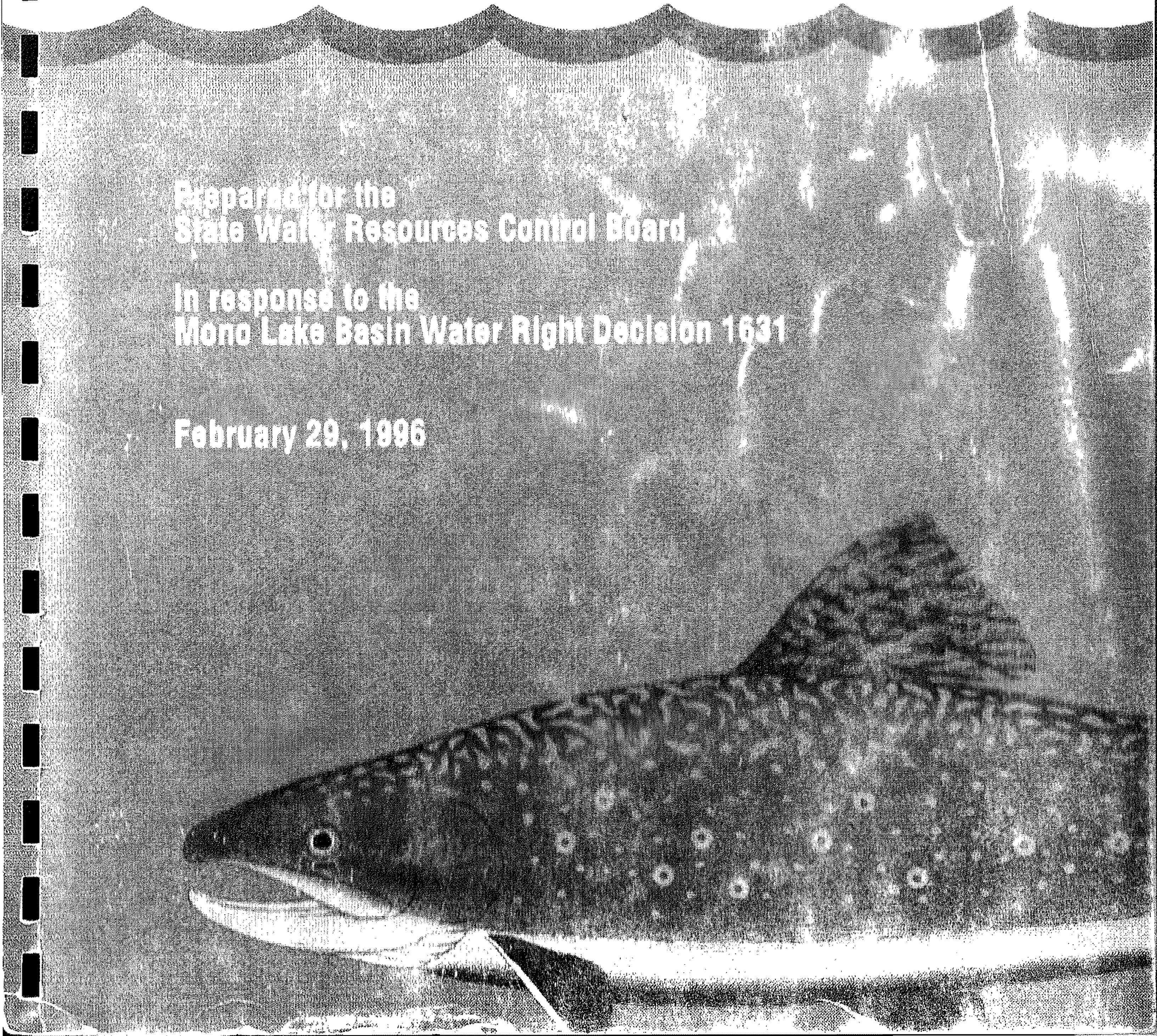
Los Angeles Department of Water and Power

MONO BASIN

Stream & Stream Channel Restoration Plan



Prepared for the
State Water Resources Control Board

In response to the
Mono Lake Basin Water Right Decision 1631

February 29, 1996

Mono Basin Stream and Stream Channel Restoration Plan

February 29, 1996

PREPARED BY THE LOS ANGELES DEPARTMENT OF WATER AND POWER

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Executive Summary

The Mono Lake Basin Water Right Decision 1631 was adopted by the State Water Resources Control Board (SWRCB) on September 28, 1994. This Decision amended Water Right Licenses 10191 and 10192, held by the City of Los Angeles, to meet the public trust needs of the Mono Basin environment, and to comply with Fish and Game Code Sections 5937 and 5946. The Decision defined instream flow requirements in the four streams from which the Los Angeles Department of Water and Power (LADWP) diverts water, and established water diversion criteria to protect wildlife and other environmental resources (air quality, scenic value, water quality standards) in the Mono Basin.

Decision 1631 requires LADWP to prepare a Stream and Stream Channel Restoration Plan, to "...restore, preserve and protect the streams and fisheries in Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek...". This document is the plan required by the SWRCB.

The restoration plan prepared by LADWP has the overall goal to **'develop functional and self-sustaining stream systems with healthy riparian ecosystem components'**. This complies with the order of the SWRCB which defined the objective for the Stream and Stream Channel Restoration Plan to be "...to restore, preserve and protect the streams and fisheries in Rush, Lee Vining, Walker and Parker creeks."

The foundation of the restoration program is built on the philosophy that "if you build it, they will come".. The proposal is to restore the stream systems and their riparian habitats by providing proper flow management, in a pattern that allows natural stream processes to develop functional, dynamic, and self sustaining stream systems. The flows will be complemented by restoration measures that will help "jump start" the process. The end result will be an ecosystem that has come to equilibrium with vegetative, hydraulic, and geomorphic factors. Long term monitoring of the parameters that indicate the health of an ecosystem will allow the SWRCB to evaluate the success of restoration.

The restoration plan proposed by LADWP depends primarily on streamflows. The proposed channel maintenance flows meet or exceed all the requirements set in Decision 1631, for all four streams, during all year types. These flows will provide the energy that is necessary for the streams to reestablish their natural processes, and become self sustaining. The streamflow management proposal is explained in detail in the Grant Lake Operations and Management Plan.

In addition to the channel maintenance flows, LADWP's proposal includes restoration measures that are complementary to the streamflows, and will help "jump start" the restoration process. These recommendations are made in response to requirements of the Order of Decision 1631 (Paragraph 8.a). The following measures are being proposed:

1. Install, and maintain as necessary, large woody debris in Rush and Lee Vining creeks, until the streams establish their own processes.
2. Rewater additional channels in Rush Creek.
3. Implement a limited planting program in the riparian area along Rush, Parker, Walker, and Lee Vining creeks; implement a planting program in the interfluve areas of Rush and Lee Vining creeks.
4. Provide sediment passage at Walker, Parker, and Lee Vining creeks.
5. Prepare flood flow contingency plans to protect highway 395 during years when the possibility of flooding exists.
6. Close roads as appropriate to limit vehicular access to sensitive areas.
7. Enforce a livestock grazing moratorium for 10 years from the date of the decision.
8. Assist the California Department of Fish and Game in the installation of fish screens on any irrigation diversions that warrant fish screens.
9. Remove existing bags of gravel from Lee Vining Creek.
10. Remove existing limiter logs and modify channel entrances in Lee Vining Creek.
11. Support the California Department of Transportation for the rehabilitation of Parker Plug.
12. Rehabilitate the Mono Return Ditch and the Lee Vining conduit to provide the necessary channel maintenance flows to Rush Creek.

Decision 1631 requires LADWP to consider constructing fish bypass facilities at Walker and Parker creeks. A thorough review of stream evaluation reports (EBASCO 1992, Deinstadt 1986) did not reveal any data, nor any analysis that identifies whether fish migration blocks if they existed, were a problem prior to the LADWP diversion of Walker and Parker creeks, or after the diversion via the conduit. The construction of fish passage facilities at Walker Creek and Parker Creek diversion facilities is considered unnecessary, and is not proposed by LADWP.

Decision 1631 requires LADWP to consider the placement of spawning gravels in all four streams. The LADWP proposal entails channel maintenance flows in the wet years that are greater than those required by Decision 1631. The flows in LADWP's proposal are considered adequate to mobilize sediment and bedload, which provide spawning gravels, in Rush Creek, Walker Creek, Parker Creek, and Lee Vining Creek. The placement of additional spawning gravels is considered unnecessary, and is not proposed by LADWP.

The LADWP Stream and Stream Channel Restoration Plan, as required by Decision 1631, includes a monitoring plan designed to evaluate the recovery of the streams. The LADWP proposal is to collect microhabitat, as well as riparian vegetation data, thalweg and width profiles on the channels, fish population indices by snorkeling, stream temperature data, conduct channel and habitat mapping, and to analyze this information to determine whether over the long term there is progress toward the goal. The proposed monitoring program is very aggressive and will provide the SWRCB, and any other interested party, with a clear picture of the stream progress toward achieving the desired state of dynamic equilibrium.

The duration of the majority of the restoration work proposed by LADWP is estimated to be 17 months from the approval of the plan by the SWRCB. A large number of parameters may influence the actual time to complete the work, such as time required for environmental documentation, permitting, licenses, and, since some of the work is limited by weather, the actual start date. Some of the proposed work, e.g. the revegetation program, rewatering Rush Creek channels, will extend to future years, since a phased approach is necessary. The monitoring program is scheduled to start as soon as a contract for the work can be secured. A limited amount of work is proposed for 1996.

The estimated cost of the LADWP proposal is $2 million. This includes the cost of the projects as proposed, as well as the preparation of the necessary environmental documentation. The largest component is the rehabilitation of the Mono Return Ditch, estimated at $887,000. Average annual expenses are estimated to be approximately $100,000. This includes the cost of changes in the operations of various facilities, as well as the cost of monitoring.

The Stream and Stream Channel Restoration Plan includes provisions for reporting to the SWRCB. These provisions meet the requirements of Decision 1631.

In reaching its Decision, the SWRCB considered extensive testimony from the involved agencies and scientific experts, and attempted to accommodate competing public trust resources to the extent possible. LADWP believes that Decision 1631 achieves the desired balance, and has fully complied with the Decision in preparing its proposal for stream and stream channel restoration.

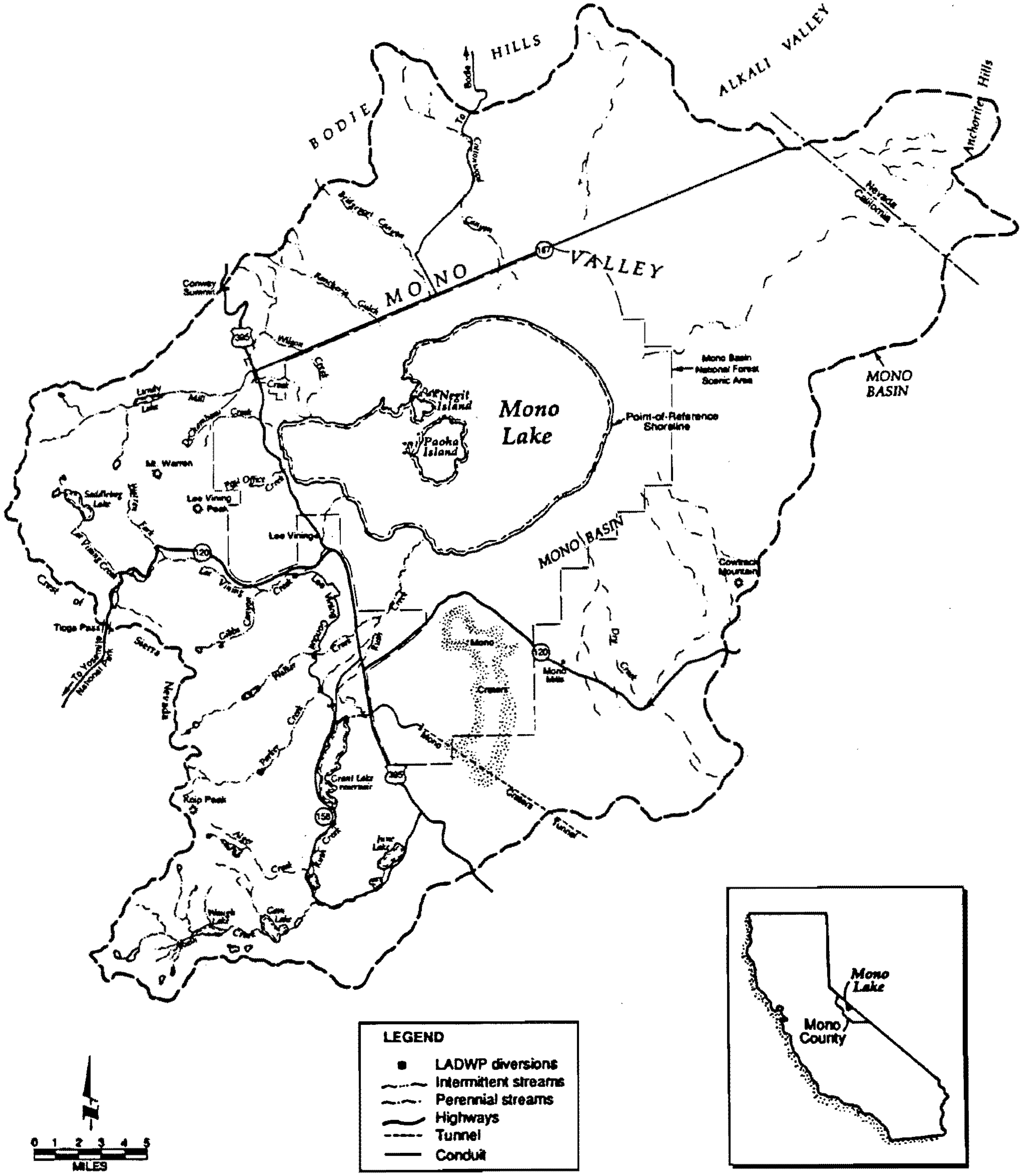
I. Introduction

According to Decision 1631, the objective of the stream and stream channel restoration plan is to restore, preserve, and protect the streams and fisheries in Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek. These are the four creeks in the Mono Basin that the LADWP historically diverted for export (Figure 1 and 2). In 1941, the LADWP was given permits (and eventually licenses) to divert the entire flow of the creeks. In Decision 1631, permanent minimum instream flow requirements were mandated for each of the creeks so that diversions could only be made after fishery flow requirements were first attained. The decision added that the LADWP must prepare a stream restoration plan for the creeks because of the negative impacts the diversions had on the fishery. This document is the plan that is required by the SWRCB.

Decision 1631 states that the plans are subject to technical and financial feasibility, reasonableness, and adequacy of measures proposed to achieve stated objectives. Restoration of certain aspects of a stream ecosystem may prove excessively costly or impractical. The decision indicates that it is not the intention of the SWRCB to commit excessive resources nor initiate projects that may not prove effective. While this plan makes no offer as to what is reasonable, it does provide the SWRCB information that will allow the SWRCB to make a determination on technical and financial feasibility, reasonableness and adequacy of the measures proposed to achieve the stated objective.

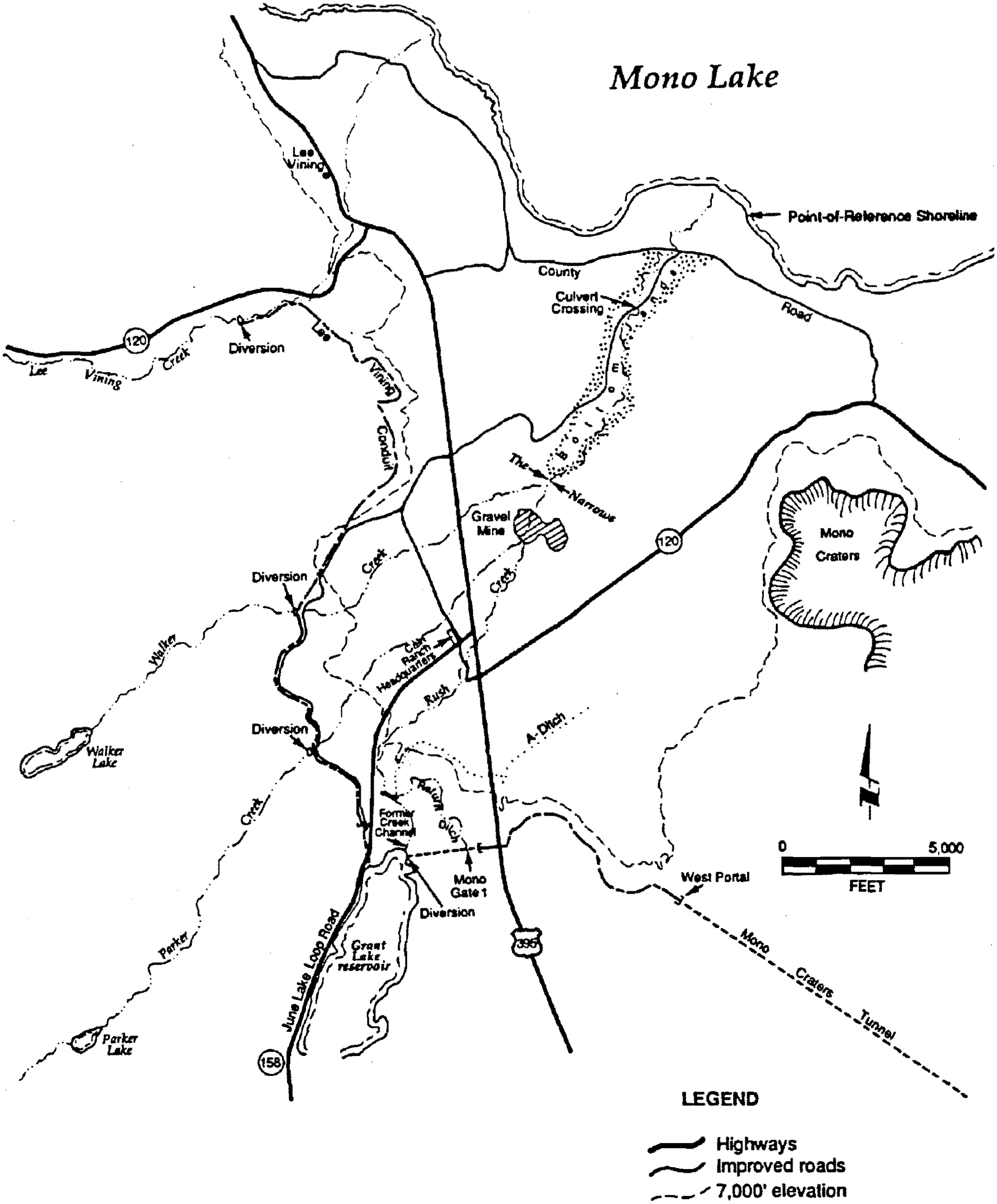
Decision 1631 makes the LADWP responsible for preparing a stream and stream channel restoration plan. It also requires the LADWP to seek active input from several named parties in developing the plan. The parties listed in Decision 1631 are: California Department of Fish and Game, California State Lands Commission, California Department of Parks and Recreation, the United States Forest Service, the National Audubon Society, the Mono Lake Committee, and California Trout, Inc. The LADWP has added additional parties or individuals to the above list that are interested in the restoration planning process, including land owners along the upper Owens River and marina owners at Grant Lake reservoir.

The schedule established in Decision 1631 required the final proposed restoration plans to be submitted to the SWRCB by November 30, 1995. In May 1995, however, the scientific experts assisting the LADWP in preparing the restoration plans concluded that additional time was necessary to prepare their reports, from which LADWP would prepare its restoration plan. On May 16, 1995, the LADWP petitioned the SWRCB for amendment of three conditions in Decision 1631. Included in the conditions was a 92-day extension in the schedule to develop the restoration plans. On July 19, 1995, the SWRCB adopted Order WR 95-10 which, among other things, granted the requested time extension. A copy of Order WR 95-10 is included as Appendix II.



Source: Mono Basin EIR

Figure 1



Source: Mono Basin EIR

Figure 2

II. Background of Stream Restoration

Before presenting the stream restoration plan, a discussion on the background of stream restoration in the Mono Basin is presented. The LADWP first exported water from the Mono Basin in 1941. While LADWP was not the first to affect the Mono Basin streams, its diversion practices did, however, severely impact them. The restoration of these streams began five decades later, under the jurisdiction of the Court. These restoration plans are the final step in the restoration of the Mono Basin streams.

1. Aquatic and Riparian Habitat Conditions Prior to 1941

The period from 1941 through 1989 represents a period of stream diversion and export from the Mono Basin by the LADWP. The diversion of water from the Mono Basin had significant impacts to the integrity of the riparian and channel systems associated with Rush, Lee Vining, Walker, and Parker creeks. Long before the LADWP began its diversions, there were impacts to the stream systems caused by hydro-electric development, irrigation practices, and grazing. Therefore, it is important to have an understanding of the general setting of the streams prior to the development of LADWP diversions. This requires an understanding of the hydrology, geomorphology, and land use that existed in the Mono Basin before 1941.

Detailed information regarding the pre-1941 physical conditions of Mono Basin streams is limited (SWRCB 1994). What information is available shows that these streams had been altered by 1941 from irrigation diversions, hydroelectric storage and releases, and livestock grazing. Stream conditions prior to 1941 are presented for each stream.

Rush Creek: Prior to the export of water from the Mono Basin, water diverted for irrigation onto both sides of the bottomlands assisted in maintaining high densities of woody plants away from the main channel (SWRCB 1994). Several ditches -- A, B, C, and Indian ditch -- diverted water from Rush Creek to irrigate pasture and crops mainly within the Rush Creek drainage. Diverted water caused the occurrence of several ponded areas alongside Rush Creek downstream of the narrows. At the same time, however, stream diversions for irrigation dewatered much of the Rush Creek channel above Highway 395. Livestock grazing, in combination with irrigation practices in the reaches above the narrows had degraded the habitat considerably (SWRCB 1994). The Rush Creek bottomlands, below the narrows, remained flowing most of the time but also experienced damage from grazing and limited water supply (SWRCB 1994). Hydroelectric power was being developed in upper Rush Creek by 1916. The control of flows for generating power modified the natural discharge.

Extensive grazing pressure had caused significant changes to understory plants but the overstory remained intact (SWRCB 1994). Channel, streambanks, and water quality had been impacted by livestock grazing, but widespread channel changes had not yet occurred.

Healthy stands of brushy riparian vegetation composed of trees, shrubs, and herbaceous plants were common along the reaches of Rush Creek. An exception was the stream reach around the B-Ditch and the old Highway 395 crossing which were degraded by construction activities.

Prior to 1941, small clusters of Jeffrey pine grew along the stream corridor and a continuous ribbon of willow and cottonwood extended along much of the corridor from Grant Lake to the narrows. Below Grant Lake, the creek received some flow during most of the years which kept riparian vegetation intact. Willows and scattered Jeffrey pines occurred with patches of quaking aspen along the edge of the valley in the lower portion of the reach below Grant Lake. Irrigation diversions caused channel dewatering above Highway 395, downstream to as far as the narrows. Little water flowed into Rush Creek from Parker and Walker creeks during the irrigation season (SWRCB 1994). From the B-Ditch to Highway 395, woody riparian vegetation was generally limited to a few patches of willows along the immediate streambank. Several cut-off and meander channels were functioning, both above and below the narrows. The bottomlands, below the narrows, had a wide dense riparian corridor, wooden marshlands, wet meadows, ponded water, and springs. The springs and their discharge areas contained watercress. Below the County Ford, little spring flow entered Rush Creek. Artificial dikes were constructed between the County Road and Mono Lake to form ponds.

Lee Vining Creek: Reports reviewed by the SWRCB (1994) determined that geomorphic and vegetative conditions between the LADWP diversion dam and Highway 395 are much the same today as they were pre-1941. Livestock grazing impacted the riparian vegetation and caused the local breakdown of stream banks prior to 1941 in the lower portion of Lee Vining Creek.

The creek above Highway 395 had a modest gradient flowing through stands of large Jeffrey and lodgepole pine, quaking aspen, black cottonwood, and willows. These conditions mainly remain this way today. The creek contained large boulders causing a series of plunge pools. Riparian vegetation was primarily willow with some quaking aspen and black cottonwood, and a substantial stand of large Jeffrey and lodgepole pine upstream of Highway 395. These conditions mainly remain this way today. The stream was a single thread channel above Highway 395 with a long side overflow channel.

Prior to 1941, lower Lee Vining Creek below Highway 395 was characterized as a main channel with several secondary channels. There was a substantial stand of woody vegetation, primarily willow, black cottonwood, and a few Jeffrey pine in the upper portion. Stands of quaking aspen occurred along the canyon walls. Numerous side channels were present. Above the County Road there was a main channel with numerous side channels spread across a wide floodplain. The woody riparian vegetation was black cottonwood, willow, and scattered Jeffrey pine. Below the County Road, the channel was restricted to one main channel with one or more side channels. There was an extensive stand of black cottonwood and willow with a few Jeffrey pine. The vegetation thinned to scattered willows across the lower half of the delta.

Walker Creek: Walker Creek below the Lee Vining Conduit flowed in various channels over the alluvial fan. Heavy irrigation formed large meadow areas over the fan area. Below Highway 395, the stream cut down through the alluvium of old lake terraces as it graded to meet the channel elevation of Rush Creek.

Very little information is available concerning pre-1941 habitat conditions in Walker Creek. Walker Creek was heavily impacted by livestock grazing and irrigation diversions prior to 1941. Extensive livestock grazing resulted in the loss of a significant amount of the riparian vegetation and the deterioration of the streambanks and channel (SWRCB 1994). The heavy demand for irrigation at times totally diverted Walker Creek and eliminated normal flows into Rush Creek. No hydroelectric power was generated within the drainage. Land owners along Walker Creek, in the early 1900's, constructed a dam at Walker Lake to increase the storage capacity for irrigation purposes. Walker Lake outlet flows were manipulated affecting the timing and magnitude of flows in Walker Creek.

Parker Creek: Parker Creek, below the present Lee Vining Conduit, flowed though various channels across the meadows formed over the alluvial fan. At present Highway 395, Parker Creek cut through the alluvium of old lake terraces to grade with Rush Creek.

Very little information is available concerning pre-1941 conditions in Parker Creek. Like Walker Creek, the pre-1941 aquatic environment was degraded by extensive livestock grazing and water diversions for irrigation (SWRCB 1994). Extensive livestock grazing resulted in the loss of much of the riparian vegetation and the deterioration of the streambanks and channel. Irrigation also added to the degradation of Parker Creek by dewatering the main channel. The Parker Creek watershed contained no hydroelectric generation of power. There was extensive manipulation of Parker Creek flows to irrigate meadows above Highway 395. These numerous irrigation diversions dried up or reduced flows in Parker Creek and caused wide fluctuation in flows.

The stream had a narrow, dense strip of woody riparian vegetation composed mainly of willow with some quaken aspen at the upper elevations. A few scattered Jeffrey and lodgepole pines bordered the stream. Many of the irrigation ditches became bordered with willow.

2. *Judicial Decisions Affecting Stream Flows and Restoration*

The Provisions of Decision 1631 which prescribe minimum stream flows for Rush, Lee Vining, Walker, and Parker creeks are a result of two cases, *California Trout, Inc. v. State Water Resources Control Board* ("Cal Trout I"), and *National Audubon Society v. State Water Resources Control Board.* In these lawsuits, the plaintiffs sought to compel the SWRCB to rescind water rights licenses issued to LADWP on the grounds that they had been issued in violation of Section 5946 of the Fish and Game Code.

The Sacramento County Superior Court denied the relief sought by the plaintiffs. It ruled that Section 5946 did not apply to the appropriation of water by diversions from dams constructed before September 9, 1953, the statute's effective date. Thereafter, an appeal was taken and the District Court of Appeal reversed; it held that Section 5946 was applicable to the LADWP water right licenses because the licenses were issued after the effective date of Section 5946. With respect to the form of relief appropriate in the case, the District Court of Appeal stated that they agree that the rule requires LADWP to reduce its diversions but, are unable to precisely determine the amount. The Court went on to say that when a decision was made to the terms and conditions of their licenses that they would assume LADWP would adhere to the conditions.

After the cases were remanded to the Sacramento County Superior Court, the Superior Court allowed the SWRCB to defer imposing the conditions mandated by Section 5946 pending establishment of required water releases. (*California Trout, Inc. v. Superior Court* "Cal Trout II"). In addition, the Superior Court denied a request by the National Audubon Society that pending a precise determination of flows necessary to comply with Section 5937, interim flows be ordered by the Court.

The plaintiffs then petitioned the District Court of Appeal for a writ of mandate against the Sacramento County Superior Court. The District Court of Appeal granted the petition; it directed the Superior Court to vacate the judgment and to issue a writ directing the SWRCB to exercise its ministerial duty to attach the following conditions to LADWP's licenses: "in accordance with the requirements of Fish and Game Code Section 5946, this license is conditioned upon full compliance with Section 5937 of the Fish and Game Code. The licensee shall release sufficient water into the streams from its dams to reestablish and maintain the fisheries which existed in them prior to its diversion of water." In addition, the Superior Court shall resolve an application by the plaintiffs for injunctive relief in the form of interim releases of water, pending the SWRCB's decision.

Pursuant to the writ issued by the District Court of Appeal, the El Dorado County Superior Court, to which the cases had been assigned after coordination with the other Mono Basin water rights cases pending before it, held an evidentiary hearing to establish interim release rates. On June 14, 1990, the El Dorado County Superior Court issued an order which provided for minimum releases into Rush, Lee Vining, Walker, and Parker creeks. In addition, the El Dorado County Superior Court ordered the parties to attempt to reach an agreement with regards to stream restoration.

In late October, 1990, the parties executed an agreement entitled Restoration Agreement on Rush and Lee Vining Creeks Restoration Program, which created a restoration technical committee (RTC) comprised of a representative from each of the specific parties. The agreement provided for the appointment of a restoration consultant and the development of an interim restoration plan to restore Rush and Lee Vining creeks' aquatic and wetland habitats and resources. Between November 1990 and September 1994, the RTC, under the supervision of the El Dorado County Superior Court, engaged in extensive interim restoration activities which are hereinafter described. The agreement provided that it would terminate "when the SWRCB action amending LADWP's water right licenses to divert from Rush, Lee Vining, Parker and Walker Creeks becomes final after all court review of the SWRCB action including exhaustion of appeals".

Decision 1631, which was adopted by the SWRCB on September 28, 1994, became final on October 28, 1994, and the interim restoration effort terminated.

3. 1994-95 Stream Restoration Activities

Pursuant to Section 8b of the Order of Decision 1631, the LADWP undertook stream restoration projects on Lee Vining and Rush creeks and completed several reports. This work had been approved by the RTC during 1994. Originally, all of the restoration work was to have been completed during 1994, but some of the work had to be postponed until 1995. The restoration work was performed under the direction of the RTC consultant and/or his subcontractor.

On Lee Vining Creek, the task was to rewater a historical channel identified as the A-4 Channel, shown in Figure 4. The purpose of rewatering additional channels is to raise the ground water elevation and to help re-establish the riparian and floodplain vegetation. The A-4 Channel is approximately 2,100 feet in length and connects to the B1 complex -- another rewatered channel. In the spring of 1995, approximately 250 willow cuttings, 500 black cottonwood cuttings, and 500 Jeffrey pines were planted along the A-4 channel.

On Rush Creek, during the early part of fall 1995, the Channel 10 and 10B complex (reach 4B), shown in Figure 3, was rewatered. The rewatering of this channel adds approximately 1,800 feet of secondary channel to Rush Creek. During 1995, the stream scientists (see discussion in Section III.2 of this report), after further evaluation, modified the original proposal approved by the RTC by moving the entrance of the channel. The change was made to improve the hydraulic conditions at the entrance. It also resulted in rewatering another 600 feet of channel.

The following is a list of reports and studies completed:

- Rewatering the A-4 Channel in Segment 3 of the Lee Vining Creek. 1994 Stream Restoration Program. December 1994.
- A Preliminary Assessment of Pre-1941 Pool Morphology Evident in Segment 3 of Lee Vining Creek, Mono County, California. December 1994.
- 1994 Stream Temperature Data for the Rush Creek, Mono County, California. January 1995.
- Correspondence to Woody Trihey regarding "Assessment of Spawning Gravel in Lee Vining Creek and Observation of Winter Habitat Conditions. May 1995."
- Quantitative Restoration Goals for Lee Vining Creek.

- Lee Vining Creek Riparian Revegetation Work Plan for 1995. March 24, 1995.
- Rewatering Channel 10 in the Rush Creek Bottomlands, Mono County, California. 1995 Stream Restoration Program. December 1995.

4. Current Status of Mono Basin Streams

The return of a constant flow regime has been the most beneficial restoration treatment applied to the Mono Basin streams. The second most effective restoration treatment has been the grazing moratorium established in 1991 by LADWP on Rush, Lee Vining, Walker, and Parker creeks. Both treatments have resulted in significant recolonization of stream and floodplain vegetation. Regeneration of several willow species, black cottonwood, wild rose, and numerous depressional wetland species (e.g., sedges, bulrushes, and cattails) is evident along all channels and throughout much of the rewatered floodplains. Significant signs of recovery continue to emerge annually as stream flows interact with riparian and geologic components. Thus, the two key factors necessary for ensuring a dynamic, functioning stream over the long-term have already been implemented. Further refinement of flow management policies will be instrumental in ensuring a self-sustaining system.

Under the jurisdiction of the El Dorado County Superior Court, direct habitat treatments have been ongoing since 1991. These efforts have been conducted by Trihey and Associates, serving as the RTC consultant. A planning team was also created to recommend treatment alternatives. Actions by the RTC have largely consisted of a direct, intervention approach in which various structures and stream reaches have been engineered. The goal of this effort has shifted between providing general fishery habitat (e.g., above Highway 395 on Rush Creek) and attempting to replicate pre-41 conditions. Applications included in this effort have been to construct pools, side channels, and backwater refuge sites; placement of woody debris; the addition of spawning gravels and other substrate materials; and artificially replanting riparian vegetation. The majority of these treatments have been implemented utilizing heavy equipment. To date, the LADWP has spent nearly $5,000,000 to implement these measures.

As of 1993, overall fish populations in the treated streams have not shown any positive response to habitat alterations (Platts, 1994). Mesick (1994) found brown trout populations in Lower Rush Creek and Lee Vining Creek responded similarly to restoration treatments implemented in 1991 and 1992. Mesick states that in terms of total number of all ages of brown trout combined in Rush Creek, there were usually more fish between March 1985 and February 1989 than between October 1990 and April 1993. After analyzing the information, LADWP's conclusion is that there has been no increase in the overall total brown trout populations in Rush Creek or Lee Vining Creek that could be attributed to artificial intervention. In fact, the opposite may have occurred -- brown trout populations decreased during this period.

In 1995, an independent stream restoration expert was asked to evaluate and assess the overall success of habitat treatments performed to date. An independent scientist, without any previous ties to the existing program, could provide an objective opinion regarding the success and direction of previous efforts. An experienced restoration specialist and stream hydrologist from Interfluve Incorporated, Bozeman, Montana, was chosen as the independent evaluator. Interfluve Inc. is widely recognized for its stream restoration expertise in the Rocky Mountain region. The Interfluve report, *Mono Basin Stream Projects - Report on the Strategy, Quality, and Success of Existing Stream Recovery Projects*, concluded that "the majority of work completed did not appear to recapture historic resource attributes nor provide a foundation for accelerated recovery of them."

The year 1995 was an extremely wet year which resulted in substantially high peak flows in Mono Basin tributaries. These peak flows had many positive and significant effects on stream habitats. The positive benefits of the 1995 flows -- the highest runoff since 1986 -- allowed many ecological processes to take place assisting in the recovery of functional stream systems. Many examples of new pools developing; increased sinuosity and point bar construction; accelerated bank building through sediment deposition; new deposits of spawning sized gravels; secondary channels being entered by high flows; surface water occurring in locations that were not directly connected with flowing channels suggesting a rising water table. Thalweg shifts, colonization of riparian vegetation in new sites, and silt deposition in some areas exceeding one foot were all evident to varying degrees in Mono Basin tributaries. Furthermore, increased growth and abundance of riparian vegetation is evident along these stream systems.

In addition, the flow events of 1995 greatly impacted previous habitat treatments, especially those applied to the main channel of Lee Vining Creek. Several large pools, previously excavated during habitat enhancement attempts with heavy equipment, are completely filled in. Over one-half of the six recently rewatered side channels were rendered nonfunctional, as their entrances became plugged with bedload material, drastically reducing flows in those channels. Limiter logs placed at the entrances of the channels either blew out or became plugged. The log at the A-4 inlet may have deflected high flows across the channel accelerating bank erosion on the opposite bank. Many artificially placed spawning gravels were displaced downstream. Large woody debris placed in pool sites, without adequate vegetation existing to naturally anchor them, were washed away. The majority of backwater sites created for fish refuge have reverted back to preconstruction conditions (e.g. wetlands) during this year's flows, as well as flows in previous years. Much of the attempts at habitat enhancement, especially in the main channel of Lee Vining Creek, were either completely destroyed or altered significantly from post-treatment conditions.

In the future, flow management, in conjunction with a grazing exclusion will continue to be the most important factors affecting restoration of these stream systems. Their influences will override any other measures taken to enhance or accelerate stream recovery.

5. Mono Gate Return Ditch Upgrade

The Mono Gate Return Ditch (Return Ditch) is used to return water from Grant Lake reservoir to Rush Creek. It was originally constructed for intermittent operational releases from Grant Lake and irrigation purposes along Rush Creek. Prior to 1983, maintenance was carried out on the Return Ditch during periods when it was dry to remove sediment and debris and to perform other work as needed. Since January 1983, there has been water continuously flowing in the Return Ditch for operational releases and later to maintain the fishery requirements in Rush Creek. The constant flow of water in the Return Ditch prevented LADWP construction crews from performing their normal maintenance. This lack of maintenance has resulted in the Return Ditch's capacity being reduced from more than 350 cfs to approximately 160 cfs.

Decision 1631 requires flushing flow releases of 300 cfs during wet-normal and wet years. On July 19, 1995, the SWRCB requested LADWP to submit a plan to the SWRCB for undertaking the necessary repairs and maintenance to allow for Decision 1631 flow releases. (See Appendix II) On August 31, 1995, LADWP sent a proposal to the SWRCB for rehabilitating the Return Ditch. A copy of LADWP's letter and the Return Ditch Rehabilitation Plan are included in Appendix III. The plan is to increase the capacity of the Return Ditch to 350 cfs without disrupting the flow into Rush Creek. This would be accomplished by forcing a spill at Grant Lake Dam and gradually dewatering the Return Ditch until completely dewatered. Once dewatered, sediment and debris would be remove from the Return Ditch and the embankment repaired. After the construction activities have been completed, the Return Ditch would gradually be rewatered. A contingency plan has also been prepared to recover stranded fish that may be found during the dewatering of the ditch.

III. Development of Stream Restoration Plan

1. Draft Scope of Work

The first step in the preparation of the restoration plans was the development of the *Draft Scope of Work for the Development of the Mono Basin Stream and Waterfowl Habitat Restoration Plans* On January 11, 1995, the LADWP released a preliminary draft scope of work to the parties listed above so that they may comment on the document. Comments were to be sent to the LADWP by January 24, 1995, to be considered and incorporated into the document. In addition to the parties listed above, the LADWP released the document to additional parties to give them an opportunity to provide input to the scope of work. Finally, an advertisement was placed in a local newspaper in Mono County to announce the availability of the document, thereby providing an opportunity for other interested parties or individuals to become involved in the restoration process. The LADWP reviewed the comments received and on February 1, 1995, submitted a draft scope of work to the SWRCB. In addition, the LADWP prepared a document entitled *Comments and Response to Comments of the Draft Scope of Work for the Development of the Mono Basin Stream and Waterfowl Habitat Restoration Plans*, which included a copy of all the comments the LADWP received on the draft scope of work. The document also showed how a comment was used or the reason why it was not incorporated.

After the draft scope of work was completed, the SWRCB hosted a workshop on February 17, 1995, to discuss the procedures for developing the restoration plans. Many parties and individuals were represented at the meeting, which was designed to answer some of the questions that interested parties, including the LADWP, had about Decision 1631 and the restoration plan development process. Many consensus agreements were reached at that meeting. Mr. Edward Anton, Chief of the Division of Water Rights for the SWRCB, compiled notes from the meeting and distributed them to meeting attendees on March 7, 1995. A copy of Mr. Anton's letter and his meeting notes are included in Appendix IV.

2. Scientific Experts Selected to Prepare Restoration Report

Three scientists (i.e. two fishery biologists and a geomorphologist) were selected by the LADWP, in consultation with several of the involved parties, to prepare a stream restoration report with recommended restoration measures. These three scientists -- Dr. Richard Ridenhour, Mr. Christopher Hunter, and Dr. William Trush -- were one time participants in the RTC process. Because of their previous experience with the Mono Basin creeks, they did not need to spend much time becoming familiar with the restoration issues.

In addition to preparing a stream restoration alternatives report, the stream scientists were given the authority to oversee the stream restoration work that was completed in 1995. They gave input and direction to the consultant who performed the work and evaluated the work when completed. They were also sought for advice on the issue of whether or not to attenuate peak flows this year and, if so, to what magnitude the limitations would be appropriate. After the high flows had passed, the scientists evaluated the effects on the creeks.

3. Formation of Technical Advisory Groups

After the Mono Basin restoration workshop, the LADWP formed Technical Advisory Groups (TAGs) for the restoration and management plans. When forming the TAGs, at least one individual from each of the named parties was invited to participate along with other individuals that in LADWP's opinion would be interested in participating. The main purpose of the TAGs was to provide input to the scientists and the LADWP in preparing the report and restoration plans. The TAGs also discussed the year's restoration program, flow management, and other issues concerning the restoration plan development.

The TAGs were divided into two different topics of discussion: one on stream restoration alternatives and the other on Grant Lake reservoir management issues, including flows to the upper Owens River. Many TAG members participated in both groups. The stream restoration TAG met four times -- May 1, July 17, September 11, 1995 and January 9, 1996. The meetings were held in Sacramento, South Lake Tahoe, Lee Vining, and South Lake Tahoe, respectively. The Grant Lake management TAG met five times, including a one-day field trip in the Mono Basin and upper Owens River. The five meetings were held on March 16, May 2, August 18, 1995, and January 9, 1996, and were located in June Lake, Sacramento, Los Angeles and South Lake Tahoe respectively, while the field trip was held on May 25, 1995. The purpose of the TAG meetings held in January was to solicit input and discussion on LADWP's draft plans.

In addition to the TAG meetings, a public meeting was held on March 16, 1995 to solicit input from local interests in the operations of the LADWP facilities in the Mono Basin and Long Valley. The focus of the meeting was on three issues: the operations of Grant Lake reservoir, the water exports to the upper Owens River, and LADWP land management in the area. More than 30 people attended the meeting, which was advertised in a local newspaper.

The TAG process proved to be valuable in the development of the plans. New ideas and information were shared and each participant had the opportunity to express his or her concerns. The LADWP provided information and data to TAG members as requested. TAG members were presentd with several opportunities to provide written comments on draft sections of the stream scientists report or on LADWP Grant Lake operational scenarios. The LADWP made its computer models available to any interested TAG member, and provided weekly charts of daily streamflows, reservoir levels, and Mono

Lake levels. The current year operations were discussed and modified based on participant input. When it became apparent that additional time was necessary for the stream scientists to prepare their report, the parties agreed to allow for a time extension as requested.

4. Completion of Stream Scientists' Restoration Report

On October 4, 1995, Dr. Ridenhour, Mr. Hunter, and Dr. Trush completed a final draft of their report entitled, *Work Plan -- Mono Basin Stream Restoration (Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek).* The 200-plus page document was received by the LADWP the following day and copies were made for distribution (see Appendix I). After receiving requests from interested TAG members as well as other interested parties, the LADWP distributed about 20 copies of the document.

As was described in the draft scope of work, the LADWP reviewed the stream scientists' restoration alternatives report to determine the technical and financial feasibility and reasonableness of the proposal. It became obvious that the stream scientists had put much effort and analysis in their proposal. While there is much useful information for the LADWP in the report, there are some areas which the LADWP cannot support. These differences preclude the LADWP from accepting the plan as written and submitting it directly to the SWRCB. Consequently, the LADWP does not endorse the work plan as submitted and prepared an alternate stream restoration plan.

5. Review Process and the Completion of the Stream and Stream Channel Restoration Plan and the Grant Lake Operations and Management Plan

On December 4, 1995, the draft Stream and Stream Channel Restoration Plan and the draft Grant Lake Management Plan were completed and distributed to the parties, members of the TAG, and interested persons. An advertisement was placed in a local newspaper, circulated in Inyo and Mono counties, to announce the availability of the document, thereby providing an opportunity for other interested parties or individuals to review and comment on the documents. The LADWP responded to more than 20 requests for copies of the document from individuals not formally involved in the process. In all, LADWP distributed more than 90 copies of the plans to almost 60 individuals.

On January 9, 1996, LADWP scheduled a TAG meeting with the parties, scientists, and interested persons to discuss and solicit input on the draft plans. The TAG meeting was very beneficial in that it provided an opportunity to clarify misunderstandings and resolve some issues in advance of the comments. The TAG meeting gave LADWP an opportunity to get an early start in evaluating comments and concerns. Another benefit derived from the TAG meeting was the formation of an ad hoc committee. The committee, consisting of four stream scientists and a representative from the Department of Fish and Game, was formed to analyze new flow scenarios for the Mono Basin streams.

The draft Grant Lake Management Plan was completed by the LADWP staff based upon input from the public meeting on Grant Lake reservoir operations, Grant Lake TAG meetings, and written comments received. The plan is included as the Grant Lake Operations and Management Plan and Grant Lake Management Plan Operational Alternatives. As required in Decision 1631, the Grant Lake Operations and Management Plan covers the operational issues of Grant Lake reservoir, releases to the four creeks, and the pattern of export to the upper Owens River.

Individuals interested in submitting comments on the draft plans had 60 days to review the plans and prepare comments. Most of the comments were received by February 4, 1996. Comments were received from 13 agencies and individuals on the draft Stream and Stream Channel Restoration Plan and from 4 agencies and individuals on the draft Grant Lake Management Plan. From the input received during the January 9, 1996 TAG meeting and from written comments, LADWP has prepared final plans for stream and stream channel restoration and Grant Lake management.

IV. Mono Basin Streamflow Management

Effective streamflow management and land management are the most effective techniques to rehabilitate the Mono Basin streams. The proposed management will facilitate natural stream processes and functions, and thereby accelerate both short-term and long-term recovery of the riparian and aquatic systems. The applied flow regime is the fundamental component of a natural restoration program, strongly influencing responses of fishery and vegetation components.

LADWP endorses a restoration policy that relies on natural processes for ecosystem recovery. This philosophy allows the creeks to recreate habitat environments without active intervention, physical alterations, or continued maintenance. The fundamental basis for LADWP's restoration plan relies on natural processes to re-establish the riparian ecosystem. The two most effective restoration treatments, proper stream flow and land management practices, are fundamental to LADWP's restoration plan.

The grazing moratorium will provide for accelerated recovery of the riparian corridor by increasing the survival of herbaceous and young woody species. LADWP's Grant Lake Operations and Management Plan promotes ecosystem recovery by providing flows adequate for building banks, scouring pools, establishing riparian/wetland vegetation on the flood plain, initiates movement of bedload, allows deposition of seeds and sediments, creates point bars, raises water tables, and other dynamic processes associated with healthy, functional stream system. The significant "positive" impacts of these processes occur during peak flow events of the wetter years. LADWP's proposed stream flows are consistent with this concept.

LADWP's Grant Lake Operations and Management Plan contains information regarding Mono Basin operations. The management plan also includes specific details regarding stream flow management practices which advocate the natural restoration process. Significant aspects of LADWP's stream flow management, as they pertain to stream channel and riparian restoration, include:

- Lee Vining Creek will experience its natural peak flow in all years, except in dry years.
- Lee Vining Creek diversions will occur on the ascending and/or descending limb of peak flows.
- Rush Creek will experience peak flows in excess of the impaired flows in the wetter year types.
- Walker and Parker creeks will experience their natural flow for the entire year, except in dry years.

Releasing flows that mimic the natural hydrologic conditions will provide the tools necessary to create channel morphology and riparian attributes inherent in healthy stream systems. This is the fundamental basis for LADWP's stream restoration program and is supported by LADWP's proposed flow regime. Proper flow and land use management will provide a stream ecosystem with diverse habitat components that are anticipated to support self-sustaining fish populations.

V. The Streams and the Status of their Development

The following information was obtained from the scientist's Work Plan (Appendix I). Most of the information was developed by the scientists to comply with Section 8.d.(3) of the Order in Decision 1631.

The Mono Lake Basin lies against the east slope of the Sierra Nevada. Several streams drain into Mono Lake from the Sierra Nevada starting at an elevation of over 13,000 feet. Streamflow is mainly generated by snowmelt with the peak runoff usually in June or July. Lowest flows occur during the late fall and early winter, though occasional rainstorms may cause short duration increases. The streams of particular interest in this restoration plan are Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek. Rush Creek and Lee Vining Creek both flow directly into Mono Lake while Walker Creek and Parker Creek are tributaries of Rush Creek.

No species of fish were endemic to the Mono Basin streams when European settlers arrived in the mid-1800s. Various species of trout were stocked in most streams in the late-1800s and early-1900s. Brook trout, rainbow trout, and brown trout have subsequently established populations. Brown trout is presently the dominant species in Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek below Grant Lake reservoir and the Lee Vining Conduit.

RUSH CREEK

a. General Characteristics Prior to Development

The watershed of Rush Creek has been described in detail by Beak Consultants Inc. (1991). The stream dropped steeply to the original Grant Lake, a glacial moraine lake, at an elevation of about 7,065 feet. The portion of Rush Creek of specific interest in this restoration plan is below the original Grant Lake. The stream gradient immediately below the natural Grant Lake is small, probably dropping only 5 or 6 feet per mile to an elevation of 7,059 feet over the first 1.5 miles or so.

The stream then cut steeply through a glacial moraine at a gradient of about 110 feet per mile over the next 0.9 miles to an elevation of about 6,940 feet. The stream leveled off to a gradient of about 85 feet per mile over the next 1.3 miles. The stream channel, over the following 2.0 miles down to the narrows, again steepened with a drop of about 230 feet for an average gradient of nearly 100 feet per mile. The narrows is a unique feature where the stream drops over 15 feet in just 250 feet. Below the narrows, the stream course again flattened in the Rush Creek bottomlands where it dropped only about 130 feet for the next 2.0 miles for a gradient of a little over 60 feet per mile. The last 2.5 miles or so to the Mono Lake was even more gradual with a slope of a little less than 35 feet per mile.

The streambed of Rush Creek between Grant Lake reservoir and the Ford was mainly derived from granitic and metamorphic rock moved downstream from the Sierra Nevada by glaciation and bedload transport during high stream flows. The valley fill in the lower reaches of the stream below the Ford included large amounts of volcanic material that is less dense, and, thus, more susceptible to bedload transport.

The average runoff for 1940 through 1994 was about 59,200 acre feet with over 70% of the unimpaired flow occurring during the peak snow melt period of May through July.

Rush Creek valley was wide immediately below Grant Lake but narrowed greatly where it passed through the glacial moraine between elevations of 7,050 and 6,956 feet. Though the valley widened below the moraine to about Highway 395, the floodplain from Highway 395 again became fairly narrow down to the narrows. After passing for about 250 feet through a very narrow notch at narrows, the floodplain remained wide to the confluence of the stream with Mono Lake.

The floodplain vegetation, before diversions began in 1941 and currently, are described by Stine (1991) and Katzel and Taylor (1993). Woody riparian vegetation immediately below Grant Lake was mainly willow with some scattered black cottonwood and Jeffrey pine. Black cottonwood and willow dominated the riparian vegetation, with quaking aspen and Jeffrey pine along the valley wall where the stream passed through a glacial moraine. From the terminus of the glacial moraine to the Narrows, there were willow thickets along the stream, scattered Jeffrey pine and black cottonwood. Below the Narrows, the floodplain was fairly uniformly covered by willows and black cottonwood and scattered patches of buffalo berry, mountain rose, and Jeffrey pine.

b. Developments Affecting the Stream

The initial use of Rush Creek water was irrigation. A dam installed near the outlet of the original Grant Lake in 1915 was enlarged in 1925 to increase and control storage capacity. Several ditches, A, B, C, and Indian, were constructed over the years to transport water from Rush Creek to irrigate pasture and crops generally within the Rush Creek drainage and entirely within the Mono Basin. C Ditch conveyed water from the original Grant Lake reservoir to the Cain Ranch area west of Rush Creek. A and B ditches conveyed large quantities of water from above and below the glacial moraine, respectively, to the Pumice Valley area east of Rush Creek. Evidence indicates that irrigation of Pumice Valley fed an extensive spring system that developed along the east side of the lower Rush Creek floodplain. Indian Ditch distributed water to meadows along the west side of the Rush Creek floodplain below the Narrows.

The hydroelectric potential of Rush Creek water was initially developed in 1916. This development included the construction of reservoirs and control systems for natural lakes at the upper elevations of the watershed. Water was released from these storage facilities to a power plant, presently operated by Southern California Edison (SCE), located upstream from Grant Lake. The control of flows for generating power has generally modified discharge down Rush Creek into Grant Lake reservoir so that snowmelt peak runoff and subsequent flood flows have been reduced (the timing of flows but not the total annual runoff is affected by the upstream hydroelectric operations of SCE so that the impaired flow during the peak snowmelt period of May through July is only about 45% of the average annual flow rather than over 70% for unimpaired flows). However, in 1967 a combination of high runoff flows and water diversion from Lee Vining Creek, Walker Creek, and Parker Creek into Grant Lake reservoir resulted in high flood flows probably in excess of 1,500 cubic feet per second (cfs) in Rush Creek below Grant Lake reservoir (Stine 1991, 1992, Stine et al. 1993). Large runoff flows, probably causing substantial bedload movement and scouring, also occurred in 1969 and in the early 1980s.

Water diversion from the Mono Basin began in 1941 with the construction of a new, larger dam at Grant Lake and the Lee Vining Conduit that could convey water from Lee Vining Creek, Walker Creek, and Parker Creek to Grant Lake. Starting in 1941, water was diverted from Grant Lake through the Mono Tunnel to the Owens Valley and eventually Los Angeles. The new dam was constructed approximately 1,600 feet downstream from the original dam which had been built at or near the outlet of the natural lake. Excepting for those instances when there have been spills from Grant Lake reservoir, all water in Rush Creek below the Grant Lake reservoir has flowed through the Mono Gate control structure and down the Mono Ditch. The Mono Ditch bypasses the approximately 0.5 miles of Rush Creek immediately below Grant Lake Dam.

Another general impact of water development on Rush Creek has been an apparent increase in water temperatures. Loss of large woody vegetation, because of desiccation during periods when little or no water was released down Rush Creek and the springs along the east side of Rush Creek below the confluence with Parker Creek failed to flow, eliminated any cooling effects of shading from a riparian canopy over much of Rush Creek below Grant Lake Dam. At times, when the water level in Grant Lake reservoir is reduced, the water released to Rush Creek may come from the warmer surface waters and may be more turbid. Since the early 1970s, the flows from the springs along the east and west sides of the valley below the narrows have been greatly reduced or eliminated; this source of cool water has not been available to cool lower Rush Creek stream water. The overall effect has been to increase both the overall water temperatures and the diurnal fluctuations in temperature within lower Rush Creek. Water temperatures in excess of 75°†F do occur during the summer in lower Rush Creek.

Lowering the level of Mono Lake caused stream incision through the lighter volcanic materials comprising floodplain deposits in the lower stream. Incision of at least 20 to 25 feet occurred at Mono Lake and extended over two miles upstream in decreasing magnitude to nearly a mile above the Ford.

Various developments have involved construction on Rush Creek that have created barriers to the movement of bedload downstream and fish upstream. Apart from the construction of Grant Lake Dam, these have included primarily culverts at road crossings.

c. Past Restoration Actions

A number of restoration activities have been initiated on Rush Creek in response to Court orders and the recommendations of the RTC. A review of these efforts has been prepared by Inter-Fluve, Inc. (1995).

Prior to the intervention of the Superior Court in 1984, water from Grant Lake reservoir flowed down the creek only during years of normal or above normal runoff. During years of low runoff, no water was released from Grant Lake reservoir to flow down Rush Creek. Beginning in 1984, the Court required a minimum flow of 19 cfs year round even when the runoff was low in several of the years because of the small snow pack. In 1989, a preliminary Court injunction stipulated that flows totaling 25,576 acre feet nearly 50% of the average annual runoff, were to be released to the stream from Grant Lake reservoir with 40 cfs during the months of April through September and 28 cfs during the months of October through February. Restoring year-round flows was the most important, single action taken to restore stream habitat of Rush Creek. Decision 1631 modified the flow schedule stipulated by the Court.

A second important action for the restoration of stream habitat was the agreement by LADWP, in response to the recommendation of the RTC, to initiate a moratorium on grazing within the riparian corridor of Rush Creek starting in 1992. Decision 1631 continues this moratorium.

Restoring minimum flows has been the most significant restoration effort that provided riparian vegetation an opportunity to re-colonize areas where water is at, or near, the ground surface. Willows, in particular, have begun to actively regenerate but other species such as black cottonwood and Jeffrey pine have been much slower to regenerate naturally. The grazing moratorium has also allowed rapid regeneration of riparian plants.

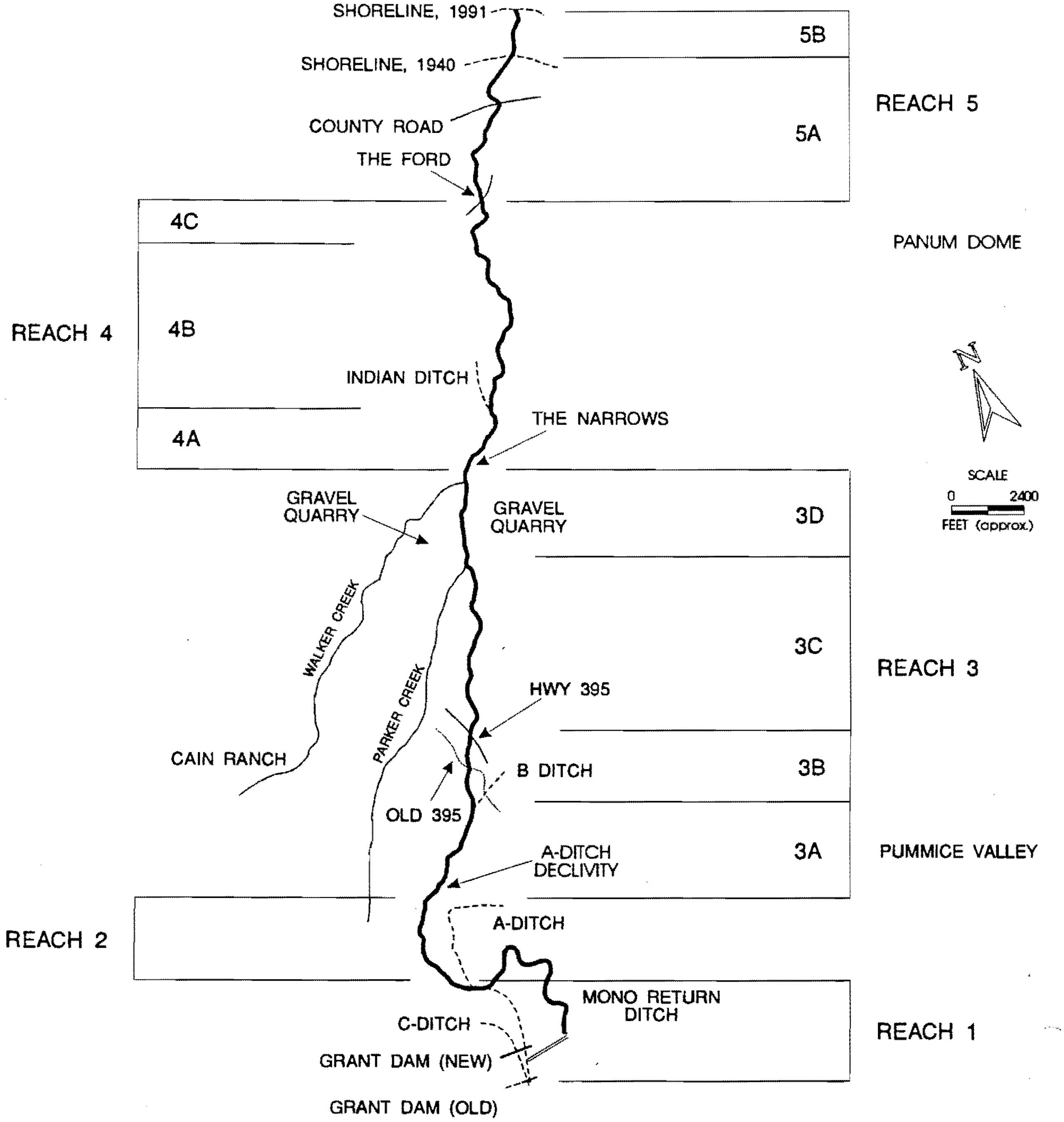
The minimum flows also have provided essential year-round habitat for fish though, in some instances, the habitat may still be of minimal quality.

For the purposes of this report, Rush Creek below the original Grant Lake has been divided into 11 reaches (Figure 3) that are distinguished by having somewhat different characteristics (Katzel and Taylor 1993). The limits of the reaches are identified by stream elevations (Katzel 1995a).

1. Reach 1

a. General Characteristics Prior to Development

Reach 1 extended nearly 0.8 miles from the original Grant Lake to the beginning of the cut through the glacial moraine (at elevation 7,059). The gradient of the stream was fairly gentle. The riparian development was primarily streamside willows and scattered Jeffrey pine across the valley and patches of quaking aspen along the edge of the valley where there was spring activity. Recruitment of spawning gravels was limited to erosion from the stream banks because the original Grant Lake served as a sediment sink.



Source: Scientists Work Plan

Reach designations on Lower Rush Creek

Figure 3

b. Developments Affecting the Reach

The first major impact on Reach 1 was the construction of the original Grant Lake Dam and the diversion of water from the stream via C Ditch. But, the most substantial impact of development on Reach 1 was the elimination of much of the stream by the construction of the second Grant Lake Dam which resulted in inundation by the expanded reservoir and the dam structure, and dewatering immediately below the dam. Water supplied via Mono Ditch or from the spillway enters the original Rush Creek channel below Reach 1. All that remains of Reach 1 is that portion of the channel between the present Grant Lake reservoir Dam and the downstream end of the Mono Ditch (from elevation 7,064 to 7,059). The channel bed below Grant Dam, though it is dry, exists with little change from pre-development conditions except for the accumulation of fines. There is little evidence of bar-pool conditions or meander through this section of the stream. Habitat complexity appears to have been provided primarily by riparian vegetation. There were extensive stands of riparian willows but they died from desiccation. Similarly, most vegetation across the floodplain has been lost.

There is a second channel which parallels the main channel in the lower portion of this reach. This second channel was apparently developed for irrigation diversion.

The A Ditch, constructed to convey irrigation water to Pumice Valley, began at the lower end of Reach 1 where the Mono Ditch presently conveys water back into the original Rush Creek channel. Modification of the stream at the entrance to A Ditch created a forebay that backed water up Reach 1. Use of the A Ditch for irrigation diversions ceased in 1970.

The other major impact is the Mono Ditch which has become a surrogate stream for Reach 1. The Mono Ditch is a 7,500-foot canal designed strictly to convey water and not to provide fish habitat. Mono Ditch normal maintenance prevents development of riparian vegetation; there is no pool/riffle morphology or bar/pool thalweg.

c. Status of Restoration

Reach 1 remains dewatered and, therefore, without stream habitat. Limited actions have been taken, at the recommendation of the RTC, to improve spawning habitat in the Mono Ditch as a pilot project. These actions have included the placement of boulder weirs and the deposition of spawning gravels in the lower 800 feet of the canal. A feasibility study was prepared for alternatives to rewater all, or portions of, Reach 1 below Grant Lake Dam.

Because Reach 1 has been either covered by Grant Lake reservoir and Dam or has been left dry, there has been no natural restoration of the entire main channel length. Only that portion of the original stream course below the present Grant Lake Dam, approximately 2,800 feet, could possibly be restored. The 7,500-foot long Mono Ditch does support fish, but does not provide natural stream habitat and should not be considered a surrogate for the stream habitat that formerly supported fish populations in Reach 1. The channel of

Reach 1, as it presently exists below Grant Lake Dam, is almost completely devoid of living riparian vegetation. Except where the former floodplain is covered by the reservoir or dam, the woody riparian vegetation may recover naturally if groundwater conditions are restored, but may take direct intervention to obtain restoration within a reasonable time.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel morphology remains essentially unchanged from the time that the present Grant Lake Dam was constructed and the stream was dewatered. Generally, the channel is wide except for the upper 600 feet which is narrow.

2. Spring Flow: There are no apparent springs that contribute to the stream flow in this reach.

3. Spawning Gravel Area: Lack of a gravel supply because of Grant Lake, and more recently, Grant Lake reservoir, and lack of stream morphology, including the very low gradient that would allow for the deposition of suitable spawning gravels, makes it unlikely that the stream immediately below Grant Lake reservoir provided much abundant spawning habitat.

4. Area of Aquatic Vegetation: Substantial aquatic vegetation likely occurred in this low gradient reach but, of course, without water there can be none at this time.

5. Amount of Cover: There is little evidence of cover except from riparian vegetation which is now dead.

6. Number of Pools: There is no evidence of pools, except possibly at the upper limits of the reach. Restoring water would not contribute to pool formation in this low gradient reach.

7. Invertebrate Population: There is no aquatic invertebrate population now but there undoubtedly would be natural recolonization if the reach were rewatered.

8. Fish Population: No fish population exists, but a population would become established if the reach were rewatered.

9. Water Temperature: Until the riparian vegetation is re-established, substantial warming of the water could occur during the hot summer period because of the wide channel and low gradient. Lethal temperatures would not likely be achieved but the heating would contribute to potential high water temperatures farther downstream.

10. Vegetative Diversity: There is very little vegetative diversity at present, and will not be, until larger species of riparian and floodplain vegetation are restored to provide suitable habitat for understory species.

11. Habitat Complexity: There is little evidence of prior habitat complexity. In addition to the development of riparian vegetation, the placement of large woody debris would add substantially to the habitat complexity if the reach is rewatered.

2. Reach 2

a. General Characteristics Prior to Development

Reach 2 of Rush Creek flows through a narrow canyon cut through the glacial moraine (from elevation 7,059 to 6,941). The gradient is steep and the stream course contains numerous boulders forming small pools and cascades. The riparian vegetation is comprised predominately of willows, large Jeffrey pine, black cottonwoods, and some quaking aspen along the valley wall.

b. Developments Affecting the Reach

Past water developments that reduced or eliminated flows had minor lasting impacts on Reach 2. Continuing spring activity has enabled the riparian vegetation to remain intact, though younger age classes of cottonwood are missing.

c. Status of Restoration

There have been no restoration actions specific to Reach 2. Those restoration actions that affected the entire stream, such as restoration of flows, have also benefited Reach 2.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: Width of the main channel is the same as it was pre-1941.

2. Spring Flow: There are spring flows throughout this reach that have been important for the maintenance of the riparian vegetation during periods of time when no surface flow was allowed downstream.

3. Spawning Gravel Area: There are pockets of spawning gravels that probably are similar to those that existed pre-1941.

4. Area of Aquatic Vegetation: There is little aquatic vegetation, and little is to be expected because of the steep gradient.

5. Amount of Cover: There is substantial cover in pools associated with boulders and root wads that is probably similar to the pre-1941 condition.

6. Number of Pools: The abundance of pools associated with boulders and large root wads is probably similar to the pre-1941 condition.

7. Invertebrate Population: Invertebrate populations are expected to be similar to those that existed pre-1941.

8. Fish Population: Fish populations have probably not been restored to approximate pre-1941 levels. There now is less opportunity for juvenile recruitment because reproduction is probably low within the stream and Mono Ditch above Reach 2; reproduction downstream also is probably only modest.

9. Water Temperature: Water temperatures are probably little affected by passage through this reach because of the steep gradient and dense riparian cover.

10. Vegetative Diversity: Since the larger riparian vegetation has experienced little changed from pre-1941 conditions, the vegetative diversity is probably in equally good condition or is recovering since stream flows were resumed.

11. Habitat Complexity: The stream habitat is generally complex with varying conditions including plunge pools, riffles, and runs, undercut banks, and boulders.

3. Reach 3A

a. General Characteristics Prior to Development

Reach 3A begins where the stream exits the glacial moraine and the floodplain broadens. It ends near the B Ditch irrigation diversion (from elevation 6,941 to 6,879). The stream gradient was lower through this section than in Reach 2. The stream channel meandered, as indicated by meander scars on the floodplain. The streambed was comprised of large cobble and small boulders in the upper portions of the reach, with smaller cobble more common toward the lower end. Woody riparian vegetation was mostly willows, with scattered black cottonwood and Jeffrey pine, and some patches of quaking aspen along the sides of the valley.

b. Developments Affecting the Reach

The reduction and elimination of flows in this reach reduced the vitality and extent of woody riparian community in the lower portions of Reach 3A. Many Jeffrey pine were harvested in the early 1940's; there are only scattered seedlings indicating the beginning of natural regeneration. Also, there is evidence that at least two natural stream meanders have been blocked off by human intervention (overflow channels #1 and #2). This action has reduced available channel length and reduced habitat complexity and refuge for smaller fish.

c. Status of Restoration

Restoration treatments, initiated by the RTC to restore habitat for fish, have been applied in Reach 3A. Side channels and pools were constructed, pieces of large woody debris were placed and anchored along the stream margins, and spawning gravels were added.

Development of secondary stream channels has substantially augmented the stream habitat in Reach 3A. As natural stream processes occur during flood flows, the added secondary channels may become more seasonal and only contain flowing water during periods of above average flows in the main channel. The primary restoration deficiency is the extent of riparian and floodplain vegetation. The riparian vegetation, primarily willows, is regenerating rapidly along the channel in the upper reach, but floodplain vegetation and meadow areas show less indication of recovery.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel width appears generally wider than the pre-1941 condition, especially at specific locations in the lower portions of the reach where it may be as much as twice as wide. There is substantial evidence that vegetative encroachment and entrapment of fines during periods of high flow are causing the channel to narrow in some locations.

2. Spring Flow: The only substantial spring flow is into the lower portion of the A Ditch declivity where a fringe of quaking aspen and a large meadow are supported by spring water. This water does not normally provide surface flow to Reach 3A but likely does provide groundwater flow .

3. Spawning Gravel Area: Some spawning gravel occurs in middle portions of this reach but little is available in the upper portions.

4. Area of Aquatic Vegetation: There is little evidence of aquatic vegetation except in side pool areas such as the "Mallard Pond" that was constructed as part of an RTC authorized restoration project.

5. Amount of Cover: Cover varies with good cover development where pools exist and large woody debris has deposited, but there is little cover in the lower and upper reach where flows are uniformly fast without meanders or pools.

6. Number of Pools: Several pools were constructed in the middle reach and some developed in association with woody debris, but few pools are in the upper and lower portions.

7. Invertebrate Population: Invertebrate populations should be normal for the character of the stream.

8. Fish Population: Fish populations are probably responding well to the improved stream habitat that is developing.

9. Water Temperature: Summer water temperatures should not be increasing abnormally, except in the lower portions where the stream is generally wider and more devoid of riparian vegetation.

10. Vegetative Diversity: The vegetative diversity seems high in the upper portions of the reach, but is still low in the lower portions where the floodplain vegetation has not yet recovered.

11. Habitat Complexity: The habitat complexity is best in the middle portions where pools and large woody debris are most abundant.

4. Reach 3B

a. General Characteristics Prior to Development

Reach 3B begins where the stream was diverted into B Ditch and extends downstream to the present alignment of Highway 395 (from elevation 6,879 to 6,833). This reach was characterized by a fairly wide floodplain. Woody riparian vegetation was generally limited to a few patches of willows along the immediate stream bank.

b .Developments Affecting the Reach

The primary impact of past water development in Reach 3B has been the loss of virtually all woody riparian vegetation. Substantial changes in the alignment of the main channel resulted from natural processes or from the extreme flood flows in 1967 and the large flood flows during the early 1980's. The entrance to B Ditch was destroyed in 1967. The stream channel appears to have incised at the same time as the channel alignments changed.

Old Highway 395 crossed Rush Creek over a bridge which was no barrier to either bedload moving downstream or fish swimming upstream.

c. Status of Restoration

There have been no restoration efforts applied specifically to Reach 3B.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel is as much as twice as wide and shallower than it was pre-1941 without indication of significant narrowing and/or deepening from vegetative encroachment.

2. Spring Flow: There is no apparent spring flow.

3. Spawning Gravel Area: Limited spawning gravel is available primarily because the steep, shallow stream morphology prevents deposition and accumulation.
4. Area of Aquatic Vegetation: Lacking slow water areas and there is little aquatic vegetation.
5. Amount of Cover: Cover is limited because there are no substantial pools, large boulders, large woody debris, or overhanging riparian vegetation.
6. Number of Pools: There are no deep pools within this reach.
7. Invertebrate Population: Invertebrate populations should be stable, though the diversity may be low because of poor habitat complexity.
8. Fish Population: Fish populations are small because of the lack of cover and habitat complexity.
9. Water Temperature: Shallow stream morphology and lack of riparian shading make this reach a potential source of heating during the summer.
10. Vegetative Diversity: Low vegetative diversity will prevail until a canopy of larger floodplain species is restored.
11. Habitat Complexity: This homogeneous reach lacks habitat complexity.

5. Reach 3C

a. General Characteristics Prior to Development

Reach 3C extends from Highway 395 to the confluence with Parker Creek (from elevation 6,833 to 6,671). The floodplain was narrow, with minor stream channel meandering. There were numerous, large boulders in the stream from about elevation 6,820 feet to elevation 6,710 feet that added greatly to habitat complexity. Woody riparian vegetation was limited to willows, black cottonwoods, and a few Jeffrey pine, with most vegetation in the middle of the reach.

b. Developments Affecting the Reach

The primary effect on Reach 3C resulting from past water developments has been the loss of riparian vegetation from desiccation. The stream course has remained intact, excepting shifts in the meander at a couple of locations. The stream continues to flow in the pre-1941 channel.

The present Highway 395 alignment includes a culvert which is a barrier to the upstream movement of fish.

c. Status of Restoration

Baffle installation in the Highway 395 culvert, to improve upstream fish passage, has been the only restoration activity specific to Reach 3C.

This reach has lost riparian and floodplain vegetation through desiccation, though willows and black cottonwood are recovering in the lower two thirds.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: Channel width is similar to the pre-1941 condition. Riparian vegetation recovery may be narrowing the channel slightly.

2. Spring Flow: There are no significant springs affecting the stream.

3. Spawning Gravel Area: The lower two thirds of the reach has good spawning gravel availability.

4. Area of Aquatic Vegetation: Aquatic vegetation is not common, and probably never was, because of the channel's steep gradient.

5. Amount of Cover: Excepting for the extreme top and bottom of the reach, the many pools and large boulders, as well as developing riparian vegetation, provide ample cover.

6. Number of Pools: Pools are especially common in the lower two thirds of the reach. Most pools have been formed by scouring around large boulders.

7. Invertebrate Population: Invertebrate populations should be abundant and diverse.

8. Fish Population: Fish populations should be abundant through most of the reach.

9. Water Temperature: After riparian vegetation has fully recovered, slight warming may continue, as probably occurred during the pre-1941 condition.

10. Vegetative Diversity: The vegetative diversity, especially in the lower two thirds of the reach, should recover as the woody riparian vegetation re-establishes.

11. Habitat Complexity: The lower two thirds of the reach has good habitat complexity, but lack of pools, large boulders, and large woody debris reduces the habitat complexity in the top and bottom portions.

6. Reach 3D

a. General Characteristics Prior to Development

Reach 3D begins at the confluence with Parker Creek and extends to and includes the Narrows, located just below the Walker Creek confluence (from elevation 6,671 to 6,597). There were springs that fed from the west side of the floodplain. The floodplain widened compared to Reach 3C, but was narrower than Reach 3B. Riparian woody vegetation was comprised mainly of willow and a few black cottonwoods. The Narrows was, and is, a unique and picturesque feature that might have been identified as a separate reach except that its short length, approximately 250 feet, make a separate designation unnecessary. The Narrows was formed as the result of the stream cutting through a narrow granitic dike that crosses the valley at approximately a right angle to the stream. The stream at this point is narrow, flowing through a series of plunge pools formed around large boulders.

b. Developments Affecting the Reach

As with upstream reaches, the impact of desiccation on the woody riparian vegetation has been the primary effect of water developments on Reach 3D. A major impact has been the movement of materials from the gravel plug on Parker Creek (the Parker Plug) into Rush Creek at the confluence of the creeks. Most gravels originating from the Parker Plug have been transported downstream of Reach 3D. The quarry operations at the present site of the Marzano Gravel Quarry immediately downstream of the Parker Creek confluence, including surface runoff along the right (east) side of the valley from irrigation diversions to Pumice Valley, had profound effects on the future character of this reach and downstream portions of Rush Creek (Stine et al. 1993). Tailings from those earlier quarry operations were pushed over the valley wall into the creek which shifted the main channel from a westside meander and generally straightened the channel. Minor bedload was also introduced onto the floodplain by surface runoff along the right valley side. The most serious impact was the movement of large quantities of bedload from these two sources by the extremely high flows in 1967. The large amount of cobble deposited as the result of the 1967 flood shifted the channel below the present Marzano Gravel Quarry, from an eastside channel alignment to become a straight and wide channel providing no habitat complexity from pools, cut banks, or other forms of cover. Substantial portions of the floodplain were covered by bedload deposition, destroying floodplain vegetation. These impacts occurred as far as two miles downstream.

c. Status of Restoration

A restoration activity specific to Reach 3D was the improved connection between the stream and the westside spring immediately below the present Marzano Gravel Quarry site (this work was possibly done by Marzano Gravel Quarry personnel - not authorized by the RTC).

There has been some decrease in main channel length. The reduction has resulted primarily from the straightening of a meander where the Marzano Gravel Quarry work area is now located and the abandonment of a right side channel below the present Marzano Gravel Quarry site during the 1967 flood event. The most obvious deficiency in this reach is the reduced extent of riparian woody vegetation.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: Except within the narrows, the channel is substantially wider than pre-1941 with limited indications that riparian encroachment is causing it to narrow. No pool-bar formation is occurring. The channel within the Narrows is as it was pre-1941.

2. Spring Flow: Significant spring flow occurred, and is occurring, from the left bank of the valley. The spring just below the mouth of Parker Creek is prevented from flowing directly into the stream by the access road to the Marzano Gravel Quarry work area. A channel has been improved to connect flow to the stream from the large spring just downstream from the present Marzano Gravel Quarry site (this work was apparently done independently by Marzano Gravel Quarry personnel).

3. Spawning Gravel Area: There are no appreciable accumulations of suitable spawning gravel in this reach because the shallow stream morphology is a long straight run without any pools. Although a large quantity of gravel material stored in the Parker Plug has been washed into the upper end of this reach, it is of questionable value as spawning gravel; most has been transported downstream beyond this reach.

4. Area of Aquatic Vegetation: There is little aquatic vegetation except at the connection with the large spring below the present Marzano Gravel Quarry site. There probably was more aquatic vegetation pre-1941 when the channel had greater sinuosity.

5. Amount of Cover: Except within the narrows, little cover is provided by riparian vegetation because there are no pools, large boulders, or large woody debris.

6. Number of Pools: Except within the narrows, there are no significant pools.

7. Invertebrate Population: Except within the narrows, invertebrates should be abundant, but lacking diversity because the habitat lacks complexity.

8. Fish Population: Except within the narrows, fish populations would be expected to be poor because of poor cover and habitat complexity.

9. Water Temperature: Water temperatures can be expected to warm until riparian vegetation recovers.

10. Vegetative Diversity: There is low vegetative diversity except where the large spring joins the stream below the present Marzano Gravel Quarry site. Diversity will remain low until more woody riparian vegetation becomes established; this will be difficult because of the large depositions of cobble during the 1967 flood.

11. Habitat Complexity: Except within the narrows, there is little habitat complexity. This reach lacks any meanders, pools, large boulders, and large woody debris.

7. Reach 4A

a. General Characteristics Prior to Development

Reach 4A extends from just below the Narrows to the start of the Indian Ditch (from elevation 6,597 to 6,553). The stream in this reach had a wide floodplain. Some secondary distributary channels and flood overflow channels also existed. The woody riparian vegetation was comprised primarily of black cottonwood and willow with patches of understory such as mountain rose and buffalo berry. Meadows supported by active springs were located along the west side of the valley.

b. Developments Affecting the Reach

A major impact on Reach 4A resulted from the large flood of 1967 (Stine et al. 1993). This flood deposited large quantities of cobble across the floodplain, filled portions of the former main channel, and created a new main channel. Secondary channels were abandoned because of either deposition of cobble during the flood or severely reduced water availability in years of normal or low runoff. The riparian vegetation was undoubtedly severely damaged by the 1967 flood event by cobble deposition. Desiccation completed the destruction , particularly for black cottonwood.

Evidence indicates that flows in Walker Creek and Parker Creek immediately below the Lee Vining Conduit provided groundwater to the westside springs which were an important source of cool water to lower Rush Creek when flows from above the Narrows were very low or nonexistent (Stine & Vorster 1994). However, spring flows decreased when water was diverted from the natural channels of Walker Creek and Parker Creek into the Lee Vining Conduit.

c. Status of Restoration

There have been no restoration actions specific to Reach 4A.

This reach has experienced reduced length of the main channel, the dewatering of most secondary channels, and the substantial reduction in woody riparian vegetation and meadows from desiccation. Extensive deposition of cobbles during the 1967 flood filled and relocated portions of the old main channel.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel is as much as one and a half times wider than pre-1941 where it occupies new channel, but probably nearly the same where it occupies old channel alignments. There is evidence of channel narrowing as the result of fines deposited among newly established riparian vegetation.

2. Spring Flow: There are substantial springs in the upper portion of this reach along the left valley wall, but none currently have surface flow to the stream. They likely feed the stream as groundwater. There were substantial springs along the right valley wall in the lower portion but none show signs of flow at this time. Evidence indicates these right valley wall springs were charged when the Pumice Valley area was formerly irrigated from A Ditch and B Ditch (Stine 1991).

3. Spawning Gravel Area: There is spawning gravel, but mostly located in the lower one fourth of the reach where the stream follows the old channel alignment. The new channel alignment is generally without the morphological characteristics necessary for spawning gravel deposition.

4. Area of Aquatic Vegetation: There is aquatic vegetation, mostly Elodea, in smaller channels and backwater areas in the lower end of the reach, but not as abundant as water cress once was.

5. Amount of Cover: There is poor cover in sections where the stream occupies new channel alignments. There is good cover in pools and undercut banks, as well as some large woody debris, in the lower one fourth of the reach where the stream occupies the old channel alignment.

6. Number of Pools: There are pools in the lower one fourth of the reach where the stream occupies the old channel alignment, but there are few pools where the stream follows a new channel alignment.

7. Invertebrate Population: This reach should be productive for invertebrates. The greatest diversity probably exists in the lower one fourth where the stream occupies the old channel alignment.

8. Fish Population: The fish population is likely poor in the upper three fourths of the reach where the stream follows a new channel alignment, but probably good in the lower portion where the stream occupies the old channel alignment.

9. Water Temperature: Water temperatures can be expected to increase through this reach during the summer wherever the riparian vegetation has not yet recovered which is primarily along new channel alignments.

10. Vegetative Diversity: The vegetative diversity varies considerably from being poor to fairly good along the riparian area in the lower portion of the reach. There is low diversity across the floodplain

11. Habitat Complexity: Habitat complexity is lacking in the upper three fourths of the reach but is fairly good where the stream follows the old channel alignment, characterized by meanders, pools, and large woody debris.

8. Reach 4B

a. General Characteristics Prior to Development

Reach 4B extends from the beginning of Indian Ditch to about 600 feet downstream from the start of the last major meander bend above the Ford (from elevation 6,553 to 6,471). The main channel was sinuous, with several secondary distributary and flood overflow channels. Woody riparian vegetation was dominated by black cottonwood and willows with thick understories of mountain rose and other species in some areas.

b. Developments Affecting the Reach

Indian Ditch irrigated the westside meadows until the early 1940s. The eastside springs flowed while Pumice Valley was irrigated, but stopped discharging substantial quantities of water in about 1970 when irrigation ceased (Stine 1991). Deposition of cobbles during the 1967 flood event seriously impacted upper portions of Reach 4B (Stine et al. 1993). Sections of the main channel and some secondary channels were filled or blocked. Cobble deposition on the floodplain and desiccation, caused by reduced flows and the drying of the eastside springs, destroyed virtually all black cottonwood and most willow riparian vegetation. Beavers occupied the area in the late 1940s and created ponds, especially along the east side of the valley, but apparently left the area when the eastside springs ceased flowing and desiccation killed the floodplain vegetation.

c. Status of Restoration

There have been limited specific restoration efforts applied in Reach 4B. An area where the main channel was cutting a meander into an adjacent meadow was protected by stream bank armoring on an RTC recommendation. At this same location, a small channel, which cut across a point bar, was enlarged to further relieve the erosive forces on the outside of the meander bend.

The most significant effect of water development has been the reduction in main and secondary channel length. Deposition of cobble during the 1967 flood diminishes through this reach and is no longer of consequence by the downstream limit of this reach. Increase in main channel length, 1.5%, is minor. The other obvious impact has been loss of riparian and floodplain vegetation. There has been substantial loss of wet meadow acreage - particularly in those areas irrigated from Indian Ditch. Loss of vegetation can be attributed primarily to desiccation resulting from lack of stream flow and the drying of springs along the right wall of the valley.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The width of the main channel is variable. Several locations braid to form islands. Other locations, that follow the former channel, are narrow and approximate pre-1941 conditions. Other channel segments following new channel alignments are wide (from one and a half to two times as wide as it was pre-1941).

2. Spring Flow: Spring flows along the left side of the valley diminish through this reach and appear of little consequence today. The springs along the right side of the valley have been substantial, but no longer show signs of water movement (apparently they have not flowed since the irrigation of Pumice Valley ceased in 1970 (Stine 1991)).

3. Spawning Gravel Area: There are many scattered accumulations of spawning gravel so that availability of suitable spawning areas would not limit fish production.

4. Area of Aquatic Vegetation: Limited Elodea is available in backwaters and smaller side channels. There is no evidence of the extensive beds of water cress reported to exist pre-1941.

5. Amount of Cover: Cover is good in many locations while lacking in others. Good cover is available where the stream meanders, and where there are pools, large woody debris, and extensive riparian vegetation. In those areas where these components are lacking, cover is limited.

6. Number of Pools: There are some excellent pools but there are also some sections where no pools of consequence exist.

7. Invertebrate Population: The varying bottom composition through the area should supports an abundant and diverse invertebrate population.

8. Fish Population: The fish population is probably good in most areas where there is good cover, but sparse where cover is lacking.

9. Water Temperature: Water temperatures can be expected to increase through this reach during the summer though the magnitude of the increase should decline as the riparian and floodplain vegetation re-establish.

10. Vegetative Diversity: Vegetative diversity is limited across the floodplain. An exception is an extensive area of willow and mountain rose adjoining the left side meadow where other plant species also exist in fair abundance. However, the mountain rose may inhibit some understory species that might otherwise thrive.

11. Habitat Complexity: The habitat complexity is variable.

9. Reach 4C

a .General Characteristics Prior to Development

Reach 4C extends from about 600 feet downstream from the start of the last meander bend in Reach 4B to the Ford (from elevation 6,471 to 6,450 - these are contemporary elevations and do not reflect elevations prior to stream incision). This reach was characterized by a fairly narrow main channel with substantial habitat diversity and well developed woody riparian vegetation. A large, nearly 1,500-foot long, meander existed on the right side of the floodplain just upstream from the Ford (Stine et al. 1993).

b. Developments Affecting the Reach

Reduced flows undoubtedly severely desiccated woody riparian vegetation in Reach 4C. Lowering the water level in Mono Lake incised the stream several feet at the lower end of the reach to no more than a foot or so at the upper end. This incision lowered the groundwater level, and also eliminated riparian vegetation. Incision may have cut through the narrow neck of a large meander resulting in the abandonment of the entire meander immediately upstream of the Ford. The culvert at the Ford has been washed out more than once by past flood events (including WY 1995).

c. Status of Restoration

No reach specific restoration treatments have been implemented in Reach 4C.
The primary deficiencies for this reach are the losses of main channel length and woody riparian and floodplain vegetation. Loss of main channel length was almost entirely the result of abandoning the large meander on the right side of the valley.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: Effects of channel incision in response to the lowering of the level of Mono Lake are evident. The incised channel in most areas appears fairly narrow, but in some sections may be nearly twice as wide as the pre-1941 channel.

2. Spring Flow: No substantial springs appeared to contribute water to this reach.

3. Spawning Gravel Area: Spawning gravel is sparse.

4. Area of Aquatic Vegetation: There is little to no aquatic vegetation.

5. Amount of Cover: Cover is available in a few places where riparian vegetation is abundant and large pools have formed.

6. Number of Pools: There are a few pools formed as a consequence of scouring around riparian rootwads.

7. Invertebrate Population: The invertebrate population should be abundant and moderately diverse.

8. Fish Population: The fish population should be modest in numbers though limited to the few areas where pools and other cover are available.

9. Water Temperature: Minor additional thermal warming of the water is expected to occur during the summer.

10. Vegetative Diversity: Since the incision has led to desiccation of most the floodplain, vegetative diversity is low across the floodplain.

11. Habitat Complexity: With the exception of a few specific locations, habitat complexity is limited.

10. Reach 5A

a. General Characteristics Prior to Development

Reach 5A extends from the Ford about 1,800 feet downstream to the County Road (from elevation 6,450 to 6,395 - these are current elevations and do not reflect elevations prior to stream incision). This reach was characterized by a moderately wide valley with substantial channel meandering. The woody riparian vegetation was extensive and the channel was generally deep with good habitat complexity. Wet meadow area existed primarily along the lower west side of the floodplain.

b. Developments Affecting the Reach

Water developments reduced flow in the main stream and desiccated riparian woody vegetation in Reach 5A. Lowering of the water surface of Mono Lake resulted in incision by the stream causing the groundwater level to drop, the abandonment of secondary channels, the creation of some new main channels, and the further desiccation and loss of woody riparian vegetation. Flood events, primarily the 1967 flood, incised the channel in response to the lower lake level, substantially straightening the main channel and abandoning secondary channels.

The culvert installed at the Ford has clearly been a block to the upstream fish migration, though there probably has been limited upstream migration when the culvert has washed out or when flows passed around the culvert. The culvert installed at the County Road may not be a barrier to upstream fish migration at some flow levels.

c. Status of Restoration

There have been no restoration treatments specific to Reach 5A.
Losses of main channel and secondary channel length are the major deficiencies. Woody riparian vegetation is recovering, but floodplain vegetation and meadow areas have not.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel is narrowing, but remains as much as one and a half to two times as wide as pre-1941 in several areas.
2. Spring Flow: There is no apparent spring activity.
3. Spawning Gravel Area: Spawning gravel accumulations are limited by the lack of channel morphology allowing gravel deposition.
4. Area of Aquatic Vegetation: There is little evidence of aquatic vegetation.
5. Amount of Cover: Cover is limited to overhanging riparian vegetation.
6. Number of Pools: There are few pools of any consequence. The few that exist have developed where the stream has undercut riparian vegetation.
7. Invertebrate Population: The invertebrate population should be abundant but not particularly diverse.
8. Fish Population: The fish population is not considered abundant because of the limited cover and pool habitat.
9. Water Temperature: Water temperatures can be expected to increase during the summer until the riparian and floodplain vegetation becomes better established.
10. Vegetative Diversity: Vegetative diversity is limited because of the sparse riparian vegetation and lack of floodplain vegetation.
11. Habitat Complexity: Largely because of incision, the habitat has poor complexity with few pools, meanders, or large woody debris.

11. Reach 5B

a. General Characteristics Prior to Development

Reach 5B did not exist immediately prior to the diversion of water from the Mono Basin since it was below the surface elevation of Mono Lake. Reach 5B presently extends from elevation 6,395 to approximately 6,376 (these are current elevations and do not reflect elevations prior to stream incision or the changing level of the lake).

b. Developments Affecting the Reach

The obvious effect of water development was the creation of Reach 5B as the result of the surface level of Mono Lake being lowered. Associated with the lowering of Mono Lake, the stream not only lengthened but incised deeply into the easily erodible channelbed of volcanic origin comprising much of the floodplain deposits in Reach 5A and Reach 5B.

The incision transported large quantities of bedload into the lake and created a wide delta at the lake. This reach is wide, and tends to meander and braid across the delta. Riparian woody vegetation was limited to small willows without large trees establishing.

c. Status of Restoration

There have been no restoration treatments applied specifically to Reach 5B. Since this reach is an artifact of the lowering of Mono Lake and the extension of the stream to the lowered lake level, there are no historic baselines establishing quantitative restoration goals. As the lake level is restored, the lower portion of this reach will be inundated. The character of Reach 5B upstream from the delta is similar to that of Reach 5A. For future restoration efforts these two reaches shall be considered as one reach.

Lee Vining Creek

a. Characteristics Prior to Development

Lee Vining Creek has been described in detail by Aquatic Systems Research (1993)

The stream dropped steeply from over 13,000 feet at the Sierra Nevada crest to an elevation of approximately 7,800 feet where the gradient flattened rather abruptly and the stream flowed through a wider valley with meadows and a riparian forest to an elevation of about 7,130 feet. It then dropped steeply to an elevation of about 6,760 feet where it again flattened for the remaining 1.7 miles of stream before it flowed into Mono Lake at approximately 6,420 feet. The last steep area was forested with large pine. The floodplain was forested with quaking aspen, Jeffrey pine, and black cottonwood in its upper reaches and black cottonwood, willow and occasional Jeffrey pine in the lower reaches.

Average runoff (for 1937 through 1987) was about 50,000 acre feet with 67% of the unimpaired flow occurring during the peak snowmelt period of May through July.

An important characteristic of this stream is that, unlike lower Rush Creek, the water temperatures remained low throughout the summer.

b. Developments Affecting the Stream

As with Rush Creek, the first development of the Lee Vining Creek water resources was for irrigation and domestic use. There were some additional early uses of Lee Vining Creek water for mining and sawmill operations. Some water used for irrigation was exported from the Lee Vining Creek drainage.

Also as with Rush Creek, the next development of water resources in Lee Vining Creek was hydroelectric generation. Water from several lakes was diverted through penstocks to power plants including a small plant immediately below Highway 395. Power generation had little impact on the total flow in the stream, but did reduce the high May through July snowmelt runoff. Hydroelectric operations on Lee Vining Creek have less impact on flows than in Rush Creek because of the less developed storage capacity within the basin.

Diversion of water from the Lee Vining watershed began with completion of the Lee Vining Conduit, which diverted water to Grant Lake reservoir on Rush Creek. These facilities were completed in 1941. The conduit could greatly reduce flows in Lee Vining Creek and, at times, diverted all water below the diversion dam during 23 of the 49 years from 1941 through 1989 (Aquatic Systems Research 1993). Reduced flows lowered groundwater levels below Highway 395, which severely stressed woody riparian vegetation. Most dead and still living woody riparian vegetation across the floodplain below the town of Lee Vining was destroyed by a fire in the early 1950's. Because the absent riparian vegetation no longer protected the floodplain from scouring, floods in 1967, especially 1969, and again in the early 1980's removed much of the sediments and topsoil from the floodplain (Stine 1991, Aquatic Systems Research 1993). The dewatered stream, the lowered groundwater levels, and the loss of sediments and topsoil seriously impedes plant regeneration and the perennial, non-woody species, in particular.

The diversion facility at the Lee Vining Conduit includes a small dam which creates a pond that accumulates bedload being transported down Lee Vining Creek. The diversion pond is periodically excavated and the accumulated sediments are generally deposited away from the stream. The stream below the diversion dam has not experienced a normal supply of fines and gravels. However, there have been instances when the diversion pond has been flushed, which has introduced large quantities of finer sediments into the stream (Aquatic Systems Research 1993).

c. Status of Restoration

Many restoration activities have been initiated in response to Court orders and RTC recommendations. A review of these efforts has been prepared by Inter-Fluve, Inc. (1995).

The foremost steps toward the restoration of Lee Vining Creek was the restoration of minimum flows that ensured perennial flow. This action, begun in December 1986 as the result of a preliminary Court injunction, required a minimum flow of 10 cfs, though the flow was subsequently reduced in October 1987 to 5 cfs at the diversion and 4 cfs at the town of Lee Vining. In 1990, the Court substantially increased minimum flows in Lee Vining Creek by stipulating that flows totaling 21,930 acre-feet were to be released at the Lee Vining Conduit diversion, with 35 cfs during April through September, and 25 cfs during October through March. Decision 1631 (SWRCB 1994) modified these required flows.

Another important action for restoring riparian vegetation was LADWP's restriction on livestock grazing in the floodplain downstream from the town of Lee Vining.

There have been additional stream restoration efforts on the recommendation of the RTC, including placement of boulder weirs, placement of spawning gravels, excavation of pools, placement of large woody debris and boulders, restoration of flows to some channels, and some planting of riparian and floodplain vegetation. The acreage planted has been minimal, and because black cottonwood and Jeffrey pine growth to a significant size requires 30 to 50 years, the long term success of planting is not yet clearly established.

Flow restoration in Lee Vining Creek has allowed riparian woody vegetation to begin recovery. Most regeneration is from willows, with black cottonwoods establishing immediately adjacent to flowing stream channels. Minor natural regeneration of large woody species has occurred in the interfluvial areas.

For this plan, Lee Vining Creek below the Lee Vining Conduit has been divided into 6 reaches (Figure 4) having different physical characteristics (Katzel and Seable 1992). Limits for each reach are identified by stream elevations (Katzel 1995a).

1. Reach 1

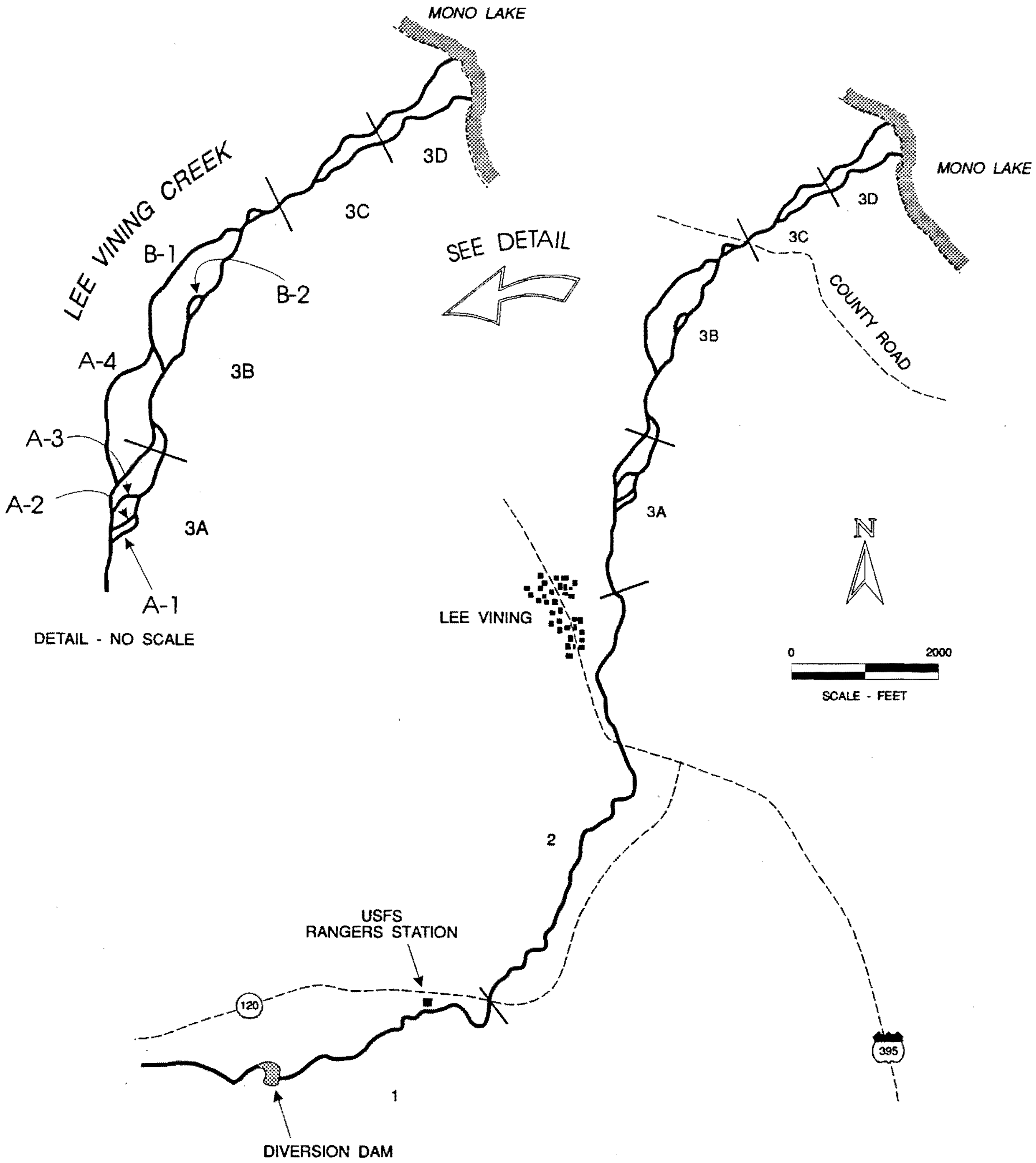
a. General Characteristics Prior to Development

Reach 1 begins at the Lee Vining diversion facility, where water from Lee Vining Creek can be diverted through the Lee Vining Conduit to Grant Lake reservoir on Rush Creek, and extends to Highway 120 (from elevation 7,175 to 7125). The stream had a modest gradient through this reach and flowed through stands of large Jeffrey and lodgepole pine, quaking aspen, black cottonwood, and willows. Meadows flanked the stream, particularly on the west side.

b. Developments Affecting the Reach

An important development in this reach was the construction of the O Ditch to irrigate the meadows on the left side of the valley. The O Ditch diverted, and continues to divert, water from above Reach 1. Return flows from irrigation activities re-enter Lee Vining Creek within the reach.

Though flows were diverted into the Lee Vining Conduit at the upper limit of Reach 1, the stream characteristics and the riparian vegetation did not suffer permanent damage. Seepage and irrigation return water from the O Ditch helped substantially to maintain the stream and vegetation. The Lee Vining Conduit diversion structure prevents movement of bedload downstream and, thereby, can deplete spawning gravels. The development of a U. S. Forest Service storage area in the middle portion of the reach apparently reduced understory riparian vegetation in this section. A small dam was placed at the lower limit of the reach to divert water into the SCE power plant located just below Highway 395. This diversion structure not only diverted water, but blocked upstream fish migration and downstream movement of bedload. The Parshall flume installed to measure stream flows immediately above the Lee Vining Conduit diversion is also a barrier to upstream fish migration.



Source: Scientists Work Plan

Reach designations for lower Lee Vining Creek

Figure 4

c. Status of Restoration

Many restoration treatments have been applied in Reach 1, including installation of large woody debris, placement of large boulder weirs, and placement of spawning gravels. Most treatments have been applied to the middle section of the reach. The SCE power plant was removed a number of years ago and the diversion dam near the lower limit of the reach has subsequently been breached and probably no longer is a barrier to upstream fish movement at most flows. Much of the substantial accumulation of bedload behind the water supply dam has washed down Lee Vining Creek, but some remains and is protected by a sand bag revetment.

The general character of Reach 1 in channel length and vegetation composition remains unchanged.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel width does not appear to differ substantially from the pre-1941 condition.

2. Spring Flow: There are no apparent springs providing surface flow in this reach.

3. Spawning Gravel Area: The diversion pond at the Lee Vining Conduit prevents bedload, including gravel suitable for spawning, from moving downstream. Also, there have been past instances when accumulated fines have been sluiced from the diversion pond causing the burial of gravels within the reach. Some spawning gravel has been deposited in the reach as part of past restoration efforts but much of this has been washed downstream.

4. Area of Aquatic Vegetation: Little aquatic vegetation exists.

5. Amount of Cover: Except in the middle portion, there is extensive cover from overhanging riparian vegetation, some pools, and large woody debris. Pools and large woody debris were added in the middle portion as past restoration efforts authorized by the RTC.

6. Number of Pools: There are pools of varying size throughout the reach with several constructed, including placement of large woody debris in the middle portion of the reach. Some pools have been affected by deposition of fines sluiced from the diversion pond.

7. Invertebrate Population: The invertebrate population should be abundant and diverse.

8. Fish Population: The fish population should be healthy, with the possible exception of the middle portion.

9. Water Temperature: Good riparian cover prevents appreciable warming during the summer. Lee Vining Creek is considered colder than desirable for trout or, at least brown trout.

10. Vegetative Diversity: Vegetative diversity is excellent, except in a U. S. Forest Service storage area.

11. Habitat Complexity: Habitat complexity appears good, except in the middle portion of the reach.

2. Reach 2

a. General Characteristics Prior to Development

Reach 2 begins at the end of the meadows where Highway 120 crosses the stream and drops steeply to just below Highway 395 and the SCE substation (from elevation 7,125 to 6,665). This reach has large boulders and a sequence of plunge pools. Riparian vegetation is primarily willow with some quaking aspen and black cottonwood, and a substantial stand of large Jeffrey and lodgepole pine upstream of Highway 395. Willow, black cottonwood, a few Jeffrey pine, and stands of quaking aspen flank the canyon walls downstream of Highway 395.

The stream is a single thread channel above Highway 395. There is substantial secondary channel development in the lower portion of the reach below Highway 395.

b. Developments Affecting the Reach

Though there are no longer functional water diversions within Reach 2, there was an irrigation diversion developed from the overflow channel that began where Highway 120 crosses the stream. This eastside overflow channel was cut off from the main stream by construction of the new alignment for Highway 120. The SCE substation at the lower end of the reach was at one time the location of a power plant which received water diverted from the stream at the lower end of Reach 1. Developments that do affect stream habitat are culverts at Highway 120, the upper end of the reach, Highway 395 at the lower end of the reach, and a 300-foot section of stream channel gunited to prevent bank erosion at the SCE substation just below Highway 395. These culverts and the gunited stream section are blocks to upstream fish migration.

c. Status of Restoration

The only restoration treatments specific to Reach 2 have been modifications to the Highway 120 culvert and the gunited section of channel at the SCE substation to make them suitable for upstream fish passage. The success of these modifications has not been fully evaluated. The Highway 395 culvert remains impassable to fish.

This is a steep stream section in a narrow canyon that has experienced little changed. The vegetation has remained essentially intact.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: There is no change from pre-1941 channel widths.

2. Spring Flow: There are no spring flows of consequence.

3. Spawning Gravel Area: Because of the steep gradient with small plunge pools, spawning gravel accumulations are limited but should be similar to pre-1941 conditions.

4. Area of Aquatic Vegetation: No appreciable growth of aquatic vegetation exists or could be expected to develop.

5. Amount of Cover: Excellent cover is provided by well-established riparian vegetation, abundant plunge pools, and below Highway 395, extensive large woody debris.

6. Number of Pools: There are numerous pools in the steep gradient area above Highway 395 and in the less steep channel below Highway 395, but not in the gunited section adjacent to the SCE substation.

7. Invertebrate Population: Invertebrate production should be high, but low diversity because of harsh conditions created by the steep stream gradient.

8. Fish Population: Fish populations should be well established though the size of the population might be limited. Stream conditions above Highway 395 do not appear well suited for rearing young fish, but conditions below the SCE substation should be good for all life stages.

9. Water Temperature: Water temperatures would not be affected throughout this reach.

10. Vegetative Diversity: The vegetative diversity appears to be high.

11. Habitat Complexity: Habitat complexity is good, with the exception of limited areas of slower water which would be desirable for juvenile trout and the gunited section at the SCE substation. Suitable habitat for juvenile fish exists in the lower portions of the reach but little is available above Highway 395.

3. Reach 3A

a. General Characteristics Prior to Development

Reach 3A begins about 1,500 feet below Highway 395 and extends down a steep gradient to a point just below where the main channel now moves eastward across the floodplain opposite the westside valley wall (from elevation 6,665 to 6,537). The upper portion of the reach had a substantial stand of woody vegetation, primarily of willow, black cottonwood, and a few Jeffrey pine. These trees thinned out in the lower portions. Stands of quaking aspen stands occurred along the canyon walls. The floodplain became wider from the upper to the lower limits of the reach. There is evidence of numerous secondary channels.

b. Developments Affecting the Reach

Developments unique to Reach 3A include the storm drain runoff from the town of Lee Vining and seepage from the sewage treatment ponds. The storm drain, which formerly also conveyed irrigation return water, delivers water onto a bench well above Lee Vining Creek. But flows reach the creek during heavy runoff periods and have cut substantially into the valley wall. Seepage from the sewage treatment ponds (and, formerly, from irrigation) support growth of an adjacent stand of quaking aspen on the left wall of the valley but does not appear to provide surface flows to the stream. Similarly, irrigation seepage, in addition to natural springs, has supported quaking aspen along the left side of the valley.

c. Status of Restoration

There have been four secondary channels (A-1, A-2, A-3, and A-4) rewatered within Reach 3A. (Figure 4) There has been minimal planting of willow, black cottonwood, and Jeffrey pine on the west side of the floodplain at the downstream end of this reach. There have been some actions authorized by the RTC to modify channel morphology and introduce large woody debris in the rewatered secondary channels.

The main channel length remains about 10% shorter than existed pre-1941. Many secondary channels have been rewatered by work authorized by the RTC. Loss of the woody riparian vegetation is still apparent, though substantial early regeneration cannot yet be detected in the aerial photographs for us to assess vegetation status.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: Channel widths are unchanged from pre-1941 conditions in the upper portion of this reach, but may be as much as one and a half times wider in some sections of the lower portion and show little evidence of narrowing.

2. Spring Flow: There is evidence that active springs are along the left valley wall in the form of a healthy quaking aspen grove. The water source appears to be the sewage treatment ponds located on the terrace immediately above the grove. Stands of quaking aspen also indicate some spring activity along the right wall of the valley.

3. Spawning Gravel Area: Spawning gravel is available but the best deposits are found in the upper portion where stream morphology favors gravel deposition.

4. Area of Aquatic Vegetation: Little aquatic vegetation occurs.

5. Amount of Cover: Cover is abundant in the upper portion of the reach, but limited in the lower portion where there are few pools and large woody debris.

6. Number of Pools: There are frequent pools in the upper portion of the reach but the lower portion is comprised mainly of long runs with few pools.

7. Invertebrate Population: The invertebrate population should be abundant and diverse.

8. Fish Population: The fish population should be good in the upper portions of the reach where there is abundant cover but poor in the lower portion.

9. Water Temperature: Water temperatures should not begin to warm during the summer until the water enters the lower portion of the reach where riparian vegetation is sparse.

10. Vegetative Diversity: Vegetative diversity appears excellent in the upper portion of the reach, but is poor in the lower portion where the riparian and floodplain vegetation is still in early stages of recovery.

11. Habitat Complexity: The habitat complexity is excellent in the upper portions of the reach but poor in the lower sections where there are few pools and limited amounts of large woody debris.

4. Reach 3B

a. General Characteristics Prior to Development

Reach 3B begins where the present main channel swings to the east away from the west side of the floodplain and extends to the County Road crossing (from elevation 6,537 to 6433). The stream course had a main channel that meandered across the floodplain. Numerous secondary channels spread across a wide floodplain. The woody riparian vegetation was extensive and comprised of primarily black cottonwood, willow, and scattered Jeffrey pine. Some meadows were present especially on the west side of the lower portions.

b. Developments Affecting the Reach

The only development within Reach 3B was an irrigation diversion on the west side of the floodplain that diverted water to irrigate meadows west of the stream near Mono Lake. This diversion is no longer functional.

c. Status of Restoration

Two secondary channels have been rewatered (B-1 and B-2) on the authorization of the RTC.(Figure 4) There have also been numerous efforts to improve the habitat in the main channel and the rewatered secondary channels including construction of pools and backwater areas, placement of large woody debris, and deposition of small quantities of spawning gravel. There has also been fairly extensive planting of willow, black cottonwood, and Jeffrey pine both along the watered streams and across the interfluvial areas.

Rewatering the B-1 and B-2 channels in Reach 3B has restored most of the secondary channel length. The loss of floodplain vegetation, both woody vegetation and meadows, is probably further along than the data implies because young regeneration cannot be readily detected in the aerial photographs used to assess vegetation. Natural regeneration of riparian black cottonwood and willow in the lower one third of the reach is progressing well.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The channel is often as much as one and a half to two times wider and shallower than existed pre-1941. Evidence that the main channel was narrower and deeper exists in pre-1941 channels such as B-1, which was the main channel, but has been rewatered as a secondary channel.

2. Spring Flow: There is no significant spring activity.

3. Spawning Gravel Area: Spawning gravel is limited because the channel morphology is generally not suitable for gravel deposition.

4. Area of Aquatic Vegetation: There is limited aquatic vegetation in backwater areas.

5. Amount of Cover: Cover is limited in the main channel to a few pools and a few pieces of large woody debris. Excellent cover exists in portions of the rewatered channels where there are more pools (some constructed) and pieces of woody debris.

6. Number of Pools: Few pools of consequence occur in the main channel but there are more pools in the rewatered channels that have the pre-1941 morphology.

7. Invertebrate Population: Invertebrate populations are likely to vary substantially between being poor in the main channel to being fairly abundant in the rewatered secondary channels.

8. Fish Population: The fish population is probably moderate to poor with improvement depending on the usage of the rewatered secondary channels.

9. Water Temperature: Water temperatures can be expected to increase during the summer though, as has been indicated, high water temperatures are not considered a problem in lower Lee Vining Creek.

10. Vegetative Diversity: Revegetation by planting and natural regeneration has been occurring. Diversity is poor but will improve as the larger species create a canopy across the floodplain .

11. Habitat Complexity: There is limited habitat complexity in the main channel where there are few pools or pieces of large woody debris and the riparian vegetation is still small, but complexity is generally better in the rewatered secondary channels.

5. Reach 3C

a. General Characteristics Prior to Development

Reach 3C begins at the County Road crossing and extends to the shoreline of Mono Lake as it existed in 1941 (from elevation 6,433 to 6,404 - these are current elevations and do not reflect elevations prior to any stream incision). The channel was restricted to one main channel at the County Road crossing but divided into two or more channels farther downstream. The gradient through this reach was modest. There was an extensive stand of black cottonwood and willow with a few scattered Jeffrey pine in the upper half of the reach, with the vegetation thinning to scattered willows across the delta of the creek in the lower half of the reach (a few white cottonwood trees were planted adjacent to the County Road crossing).

b. Developments Affecting the Reach

The only development unique to Reach 3C is the County Road crossing which formerly was a bridge but is presently a culvert (approximately 30-inch diameter) and a ford. Though the culvert may be impassable to fish migrating upstream, the ford is passable when adequate flows are available.

c. Status of Restoration

There has been stream improvement authorized by the RTC for Reach 3C. These treatments included pool development and placement of large woody debris.

The main channel length remains the same as existed pre-1941. Braiding across the upper delta has substantially increased the length of secondary channels. Incision up to 10 feet in the lower portions of the reach, desiccation caused by no flows, and the fires, contributed to the loss of floodplain vegetation. Riparian vegetation is recovering well in the upper half of the reach, but poorly in the lower half.

The following is a summary of the characteristics of the reach:

1. Average Width of the Main Channel: The main channel is generally one and a half times wider than existed pre-1941; there is little indication it is narrowing.
2. Spring Flow: There is no significant spring activity.
3. Spawning Gravel Area: Spawning gravel accumulations are limited since there are few areas where the stream morphology is suitable for gravel deposition.
4. Area of Aquatic Vegetation: Little aquatic vegetation exists.
5. Amount of Cover: Cover is limited to a few pools and some riparian vegetation.
6. Number of Pools: The few pools are shallow without lateral undercutting or large woody debris.
7. Invertebrate Population: Productivity of invertebrates should be abundant but diversity should be poor.
8. Fish Population: The fish population is expected to be poor because of the lack of cover.
9. Water Temperature: Water temperatures can be expected to increase during the summer.
10. Vegetative Diversity: There is low vegetative diversity because of the early development of the riparian vegetation and the limited floodplain vegetation.
11. Habitat Complexity: Habitat complexity is poor from lack of meanders, pools, and large woody debris.

6. Reach 3D

a. General Characteristics Prior to Development

Reach 3D extends from the 1941 lake shore of Mono Lake to the present shoreline of Mono Lake (from elevation 6,6404 to 6,376 - these are current elevations and do not reflect elevations prior to stream incision or the changing level of the lake). Reach 3D did not exist within historic times before the level of Mono Lake began to recede after 1941.

b. Developments Affecting the Reach

The only development impacting Reach 3D has been the dropping of the elevation of the Mono Lake shoreline which caused the stream to extend and create this reach.

c. Status of Restoration

Since this reach did not exist prior to 1941, no quantitative goals have been established for its restoration. As the level of the lake is raised, the inundated portion of the stream will be lost. Generally, the characteristics of Reach 3D are similar to those of Reach 3C and their restoration efforts should be similar. However, one interesting and potentially productive section of this Reach 3D is the series of well vegetated marshes with willow, rushes, and cattails that have developed near the confluence with Mono Lake. These marsh habitats may or may not redevelop in response to rising, instead of declining, lake levels but, if they do, they should be encouraged and protected. For future restoration efforts, Reach 3D will be considered as part of Reach 3C.

Walker Creek

a. General Characteristics Prior to Development

Walker Creek has been thoroughly described by Ebasco Environmental and Water Engineering and Technology, Inc. (1992). The stream flowed steeply from the east front of the Sierra Nevada to 7,150 feet at the Lee Vining Conduit where its gradient decreased substantially as it began to flow in one or another of various channels across meadows formed over the alluvial fan. The last 3.7 miles of Walker Creek flowed across the meadows and then cut down through the alluvium and old lake terraces into Rush Creek at an elevation of 6,613 feet about 4.25 miles from the Mono Lake shoreline. The estimated average runoff for 1940 to 1994 was a about 5,400 acre feet with over 60% of the annual runoff occurring in May through August.

b. Developments Affecting the Stream

There has been no development for generation of hydroelectric power in the upper watershed of Walker Creek. However, there has been impacts by private owners manipulating the level of Walker Lake and, thereby, affecting the timing and magnitude of downstream flows.

There has been extensive development of the stream for irrigating the Cain Ranch meadows above old Highway 395. Many small lateral ditches were developed to spread the water across the meadow. The effect of these irrigation practices limited the flow in the main stream channel and often eliminated surface flow into Rush Creek. Evidence indicates the stream flows immediately below the Lee Vining Conduit were the primary source of the groundwater that subsequently emerged as springs along the west side of lower Rush Creek (Stine & Vorster 1994).

The other major development of the water resources of Walker Creek was the construction of a diversion structure that allowed water from the stream to be diverted through the Lee Vining Conduit to Grant Lake reservoir on Rush Creek. The diversion structure, which became functional in 1941, blocked downstream movement of bedload, including potential spawning gravels, and the upstream movement of fish. Water diversion to Grant Lake reservoir also affected the timing and volume of flows in Walker Creek.

Diversions to Grant Lake reservoir and irrigation diversions limited any flows below the diversion to spring and summer, resulting in the loss of any singular defined main channel. In many years, there was no flow at old Highway 395. Desiccation caused significant die-backs of woody riparian vegetation; in some areas below old Highway 395, killed all vegetation except near the Rush Creek confluence.

c. Status of Restoration

A number of restoration activities have been initiated on Walker Creek in response to Court orders and the recommendations of the RTC. A review of these efforts has been prepared by Inter-Fluve, Inc. (1995).

The most significant action to restore the stream habitat was the Court order establishing minimum flow releases past the Lee Vining Conduit diversion structure starting in 1990. This action assured that the stream would flow perennially. The Court stipulated that flows be released to the stream at the Lee Vining Conduit with 6 cfs during the months of April through September and 4.5 cfs during the months of October through March. The Court order also required improvements to the stream channel to accommodate the required flows. Decision 1631 requires the same flows as the Court stipulated flows and does not differentiate between dry, normal, and wet years. Implementing a minimum flow schedule has made Walker Creek a stream capable of sustaining fish which it could not previously do below the irrigation diversions.

At the recommendation of the RTC, grazing has been excluded from the riparian corridor of Parker Creek. This action, along with the restoration of flows in the stream, has benefited the recovery of riparian vegetation.

For this report, Walker Creek below the Lee Vining Conduit has been divided into 2 reaches. The limits of the reaches are identified by stream elevations.

1. Reach 1

a. General Characteristics Prior to Development

Reach 1 extends from the diversion structure at the Lee Vining Conduit to Highway 395 (from elevation 7,150 to 6,790). Throughout this reach, the stream flowed out across a wide alluvial fan. There were multiple channels at the upper end of the reach which were vegetated with willow and quaking aspen. About one quarter of the way across the alluvial fan the stream flowed across meadows that had scattered patches woody vegetation.

b. Developments Affecting the Reach

Diversion into the Lee Vining Conduit and the irrigation diversions occurred within Reach 1. These diversions desiccated the riparian area of the stream, especially in the lower portions of this reach, causing the vegetation, mainly willows to die back. The diversion structure at the Lee Vining Conduit is impassable to upstream migrating fish and includes a diversion pond that prevents the downstream movement of bedload.

Both the culvert at old Highway 395 and the Parshall flume immediately downstream of old Highway 395 have created likely barriers to the upstream movement of fish. No action has been taken to improve the passability of either structure.

c. Status of Restoration

Since pre-1941 conditions have not been established for all restoration goals on Walker Creek such as they have for Rush Creek and Lee Vining Creek, individual comments about Reach 1 will be made for each restoration goal.

The following is a summary of the characteristics of the reach:

1. Length of the Main Channel: The length of the present main channel of this reach is approximately 12,400 feet. This is a restored channel that was created at the direction of the Court to accommodate the water provided by the minimum flow schedule for Walker Creek. Because of the elaborate irrigation diversions that previously existed throughout this reach and the desiccation, the pre-1941 main channel could not be readily identified.

2. Sinuosity of the Main Channel: The channel has a sinuosity of 1.305. Most sinuosity is in the lower reach, particularly between old Highway 395 and existing Highway 395.

3. Gradient of the Main Channel: The gradient is 0.028 ft/ft. The steepest portion of the channel is in the upper half.

4. Length of Secondary Channels: The extent of pre-1941 secondary channels in this reach is a matter of debate. Since the upper portions flow over an old alluvial fan, there were various channels established at different times but it is not clear whether more than one channel carried water at any one time immediately prior to the development of the extensive irrigation diversion system. We believe that water was usually contained within a single channel except during periods of overbank flows.

5. Percentage of Stream Bank Length with Established Woody Vegetation: Extensive grazing over the past century has undoubtedly affected the pattern and composition of the riparian vegetation. By the time the capability to divert water from Walker Creek to Grant Lake reservoir was developed in 1941, riparian vegetation along what has now been restored as the main channel was limited to dense patches of willow that became more scattered in the lower portions of the reach. A few scattered Jeffrey and lodgepole pine also occurred along the upper portions of the reach. With year-round flows re-established, the willow, which shows signs of extensive die-back, is recovering but there is no indication that the

extent of riparian vegetation is increasing. Willow recovery between old Highway 395 and the existing Highway 395 alignment is less apparent. Exclusion of grazing from the riparian zone has enhanced recovery of the riparian vegetation.

6. Area of Woody Vegetation on the Floodplain: It is difficult to discuss the floodplain along this reach because there is no defined valley as the stream flows across an old alluvial fan. Willow thickets do occur away from the stream course in the upper portions of the reach but these thin out in the lower portions. There is no evidence that the area covered by these willow thickets is increasing.

7. Area of Meadow on the Floodplain: Most area away from the riparian zone is vegetated by meadow. This meadow has been sustained by extensive irrigation and whether or not it reverts to some other form of vegetation may depend on the extent of future irrigation

8. Average Width of the Main Channel: The restored main channel is narrow and appears stable. The channel may be narrower and more stable now than it was prior to irrigation when the streamside vegetation, especially the grasses and sedges did not provide the dense mat that now exists along the streambanks.

9. Spring Flow: There are no apparent spring flows that affect the stream. However, some left bank springs along lower Rush Creek could be recharged in the upper portions of this reach (Stine & Vorster 1994).

10. Spawning Gravel Area: There are numerous, small pockets of suitable spawning gravel. There is a lack of recruitment of gravel as bedload because of the diversion pond at the Lee Vining Conduit.

11. Area of Aquatic Vegetation: There is little slow or backwater areas where aquatic vegetation could be expected to develop.

12. Amount of Cover: When the channel was defined and restored, riparian vegetation was removed to allow unimpeded flows. This action reduced instream cover. However, there is still substantial cover provided by small woody debris in the upper portions of the reach and by many undercut banks associated with meanders in the lower portions.

13. Number of Pools: Many pools formed by riparian root wad scouring in the upper portions of the reach and by meander formation in the lower portions.

14. Invertebrate Population: Invertebrate populations should be abundant and diverse.

15. Fish Population: A small but healthy fish population has become established.

16. Water Temperature: Because of the narrow channel, warming of the water should be minimal during the summer except possibly in the lower sections.

17. Vegetative Diversity: Since grazing has been restricted from the riparian zone, the vegetative diversity has probably increased though it may not be to pre-grazing levels. Diversity is undoubtedly better than pre-1941 when much of the present main channel was dry.

18. Habitat Complexity: The habitat is complex with much riparian vegetation and small woody debris in the upper portions. Meanders with extensive undercut banks in the lower portions provide numerous pools and cover, but additional riparian vegetation would be desirable.

2. Reach 2

a. General Characteristics Prior to Development

Reach 2 extends from Highway 395 to the confluence with Rush Creek (from elevation 6,790 to 6,613). Through this reach, the stream followed a narrow valley cut through alluvium and lake terrace deposits. The floodplain was narrow with little riparian vegetation except for the last few hundred yards above the Rush Creek confluence where springs supported a substantial stand of willow, quaking aspen, and a few black cottonwood along the floodplain and valley walls.

b. Developments Affecting the Reach

In addition to the impacts of diverting all water before reaching old Highway 395, the only development within this reach was construction of Highway 395 which has two culverts to convey Walker Creek. These culverts are not considered passable by fish migrating upstream and do not appear adequate to convey natural flood flows.

c. Status of Restoration

Since pre-1941 conditions have generally not been established for all restoration goals on Walker Creek, as for Rush Creek and Lee Vining Creek, individual comments will be made about Reach 2 for each restoration goal.

The following is a summary of the characteristics of the reach:

1. Length of the Main Channel: The present length of the main channel is approximately 7,080 feet. Since the stream is constrained to a fairly narrow valley, the original channel length was probably the same as the present length.

2. Sinuosity of the Main Channel: The sinuosity of the main channel is 1.242 which is probably similar to the prior condition.

3. Gradient of the Main Channel: The gradient is 0.025 ft/ft which is probably similar to the prior condition.

4. Length of Secondary Channels: The narrow valley precludes secondary channel development.

5. Percentage of Stream Bank Length with Established Woody Vegetation: There is evidence of woody vegetation along most of this reach but much of it in the upper half of the reach completely died when the reach was desiccated. The riparian vegetation in the lower half has been able to begin recovery since water has been restored to the channel. The vegetation in the lower fewer hundred yards of the reach, including willow, quaking aspen, and black cottonwood, survived in reasonably good condition because of active springs near the confluence of Walker Creek with Rush Creek.

6. Area of Woody Vegetation on the Floodplain: The floodplain is narrow and, except for quaking aspen and black cottonwood where it enters the Rush Creek valley, the floodplain supports only a few willow and buffalo berry.

7. Area of Meadow on the Floodplain: In those parts of the upper portions of the reach where there is no woody vegetation; some of the narrow floodplain is vegetated with grasses and sedges.

8. Average Width of the Main Channel: The width of the main channel is narrow and probably similar to pre-1941 conditions. As part of the Court directed project to define the channel of Walker Creek, a sediment trap was installed in Reach 2 at the power line crossing at approximately elevation 6,757. The trap was not maintained and has subsequently been removed.

9. Spring Flow: There is apparent spring influence represented by quaking aspen groves along both sides of the valley near the confluence of this reach with Rush Creek.

10. Spawning Gravel Area: Small spawning gravel deposits exist throughout the reach.

11. Area of Aquatic Vegetation: No areas of aquatic vegetation have been observed.

12. Amount of Cover: The poor condition of the riparian vegetation in the upper portions reduces the available cover but there are undercut banks throughout the reach and good riparian development in the lower one quarter that provide good cover.

13. Number of Pools: There are many pools throughout the reach.

14. Invertebrate Population: Invertebrate populations should be high in numbers and diversity.

15. Fish Population: A modest fish population probably exists with the best populations probably being in the lower one quarter where the quaking aspen and cottonwood stands exist.

16. Water Temperature: Water temperatures should not be affected appreciably during the summer.

17. Vegetative Diversity: Vegetative diversity is limited in the upper three quarters of the reach because of the die-back caused by desiccation but it appears good in the area influenced by springs in the lower quarter.

18. Habitat Complexity: Lack of live riparian vegetation in the upper three quarters of the reach reduces habitat complexity, but complexity appears excellent in the lower one quarter with good riparian vegetation, many pools, and abundant accumulations of small woody debris.

PARKER CREEK

a. General Characteristics Prior to Development

Parker Creek has been thoroughly described by Ebasco Environmental and Water Engineering and Technology, Inc. (1992)

The stream flows steeply from the east front of the Sierra Nevada to approximately 7,140 feet at the Lee Vining Conduit where its gradient decreases substantially as it began to flow in one or another of various channels across meadows formed over the alluvial fan. Parker Creek starts cutting through the alluvium and old lake terrace at Highway 395 to meet Rush Creek at an elevation of 6,671 feet. The estimated average runoff for 1940 to 1994 was about 9,100 acre feet with over 60% during the months of May through August.

b. Developments Affecting the Stream

There has been no development for generation of hydroelectric power in the upper watershed of Parker Creek.

There has been extensive manipulation of the stream for irrigation of the Cain Ranch meadows above old Highway 395. Irrigation diversion structures were constructed above and below the Lee Vining Conduit. The irrigation diversions from Parker Creek changed both the timing and the volume of flows. Irrigation diversions reduced flow in the main stream channel, and for many years, prevented surface flows from reaching Rush Creek. Evidence indicates that the stream flows immediately below the Lee Vining Conduit were the primary source of groundwater that subsequently emerged as springs along the west side of lower Rush Creek (Stine & Vorster 1994)..

The other major development of the water resources of Parker Creek was the construction of a diversion structure into Lee Vining Conduit. The diversion structure, which became functional in 1941, blocked downstream transport of bedload, including potential spawning gravels, and the movement of fish upstream. The diversions to Grant Lake reservoir also changed the timing and the volume of flows in Parker Creek. Diversions to Grant Lake reservoir combined with irrigation diversions dewatered the channel at and below old Highway 395 after 1948. Desiccation caused the woody riparian vegetation to die back, except near the confluence with Rush Creek.

In addition to the Lee Vining Conduit diversion structure, there have been other installations on Parker Creek that created barriers to the upstream migration of fish including various culverts and flumes.

c. Status of Restoration

A number of restoration activities have been initiated on Parker Creek in response to Court orders and RTC recommendations. A review of these efforts has been prepared by Inter-Fluve, Inc. (1995).

The most significant action to restore the stream habitat was the establishment of minimum flow releases past the Lee Vining Conduit diversion structure. In 1990, the Superior Court stipulated that flows totaling 5,478 acre-feet be released at the Lee Vining Conduit with 9 cfs during April through September, and 6 cfs during October through March. This action assured that the stream flowed permanently. The Court order also required improvements to the main stream channel to accommodate the required flows. Decision 1631 requires the same flows as the Court stipulated flows. Implementation a minimum flow schedule made Parker Creek a stream capable of sustaining fish which it could not previously do below the irrigation diversions.

At the recommendation of the RTC, grazing has been excluded from the riparian corridor of Parker Creek. This action, plus restoring stream flows, has greatly benefited riparian vegetation recovery.

For this report, Parker Creek below the Lee Vining Conduit has been divided into 2 reaches distinguished by having somewhat different characteristics. The limits of the reaches are identified by stream elevations:

1. Reach 1

a. General Characteristics Prior to Development

Reach 1 extends from the Lee Vining Conduit to Highway 395 (from elevation 7,140 to 6,838) (Reach 1 includes subreaches 1 to 3). This reach flowed over an alluvial fan which, for the most part, was covered by meadow. The stream course had a narrow, dense strip of woody riparian vegetation comprised mainly of willow, but with some quaking aspen at the upper elevations and a few scattered Jeffrey and lodgepole pine (Ebasco

Environmental Water Engineering & Technology, Inc. 1992). At one time, there may have been multiple channels in the upper portion of the reach.

b. Developments Affecting the Reach

The diversion into the Lee Vining Conduit and the irrigation diversions occurred within Reach 1. These diversions desiccated the riparian area, especially in lower portions of this reach, causing the vegetation (mainly willows though there were a few Jeffrey pine in the upper portions of the reach) to die back.

The diversion structure at the Lee Vining Conduit is impassable to upstream migrating fish and includes a diversion pond that prevents movement of bedload downstream. A culvert, installed at old Highway 395, appears impassable to upstream fish migration. Also, as part of a Court ordered project to redefine the stream channel, a sediment trap was constructed approximately 600 feet upstream from old Highway 395. This sediment trap also appears to be a barrier to upstream fish migration. A Parshall flume located downstream of old Highway 395 is another barrier to the upstream movement of fish. All these potential barriers remain intact.

c. Status of Restoration

Since pre-1941 conditions have not been established for all restoration goals on Parker Creek such as they have for Rush Creek and Lee Vining Creek, individual comments will be made about Reach 1 for each restoration goal.

The following is a summary of the characteristics of the reach:

1. Length of the Main Channel: The length of the present main channel is approximately 18,240 feet. Specific action was taken at the direction of the Court to develop a singular, main channel between the Lee Vining Conduit diversion and the old Highway 395. The alignment followed is that of the former channel, even though irrigation practices had dewatered most of this alignment during most of each year.

2. Sinuosity of the Main Channel: The channel has a sinuosity of 1.604. Most sinuosity (some of it remarkable to behold) is in the lower three quarters of the reach.

3. Gradient of the Main Channel: The gradient is 0.016 ft/ft. The steepest gradient is in the upper half of the reach.

4. Length of Secondary Channels: The extent of pre-1941 secondary channels is a matter of debate. Since the stream in the upper portions of this reach flowed over an old alluvial fan, there were various channels established at different times but it is not clear whether more than one channel carried water at any one time immediately prior to the development of the extensive irrigation diversion system.

We believe water was usually contained within a single channel except during periods of high flow.

5. Percentage of Stream Bank Length with Established Woody Vegetation: Extensive grazing for more than a century has undoubtedly affected the pattern and composition of the riparian vegetation. By the time the capability to divert water from Parker Creek to Grant Lake reservoir was developed in 1941, riparian vegetation along what has now been restored as the main channel was limited to a fairly continuous stand of willow. Scattered Jeffrey and lodgepole pine also occurred along the upper portions of the reach. With year-round flows re-established in the stream, the willow, which shows sign of extensive die-back, is recovering except in the portion between old Highway 395 and Highway 395, but there is no sign that the extent of riparian vegetation is increasing. An exception to the evidence of recovery is between old Highway 395 and the existing Highway 395 alignment where the recovery of the willow is less apparent. Another important action that helped restore riparian vegetation was protection of the riparian corridor from sheep grazing, done at the recommendation of the RTC.

6. Area of Woody Vegetation on the Floodplain: It is difficult to discuss the floodplain because there is no defined valley, only an old alluvial fan. Patches of willows occur away from the stream course in the upper portions of the reach but these thin out in the lower portions. There is no evidence that the area covered by willows is increasing.

7. Area of Meadow on the Floodplain: Most area away from the riparian zone is vegetated by meadow. This meadow has been sustained by extensive irrigation and whether or not it reverts to some other form of vegetation may depend on the extent of future irrigation.

8. Average Width of the Main Channel: The main channel is narrow and appears stable. The channel may be narrower and more stable now than it was prior to irrigation when the streamside vegetation, especially from the grasses and sedges, that grow a dense mat along the present stream banks.

9. Spring Flow: There are no apparent spring flows. However, some of the left bank springs along lower Rush Creek may be recharged from water in the stream channel immediately below the Lee Vining Conduit (Stine & Vorster 1994).

10. Spawning Gravel Area: There are numerous, small pockets of suitable spawning gravel. There is a lack of recruitment of gravel as bedload because of the diversion pond at the Lee Vining Conduit.

11. Area of Aquatic Vegetation: There are some back water areas where aquatic vegetation could be expected to develop.

12. Amount of Cover: The redefinition of the channel directed by the Court included clearing riparian vegetation, both dead and alive, from within the stream channel (Ebasco Environmental and Water Engineering & Technology, Inc. 1992). Except for allowing better access to the stream and preventing the stream from leaving its existing course, the clearing of the vegetation does not seem to provide any appreciable habitat benefits. Regardless, there is extensive cover provided by small woody debris in the upper half of the reach and by many undercut banks associated with meanders in the lower portions.

13. Number of Pools: Many pools formed by scouring induced by the root wads of riparian vegetation in the upper portions of the reach and by meander formation in the lower portions.

14. Invertebrate Population: Invertebrate populations should be abundant and diverse.

15. Fish Population: A healthy fish population likely exists.

16. Water Temperature: Because of the narrow channel, warming of the water should be minimal during the summer except possibly in the lower section between old Highway 395 and the present Highway 395 alignment.

17. Vegetative Diversity: Since grazing has been restricted from the riparian zone, the vegetative diversity has probably increased, though it is not known whether to pre-grazing levels. Diversity is undoubtedly better than when much of the present main channel was dewatered.

18. Habitat Complexity: The habitat is complex with much riparian vegetation and small woody debris in the upper portions and meanders with extensive undercut banks in the lower portions that provide numerous pools and cover.

2. Reach 2

a. General Characteristics Prior to Development

Reach 2 extends from Highway 395 to the confluence with Rush Creek (from elevation 6,838 to 6,671) (Reach 2 includes subreach 4). The stream flowed through a narrow valley that cut through the alluvium and old lake terraces along Rush Creek. There was riparian vegetation, mainly willows, along this reach with a few larger black cottonwoods and Jeffrey pine near the confluence with Rush Creek (Ebasco Environmental and Water Engineering & Technology, Inc. 1992).

b. Developments Affecting the Reach

A specific impact to Reach 2 that was indirectly related to water development was the creation of what is known as the Parker Plug. This plug was created from the deposition of gravel spoils into the then dry Parker Creek channel at a California Department of Transportation gravel quarry operation a few hundred yards upstream from the confluence with Rush Creek between stream elevations 6,800 and 6,810. These materials were apparently deposited during years when diversions dewatered this portion of Parker Creek.

A culvert was installed to convey Parker Creek water under Highway 395. This culvert appears to be a complete barrier to the upstream migration of fish.

c. Status of Restoration

Since pre-1941 conditions have generally not been established for all restoration goals on Parker Creek such as they have for Rush Creek and Lee Vining Creek, individual comments will be made about Reach 2 for each restoration goal.

The following is a summary of the characteristics of the reach:

1. Length of the Main Channel: The present length of the main channel is approximately 5,500 feet. Since the stream is constrained to a fairly narrow valley, the original channel length has probably remained the same.

2. Sinuosity of the Main Channel: The sinuosity of the main channel is 1.366 which is probably similar to the pre-1941 condition.

3. Gradient of the Main Channel: The gradient is 0.030 ft/ft which is probably similar to the pre-1941 condition.

4. Length of Secondary Channels: The narrow valley precludes secondary channel development. An exception is immediately upstream from the confluence with Rush Creek where extensive deposits of gravel from the Parker Plug caused the stream to braid, but the 1995 flood flows have defined a single channel in this section of the stream.

5. Percentage of Stream Bank Length with Established Woody Vegetation: There is evidence of woody vegetation along most of this reach, though most of it apparently died when the reach was desiccated excepting in the lower portions where the stream approaches and enters the Rush Creek valley. There is little indication that the dead riparian vegetation is able to recover by sprouting from the root stock even though water has been restored to the channel. Riparian vegetation is in generally good condition in the last few hundred feet before the confluence with Rush Creek where spring flows apparently helped sustain the vegetation.

6. Area of Woody Vegetation on the Floodplain: The floodplain is narrow through most of this reach and especially in the middle portion of the reach. There are some buffalo berry and willow along the upper portions and willow, some black cottonwood, and a few Jeffrey pine where the stream enters the Rush Creek valley.

7. Area of Meadow on the Floodplain: The narrow floodplain supports no meadow areas with the exception of some very minor areas in the upper reach.

8. Average Width of the Main Channel: The width of the main channel is narrow and probably similar to pre-1941 conditions except where the stream joins Rush Creek. Extensive deposition of gravels from the Parker Plug has caused the stream to spread out with wide, multiple channels immediately above the confluence of the stream with Rush Creek. Substantial efforts recommended by the RTC were directed to re-establish the channel that had been filled by gravels at the Parker Plug. Much material was removed and boulders placed to protect the banks from additional erosion, but the work recommended by the RTC was not completed and subsequent high flows have eroded additional gravel downstream.

9. Spring Flow: There is spring influence represented by some black cottonwoods and Jeffrey pine near the confluence with Rush Creek.

10. Spawning Gravel Area: Some spawning gravel deposits exist in the upper third of the reach, but though there are extensive gravels farther downstream, the stream morphology does not favor spawning until below the area of the Parker Plug.

11. Area of Aquatic Vegetation: No areas of aquatic vegetation have been observed.

12. Amount of Cover: The condition of the riparian vegetation in the upper portions of the reach reduces the available cover but there are undercut banks in this area. There is essentially no cover in the middle portion where the Parker Plug is located. Good riparian development provides excellent cover in the lower one quarter of the reach.

13. Number of Pools: There are a substantial number of pools in the upper portion of the reach and some below the Parker Plug, but few have yet formed in the lower section immediately above the confluence with Rush Creek.

14. Invertebrate Population: Invertebrate populations should be high in numbers and diversity except in the Parker Plug section where populations and diversity are probably low.

15. Fish Population: A modest fish population probably exists except in the Parker Plug section.

16. Water Temperature: Water temperatures may be increased during the summer in the Parker Plug section.

17. Vegetative Diversity: Vegetative diversity is limited in the upper three quarters of the reach because of the die-back caused by desiccation, and where it was covered by the Parker Plug material, but it appears good in the area affected by springs in the lower one quarter.

18. Habitat Complexity: The lack of live riparian vegetation in the upper three quarters of the reach reduces habitat complexity. The middle third of the reach in the area of the Parker Plug is without habitat complexity. However, complexity appears good with healthy riparian vegetation, many pools, and accumulations of small woody debris in the area below the Parker Plug but above the Rush Creek valley. The 1995 flood flows have defined a single channel in the section of stream immediately above the confluence with Rush Creek, but no pools have yet formed though large woody debris is abundant.

VI. Proposed Restoration Treatments for Mono Basin Creeks

The goal of the restoration plan is to "restore, preserve, and protect the streams and fisheries in Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek," as stated in Decision 1631. The fundamental concept of the restoration plan is that flow management within the streams, in accordance with the Order of Decision 1631, will result in the restoration of the streams.

The LADWP feels the best mechanism to achieve this goal is by reestablishing functioning riverine-riparian ecosystems in all the streams. The objective by which the LADWP will achieve this goal is by providing varying stream flows which will result in a dynamic equilibrium between channel change, aggradation/degradation, vegetation, and other biotic components.

Riparian-wetland health (functioning condition), an important component of watershed condition, refers to the ecological status of vegetation, geomorphic, and hydrologic development, along with the degree of structural integrity exhibited by the riparian-wetland area. A quote from Prichard (1993) states: "A healthy riparian-wetland area is in dynamic equilibrium with the streamflow forces and channel aggradation/degradation processes producing change with vegetation, geomorphic, and structural resistance. In a healthy situation, the channel network adjusts in form and slope to handle increases in stormflow/snowmelt runoff with limited perturbation of channel and associated riparian-wetland plant communities." Again, the objective by which the LADWP will achieve this goal focuses on providing varying streamflows which, in time, will result in a dynamic equilibrium between channel change, aggradation/degradation, vegetation, and other biotic components. The purpose of monitoring is to determine whether the goal is being met by the objective. Specifically, vegetation transects, snorkeling, microhabitat, thalweg, longitudinal profile, temperature, habitat mapping, and aerial photography are all measures of change in the physical and biological structure of each stream. Success is measured in terms of positive differences between years in these parameters allowing for year type.

Fundamental to the restoration program is the development and maintenance of a healthy riparian system. The two dominant treatments that will accelerate riparian recovery and set the stage for physical processes to create a dynamic, self-sustaining stream system are proper flow management coupled with a grazing moratorium.

The proposed restoration program relies heavily on the restorative capabilities of natural stream processes. Thus, this plan does not require the continuation of physical alteration and modification of the stream channels. As previously indicated, nearly $5,000,000 has already been spent on implementing a wide range of modifications to stream channels and riparian systems. The following items respond to the requirements in Decision 1631 to make recommendations on elements listed in paragraph 8(a). (SWRCB, 201)

Instream Habitat Restoration Measures for Rush Creek (with Lee Vining, Walker, and Parker Creek Recommendations);

With the exception of placing large woody debris (LWD) in the creeks, LADWP does not intent on performing any instream habitat restoration measures in the Mono Basin creeks.

The LADWP proposal includes placing LWD located in the floodplain of Rush Creek and Lee Vining Creek in addition to the LWD stored at the Cain Ranch.

The placement of large woody debris (LWD) is a measure that will provide beneficial effects in the near future, now that the recovery of streamside vegetation is well underway. The addition of LWD will likely result in positive benefits to the streams by providing additional channel roughness and cover, thereby increasing habitat complexity. Complex pieces are preferred to maximize habitat complexity. Anchoring any woody debris will be completely avoided, allowing the stream to naturally rearrange LWD pieces during periods of high flows.

Large amounts of old woody debris, large and small, is present on the floodplains of Rush Creek. The LADWP proposes to place the larger more stable woody debris, for the first several years, utilizing hand crews. As vegetation continues to recover, the ability of these streams to handle woody debris and create habitat complexity will increase.

LWD located on-site will be placed by hand crews. LWD stored at Cain Ranch and LWD found off-site and that is too heavy to move by hand will be placed utilizing a helicopter.

<u>Proposal</u>

Large woody debris will be distributed in Rush Creek as follows:

- **2 pieces between elevations 6886 and 6882 in Reach 3A.**
- **9 pieces between elevations 6875 and 6840 in Reach 3B; six additional pieces will be placed in the rewatered channel.**
- **8 pieces between elevations 6829 and 6676 in Reach 3C.**
- **3 pieces in Reach 3D above the Narrows in the existing main channel, and nine pieces in the rewatered channel between elevations 6670 and 6639 in the rewatered channel.**
- **6 pieces between elevations 6594 and 6556 in Reach 4A.**
- **4 pieces between elevations 6545 and 6481 in Reach 4B.**
- **1 piece at elevation 6467 in Reach 4C.**

- **10 pieces between elevations 6445 and 6388 in Reach 5A (this reach includes what has been formerly considered Reach 5B).**

LADWP proposes to place LWD in Lee Vining Creek. The larger more stable woody debris located in the floodplain of Lee Vining Creek will be placed into the creek by hand crews. LWD stored at Cain Ranch and LWD found off site too heavy to move by hand will be placed utilizing a heavy-lift helicopter.

Proposal

Large woody debris will be distributed in Lee Vining Creek as follows:

- **3 pieces between elevations 6575 and 6546 in the main channel of Reach 3A, and six small pieces between elevations 6552 and 6516 in the A-4 channel of Reach 3A.**
- **5 pieces between elevations 6529 and 6478 in Reach 3B.**
- **3 pieces between elevations 6416 and 6402 in the right channel of Reach 3C, and three pieces between elevations 6414 and 6400 in the left channel of Reach 3C.**

Large amounts of old woody debris, large and small, is present on the floodplains of Lee Vining Creek. Some wood may be suitable for placing into the creek. The LADWP proposes to annually place, for the first several years, portions of this material with the use of hand crews. As vegetation continues to recover, the ability of these streams to handle woody debris and create habitat complexity will increase.

Schedule

LADWP proposes to conduct the field work during the first full field season after the SWRCB approves the plan. Because the cost to mobilize and demobilize is high, are goal is to complete the field work in one season.

Cost

The estimated cost for this is $305,000. The cost may be reduced if field conditions allow the use of a smaller helicopter.

Rewatering of Additional Channels of Rush Creek and Lee Vining Creek;

The objective for rewatering channels is to attempt to accelerate rising water tables within the floodplain to promote quicker recovery of riparian and floodplain vegetation. Natural processes to restore habitat are relied upon to the extent possible. Artificial measures do not duplicate the biodiversity resulting from natural recolonization of riparian communities; therefore revegetation by this method is preferred.

The action of rewatering these channels has the additional benefits of adding channel length as well as having the potential to create pockets of waterfowl habitat in backwater areas. Many wildlife species dependent on riparian communities will also benefit.

Watering of off-channel areas, depressions, and side channels -- especially those in the bottomlands of Rush Creek -- will have diversion channels constructed under the guidelines of the following criteria:

- Entrances of proposed diversion channels will be opened preferably with hand labor.
- Vertical excavations of two feet or less, and horizontal excavations (i.e., channel widths) of five feet or less are desirable for diverting water from the main channel.
- Minimal linear excavation should occur to ensure flow into a channel.
- Rewatering channels or other depressions will be conducted in such a way that the new channel is properly vegetated before higher flows are considered to ensure minimal damage and sustainability.
- Emphasis will be placed on minimizing site disturbances so that adverse impacts to existing vegetation and channels are not significant.
- Any rewatered area or channel will not be artificially revegetated until a five-year period determines the potential for natural seedling establishment and growth of existing plants. The lessons learned from past rewatering efforts along these streams clearly demonstrate natural recolonization of riparian vegetation quickly occurs in areas left undisturbed by construction activities.

Once a particular area or old channel has been rewatered, there will be no future maintenance to sustain it by performing annual cleaning of a diversion channel. From then on the stream will make the final determination on whether these channels should persist. Future changes in the division of flows between the rewatered channels and the main channel resulting from natural processes will be allowed to proceed. No additional work in succeeding years will be performed on the channels to maintain the opening. The stream will either accept or reject the channel.

Several channels in Lee Vining Creek have been rewatered. The six channels rewatered represent a significant increase in channel length and provide additional habitat to the creek. No additional channels are proposed for rewatering on Lee Vining Creek.

Proposal

The following channels on Rush Creek will be rewatered:

- *Reach 3A*: Entrances to two overflow channels (between elevations 6942 and 6927) have been blocked by the presence of artificial berms. Portions of these berms will be removed to the level of the original channelbed to allow water to flow into these channels. Minor modification will be required at the downstream meander to direct water into the left-bank channel at the upper end of the meander. Good habitat complexity exist in both proposed channels. The total length of both channels combined is approximately 980 feet.
- *Reach 3B*: All flow will be diverted from the channel on the right side of the island at elevation 6,881 feet into the former main channel of Rush Creek (the right side when looking downstream). The flow on the left side will be allowed to continue flowing down the existing main channel. Without further modification, the diverted flow should follow the former main channel alignment and rejoin the existing main channel at elevation 6,862. This will add approximately 1120 feet of channel. It is anticipated that groundwater recharge will increase thereby promoting regeneration of riparian vegetation.
- *Reach 3D*: The abandoned east side channel in Reach 3D, extending from elevation 6639 to 6614, will be rewatered. The channel will be restored as the main channel and only 5 cfs will be allowed to flow down the present main channel when flows in Rush Creek are 47 cfs as measured at the Mono Gate Return Ditch.
- *Reach 4A*: The abandoned east side 1A channel in Reach 4A will be rewatered via construction of a channel linkage from the existing main channel starting at an approximate elevation of 6584. The flow in the rewatered channel will be approximately 15 cfs of base flows. A total of approximately 1020 feet of secondary channel will be added. It is anticipated that recovery of floodplain vegetation will be significantly accelerated. This stretch of channel contains excellent habitat characteristics that will benefit the fishery. Intervention (i.e., excavation and filling) to develop the linkage will be as slight as possible.
- *Reach 4B*: The portion of the east side channel complex, in the vicinity of elevation 6500, will be rewatered. The flow in the channel will be approximately 10 cfs of the base flow. A channel linkage will be designed to minimize disturbance to the entrance site and avoid any unnecessary construction. It is anticipated that this channel will provide waterfowl mitigation benefits as well, as this channel has potential for water impoundments due to old beaver pond structures still persisting. The guidelines for constructed diversion channels presented at the beginning

of this section will be strictly followed. Total channel length rewatered is approximately 3300 feet.

INO

13 + 14

11

- ***Reach 4C*: Over 1300 feet of main channel immediately upstream of the "Ford" was abandoned when the stream downcut a new channel across the narrow neck of a large meander, in response to lowered lake levels. The former main channel (near elevations 6480 to 6451) will be rewatered. Consideration will be given when selecting the site that provides the easiest entrance and requires the least intervention. Approximately 10 cfs of base flow will be released into this channel when 47 cfs is measured at the Mono Gate Return Ditch. No heavy equipment work will be necessary in the new channel other than what would be required at the entrance. This action will replenish a significant portion of previously lost stream length and habitats due to channel abandonment. Waterfowl benefits are also anticipated.**

Schedule

LADWP proposes to begin the construction work during the first full field season after the SWRCB approves the plan. The goal is to complete as much work as possible during the first year of construction activities. Because there are uncertainties about the level of effort required to open many of the channels, it may be impossible for LADWP to open all of the channels in the first year. The channels may have to be opened during the course of two or more years. As such, the channels will be prioritized to allow those channels with the higher biological values to be opened first.

Cost

$180,000

Cost savings of approximately 15% may be realized if the effort to obtain environmental documents, permits and approvals for the six channels can be combined into one process.

Riparian Vegetation Restoration for Rush Creek and Lee Vining Creek;

A fundamental weakness of past restoration efforts is a lack of complete understanding of riparian vegetation dynamics. It is important to allow temporal considerations within ecological restoration. Vegetation processes associated with natural recovery trends will proceed over years and decades. The LADWP's focus of restoration is to restore the ecological functions of the riparian ecosystems rather than reconstructing a specific streamside community as it might have appeared at some previous point in time.

Part of the necessary recognition of the temporal aspects of riparian recovery include the pattern of establishment of willows and cottonwoods. The majority of seedling establishment of these species initially will be limited to floodplains and point bars that are inundated during periods of flood events. Given their ecological requirements, recovery of woody species in interfluves is still likely to occur, but at a slower pace.

Previous revegetation efforts did not consider the autecology of specific willow species that occur on Mono Basin creeks (i.e., *Salix lutea*, *S. lasiandra*, *S. exigua*, *S. lasiolepis*, etc.). Each of these species has distinct site requirements and ecological functions which are extremely important to recognize in any planning effort. Documenting their occurrence and re-establishment before any generalized planning and planting efforts is essential.

The stream scientists' work plan recommends that plantings of cottonwood be conducted "within the present or designed planform geometry that allows natural stand regeneration . . .". Recent field observations indicate that these locations are where regeneration is currently occurring. Because of the numerous and well-spaced seed sources existing along Rush and Lee Vining Creeks, there are few locations, if any, where seed dispersal has been limiting on suitable regeneration sites.

An appreciation of site potential is critical in obtaining successful regeneration of riparian species. A vegetation community cannot be forced into a site where it cannot be self-sustained. Temporal considerations should be considered at certain sites because they must often undergo successional processes before they can sustain riparian communities. Thus, attempts to force sites into a desired vegetation condition before needed site conditions occur are usually unsuccessful.

With the continuation of permanent flows and the elimination of livestock influences on regeneration in the riparian zones, sustainable cottonwood and willow communities are currently developing and will undoubtedly continue to occur. The degree of vegetation recovery will be in direct response to the hydrological dynamics and geomorphic substrates of the ecosystem. A return to pre-Euroamerican settlement conditions cannot be realistically achieved, regardless of how much it is desired. Many areas do not support the same hydrologic and geomorphic conditions existing in prior conditions.

In the recent vegetation assessment provided to the RTC (Messick, 1994), it is stated that vegetation recovery has occurred on 34 acres within the last 5 years. This represents approximately 23 percent of the 145 acres lost between 1940 and 1989 -- a 23 percent recovery in approximately four to five years for an area that had experienced nearly a half century of degradation represents an exceptional rate of recovery, especially in light of recent prolonged drought conditions of the early 1990s. This situation also indicates that additional recovery of native plant communities should be expected to continue as the hydrologic reconnection of subsurface water pathways, depressional wetlands, side channels, etc., continue to occur.

Based on input from Dr. Platts, Dr. Trush, Dr. Ridenhour, and Mr. Hunter it appears that planting of the interfluve sites with Jeffery pine is necessary and reasonable due to their slow regeneration rates and the need to accelerate "Large Woody Debris" sources on the floodplains of Rush and Lee Vining creeks. Since black cottonwood plantings would only last for one generation and does not create a sustainable cottonwood community, planting of this species will not be conducted. Areas to be planted will be identified during the first field season after the plan is approved.

In 5 years we will have a much clearer picture of the natural recovery of the ecosystem. Especially since numerous channels will have been rewatered improving groundwater tables and promoting riparian regeneration. If water tables rise in the next few years riparian species should respond and new areas of natural regeneration can be mapped. This will provide scientists a better understanding of where it would be ecologically and economically most effective to replant.

Proposal

Based on the above considerations, the LADWP will conduct a planting program as follows:

- **LADWP considers the rewatering of side channels to be the most effective treatment to establish riparian and wetland vegetation. Promoting natural colonization utilizing this method is preferred because artificial measures are not capable of matching the biodiversity composition that naturally establishing riparian communities exhibit. Therefore, there will be a five-year planting moratorium on rewatered areas.**
- **After five years, a qualified riparian ecologist will be retained by the LADWP to assess the need for future plantings.**
- **In the interim, plantings will be undertaken in the following areas:**
  1. **Lee Vining Creek;**
     - a) **Lee Vining Creek in Reach 3C/3D below the County road**
     - b) **LADWP proposes to plant Jefferey pines in interfluve areas that are currently lacking "Big Wood". Areas targeted for planting will be site suitable for regeneration based on Jeffrey pine species requirements. These sites will be finalized during the first full field season after field reconnaissance. It is estimated that approximately 250 Jefferey pines will be planted; the actual number will be determined based on acreage of suitable sites.**
  2. **Walker Creek;**
     - a) **Willows will be planted along the stream banks of Reach 1 between old Highway 395 and Highway 395.**

   b) Willows will be planted along stream bank of reach 3 between Highway 395 and elevation 6,760.

3. Parker Creek
   a) Willows will be planted along the stream banks of Reach 1 between old Highway 395 and Highway 395.
   b) Willows will be planted along stream bank of reach 3 between Highway 395 and elevation 6,750.
4. Rush Creek
   a) Rush Creek in Reach 3B, in the vicinity of the old Highway 395 bridge disturbed by historic road, grazing, and dewatering activities and any sites disturbed by rehabilitation construction activities (i.e., Channel 10 complex)
   b) The LADWP will plant the interfluve and upper terrace sites that are currently lacking Jeffery pine. As is the case with Lee Vining Creek, Jeffery pine will be planted in sites suitable for regeneration based on species requirements. Reaches targeted for this effort extent from reach 3B through 5A above elevation 6392 on Rush Creek. It is estimated that approximately 750 Jeffery pines will be planted; the actual number will be determined based on acreage of suitable sites.

Planting of vegetation will be conducted to correspond with the proper site potential each location has regarding expected riparian communities. After the site potential has been determined, and, based on existing conditions, appropriate species will be planted which are best suited for the location.

Schedule

Planting will begin during the first full field season after the SWRCB approves the plan. This is contingent upon the support and cooperation of the parties in organizing youth groups or other field hands to assist in the planting. If additional support is not garnered, then we would anticipate starting in the second field season after the plan has been approved by the SWRCB. The planting would be done over a three year period. Depending on the level of support from youth groups and volunteers, we may be able to complete the work in two field seasons.

Cost

$220,000

$50,000 to $73,000 per year for three years. The low end assumes using youth groups and volunteers and no heavy equipment. The high end assumes using LADWP crews and heavy equipment.

Costs are contingent on the level of support LADWP receives from youth groups and volunteers. Costs are also depended on the type of substrate the revegetation work is being carried in. If the substrate consists of primarily cobble, then a backhoe equipped with an auger will have to be used. If the substrate consists of fines and cobble, the work can be performed using hand crews and at a much quicker pace.

Sediment Bypass at Lee Vining Creek Intake;

The purpose of providing sediment passage at the diversion structures is to allow the reaches below the conduit to continue to receive the sediment carried by the creek. Sediment plays an important role in maintaining the integrity of the creek system to provide habitat suitable for fish. The transportation of sediment is a mechanical action, where the size that can be transported depends on the velocity of the flows. The majority of sediment is transported during high flows. The process is essential, however not very rapid; the results of the interception of sediment may go unnoticed for decades.

LADWP's diversion structures act as desiltation basins, trapping sediment transported by the streams. To properly operate the diversion facilities, LADWP normally cleans the diversion facilities of accumulated sediment after high flow events, approximately every 3 to 5 years. The dredged material is either accumulated on site, or transported elsewhere.

LADWP proposes to implement a program to allow sediment and bedload to carry down pass the Intake facility. The program would necessitate changing operating and maintenance practices and allowing Lee Vining Creek to be flow through. Maintenance practice in the past involved removing the sediment and debris from the pond and consequently from the system. The program would include a means of returning the bedload material back to the stream system.

Other alternatives were considered but were not considered economically feasible. One alternative involves the construction of a barrier wall inside the pond and significant modifications to the Intake facilities. Retaining the pond is necessary to operate our diversion facility. The modifications would allow the streams to flow through carrying sediment, but also allows diversion when the appropriate conditions for that arise. This alternative could work, and would also achieve the result of preserving the function of the streams, albeit at a much larger cost. The estimate for this alternative at Lee Vining Creek is $1,140,000. Other disadvantages to this alternative are some continuing maintenance costs, and the likelihood of construction impacts.

Proposal

LADWP proposes to allow the sediment transport function of the creek to continue. This will be accomplished by modifying LADWP's current dredging operations. Instead of removing the sediment and disposing of it, LADWP will modify the current operation to return the material to the system. Each year, from October through March, the pond will be gradually drawn down and the entire flow of the creek allowed to flow through outlet gates located on the bottom of the facility. This will allow the stream to gradually erode the accumulated material from the bottom of the pond and carry it through the system. This process will move material through the system; however, it may not result in removing all of the material accumulated in the pond. As such, the program may also involve mechanically placing dredged material from the pond to lower Lee Vining Creek. Before high flow events, LADWP will distributed the dredged material along the streambed downstream of the Intake. The dredging will be done prior to a high flow event. This will ensure that the sediment will be distributed through the system without overloading the system. The plan is to place the piles in a manner which will allow the stream to have access to the sediment and gradually erode the piles. It is estimated that the cost to LADWP will be approximately $13,000 each time the operation is performed. These costs are above and beyond the cost already incurred by LADWP in cleaning the ponds.

Schedule

Flow through operation will commence the first October after the SWRCB approves the restoration plan.

Dredging will occur every 3-5 years or before a high flow event.

Cost

Flow Through

Capital costs are $10,000 to improve Intake facility.
Operation and Maintenance cost are $5,000 annually.

Dredging

Costs above our normal operation and maintenance is $13,000 for each application.

Flood Flow Contingency Measures;

One of the concerns expressed in the past about flow management of the Mono Basin creeks is that of high streamflows. It was felt that the Mono Basin creeks might not be capable of adequately sustaining high flow events. One of the guidelines for the RTC was that "it may be appropriate to recommend actions to attenuate high flows until the streams' ability to beneficially accommodate high flows is restored."

After examining the high flow events of 1995, the stream scientists apparently do not agree with this policy. Based on input received from the stream TAG, the LADWP attenuated the peak flows on Lee Vining Creek. At the September 11, 1995 Stream TAG meeting, however, the stream scientists indicated that they regretted attenuating the peak flow. On Rush Creek, the peak flow was allowed to spill over Grant Lake and into the lower portion of the creek. The stream scientists agreed that the high flow was beneficial to the creek.

The LADWP agrees with the stream scientists and will not divert the peak flows on the Mono Basin creeks simply for the sake of "protecting" the creek. The creeks apparently do not need this type of protection. The LADWP will release the peak flows down the creeks when it can do so without adversely affecting its Mono Basin water supply. During the transition period, peak flows of each creek will be bypassed for the large majority of years.

During the 1995 runoff, flows in Walker Creek and Parker Creek exceeded the capacity of the culverts under Highway 395. The capacity of the culverts proved to be insufficient to handle the high flows, hence the flows in each creek were attenuated to avoid flooding Highway 395. The LADWP will monitor the road culverts during high flows until Caltrans has an opportunity to replace them with larger culverts. Caltrans has indicated that they can replace them in the year 2000 during the proposed widening of Highway 395. A copy of their letter (dated October 12, 1995) is included as Appendix V.

Proposal

The LADWP will not divert the Mono Basin creeks for the purpose of protecting the stream from high flow. If there is flooding potential to Highway 395 or other facilities, the LADWP will divert the peak flows and use Grant Lake reservoir or Lee Vining Conduit releases to prevent damage to facilities.

Schedule

LADWP will make adjustments to the flows when requested by Caltrans.

Cost

Included in normal operation and maintenance costs.

Limitations on Streamcourse Vehicular Access;

Several unpaved roads in the Rush and Lee Vining creek floodplains have been identified by LADWP for closures. These roads are impacting or have the ability to inhibit the recovering riparian vegetation. On Rush Creek there are thirteen sites proposed and on Lee Vining Creek there is one site proposed.

Proposal

LADWP will close several roads in the floodplains on Rush and Lee Vining creeks. Figure 5 indicates the proposed closures for Rush Creek. Figure 6 indicates the proposed closures for Lee Vining Creek. This proposal include all lateral roads that are affecting or have the potential to affect wetland or riparian vegetation. The cutoff point for road closures, to the extent possible, will be at the interface of the upland vegetation and the functional floodplain. Parking areas will be considered at the junctions of closed roads.

The LADWP will continue to allow access to existing main roads. Roads not under the jurisdiction of LADWP have not been considered. Decisions concerning those road will be left with the responsible agency.

The LADWP will contact the Mono County Road Department to recommend that the "ford crossing" not be repaired with a large culvert as in past practices. Instead we will recommend that Mono County either consider closing the road or installing an "Arizona crossing" to provide fish passage and allow vehicles to cross except during periods of high flows. A properly constructed "Arizona crossing" would allow the creek to migrate and gain sinuosity without locking the creek into a fix position.

Schedule

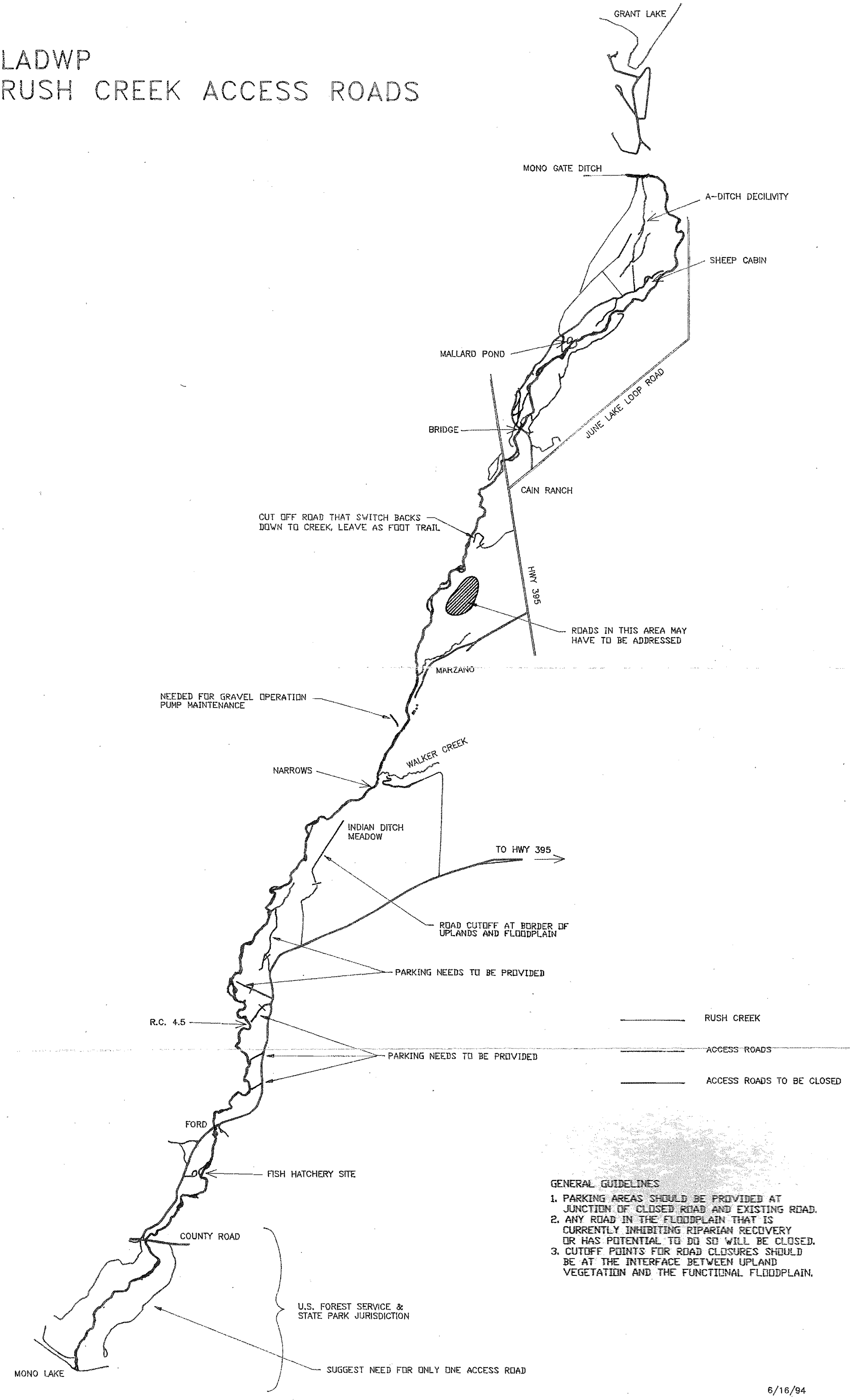
Work will begin during the first full field season after the SWRCB has approved the plan. The work may require three seasons to complete.

Cost

The total expenditure is approximately $115,000.

Figure 5: LADWP Rush Creek Access Roads

LADWP
RUSH CREEK ACCESS ROADS



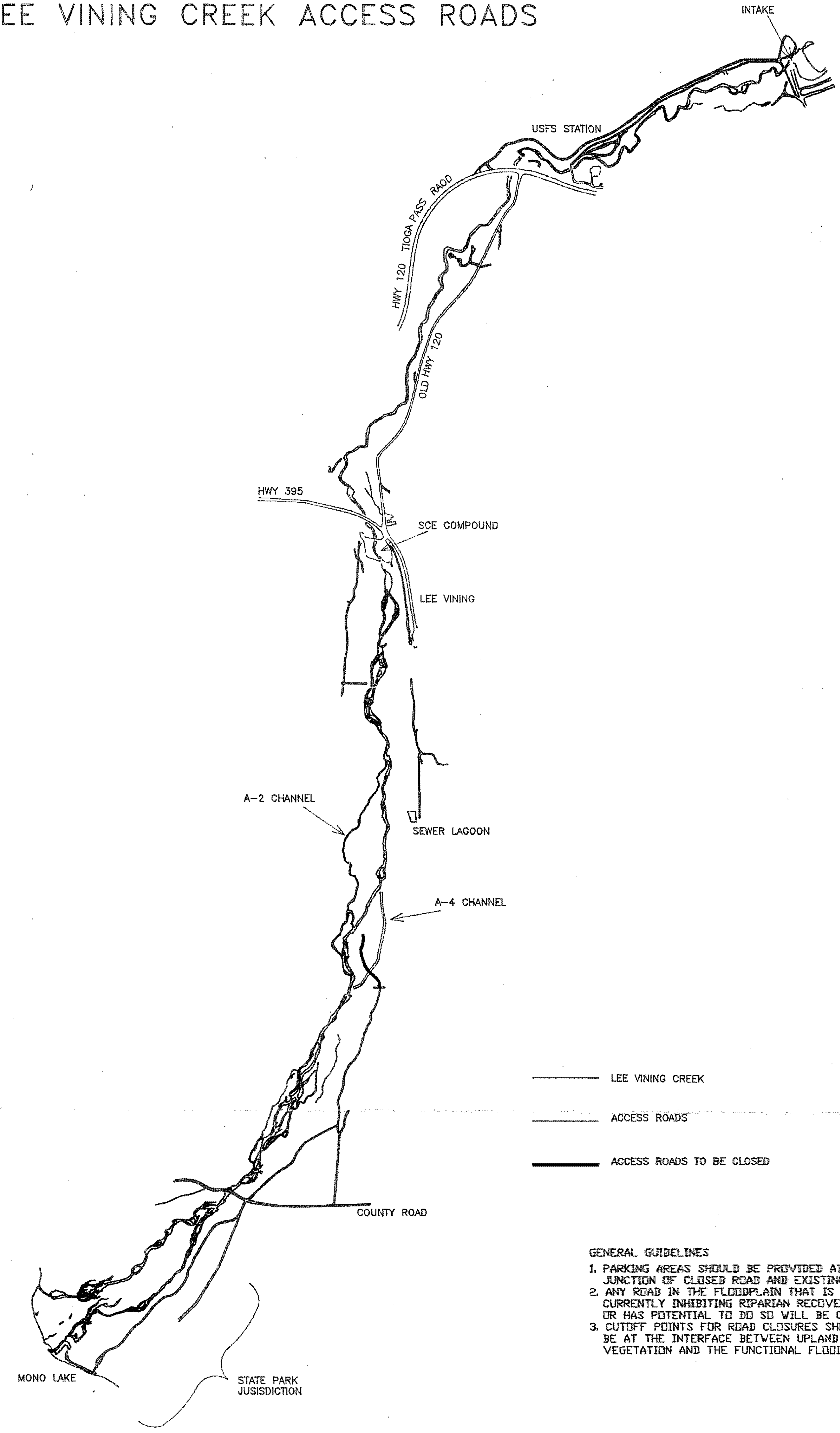
GENERAL GUIDELINES

1. PARKING AREAS SHOULD BE PROVIDED AT JUNCTION OF CLOSED ROAD AND EXISTING ROAD.
2. ANY ROAD IN THE FLOODPLAIN THAT IS CURRENTLY INHIBITING RIPARIAN RECOVERY OR HAS POTENTIAL TO DO SO WILL BE CLOSED.
3. CUTOFF POINTS FOR ROAD CLOSURES SHOULD BE AT THE INTERFACE BETWEEN UPLAND VEGETATION AND THE FUNCTIONAL FLOODPLAIN.

6/16/94

Figure 6: LADWP Lee Vining Creek Access Roads

LADWP
LEE VINING CREEK ACCESS ROADS



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3. CUTOFF POINTS FOR ROAD CLOSURES SHOULD BE AT THE INTERFACE BETWEEN UPLAND VEGETATION AND THE FUNCTIONAL FLOODPLAIN.

6/16/94

Construction of Fish and Sediment Bypass System around Licensee's Diversion Facilities on Walker Creek and Parker Creek;

Fish Passage

The Walker and Parker creek intakes have been recommended for modification to allow fish and sediment passage by the stream scientists. There is at this time, however, no data to indicate that the structure is a limiting factor affecting fish population or composition.

The LADWP proposal is to not construct any fish passage facilities around the diversion structures at Walker and Parker creeks. The proposal is based on two factors: first, the stream evaluation reports prepared by EBASCO (1992) produced no data or analysis that identifies whether fish migration blocks, if they exist, were a problem prior to LADWP's diversion of Walker and Parker creeks, or after the diversion via the conduit; second, any fish passage at Walker and/or Parker creeks would be very expensive (it is estimated that fish passage at these facility would cost approximately $1,000,000 each).

Under the LADWP proposed restoration, the fishery at Walker and Parker creeks will be better off, as the creeks will be in a flow-through condition the majority of the time, and the extensive diversions to irrigate Cain Ranch complex will not be taking place.

Sediment Bypass Facilities

The purpose of providing sediment passage at the diversion structures is to allow the reaches below the conduit to continue to receive the sediment carried by the creek. Sediment plays an important role in maintaining the integrity of the creek system to provide habitat suitable for fish. The transportation of sediment is a mechanical action, where the size that can be transported depends on the velocity of the flows. The majority of sediment is transported during high flows. The process is essential, however not very rapid: the results of the interception of sediment may go unnoticed for decades.

LADWP's diversion structures act as desiltation basins, trapping sediment transported by the streams. To properly operate the diversion facilities, LADWP normally cleans the diversion facilities of accumulated sediment after high flow events, approximately every 3 to 5 years. The dredged material is either accumulated on site, or transported elsewhere.

LADWP proposes to implement a program to allow sediment and bedload to carry down pass the intake facilities. The program would necessitate changing operating and maintenance practices and allowing Walker and Parker creeks to be flow through. Maintenance practice in the past involved removing the sediment and debris from the ponds and consequently from the systems. The program would include a means of returning the bedload material back to the stream systems.

Other alternatives were considered but were not considered economically feasible. One alternative involves the construction of a barrier wall inside the ponds and significant modifications to the intake facilities. Retaining the ponds is necessary to operate our diversion facilities. The modifications would allow the streams to flow through carrying sediment, but also allows diversion when the appropriate conditions for that arise. This alternative could work, and would also achieve the result of preserving the function of the streams, albeit at a much larger cost. The estimate for this alternative at Walker and Parker creeks is $600,000 each. Other disadvantages to this alternative are some continuing maintenance costs, and the likelihood of construction impacts.

Proposal

Fish Passage

LADWP is not proposing to provide for fish passage.

Sediment Bypass

LADWP proposes to allow the sediment transport function of the creeks to continue. This will be accomplished by modifying LADWP's current dredging operations. Instead of removing the sediment and disposing of it, LADWP will modify the current operation to return the material to the system. Each year, from October through March, the ponds will be gradually drawn down and the entire flow of the creeks will be allowed to flow through outlet gates located on the bottom of the facilities. This will allow the streams to gradually erode the accumulated material from the bottom of the ponds and carry it through the system. This process will move material through the systems; however, it may not result in removing all of the material accumulated in the ponds. As such, the program also involve mechanically placing dredged material from the ponds to the creeks below the Intakes. Before high flow events, LADWP will distributed the dredged material along the streambeds downstream of the Intakes. The dredging will be done prior to a high flow event. This will insure that the sediment will be distributed through the systems without overloading them. The plan is to place the piles in a matter which will allow the streams to have access to the sediment and gradually erode the piles. It is estimated that the cost to LADWP will be approximately $13,000 for each pond each time the operation is performed. These costs are above and beyond the cost already incurred by LADWP in cleaning the ponds.

Schedule

Flow through operation will commence October 1998.

Dredging will occur every 3-5 years or before a high flow event.

Cost

Flow Through

Capital costs are $20,000 to improve both intake facility.
Operation and maintenance cost are $5,000 annually.

Dredging

Costs above our normal operation and maintenance cost is $26,000 for both ponds per application.

Livestock Grazing Exclusions in Riparian Areas Below Licensee's Point of Diversion on all Diverted Streams after the Period Specified in Term 5 of this Order;

The control of grazing within the floodplains of Rush, Lee Vining, Parker, and Walker creeks has been the second most important restoration treatment to date. Because of the stream conditions prevalent before the moratorium, it was essential to eliminate grazing to accelerate recovery of a healthy riparian system.

Proposal

The LADWP will continue the grazing moratoriums on the above-mentioned creeks for a minimum of ten years following the acceptance of this restoration plan. Grazing thereafter will only be on a limited basis at most, and only after careful analysis of vegetation conditions has been evaluated. Any proposal for future grazing will require SWRCB approval.

Livestock grazing could commence when herbaceous vegetation is vigorous with sufficient control over groundcover. Rooting structure is adequate to protect riparian soils and streambank morphology. Woody vegetation is vigorous and large enough to withstand grazing use and have the ability to produce the necessary age classes to sustain necessary canopy cover.

Schedule

Moratorium in place. Continue moratorium for a minimum of 10 years.

Cost

Cost to LADWP are insignificant. Impacts to the local economy are beyond the scope of this plan.

Feasibility Evaluation of Installing and Maintaining Fish Screens at all Points of Diversion from the Streams, including Irrigation Diversions on LADWP Property;

LADWP will consult with the Department of Fish and Game (DFG) on the feasibility of installing and maintaining fish screens on all of its diversions in the Mono Basin. LADWP may decide to resume limited irrigation below the conduit on Cain Ranch. If irrigation is resumed, LADWP will consult with DFG on the need for installing fish screens on those facilities.

Article 3 of Chapter 3 of Part 1 of Division 6 of the Fish and Game Code applies to conduits with a flow capacity greater than 250 cfs. Generally, the DFG can order the owner of the conduit to install a screen on the conduit when in the opinion of the DFG a screen is necessary to prevent fish from passing into the conduit.

Article 4 of Chapter 3 of Part 1 of Division 6 of the Fish and Game Code applies to conduits with a flow capacity of less than 250 cfs. Generally, DFG shall examine new or existing conduits and may install fish screens when in the opinion of the DFG such a screen is practical and necessary.

Proposal

Contact DFG regarding the necessity of installing fish screens.

Schedule

The LADWP will contact the DFG within 6 months after the SWRCB has adopted the restoration plan.

Cost

The cost for installing fish screens on diversion facilities are determined by the Fish and Game Code.

Grant Lake Operations and Management Plan;

See Grant Lake Operations and Management Plan.

Additional Measures Considered;

During the stream TAG process, measures in addition to those listed in Decision 1631 were suggested. The Work Plan prepared by the stream scientists also lists recommendations beyond those of Decision 1631. The following are LADWP's proposals made in addition to the requirements listed in the decision.

Rehabilitate the Return Ditch

LADWP proposes to rehabilitate the Mono Gate Return Ditch to increase the capacity to approximately 380 cfs and to improve the reliability.

The scope of the work includes dewatering the Ditch, dredging the accumulated sediment, and stabilizing the side slopes susceptible to seepage and erosion. The SWRCB requested LADWP to prepare a rehabilitation plan for the Ditch and a copy of the rehabilitation plan submitted by LADWP is included in Appendix IV. Rehabilitating the Ditch will increase its current capacity of 160 cfs to its historical capacity of 380 cfs. This facility improvement will allow LADWP to release base and maintenance flows in accordance with Decision 1631. It should be noted that flows above the capacity of the Ditch can be attained in Rush Creek during wet years, without rehabilitating the ditch. This can be accomplished by spilling Grant Lake reservoir (as occurred during July and August of 1995) and through releases from the Lee Vining Conduit spillway.

Proposal

LADWP will rehabilitate the Mono Return Ditch. This is the most economical and feasible alternative to provide channel maintenance flows in Rush Creek. In addition, rehabilitating the Ditch will provide LADWP with the necessary control to release base and peak flows for all year types. Peak flows in excess of 350 cfs can be achieved by utilizing the Lee Vining Conduit spillway and during extreme wet years by spilling Grant Lake reservoir.

Schedule

The design work is scheduled to start shortly after the SWRCB approves LADWP's plan. The entire project duration is estimated to be two years. Actual construction will last approximately two months.. This schedule is highly dependent on LADWP's ability to complete environmental documents and obtain permits and approval from several regulatory agencies.

Cost

The estimated cost to rehabilitate the ditch is approximately $885,000.

Removal of Bags of Spawning Gravel

The LADWP agrees with the stream scientist's proposal to distribute bags of gravels into the stream that are currently located immediately upstream of an old diversion dam on Lee Vining Creek.

Proposal

The bags of gravel, located immediately above the former diversion dam at elevation 7130, will be removed. The top layer of bags will be opened each

year; the bags will be removed, and their contents will be allowed to be redistributed by the stream.

Schedule

The LADWP will remove the first layer of bags in the fall of 1996.

Cost

The work will be performed inconjunction with other stream restoration work.

Removal of Limiter Logs

LADWP agrees with the stream scientists recommendation to remove all limiter logs on Lee Vining Creek. The work will also involve reworking the channel entrances to remove accumulated sediment and debris from obstructing the flow into the channels.

Proposal

All remaining limiter logs on Lee Vining Creek will be removed. Sediment and debris will be removed from the entrances of the channel.

The limiter logs at the entrance to the A-1 and A-4 channels will be removed, accumulated gravels and cobble in the entrance to the channels will be removed, boulders used to hold the limiter logs in place will be removed, and a large boulder or a large piece of woody debris will be placed immediately upstream in the main channel to better direct flows into the A-1 and A-4 channels.

The limiter logs at the entrance to the B-1 channel will be removed, the accumulated gravels and cobble in the entrance to channels B-1 and B-2 will be removed, the boulders used to hold the limiter logs in place will be removed, and a large boulder or a large piece of woody debris will be located immediately upstream in the main channel to better direct flows into the B-1 and B-2 channels.

Placement of limiter logs at any channel entrances will not be considered in the future.

Schedule

Work to be performed in the fall of 1996.

Costs

The estimated expenditure for carrying out the work on the six channels is $16,500.

Parker Creek Plug

Some work should be done to reduce the rate of gravel into the stream from hillslope sources during high flow events; however, there may be benefits in allowing these materials to be slowly incorporated into the Rush Creek system. Parker plug materials represent a long-term source of gravels and fines for Lower Rush Creek. The economic and ecological consequences of various alternatives should be weighed in determining what work should be implemented at this site.

Proposal

The LADWP staff contacted Caltrans in mid February, 1996, to inquire on the status of Caltrans plans for the "Parker Plug" site. Caltrans indicated that its intent is to submit reclamation plans to the LADWP for the site in early summer 1996. The plan will closely follow the recommendations contained in the stream scientist's Work Plan on page 188 regarding slope, channel definition, and providing enough room for development of a small floodplain.

Schedule

Summer 1996.

Cost

Cost will be borne by Caltrans.

Additional Measures Considered but not Proposed;

The following are proposals that were made during the stream TAG process or proposed by the stream restoration scientists, but are considered either unnecessary or not feasible.

Spawning Gravel Replacement Programs Downstream of Licensee's Point of Diversion on Rush Creek, Lee Vining Creek, Walker Creek, and Parker Creek;

LADWP will not add spawning gravel to the Mono Basin streams. LADWP and some experts do not believe that spawning gravels are lacking in any of the project streams. As vegetation has increased throughout the floodplains and interacted with the flow regimes, spawning gravels have become more apparent in the system. At numerous sites, "new" accumulations of spawning gravels were observed after last year's (1995) flow events.

Construct Pools

The construction of pools is not necessary. With proper flow management, recovery of riparian vegetation, and debris accumulations, the creek will form natural, complex pool habitats.

Remove Sod and Sediment

Removing sod and sediment is not necessary. Previous treatments on Lee Vining Creek included rewatering one of the channels without disturbing any of the sod or sediment that had accumulated. Within a very short period, the channel showed progress of naturally clearing itself of the sod and sediment.

Place Large Boulders

This action is not necessary for the Mono Basin creeks, cobbles and boulders are not in short supply.

Rewater Spring Sources

Attempts at rewatering "spring" sources by irrigating upland areas are of questionable value given the current information. Further, they would be costly, likely require water in addition to Decision 1631 flows, and impact flows on Walker and Parker creeks. Therefore, the LADWP will not propose rewatering springs.

Grant Lake Outflow Facility

There currently exist two methods for releasing water into lower Rush Creek from Grant Lake reservoir -- the Mono Gate Return Ditch (Ditch) and the Grant Lake Dam Spillway. In its current condition, the Ditch cannot satisfy peak flow releases as stipulated in Decision 1631 (200 cfs and 300 cfs during normal and wet years, respectively). Due to the accumulation of sediment, aquatic plant growth, erosion and seepage, and the potential for side slope failure, the Mono Gate Return Ditch capacity is currently limited to 160 cfs.

Several proposals which have been suggested for releasing higher flows into lower Rush Creek involve the construction of new capital facilities. These proposals include pump/siphoning over the spillway, pumping over the dam crest, or tunneling a new reservoir outlet. Both the pump/siphon and pump station alternatives would be used in conjunction with the Ditch while the new outlet would eliminate the need for the Ditch. All three alternatives provide water for Reach 1 of Rush Creek which was dewatered after the construction of Grant Lake Dam; however, only the new outlet provides water to Reach 1 on a continuous basis. Reach 1 corresponds to the historic Rush Creek channel that extends from Grant Lake Dam to the confluence of Rush Creek and the Mono Gate Return Ditch.

Proposal #1: 300 cfs Siphon

One alternative for meeting the flushing flow requirements is to add a siphon and priming pump system which would convey water from Grant Lake Reservoir to Reach 1. This flow would supplement flow from the Ditch at the confluence with Rush Creek. The siphon system would include a portable pump which would be used to prime the pipe and initiate the siphoning action, approximately 7,500 feet of pipe (3-42 inch diameter pipes 2,500 feet in length), siphon breakers, pipe supports, appurtenant fittings, an energy dissipating cascade structure, and a stilling basin. Advantages of a siphon/pump delivery system versus a pump only system is the energy/cost savings attributable to operating the pumps as well the capital expense of constructing a large scale pump station. A small mobile priming pump could be used to slowly fill the siphon pipes and induce the siphoning action. Using a single small portable priming pump eliminates the costs of a large scale pump station which would require an electrical substation and power supply. However, two significant physical limitations exist when utilizing a siphon system:

1. The crown of a siphon (i.e. the point of highest elevation) is physically limited to 1.133B feet above the headwater level where B is the barometer reading in inches of mercury. Once the crown of the siphon surpasses this difference, the absolute pressure in the siphon falls below the vapor pressure of water. For Grant Lake Reservoir, the absolute maximum difference allowed between the crown and the reservoir water surface elevation is approximately 26 feet. When the crown of the siphon surpasses this difference, the absolute pressure in the siphon falls below the vapor pressure of water, creating a cavitating atmosphere. It should be noted that the operational range for Grant Lake is approximately 48 feet (i.e. the difference in elevation between the spillway crest and minimum storage of 11,500 acre-feet), exceeding the maximum functional siphon lift.

   Furthermore, constructing a siphon over the spillway would be subject to approval by the State Department of Water Resource's Division of Safety of Dams. An application for alteration of the spillway would be needed to be submitted and approved. The application may be approved if it is shown that the capacity and dependability of the spillway is not adversely affected. If construction of a siphon on the spillway or buried beneath the spillway is not permitted, the siphon would traverse over the crest of the dam, a minimum of 15 feet above the spillway level. Thus, if alterations to the spillway are not permitted, the functional range of the siphon would be reduced to 11 feet below the spillway elevation.

   Furthermore, since the crest of the siphon is located at the top of the pipe, the functional range would be 0-11 feet, depending on the size of pipe. Using a single 78-inch diameter pipe would reduce the functional range to 4 feet. Utilizing 42-inch diameter pipes increases the functional range to 8 feet below the spillway elevation.

2. A second limitation of a siphon is the inability to effectively regulate flows. Siphons are typically utilized as reservoir spillways which discharge flow based solely on the hydraulic conditions. Siphon spillways operate automatically until either the headwater falls below the intake elevation or until a siphon breaker admits atmospheric pressure at the crest of the siphon. When a siphon breaker is activated, air at atmospheric pressure is introduced at the crest of the siphon, canceling the suction and completely terminating flow. Regulating a siphon by means of a valve at the intake or terminus is not operationally feasible as it tends to disturb the siphoning action. The flow through the siphon is a function of pipe diameter, length, and water surface elevation. Therefore, ramping of flows could not be adjusted consistently or accurately. A very limited amount of ramping can be accomplished by utilizing a multiple pipe system. Utilizing three 42-inch diameter pipes, the flow can be adjusted in 100 CFS increments.

The cost for a 3 pipe siphon system (42-inch diameter) and priming pump is estimated at $5.6 million. The cost of the siphon includes a portable pump system, piping, pipe supports, energy dissipating cascades, and stilling basin. Any significant alterations to the dam or spillway, including burying the siphon beneath the spillway, would significantly increase the cost of construction. The estimate does not include operating and maintenance costs. Operationally, it is much more practical to consider a pump system rather than a siphon system.

Cost

The cost for this alternative is approximately $6,470,000. This estimate includes the cost of rehabilitating the Return Ditch, since the Return Ditch would be used in conjunction with the siphon.

Proposal #2: Pump Facility over Grant Lake Dam

Operationally, it is more practical to install a pump station. This alternative would pump water over the crest of Grant Lake Dam. The pump station site would be located near the crest of the dam. Unlike the siphon, a pump station will provide flexibility in releasing controlled flows at various reservoir elevations. However, transitional flows during ramping would require multi-speed motors or several various sized motors. Such specialized features will tend to increase total project cost.

A pump system would transport up to 300 CFS of water from the reservoir, over the crest of the dam, and into Reach 1 of Rush Creek. This flow would supplement flow from the Return Ditch at the confluence with Rush Creek. The pump system would include a pump station facility, approximately 2,500 feet of 78 inch diameter pipe, pipe supports, appurtenant fittings, an energy dissipating cascade structure, stilling basin, and an electrical substation. Variable speed pumps and a detailed piping system would be required for ramping flows. The pump station provides the flexibility of operating under various reservoir surface elevations. A pump station also provides a limited amount of flexibility for regulating flows. However, operation and maintenance costs, including electrical needs, would be very significant.

The estimated cost for a pump system with a 78-inch pipe delivery system is estimated at $13.6 million. The cost estimate does not include operation or maintenance costs of the pump station. The construction cost for a 300 CFS pump station, not including the delivery system, is estimated at $6 million dollars. This is a rough estimate based on the historic cost of construction for a similar size pump stations. For instance, LADWP's Stone Canyon Pump Station in Los Angeles, which has a capacity of approximately 140 CFS, had a total cost of construction of approximately $15 million dollars. In city pump stations range in costs from $1.5 to $5 million dollars per 50 CFS unit. Although the pump plant at Grant Lake would operate more than double the capacity of the Stone Canyon Pump Station, the cost is estimated at less than half the cost assuming a no frills project.

Typical pump stations constructed within Los Angeles must satisfy aesthetic requirements, have limited site accessibility, include noise suppression and abatement designs, and incorporate remote controlled equipment. Many of these features are not included in the estimated cost of the conceptualized pump system. The estimated cost for the project may be significantly greater when considering installation of power lines to power the pump station.

Cost

The preliminary cost estimate to construct a 300 cfs pump station is $14.5 million. This estimate includes the cost of rehabilitating the Return Ditch, since the Return Ditch would be used in conjunction with the siphon. This estimate, however, does not include annual operation and maintenance costs nor the cost to bring power to the site.

Proposal #3: New outlet Structure and Tunnel for Grant Lake Dam

The final alternative consists of constructing a new 600 CFS outlet structure and tunnel. This alternative does not require rehabilitation of the Ditch. Instead, all flows would be released from the new outlet structure and delivered to Reach 1 through a 10 foot diameter tunnel. The length of the tunnel is estimated at 1,700 feet. In order to maintain the structural integrity of the dam, a tunnel would be bored through the undisturbed hillside, around the east abutment of the dam. The inlet would be located at an elevation of approximately 7,085 feet with the outlet discharging at an elevation of 7,058 feet.

To prevent high flows from eroding Reach 1, an energy dissipating stilling basin would be located at the outlet. Flow would be regulated at the outlet by three 30" diameter Howell-Bunger valves which are also designed to dissipate the energy of the water. However, significant custom fabricated piping is required to attach the outlet valves to the 10 foot diameter tunnel. In addition, an emergency 10 foot diameter valve would be located at the inlet. The tunnel system would also include flow measuring devices to monitor and regulate flows. This alternative does provide flexibility in regulating flows. The estimated cost for a new outlet, tunnel, valves, fittings, and stilling basin is estimated at $13 million.

Cost

The preliminary cost estimate to construct the new reservoir outlet and tunnel is $13 million.

Selection of an Alternative

The pump/siphon and pump station alternatives can not be relied upon to provide both base and peak flows on a continuous basis due to the inability to control the flow or the high operation and maintenance costs. These facilities require rehabilitation of the Ditch. Constructing either the pump/siphon or the pump station, in addition to rehabilitating the Ditch, will increase total project costs to $6.5 or $14.5 million, respectively. Therefore, LADWP considers both the pump/siphon and the pump station option unfeasible, especially since operation of these facilities would occur on a limited basis (i.e., during peak flow periods of wet years).

Constructing a new reservoir outlet would provide control while minimizing operation and maintenance costs. Constructing a new outlet facility rewaters Reach 1 and provides peak flows in excess of 350 cfs.

However, peak flows can be attained in lower Rush Creek, even without rehabilitating the Ditch. Peak flows can be accomplished by spilling Grant Lake reservoir and augmenting the flow with the Lee Vining Conduit spillway. For example, lower Rush Creek experienced flows in excess of 550 cfs during 1995.

Professional disagreement exist on the benefits of rewatering Reach 1. The potential benefits derived from rewatering Reach 1 are questionable from a biological perspective. In light of this and the $13 million cost of constructing a new outlet, LADWP does not consider this reasonable.

LADWP, therefore, does not consider it reasonable to pursue this option when other more economical alternatives, which provide similar benefits and exceed Decision 1631 flow requirements, are available. LADWP's proposal for providing channel maintenance flows to Rush Creek is to rehabilitate the Mono Gate Return Ditch, and augment the flow with spills from the Lee Vining conduit.

VII. Monitoring Plan

Monitoring will track the success of restoration efforts in creating a healthy, functioning stream system that is dynamic yet capable of handling high flow events with minimal perturbation. The short-term goal of LADWP's monitoring program is to demonstrate improving riparian/aquatic systems, or the lack of. Long-term trends of monitored variables will indicate whether the riverine-riparian systems are attaining dynamic equilibrium and are in a healthy state.

The end product of restoration efforts is difficult to accurately predict as we are dealing with an ecosystem that has to come to equilibrium with vegetative, hydraulic, and geomorphic factors. While there are undoubtedly a host of alternative methods to employ in monitoring, no methods known to science can predict how much of any particular parameter will signal success (i.e., a riverine-riparian system has reached its optimum functioning condition). Thus it is impossible to set quantifiable thresholds as objectives. Rather, it is the long-term trends of the monitored variables that will indicate whether the riverine-riparian systems are attaining dynamic equilibrium.

The process of riverine-riparian rehabilitation is not linear. Biotic systems within riverine-riparian habitats all fluctuate over time, usually in response to the hydrologic cycle. It is known that trout populations typically cycle through highs and lows in 3- to 5-year periods; less is known about riparian vegetation. It is recognized, however, that long-term monitoring is required to identify long-term trends. A functional ecosystem (physical and biological) is stochastic; the dynamic equilibrium defined as the node around which the system fluctuates. At best, one can only develop a qualitative checklist of hydrologic, vegetative, and channel features that leads to the functional rating of a system (Prichard, 1993). However, the interpretation of such checklists will vary between observers. Specific fish-vegetation-wildlife-channel objectives cannot be quantified.

The monitoring of long-term trends will guide the restoration efforts toward the goal of the ultimate healthy stream condition in which "... the channel network adjusts in form and slope to handle increases in stormflow/snowmelt runoff with limited perturbation of channel and associated riparian-wetland plant communities."(Prichard, 1993)

The following is a checklist (Figures 7 and 8) used by the Bureau of Land Management to assist in determining the functional state of riparian-wetlands. Also provided are Figures 9, 10, and 11 to depict evolutionary processes showing successional stages of recovering systems. In Figures 9, 10, and 11, the successional stages progress from the bottom of the page to the top. If a system is functioning properly, one would expect the system to change from the illustration shown on the bottom of the page towards that shown on the top of the page.

Standard Checklist

Name of Riparian-Wetland Area: ______________________

Date: ______________ Segment/Reach ID: ______________

Miles: ______________ Acres: ______________

ID Team Observers: ______________________

Yes	No	N/A	HYDROLOGIC
			Floodplain inundated in "relatively frequent" events (1-3 years)
			Active/stable beaver dams
			Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			Riparian zone is widening
			Upland watershed not contributing to riparian degradation

Yes	No	N/A	VEGETATIVE
			Diverse age structure of vegetation
			Diverse composition of vegetation
			Species present indicate maintenance of riparian soil moisture characteristics
			Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
			Riparian plants exhibit high vigor
			Adequate vegetative cover present to protect banks and dissipate energy during high flows
			Plant communities in the riparian area are an adequate source of coarse and/or large woody debris

Yes	No	N/A	EROSION DEPOSITION
			Floodplain and channel characteristics (i.e., rocks, coarse and/or large woody debris) adequate to dissipate energy
			Point bars are revegetating
			Lateral stream movement is associated with natural sinuosity
			System is vertically stable
			Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Figure 7

Remarks

Summary Determination

Functional Rating:

Proper Functioning Condition ________
Functional—At Risk ________
Nonfunctional ________
Unknown ________

Trend for Functional—At Risk:

Upward ________
Downward ________
Not Apparent ________

Are factors contributing to unacceptable conditions outside BLM's control or management?

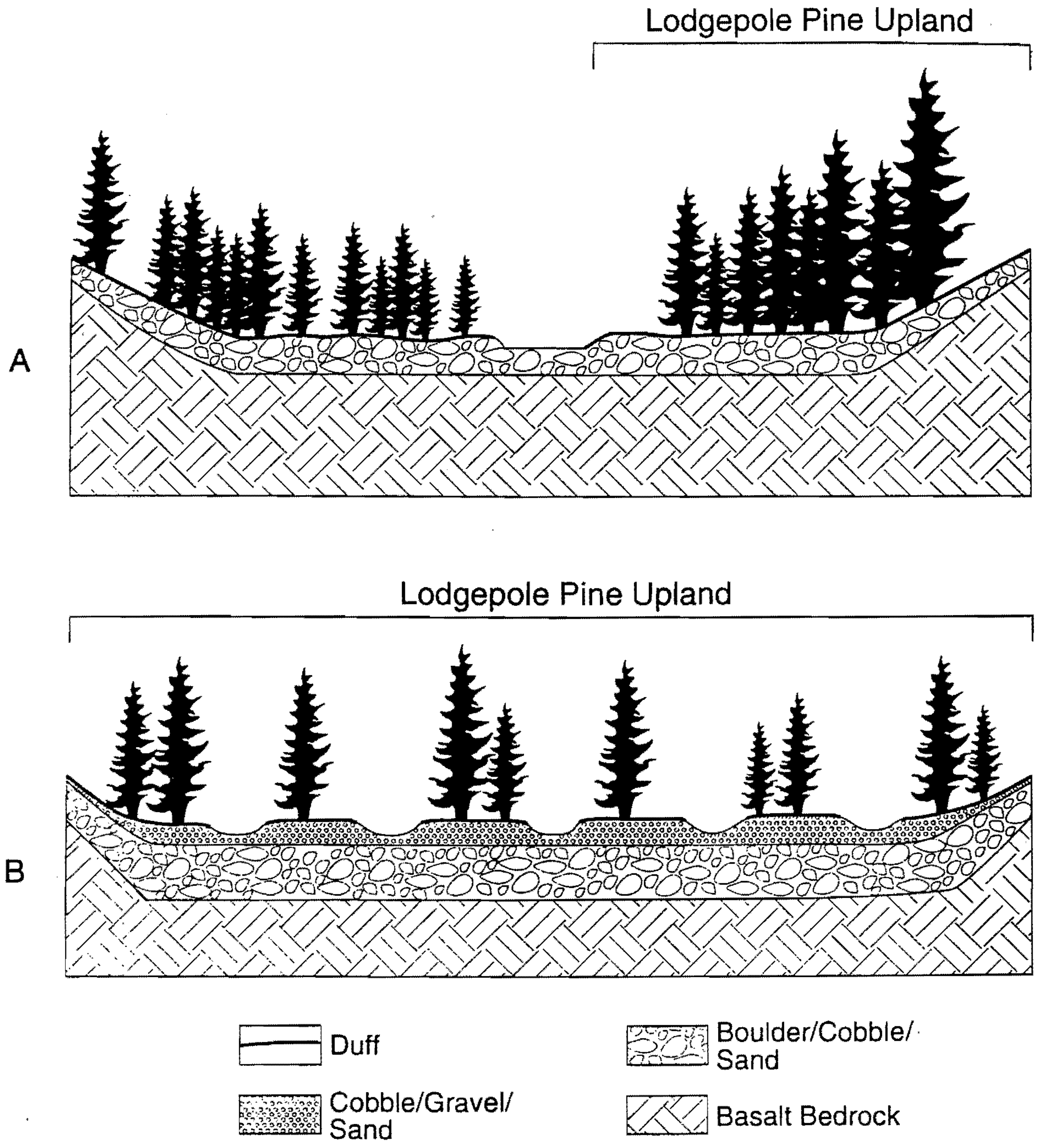
Yes ________
No ________

If yes, what are those factors?

____ Flow regulations
____ Channelization
____ Augmented flows
____ Mining activities
____ Road encroachment
____ Other (specify) ________________
____ Upstream channel conditions
____ Oil field water discharge

Figure 8

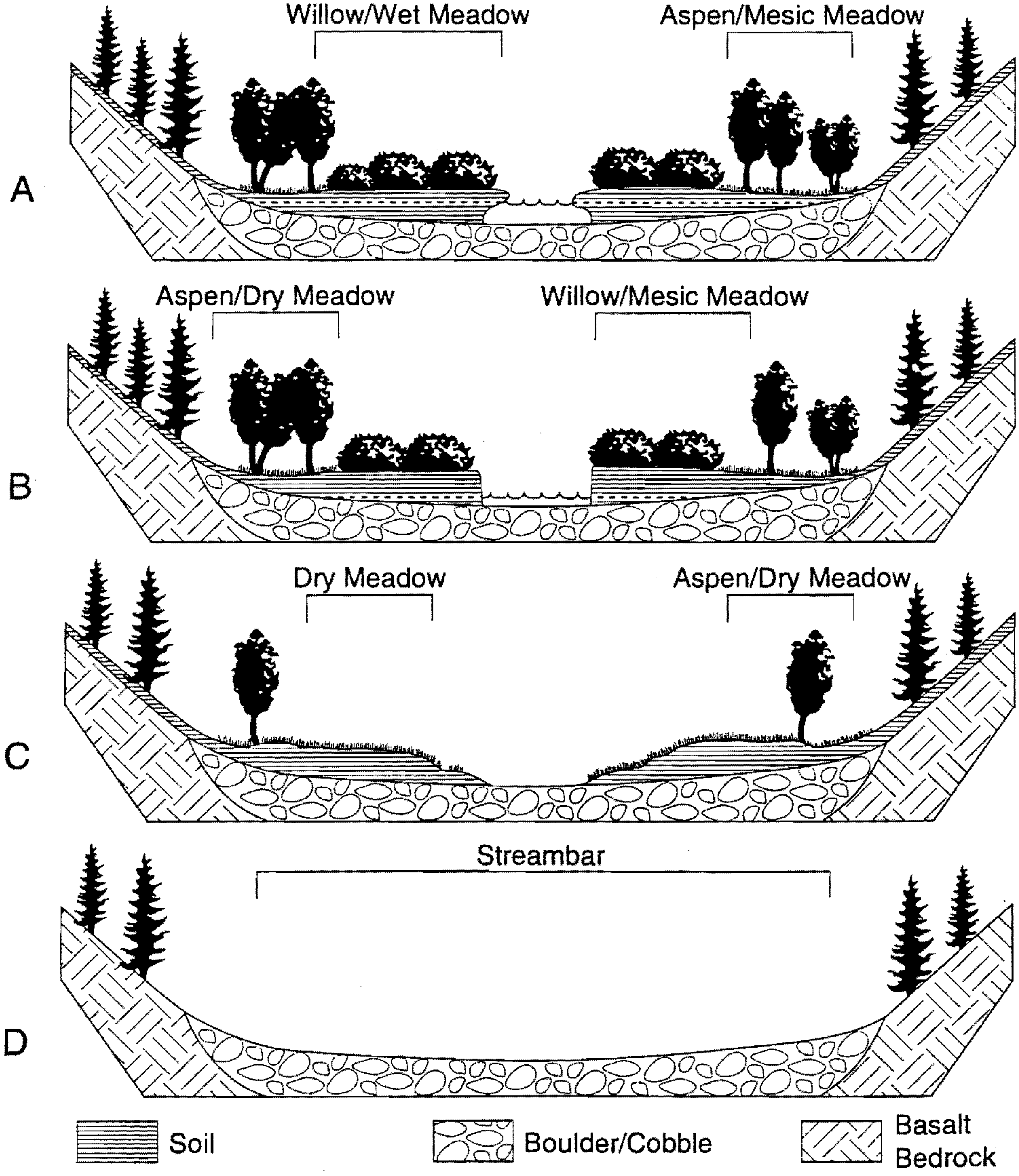
Glacial Valley-Bottom Type



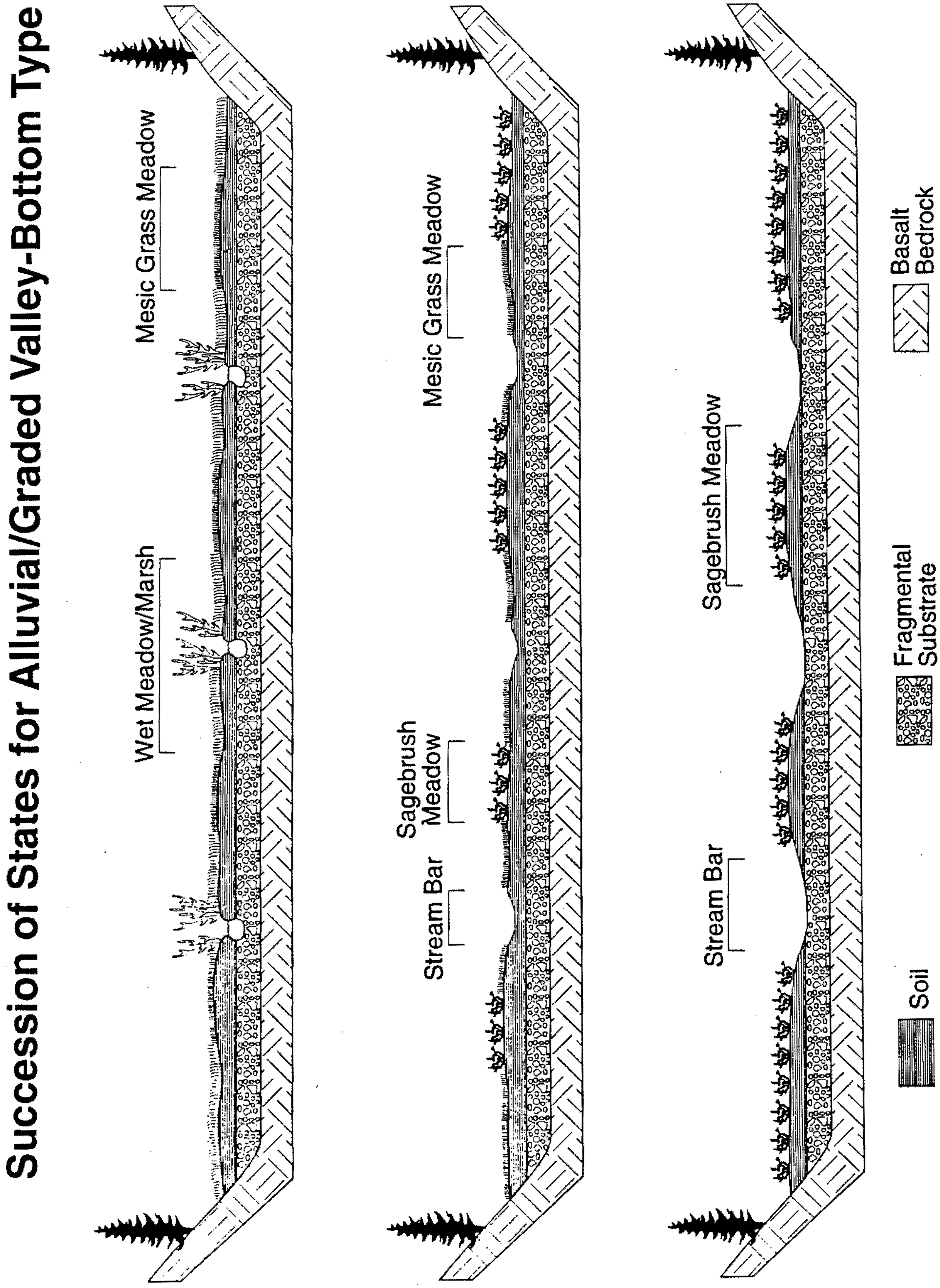
Successional Stages of Recovering System

Figure 9

Succession of States for Fluvial/V-Shaped Depositional Valley-Bottom Type



Successional Stages of Recovering System
Figure 10



Successional Stages of Recovering System

Figure 11

Both the checklist and figures are taken from Appendices C and D of the US Department of the Interior-Bureau of Land Management technical report "Riparian Area Management TR 1737-9, 1993."

The variables presented in the monitoring program are indeed fish microhabitat parameters (Simonson et al., 1994; Armantrout, 1982; Fausch et al., 1988; Kershner et al., 1992; Osborn et al., 1991; Oswood and Barber, 1982; Platts et al., 1983; Schlosser, 1982). If trout is viewed as the principle response variable to changes in microhabitat, then it is of greatest importance to examine the totality of habitat rather than individual habitats. Recent work by Pert and Erman (1994) shows that trout do not respond to simply one habitat feature (e.g., pool versus run), but trout do utilize to one degree or another (diurnally and seasonally) collective micro habitat and mesohabitat features. Evaluation of the success or failure of restoration efforts is, in the most simple terms: positive, negative, or no change in microhabitat variables.

No quantitative goals have been set for pre-41 fish population sizes. The restoration program is built on the philosophy that, "If you build it, they will come." The intent of the fish monitoring is to determine how the overall fishery is responding to restoration efforts. However, Eastern Sierra trout populations vary widely from year to year. If monitoring of habitat features shows continued improvement towards recovery, and ecological processes are developing to create a self-sustaining system, restoration will still be considered successful even if major increases in fish population trends do not occur. Habitat recovery is considered of primary importance for the long-term maintenance of a productive fishery.

There may be concerns that failure of fish populations to respond to developing habitat features could indicate that developing features are not conditions which would keep fish in good condition. This reflects a fundamental assumption in fisheries science that good habitat equals good fisheries. In fact, this is one of the most untested assumptions in biology. Two recent and important studies clearly show that one must not assume fish productivity will increase as habitat quality and/or quantity increase. Zorn and Seelback (1995) found no positive relation between habitat area and fish carrying capacity as a function of streamflow. Ironically, Zorn and Seelback found a negative relationship between stream discharge and fisheries because of less upstream/downstream movement during low-flow periods. Clarkson and Wilson (1995) tested the relationship between trout biomass and microhabitat variables (essentially the same methodology as our monitoring program) and concluded that trout in the study area were less limited by physical habitat than by climatic events or predation and competition influences. Consequently, one must not deduce that improvement in habitat conditions will result in increased fisheries biomass and population.

Methodology: Stream channel, water column, riparian vegetation, and fish population responses to restoration treatments will be determined utilizing "green line methods" (USDA, 1992), stream and riparian evaluations (Platts et al, 1983 and 1987), fish snorkeling surveys, and channel characteristics. Thalweg/width profiles, stream temperature, channel and habitat mapping, and aerial photography will also be conducted.

The Hankin and Reeves methodology has been considered but not selected because it has shown to lack precision and is generally not reproducible; two observers will obtain different measurements. The Hankin and Reeves methodology cannot account for bias or control variability within sample sites. In fact, the microhabitat methodology measures more transects than Hankin and Reeves and, thus, can account for variation to a much greater degree. The assumption that the purpose of microhabitat and vegetation monitoring is to extrapolate from measured reaches to unmeasured reaches is not the case. The purpose of monitoring is to measure microhabitat and vegetation changes at specific sites as an indication of overall change in the streams. The methodology does not allow for extrapolation of results to other reaches.

Detailed Descriptions of Task

Microhabitat Methods

Microhabitat is defined as discrete stream variables that collectively create site specific aquatic habitat for fish. Microhabitats at each site are determined utilizing a stream cross-sectional method outlined by Platts et al (1983 and 1987). Each transect is delineated by stretching a measuring tape across the upstream end of each site. The transect passes through a reference point defined as the channel midpoint. The transect line extends from that point and traverses across the stream perpendicular to the main streamflow to establish reference points on the right and left banks. Facing downstream, the right bank is defined. The next transect line is determined by measuring along the middle of the channel 10 feet downstream from the previous midpoint. This measurement determines the position of the second transect line and reference point on the right bank. The process is repeated until 30 transects are established at each site. Sites are selected randomly within a given reach.

Microhabitat monitoring will be performed in the first field season and once every five years following. Microhabitat monitoring will be monitored the summer following any "extreme wet" year event, which resets the five year interval cycle for monitoring.

The following habitat variables at each transect line will be measured:

- *Channel Width*: This is the distance along the transect line beginning at top of bank on one bank and ending at the top of bank on the opposite bank. Channel width is recorded to the nearest foot. If top of functioning bank (a bank topped by extreme flows) is not identifiable, then the high water mark of wet years will be used.

- *Wetted Perimeter Width*: This is the distance from the edge of the water on one bank or channel side to the edge on the opposite bank or channel side. Wetted width is recorded to the nearest foot. Channel width is a constant and wetted width depends upon the flow at the time of measurement.

- *Riffle Widths*: These are portions of the water column identified by fast water velocity, relatively shallow stream depths, and a relatively steep water surface slope with a straight to convex channel profile (Helm, 1985). Width of riffles that occur on the transect line are recorded to the nearest foot.

- *Run Width*: This is the area of the water column that does not form distinguishable pools or riffles, but has a rapid nonturbulant flow (Helm, 1985). Runs are too deep to be a riffle and too fast to be a pool. They have uniform, flat channel profiles. Width of runs that occur on the transect line are measured to the nearest foot.

- *Pool Width*: This rating estimates the capability of the pool to provide fish survival and growth requirements (Platts et al, 1983). This requires the combination of a cover analysis with direct measurements of the greatest pool diameter and depth. Materials or conditions, such as logs, organic debris, overhanging vegetation, boulders, undercut banks, or water depth, provide pool cover and protection for fish. If the transect line intercepts more than one pool, we will sum the pool widths times their respective quality ratings (ratings used are in Platts et al, 1987). This total is then divided by the pool total width to estimate the weighted average pool rating.

- *Bank Angle*: This measurement monitors land uses that change the morphology and location of the streambanks. A clinometer will be used to measure the angle formed by the downward sloping streambank as it meets the more horizontal stream bottom. For undercut banks, bank angle is determined by placing the clinometer on the top of a measuring rod as it forms the angle determined by the protruding edge of the bank to the midpoint of the deepest penetration of the undercut under the transect line. If the bank was not undercut, the bank angle is measured by placing the clinometer on the top of the measuring rod which is aligned parallel with the streambank along the transect. The clinometer reading is subtracted from 180° to get the bank angle. For each transect, the measured bank angles are reported.

- *Average and Thalweg Depths*: Stream depths are determined across a transect by averaging water depths taken at three locations: one-fourth, one-half, and three-fourths stream width. The total of the three water measurements are then divided by four to account for the zero depths at the stream margin where the water surface and the bank or the channel meet. Thalweg depth is recorded at the deepest point along the transect. Depths are measured to the nearest inch.

- *Substrate*: The composition of the channel substrate is measured at one-foot increments along the transect line. At each increment, the substrate composition of the stream bottom is visually estimated and bottom materials are assigned to substrate classes (boulder, rubble, gravel, and fines as described in Platts et al, 1983). The individual one-foot classes of substrate are then totaled to get the amount of streambed in each of the size classes. The combined substrate widths, measured to the nearest foot, equal the total transect width.

- *Bank Cover*: The ability of vegetation and other materials on the streambank to resist erosion from flowing water are rated. The rating corresponds primarily to stability generated by the vegetative cover, except in those cases where bedrock or rubble stabilize the bank.

- *Vegetative Overhang*: This rates only the vegetation overhanging the water column within 12 inches of the water surface. Vegetative overhang is measured as the distance between the point of the farthest protrusion of the streambank over the water surface to the farthest point that vegetation covers the water column. This measurement does not include undercut banks. Overhang is measured to the nearest inch.

- *Canopy Cover*: This is a measure of the amount of shading a stream receives from canopy formed by trees and shrubs that hang over the stream at a distance greater than 12 inches above the stream surface. Canopy cover is measured as the percentage of a transect line covered overhead by trees and shrubs.

- *Bank Alteration*: This reflects changes that take place in the bank from any influence. The rating consists of five classes. Each, except the one with no alteration, has an evaluation spread of 25 percentage points. To assess bank alteration, the bank is assigned to one of five classes.

- *Organic Debris*: Woody debris consists of submerged logs, root wads, and brush piles on the stream channel. The amount of woody debris along a transect line is measured to the nearest foot and then calculated as a percentage of the total stream width.

- *Bank Undercut*: Undercut is an indicator of how successfully streambanks are protected under alternative land uses. The undercut is measured as the distance from the farthest point of protrusion on the bank to the farthest undercut of the bank. Water level does not influence this reading. Undercuts are measured to the nearest inch.

Riparian Vegetation Methods

Three measurements of riparian habitat at each of the sampling sites will be taken utilizing the Green Line methodology. Vegetation types are identified according to physiognomic class (i.e., aquatic, forested, shrub, herbaceous, and substrate). Vegetated types with a physiognomic class are named by the dominant plants in the tree or shrub stratum and by the hydric status (e.g., wet, mesic, dry) of the dominant plants in the herbaceous stratum. Substrate types with less than 30 percent plant cover are named by the dominant size class of the substrate (sand, gravel, cobble, or boulder). The names of substrate types with greater than 30 percent plant cover are prefixed with "herbaceous" to distinguish them from unvegetated substrate types (e.g., herbaceous gravel bar). Numeric codes for vegetation types are developed.

Riparian vegetation monitoring will be completed in the first full field season following the adoption of the restoration plan and thereafter at five year intervals until 2014. Vegetation will be monitored the summer following any "extreme wet" year event, which resets the five year interval cycle for monitoring.. The riparian methods are described as follows:

- *Cross Channel Transects*: At each sample site, the width of riparian vegetation types are measured along each of three transects oriented perpendicular to the stream and at 100-foot intervals. Vegetation measurements start from one edge of the floodplain vegetation and work across to the opposite side where the floodplain vegetation ends. Length of the transects is flexible as riparian floodplain widths will vary according to changes in water tables. These transects may be narrow in some sites, and in other areas, may extend from bluff to bluff. Interfluve vegetation changes and adjustments in side channel morphology are recorded during the process. These cross channel transects allow determination of floodplain vegetation changes. As water tables increase with recovering riparian health, transition from drier vegetation types to riparian/wetland communities can be detected. On each transect, the landform (i.e., terrace) and vegetation types are recorded by code. The minimum and maximum bank elevation of each vegetation type above the water or channel level are measured.
- *Green Lines*: Sampling vegetation type composition along the edge of the channel provides additional information between cross channel transects. "Green lines" represent the high water mark of the stream starting at the point where the first cross channel transect crosses the green line on the right bank (facing downstream). Identification of the vegetation types that make up the green line are determined for 110 meters (363 feet) upstream along the right bank and 110 meters downstream along the left bank. The longitudinal edge of the green line is marked for subsequent shrub counts (Figure 10). Green line widths are not the same as the widths of cross channel transects described previously.
- *Woody Species*: The number of shrubs are counted (by species and age class) within a corridor 2 meters (six feet) out from the green line (110 meters on each side of the stream). For plants that put out suckers (e.g., *Salix*, wood rose, tamarisk), clumps are counted rather than individual stems (Figure 11).
- *Photo Points (ground)*: Photo points are established at each sampling site to be repeated during each sampling period. Visual documentation of habitat changes is recorded.
- *Aerial Photography*: Aerial photographs will be taken on all four tributaries of concern at five-year intervals, including the entire stream reaches below the conduit, as well as below Grant Lake. Photography will be at 1":6000' scale to be useful for vegetation and channel monitoring. Vegetation at the community type level will be tracked over time from these aerials.

GREEN LINE VEGETATION COMPOSITION MEASUREMENT

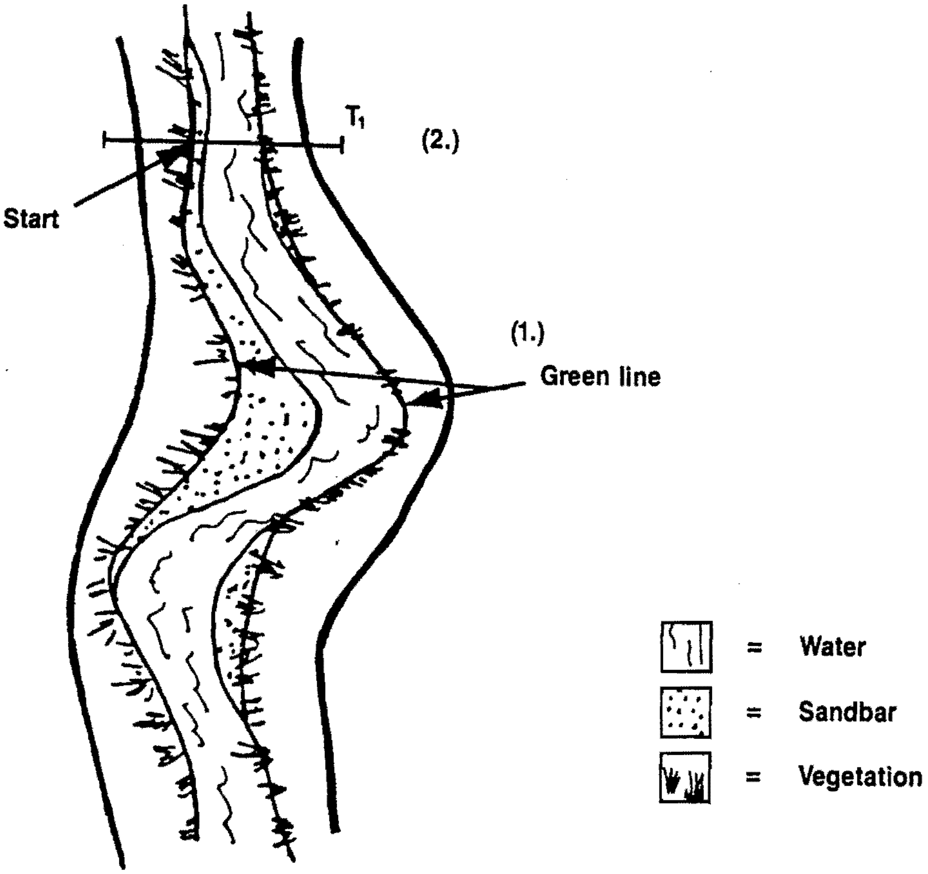
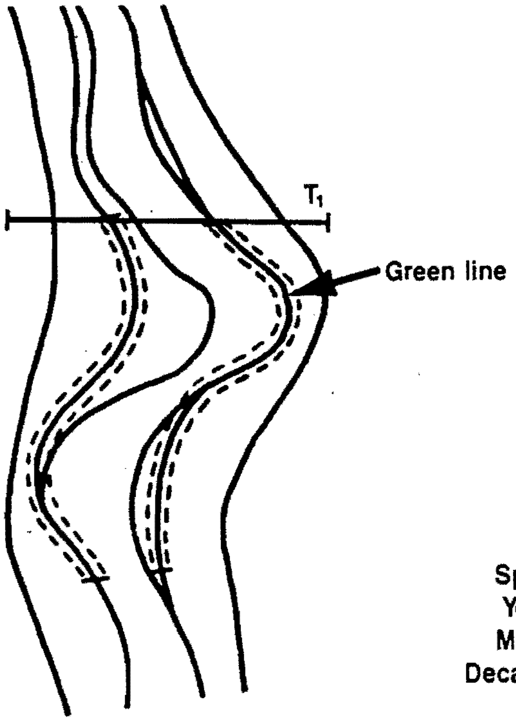


Figure 12

SHRUB COUNTS
(by Age Class)

363 ft. each side (726' total)
3 ft. each side of green line =6 ft. wide belt } = 1 / 10 Acre



Example

Sprouts	3	} =	Healthy Reproduction
Young	21		
Mature	12		
Decadent	10		
Dead	2		

Figure 13

For further details and clarification on methodologies, see the "Integrated Riparian Evaluation Guide, USDA 1992."

Thalweg/Width Profiles

Closely spaced measurements of thalweg depth and wetted width of the main channels will be conducted on Rush and Lee Vining creeks in conjunction with the above-described sampling. On Rush Creek, a thalweg/width survey will be conducted from the County road to the "narrows." On Lee Vining Creek, a thalweg/width survey will be taken from the top of Reach 3A to the end of Reach 3C. Sample points will be at approximately 3 meter (10-foot) intervals. In addition, one 400-meter section on both Parker and Walker creeks will be profiled. Sample points will be at approximately five-foot intervals and located near green line and microhabitat sites. These measurements will be conducted during periods of normal low flow.

Profiles will be sampled referencing horizontal benchmarks (i.e., start of reach designations, landmarks, etc.) for clarification.

Thalweg/width profiles are expected to yield valuable information regarding channel recovery and development (e.g., pool development) over time.

Snorkeling Methodology to be Used in Mono Basin Tributaries to Estimate Fish Populations

Fishery trends of trout populations will be by direct underwater observation, typically in August for brown trout during their nonmigratory residence phase. Underwater observation by snorkeling is a quick, inexpensive, and nondestructive census method that is not limited by deep, clear, nonconductive water as is electrofishing. Several studies (e.g., Schill and Griffith, 1984; Hicks and Watson, 1985; Zubik and Fraley, 1988; Hillman et al, 1992; Thurow, 1994) have shown that this is an unbiased census technique; however, Hillman et al (1992) showed that it may bias counts of Chinook salmon (*O. tshawytscha*) and steelhead (*O. mykiss*) when stream temperatures fall below 14°C and concealment cover is abundant.

Underwater observations are utilized to determine trends in a site if the water is 14°C or warmer; visibility is at least 1.5 meters; and a two-inch fish on the stream bottom can be identified clearly. Snorkeling will be conducted on clear days between 0900 and 1600 hours. Underwater methods follow those described by Thurow (1994).

During snorkel surveys, a team of two to five observers estimate trout numbers in sampling sites. Observers float downstream through the site and estimate population numbers if water depth is greater than 0.5 meters (20 inches); if the water depth is under 0.5 meters, observers crawl upstream through the site. Site widths and lengths will be measured with an optical rangefinder or measuring tape.

During downstream floats, members of the team enter the water about 10 to 15 meters upstream from the site. They usually hold onto connected lengths of 3-centimeter-diameter plastic (PVC) pipe to maintain a prescribed spacing from one another. Underwater visibility determines spacing, which ranges from about 2.0 to 5.5 meters. Members of the team count only those fish within the site that passes underneath in a lane between themselves and the observer to their left. The flexible PVC pipe enables the observers on each end of the counting lane to position themselves about 1 meter ahead of the others. This facilitates counting any fish that tend to move laterally along the counting line. An observer moves upstream in the water along the stream margin to count fish stationed close to each bank.

For surveys conducted by crawling upstream, members of the team enter the water about 7 to 10 meters downstream from the sampling site and then move upstream at a uniformly slow rate into and through the site. Observers count only those fish that are within a predetermined counting lane. Communication among observers consists of a series of slow-motion hand signals. Thus, fish that move across counting lanes are not counted twice.

Trout are divided into 13 total length size classes, each 2 inches long, from 2 to 25 inches. For each trout observed, its length is estimated and assigned to one of the size classes.

Extensive validation effort with electrofishing is required if snorkeling is intended to measure population size and length to weight ratios. However, the purpose of LADWP's snorkeling efforts are to follow trends in the fishery, with a focus on species presence and absence and relative abundance within age groups. Data obtained from snorkeling is adequate to determine if spawning, recruitment, growth, and longevity by species responds to habitat improvements.

There is little value in measuring growth rates, mortality, competition, or total population because management cannot provide anything to improve growth rates, reduce mortality, limit competition, or increase the population (other than annual stocking).

The LADWP does not advocate electrofishing because the magnitude of injury and mortality from electrofishing practices is significant. The literature supports this assumption, with numerous studies that confirm substantial loss and long-term injury of fishes following electrofishing (Reynolds and Kolz, 1995; Sharber et al., 1995; Sharber et al., 1994; McMichael, 1993; Roach, 1992; Taube, 1992; Mesa and Schreck, 1989; Zalewski and Cowx, 1990).

Extensive validation effort with electrofishing is required if snorkeling is intended to measure population size and length to weight ratios. However, the purpose of snorkeling should be to simply follow trends in the fishery, with a focus on species presence and absence and relative abundance within age groups.

Fish population monitoring will be conducted for Rush and Lee Vining creeks, while Parker and Walker creeks will only be monitored for habitat parameters. Since Parker and Walker creeks are basically free-flowing streams without any management interventions, it will involve unnecessary cost and effort to monitor a fishery that develops under natural conditions.

Stream Temperature

On Rush Creek, stream temperature will be monitored at the old Highway 395 bridge and at the ford crossing. On Lee Vining Creek, stream temperatures will be recorded near Highway 395 and another at the County road. The two most important stations include the Ford on Rush Creek and the County road on Lee Vining Creek because they measure the cumulative effects of all factors (flow, shading, hyporheic exchange, groundwater) affecting stream temperatures. These two sites, coupled with the upstream stations, will provide an understanding as to the extent to which stream flows are being warmed along the lower most sections of each stream. Walker and Parker creeks will not have water temperature monitoring stations. Monitoring will show daily maximum and minimum temperatures. Temperatures will be monitored for 10 years or until temperature is no longer considered a problem.

Establishing additional stream temperature monitoring stations below diversion facilities, and at the terminus of each creek, substantially increases monitoring costs but will not necessarily improve our understanding of temperature problems. We are not aware of temperature problems below diversion facilities but, rather, in the lower ends of streams. Grant Lake will be operating around 30 to 35,000 acre-feet of storage, reducing upstream concerns.

Channel and Habitat Mapping

Four primary channel mapping sites, each 2000 feet long, will be conducted on Rush and Lee Vining Creeks. These are:

- On Rush Creek, in Reach 3A, beginning at elevation 6884 feet msl. and mapping upstream.
- On Rush Creek, in Reach 4B, beginning at elevation 6472 feet msl. and mapping upstream.
- On Lee Vining Creek, above A1 inlet (at 6626 feet msl.) and mapping upstream
- On Lee Vining Creek, downsteam of B2 inlet (6482 feet msl.) and mapping upstream.

The following features/tasks will be included on each channel mapped:

- A permanent benchmark established at both ends of the monitored reach (generally a concrete base set with a carriage bolt).

- A longitudinal profile of the main channel/principal secondary channels' thalweg and present water surface surveyed with an engineer's level.

- A planform map (scale 1:50) of the floodway showing all stream habitats, LWD, floodplain and terraces, point bars, and channel widths. This task can be greatly facilitated with aerial photographs.

- Selected surface pebble counts, nor more than four per reach, will quantify changes in substrate composition.

Channel mapping will occur in the first year (either 1996 or 1997), and after each "extreme wet year" thereafter for 25 years or until the vegetative recovery has developed adequately. It is in extreme wet years that streams acquire enough power to substantially alter channel and habitat morphology. There is little value in committing to routine mapping at specific intervals if an "extreme wet year" does not occur within that time frame.

Proposal

***Site Selection*: Specific monitoring sites will be identified by LADWP after conducting field surveys. The field surveys will be performed during the first full field season (field season is April 15 through October 15) after the SWRCB approves the plan. The DFG will be invited to participate in the selection of monitoring sites. LADWP will monitor representative reaches on each stream as follows:**

Rush Creek

Monitoring sites will be selected in Reaches 3A, 3C, 4, and 5A. Several additional monitoring sites will be selected in rewatered channels. The total number of sites will depend upon the number of representative channel sites needed.

Lee Vining Creek

Monitoring sites will be selected in Reaches 3A, 3B, 3C, with an additional monitoring site in the B1 channel.

Parker Creek

One monitoring site will be selected between old Highway 395 and the LADWP conduit.

Walker Creek

One monitoring site will be selected between old Highway 395 and new Highway 395.

Monitoring Reporting

After each monitoring effort, data will be compiled and submitted to the SWRCB within eight months after the end of data collection. These compilations and all basic data will also be available to the public.

The details of riparian vegetation monitoring (Green line, cross-channel transect, and woody species survey) are described in "USFS 1991, Integrated riparian evaluation guide," USDA Forest Service, Intermountain Reg., Ogden UT. Comments received on the draft Stream Restoration Plan, regarding riparian vegetation typing and cross-channel transects are thoroughly incorporated in the methodology.

Schedule

The LADWP is proposing to begin the field work during the first full field season after the SWRCB approves the restoration plan. A full field season is defined as the period April 15 through October 15 of any given year. Other work, such as planning, designing, contracting, coordination with DFG, and obtaining permits and approvals, will commence after the SWRCB approves the plan.

The monitoring will be performed in subsequent years at five-year intervals until 2014 or longer if conditions warrant. In addition to the five year interval, the green line, microhabitat, and thalweg/width profiles will be monitored the summer following an "extreme wet" year event; in this case the five year interval cycle for monitoring will start again.

Cost

$175,000 per year

VIII. Environmental Documentation and Regulatory Compliance

The stream restoration measures proposed in this plan will require some environmental documentation for compliance with the California Environmental Quality Act and/or the National Environmental Policy Act. In addition, permits and approvals will have to be obtained from one or more governmental agency before any physical work can proceed. Until more specific information is developed, there will be some uncertainty as to what is needed for environmental compliance and the type of permits and approval that will have to be obtained.

Regulatory and Permitting Requirements

Scenic Area and Tufa Reserve Plans: In 1984, Congress designated federal lands within the Mono Basin as a National Forest Scenic Area. The Scenic Area Comprehensive Management Plan (Management Plan) was developed to protect its geologic, ecological, cultural, scenic, and other natural resources, while allowing recreation, scientific, and other activities consistent with this goal. In the Scenic Area management plan, the Forest Service developed management direction by resource. The stream restoration work the LADWP is proposing is consistent with the direction and policies in the Management Plan. In particular, the work in the riparian areas is consistent with the language in Subsection 16 Wildlife/Fish/Vegetation, Section C Management Direction by Resource, Chapter III Management Direction, in the Management Plan.

Members of the Forest Service have participated in the Stream Restoration TAG meetings. The TAG was established by the LADWP for soliciting input for consideration in the Stream Restoration Plan. The LADWP will continue to consult with the Forest Service when implementing the final Stream Restoration Plan.

Mono Lake Tufa State Reserve: In 1982 the State of California designated the state-owned lands below elevation 6,417 feet as the Mono Lake Tufa State Reserve. The reserve was established to preserve the tufa and other natural and cultural features at Mono Lake. Park and Recreation manages the reserve under guidelines and statues favoring a natural and undisturbed environment. The projects the LADWP are proposing to undertake on the streams are outside the boundaries of the reserve. There will be no impacts to the tufa or other natural and cultural features associated with the restoration activities; however, as Decision 1631 points out, raising the lake to 6,392 feet will result in covering and toppling tufa and destroying existing sand structures.

Other Environmental Statutes and Approvals

California State Water Quality Control Board, Lahontan Region -- Conditional waiver of waste discharge requirements and Clean Water Act Section 401 Water Quality

Certification: Most of the stream restoration measures and facility modifications will require compliance with the State Water Quality Control Board's (SWQCB) Water Quality Control Plan for the Lahontan Region (Basin Plan). Compliance will be determine during the permit/waiver process. The permit/waiver process involves, among other things, a review of the project to determine whether it complies with water quality objectives and beneficial uses for Mono Lake and its tributaries.

An application for a permit/waiver requires a complete description of the project. Once received the SWQCB can determine the appropriate action for the application (i.e., waiver or permit). Generally, depending on the action the SWQCB takes, it will take from 30 to 120 days to process an application. Several factors must be considered when attempting to determine the time involved in obtaining permit(s) and/or a waiver(s). First, it must be determined whether the project is defined as all of the measures proposed in the final Stream Restoration Plan or if each of the measures proposed in the plan can be defined as separate projects. Second, there must be detailed descriptions of the projects with assumptions on the amount of disturbance that will likely occur to the stream and stream channel. Finally, there must be an implementation schedule. All of this information is required before the SWQCB can determine the type of approval and the time involved to process the approval.

Requests submitted previously to the SWQCB for projects on the Mono Basin streams may provide an estimate for determining a time frame. However, until the Stream Restoration Plan is final and the design and engineering is complete, there is no way of reasonably estimating the time frame with any certainty. In a letter dated November 21, 1995, the SWQCB indicated that without more information they would only be able to provide an estimates which ranges from 30 to 120 days. A copy of the SWQCB's letter is included in Appendix VI.

LADWP will continue to consult with the SWQCB's staff, especially during the development of the projects and submittal of the requests, to ensure that the information in our requests are complete.

<u>Army Corps of Engineers</u> -- Nationwide Permits under Section 404 of the Clean Water Act: As is the case with the SWQCB, the time involved in processing a request will depend primarily on LADWP providing detailed descriptions for the stream restoration projects proposed in the final Stream Restoration Plan. Another consideration will be the size of the project. The Army Corps of Engineers (Corps) may consider the Stream Restoration Plan as one project or it may consider each of the proposed restoration measures as individual and separate projects. In a letter dated November 16, 1995, the Corps indicated that without more detailed descriptions of the projects activities they would be unable to provide LADWP with specific permit requirements or give any estimate of time other than 30 to 120 days. A copy of the Corps letter is included in Appendix VII.

The LADWP will continue to consult with the Corps. As more information becomes available for the Stream Restoration Plans and more details developed on the stream restoration measures the Corps will be better able to provide information on approvals and time frames.

California Fish and Game -- Complying with California Fish and Game Code Section 1601: Most of the stream restoration work proposed will require compliance with Section 1601. Section 1601 requires the LADWP to submit plans to the DFG for projects impacting water courses. The plans must be sufficient to indicate the nature of the project for construction. There are statutory time requirements for the DFG and LADWP to respond to plans submitted and for modifications proposed to the plans; however the time may be extended if that is mutually agreed upon. The time involved in reaching an agreement also depends on the amount of negotiations required and whether or not the process involves arbitration.

Time Frame for Permitting and Approval Process

State Water Quality Control Board	60 to 120 days
Army Corps of Engineers	30 to 120 days
Department of Fish and Game	30 days to Indefinite

A permit or waiver must first be obtained from the SWQCB before the Corps can issue a permit.

Environmental Documentation

California Environmental Quality Act (CEQA): Several options may be available for LADWP to consider for complying with CEQA when implementing the final Stream Restoration Plan. They range from a Categorical Exemption to preparing an Environmental Impact Report. The option the LADWP selects will significantly affect the time involved for complying with CEQA. It is our opinion that many of the stream restoration measures that are proposed qualify for a Categorical Exemption. The remainder of the projects, where a Categorical Exemption is not appropriate, may only require a Mitigated Negative Declaration.

Under CEQA, Section 15301, certain activities related to the operation, repair, maintenance, or minor alteration of existing public or private structures, facilities, mechanical equipment or topographical features , involving negligible or no expansion of use beyond that previously existed are categorically exempt. Modifications to the control structures and rehabilitating the Mono Gate No. 1 Return Ditch appear to be covered under this section.

Previous stream restoration activities in the creeks were performed with Mitigated Negative Declarations. CEQA documents were prepared for each project. Depending on whether the stream restoration plan is defined as the project or if the plan's stream restoration measures are considered each as a project and independent of one another, as previously done, may have an effect on CEQA requirements.

Until the stream restoration plan is final and more details are available on the measures proposed, no determination on the minimum CEQA requirements can be made.

National Environmental Protection Act (NEPA): NEPA applies to projects which are carried out, financed, or approved in whole or in part by federal agencies. Since some of the stream restoration measures proposed may be on Forest Service lands and some projects will require approval from the Corps, LADWP will probably have to prepare NEPA documents. Previous restoration projects were covered under the authority of a Nationwide Permit 33 with NEPA documents.

The NEPA process is similar to CEQA. The level of effort will be determined based on the particular action and by the degree in which the action may adversely affect the environment. Until more information is developed for the proposed projects, there will be no way of determining NEPA requirements nor the time required to meet them.

Time Frame for Environmental Compliance: The time involved to comply with CEQA and/or NEPA could range from approximately 45 days to more than one year.

IX. Project Administration

Schedule for Implementing the Restoration Plan

Implementing this restoration program includes several different components. These components can best be summarized as follows: 1) flow management practices, 2) stream and stream channel restoration measures, and 3) monitoring activities. Figure 12 provides a timeline summary for implementing the stream and stream channel restoration work. Implementation of each specific restoration measure is contingent on LADWP complying with applicable state and federal environmental regulations. Due to the uncertainty in the time involved to complete the environmental documentation process, actual implementation dates may occur earlier or later than indicated on the schedule.

There are several steps that need to be undertaken before commencing with implementation of restoration measures. The following is a list of steps that LADWP must follow for completing the restoration measures:

- Conduct field surveys of the project sites;
- Prepare engineering and design documents;
- Prepare environmental documents;
- Obtains permits and approvals; and
- Implement restoration measures.

Figures 13, 14, 15, 16, 17, and 18 provide detailed breakdowns on the time and sequence of performing the various task. Some of the measures include time for contracting and allows for contingencies to perform the physical work in one or more years. The figures are for illustration purposes only. The figures illustrate the logic we would use for planning purposes and attempts to estimate the time required to complete the various tasks. The time shown to complete a particular task, however, may differ significantly as more information on the projects are developed. As indicated in section VII. Environmental Documentation and Regulatory Compliance, until more specific information is developed there will be some uncertainty to the time required to complete the process.

Water Management

In response to Decision 1631, LADWP developed a spreadsheet based operation model (Grant Lake Operations Model) to provide guidance in managing future flows within the Mono Basin and Upper Owens River. This model provides guidelines for creek releases and diversions and will be included as a part of the Grant Lake Operations and Management Plan. LADWP will implement the flow management practices, as outlined in the management plan, after the restoration plan is submitted to and approved by the SWRCB.

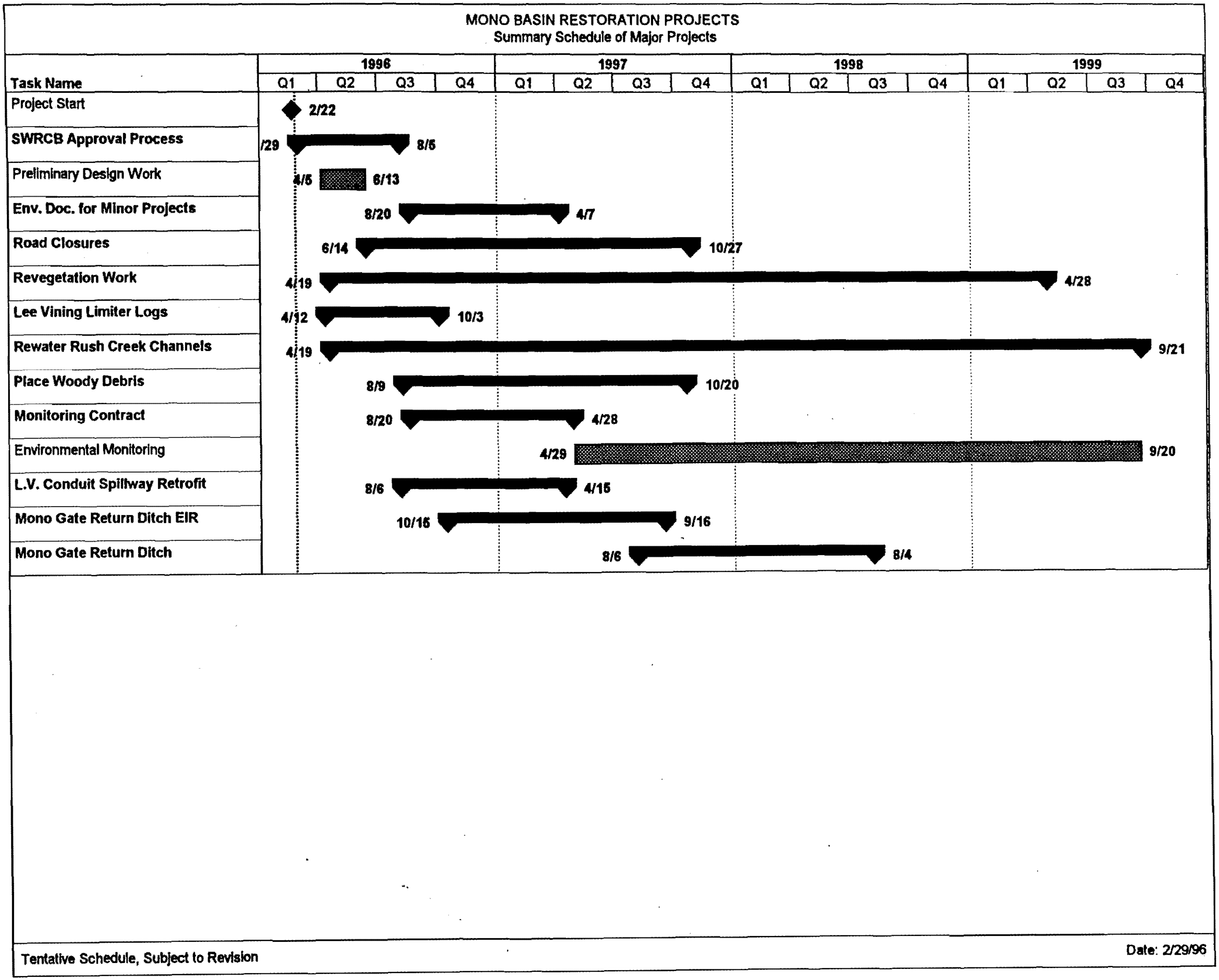
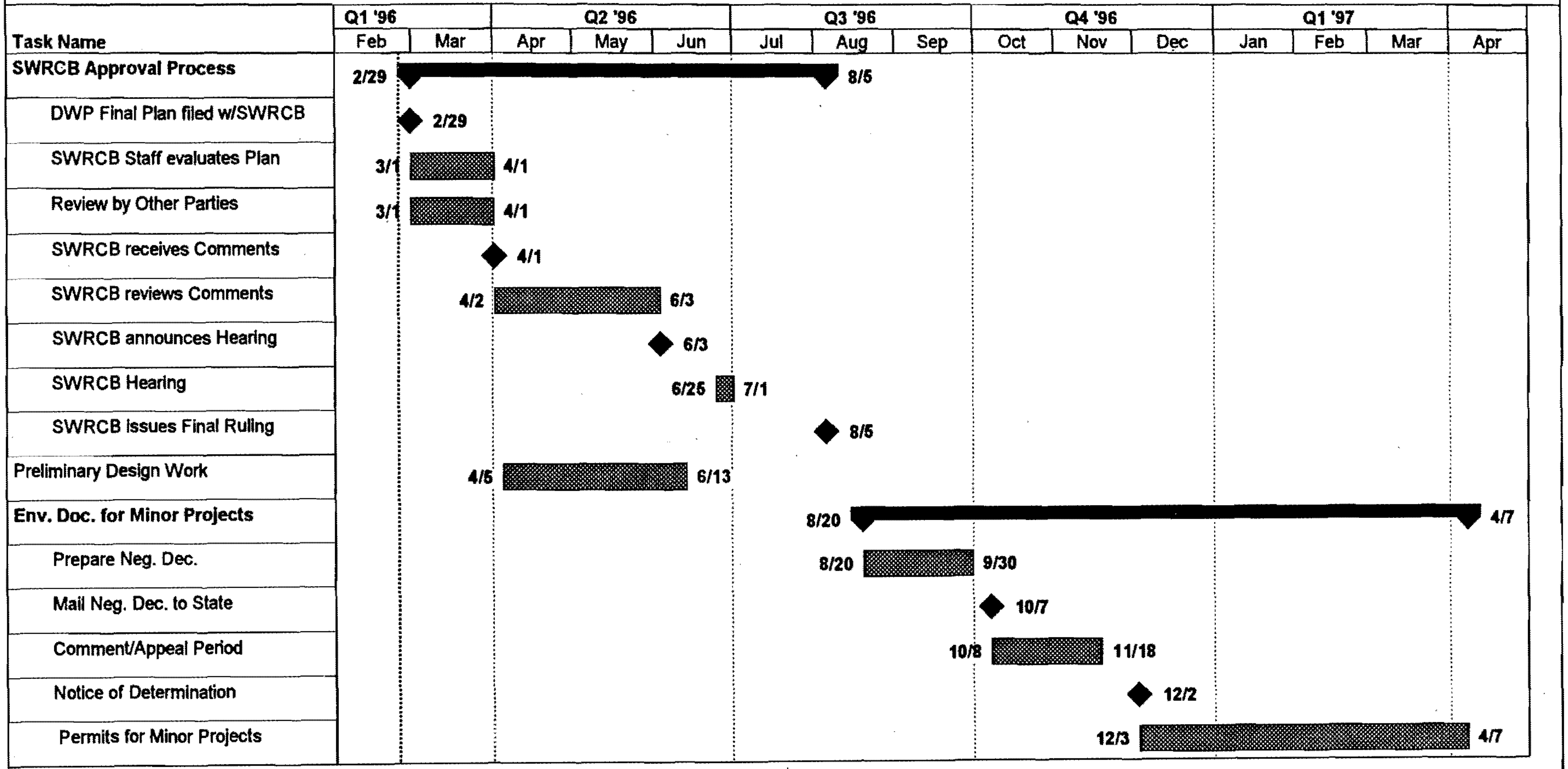

MONO BASIN RESTORATION PROJECTS
Summary Schedule of Major Projects
Task Name
1996
1997
1998
1999
Q1
Q2
Q3
Q4
Project Start 2/22
SWRCB Approval Process /29 8/5
Preliminary Design Work 4/5 6/13
Env. Doc. for Minor Projects 8/20 4/7
Road Closures 6/14 10/27
Revegetation Work 4/19 4/28
Lee Vining Limiter Logs 4/12 10/3
Rewater Rush Creek Channels 4/19 9/21
Place Woody Debris 8/9 10/20
Monitoring Contract 8/20 4/28
Environmental Monitoring 4/29 9/20
L.V. Conduit Spillway Retrofit 8/6 4/15
Mono Gate Return Ditch EIR 10/15 9/16
Mono Gate Return Ditch 8/6 8/4
Tentative Schedule, Subject to Revision
Date: 2/29/96

Figure 14

MONO BASIN RESTORATION PROJECTS
SWRCB & Minor Project Environmental
Documentation Process



Tentative Schedule, Subject to Revision

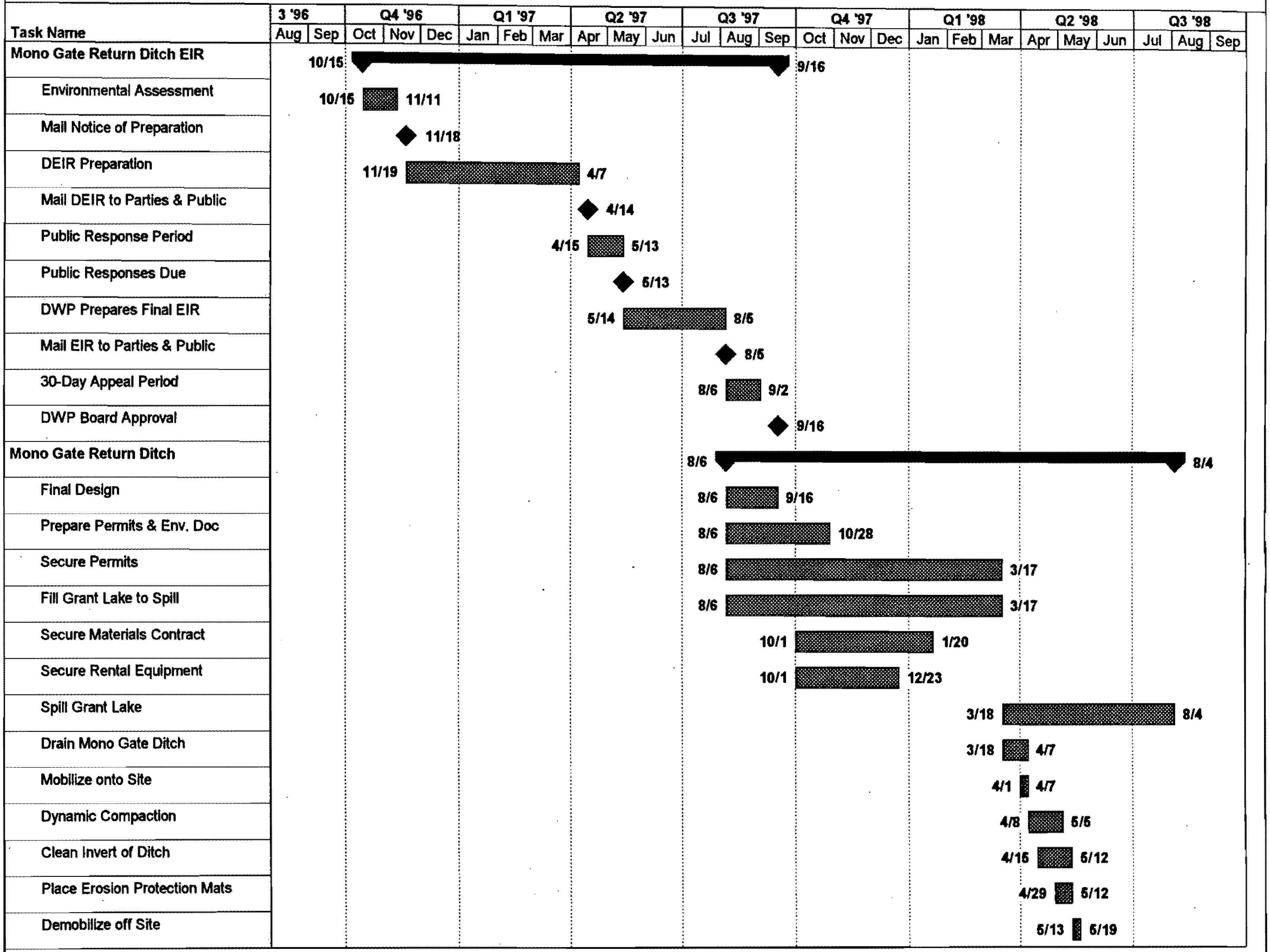
Date: 2/29/96

Figure 15

Figure 16

MONO BASIN RESTORATION PROJECTS

Mono Gate Return Ditch Rehabilitation

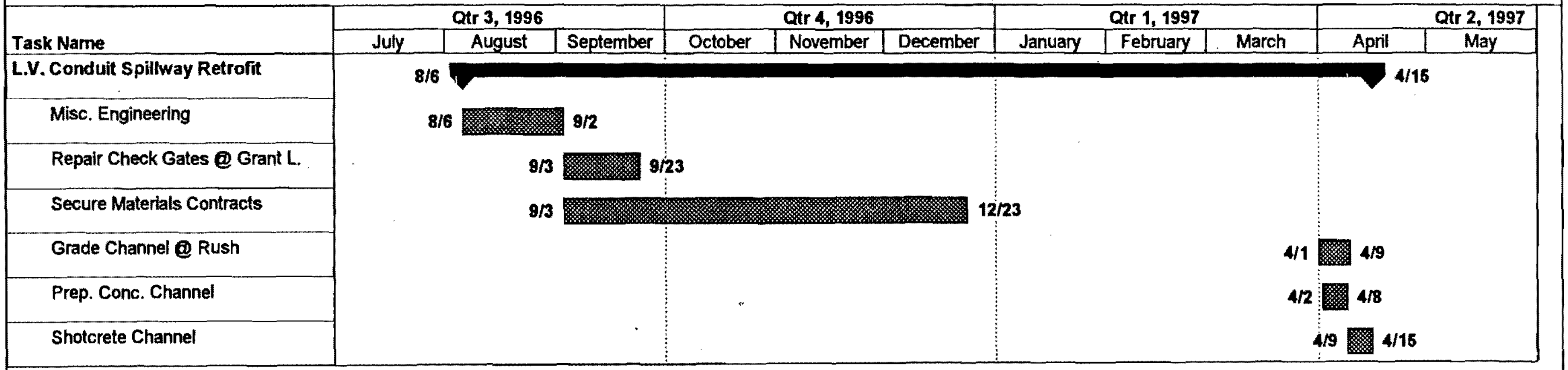


Mono Gate Return Ditch EIR	10/15	9/16
Environmental Assessment	10/15	11/11
Mail Notice of Preparation		11/18
DEIR Preparation	11/19	4/7
Mail DEIR to Parties & Public		4/14
Public Response Period	4/15	5/13
Public Responses Due		5/13
DWP Prepares Final EIR	5/14	8/5
Mail EIR to Parties & Public		8/5
30-Day Appeal Period	8/6	9/2
DWP Board Approval		9/16
Mono Gate Return Ditch	8/6	8/4
Final Design	8/6	9/16
Prepare Permits & Env. Doc	8/6	10/28
Secure Permits	8/6	3/17
Fill Grant Lake to Spill	8/6	3/17
Secure Materials Contract	10/1	1/20
Secure Rental Equipment	10/1	12/23
Spill Grant Lake	3/18	8/4
Drain Mono Gate Ditch	3/18	4/7
Mobilize onto Site	4/1	4/7
Dynamic Compaction	4/8	5/5
Clean Invert of Ditch	4/15	5/12
Place Erosion Protection Mats	4/29	5/12
Demobilize off Site	5/13	5/19

Tentative Schedule, Subject to Revision

Date: 2/29/96

MONO BASIN RESTORATION PROJECTS
Lee Vining Conduit Spillway Repairs

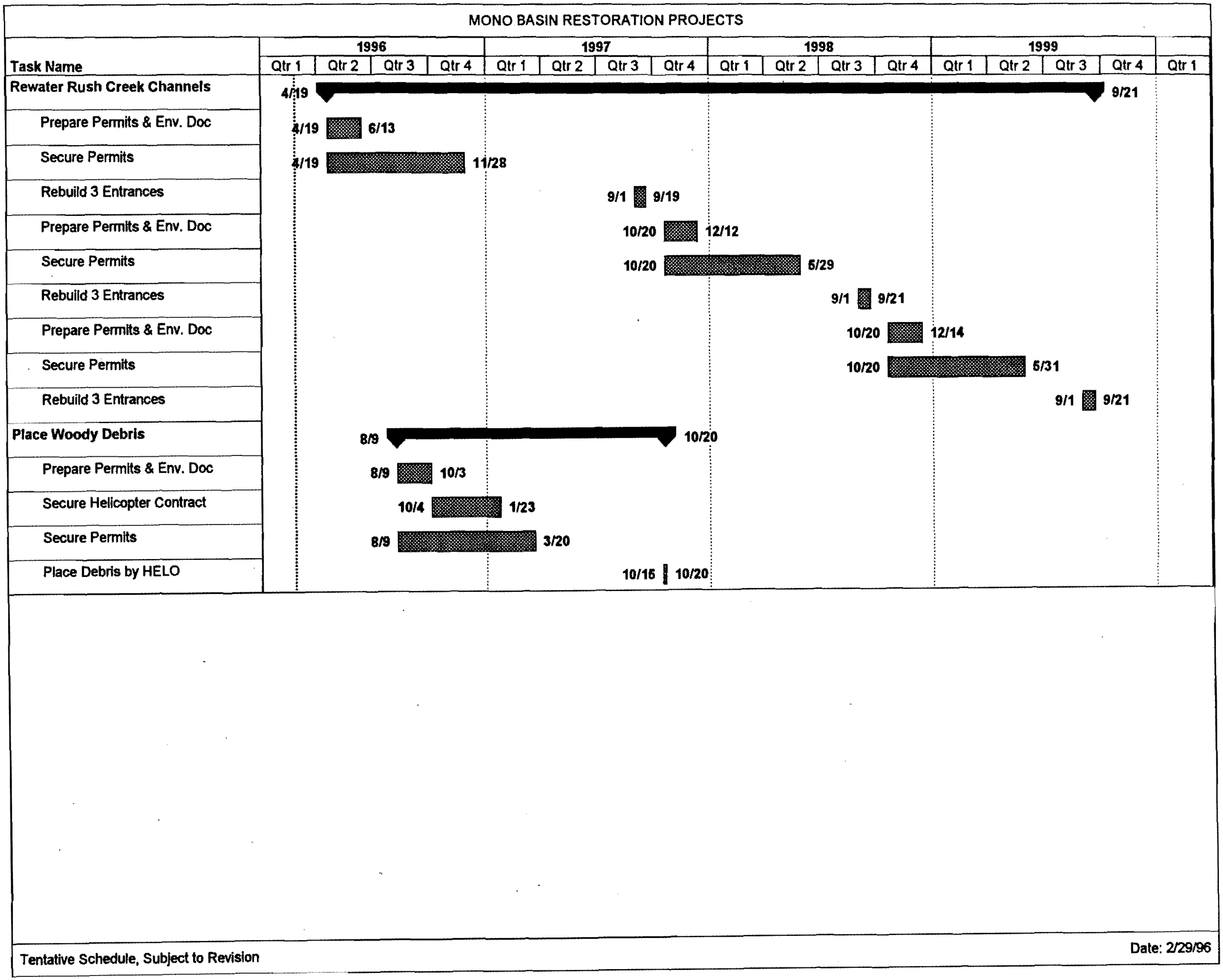


Tentative Schedule, Subject to Revision

Date: 2/29/96

Figure 17

Figure 18


MONO BASIN RESTORATION PROJECTS
Task Name
1996
1997
1998
1999
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Rewater Rush Creek Channels
4/19
9/21
Prepare Permits & Env. Doc
4/19
6/13
Secure Permits
4/19
11/28
Rebuild 3 Entrances
9/1
9/19
Prepare Permits & Env. Doc
10/20
12/12
Secure Permits
10/20
5/29
Rebuild 3 Entrances
9/1
9/21
Prepare Permits & Env. Doc
10/20
12/14
Secure Permits
10/20
5/31
Rebuild 3 Entrances
9/1
9/21
Place Woody Debris
8/9
10/20
Prepare Permits & Env. Doc
8/9
10/3
Secure Helicopter Contract
10/4
1/23
Secure Permits
8/9
3/20
Place Debris by HELO
10/16
10/20
Tentative Schedule, Subject to Revision
Date: 2/29/96

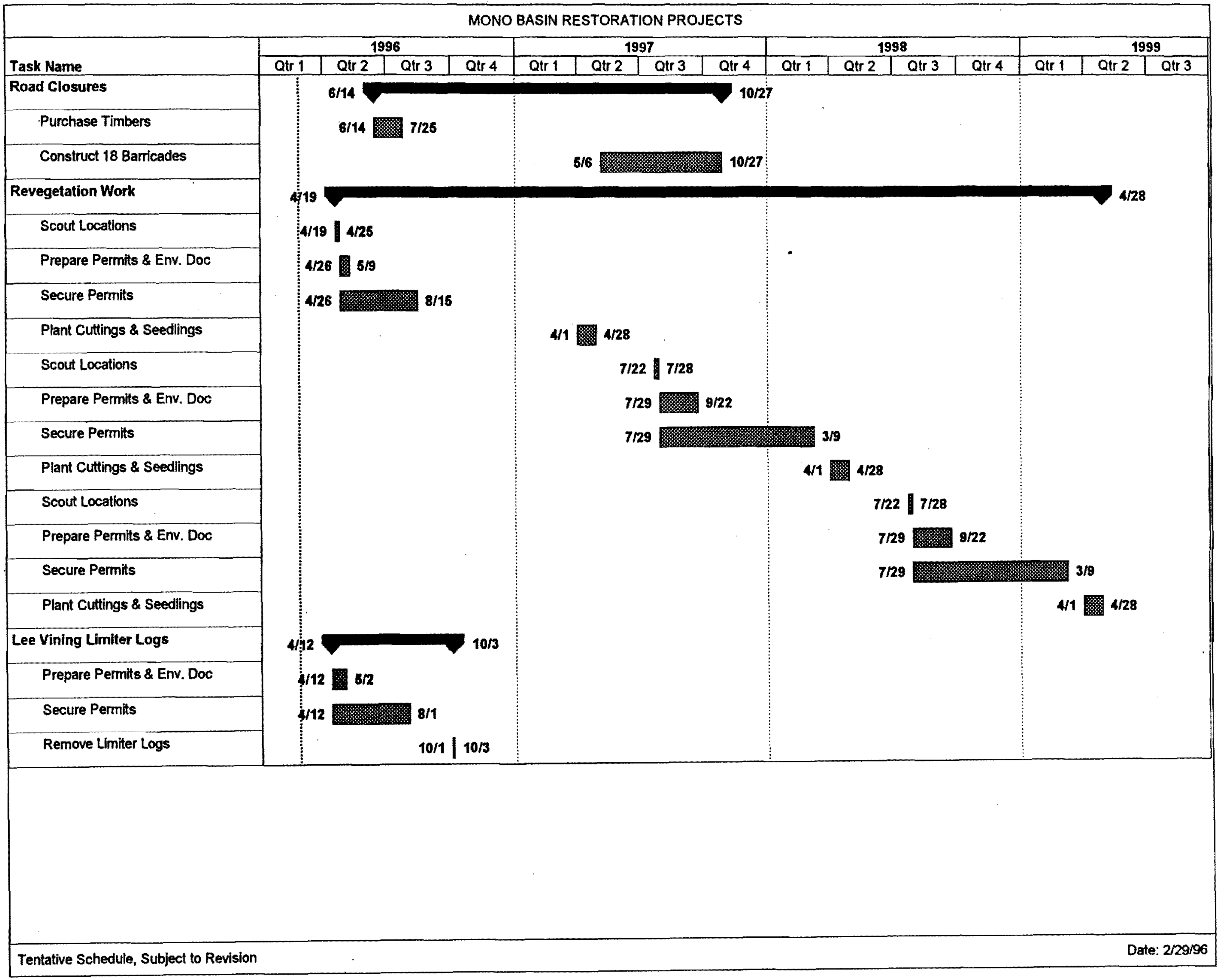
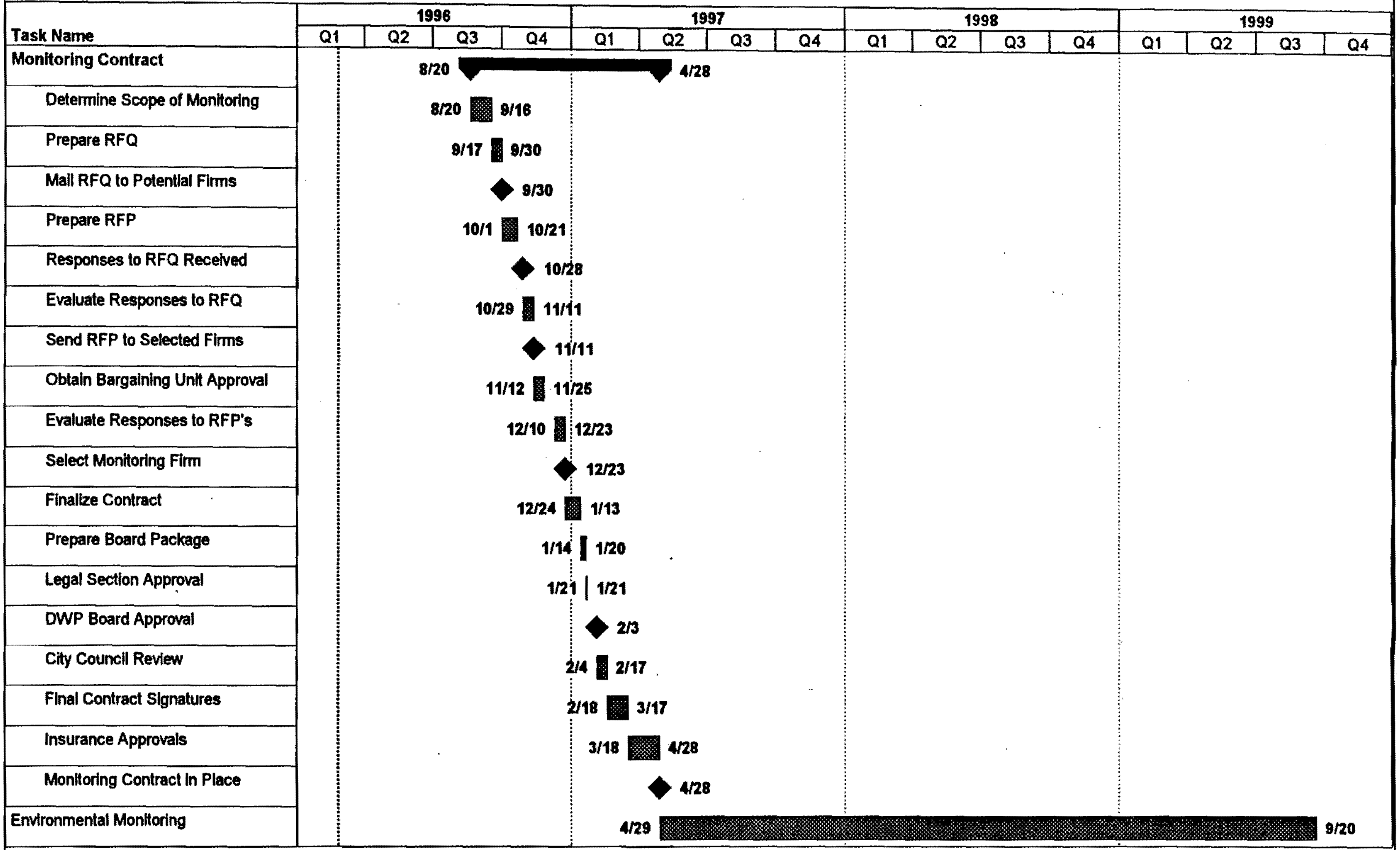

MONO BASIN RESTORATION PROJECTS
Task Name
1996
1997
1998
1999
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Road Closures 6/14 10/27
Purchase Timbers 6/14 7/25
Construct 18 Barricades 5/6 10/27
Revegetation Work 4/19 4/28
Scout Locations 4/19 4/25
Prepare Permits & Env. Doc 4/26 5/9
Secure Permits 4/26 8/15
Plant Cuttings & Seedlings 4/1 4/28
Scout Locations 7/22 7/28
Prepare Permits & Env. Doc 7/29 9/22
Secure Permits 7/29 3/9
Plant Cuttings & Seedlings 4/1 4/28
Scout Locations 7/22 7/28
Prepare Permits & Env. Doc 7/29 9/22
Secure Permits 7/29 3/9
Plant Cuttings & Seedlings 4/1 4/28
Lee Vining Limiter Logs 4/12 10/3
Prepare Permits & Env. Doc 4/12 5/2
Secure Permits 4/12 8/1
Remove Limiter Logs 10/1 10/3
Tentative Schedule, Subject to Revision
Date: 2/29/96

Figure 19

MONO BASIN RESTORATION PROJECTS
Secure Environmental Consultant Contract & Commence Monitoring
Monitoring will be performed as described in Plan



Tentative Schedule, Subject to Revision

Date: 2/29/96

Figure 20

Restoration Measures

In-stream restoration measures being proposed for 1996 include removing limiter logs on Lee Vining Creek and modifying the channel entrances, beginning the planning and engineering, development of environmental documents, and obtaining approvals and permits. LADWP will remove limiter logs from the entrances of 4 historic channels on Lee Vining Creek. The removal of the limiter logs is contingent on LADWP obtaining permits and approvals. Revegetation will primarily rely on natural recovery processes. However, LADWP will implement a limited planting program on selected creek reaches and at sites disturbed by restoration activities. This work will involve developing the plans, environmental documents, and obtaining permits and approval for performing revegetation activities in March/April 1997.

Monitoring

LADWP will initiate the monitoring program in the first full field season. The monitoring program includes observations of the microhabitat conditions, riparian vegetation, channel thalweg/width profiles, fish population surveys, channel and habitat mapping, stream temperature, and aerial photography. Monitoring will continue at the frequency established by this restoration plan.

Return Ditch

The LADWP is currently preparing a plan to rehabilitate the Mono Gate Return Ditch (Ditch) between Mono Gate #1 and its confluence with Rush Creek. The scope of this work includes dewatering the Ditch, dredging accumulated sediment, and stabilizing several slopes to prevent seepage and erosion. This work is required to increase the Ditch's capacity from 160 cfs to its historical maximum of 380 cfs. This work is subject to CEQA and may also be subject to NEPA since LADWP must obtain permits from the Corps. In addition, LADWP will submit plans to the DFG for approval and to the SWQCB to obtain a permit/waiver for discharge requirements.

Factors Affecting Implementation of Restoration

The LADWP intends on implementing approved restoration measures as expeditiously as possible. However, LADWP has to maintain a functional agency that is obligated to supply the City of Los Angeles with the reliable water and power sources. LADWP will coordinate restoration efforts without neglecting necessary maintenance activities that are imperative to the operation of our facilities. At the same time. LADWP has to deal with the same challenges as any other business. LADWP has not been immune from these trends.

Further, LADWP is currently experiencing system wide reorganization involving personnel reductions and has to operate with a reduced budget. In spite of all this, LADWP still must provide the same level of service as previously provided. Thus to accomplish the implementation of the restoration measures, LADWP will require more efficient planning and the cooperation of everyone concerned.

In addition to routine maintenance and Mono Basin work, there are other resource issues the Department is obligated to deal with within Inyo and Mono counties. As such, the Department has attempted to include time frames that are flexible and allow reasonable determinations for completion of the Mono Basin restoration.

There are also many factors that are beyond the control of LADWP that may hinder completion of work in a desired manner. For example, sustained high flows in above average years may reduce our capacity to work in the streams as well as shorten the window of opportunity in which our field crews can work in a given season.

LADWP has every intention to complete approved restoration measures in a timely manner. In keeping with the cooperative spirit LADWP will initiate engineering and planning for many of the measures proposed in the plans in advance of the SWRCB's approval. The SWRCB and interested parties are being asked to recognize the potential and unforeseen factors that may require minor adjustments in our implementation schedule. Working together and being understanding of LADWP's constraints will aid in the successful implementation of the restoration measures.

Cost Estimate to Implement the Restoration Plan

Funding for the majority of the restoration projects will come directly from conventional funding methods (i.e., water rate revenues). Whenever possible, the LADWP will seek alternative methods of project funding such as state and federal grants; however, the majority of costs will be borne by the LADWP. The initial cost estimate to implement the stream restoration plan is approximately $2 million. Table 1 summarizes the cost estimates for improving LADWP facilities, conducting a monitoring program, and performing instream restoration measures.

Table 1

Item	Personnel	Equipment	Material	Total	Contingency	Total Costs
I. LEE VINING CONDUIT SPILLWAY MODIFICATIONS						
1. Remove, Repair, and Refit Existing Check Gates	$14,884	$5,571	$1,500	**$21,956**		(includes ext, OH, & contingency)
2. Grade & Adjust Dirt Channel Alignment	$5,717	$4,711	$500	**$10,927**		
3. Mobilize & Prep. Concrete Channel Surface	$8,237	$3,432	$1,500	**$13,169**		
4. Shotcrete Resurface Concrete Channel	$12,578	$5,483	$9,500	**$27,561**		
TOTAL:	**$41,416**	**$19,198**	**$13,000**	**$73,500**	**$26,500**	**$100,000**
II. PLACE WOODY DEBRIS IN STREAMS						
1. Permitting & Environmental	$12,980	$50,484	$250	**$63,714**		
2. Place Root Balls in Stream	$5,089	$149,631	$1,000	**$155,720**		
TOTAL:	**$18,069**	**$200,115**	**$1,250**	**$220,000**	**$85,000**	**$305,000**
III. REWATERING ADDITIONAL CHANNELS AT RUSH CREEK						
1. Design & Permitting	$29,319	$550	$500	**$30,369**		
2. Supervision & Support of Rewatering Job	$23,578	$6,034	$2,000	**$31,612**		
3. Reach 3a	$4,155	$3,272	$0	**$7,426**		
4. Reach 3b	$2,661	$2,314	$0	**$4,975**		
5. Reach 3d	$5,246	$6,252	$0	**$11,497**		
6. Reach 1a	$7,650	$8,928	$0	**$16,578**		
7. Reach 4b Linkage	$1,994	$1,957	$0	**$3,951**		
8. Reach 4bii	$731	$682	$0	**$1,413**		
9. Reach 13 (Big Bend)	$9,605	$10,714	$0	**$20,319**		
TOTAL:	**$84,937**	**$40,704**	**$2,500**	**$125,000**	**$55,000**	**$180,000**
IV. REVEGETATE RIPARIAN AND INTERFLUVE AREAS						
1. Design & Permitting	$49,656	$567	$600	**$50,823**		
2. Revegetation Activities	$86,048	$17,997	$0	**$104,045**		
TOTAL:	**$135,704**	**$18,564**	**$600**	**$155,000**	**$65,000**	**$220,000**
V. REMOVE PREVIOUSLY GENERATED WASTE						
TOTAL:	$3,571	$0	$0	**$3,571**	**$1,429**	**$5,000**
VI. SEDIMENT PASSAGE AT LEE VINING, WALKER & PARKER CREEKS						
1. Design & Permitting	$10,245	$481	$1,000	**$11,726**		
2. Refit & Repair Sluice Gates	$4,636	$2,138	$3,000	**$9,774**		
TOTAL:	**$14,881**	**$2,619**	**$4,000**	**$21,500**	**$8,500**	**$30,000**

Table 1(cont.)

Item	Personnel	Equipment	Material	Total	Contingency	Total costs
VII. MONO BASIN ROAD CLOSURES						
1. Set Barricades Across Roads	$45,291	$30,874	$6,800	**$82,965**		
TOTAL:	**$45,291**	**$30,874**	**$6,800**	**$82,965**	**$32,035**	**$115,000**
VIII. REPAIR ENTRANCES TO LEE VINING CREEK CHANNELS						
1. Permitting & Environmental	$7,802	$316	$250	**$8,368**		
2. Remove Diversion Structure	$2,546	$751	$200	**$3,497**		
TOTAL:	**$10,348**	**$1,067**	**$450**	**$12,000**	**$4,500**	**$16,500**
IX. REHABILITATE MONO RETURN DITCH						
1. Design & Permitting	$52,785	$908	$1,000	**$54,692**		
2. Mobilize Onto Site	$10,273	$15,502	$1,500	**$27,274**		
3. Clean Invert of Ditch	$37,118	$53,236	$0	**$90,354**		
4. Dynamic Compaction of Loose Material	$57,734	$59,094	$0	**$116,828**		
5. Place Erosion Protection Mats	$15,962	$5,408	$242,000	**$263,370**		
6. Demobilize Off of Site	$14,713	$24,119	$0	**$38,832**		
TOTAL:	**$188,584**	**$158,267**	**$244,500**	**$590,000**	**$295,000**	**$885,000**
X. ENVIRONMENTAL DOCUMENTATION						
TOTAL:	$105,000	$0	$0	**$105,000**	**$40,000**	**$145,000**
XI. MONITORING						
1. Collection	$102,571	$0	$0	**$102,571**		
2. Data Analysis	$22,857	$0	$0	**$22,857**		
TOTAL:	**$125,429**	**$0**	**$0**	**$125,000**	**$50,000**	**$175,000**

GENERAL COMMENTS:

I. ONE TIME COST - No O&M considered.
II. ONE TIME COST - Future cost will be determined from stream monitoring data.
III. ONE TIME COST - Work may be performed in one season or in phases over 3 years.
IV. ONE TIME COST - Assumes three seasons of revegetation. Programs for additional vegetation will be determined from stream monitoring data.
V. ONE TIME COST -
VI. ANNUAL COST - Cost includes O&M for flow through and placement of sediment. These costs do not include normal O&M to remove sediment.
VII. ONE TIME COST -
VIII. ONE TIME COST -
IX. ONE TIME COST - O&M every 5 years at $50,000.
X. Estimate for first year projects. Additional environmental documents may be required for subsequent years.
IX. Costs are incurred every 3 to 5 years.

Periodic Reporting of Restoration Work to SWRCB

Due to the winter conditions normally experienced in the Mono Basin, the majority of restoration work will typically occur between April and October. Based on this, LADWP will report to the SWRCB twice a year. The first report, submitted by March 1 of each year, will summarize the planned restoration activities for the current year. Cost estimates, implementation schedule, and the scope of work will be included in the report. The second report, submitted by December 1, will report on the progress and status of the restoration efforts. Results from the monitoring program will not be included in these documents; instead, monitoring data will be provided as a separate document within eight months after collection. In addition to submitting these reports to the SWRCB, LADWP will provide copies of the reports to interested parties. Reporting to the SWRCB will commence on December 1, 1996 to summarize the 1996 restoration activities.

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