be used in determining the effects of the plan exist for each of these requirements. This section focuses directly on how the plan would meet the WSRA requirement to protect and enhance river values if alternative 4 were to be selected. The NEPA, NHPA, and Wilderness Act analyses are presented in chapter 8.

All the action alternatives, including alternative 4, would protect and enhance river values as described in detail in chapter 5 and summarized in this chapter under “Summary of Protection and Enhancement of River Values under All Action Alternatives,” beginning on page 7-28. In addition, alternative 4 would take the following additional actions, primarily related to management of visitor use, user capacity, and development, to further protect or enhance river values.

Free-Flowing Condition of the River

So long as low flows remained around or above 1.0 cubic foot per second, average water withdrawals of 60,000 to 70,000 gallons per day would ensure that management could maintain consumption at no more than 10% of flow during low-flow periods and impose additional temporary conservation measures if necessary, as discussed in chapter 5.

The average estimated water demand for alternative 4 has been calculated as shown in table 7-12.

Table 7-12.
Summary of Average Estimated Water Demand, Alternative 4

| Facility | Current consumption per unit | No-Action | | Alternative 4 | |
|---|---------------------------------------|--------------------------|-----------------|--|-----------------|
| | | Number of units | Gallons per day | Number of units | Gallons per day |
| Campsites | 100 gallons/site/ day | 304 sites | 30,400 | 304 sites | 30,400 |
| | 500 gallons/group site/day | 7 group sites | 3,500 | 7 group sites | 3,500 |
| Recreational vehicle dump station | 50 gallons/use/ day | 32 dumps | 1,600 | 32 dumps | 1,600 |
| Tuolumne Meadows Lodge | 30 gallons/person/ day | 276 guests | 8,280 | 276 guests | 8,280 |
| Camper showers | 10 gallons/person/shower | 0 | 0 | 35 showers | 350 |
| NPS housing | 50 gallons/employee/ day in housing | 104 employees in housing | 5,200 | 133 employees in housing | 6,650 |
| | 25/gallons/employee/ day in campsites | 0 employees in campsites | 0 | 30 employees in campsites | 750 |
| Concessioner employee housing | 50 gallons/employee/ day | 103 employees | 5,150 | 103 employees | 5,150 |
| Cafeteria meals (2 per concessioner employee) | 6 gallons/person/day | 206 meals | 1,236 | 206 meals | 1,236 |
| Store/grill | 5 gallons/person/day | 1,148 visitors | 5,740 | Total visitor capacity increased by 1% | 5,797 |
| Visitor center /visitor contact station | 5 gallons/visitor/day | 607 visitors | 3,035 | Total visitor capacity increased by 1% | 3,065 |
| Total consumption | | | 64,141 | | 66,778 |

As shown by the calculations in table 7-12, an increase in employee housing would increase the average demand for domestic water by 4% to about 67,000 gallons per day. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow unless climate change led to longer low-flow durations occurring earlier in the summer, in which case further reductions in water use would be required.

Management to Protect Water Quality

Risks to water quality in the Tuolumne Meadows area would be mitigated by upgrading the wastewater treatment plant, treatment ponds, and sprayfields. The improved utilities would be designed for loads commensurate with estimates of domestic water use. The risk to water quality from fuel storage at the public fuel station would be eliminated. A further reduction in risks to water quality would be achieved greatly reducing the size of the concessioner stable operation. Risks to water quality at Glen Aulin would be mitigated by replacing flush toilets with composting toilets and reducing the guest capacity, which would decrease the demand for water to no more than 500 gallons per day. Monitoring would be ongoing to ensure that water quality remained excellent at both Tuolumne Meadows and Glen Aulin.

Management to Protect the Subalpine Meadow and Riparian Complex

Most of the actions to protect and enhance the subalpine meadow and riparian complex would be common to all the action alternatives. Alternative 4 would additionally enhance this river value by directing visitors to designated trails and delineating or fencing certain trail segments to facilitate the ecological recovery of adjacent vegetation. The subalpine meadows in Lyell Canyon would be protected by regulating the amount and locations of stock use, as described for alternative 2.

Management to Protect Archeological Sites

The same management of visitor use described above would also reduce impacts on archeological sites in the Tuolumne Meadows and Lower Dana Fork segments. Monitoring would be ongoing to ensure that site disturbance did not exceed the protective standard established for these sites. If conditions were not being maintained within the protective standards, additional actions would be taken to further manage or reduce visitor use, as described in chapter 5.

Management to Protect and Enhance Scenic Values

Scenic views and viewpoints in the Tuolumne Meadows area and along the Tioga Road corridor would be protected and enhanced under all the action alternatives by managing unnatural features, such as facilities and parked cars, to minimize their intrusion into remarkable views.

The eight scenic vista points identified by the *Tuolumne River Plan* would be protected and enhanced if necessary by removing encroaching vegetation, primarily conifers.

Management to Protect and Enhance the Wilderness Experience along the River

The wilderness experience along trails in wild segments but within reach of a day hike from Tuolumne Meadows would be protected by restricting use to levels that resulted in encounters with no more than ten other parties per hour, 80% of the time, sampled over the entire season, including weekdays and weekends.

Management to Protect and Enhance Tioga Road Access to the River through Tuolumne and Dana Meadows

Opportunities for scenic driving along Tioga Road would be enhanced by eliminating undesignated roadside parking and the congestion currently caused by vehicles slowing to park and pedestrians crossing the road. Opportunities for people wishing to park and get out of their cars would be enhanced by increasing the number of designated parking spaces.

Summary Comparisons of Alternatives

Protection and Enhancement of River Values, Alternatives 1–4

The actions that would be taken under each alternative to protect and enhance river values are summarized and compared in table 7-13.

Table 7-13.
Summary Comparison of Alternative Actions to Protect and Enhance River Values

| WILD SEGMENTS | | | | |
|---|----------------------|----------------------|----------------------|----------------------------------|
| Actions to Protect and Enhance River Values | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 (preferred) |
| Free Flow | | | | |
| Continue to work cooperatively with the San Francisco Public Utilities Commission and others to inform releases from O’Shaughnessy Dam intended to more closely mimic natural flows. | ✓ | ✓ | ✓ | ✓ |
| Water Quality | | | | |
| Eliminate or mitigate the risk associated with wastewater disposal at the Glen Aulin High Sierra Camp (details would differ as shown below): | ✓ | ✓ | ✓ | ✓ |
| ▪ Close the camp, eliminating the risk to water quality. | ✓ | | | |
| ▪ Convert camp to a seasonal outfitter camp to greatly reduce water use. | | ✓ | | |
| ▪ Continue to restrict water use at the camp to 600 gallons per day. | | | ✓ | |
| ▪ Reduce water use at the camp to 500 gallons per day. | | | | ✓ |
| Replace the composting toilet at the backpacker campground at Glen Aulin. | ✓ | ✓ | ✓ | ✓ |
| Biological Values | | | | |
| Subalpine Meadow and Riparian Complex | | | | |
| Discontinue commercial pack stock use to reduce impacts on subalpine meadow/riparian areas. | ✓ | | | |
| Reduce the potential for stock-related impacts in Lyell Canyon by reducing commercial use capacity to 192 grazing-nights per year and regulating an opening date, campsite locations and access routes, and grazing locations. | | ✓ | ✓ | ✓ |
| Restore localized areas previously disturbed by human use in Lyell Canyon, using techniques that meet the minimum-requirement criteria established under the Wilderness Act. | ✓ | ✓ | ✓ | ✓ |
| Low-Elevation Riparian and Meadow Habitat | | | | |
| Make informed recommendations for water releases from O’Shaughnessy Dam that would provide maximum ecological benefits to the river-dependent ecosystems below the dam. | ✓ | ✓ | ✓ | ✓ |
| Cultural Values | | | | |
| Archeological Landscape | | | | |
| Protect prehistoric archeological sites by diverting use away from sensitive areas. | ✓ | ✓ | ✓ | ✓ |
| Mitigate ecological restoration practices by using noninvasive techniques wherever possible, and undertake site-specific treatment actions, such as data recovery, where necessary to avoid resource loss through park actions or natural forces. | ✓ | ✓ | ✓ | ✓ |
| Scenic Values | | | | |
| Scenery through Lyell Canyon and the Grand Canyon of the Tuolumne | | | | |
| Continue to allow the natural scenery to evolve in response to natural ecological processes, with no management of scenic vistas (no scenic vista points are managed in wild segments). | ✓ | ✓ | ✓ | ✓ |

Table 7-13.
Summary Comparison of Alternative Actions to Protect and Enhance River Values (continued)

| WILD SEGMENTS (continued) | | | | |
|---|----------------------|----------------------|----------------------|----------------------------------|
| Actions to Protect and Enhance River Values | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 (preferred) |
| Recreational Value | | | | |
| Wilderness Experience Along the River | | | | |
| Enhance opportunities for primitive, unconfined recreation in a primitive setting (details would differ as shown below): | ✓ | ✓ | ✓ | ✓ |
| <i>Overnight use:</i> | | | | |
| <ul style="list-style-type: none"> Continue to manage overnight use in wilderness through an overnight trailhead quota system (see "Maximum Amounts of Use," below) to protect opportunities for solitude. | ✓ | ✓ | ✓ | ✓ |
| <i>Trail use:</i> | | | | |
| <ul style="list-style-type: none"> Greatly reduce (by approximately half) the maximum day use levels along wilderness trails within reach of day hikes from Tioga Road, making them more commensurate with use levels in remote wilderness, thereby enhancing opportunities for solitude. A standard of no more than 4 encounters with other parties per hour (80% of the time) would be maintained through implementation of a day trailhead quota system similar to the overnight trailhead quota system if necessary. | ✓ | | | |
| <ul style="list-style-type: none"> Manage day use levels along wilderness trails within reach of day hikes from Tioga Road to achieve a standard of no more than 10 encounters with other parties per hour (80% of the time). | | ✓ | ✓ | ✓ |
| Allow limited recreational whitewater boating on portions of the river to provide opportunities for people with expert paddling skills to experience and connect with the Tuolumne in a uniquely adventurous pursuit. | | ✓ | | |
| <i>Commercial use:</i> | | | | |
| <ul style="list-style-type: none"> Discontinue all commercial use in wilderness. | ✓ | | | |
| <ul style="list-style-type: none"> Allow commercial use in wilderness, with restrictions on types and levels of use based on a determination of extent necessary that gives priority to noncommercial use and restricts commercial use to no more than 1 overnight group per zone per night and no more than 1 day group per trail per day. | | | ✓ | |
| <ul style="list-style-type: none"> Allow commercial use in wilderness, with restrictions on types and levels of use based on a determination of extent necessary that gives priority to noncommercial use and restricts commercial use to no more than 2 overnight groups per zone per night and no more than 2 day groups per trail per day. | | ✓ | | ✓ |
| <i>Concessioner stock day rides:</i> | | | | |
| <ul style="list-style-type: none"> Discontinue concessioner stock day rides into wilderness to reduce stock impacts on trails used by hikers. | ✓ | | | ✓ |
| <ul style="list-style-type: none"> Continue concessioner stock day rides into wilderness but at a reduced capacity to reduce conflicts on trails. | | ✓ | ✓ | |
| <i>Glen Aulin:</i> | | | | |
| <ul style="list-style-type: none"> Remove the Glen Aulin High Sierra Camp to enhance opportunities for self-reliance. | ✓ | | | |
| <ul style="list-style-type: none"> Convert the Glen Aulin High Sierra Camp to a seasonal outfitter camp to allow guests to connect with the river in a setting with no permanent facilities (except a composting toilet). | | ✓ | | |
| <ul style="list-style-type: none"> Retain the Glen Aulin High Sierra Camp at reduced capacity to allow guests to connect with the river in a remote setting. | | | ✓ | ✓ |

Table 7-13.
Summary Comparison of Alternative Actions to Protect and Enhance River Values (continued)

| SCENIC SEGMENTS | | | | |
|---|----------------------|----------------------|----------------------|----------------------------------|
| Actions to Protect and Enhance River Values | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 (preferred) |
| Free Flow | | | | |
| Reduce demand for domestic water withdrawals from the Dana Fork (details would differ as shown below): | ✓ | | | |
| ▪ Reduce employee housing. | ✓ | | | |
| ▪ Reduce overnight lodging. | | | ✓ | |
| ▪ Eliminate overnight lodging. | ✓ | | | |
| ▪ Reduce overnight camping. | ✓ | | | |
| Continue to improve water conservation and sustainability practices, including installation of water meters, use of low-flow fixtures, and visitor and employee education, and identify and implement additional long-term water conservation measures. | ✓ | ✓ | ✓ | ✓ |
| Improve the Tioga Road bridge at Tuolumne Meadows and the footbridge at Parsons Memorial Lodge to mitigate impacts on river hydrology during periods of high flows. Improvements to the footbridge would be compatible with its historic character. | ✓ | ✓ | ✓ | ✓ |
| Remove the boulder riprap from approximately 150 feet of riverbank near the campground A-loop road to allow the river to flow more freely. | ✓ | ✓ | ✓ | ✓ |
| Water Quality | | | | |
| Upgrade utility systems to conserve water and protect water quality (details would differ as shown below): | ✓ | ✓ | ✓ | ✓ |
| Remove the wastewater ponds and sprayfields and replace them with new facilities on the south side of Tioga Road. | ✓ | | | |
| Stabilize the road cut east of Tuolumne Meadows along Tioga Road to reduce erosion into the Dana Fork. | ✓ | ✓ | ✓ | ✓ |
| Continue best management practices to mitigate the potential for impacts on water quality associated with stock use. | ✓ | ✓ | ✓ | ✓ |
| Eliminate concessioner stock day rides to reduce stock use and risks to water quality. | ✓ | | | ✓ |
| Reduce concessioner stock day rides to reduce stock use and risks to water quality. | | ✓ | ✓ | |
| Remove the public fuel station to eliminate the risk to water quality posed by this facility. | ✓ | | ✓ | ✓ |
| Biological Values | | | | |
| Subalpine Meadow and Riparian Complex | | | | |
| Eliminate undesignated roadside parking and associated informal trails. | ✓ | ✓ | ✓ | ✓ |
| Remove structures inappropriately sited near the riverbank or in wet areas. | ✓ | ✓ | ✓ | ✓ |
| Crush or remove the existing wastewater line that runs beneath the meadow from the treatment plant to the containment ponds. | ✓ | | | |
| Restore riparian vegetation along riverbanks. | ✓ | ✓ | ✓ | ✓ |
| Mitigate effects of Tioga Road culverts on surface flows into Tuolumne Meadows. | ✓ | ✓ | ✓ | ✓ |
| Mitigate the effects of the Great Sierra Wagon Road bed on surface flows across Tuolumne Meadows. | ✓ | ✓ | ✓ | ✓ |
| Conduct additional research to support ecological restoration. | ✓ | ✓ | ✓ | ✓ |
| Reduce user capacities to protect subalpine meadow/riparian habitat from foot traffic. | ✓ | | ✓ | |
| Confine use to protect subalpine meadow/riparian habitat from foot traffic. | | ✓ | | ✓ |
| Increase interpretive programming to educate visitors about the fragility of meadow/riparian areas. | ✓ | ✓ | ✓ | ✓ |

Table 7-13.
Summary Comparison of Alternative Actions to Protect and Enhance River Values (continued)

| SCENIC SEGMENTS (continued) | | | | |
|--|----------------------|----------------------|----------------------|----------------------------------|
| Actions to Protect and Enhance River Values | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 (preferred) |
| Cultural Values | | | | |
| Archeological Landscape | | | | |
| Protect prehistoric archeological sites by removing informal trails and managing visitor use to avoid sensitive areas. | ✓ | ✓ | ✓ | ✓ |
| Avoid, reduce, or mitigate the potential effects of ecological restoration by using noninvasive techniques wherever possible, and undertake site-specific treatment actions, such as data recovery, where necessary to avoid resource loss through park actions or, where possible and practicable, through natural forces. | ✓ | ✓ | ✓ | ✓ |
| Parsons Memorial Lodge | | | | |
| Continue to preserve Parsons Memorial Lodge through periodic assessments and appropriate treatments directed by the List of Classified Structures. | ✓ | ✓ | ✓ | ✓ |
| Scenic Values | | | | |
| Scenery through Dana and Tuolumne Meadows | | | | |
| Maintain views from eight scenic vista points, following individual work plans developed to protect ecological conditions at each particular location. | | ✓ | ✓ | ✓ |
| Mitigate human intrusions into views by eliminating undesignated roadside parking, removing informal trails, and restoring more natural conditions to many currently disturbed sites. | ✓ | ✓ | ✓ | ✓ |
| Recreational Value | | | | |
| Tioga Road Access to the River through Tuolumne and Dana Meadows | | | | |
| Retain seasonal (generally late May or early June through October) recreational access to the river through Tuolumne and Dana Meadows by way of Tioga Road. Recreational opportunities afforded by this access include both scenic driving along the river and the opportunity to park and get out of cars to enjoy recreational experiences in a river-related landscape. | ✓ | ✓ | ✓ | ✓ |
| Retain Tioga Road on its current alignment. | ✓ | ✓ | ✓ | ✓ |
| Enhance the scenic driving experiences by eliminating undesignated roadside parking. | ✓ | ✓ | ✓ | ✓ |
| Increase the amount of designated parking available to visitors wishing to get out of their cars and enjoy recreational experiences in a river-related landscape. | | ✓ | ✓ | ✓ |

User Capacities, All Alternatives

The visitor and administrative use capacities under each alternative are summarized and compared in table 7-14.

Table 7-14.
Corridorwide Comparison of Visitor Use Capacities, by Alternative

| Visitor Overnight Capacity | | | | | |
|---|--|--|--|--|--|
| Segment | Current Overnight Visitors | Maximum Overnight Visitors, Alternative 1 | Maximum Overnight Visitors, Alternative 2 | Maximum Overnight Visitors, Alternative 3 | Maximum Overnight Visitors, Alternative 4 |
| Scenic Segments | | | | | |
| Tuolumne Meadows Lodge | 276 | 0 | 276 | 136 | 276 |
| Tuolumne Meadows Campground | 2,034 | 1,632 | 2,280 | 2,034 | 2,034 |
| Wild Segments | | | | | |
| Glen Aulin HSC | 32 | 0 | 32 | 28 | 20 |
| Wilderness | 400 | 400 | 400 | 400 | 400 |
| Subtotal, Overnight | 2,742 | 2,032 | 2,988 | 2,598 | 2,730 |
| Visitor Day Use Capacity | | | | | |
| Segment | Maximum People At One Time, Based on 2011 Vehicle Count | Maximum People At One Time, Alternative 1 | Maximum People At One Time, Alternative 2 | Maximum People At One Time, Alternative 3 | Maximum People At One Time, Alternative 4 |
| Scenic Segments | | | | | |
| Access from Tuolumne Meadows (designated parking) | 986 | 796 | 1,676 | 1,331 | 1,467 |
| Access from Tuolumne Meadows (undesignated parking) | 551 | 0 | 0 | 0 | 0 |
| Access from Tuolumne Meadows (arrival by bus) | 225 | 225 | 225 | 225 | 360 |
| Access from below O'Shaughnessy Dam | 12 | 12 | 12 | 12 | 12 |
| Subtotal, Day Use | 1,774 | 1,033 | 1,913 | 1,568 | 1,839 |
| Total Visitor Overnight and Day Use People At One Time | 4,516 | 3,065 | 4,901 | 4,166 | 4,569 |
| Administrative Capacity | | | | | |
| Segment | Maximum employees (existing) | Maximum employees, Alternative 1 | Maximum employees, Alternative 2 | Maximum employees, Alternative 3 | Maximum employees, Alternative 4 |
| Wild Segments | | | | | |
| Concessioner | 9 | 0 | 9 | 9 | 8 |
| Scenic Segments | | | | | |
| NPS | 150 | 100 | 174 | 124 | 163 |
| Concessioner | 103 | 2 | 103 | 103 | 103 |
| Total Administrative People At One Time | 262 | 102 | 286 | 236 | 274 |
| Total People At One Time | 4,778 (existing) | 3,167 (proposed) | 5,187 (proposed) | 4,402 (proposed) | 4,843 (proposed) |

Average Estimated Water Demand, Tuolumne Meadows, All Alternatives

The average estimated water demand associated with facilities and use at Tuolumne Meadows under each alternative is summarized and compared in table 7-15.

Table 7-15.
Summary Comparison of Average Estimated Water Demand, All Alternatives

| Facility | Current consumption per unit | No-Action | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|--|--------------------------|-----------------|---------------------------------------|-----------------|---|-----------------|--|-----------------|--|-----------------|
| | | Number of units | Gallons per day | Number of units | Gallons per day | Number of units | Gallons per day | Number of units | Gallons per day | Number of units | Gallons per day |
| Campsites | 100 gallons/ standard site/day | 304 sites | 30,400 | 237 sites | 23,700 | 304 sites | 30,400 | 304 sites | 30,400 | 304 sites | 30,400 |
| | 50 gallons/ walk-in site/day | 0 | 0 | 0 | 0 | 41 walk-in sites | 2,050 | 0 | 0 | 0 | 0 |
| | 500 gallons/ group site/day | 7 group sites | 3,500 | 7 group sites | 3,500 | 7 group sites | 3,500 | 7 group sites | 3,500 | 7 group sites | 3,500 |
| Recreational vehicle dump station | 50 gallons/ use/ day | 32 dumps | 1,600 | 32 dumps | 1,600 | 32 dumps | 1,600 | 32 dumps | 1,600 | 32 dumps | 1,600 |
| Tuolumne Meadows Lodge | 30 gallons/ person/ day | 276 guests | 8,280 | removed | 0 | 276 guests | 8,280 | 136 guests | 4,080 | 276 guests | 8,280 |
| Camper showers | 10 gallons/ shower/day | 0 | 0 | 0 | 0 | 35 showers | 350 | 0 | 0 | 35 showers | 350 |
| NPS housing | 50 gallons/ employee/ day in housing | 104 employees in housing | 5,200 | 100 employees in housing | 5,000 | 144 employees in housing | 7,200 | 104 employees in housing | 5,200 | 133 employees in housing | 6,650 |
| | 25/gallons/ employee/ day in campsites | 0 employees in campsites | 0 | 0 employees in campsites | 0 | 30 employees in campsites | 750 | 20 employees in campsites | 500 | 30 employees in campsites | 750 |
| Concessioner employee housing | 50 gallons/ employee/ day | 103 employees | 5,150 | 2 employees | 100 | 103 employees | 5,150 | 103 employees | 5,150 | 103 employees | 5,150 |
| Cafeteria meals (2 per concessioner employee) | 6 gallons/ person/day | 206 meals | 1,236 | 0 meals | 0 | 206 meals | 1,236 | 206 meals | 1,236 | 206 meals | 1,236 |
| Store/grill | 5 gallons/ person/day | 1,148 visitors | 5,740 | Removed | 0 | Total visitor capacity increased by 10% | 6,257 | Total visitor capacity decreased by 8% | 5,281 | Total visitor capacity increased by 1% | 5,797 |
| Visitor center / visitor contact station | 5 gallons/ visitor/day | 607 visitors | 3,035 | Total visitor capacity reduced by 34% | 2,064 | Total visitor capacity increased by 10% | 3,308 | Total visitor capacity decreased by 8% | 2,792 | Total visitor capacity increased by 1% | 3,065 |
| Total consumption | | | 64,141 | | 35,964 | | 70,081 | | 59,739 | | 66,778 |

Summary Comparison of Site Development at Tuolumne Meadows, All Alternatives

The facilities that would be provided at Tuolumne Meadows under each alternative are summarized and compared in table 7-16, and parking capacities are summarized and compared in table 7-17. The location numbers in table 7-16 correspond to the numbering on the site development maps for each alternative.

Table 7-16.
Site Plan Summary, All Alternatives

| Location | No-Action Alternative | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|----------|---|--|---|--|---|
| 1 | <p>Pothole Dome scenic pullout/parking areas:</p> <ul style="list-style-type: none"> Retain roadside pullout/day parking and trailhead on north side of road. Retain roadside pullout/day parking on south side of road. Retain trail to Pothole Dome. | <p>Pothole Dome scenic pullout/parking areas:</p> <ul style="list-style-type: none"> Designate day parking with trailhead on north side of road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of road. | <p>Pothole Dome scenic pullout/parking areas:</p> <ul style="list-style-type: none"> Designate day parking with trailhead on north side of road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of road. Add parking, viewing, picnicking area east of Pothole Dome. | <p>Pothole Dome scenic pullout/parking areas:</p> <ul style="list-style-type: none"> Designate day parking with trailhead on north side of road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of road. Add parking, viewing, picnicking area east of Pothole Dome. | <p>Pothole Dome scenic pullout/parking areas:</p> <ul style="list-style-type: none"> Designate day parking with trailhead on north side of road. Improve trail to Pothole Dome. Formalize roadside pullout (four vehicles) on south side of road. Add parking, viewing, picnicking area east of Pothole Dome. Add parking/viewing/picnicking area east of Pothole Dome. |
| 2 | <p>Tioga Road through the Tuolumne Meadows area:</p> <ul style="list-style-type: none"> Retain Tioga Road in its current alignment. Allow undesignated roadside parking. Retain Tioga Road bridge. | <p>Tioga Road through the Tuolumne Meadows area:</p> <ul style="list-style-type: none"> Retain Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. | <p>Tioga Road through the Tuolumne Meadows area:</p> <ul style="list-style-type: none"> Retain Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. Add hiking trail that parallels the road. | <p>Tioga Road through the Tuolumne Meadows area:</p> <ul style="list-style-type: none"> Retain Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. | <p>Tioga Road through the Tuolumne Meadows area:</p> <ul style="list-style-type: none"> Retain Tioga Road in its current alignment. Add roadside curbing to eliminate undesignated roadside parking and associated informal trails. Add approximately four viewing turnouts (four vehicles each; no parking). Upgrade Tioga Road bridge to improve free flow of river. Add hiking trail that parallels the road. |
| 3 | <p>Existing Cathedral Lakes trailhead:</p> <ul style="list-style-type: none"> Allow undesignated roadside parking; retain trailhead. | <p>Existing Cathedral Lakes trailhead:</p> <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | <p>Existing Cathedral Lakes trailhead:</p> <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | <p>Existing Cathedral Lakes trailhead:</p> <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. | <p>Existing Cathedral Lakes trailhead:</p> <ul style="list-style-type: none"> Relocate trailhead and parking to location #6; restore to natural conditions. |

Table 7-16.
Site Plan Summary, All Alternatives (continued)

| Location | No-Action Alternative | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|----------|---|--|--|---|---|
| 4 | Existing wastewater ponds and sprayfields: <ul style="list-style-type: none"> ▪ Retain ponds, sprayfields, and service road. | Existing wastewater ponds and sprayfields: <ul style="list-style-type: none"> ▪ Pending additional planning, replace with upgraded wastewater treatment plant at locations #7 and #9; restore to natural conditions. | Existing wastewater ponds and sprayfields: <ul style="list-style-type: none"> ▪ Retain and upgrade (or relocate if feasible). | Existing wastewater ponds and sprayfields: <ul style="list-style-type: none"> ▪ Retain and upgrade (or relocate if feasible). | Existing wastewater ponds and sprayfields: <ul style="list-style-type: none"> ▪ Retain and upgrade (or relocate if feasible). |
| 5 | Area east of Budd Creek: <ul style="list-style-type: none"> ▪ Retain as undeveloped natural area. | Area east of Budd Creek: <ul style="list-style-type: none"> ▪ Construct new Cathedral Lakes trailhead connector. ▪ Retain as undeveloped natural area except for trail segment. | Area east of Budd Creek: <ul style="list-style-type: none"> ▪ Co-locate new NPS and concessioner stables and day parking. ▪ Build new hard-sided cabin for two stable employees. ▪ Construct new Cathedral Lakes trailhead connector. | Area east of Budd Creek: <ul style="list-style-type: none"> ▪ Construct new Cathedral Lakes trailhead connector. ▪ Retain as undeveloped natural area except for trail segment. | Area east of Budd Creek: <ul style="list-style-type: none"> ▪ Construct new Cathedral Lakes trailhead connector. ▪ Retain as undeveloped natural area except for trail segment. |
| 6 | Existing visitor center and Road Camp: <ul style="list-style-type: none"> ▪ Retain visitor center and day parking. ▪ Retain NPS employee housing. ▪ Retain maintenance yard and office. | Existing visitor center and Road Camp: <ul style="list-style-type: none"> ▪ Relocate visitor contact station to location #15; convert building to park operations. ▪ Construct new Cathedral Lakes trailhead with day and overnight parking. ▪ Retain maintenance yard and office. ▪ Increase NPS employee housing. | Existing visitor center and Road Camp: <ul style="list-style-type: none"> ▪ Relocate contact station to location #11; convert building to park operations. ▪ Construct new Cathedral Lakes trailhead with day and overnight parking. ▪ Retain maintenance yard and office. ▪ Increase NPS employee housing. | Existing visitor center and Road Camp: <ul style="list-style-type: none"> ▪ Retain visitor center in current location. ▪ Construct new Cathedral Lakes trailhead and picnic area, day and overnight parking. ▪ Relocate maintenance yard and office to location #7. ▪ Retain NPS employee housing. | Existing visitor center and Road Camp: <ul style="list-style-type: none"> ▪ Relocate visitor contact station to location #9; convert building to park operations. ▪ Construct new Cathedral Lakes trailhead with day and overnight parking. ▪ Relocate maintenance yard and office to location #7 ▪ Increase NPS employee housing. |
| 7 | Wastewater treatment plant: <ul style="list-style-type: none"> ▪ Retain wastewater treatment plant. ▪ Retain recreational vehicle dump station. | Wastewater treatment plant: <ul style="list-style-type: none"> ▪ Upgrade wastewater treatment plant. ▪ Retain recreational vehicle dump station. | Wastewater treatment plant: <ul style="list-style-type: none"> ▪ Upgrade wastewater treatment plant. ▪ Retain recreational vehicle dump station. | Wastewater treatment plant: <ul style="list-style-type: none"> ▪ Upgrade wastewater treatment plant. ▪ Retain recreational vehicle dump station. ▪ Add new modest operational facilities related to roads, trails, buildings, and grounds. ▪ Add NPS maintenance yard and office, and relocate existing aboveground diesel fuel tank to this location. | Wastewater treatment plant: <ul style="list-style-type: none"> ▪ Upgrade wastewater treatment plant. ▪ Retain recreational vehicle dump station. ▪ Add NPS maintenance yard and office, and relocate existing aboveground diesel fuel tank to this location. |

Table 7-16.
Site Plan Summary, All Alternatives (continued)

| Location | No-Action Alternative | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|-----------------|---|--|--|---|--|
| 8 | Parsons Memorial Lodge: <ul style="list-style-type: none"> Preserve Parsons Memorial Lodge and retain vehicle access. Retain footbridge. | Parsons Memorial Lodge: <ul style="list-style-type: none"> Preserve lodge; eliminate vehicle access. Upgrade footbridge to improve free flow of river. | Parsons Memorial Lodge: <ul style="list-style-type: none"> Preserve lodge and retain vehicle access. Upgrade footbridge to improve free flow of river. | Parsons Memorial Lodge: <ul style="list-style-type: none"> Preserve lodge and retain vehicle access. Upgrade footbridge to improve free flow of river. | Parsons Memorial Lodge: <ul style="list-style-type: none"> Preserve lodge and retain vehicle access. Upgrade footbridge to improve free flow of river. |
| 9 | Area west of Unicorn Creek: <ul style="list-style-type: none"> Retain as undeveloped natural area. | Area west of Unicorn Creek: <ul style="list-style-type: none"> Retain as undeveloped natural area; if needed, use area for wastewater treatment facilities. | Area west of Unicorn Creek: <ul style="list-style-type: none"> Add day parking and picnic area. Add trailhead for Parsons Memorial Lodge. | Area west of Unicorn Creek: <ul style="list-style-type: none"> Retain as undeveloped natural area. | Area west of Unicorn Creek: <ul style="list-style-type: none"> Add new small visitor contact station, picnic area, trailhead for Parsons Memorial Lodge, and day parking. |
| 10 | Tuolumne Meadows campground: <ul style="list-style-type: none"> Retain campground in current loop configuration (304 sites plus 7 group sites). Retain campground office and day parking. Retain Elizabeth Lakes trailhead and day parking. | Tuolumne Meadows campground: <ul style="list-style-type: none"> Retain smaller campground; remove the A-loop road and all 67 A-loop campsites. Retain campground office and day parking. Add vending machine for ice and firewood. Relocate entrance road outside of floodplain. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | Tuolumne Meadows campground: <ul style="list-style-type: none"> Expand campground in current configuration, adding 41 additional walk-in campsites; relocate the A-loop sites closest to the Lyell Fork. Retain campground office and day parking. Retain existing entrance road. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | Tuolumne Meadows campground: <ul style="list-style-type: none"> Retain campground in current configuration at current capacity. Retain campground office and day parking. Retain existing entrance road. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. | Tuolumne Meadows campground: <ul style="list-style-type: none"> Retain campground at current capacity; realign the A-loop road and relocate campsites closest to Lyell Fork Retain campground office and day parking. Relocate entrance road outside of floodplain. Formalize John Muir Trail connection. Retain Elizabeth Lakes trailhead and day parking. Remove riprap from riverbank. |
| 11 | Existing commercial services core: <ul style="list-style-type: none"> Retain store, grill, mountaineering shop/school, public fuel station, and day parking. Retain concessioner employee housing. | Existing commercial services core: <ul style="list-style-type: none"> Remove store, grill, mountaineering shop/school, public fuel station and post office. Convert area to day parking and picnic area. Add new public restroom. Add trail connector to campground. Remove concessioner employee housing. | Existing commercial services core: <ul style="list-style-type: none"> Retain store, grill, public fuel station, and post office. Remove mountaineering shop/school. Add visitor contact station, shower/restroom facility, picnic area, and day parking. Add trail connector to campground. Relocate concessioner employee housing to location #20. | Existing commercial services core: <ul style="list-style-type: none"> Retain store, grill, post office, and day parking. Remove mountaineering shop/school and public fuel station. Upgrade restroom. Add trail connector to campground. Relocate concessioner employee housing to location #18. | Existing commercial services core: <ul style="list-style-type: none"> Retain store, grill, and post office; expand day parking. Remove mountaineering shop/school and public fuel station. Upgrade restroom. Add trail connector to campground. Relocate concessioner employee housing to location #18. |

Table 7-16.
Site Plan Summary, All Alternatives (continued)

| Location | No-Action Alternative | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|-----------|---|--|---|---|--|
| 12 | Existing concessioner stable: <ul style="list-style-type: none"> Retain concessioner stable and day parking. Retain concessioner employee housing. Retain day and overnight parking along access road. | Existing concessioner stable: <ul style="list-style-type: none"> Co-locate NPS stable with concessioner stable (for administrative use only). Remove most concessioner employee housing except for one hard-sided cabin for two stable employees; restore to natural conditions. Eliminate parking along access road. | Existing concessioner stable: <ul style="list-style-type: none"> Relocate concessioner stable and concessioner employee housing to location #5. Add meadow overlook picnic area and day parking. Retain day and overnight parking along access road. | Existing concessioner stable: <ul style="list-style-type: none"> Retain concessioner stable and day parking. Retain one hard-sided cabin for two stable employees (most employee housing relocated to location #18). Retain day and overnight parking along access road. | Existing concessioner stable: <ul style="list-style-type: none"> Co-locate NPS and concessioner stable (for administrative use only). Retain one hard-sided cabin for two stable employees (relocate most concessioner employee housing to location #18). Retain day and overnight parking along access road. |
| 13 | Lembert Dome: <ul style="list-style-type: none"> Retain day parking and trailheads for Lembert Dome and Parsons Memorial Lodge. Retain picnic area. | Lembert Dome: <ul style="list-style-type: none"> Retain day parking and trailheads for Lembert Dome and Parsons Memorial Lodge. Retain picnic area. Add shuttle stop. | Lembert Dome: <ul style="list-style-type: none"> Expand day parking. Retain picnic area. Add shuttle stop. Add Parsons Memorial Lodge trailhead. | Lembert Dome: <ul style="list-style-type: none"> Expand day parking and retain trailheads for Lembert Dome and Parsons Memorial Lodge. Retain picnic area. Add shuttle stop. | Lembert Dome: <ul style="list-style-type: none"> Expand day parking and retain trailheads for Lembert Dome and Parsons Memorial Lodge. Retain picnic area. Add shuttle stop. |
| 14 | Old Tioga Road/Great Sierra Wagon Road: <ul style="list-style-type: none"> Preserve as trails. | Old Tioga Road/Great Sierra Wagon Road: <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of old roads to meadow hydrology. | Old Tioga Road/Great Sierra Wagon Road: <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of old roads to meadow hydrology. | Old Tioga Road/Great Sierra Wagon Road: <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of old roads to meadow hydrology. | Old Tioga Road/Great Sierra Wagon Road: <ul style="list-style-type: none"> Preserve as trails; mitigate impacts of old roads to meadow hydrology. |
| 15 | Existing wilderness center and NPS stable: <ul style="list-style-type: none"> Retain wilderness center and overnight parking. Retain NPS stable. | Existing wilderness center and NPS stable: <ul style="list-style-type: none"> Combine new, small visitor contact station with existing wilderness center; expand parking. Relocate NPS stable to location #12; use site for expansion of NPS employee housing, if needed. | Existing wilderness center and NPS stable: <ul style="list-style-type: none"> Combine ranger station with existing wilderness center; expand parking. Relocate NPS stable to location #5; use site for expansion of NPS employee housing, if needed. | Existing wilderness center and NPS stable: <ul style="list-style-type: none"> Retain wilderness center; expand parking. Retain NPS stable. | Existing wilderness center and NPS stable: <ul style="list-style-type: none"> Retain existing wilderness center; expand parking. Move NPS stable to location #12; use site for expansion of NPS employee housing, if needed. |
| 16 | Existing ranger station and Ranger Camp: <ul style="list-style-type: none"> Retain ranger station and day parking. Retain aboveground diesel fuel tank. Retain NPS employee housing. | Existing ranger station and Ranger Camp: <ul style="list-style-type: none"> Retain ranger station and day parking. Retain aboveground diesel fuel tank for administrative use. Replace NPS employee housing with hard-sided cabins. | Existing ranger station and Ranger Camp: <ul style="list-style-type: none"> Relocate ranger station function to location #15. Retain the aboveground diesel fuel tank. Replace NPS employee housing with hard-sided cabins. | Existing ranger station and Ranger Camp: <ul style="list-style-type: none"> Retain existing ranger station and day parking. Relocate the aboveground diesel fuel tank to location #7. Replace NPS employee housing with hard-sided cabins. | Existing ranger station and Ranger Camp: <ul style="list-style-type: none"> Relocate ranger station to location #6. Relocate the aboveground diesel fuel tank to location #7. Replace NPS employee housing with hard-sided cabins. |

Table 7-16.
Site Plan Summary, All Alternatives (continued)

| Location | No-Action Alternative | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|-----------------|---|---|--|--|---|
| 17 | Bug Camp, Dog Lake/John Muir Trail parking: <ul style="list-style-type: none"> ▪ Retain NPS employee housing. ▪ Retain day and overnight parking. | Bug Camp, Dog Lake/John Muir Trail parking: <ul style="list-style-type: none"> ▪ Increase day and overnight parking. ▪ Remove NPS housing. | Bug Camp, Dog Lake/John Muir Trail parking: <ul style="list-style-type: none"> ▪ Increase day and overnight parking. ▪ Remove NPS housing. | Bug Camp, Dog Lake/John Muir Trail parking: <ul style="list-style-type: none"> ▪ Increase day and overnight parking. ▪ Retain NPS employee housing. | Bug Camp, Dog Lake/John Muir Trail parking: <ul style="list-style-type: none"> ▪ Increase day and overnight parking. ▪ Retain NPS employee housing. |
| 18 | Tuolumne Meadows Lodge: <ul style="list-style-type: none"> ▪ Retain lodge and overnight parking. ▪ Retain roadside parking along access road. ▪ Retain concessioner employee housing. | Tuolumne Meadows Lodge: <ul style="list-style-type: none"> ▪ Remove lodge, parking, and employee housing; restore area to natural conditions. | Tuolumne Meadows Lodge: <ul style="list-style-type: none"> ▪ Retain lodge at current capacity. ▪ Eliminate roadside parking. ▪ Relocate concessioner employee housing to location #20. | Tuolumne Meadows Lodge: <ul style="list-style-type: none"> ▪ Retain lodge with reduced capacity. ▪ Eliminate roadside parking. ▪ Expand concessioner employee housing. | Tuolumne Meadows Lodge: <ul style="list-style-type: none"> ▪ Retain lodge at current capacity. ▪ Upgrade shower house. ▪ Eliminate roadside parking. ▪ Expand concessioner employee housing. |
| 19 | Water treatment facility: <ul style="list-style-type: none"> ▪ Retain water treatment facility. | Water treatment facility: <ul style="list-style-type: none"> ▪ Upgrade water treatment facility. | Water treatment facility: <ul style="list-style-type: none"> ▪ Upgrade water treatment facility. | Water treatment facility: <ul style="list-style-type: none"> ▪ Upgraded water treatment facility. | Water treatment facility: <ul style="list-style-type: none"> ▪ Upgrade water treatment facility. |
| 20 | Gaylor Pit: <ul style="list-style-type: none"> ▪ Retain helipad. ▪ Allow undesignated day parking. | Gaylor Pit: <ul style="list-style-type: none"> ▪ Retain helipad. ▪ Discontinue undesignated parking. | Gaylor Pit: <ul style="list-style-type: none"> ▪ Add NPS and concessioner employee housing. ▪ Retain helipad. | Gaylor Pit: <ul style="list-style-type: none"> ▪ Retain helipad ▪ Add day parking | Gaylor Pit: <ul style="list-style-type: none"> ▪ Add NPS employee campsites, vault toilets, and potable water tank. ▪ Retain helipad. |

Table 7-17.
Summary Comparison of Designated Parking, Tuolumne Meadows, All Alternatives

| Type of Parking | Current | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Parking Area Description |
|--|------------------------|---------------|---------------|---------------|---------------|--|
| Day Parking Spaces (in Designated Parking Areas) | 16 | 16 | 16 | 16 | 16 | existing parking area at Pothole Dome |
| | 0 | 0 | 20 | 20 | 20 | new parking/viewing area east of Pothole Dome |
| | 0 | 4 | 4 | 4 | 4 | existing roadside pullout south of Pothole Dome |
| | 0 | 0 | 58 | 0 | 0 | new parking area associated with the relocated stables (alternative 2 only) |
| | 50 | 50 | 126 | 113 | 76 | existing parking area at the current visitor center |
| | 0 | 0 | 80 | 0 | 80 | new day parking area west of Unicorn Creek and across Tioga Road from the Parsons Memorial Lodge trailhead |
| | 11 | 13 | 13 | 13 | 13 | existing parking area at the campground office |
| | 11 | 11 | 11 | 11 | 11 | existing parking in the campground for the Elizabeth Lakes trailhead |
| | 0 | 10 | 0 | 0 | 0 | A-loop day use parking (alternative 1 only) |
| | 15 | 0 | 15 | 15 | 30 | existing parking area at the fuel station |
| | 51 | 50 | 55 | 55 | 55 | existing parking area at the store and grill |
| | 58 | 0 | 30 | 58 | 38 | existing parking area at the concessioner stable |
| | 0 | 0 | 34 | 34 | 34 | roadside parking along the road to the concessioner stable |
| | 29 | 25 | 50 | 37 | 50 | existing parking area at the base of Lambert Dome |
| | 7 | 7 | 7 | 7 | 7 | existing parking area at the ranger station |
| | 25 | 52 | 52 | 45 | 52 | existing parking area at the Dog Lake/John Muir Trail trailhead |
| | 0 | 0 | 0 | 15 | 5 | existing parking area at Gaylor pit |
| | 67 | 67 | 71 | 67 | 71 | existing parking areas in the road corridor east of Tuolumne Meadows, including the Mono Pass and Gaylor Peak trailheads and the Dana Meadows and other pullouts |
| | 340 | 305 | 642 | 510 | 562 | Subtotal, Day parking spaces |
| Overnight Parking Spaces (excluding cars parked in the Tuolumne Meadows campground) | 58 | 89 | 86 | 86 | 89 | existing parking area at the wilderness office |
| | 33 | 68 | 59 | 59 | 68 | existing parking area at the Dog Lakes/John Muir Trail trailhead |
| | 102 | 0 | 102 | 70 | 102 | Tuolumne Meadows Lodge |
| | - | 19 | 35 | 32 | 35 | relocated parking area for Cathedral Lakes trailhead |
| | - | - | 58 | 56 | 58 | roadside parking along the road to the concessioner stable |
| | | 193 | 176 | 340 | 303 | 352 |
| Total | 533^a | 481 | 982 | 813 | 914 | All Designated Day and Overnight Parking Spaces, Tuolumne Meadows |

a In addition to vehicles in these designated parking spaces, an estimated 337 vehicles currently park in undesignated spaces during peak periods.

Environmentally Preferable Alternative

Legal Mandates

The Council on Environmental Quality (CEQ) regulations implementing NEPA (*Code of Federal Regulations* 40:1505.2) and the NPS NEPA guidelines require that “the alternative or alternatives which were considered to be environmentally preferable” be identified. *Environmentally preferable* is defined as “the alternative that will promote the national environmental policy as expressed in NEPA section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources” (CEQ 1981).

Section 101 of NEPA states that:

It is the continuing responsibility of the Federal Government to . . .

- (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;*
- (2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;*
- (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;*
- (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;*
- (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life’s amenities; and*
- (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.*

Conformance

Alternative 4 would best fulfill the responsibilities of the NPS to select the alternative that has the least amount of impacts to the biological and physical environment; that best protects, preserves, and enhances historic, cultural, and natural resources; and that best supports diversity and variety of individual choice.

The no-action alternative would provide for diversity and variety of individual choice; however, it would not best fulfill any of the other requirements, particularly at Tuolumne Meadows, where increasing amounts of use would continue to adversely affect ecologically sensitive meadow and riparian areas, archeological resources, scenic values, visitor experience, visitor safety, and park operations. Additionally, aging utilities at Tuolumne Meadows and Glen Aulin would continue to pose risks to water quality under the no-action alternative.

All of the action alternatives would fulfill all of the above requirements to some degree. In addition, all of the action alternatives would fulfill these requirements somewhat equally, through continuation of existing wilderness and resource management policies, ecological restoration of fragile meadow and riparian areas, protection of water quality, protection of archeological resources, and conformance with existing requirements under Executive Order 13514 to improve energy efficiency, reduce consumption and waste, and conserve water use to improve sustainability of NPS operations and facilities. The alternatives would vary primarily in water

consumption and related risks to water quality and habitat, protection of historic resources, and diversity of recreational opportunities.

Alternative 1 would remove significant historic resources at Tuolumne Meadows Lodge and Glen Aulin High Sierra Camp. It would also impose the most restrictions on diversity of visitor use in the most popular portions of the corridor. Alternative 2 would provide outstanding, diverse recreational opportunities in the river corridor. However, the historic setting at Tuolumne would be altered, and water consumption and associated risks would remain. Alternative 3 would provide outstanding recreational opportunities similar to existing conditions and would retain the historic setting of Tuolumne Meadows, but like alternative 2, it would not reduce risks to water quality to the degree that would occur under alternative 4.

In comparison, alternative 4 would strike a balance between maintaining the historic setting of the river corridor, maintaining a diversity of recreational opportunities, and allowing for extensive natural resource management at Tuolumne Meadows to restore natural ecosystem function to the extent possible.

Alternatives Dismissed from Further Consideration

Keep Tioga Road Open Year-Round

From roughly November to late May or early June, the Tioga Road is closed due to snow and icy conditions. The alternative of keeping the road open during winter is not considered feasible because the road is not engineered for year-round use. The feasible avalanche control work on both the Tioga Road and Highway 120 East toward Lee Vining Canyon might not be adequate to mitigate hazards to public and park staff. In addition, infrastructure along the road is not adequate to support road clearing operations and visitor protection activities. Costs and resource impacts associated with reengineering and maintaining the road for year-round access would be unreasonable. Also the wilderness boundary poses a constraint on any potential reengineering.

Closing Tioga Road in the winter does not adversely affect the outstandingly remarkable recreational value of the Tuolumne River. During this time, the recreational value of the Tuolumne Meadows and Lower Dana Forks segments shifts from river access via Tioga Road to a wilderness experience along the river. The snow season is a quiet time to enjoy solitude in the raw elements of winter.

Realign or Eliminate Tioga Road through the Tuolumne Meadows Area

Closing the Tioga Road to through-traffic through the Tuolumne Meadows area was not considered a reasonable alternative. The Tioga Road is one of the few east-west trans-Sierra highways, and its closure would significantly affect regional summer and fall travel patterns across the Sierra. The nearest east-west corridor to the north is along the Sonora Pass (Highway 108); the nearest southerly route is over the Tehachapi Pass from Highway 395 to Bakersfield.

The issue of realigning the road away from the river corridor through Tuolumne Meadows was considered during the early phases of planning. However, a study conducted for the NPS aimed at assessing the effects of the Tioga Road on the hydrologic processes in Tuolumne Meadows (Cooper et al. 2006) found that the Tioga Road does not appear to affect hydrologic conditions in Tuolumne Meadows except in localized areas. Culverts beneath the road channelize water during periods of high spring runoff, thereby creating localized variation in meadow hydrology but not affecting the amount of surface water or groundwater recharge from what would occur if the road was not there. The role of the road appears to be minimal with respect to conifer encroachment. Consequently, it does not appear that road realignment would enhance the protection of river-related ecological values.

Relocate Park Operations and Housing Functions to Lee Vining

The NPS considered the feasibility of relocating some park operations functions (including a maintenance yard and stable), some administrative offices, and some employee housing to an administrative site in Inyo National Forest (in Lee Vining Canyon), where they could be co-located with similar USFS functions.

After some analysis, the NPS determined that it would not be cost-effective to spend limited public funds to relocate seasonal facilities to Lee Vining, where they could only be used three or four months per year by Yosemite National Park staff (since Tioga Road is closed in the winter). Funds would be better allocated to year-round facilities badly needed throughout the park.

Furthermore, the NPS determined that a certain amount of employee housing and maintenance and administrative facilities are necessary at Tuolumne Meadows to effectively and efficiently support resource management and visitor use. Necessary facilities were identified for each alternative based on user capacity and the kinds of resource management and visitor use management needed to implement the alternative.

Although some employees could be housed off site if alternative housing was available (which it currently is not), many employees are considered “required occupants” who must be housed on site to respond to visitor and resource safety and operational emergencies. Maintenance functions requiring rapid response or large equipment would be greatly hampered by having to travel over Tioga Road from Lee Vining Canyon. The NPS also determined that frequently trailering the pack stock needed to support routine ranger patrols and maintenance would present a safety hazard if the stable was relocated to Lee Vining Canyon.

For these reasons, the NPS determined that park operations, administrative offices, and housing would be retained in the Tuolumne Meadows area rather than developing a new administrative site on Inyo National Forest land in Lee Vining Canyon.

Close or Reduce the Use of the Backpacker Camp at Glen Aulin

Because Glen Aulin is at the intersection of four popular trails that provide access to large parts of the wilderness, and because of the paucity of other low-impact camping areas nearby, removing the backpacker camp or reducing the capacity of the Glen Aulin wilderness zone and related trailhead quotas would cause large changes in visitor use patterns over a large part of the wilderness within the Tuolumne River corridor. This would be better analyzed in the upcoming Yosemite Wilderness Stewardship Plan, which will update the current *Yosemite Wilderness Management Plan*. For this reason, this concept was dismissed from further consideration.

Relocate the Wastewater Treatment Plant to the Site of the Existing Ponds and Sprayfields

Relocating the wastewater treatment plant to the north side of the river (near the existing wastewater ponds and sprayfields) was considered but dismissed for several reasons:

- Conveying the wastewater to this location would require either continuing to use the existing force main (line) under Tuolumne Meadows, or constructing a new line from the Lumbert Dome parking lot west along the gravel road to the ponds. The route across the meadow is undesirable because potential failure of the line could degrade water quality (although the line is currently in good condition) as well as the outstandingly remarkable biological values in Tuolumne Meadows. A new wastewater line along the gravel road could disturb known archeological sites in the area, thus potentially degrading these outstandingly remarkable cultural values. The same line could also degrade the outstandingly remarkable

biological values in Tuolumne Meadows because the gravel road cuts across portions of those meadows and a new wastewater line could disrupt groundwater flow into the meadows. Construction of that line would also pose a threat of disturbance to the mineral spring habitat at Soda Springs. While that habitat is not an outstandingly remarkable value, it is home to several rare plants whose protection the NPS is obligated to ensure.

- Construction of a new wastewater plant at the site of the ponds would constitute a new visual intrusion into the area. While it might be possible to design the plant in such a way that it would not be visible from the river corridor (and intrude into views that contribute to an outstandingly remarkable scenic value), that possibility is not a guarantee. Furthermore, a new wastewater treatment plant in this location would almost certainly be visible from Lember and Pothole Domes, thus amplifying the incursion into the area's scenic integrity already presented by the wastewater ponds.
- The Wilderness boundary was drawn very close to the existing ponds and sprayfields, thus leaving little room for new construction of any kind. The space necessary for a full treatment plant means that it could not be sited by the ponds without violating the wilderness boundary.

In conclusion, the possibility of relocating the wastewater treatment plant to the site of the existing ponds and sprayfields was dismissed because it would degrade several outstandingly remarkable values, would violate the wilderness boundary, could harm sensitive plant habitat, and would present a new incursion into the scenic integrity of Tuolumne Meadows.

Relocate Visitor Service to a Site in the Tuolumne Meadows Area Outside the River Corridor

The feasibility of relocating the facilities necessary for visitor use to areas outside the river corridor boundary is severely constrained by the boundaries of the Yosemite Wilderness, which generally overlap into the scenic segments of the corridor. The site most suitable for development that is outside both the river corridor and the designated wilderness is currently occupied by the campground B–G loops. The option of locating a visitor contact station and possibly a store and grill at the site currently occupied by the campground D loop was considered but dismissed because of the potential for impacts on Unicorn Creek and adjacent wetlands, and because of the number of campsites that would have to be either eliminated or redistributed to other campground locations. Redistributing these sites was dismissed because it would not be cost-effective and it would increase the site density within the campground.

Replace the Tuolumne Meadows Lodge with a More Permanent Facility

Replacing the Tuolumne Meadows Lodge with a larger and more permanent facility was not considered reasonable for several reasons:

- Any new construction in a wild and scenic river corridor must be necessary for visitor use and resource protection and infeasible to locate outside the river corridor. A new lodge is not necessary, given the presence of the existing Tuolumne Meadows Lodge, which is functional and appealing to many.
- A new lodge would result in adverse effects on the Tuolumne Meadows Historic District. The Tuolumne Meadows Lodge and High Sierra Camp was recommended eligible for listing on the National Register of Historic Places as a historic district in 1989 and 2004 (Kirk and Palmer 2004). The building and structures are designed to be as simple as possible, with no architectural ornamentation. The most distinctive feature of the area (established in 1916) is the village-like clustering, with the dining hall serving as the central hub to the clustering. Replacing part of the lodge (for example, half the tent cabins) with a new lodge would

heavily affect the rustic, village-like character of the lodge, thus causing an adverse effect on the historic district.

- If a new lodge included rooms with private baths (as it most likely would because such rooms are the norm in contemporary hotel construction), water withdrawals from the Dana Fork would likely increase because the ready access to domestic water in the hotel rooms would likely lead to greater per capita water consumption. As noted in chapter 5, water withdrawals from the Dana Fork are already at capacity, so construction of a new lodge would most likely cause water withdrawals that exceed NPS regulations.
- A persistent theme in public scoping was to keep the development in Tuolumne Meadows like it is now: rustic. Commenters were mostly opposed to the idea of building a modern new lodge in the area.
- Any construction of a new lodge in Tuolumne Meadows would be prohibitively expensive due to the area's remoteness and heavy snow loads. Such costs would be passed along to the visitor, thereby resulting in considerably higher lodging costs than the lodge currently charges. Providing affordable lodging is a common request heard in public comments in Yosemite; a new lodge would not address this concern.

In conclusion, based on wild and scenic river management regulations, interests and concerns raised during scoping, resource concerns, and high construction costs, the idea of constructing a new, permanent lodge at Tuolumne Meadows was dismissed from further consideration.

Increase Use Beyond the Level Considered in Alternative 2

A user capacity even higher than that considered in alternative 2 was considered but rejected for several reasons.

First, as noted in several places in this chapter, water withdrawals from the Dana Fork are already near the 70,000 gallon per day capacity, and alternative 2 would increase withdrawals to capacity. A user capacity above what is proposed in alternative 2 would demand more water from the Dana Fork than the river can provide without affecting the river's free-flowing character.

Additionally, the parking and infrastructure necessary for additional use would be difficult to construct without affecting the scenic or subalpine meadow and riparian values of the river corridor. Also, with the designated wilderness boundary closely approaching the road and the meadows, there is insufficient space to construct parking lots much larger than those proposed in alternative 2.

For these reasons, the idea of accommodating a higher user capacity than what is proposed in alternative 2 was dismissed from further consideration.

Allow Boating on the Tuolumne River in the Meadows Area

Allowing boating on the Tuolumne River in the meadows area was considered but dismissed for several reasons:

- Most importantly, the riverbanks in the meadows area currently have less willow vegetation than would be expected under natural conditions (as discussed in chapter 5). Boaters inevitably land on the banks to explore their surroundings, thus trampling the ground adjacent to the river. More trampling would only cause the willow recruitment problem to worsen.
- While alternative 2 provides for a very limited amount of boating below the meadows, most floaters would have to take out at the northwestern end of the meadows and hike (with their boats) back to the lodge area (where they would presumably have put in their boats). This would increase visitor use on the Glen Aulin

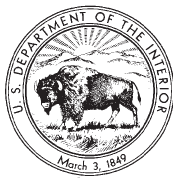
trail, which is already at levels approaching the management standard; boaters would easily push such use beyond the management standard.

- The stretch of water in the Tuolumne Meadows area is deceptively swift, much more so than the Merced River in Yosemite Valley. Were boating to be allowed, more boaters would need to be rescued, thus adversely affecting the limited park operations function in this remote area.

For these reasons, the idea of boating on the river in the meadows area was dismissed from further consideration.



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.



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(Photo by Kristina Rylands)

*Front cover: Tuolumne Meadows,
Unicorn Peak and Cockscomb*
(Photo by Randy Fong)