LOWER OWENS RIVER PROJECT

ECOSYSTEM MANAGEMENT PLAN

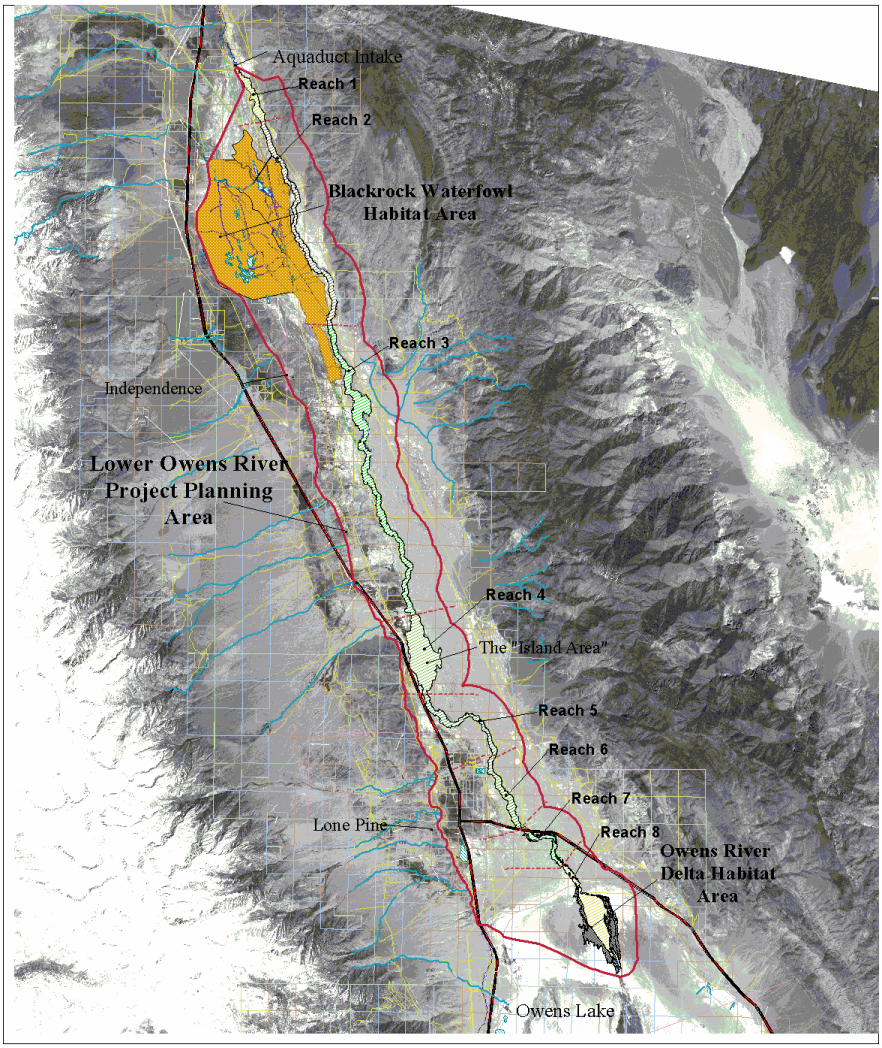

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TABLE OF CONTENTS

CHAPTER 1 - MANAGEMENT CONCEPTS

To achieve success in the restoration of the Lower Owens River, there are three basic requirements: (1) to understand ecosystem function; (2) to give the system time; and (3) to appreciate self-design.

Ecosystem restoration is a relatively new and evolving field of scientific and practical knowledge that still lacks some basic information and understanding of subtle ecological functions and interactions. Consequently, ecosystem restoration must begin at scales where our knowledge base is better understood, and then we are able to set the pathways for natural forces to follow and organize around over time.

Even though currently there is little hard scientific backing in the discipline of rebuilding and restoring whole ecosystems, what works and doesn't work in different types of ecosystems is learned and relearned every time we rehabilitate nature's processes. Subtle ecosystem interactions are better understood when we allow nature the time to respond to the reintroduction of natural resources. Through careful monitoring of the effects of macro-scale interventions, we can then adaptively manage with confidence and use more subtle interventions at micro-scales to influence the direction of restoration efforts toward a functional and sustainable ecosystem.

Management of the Lower Owens River ecosystem will emphasize the "self-designing" or "self-organizing" capacity of nature to recruit species and to make choices from those species that have been introduced. Self-design emphasizes the development of natural habitat. Scientific knowledge in the field of ecology verifies that natural forces do ultimately self-design around habitat by choosing the most appropriate species to fill niches and establish rates of recruitment, production and growth. Self-design allows the natural colonization of plant and animal species to attain balance and optimum biodiversity with minimal human manipulation of materials or processes. In other words, sustainable ecological restoration should not rely upon a human-built and artificially maintained ecosystem. We emphasize instead, to the greatest extent possible within the constraints of continued multiple uses, to give nature back what it needs to function and then take a hands-off approach that adapts management interventions to what nature is teaching us about what it needs to achieve a healthy balance.

The concept, or specifically the ability of the Lower Owens River to "self-design" or "self-organize," has been questioned due to the amount of disturbance and manipulation that has occurred and will continue to occur into the future. Biotic and abiotic components will adjust with adequate time, and then will be able to naturally self-design to the Lower Owens River macro-scale flow regime of 40/200 cfs. Unless natural conditions are continuously reset with excessive and proactive human interventions to attempt to *force* nature and the restoration process along an inappropriate path, nature can and will organize by way of natural ecological processes toward a functional condition.

Regulators and interested parties who are monitoring and measuring restoration success often make the mistake of not allowing adequate time for natural self-designing processes to develop before passing judgment. Legal, political and economic human priorities too often demand unnatural and mechanistic interventions for "quick-fixes" that usually do not allow the time necessary for nature to find balance, and actually can often

be undermining or even destructive to ecological restoration efforts. Because of the stochastic nature of hydrologic events, and the naturally slow and progressive development of ecosystems, sometimes in spurts and sometimes in the slow process of recruitment and growth, a five year horizon is arbitrary and probably too short a time period. Ecological models show that the further initial conditions are from a steady state, the more time is required for that system to reach, or even approach, steady state. The Lower Owens River ecosystem is currently very far from a balanced steady state; regulators should assume a time horizon of 15 to 20 years before evaluations are made about restoration success.

Short term and long-term management plans for the Lower Owens River Project (LORP) are not written in stone. LORP management plans are written in a flexible manner so as to be altered and revised when necessary through adaptive management decisions and interventions. Management plans must be amenable to change and the documents must not become an impediment to frequent revisions. Management plans must be developed and presented in such a way that strategies can be implemented quickly to respond to changes in the evolving ecosystem.

The two most important management tools for the Lower Owens River ecosystem are stream flow (i.e., the interaction of surface water and groundwater) and land use strategies. Water and land use management together exerts the greatest influence on the river's biotic and abiotic components and, ultimately, the degree of functional state attained by the total ecosystem. Whether the fishery reaches the desired goal of a healthy warm water community, T&E species recover, or land use activities are sustainable, depends to a large degree upon how successful are water and land use management interventions to restore the river to a functional ecosystem.

Each ecological component has a distinct set of management objectives or desired outcomes and a set of actions that will attain the management objectives. Management objectives and actions have been determined by data analysis and decision-making that has been completed the last several years. Numerous technical memoranda for each project component of the river ecosystem plan have been published, and these technical memoranda contain detailed analysis of data, describe options, present recommendations and establish decisions that are now the management objectives for each ecological component. Technical memoranda are referenced in footnotes in this Ecosystem Management Plan for the reader who wants more detailed information about how management objectives and actions have been set.

Adaptive management is described in the last section of this Plan and is the singular most important element for managing the river ecosystem to reach the desired goals. Management of the Lower Owens River requires a long-term commitment to allow for the evolution of natural processes to culminate in a functioning river ecosystem. Nature generally operates on an unpredictable time scale, and management must be able to adapt to subtle changes that occur over long periods of time. Achieving the goals of the LORP means using active management tools in innovative ways over time to adapt to changing ecosystem conditions.

Adaptive management can be defined in academic terms as a management intervention tool to strategically probe the functioning of an ecosystem with six main steps: 1) problem assessment, 2) design, 3) implementation, 4) monitoring, 5) evaluation, and 6) adjustment. But adaptive management can also be defined in a broader context as

a framework for management and decision-making at the watershed level. For practical purposes, the LORP has already completed steps 1 and 2. With the reintroduction of flows and implementation of this Ecosystem Management Plan, step 3 will be accomplished. Monitoring will complete step 4, and evaluation of trends will complete step 5. Decision-making to take actions and make changes that improve trends will complete step 6.

The principle tool of adaptive management is monitoring. Monitoring data is then used to measure progress toward a desired management objective over time. The data and information derived from monitoring of ecological components provides the necessary information to allow us to adapt actions and methods to real-time circumstances and unforeseen events. Details of monitoring activities are described in a separate chapter because monitoring is a distinct effort that supports management, but is not, in and of itself, management. The monitoring plan is comprehensive and includes monitoring of actions, methods and trends toward management objectives that are set in all management plans.

IMPLEMENTATION, MAINTENANCE AND OPERATION GUIDELINES[1]

Many exotic plant control measures have been incorporated into the overall management strategy and water control measures. The potential risk of infecting new areas with salt cedar or of increasing the vigor and productivity of existing stands is considered a significant issue in the Blackrock Waterfowl Habitat Area, the Owens River Delta Habitat Area and the Owens River Riparian Area. As a result, several wetland management practices, such as water drawdowns (partial drainage) will be restricted to reduce this risk. Other management practices that will help circumvent and limit the spread of salt cedar (tamarisk) include: (1) minimizing construction and other disturbance of substrates; (2) providing for good water circulation and drainage in wetlands to minimize accumulation of salts; (3) restricting use of fire for vegetation management--when fire is used, then flushing or leaching along with careful monitoring should follow, (4) timing, duration and extent of wetland water drawdowns will be managed to minimize the chance of invasion by tamarisk (i.e., winter months); and (5) monitoring will be focused upon the early detection of tamarisk recruitment.

Although the suggested procedures were designed for the Blackrock Waterfowl Habitat Area, they are also appropriate and applicable to the entire LORP. Construction and routine maintenance of facilities (e.g. roads, berms, ditches, gates, etc,) are designed to avoid or reduce the risk of impacting special status plants and wildlife, while also minimizing any conditions that could promote the expansion of salt cedar and other exotic plant pests. Appropriate scheduling of construction and maintenance will help avoid many potential impacts to wildlife and will minimize exotic plant recruitment.

[1] see. Technical Memorandum # 04, Mapping Existing Vegetation Types for the Blackrock Waterfowl Habitat Area.
see. Technical Memorandum # 15, Resource Management in the Blackrock Waterfowl Habitat Area.
see. Technical Memorandum # 08, Owens River Delta Habitat Area.
see. Technical Memorandum # 18, Blackrock Waterfowl Habitat Area Implementation.
see. Technical Memorandum # 20 Special Status Wildlife and Plants Species Accounts.

Contingency measures will help prevent establishment of the exotic pest plants in the event that new areas become infected.

Plants

Appropriate scheduling of construction and maintenance activities reduces the risk of establishing new populations of exotic pest plants.

- Schedule construction and maintenance activities during the period when salt cedar seed production is lowest, to the extent possible. This period is usually from about November to March.

The following procedures and precautions should be taken prior to new construction activities:

- Focused pre-construction surveys for the presence of special status plants should be conducted. Any construction or maintenance activity that would impact a special status plant population will be avoided.
- Focused pre-construction surveys for the presence of exotic pest plants should be conducted.

When construction or maintenance occurs in areas with an established exotic pest plant population, the following procedures and precautions should be taken:

- If the problem is salt cedar, the Inyo County Water Department Salt Cedar Control Team should be contacted to provide assistance in eradication at the site.

- To the extent possible, established exotic pest plants at the work location should be eradicated as completely as possible before beginning construction or maintenance on structures.

- Barrow areas should be selected very carefully and generally not include materials from areas with an established population of exotic pest plants. Barrow material should not include stems, roots or other plant parts that might promote the spread of undesirable plants.

- Mulch or landscape cloth might be an effective deterrent to germination of weeds at small sites.

Drawdown zones and new construction and maintenance sites will be monitored to detect recruitment of exotic plants. If exotic pest plants such as salt cedar, Russian olive, or perennial pepperweed, etc. are detected, the plants should be controlled before they have a chance to become established.

A combination of the following contingency measures is probably appropriate:

- Application of a broadleaf specific herbicide is a very effective means of eradicating young plants. The most appropriate herbicide to use depends upon specific site factors, including the target plant species, whether the site is wet or dry and the size of the treatment area.

- Hand removal of young plants is an option if the extent of problem is small.

- Cutting and flooding of young plants is an effective means of killing salt cedar if the plants can be completely submerged in water for 6 weeks.

Wildlife

Reduce the level of disturbance to wildlife, especially during nesting times, by scheduling management and maintenance activities outside sensitive periods. To the extent possible, prescribed burning, construction and repair of water control structures, and roadside maintenance such as mowing and grubbing should be scheduled during the least sensitive periods for wildlife.

- The least sensitive period for nesting birds will be generally from mid-September to early January. For example, loggerhead shrike (mid-January to early September), Le Conte's thrasher (mid-January to early September), California quail (April to August), mallard (February to July) and northern harrier (March to mid-September).
- Prescribed burning should only be implemented as a last measure to reduce residual emergent vegetation in wetlands. Burns should only be conducted in wetlands and implemented during the least sensitive time for ground nesting birds (mid-September through January). No burns should be allowed within or adjacent to riparian areas.
- Snags and downed woody material are a very important special habitat element for many species of wildlife and should not be cut or removed. Most snags and woody material are restricted to riparian areas and the areas around springs and seeps. Present LADWP policy prohibits the cutting and removal, for whatever reason, of snags, downed woody material and other live vegetation.
- To the extent possible, roadside vegetation and hedgerows should be left alone because they provide valuable nesting areas for many birds and increase structural richness.
- To the extent possible, understory vegetation and plant structure (i.e., herbaceous, shrubs, young trees, tree branches, etc.) in and around any forested areas (e.g., tree lots, riparian, lakeside, etc.) should be left alone. These areas provide valuable nesting, resting, roosting and cover for many species and they increase the structural richness of the site.

CHAPTER 2 – RIVER MANAGEMENT PLAN

SURFACE WATER

The flows for the Lower Owens River are designated in the MOU. The base flow will be 40 cfs, with an annual riparian flow of up to 200 cfs, and an annual average flow of 6 to 9 cfs to be released to the Delta habitat area.

To accommodate the schedule for the construction of the pump station, water will be released to the river in two phases. The two phases and the planned schedules for commencing each phase are described below.

The Phase I release will begin once LADWP has completed the channel clearing work, the modification of the River Intake structure, and the installation of 18 temporary flow measuring stations and culverts. LADWP will begin releasing water to the Lower Owens River via the Intake. Flow releases will be increased daily in five-cfs increments until a continuous flow is achieved from the Intake to the Delta. Flows in the currently wetted reach of the river (5 to 17 cfs) will be maintained during this phase. It is expected that releases from the spillgates that currently supply the wet reach of the river will be reduced as new flows released from the Intake reach the wet reach.

Once construction of the pump station is completed, releases from the River Intake (Phase II) will be increased in 1 to 5 cfs daily increments, supplemented as necessary by various spillgates, until a 40 cfs baseflow is achieved from the Intake to the pump station. Flow adjustments based on the monitoring and thresholds described below will be conducted once the releases commence, but the flow adjustments will be subject to the objective of achieving the 40 cfs flows from the Intake to the pump station within about 30 days of the commencement of Phase II releases. An additional six months may be required to stabilize the 40 cfs flows throughout the channel.

The timing of the seasonal habitat flows is designed to coincide with seed production by willows and cottonwoods in the floodplain (e.g., late spring), thereby providing an opportunity to stimulate growth of new trees on the floodplain adjacent to the river channel. The initial seasonal habitat flow will be released to the river in late May or early June following the initiation of Phase II flow releases. The seasonal habitat flows will be released from the River Intake. Seasonal habitat flows not captured by the pump station will flow to the Delta.

Annual seasonal habitat flows will be released in May or early June. The maximum amount of the annual seasonal habitat flow will be determined each year based on runoff conditions, as specified in the nomograph shown in Figure 2. No flows above the 40 cfs base flows will be released from the River Intake in years when the runoff is predicted to be 50 percent or less of the annual average. If runoff is greater than 50% of normal, the amount of the flow will increase proportionally in accordance with runoff up to a maximum release of 200 cfs. When runoff is 100% of normal or greater, seasonal habitat flows will be 200 cfs.

Management Objective 1: The management objective for water delivery in Phase I and II is two-fold: (1) to recharge aquifers and bank storage, and (2) to achieve as close as possible to 40 cfs in all river reaches while also protecting water quality and aquatic biota.

Action 1-1: Prior to initiating the Phase 1 releases, LADWP will mechanically remove sediments and marsh vegetation obstructions from approximately two miles of the river channel downstream of the River Intake. A 15-foot wide swath will be excavated within the middle of the existing 40-50 foot wide channel to allow 40 cfs to pass. It is anticipated that the 40 cfs base flow, coupled with seasonal habitat flows up to 200 cfs, will generate enough erosive force to maintain an open channel.

Action 1-2: Installation of temporary gauges and water quality sampling stations in the following locations throughout the river:

Permanent gauging capabilities below the Intake
Above Blackrock Ditch Return
Below Blackrock Ditch Return
East of Goose Lake
Goose Lake Return
Five Culverts
Below Billy Lake Return
Mazourka Canyon Road
Below Locust Return
Manzanar Reward Road
Below George's Return
Reinhackle Springs
Below Alabama Gates Return
Lone Pine Ponds
Lone Pine Narrow Gage Road
Keeler Bridge
Above Pumpback Station
Below Pumpback Station

Action 1-3: Once LADWP has completed the channel clearing work, the modification of the River Intake structure, and the installation of temporary flow measuring stations and culverts, Phase I flow releases will begin via the River Intake. Releases will be increased daily in five-cfs increments until a continuous flow is achieved from the Intake to the Delta. During this phase, flows throughout the Lower Owens River would be the same as have occurred under past practices in the currently wet reach of the river (from about five to 17 cfs). It is expected that releases from the spillgates that currently supply the wet reach of the river will be reduced as new flows released from the Intake reach the wet reach.

Action 1-4: Once construction of the pump station is completed, Phase II flow releases will begin. Flow from the River Intake will be increased in 1 to 5 cfs daily increments, supplemented as necessary by various spillgates, until a 40 cfs baseflow is achieved from the Intake to the pump station. Flow adjustments based on the monitoring and thresholds described below will be conducted once the releases commence, but the flow adjustments will be subject to the objective of achieving the 40 cfs flows from the Intake to the pump station within about 30 days of the commencement of Phase II releases.

Action 1-5: Surveys will be made of the river during Phase I and II to identify flow barriers, and to remove or breach manmade dams and replace culverts that significantly intercept or impede flow.

Action 1-6: An initial seasonal habitat flow of 200 will be released to the river in late May or early June 2005. After the initial seasonal habitat flow, subsequent annual seasonal habitat flows will be released in May or early June. The maximum amount of the annual seasonal habitat flow will be determined each year based on runoff conditions. No flows above the 40 cfs baseflows will be released from the River Intake in years when the runoff is predicted to be 50 percent or less of the annual average. If runoff is greater than 50% of normal, the amount of the flow will increase proportionally in accordance with runoff up to a maximum release of 200 cfs. When runoff is 100% of normal or greater, seasonal habitat flows will be 200 cfs.

Management Objective 2: Following Phase I and Phase II and the initial seasonal habitat flow, management will be based on maintaining a 40 cfs base flow, or as close as possible, within all river reaches, and annual seasonal habitat flows up to 200 cfs.

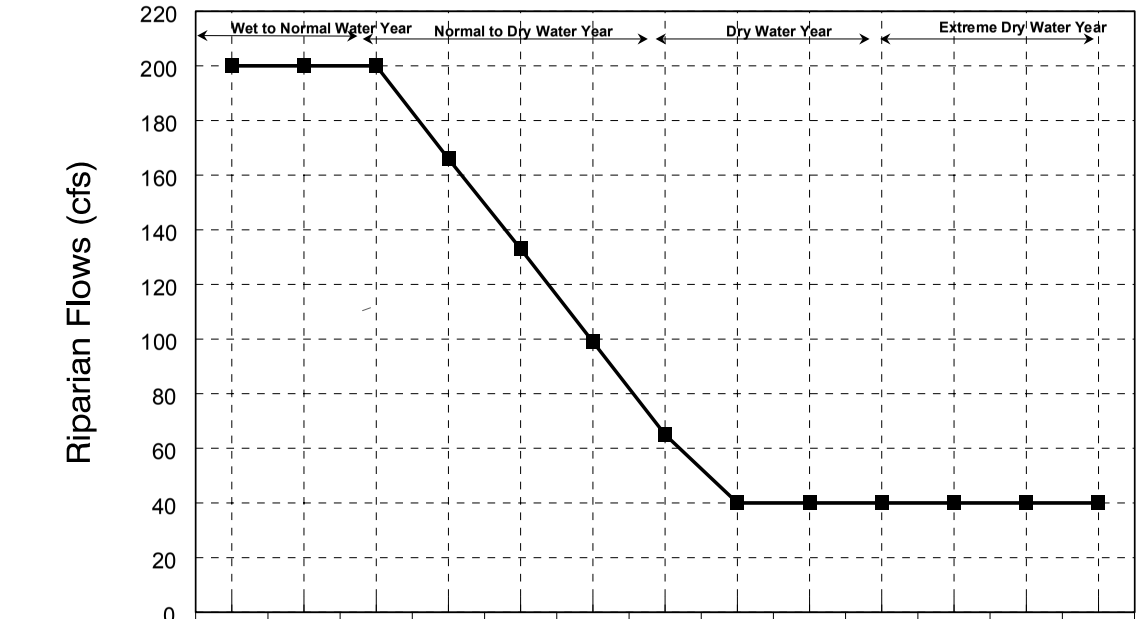
Action 2-1: Evaluate losing/gaining reaches and flow equilibrium to determine flow stability. It is possible that the river will continue to lose an average of 1 cfs/mile after the equilibration period is attained. In the event of natural flow losses, flows will be adjusted with augmentation from spillgates and returns (i.e., Blackrock Ditch, Goose Lake return, Billy Lake return, Locust Spill Gate, Georges Spill Gate, and Alabama Gates) to maintain as close to the base flow conditions of 40 cfs as possible throughout the river.

Action 2-3: Temporary gauging stations will be removed once flow losses are accounted for, and a minimum of four permanent gauging stations will be established in the river for continuous monitoring of stream flow. Without an adequate spread of metered sections it is difficult to determine changes in water flow by reach and to implement adaptive management strategies over time. The initial water release plan will be monitored by a spread of gauging stations that will cover more channels and spill gate sections than will eventually be necessary.

Action 2-4: Magnitudes of seasonal habitat flows will be determined each year as an analog of the runoff year. A nomograph (Figure 2), developed from runoff year model predictions, will be used for deciding on these flows as described previously. Duration of seasonal habitat flows will depend upon increasing flows from the base flow of 40 cfs at a rate of 25% of the previous day's flow to the peak for that year and decreasing to the 40 cfs base flow at the rate of 20% of the previous day's flow. This will result in flow duration of 14 days from the rise to the fall of the hydrograph for a 200 cfs seasonal habitat flow. However, flows must be timed to coincide with the onset of willow and cottonwood seeding and dropping. Timing seasonal habitat flows to enhance willow/cottonwood seed dispersal provides some selective advantage over salt cedar and optimizes seeding and germination for native riparian plant species. Annual seed development will vary from the upper reaches of the Lower Owens River to the furthest downstream reaches, which may be far earlier. Consequently, seasonal habitat flow timing should be based on the reach of river where seed development is latest in the spring.

Action 2-5: Channels in the island area are historic channels and remnants of oxbows located mostly on the east side of the river; they will be reconnected eventually by the seasonal habitat flows of up to 200 cfs and will carry most of the 40 cfs base flow. River flow will be allowed to naturally define the channels through the island area by relying upon adaptive management to respond to grazing, mosquito or flooding problems that may arise.

FIGURE 2. Nomograph for Annual Riparian Flows



Runoff (ac-ft)	478219	438368	398516	358664	318813	278961	239110	199258	159406	119555	79703	39852	0
% Normal Runoff	120	110	100	90	80	70	60	50	40	30	20	10	0

WATER QUALITY[1]

There are two principal water quality problems associated with the LORP and rewatering the river between the intake and Owens Lake. The first problem is the potential for fish kills when water is reintroduced into the river. The second problem is the probable violation of State water quality goals in the initial years of the restoration effort.

Management of the river will require careful reintroduction of flows in order to minimize and prevent a fish kill. To prevent a fish kill and to minimize stress on existing fish populations from rapidly deteriorating water quality conditions, flow introduction will be gradual. During the period when aquifers and bank storage systems are being re-filled, stream water quality and fisheries will be monitored very closely for deteriorating conditions.

The second area of concern is short-term water quality conditions. During the early years of channel rewatering it is probable that dissolved oxygen, ammonia, pH, temperature and turbidity will not meet Lahontan Regional Water Quality Control Board (LRWQCB) Water Quality Plan Objectives. In time, however, as riparian vegetation matures, stream flows reach equilibrium, riparian pasture vegetation buffers are established and muck deposits are assimilated, water quality objectives can be met. In the short term, however, it will be essential to work closely with the LRWQCB to establish variances for water quality objectives.

Management Objective 1: Sampling of water quality parameters and fish health during Phase I and II flow introduction.

Action 1-1: During the month prior to the commencement of Phase I flows, water quality monitoring will occur once to establish baseline conditions. Water quality measurements will be taken at nine stations and will include electrical conductivity, dissolved oxygen, pH, turbidity, temperature, ammonia, hydrogen sulfide, and tannins and lignins. Water quality monitoring will focus on the wet reach of the river where water quality impacts are more likely to occur. Ambient air quality measurements for hydrogen sulfide, methane, and ammonia will also be taken at these stations. The sampling stations will be:

Permanent gauging capabilities below the Intake
Five Culverts
Mazourka Canyon Road
Manzanar Reward Road
Reinhackle Springs
Lone Pine Ponds
Lone Pine Narrow Gage Road
Keeler Bridge
Below Pumpback Station

[1] See Technical Memorandum #7 Water quality in the Lower Owens River: existing and future conditions.

Action 1-2: Once Phase I releases have commenced; flow rates will be monitored at the temporary gauging stations. During this period, water quality monitoring will be conducted weekly or bi-weekly, if needed.

Action 1-3: Once Phase II releases begin, water quality will be monitored 1-5 days per week for up to six months, as necessary, then one day per week for another six months. Thereafter, water quality monitoring will cease (except during seasonal habitat flow releases). Water quality parameters that will be monitored include electrical conductivity, dissolved oxygen, pH, turbidity, temperature, ammonia, hydrogen sulfide, and tannins and lignins. Ambient air quality measurements for hydrogen sulfide, methane, and ammonia will also be taken. The condition of fish that are visible at each station will also be observed for evidence of stress such as excessive jumping, lying motionless near the surface, rapid gill movement, and poor coloring or body appearance.

Action 1-4: If it is determined, based on the water quality thresholds and fish health, that conditions in a portion of the river are such that a substantial fish kill is likely, flows downstream of the River Intake will be augmented with higher quality water released from the spillgates (to improve water quality and to provide refuges). However, because Phase 2 would involve increasing flows from the Phase 1 to 40 cfs within 30 days of initiating the Phase 2 flows, it will not be possible to hold releases steady or to reduce releases.

To assist in determining whether supplemental releases from the spillgates are warranted , the following water quality thresholds have been established:

- Decrease in dissolved oxygen to less than 90 percent of the natural concentration based on one month of baseline data collection, and/or
- 10 percent increase in hydrogen sulfide concentration above ambient levels as determined by one month of baseline data collection, and/or
- 10 percent increase in ammonia concentration above ambient levels as determined by one month of baseline data collection.

Management Objective 2: To the extent possible, meet or exceed water quality standards and criteria of the LRWQCB during seasonal habitat flow.

Action 2-1: Prior to the release of the first three seasonal habitat flows, water quality will be monitored one time at the nine monitoring stations listed above. During the first three releases of flows, water quality will be measured five times per week during the seasonal habitat flows and for up to two weeks after the seasonal habitat flows. The following conditions will be monitored: electrical conductivity, dissolved oxygen, pH, turbidity, temperature, ammonia, hydrogen sulfide, and tannins and lignins. In addition, ambient air quality measurements for hydrogen sulfide, methane, and ammonia will be measured during the same

period. The condition of fish that are visible at each station would also be observed for evidence of stress such as excessive jumping, lying motionless near the surface, rapid gill movement, and poor coloring or body appearance. After three years of seasonal habitat flow releases, water quality monitoring will be discontinued.

Action 2-2: The monitoring data will be evaluated to determine the potential of the seasonal habitat flows for causing a substantial fish kill. To assist in making this determination, the following monitoring thresholds have been established:

- Decrease in dissolved oxygen to less than 90 percent of the natural concentration based on baseline data collection, and/or
- 10 percent increase in hydrogen sulfide concentration above ambient levels as determined by baseline data collection, and/or
- 10 percent increase in ammonia concentration above ambient levels as determined by baseline data collection.

If it is determined, based on the monitoring indicators and other relevant data and information, that the seasonal habitat flows are causing substantial water quality and fish impacts, seasonal habitat flows downstream of the River Intake will be augmented with higher quality water released from the spillgates solely for the purposes of reducing water quality impacts. This augmentation of seasonal habitat flows would only occur during the first three seasonal habitat flows.

RIPARIAN HABITAT[2]

Riparian areas in watersheds provide numerous ecological links between upland areas and their aquatic ecosystems, besides creating shade, cover and organic debris for fish and wildlife. Riparian zones with woody debris provide an extremely important structural component in aquatic ecosystems, often becoming the dominant element in the physical structure of streams while also providing an important nutritional substrate for the aquatic ecosystem.

A critical role of the riparian ecosystem is met when coarse, woody debris naturally falls into streams; debris (allochthonous) inputs that dominate small streams are their main source of energy. Riparian vegetation has been shown to exert significant control over fluvial processes, but also largely determines instream habitat by providing: (1) flow resistance; (2) log jams that create flow interruptions; (3) interception and storage of sediment; (4) bank strengthening; and (5) concave bank bench deposition. These types of flow disturbance regimes in stream ecosystems are vital to shape the riparian zone and its vegetation. By establishing riparian flows that exceed channel capacity for the LORP, we are providing the fundamental disturbance regime to restore the Lower Owens River ecosystem.

[2] See Predicted future vegetation types in the Lower Owens River; a report prepared for LADWP and Inyo County, June, 1997.

The heart of an ecologically healthy watershed is the riparian habitat. Riparian habitat is shaped not only by channel geomorphology, hydrologic pattern, spatial position of the channel in the drainage network, and the natural disturbance regimes, but is also affected by habitat dynamics, water quality and the animal community. All of these factors interact to affect riparian habitat, but riparian habitat also affects each of these ecological processes as well. Technical Memoranda No. 19 and 20 provide substantial detail on expected riparian habitat values.

Management Objective 1: Develop a lateral and longitudinal corridor of native riparian plant communities throughout the river by using annual seasonal habitat flows of up to 200 cfs. Riparian habitat should be dominated by willow, cottonwood and wet meadow vegetation that exhibits healthy age structure developing toward late seral stages.

Action 1-1: Implement seasonal habitat flows after the initial phases of flow reintroduction. Flow magnitude is to be based upon the run-off year and will follow the nomograph, as shown in Figure 2, and described in the Surface Water Management section.

Action 1-2: Seasonal habitat flows alone will not determine vegetation trends, therefore land management and grazing strategies will be used to enhance and influence riparian zones. Land and water management will be constantly coordinated through monitoring feedback to ensure that riparian habitat is developing a healthy age structure, diversity and trend toward late seral stages.

Action 1-3: Active interventions, such as planting of riparian and upland vegetation, can be employed if adaptive management indicates such actions would be beneficial. Specific areas of the river or uplands where planting and vegetating efforts could be performed will require time to identify and assess after first allowing water and land management efforts to show positive results before intervening in other ways.

TULES AND MUCK[3]

The Lower Owens River supports a high biomass of rushes (*Scirpus acutus*) and cattails (*Typha* sp.), collectively known as tules. Tules completely dominate wetted reaches of the channel from just above Mazourka Canyon Road to the Delta. Rush and cattail dominance will continue in certain reaches, and perhaps increase with future stream flows of 40 cfs base flow and up to 200 cfs annual riparian flow. Tules have both a positive and negative effect on water quality. Prolific tule growth and die-off could have an ongoing and deleterious effect on dissolved oxygen, BOD and sediment transport and deposition. Channel dominance by tules, as well as the influence of beaver dams and other hydrologic controls, can negatively influence stream flow by creating backwater effects.

[3] See Technical Memorandum #9 Management of tules and organic sediments.

Excessive tule biomass can have some disadvantages to the development of a flowing and functioning Lower Owens River, but tules also provide ecological benefits. Tule growth in the Lower Owens River provides bank and channel stability, reduces erosion and adds shade and nutrients. Mudflats that are often adjacent to tules provide winter habitat for waterfowl and shorebirds, and tule and other dense vegetation stands provide valuable refuge and early rearing habitat for both native and introduced fish species. Stands of emergent vegetation such as tules can substantially improve water quality by filtering sediments from stream flow, by removing nutrients and organic and suspended solids, and by modifying both low winter and high summer temperatures.

As a result of the ecological benefits provided, the LORP does not desire to eliminate tules, but to control and manage negative influences on river flow and function as a result of excessive tule growth. Tule encroachment into the channel will occur in the future no matter what method is used to prepare the channel, but encroachment will be influenced by the magnitude of depth and velocity of stream flows, by interaction with shading, and by competition with other vegetation types.

Tules are ultimately controlled by the interaction of light, depth, velocity and competition. Maximum depth of water to limit tule growth is a function of light penetration that permits photosynthesis in inundated portions of tule stems. By reducing photon flux, partial or complete shading of tules may greatly reduce the maximum depth where emergent plants can grow. Analysis indicates that tule trimlines are clustered below the water surface at about 50 cm/s; at high flows in most reaches of the river both depth and velocity must approach or exceed 200 cfs to control tules.

Light penetration into the water column becomes a significant tule control mechanism as overhead canopy expands to shade the river. As the river recovers to a healthy, functioning riverine ecosystem, shading by willows, cottonwoods and other trees will increase over time. A dense canopy will develop over areas of the river within the first decade and will create a very significant shading effect. The four-way interaction of depth, velocity, light and competition, which have all been shown to limit tule growth, should result in a natural tule control mechanism at flows that are also compatible with fish and wildlife habitat needs.

Deposits of sand, silt and organic sediments (muck) are confined to the wetted reach of the Lower Owens River. Low volume and low velocity flows over the years have allowed organic sediment and sand to accumulate throughout the lower channel (deposits are several feet thick in some places). Organic sediments can be a source of organic loading if high flows cause scour and mobilize bottom materials, yet organic sediments that are not mobilized can contribute to anaerobic streambed conditions.

Management of organic sediments in the Lower Owens River will be based upon the natural consequences of stream flow. Mechanical removal of organic sediments has been rejected for the LORP because it will retard river restoration efforts by adding negative environmental impacts and degrading the wetted reaches of the river. Bottom muck will be gradually redistributed and naturally moved onto landforms during slow rewatering; these organic sediments are essential to restoring and maintaining stream banks and riparian vegetation processes.

In the short term, however, organic sediments may exacerbate poor water quality conditions. But in time, as the ecosystem begins to improve and change from a dysfunctional to a functional state, water quality will approach balance and sediment

redox potential will change as anaerobic conditions decline. In short, leaving organic sediments in place poses less risk to ecosystem recovery than mechanical removal.

Management Objective 1: Active intervention in tule removal during the initial years in areas that significantly intercept or impede flow.

Action 1-1: Evaluate tule blockages during start-up of flow reintroduction between the intake and Alabama Gates, and create a channel through tule beds if blockage is severe.

Action 1-2: Evaluate tule blockages during start-up of flow reintroduction between Alabama Gates and the Delta, and create a channel through tule beds if blockage is severe.

Action 1-3: Allow tules and riparian communities to achieve a natural balance in response to base and riparian flows that will create river reaches of both closed and open canopy over time.

FISHERIES[4]

Fish habitat management, which will include land use and stream flow management, will be performed as part of the overall LORP management. Fisheries management *per se* (i.e., stocking and regulations) is the responsibility of the California Department of Fish and Game (CDFG). Nevertheless, agencies must collaborate to pool and analyze data during the monitoring years to implement effective and fair adaptive management strategies.

Fisheries management is expected to establish a healthy warm-water recreational fishery and to provide habitat for native species. Seasonal habitat and base flows are intended to enhance warm-water recreational fishery as well as benefit biodiversity and T&E species. Habitat indicator species designated in the Memorandum of Understanding (MOU) for the LORP are:

X Largemouth bass (*Micropterus salmoides*)
X Smallmouth bass (*Micropterus dolomieui*)
X Bluegill (*Lepomis macrochirus*)
X Channel catfish (*Ictalurus punctatus*)
X Owens sucker (*Catostomus fumeiventris*)
X Owens pupfish (*Cyprinodon radiosus*)
X Owens tui chub (*Gila bicolor snyderi)*

Fish habitat within the LORP area includes the river channel, beaver ponds, oxbows and side channels, off-channel lakes and ponds, spillage ditches, and spring and

[4] See Technical Memorandum #14 Fisheries in the Lower Owens River: existing and future conditions.

artesian well ponds. The maps following this chapter illustrate the LORP area and delineate major features between the intake and Owens Lake.

In addition to instream channel flows, flows will also be managed to connect off-channel fish habitats with the river channel. These connections will serve as corridors for fish migration, spawning and nursery areas, and rearing areas; corridors will also provide pathways for fish movement and create riparian habitat for a variety of birds, mammals, reptiles and amphibians.

Stream corridors to be developed in the Lower Owens River will capitalize on existing connections (see maps). A connection will be established from Blackrock Ditch to Upper and Lower Twin Lakes through Waggoner wetlands, and from Coyote/Grass Lake complex to Upper and Lower Goose Lakes forming a corridor that will be extended to connect with the river channel[5]. The connections will be accomplished by directing approximately 5 cfs of flow through the existing channel (currently runs south from Goose Lake and nearly parallel with the river to a confluence just above Five Culverts). Flow in the Blackrock Ditch will be extended to the river so that a continuous corridor from the Lower Owens River through the Blackrock wetlands, through the Twin Lakes complex, through Goose Lake and back to the river channel will be created. This corridor will allow the free movement of fish between the off-channel lakes and ponds to the river, thus providing substantially more habitat with greater diversity. Largemouth bass and bluegill are already present in these lakes and ponds and the corridor will give these game species access to and egress from the river.

Another corridor, originating at the Independence spill gate and continuing through Long Pond to Billy Lake and the river channel, will be maintained (see maps).

Off-channel lakes and ponds currently provide high quality warmwater fish habitat for largemouth bass, and bluegill in particular. Habitat quality is expected to improve and increase as more water flows through Twin and Goose Lake complexes to meet corridor flow requirements; new flows will increase the turnover time in the lakes and slightly raise water surface elevations. Warmwater fish species will have access to the river channel and lakes and will move between the two, but due to high water temperatures and low dissolved oxygen concentrations in the migration corridors throughout the day, fish will probably exhibit the greatest migration activity at dusk and early evening.

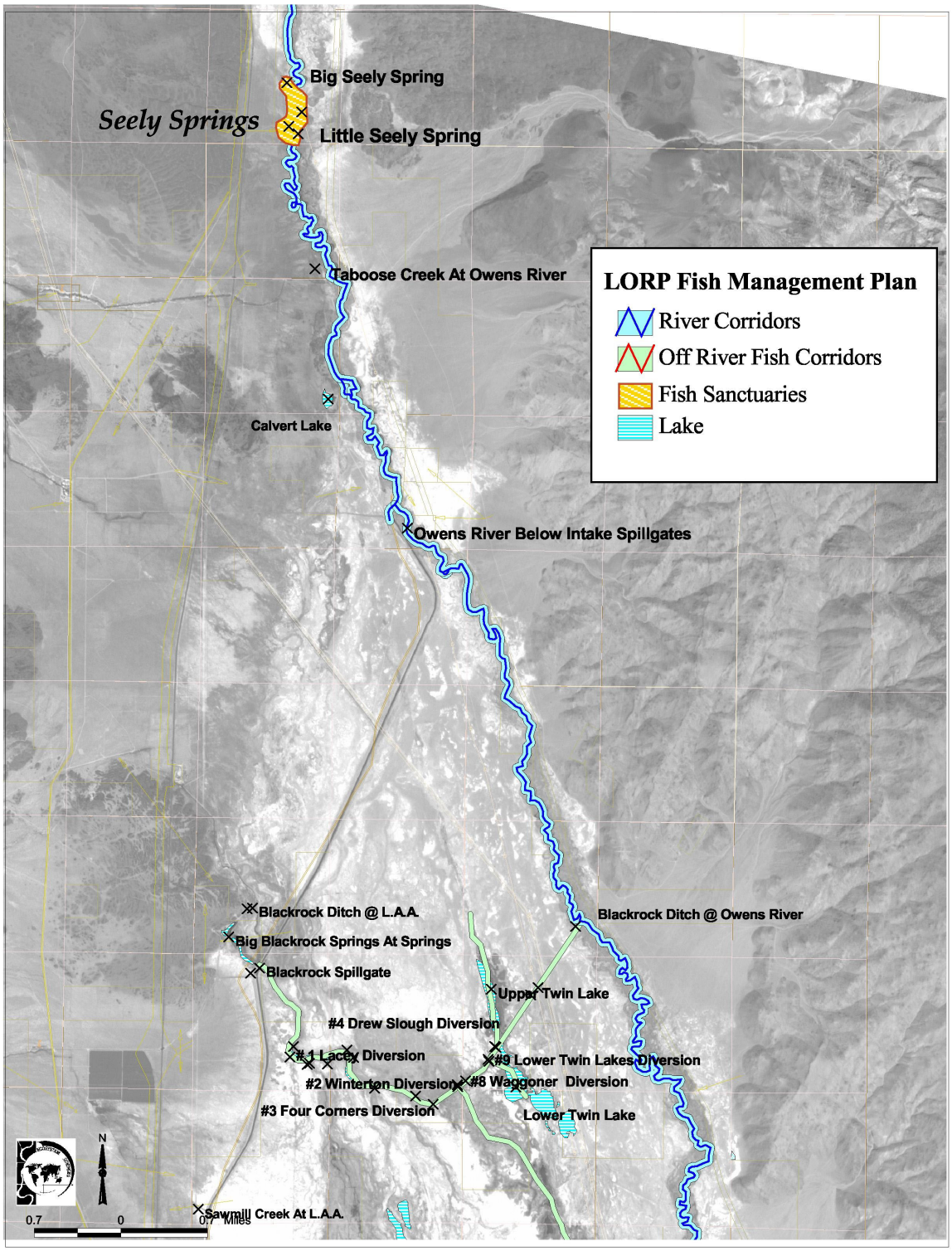
Shallow water habitat, biomass of vegetation, high water temperatures, low dissolved oxygen, and low flow velocities are expected to characterize migration corridors, and will most likely be the preferred habitat for non-game fish species like mosquito fish, carp and suckers. In time, as native fish populations recover and are allowed to recolonize aquatic habitats, pupfish will also be commonly found in the corridors connecting lakes, ponds, wetlands and the river. The same corridors that allow native fish movement will also allow the movement of non-native fish, but these corridors will not be utilized as native fish sanctuaries. It has been suggested that the corridors connecting the river directly to native fish sanctuaries should have barriers to prevent upstream fish movement from the river. However, since these corridors are not native fish sanctuaries, and native fish sanctuaries will not initially be connected to the

[5]An optional corridor may be established linking Lower Twin Lake directly with the Coyote/Grass lake complex as shown in the river map.

river, screens and barriers will not be required. Small sensitive habitats for native fish, such as Well 368, will not be connected with the river, therefore, non-native fish from the river will be unable to move into this sensitive native fish area.

Although beaver activity has removed much of the willow and other shrub and woody vegetation, beaver dams also create favorable tule conditions, provide important fish rearing habitat and mesic meadows, and promote the growth of other riparian species. The physical removal of beaver dams will undoubtedly result in more adverse environmental impacts than environmental benefits.

In the short-term, beaver ponds will continue to provide the dominant fish habitat in the river reach below Mazourka Canyon Road to the Delta. Beaver dams should be left as they are in most areas of the LORP, and allow natural forces associated with future riparian and base flows to incorporate them into the riverine ecosystem. Fish will continue to concentrate in beaver ponds in the river reach below Mazourka Canyon Road in the short term. However, as riparian and base flows begin to alter river channel habitat and beaver ponds, game fish will quickly expand into the increasing river habitat as pond habitat declines.


Seely Springs
Big Seely Spring
Little Seely Spring
Taboose Creek At Owens River
Calvert Lake
Owens River Below Intake Spillgates
LORP Fish Management Plan
River Corridors
Off River Fish Corridors
Fish Sanctuaries
Lake
Blackrock Ditch @ L.A.A.
Big Blackrock Springs At Springs
Blackrock Spillgate
Blackrock Ditch @ Owens River
Upper Twin Lake
#4 Drew Slough Diversion
#1 Lacey Diversion
#9 Lower Twin Lakes Diversion
#2 Winterton Diversion
#8 Waggoner Diversion
#3 Four Corners Diversion
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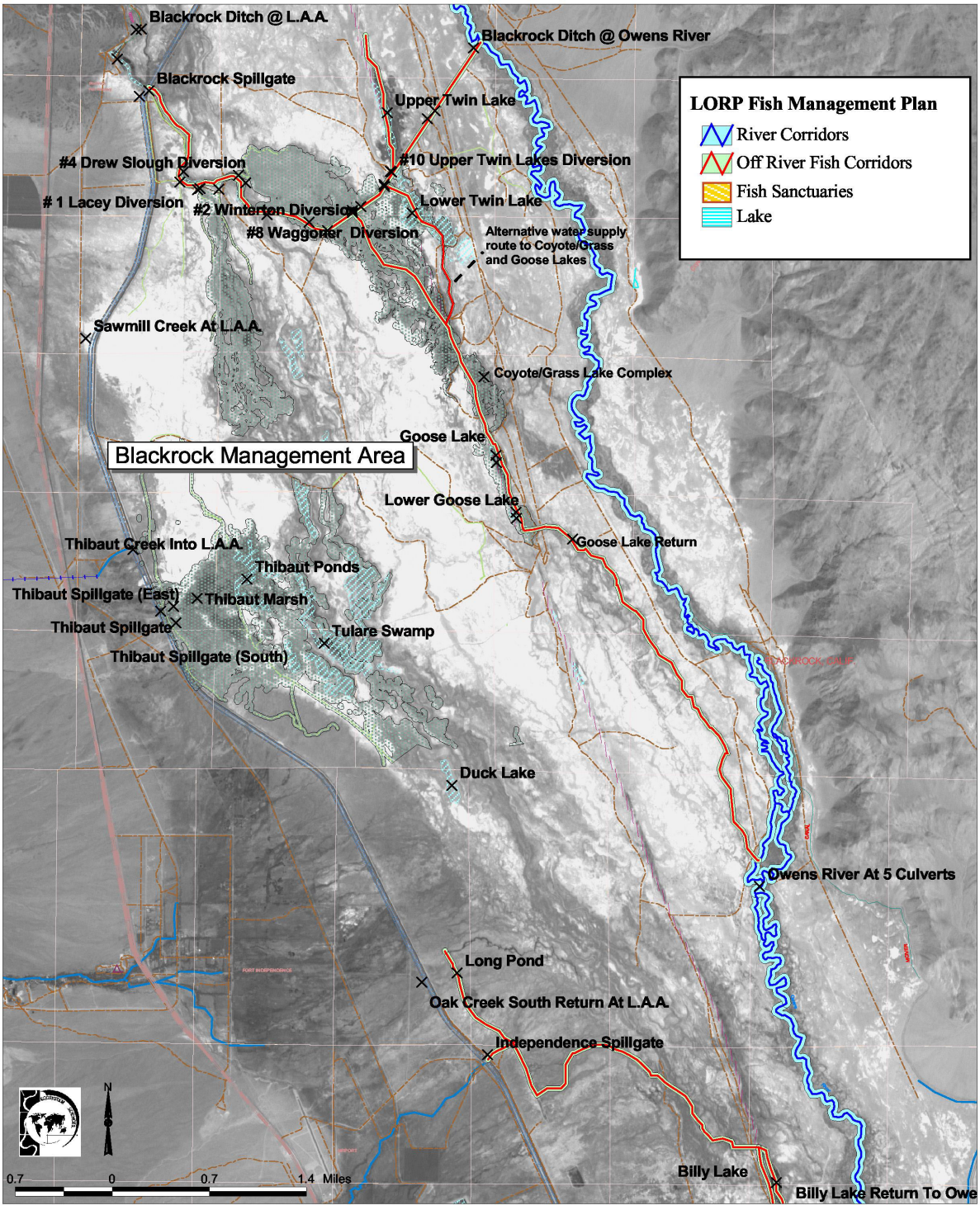
Sawmill Creek At L.A.A.


Blackrock Ditch @ L.A.A.
Blackrock Ditch @ Owens River
Blackrock Spillgate
Upper Twin Lake
#4 Drew Slough Diversion
#10 Upper Twin Lakes Diversion
1 Lacey Diversion
#2 Winterton Diversion
Lower Twin Lake
#8 Waggoner Diversion
Alternative water supply route to Coyote/Grass and Goose Lakes
LORP Fish Management Plan
River Corridors
Off River Fish Corridors
Fish Sanctuaries
Lake
Sawmill Creek At L.A.A.
Coyote/Grass Lake Complex
Goose Lake
Blackrock Management Area
Lower Goose Lake
Thibaut Creek Into L.A.A.
Goose Lake Return
Thibaut Ponds
Thibaut Spillgate (East)
Thibaut Marsh
Thibaut Spillgate
Tulare Swamp
Thibaut Spillgate (South)
Duck Lake
Owens River At 5 Culverts
Long Pond
Oak Creek South Return At L.A.A.
Independence Spillgate
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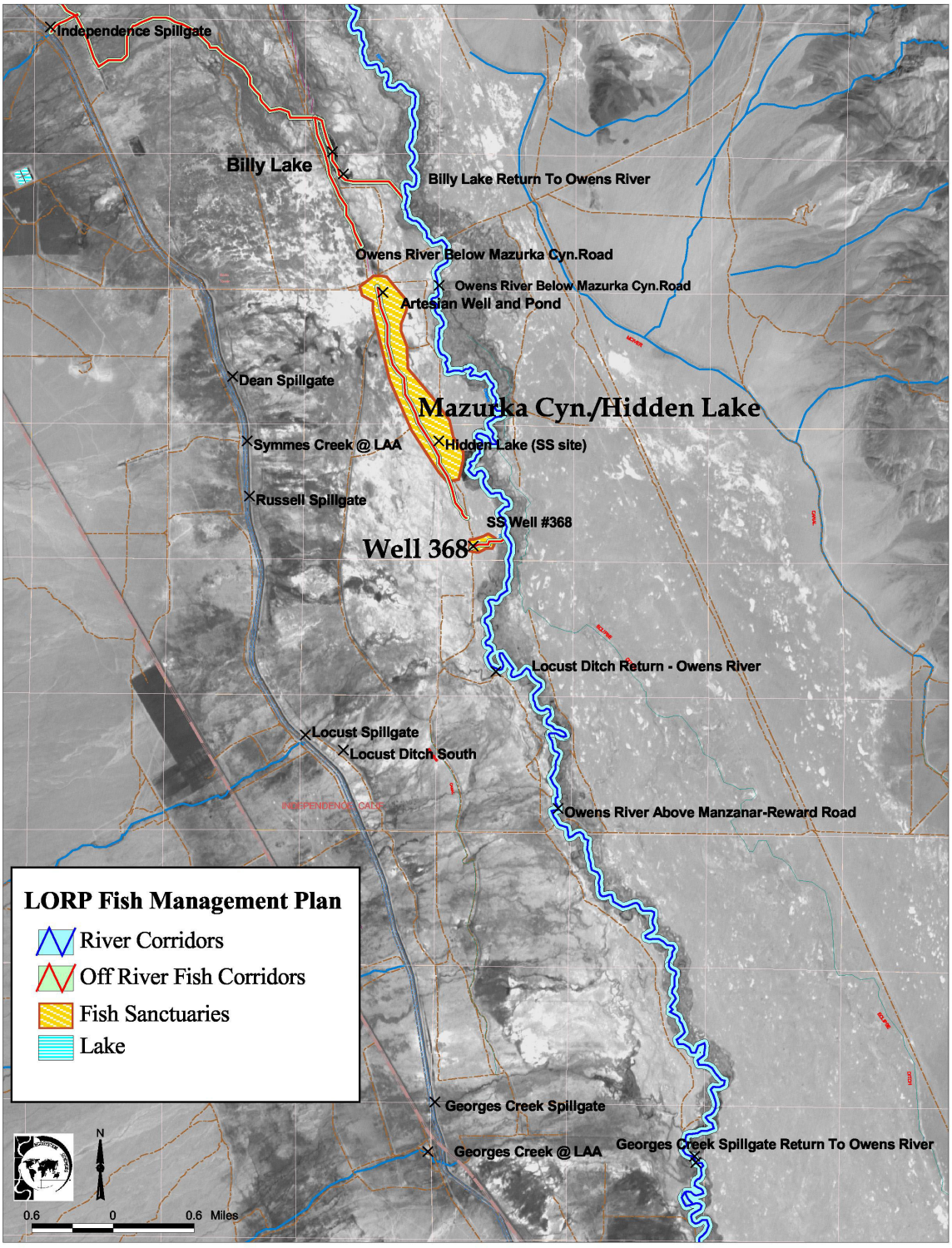
Independence Spillgate
Billy Lake
Billy Lake Return To Owens River
Owens River Below Mazurka Cyn.Road
Owens River Below Mazurka Cyn.Road
Artesian Well and Pond
Dean Spillgate
Mazurka Cyn./Hidden Lake
Symmes Creek @ LAA
Hidden Lake (SS site)
Russell Spillgate
SS Well #368
Well 368
Locust Ditch Return - Owens River
Locust Spillgate
Locust Ditch South
Owens River Above Manzanar-Reward Road
LORP Fish Management Plan
River Corridors
Off River Fish Corridors
Fish Sanctuaries
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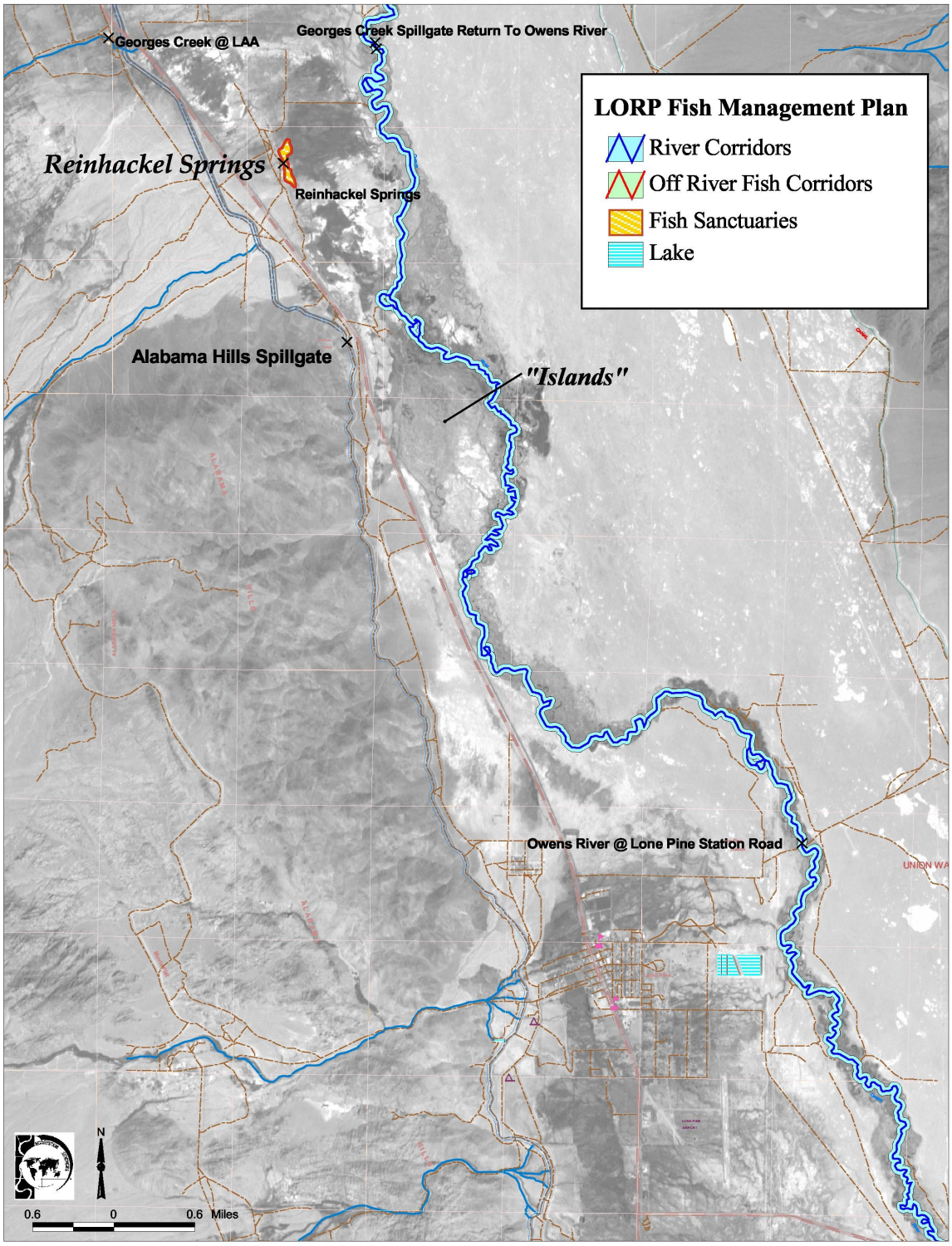
Georges Creek @ LAA
Georges Creek Spillgate Return To Owens River
Reinhackel Springs
Reinhackel Springs
Alabama Hills Spillgate
"Islands"
Owens River @ Lone Pine Station Road
LORP Fish Management Plan
River Corridors
Off River Fish Corridors
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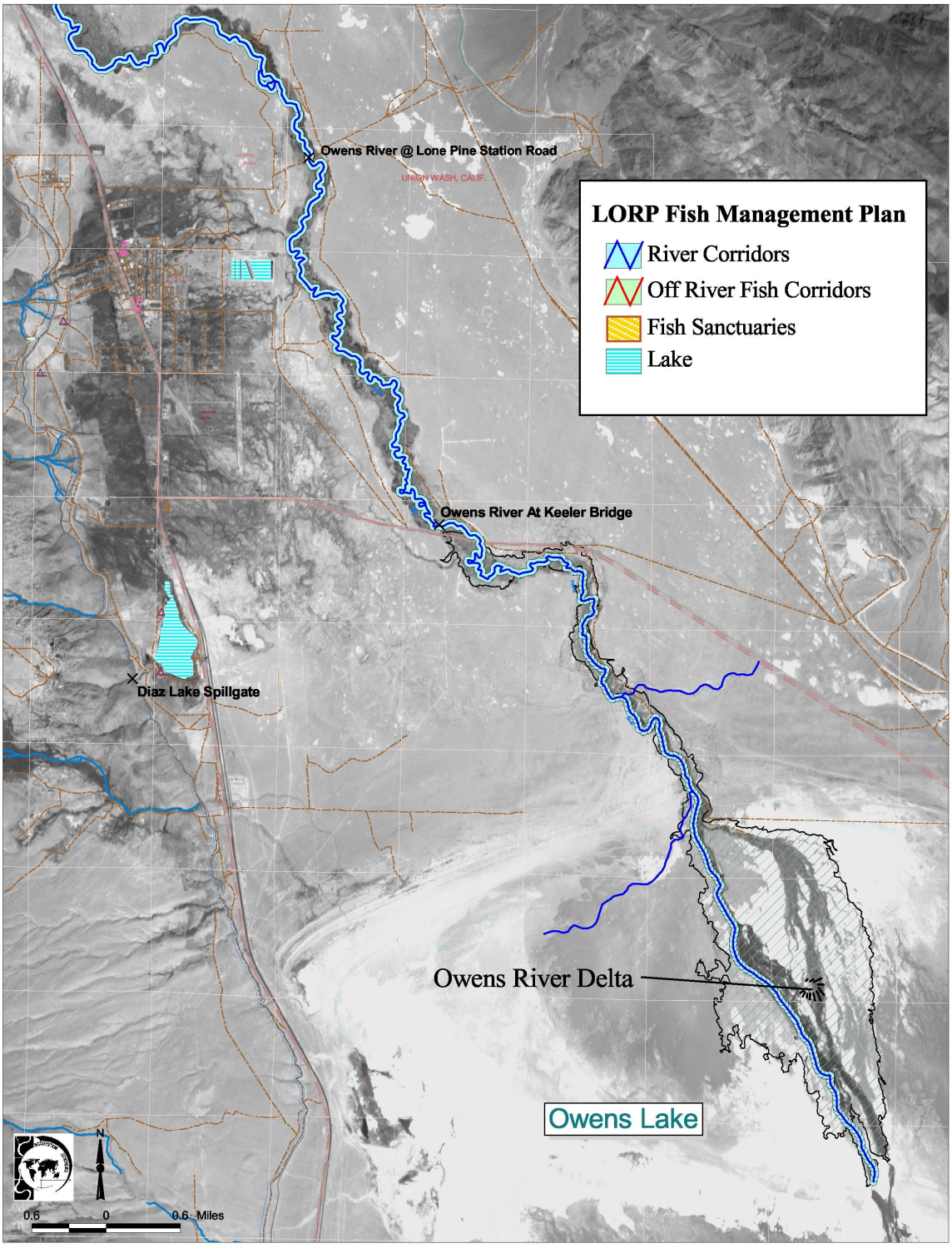
Owens River @ Lone Pine Station Road
UNION WASH, CALIF.
LORP Fish Management Plan
River Corridors
Off River Fish Corridors
Fish Sanctuaries
Lake
Owens River At Keeler Bridge
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Owens River Delta
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Management Objective 1: Create and sustain a warmwater recreational fishery in good condition.

Action 1-1: Water from Lower Twin Lake will be conveyed along the ditch to its southern terminus where it will be diverted to Upper Goose Lake at two different points. The first diversion will be the new spillgate (No. 101), which would discharge the flows into the lower Waggoner wetlands. For these new flows to reach Upper Goose Lake, an existing culvert (No. 98) and wooden bridge (No. 97) will be enlarged. The second diversion will connect the new ditch to an existing ditch that extends 2,200 feet south to Upper Goose Lake . The latter ditch will be widened to convey about 5 cfs. To create a continuous flow between these off-channel lakes and the river, 5 cfs or more will be directed through the Lower Twin Lakes Diversion into Lower Twin Lake. These flows will continue along existing ditches to the Coyote/ Grass Lake Complex, through Goose Lake, and then to the river at "5 Culverts." The total linear distance of this new flow from the Lower Twin Lake Diversion to the river is about 5.3 miles. Approximately 5 cfs will be maintained between Goose Lake and the river to allow unimpeded passage for fish between the lakes and river.

Action 1-2: Maintain Upper Twin and Goose lakes at staff gage reading of 1.5 to 3 to ensure that water levels are high enough for Goose Lake to spill and, thus, create corridor connectivity with the river. Billy Lake will also remain full to ensure spillage and corridor connectivity with the river.

Action1-3: Maintain as close to 40 cfs as possible in all river reaches.

Action 1-3: Retain beaver ponds that do not interfere with flow management as primary, shorterm fish habitat.

Action 1-4: Consult with CDFG as needed on population management and angling as well as the need to stock warmwater game fish in various habitat types throughout the river, corridors, and lakes and ponds.

Management Objective 2: Encourage high quality habitat for native fish species.

Action 2-1: Maintain corridors that link Blackrock, Billy Lake and off-channel lakes and ponds with the river.

Action 2-2: Maintain adequate flow in corridors to allow fish movement and connectivity.

Action 2-3: Coordinate with CDFG on management plans for designated fish sanctuaries for T&E fish protection and/or recovery.

WILDLIFE[6]

California Department of Fish and Game (CDFG) has sole responsibility for setting hunting seasons and regulations, as it does in fisheries regulations. Wildlife habitat management, including land use and flow management, will be performed as part of the overall LORP and will be in cooperation with all state, federal and county agencies. Wildlife management in the river and riparian system will focus on three primary areas: (1) water and riparian bird species; (2) protection and recovery of T&E species; (3) and beaver control.

Target wildlife species for the LORP are considered "umbrella" species, which means that managing habitat for these species automatically provides habitat for many other species with similar life history requirements. Target species included in the wildlife/wetlands management plan include species that are closely associated with riverine-riparian habitat, as well as species associated with wetlands, open meadows and grasslands.[7]

Tule elk and cowbirds are also important components of river wildlife management. The goal of tule elk management is to protect and maintain the herd through effective habitat management. Good ecological habitat management throughout the LORP area will also lead to more effective control of cowbird numbers. Even though cowbird parasitism is occurring now in the LORP area, LADWP and Inyo County have joint responsibility only to manage wildlife habitat. Animal populations and individual species like cowbirds are the responsibility of CDFG, who are mandated with the authority and responsibility to manage animal populations.

However, there are many different approaches to restore, protect, enhance and maintain wildlife species for any geographic location. With any specific approach there is also a spectrum of management objectives that can be implemented to achieve desired conditions. Obligate riparian birds are one extremely important and visible component of the plant and animal species that compose the biotic communities of the LORP. All of these species, including riparian birds, depend to one extent or another on a complex mix of conditions and resources provided by their habitat. Broad scale sustainable management of the LORP requires that the most effective and meaningful approaches are used and that management objectives are prioritized. Habitat management is, without question, the most preferred approach because manipulations of animal populations with predator-prey introductions or other inter-specific interventions are poorly understood; it is only treating a symptom of the problem rather than the underlying cause. Cowbird trapping may be a valid only in very site and resource specific circumstances. Trapping as a control for cowbirds is, at best, only a temporary and mechanistic approach that is not naturally sustainable.

The goal of beaver management in the Lower Owens River is to protect the development and sustainability of healthy riparian vegetation, particularly willow and other shrub species. Management will take into consideration the amount of beavers

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[6] See Technical Memorandum # 13 Distribution and abundance of beaver in the Lower Owens River; and Pearce, R.A. 1997. Lower Owens River Project and the Owens Valley mosquito abatement program, Inyo County.

[7] See Technical Memorandum # 19 Riparian wildlife management summary of management concepts and priorities.

allowed by river reach, as well as the vegetative condition of willow per acre. The accepted methodology to determine beaver numbers is to calculate the number of colonies/km and relate it directly to available willow habitat—this method of calculating total numbers of beaver also assumes that the number of animals per colony does not vary greatly throughout an area. The number of beaver in a colony usually remains relatively constant in small areas of river, however, the Lower Owens River covers over 60 miles. Past studies have shown that the number of animals per colony can vary substantially over substantial lengths of river, therefore the standard methodology may not be an effective measurement for the LORP. But consistent flows in the restored Lower Owens River will over time create higher surface water elevation and discharge, and the LORP riverine-riparian area will gradually and naturally become more homogenous. This natural ecological control should effectively limit the numbers of beaver in the river as some beaver turn to bank dwelling rather than dam building.

Management Objective 1: Promote wildlife habitat and biodiversity in the river channel and riverine-riparian system.

Action 1-2: Revise habitat maps and recalculate Habitat Units at appropriate intervals to establish habitat trends.

Action 1-3: Coordinate land and water management monitoring feedback with wildlife monitoring to promote riparian habitat and biodiversity through adaptive management actions.

Management Objective 2: Control beaver to protect the development and sustainability of riparian vegetation, particularly willow and other shrub species.

Action 2-1: Continue the existing beaver control program of limited trapping at selected locations along the river where dams have caused adverse hydraulic, water quality, or ecological impacts.

Action 2-2: Hold beaver populations to a density of 1-beaver/29 acres of available willow habitat by river reach while willow growth is still in poor condition.

Action 2-3: Hold beaver populations to a density of 1-beaver/8 acres of available willow habitat by river reach when willow returns to good condition.

Management Objective 3: Maintain the tule elk population within the Lone Pine herd management area in a healthy, self-sustaining condition.

Action 3-1: Rely upon seasonal habitat flows to create and sustain diverse riparian habitat. Livestock operations will be modified through land management plans to allow establishment of new riparian vegetation and to enhance existing riparian

and wetland habitat. Improved riparian habitat conditions will also reduce elk-cow foraging conflicts.

Action 3-2: CDFG will remain responsible for directly managing elk herd populations and hunting regulations.

Management Objective 4. Manage brown-headed cowbird parasitism on riparian bird species nests.

Action 4-1: Rely upon the structure and diversity of riparian vegetation and landscape-scale factors, and improved land use management as the first line of control. As riparian vegetation improves, i.e. larger stands of woody species, less fragmentation of riparian areas, and diversity in vegetation species, habitat values to cowbirds will be reduced and habitat value to preferred bird species will increase.

Action 4-2. If monitoring shows that cowbird parasitism is a problem, the next action could be an active trapping program.

CHAPTER 3 – WETLAND MANAGEMENT PLAN

INTRODUCTION

Wetland management for the LORP is in two distinct areas, the Blackrock Waterfowl Habitat Area and the Owens River Delta Habitat Area (see maps at the end of this chapter). Wildlife species that occur in these two areas are somewhat similar, but management of water to maintain these two wetland areas is very different. Blackrock Waterfowl Habitat Area is a "managed wetland" with a high degree of mechanistic intervention and maintenance; it consists of four separate management units with a highly controlled water regime (i.e., flooding frequency, duration, depth and drawdown).

The Owens River Delta Habitat Area, however, managed as a natural extension of the Lower Owens River. Minimal interventions and no controls on water distribution other than release of flows below the pumpback station are the primary management tools for the Delta.

BLACKROCK WATERFOWL HABITAT AREA

The Blackrock Waterfowl Habitat Area consists of four separate management units: Drew, Waggoner, Winterton, and Thibaut. The total area within which flooding could potentially occur within the four units is approximately 1,342 acres. Under the MOU, LADWP is required to flood 500 acres out of this 1,342 total. In addition, the areas within 300 feet of the flooded areas, called “adjacent zones,” are expected to benefit from the flooding and to provide important nesting, resting, and feeding habitat for waterfowl and many other wildlife species that use the Blackrock area. The total area of these adjacent zones in the four Blackrock management units is 1,241acres. Thus, the Blackrock Waterfowl Habitat Area consists of a total of 2,583 acres within four management units.

The extent of the flooded area is expected to change relative to the water released, water spreading and actual evapotranspiration. Table 1 shows the approximate extent potential flooding area for each of the four management units in the Blackrock area and the areas adjacent to the flooded areas that are expected to be influenced by the flooding.

Specific objectives for the Blackrock Waterfowl Habitat Area include the following: (1) provide a reliable and dependable source of water and wetland habitat that will attract resident and migratory waterfowl and shorebirds, the MOU indicator species for this project element; and (2) maintain the ratio of open water wetlands to emergent/seasonal wetlands at about 50 percent each, with a range of about 40 to 60 percent throughout the entire area.

Figure1. Location of Management Units and future wetlands in the Blackrock area.

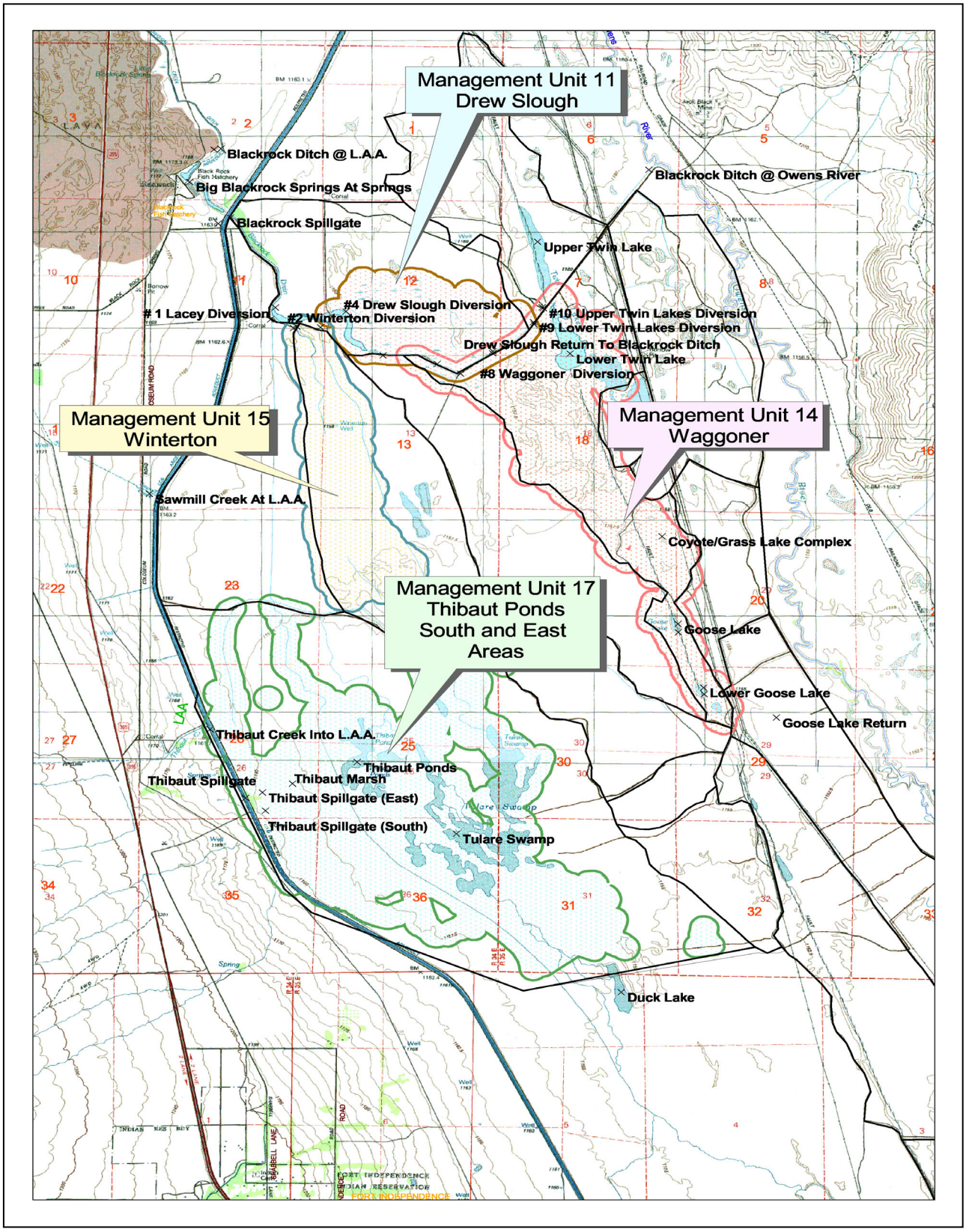


TABLE 1
POTENTIAL FLOODING AREAS AND ADJACENT HABITAT ZONES

BLACKROCK Management Unit	**Potential Flooded Area** (acres)	**Adjacent Habitat Zone** (acres)	**Total Management Unit Area** (acres)
Drew	246	151	397
Waggoner	327	271	598
Winterton	281	244	525
Thibaut	488	575	1,063
Totals (acres)	**1,342**	**1,241**	**2,583**

Management objectives will be met for the Blackrock area by manipulating a carefully designed water regime, evaluating and monitoring habitat response, and adaptively managing conditions in four separate management units. These four units will be managed in concert in order to derive a spectrum of wildlife values over time and space so that approximately 500 acres of the habitat area will be flooded at any given time in a year, when the runoff to the Owens River watershed is forecasted to be average or above average. The management objective of flooding at least 500 acres during normal or above normal runoff years is specified in the MOU. In practice there will usually be >500 acres of wetlands flooded in the Blackrock Waterfowl Habitat Area.

The Blackrock Waterfowl Habitat Area is a highly altered artificial wetland that would not exist and could not be maintained without a considerable investment of resources to continuously intervene and manipulate water resources in order to maintain a variety of wetland habitats. The LORP is intended to create and maintain diverse wetland habitat values while also minimizing the use, extent and frequency of overt and unnecessary intervention and manipulation of natural resources. It is also important to remember that the level of intervention necessary for management of the Blackrock Area is generally contrary to the basic LORP philosophy of allowing natural processes to reestablish a functioning ecosystem.

A relatively hands-off approach, except for manipulation of the water regime, is the preferred strategy. The management approach for each unit at Blackrock is, therefore, somewhat different, depending upon the existing condition and extent of habitat, the configuration and composition of adjacent habitat, existing water conveyance and control structures, and surface topography of the unit. Technical Memorandum No. 4 discusses the extent and composition of existing wetlands in the Blackrock Waterfowl Habitat Area. While each unit is managed separately, wildlife values are actually derived as a consequence of management in the entire region.

Water supply to the Thibaut Ponds/Tulare Swamp management unit (17) is directly off the aqueduct through the Thibaut Spillgate. Water supply to the other three management units is through several spillgates off the Blackrock Ditch, which in turn is supplied by the aqueduct through the Blackrock Ditch Spillgate. Water cycled through

the waterfowl management units is normally not returned to the Owens River. Some water that is released from the Drew Slough management unit (11) could re-enter the river channel through the Blackrock Ditch. Similarly, a portion of the water drained from the Waggoner management unit (14) could reenter the river through the Coyote/Grass Lakes complex and the Goose Lakes, via the Goose Lake Return to the Owens River. Surface water from these two management units would usually only reach the river when there is a large drawdown, such as the shift from the wet to dry phase of the water cycle.

All management units will be cycled through wet and dry phases. Generally, the duration of the wet phase will last 2 to 3 times longer than the dry phase, and the entire cycle for completion of any unit is expected to require between 5 to 7 years. For example, a particular management unit might be flooded in a wet phase for 3 to 4 years, and the drawdown to create a dry phase will then last 2 to 3 years, creating a 5 to 7 year cycle for each management unit. The wet phase will be initiated by rapidly flooding proposed wetlands, then allowing water fluctuations to alter elevations for enhancement of seasonal and fringe wetlands.

Concerns have been raised about the possible effects of "lengthy" proposed wet and dry phases. It has been suggested that losses of wetland plants could be incurred in a 2-3 year dry phase, or that a long stable flooding phase could produce little diversity and reduce habitat quality. Lengthy wet and dry cycles are not a part of this plan. Water levels will fluctuate within each wet phase in order to provide a variety of resources to many different wetland species. The initial wet and dry cycles suggested in Technical Memorandum No. 8 will change and be adaptively managed as the LORP evolves. Factors that will provide feedback for these decisions include the relative response of the management unit, the available water, the development of wetland vegetation, and the need to reduce the extent of robust emergent vegetation.

The Blackrock area should not be seen as an area managed only for the production of a single wildlife species (i.e., ducks). Dry periods and the judicious use of fire are necessary to reestablish a favorable ratio of open water to emergent vegetation. Soil disturbance and rapid water drawdowns during most of the year must be avoided and/or limited to reduce the risk of intrusions of saltcedar and invasions of other exotic vegetation. Mechanical control and frequent burning of accumulated vegetation is not prudent, nor is it the preferred strategy, to manage the Blackrock Waterfowl Habitat Area.

Any wetland that is maintained in the same condition over many years will likely show a decline in productivity. Simple impoundments of water year after year generally results in lower waterfowl, shorebird and water bird productivity and use. Periodic disturbances (i.e., drawdowns) are not only natural, they are essential to the long term productivity and wildlife use of managed marshes.

The overall strategy to maintain Blackrock as a wetland habitat is to allow the value of each management unit to vary in regard to a specific functional species group (e.g., open water birds) as wetlands develop and evolve. Each management unit at Blackrock will be in a different condition or state at any given time, and therefore the entire habitat area will always provide a diverse set of conditions across a relatively broad landscape. The value of any specific site to any species group will continue to change as habitat changes, but the Blackrock Area as a whole will always provide adequate resources to sustain a wide range of wildlife species.

The management objectives of Blackrock Waterfowl Habitat Area are to maintain the existing habitat in order to provide opportunities to reestablish resident and migratory waterfowl populations, and also to provide habitat for other native species. Diverse natural habitats will be created and maintained to be as self-sustaining as possible through flow and land management that is consistent with the needs of the habitat indicator species for the Blackrock Waterfowl Habitat Area.

The habitat indicator species listed in the MOU for the Blackrock Waterfowl Habitat Area are:

Native fish:

- Owens pupfish (state and federal endangered species)
- Owens tui chub (state and federal endangered species)

Native birds:

- Northern harrier
- Least bittern
- Rails
- Marsh wren
- Resident, migratory, and wintering waterfowl
- Resident, migratory, and wintering wading birds
- Resident, migratory, and wintering shorebirds

Water Management

In this Plan, the water management for each of the four management units is only one approach from an infinite number of possible implementation schedules that will meet the acreage requirements for Blackrock; these schedules function as a reasonable example and a starting position to initiate the LORP. Water releases are a first estimate of an implementation schedule that will incorporate the 500-acre requirements and several management concepts embodied in the LORP. The following concepts are very important to achieve the long term goals for the Blackrock Waterfowl Habitat Area.

The management strategies for different types of water years are summarized below:

Forecasted Average to Above Average Water Year (100 percent or more of the average annual runoff). The MOU requires that 500 acres of habitat be flooded at any given time under these runoff conditions. This acreage requirement would be met through flooding operations in one or more of the four management units at any one time.

Forecasted Below Average Water Year (50 to 99 percent of average annual runoff). The MOU states that water for the Blackrock Waterfowl Habitat Area will be reduced in general proportion to the reduction in the forecasted runoff. The amount of acreage to be flooded in years when the runoff is forecasted to be less than average

will be set by the Standing Committee based on recommendations in the LORP Plan and in consultation with the CDFG. The LORP Plan proposes that under these conditions, the duration of the dry phase of a management unit then in a dry phase would be extended, and water supply to units then in a wet phase would be reduced. Hence, there would not be a rapid and substantial change in water conditions in these years. Instead, there would be small incremental changes in the amount of water in the area, reflecting the general reduction in runoff throughout the valley.

Forecasted Dry Years (less than 50 percent average annual runoff). The MOU states that water would be applied to the Blackrock Waterfowl Habitat Area in dry years, and that even in the driest years available water will be used in the most efficient manner to maintain the habitat. Under these conditions, the LORP Plan recommends that the only area to receive water would be the Thibaut Unit. This area would be supplied with water via releases from the East Spillgate. It is a relic natural spring/seep complex that supports a high diversity of birds, and impounded water is very shallow and covers a very wide area. Ecosystem Sciences estimates that a dry year release of 360 acre-feet would support 150 to 250 acres of wetlands in the Thibaut Unit on a short-term basis. Final water allotments and flooded extents will be determined by the Standing Committee.

Overall Management Objective 1: Create, enhance and sustain a diverse and productive "managed wetland" community for resident and migratory species, management indicator species and special status species.

Action 1-1: Implement coordinated wetland management objectives in a complex of four management units.

Action 1-2: Implement an inspection of and make improvements to existing water control facilities in all units.

Action 1-3: Flood approximately 500 acres of the habitat area at any given time in a year when the runoff to the Owens River watershed is forecasted to be average or above average.

Action 1-4: Initiate seasonal and wet-dry cycle water practice in all management units.

Action 1-5: Periodically implement a complete water drawdown to restart a wet-dry cycle, reduce salinity, control vegetation and revitalize productivity.

Action 1-6: Periodically implement flooding to create seasonal wetlands to provide important fall/winter and spring/summer foods in seasonally important areas such as open water, mudflats, shallow water wetlands, and to enhance nesting and brooding areas.

Action 1-7: Periodically implement partial water drawdowns to increase food availability, concentrate foods and manage emergent vegetation.

Action 1-8: Manage emergent wetlands in a hemi-marsh condition e.g., emergent vegetation covering from between 40 to 60 % of the flooded area.

Action 1-9: As a contingency, use small controlled burns to reduce the amount and extent of emergent vegetation, once the emergent vegetation exceeds about 60 % of the flooded area and the dry phase has been initiated.

Action 1-10: Manage at least 50% of the wet and mesic meadows and adjacent uplands (i.e., within 300 feet of maximum flooded area, approximately 1,241 acres) as potential nesting and escape cover (dense herbaceous and low shrub layer about 60 to 100 cm in height).

Action 1-11: Increase connectivity among other components of the LORP ecosystem. Increasing connectivity includes establishing new and/or more reliable hydrologic and vegetation pathways among various functional components of the LORP. Increased connectivity is also established through conduits that are in better condition, and can thus function properly. The assumption is that more and better connections will allow a broader range of species to exploit necessary resources throughout a wider array of conditions.

Action 1-12: Implement long-term habitat monitoring of the Blackrock area including on the ground assessment of wetlands and adjacent nesting and brooding habitat, and periodic re-mapping of wetlands (see Monitoring Plan).

Management Unit 11 - Drew Slough

Although it is the area of lowest priority, Drew Slough shows very high potential as a shallow seasonal wetland and bird nesting habitat, a fall/winter/spring shorebird foraging area, and a year round area for wading birds. Topographic uniformity and its position relative to Blackrock Ditch make Drew Slough easily manageable, but also limits diversity in the site. Drew Slough unit can be managed on an as-needed basis; for example, it can be managed to supply particular resource needs when they are identified in the Blackrock area.

Management Objective 1: Create and sustain diverse and productive managed wetland complex of mesic and wet meadows, shallow wetlands, and adjacent nesting/escape cover habitat for resident and migratory species, management indicator species and special status species.

Action 1-1: Increase the extent of wetlands in the Drew Slough Unit from 39 acres up to a maximum of 246 acres.

Action 1-2: Increase the extent and habitat quality of prime upland and wetland nesting areas to at least 151 acres.

Action 1-3: Increase availability and quality of proximate upland cover for nesting and escape by increasing overall height and density of vegetation, and by increasing amount of residual vegetation remaining after grazing.

Action 1-4: Increase shallow wetlands to a maximum extent of 246 acres.

Management Unit 14 - Waggoner Area

The Waggoner unit is less easily managed than the Winterton area due mainly to its proximity to dense stands of salt cedar. By separating the Waggoner unit's water supply from the lakes' supply we will be able to increase water use efficiency and the potential for development of overall wetland habitat. This unit has the greatest topographic diversity as well as the greatest extent of deepwater wetlands in the LORP area. The proximity of the Waggoner unit to off-river ponds and lakes increases inter-area exchange and jointly enhances the wetland habitat value of both areas.

Management Objective 1: Create and sustain a diverse and productive managed wetland complex of mesic and wet meadows, shallow and semi-permanent seasonal wetlands, open deep water ponds, and adjacent nesting/escape cover habitat for resident and migratory species, management indicator species and special status species.

Action 1-1: Increase existing extent of wetlands from 196 acres to a maximum extent of about 310 acres (an increase of 114 acres). With control of emergent vegetation these wetlands are unique in relation to adjacent open water and wooded wetlands (lakes and ponds). Diversity of landforms should help to provide very high quality nesting and brood water habitat.

Action 1-2: Increase brooding habitat in shallow wetlands to a maximum extent of 310 acres.

Action 1-3: Improve infrastructure for better management of lakes, ponds and wetlands in the Waggoner Management Unit with separate water management for off-river lakes and ponds area and wetlands area. Continue management of Lower Twin, Coyote/Grass Lakes, and Upper and Lower Goose Lakes as indicated in fisheries plan for the LORP. The extent of all lakes should remain the same as existing conditions of 169 acres (Lower Twin-53 acres; Coyote/Grass Lakes-53 acres; Goose Lakes-63 acres). Average annual water use for all lakes should be reduced to less than existing conditions (1,084 ac-ft per year) because 196 acres of wetlands will not be maintained to supply water to the lakes.

Action 1-4: Earlier and more extensive flooding of fall/winter shallow wetlands, and water drawdowns in early spring to concentrate food supplies and to increase wet and mesic cover.

Action 1-5: Increase availability and quality of proximate upland cover for nesting and escape. The best brood covers in the Blackrock management area will be provided within this unit (Waggoner wetlands) and within management unit 15.

Action 1-6: Water drawdown of seasonal and semi-permanent wetland to a limited extent. The risk of salt cedar invasion in the Waggoner Unit is moderate,

but changes in the water supply should provide better water quality and circulation and help to isolate the wetland from established salt cedar populations.

Action 1-7: Increase the extent and quality of prime upland and wetland habitat nesting areas to at least 271 acres.

Figure 2. Location and extent of future wetlands and facilities in Management Unit 11, Drew Slough Area, in the Blackrock Waterfowl Habitat Area.

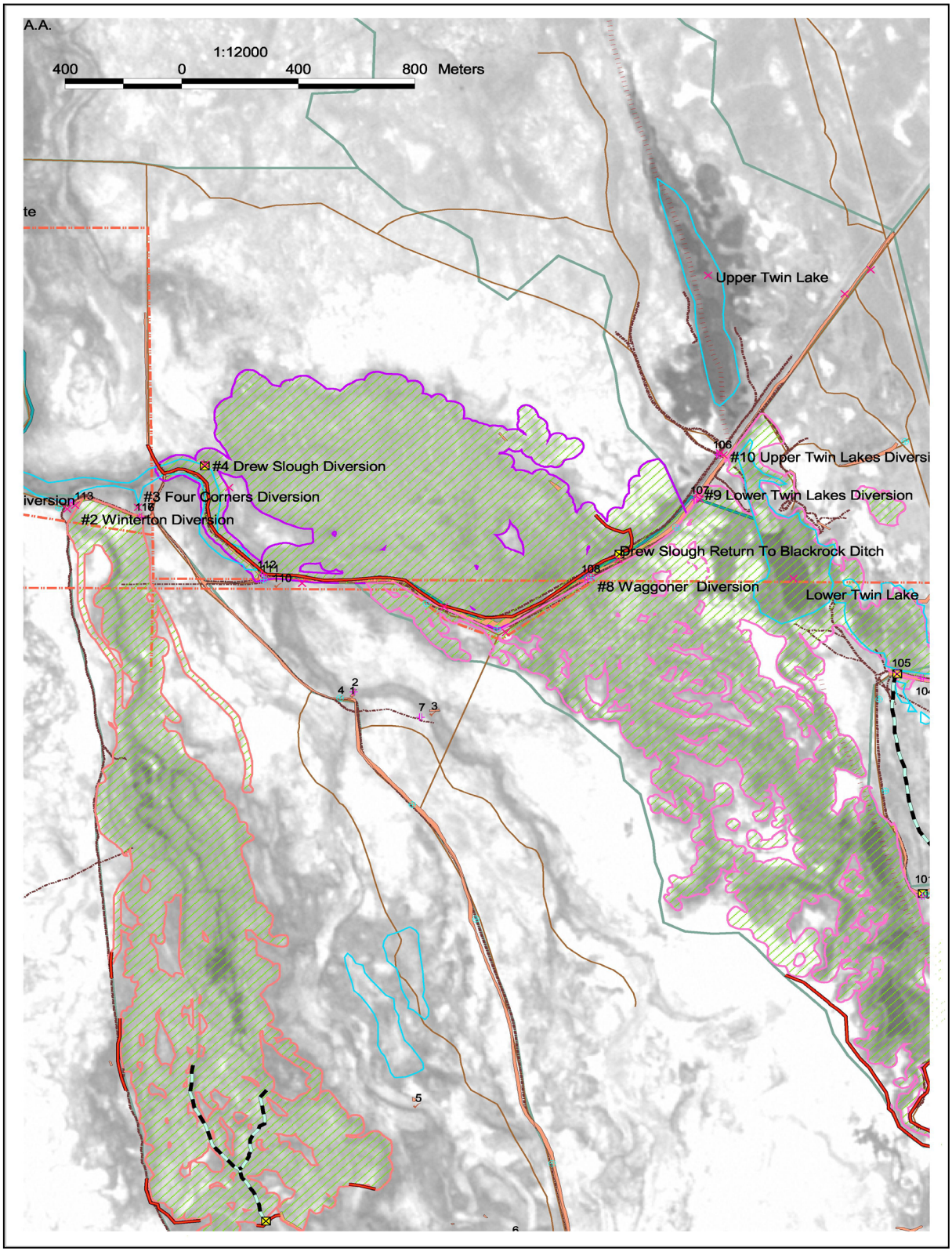
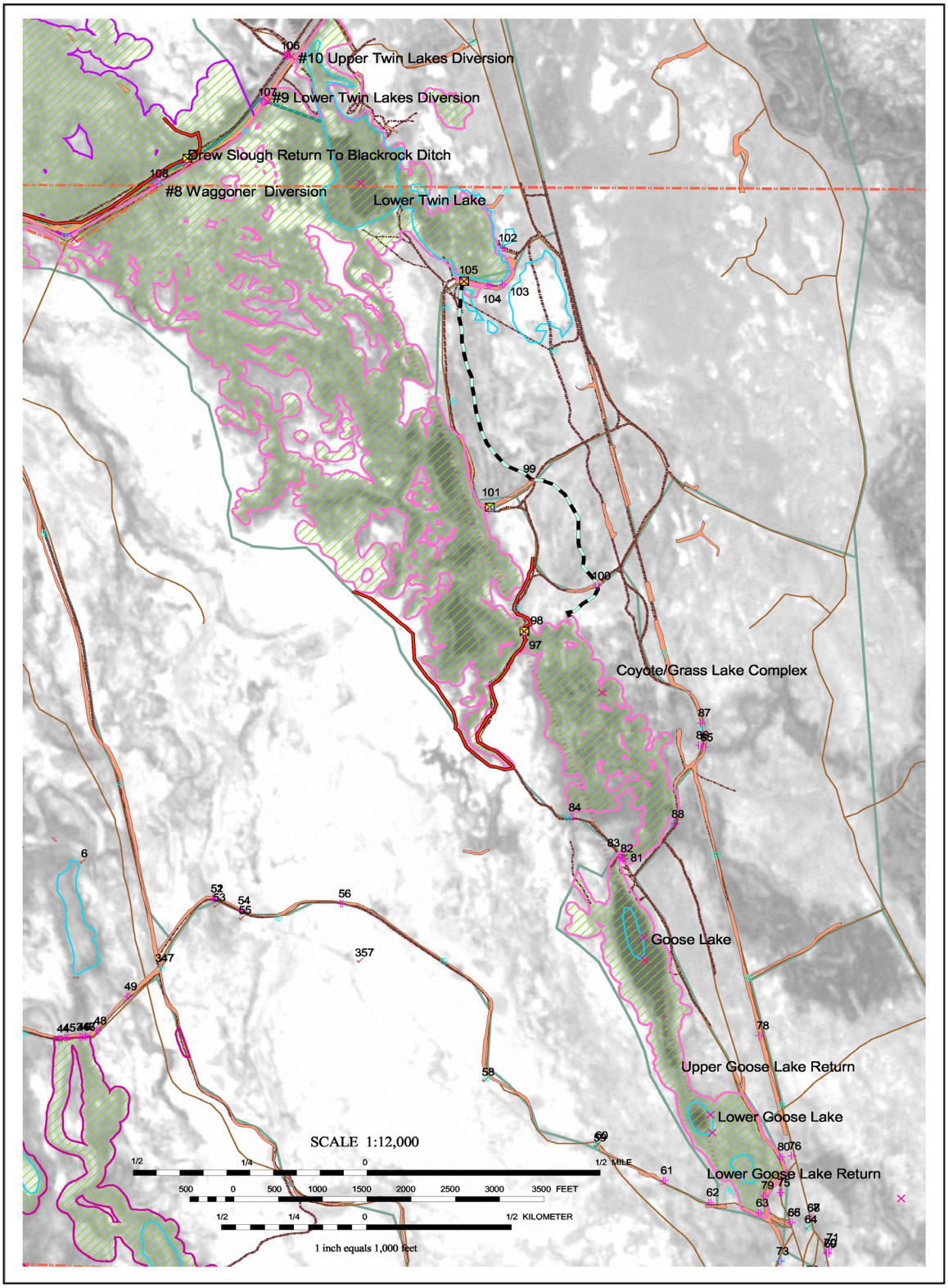


Figure 3. Location and extent of future wetlands and facilities in Management Unit 14, Waggoner Area, in the Blackrock Waterfowl Habitat Area.



Management Unit 15 - Winterton Area

The Winterton Management Unit (15) is a high priority area due to the ease of its manageability and its potential for productivity. The Winterton unit is similar to Unit 14 in that it offers a high diversity of uplands that will become islands and peninsulas that will develop into prime waterfowl nesting and brooding areas under LORP wetland management. The unit also offers the potential to become very suitable for fall/winter seasonal wetlands and spring/summer water drawdowns (i.e., water supply is reduced to simulate drawdown).

Management Objective 1: Create and sustain a diverse and productive managed wetland complex of mesic and wet meadows, shallow and seasonal and semi-permanent wetlands, some deep water ponds, and adjacent nesting/escape cover habitat for resident and migratory species, management indicator species and special status species.

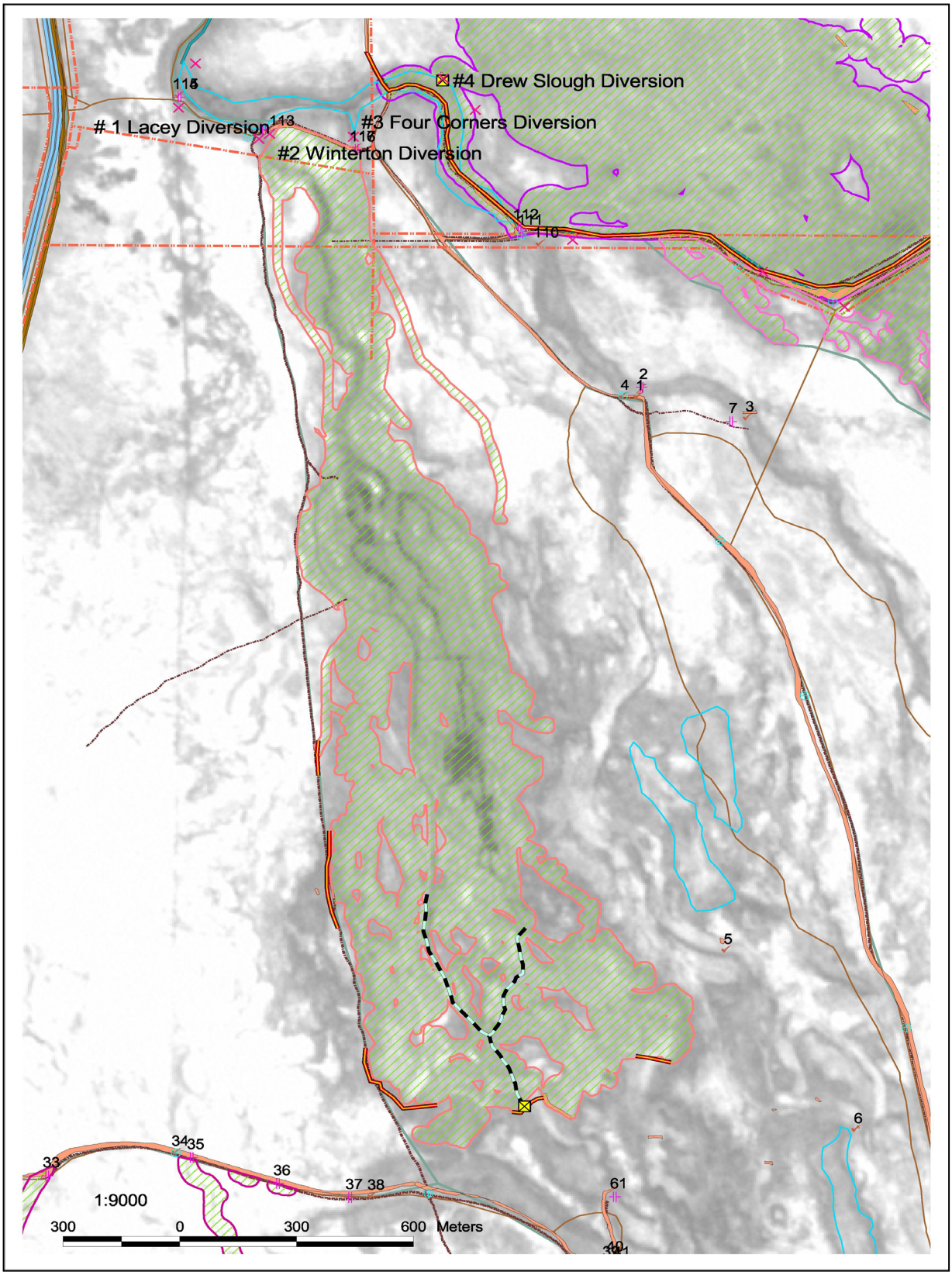
Action 1-1: Increase availability and quality of proximate upland cover habitat for nesting and escape. The best brood cover habitat for these areas will be provided at Management Units 15 and 14. Water drawdowns of seasonal and semi-permanent wetlands is to be implemented, but the risk of salt cedar invasion in the Winterton Area is minimal because of the location of salt cedar, good water quality and the relative lack of disturbance.

Action 1-2: Increase the extent of wetlands in the Winterton Unit from 76 acres up to a maximum of 279 acres.

Action 1-3: Increase the extent and habitat quality of prime upland and wetland nesting areas to at least 243 acres.

Action 1-4: Increase brooding habitat in shallow wetlands to a maximum extent of 525 acres.

Figure 4. Location and extent of future wetlands and facilities in Management Unit 15, Winterton Area, in the Blackrock Waterfowl Habitat Area.



Management Unit 17 - Thibaut Ponds / Tulare Swamp

The Thibaut Ponds/Tulare Swamp management unit (17) is the highest priority area of the LORP wetland habitat restoration effort, especially under minimum water conditions. Water to this management area is supplied by the spillgates on the LA Aqueduct; the Thibaut Ponds East and Thibaut Ponds West spillgates. Thibaut Ponds-East Spillgate, in the northern and western part of the Blackrock Management area, consists of a tall wet meadow, a flooded alkali meadow with emergent wetlands, and shallow wetlands; it also has yearlong use.

Thibaut Ponds-South Spillgate is part of the south and southeastern LORP area, and is a shortgrass wet meadow with shallow wetlands, mudflats, adjacent weedy vegetation and fall-winter-spring open water wetlands. This management unit currently exhibits the most natural wetland in the Blackrock Waterfowl Habitat Area. Although the unit is not the most productive in terms of potential abundance of birds, it does provide the greatest diversity of unique wetland types and the highest bird species richness in the area. Water use per unit area is very low and persistence of winter ponds is very high; there are no deep water wetlands in this unit.

Water released through the Thibaut East Spillgate can be used to supply most of this unit by moving east to the pond after release, spreading out, moving south through a series of ponds and mud flats, and eventually moving out of the unit. Water released from the Winterton unit (15) also provides wetland benefits when it moves through a series of sloughs and eventually enters the Thibaut unit.

Management Objective 1: Create and sustain a diverse and productive managed wetland complex of mesic and wet meadows, seasonal and shallow semi-permanent wetlands, winter and open water ponds, and adjacent nesting/escape cover habitat for resident and migratory species, management indicator species and special status species.

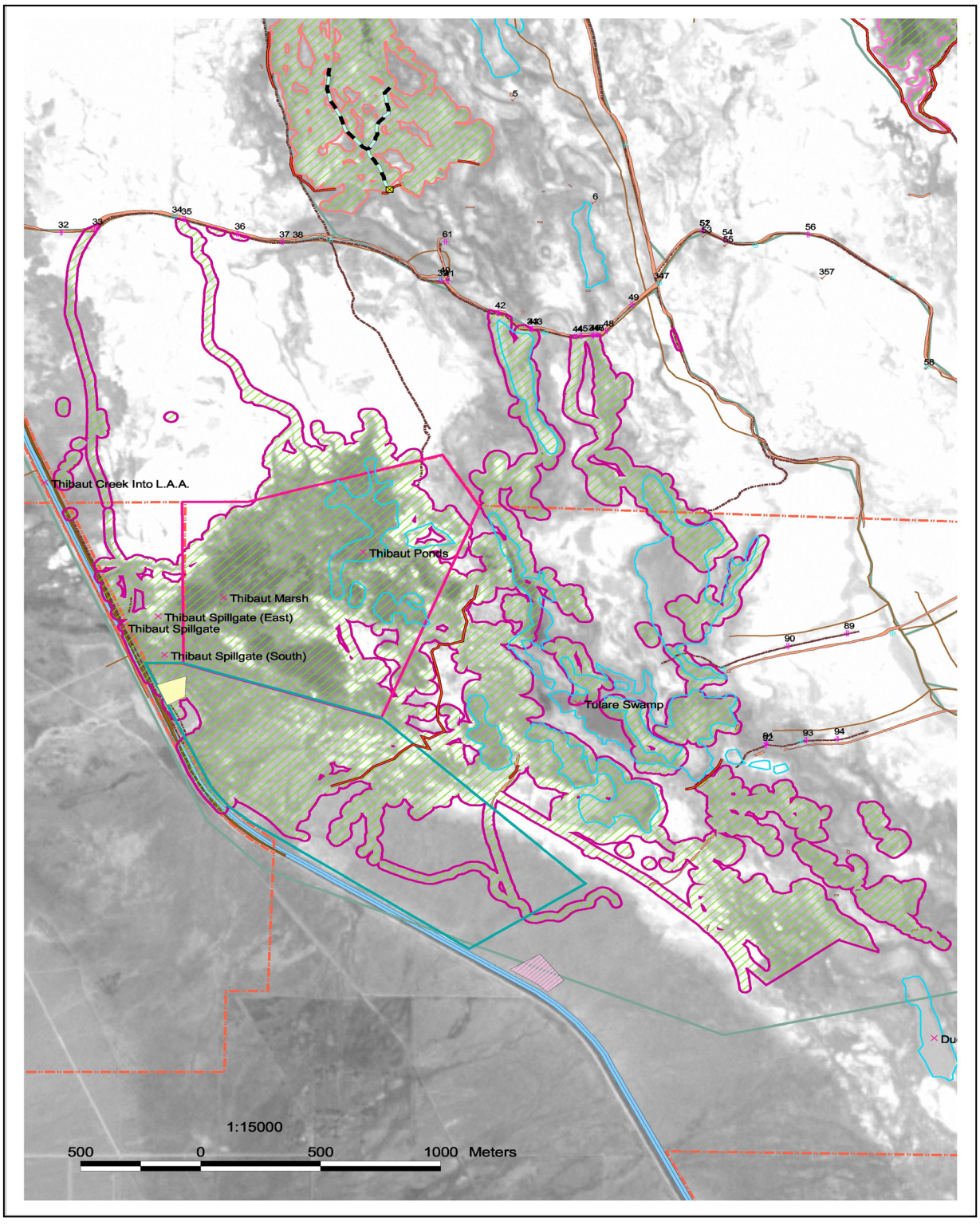
Action 1-1: Increase availability and quality of proximate upland cover habitat for nesting and escape. The best brood cover for these areas will be provided in Management Units 14 and 15, within a few miles of the Thibaut unit.

Action 1-2: Partial water drawdowns in both East and South seasonal and semi-permanent wetlands will be used in this management unit. The risk of salt cedar invasion in the Thibaut unit is marginal because of the location of salt cedar, good water quality, the relative lack of disturbance, and thick existing wetland vegetation cover. The Thibaut unit will continue to provide some of the highest quality shallow wetlands for shorebirds, upland shorebirds (e.g., long-billed curlew, etc.), dabbling ducks, geese and tundra swans.

Action 1-3: Periodically increase the extent of wetlands in the East unit from 431 acres to a maximum of 656 acres, and in the South unit from 278 acres to 386 acres.

Action 1-4: Periodically increase the extent and quality of prime upland and wetland habitat nesting areas to at least 929 acres.

Figure 5. Location and extent of future wetlands and facilities in Management Unit 17, Thibaut Ponds Area (Thibaut East and South supply ditch), in the Blackrock Waterfowl Habitat Area.



Action 1-5: Increase shallow wetlands brooding habitat to a maximum extent of about 246 acres.

Action 1-6: Habitat quality will be enhanced by improved water management, changes to livestock management practices in the Thibaut lease, and some limited use of controlled burning. Proposed changes to livestock management practices include reduction of herd size, development of a non-use riparian pasture, development of two new pastures with restricted livestock use, and construction of a new corral. Concerns have been raised about spring grazing in the riparian areas because of potential impacts to spring bird nesting. Spring grazing will continue, but will coincide with green-up and will make use of the enhanced potential of the eastside uplands. The utilization rates set for grazing will ensure that there is adequate willow recruitment and growth to meet the habitat Management Objectives.

Action 1-7: Develop an 846-acre riparian pasture in the Thibaut Lease that will exclude livestock. This measure will allow recovery of the riparian community and will have significant beneficial impacts to wildlife in the Thibaut wetlands and the Thibaut Lease (see Land Management Plan).

Action 1-8: Develop two new pastures, one centered on the Thibaut Ponds East unit (247 acres) and the second along the western boundary of the lease (211 acres) (see the Land Management Plan). Development of two new pastures and relocation of the corral to the south is expected to improve the quality of wetlands by increasing the overall height and density of vegetation and by increasing the amount of residual vegetation remaining after grazing. Management Objectives should also reduce mechanical damage and disturbance to nesting and cover areas in the pasture.

In the 247-acre wetland pasture, grazing will be excluded during the first year of the Blackrock Waterfowl Habitat Program, and will be excluded every other year thereafter. Grazing will not be allowed in either pasture in alternate years from March 1st through June 15th. The western pasture encompasses several known populations of *Calochortus excavatus* and *Sidalcea covillei*. Grazing in this special status plant pasture will be the same as in the Waterfowl Pasture (see the Land Management Plan).

PROJECT IMPLEMENTATION

The Blackrock Waterfowl Habitat Area management will be implemented in several steps. First, the infrastructure for operation and maintenance of the management area and associated LORP management features such as land management will be upgraded as necessary. Some of these improvements will be specific to the operation while other improvements will be made to facilitate compliance monitoring and facility operations. Initial project implementation will probably occur over at least 10 years and

will involve three management units: Thibaut, Waggoner and Winterton. Generally, the extent of flooding of the Thibaut unit will increase to about 354 acres. The extent of flooding will be decreased in the Waggoner area to reduce the amount of living and residual emergent vegetation that covers approximately 107 acres of the unit. Fire might be used to help reduce the amount of vegetation, if necessary. Simultaneously, the extent of flooding in the Winterton will be increased to about 164 acres. This manipulation of the three management units is called Cycle 1. The cycle is expected to last for several years.

When the pool area of the Winterton Unit develops 40 to 60 percent cover of emergent vegetation, flooding will be discontinued or reduced in the unit and will be initiated in the Waggoner Unit. Depending on conditions at the Thibaut and Winterton units, between 100 and 150 acres (Cycle 2) will be flooded in the Waggoner Unit as needed to achieve 500 acres of flooded area. The Drew Unit will not be flooded at any time, unless it is needed to create additional flooded areas to achieve the 500-acre MOU requirement. The Thibaut Unit will be permanently flooded, unless emergent vegetation begins to fill in the open water areas, at which time the unit would be shifted to a dry phase and flooded areas in one or more of the other three units would be increased to meet the MOU requirement.

The extent of the flooded areas in all of the units but especially the Thibaut unit will fluctuate with the water supply and on a seasonal basis. Seasonal water level fluctuations are an important attribute of managed wetlands. Water level changes provide substrate for aquatic invertebrates and macrophytes, both are essential food resources for many migrant and resident waterbirds, especially brooding young..

During the first year of the active phase, the newly flooded areas would consist of mostly open water. Over time, emergent wetland plants would colonize the margins of the newly flooded areas until emergent wetlands (i.e., cattail and bulrush marsh) would occur throughout much of the flooded areas. As the water is removed from these areas for a dry cycle, other wetland plants and annuals would colonize the newly exposed substrate. It is anticipated that vegetation within about 300 feet of the edge of flooded areas, or "adjacent zones," would receive greater soil moisture from elevated groundwater and seepage, resulting in higher plant productivity and colonization by wetland plants. These areas are expected to develop into a mosaic of wet meadows, emergent vegetation, mesic meadows, and seasonally flooded areas. The degree of influence that flooding will have on these areas will depend on soil types and water holding capacities of adjacent area soils. The higher plant growth and vegetative density in these adjacent areas will provide high quality habitat for nesting waterfowl.

OWENS RIVER DELTA HABITAT AREA

The amount, timing and duration of water flows to the delta are the three most important actions to manage delta resources. Several periods of flows higher than baseflows will ensure more efficient use and better distribution of water resources.

The management action for creating and enhancing habitats in the Delta is to establish baseflows and pulse flows to the Delta from the Lower Owens River with an average annual flow of 6 to 9 cfs, as specified in the MOU. The habitat indicator species identified in the MOU for the Delta Habitat Area are as follows: Owens pupfish and

Owens tui chub; resident, migratory, and wintering waterfowl; resident, migratory, and wintering wading birds; and resident, migratory, and wintering shorebirds.

LADWP believes that by enhancing and maintaining the acreage of wetlands and water (645 acres) that existed in 1996, at the time of the approval of the MOU, LADWP will have met and exceeded the MOU goals. Notwithstanding this belief, the proposed flow regime for the Delta Habitat Area is designed to enhance and maintain more than 800 acres of water and vegetated wetland that existed in 2000 (WHA current study)[8].

If monitoring indicates that the MOU goals are not being met, or if the 2000 conditions are not being maintained, under adaptive management, adjustments of flows to the Delta Habitat Area within the 6 to 9 cfs annual average range specified in the MOU will be made in to attempt to meet the MOU goals and to maintain the 2000 Delta conditions. Also, if monitoring indicates that flows to the Delta can be reduced while still meeting the MOU goals and maintaining the 2000 Delta conditions, flows may be adjusted downward within the 6 to 9 cfs annual average range.

Water Management

The proposed management actions for the Delta Habitat Area consist of two types of flow releases; seasonal baseflows and four seasonal pulse flows. The sum of seasonal baseflows and pulse flows will be within the 6-9 cfs average annual flow allocation stipulated in the MOU. The water management plan entails:

- Implementation of initial base flows to meet the MOU goals and to maintain water and vegetated wetland for 2000 conditions.
- Implementation of seasonal pulse flows to enhance vegetation and habitat conditions.
- Monitoring and adaptive management.
- Determination of base flow

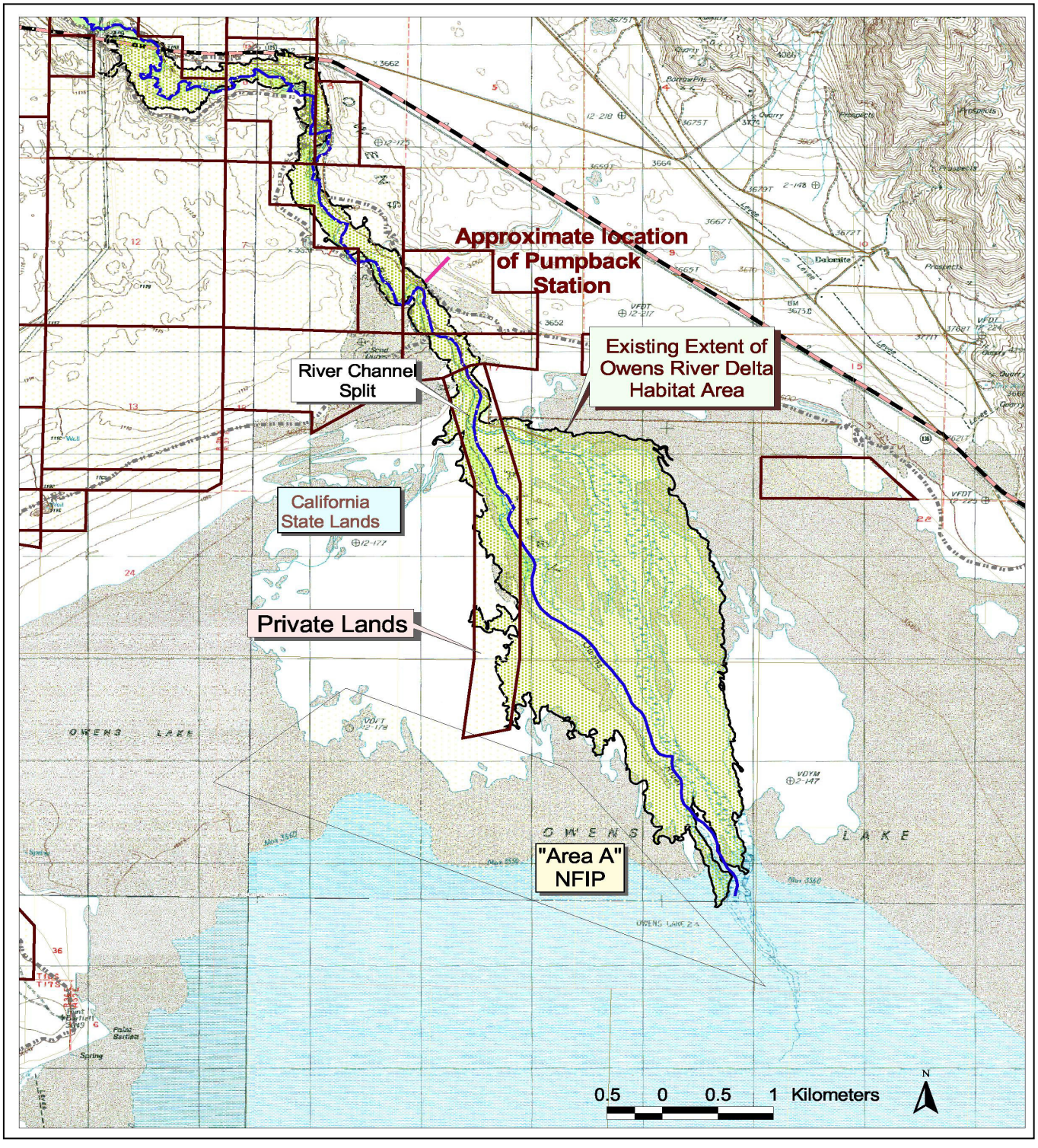
Establishment of base flows (first year)

Flow into the Delta less flow out of the Delta is a measure of the water stored and consumed, or that needed to sustain existing water and vegetated wetland. The difference between inflow and outflow is an estimate of the total water demand (evaporation, transpiration, storage and infiltration) integrated over all existing vegetation types in the Delta Habitat Area. Base flows will be established based on monitoring of outflow to ensure that water and vegetated wetland that exists at the time of project implementation is maintained. Given the historic expansion of wetland in the Delta Habitat Area, the extent of wetland that will exist upon project implementation is expected to exceed that which existed in 2000.

Base flows will be established during the first year of releases to maintain 0.5 cfs average daily outflow from the Delta Habitat Area, as described below.

[8] White Horse Associates is currently mapping the extent of wetland vegetation and water from the 2000 digital orthophotos. The total area of vegetated wetlands identified from preliminary mapping is over 800 acres. When White Horse Associates completes this mapping in 2002, it will serve as the existing condition for water and vegetated wetland in the Delta Habitat Area.

Figure 6. Owens River Delta Habitat Area.



An initial base flow (5.3 cfs) based on an estimate of ET demand will be released to the Delta Habitat Area upon project implementation. Stream gages equipped with recording devices will be installed in the outlet of the lower west branch and in the outlet of the lower east branch. Measures of outflow will be analyzed every 14 days during the first year following project implementation. If the total average daily outflow from the two gages for a 14-day monitoring period is less than 0.5 cfs, base flow for the subsequent monitoring period will be increased by at least the difference between measured outflow and 0.5 cfs. If the total average daily outflow from the two gages for a 14-day monitoring period is greater than 0.5 cfs, base flows may be decreased for the subsequent monitoring period by less than the difference between measured outflow and 0.5 cfs.

A record of base flows needed to maintain 0.5 cfs average daily outflow for 14 day monitoring periods will be compiled the first year after project implementation. This record will be used to calculate average summer (May 1 to September 30), fall (October 1 to November 31), winter (December 1 to February 28), and spring (March 1 to April 31) seasonal base flows, which will be applied in all subsequent years. Seasonal base flows will thus be established based on direct measurement of water demand for vegetation resources that will exist the first year following project implementation. Seasonal base flows may also be adjusted based on mid and long-term triggers subsequently discussed under Monitoring and Adaptive Management (Chapter 7). The total regulated inflow (base flow and subsequently discussed seasonal pulse flows) will be within the 6 to 9 cfs average annual flow stipulated in the MOU.

Adjustment of base flow (subsequent years)

Once the base flow releases for the subsequent years have been established, the base flow releases will be adjusted within the 6 to 9 cfs range base upon monitoring triggers. (See Monitoring and Adaptive Management chapter.) The triggers for adjusting base flows are:

- An average decrease of 10% or more during any three-year period in the 2000 Delta vegetated wetland conditions as estimated from annual mapping from satellite images. This trigger will be in effect for the first 15 years after the commencement of releases of base flows to the Delta.

- A 20% reduction in habitat suitability (acres + conditions) as measured annually for 15 years after the commencement of releases of base flows to the Delta.

- A determination that that base flows to the Delta can be reduced while still meeting the MOU goals and maintaining the 2000 Delta conditions (not causing the declines in vegetation conditions or habitat suitability described above).

Seasonal Pulse Flows

The four pulse flows to enhancement Delta habitat include:

- Period 1: Flows of 25 cfs/day for 10 days will occur at the on-set of the growing season (the end of March-to the middle of April). This period is selected to replenish the freshwater lens prior to plant emergence from dormancy and because saltgrass (the primary component of Transmontane Alkaline Meadows) can more affectively and efficiently utilize water at this time. The flows will also increase the extent and availability of water and nutrients throughout the Delta, and enhance foraging areas in the vegetation-playa-water interface (i.e., attract migratory species, and irrigate and maintain vegetation).

- Period 2: Flows of 20 cfs/day for 10 days in the late spring to mid-summer (late June to early July) – a period when water is becoming scarce (limiting) in the Delta and on surrounding playa. Increasing the availability and distribution of freshwater and nutrients during this period will provide direct and indirect benefits to the vegetation communities and the myriad invertebrates and vertebrate wildlife species.

- Period 3: Flows will be increased to 25 cfs/day for 10 days in September – late in the growing season. Water and nutrients are even more limiting during this period than during the previous period. Increasing the extent of water will also benefit fall migrant and resident wildlife.

- Period 4: A late fall – early winter (November – December) pulse of 30 cfs/day for 5 days will directly benefit wildlife that utilize the Delta during this period as well as provide some recharge to the freshwater lens.

Management Objective 1: In the first year, determine appropriate seasonal base flows.

Action 1-1: Install two continuous gauge recorders in the outlet of the lower west branch and in the outlet of the lower east branch.

Action 1-2: Measures of daily outflow will be analyzed every 14 days during the first year following project implementation. If the total average daily outflow from the two gages for a 14-day monitoring period is less than 0.5 cfs, base flow for the subsequent monitoring period will be increased by at least the difference between measured outflow and 0.5 cfs.

Action 1-3: A record of base flows needed to maintain 0.5 cfs average daily outflow for 14 day monitoring periods will be compiled the first year after project implementation. This record will be used to calculate average summer (May 1 to September 30), fall (October 1 to November 31), winter (December 1 to February 28), and spring (March 1 to April 31) seasonal base flows, which will be applied in all subsequent years.

Management Objective 2: Create, enhance and sustain a diverse complex of wetlands for resident and migratory species, management indicator species and special status species.

Action 2-1: Implement base flows to create, enhance and sustain existing habitat.

Action 2-2: Implement 4 periodic habitat maintenance flows (pulse flows) to the Delta that will increase the distribution and availability of water and nutrients at key times throughout the year with only minor disturbance to habitat.

Action 2-3: Implement beaver control measures and selective use of prescribed burning on a contingency basis only as necessary.

Action 2-4: Perform monitoring and adaptive management described in this Plan.

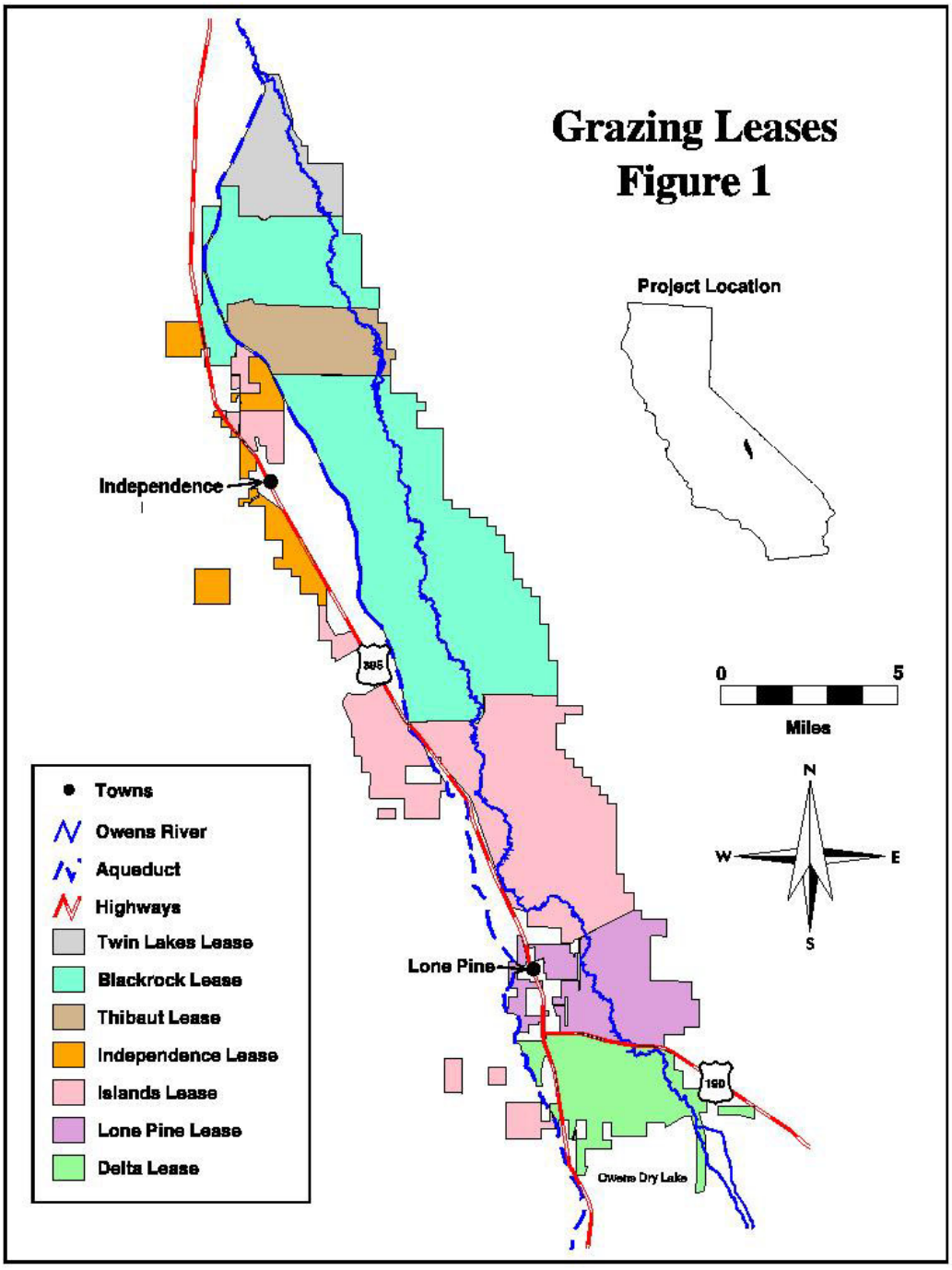
CHAPTER 4 – LAND MANAGEMENT PLAN

INTRODUCTION

A land management plan to address all aspects of livestock grazing is an essential element of the LORP. A process to develop a separate management plan for each lease has been developed by an interdisciplinary team working closely with the lessees. The overarching LORP management objective to develop a healthy, functioning Owens River riparian ecosystem will be met while still ensuring that lessees are able to sustain ranching operations in a multiple use plan. Land management goals are consistent with the management objectives of the LORP and critical elements have all been met, while at the same time providing for the continuation of sustainable uses of water gathering, recreation, livestock grazing, agriculture and other activities.

Grazing management plans for each lease within the LORP area have been developed with the following criteria: (1) manage grazing in riparian areas to limit impacts to young willow and to allow a willow canopy to develop; (2) establish a productive and functioning river ecosystem; and (3) share responsibility between all resource users, including lessees and recreationists, for the sustainable use of the LORP resources. With these criteria in mind, grazing land management is an essential and interrelated element to all other uses of the LORP area. Maps of all leases and essential features are presented at the end of this chapter.

The land management planning area is limited to LADWP lands within the LORP. The LORP planning area includes all LADWP land below the aqueduct intake to Owens Dry Lake, and also includes all lands east of the LADWP aqueduct to the Inyo-White Mountains. Six major individual grazing lease plans within the LORP area (Map 1) have been completed, and two small use parcels at the north and south end of the LORP area also have individual land use plans. The total area with land use plans is approximately 79,000 acres. The driest (mesic) leased lands are in higher elevation terraces, uplands east and just west of the river. Mesic lands are commonly closest to the aqueduct and near internal ditches and active springs, such as Reinhackle.


Grazing Leases
Figure 1
Project Location
Independence
Lone Pine
395
190
Owens Dry Lake
0
5
Miles
N
W
E
S
Towns
Owens River
Aqueduct
Highways
Twin Lakes Lease
Blackrock Lease
Thibaut Lease
Independence Lease
Islands Lease
Lone Pine Lease
Delta Lease

Longer-term leases are the preferred option for each lease under this plan; long-term leases allow for continuous cooperative stewardship of leased lands, but individual leases will also be contingent upon the appropriate management of each lease under the grazing management plans. Leasing contracts will include a fire and fence maintenance policy as follows:

Fire Policy – Any unmanaged fire burning within the LORP land management area will result in the recommendation to rest the burned area from all uses for up to 3 years . The final decision on how long the burned area will be rested will be determined by LADWP after critical review of the circumstances on a case by case basis. The term "recommended" is justified due to the fact that fire outcomes must be first evaluated on an individual case basis. Before any actions can be taken, including a recommendation to rest the burned area following an unmanaged fire, an evaluation of the ecological or range site conditions, climactic conditions, the recovery rate of the area, and management of livestock and/or other uses of the burn area must first be assessed. Some areas are capable of returning quickly due to soil, water and vegetative conditions. The final decision to determine the length of the rest time will be determined after critical review of the particular circumstances of each unmanaged burn.

Fence Maintenance Policy. – All necessary fences within the LORP area will be maintained by the grazing lessee on a yearly basis under terms of each lease. All fence maintenance will be completed to the satisfaction of LADWP before livestock are allowed to return to the leased land.

New Fences. - All fences used for the protection of riparian-riverine habitats will be 5 strand with a high tensile smooth top wire. Fence posts will be placed 12 feet apart with 3 stays between each post. Fences used to manage upland habitats can be constructed using 4 strands. Special fence provisions will be made for frequently used elk crossing sites. Additional cattle guards will be placed at critical traffic junctions to promote recreational movement, and locks will not be used on new gates where open access was available in the past.

Recreation. – Recreation policy is discussed in the Recreation chapter of this Ecosystem Management Plan. Recreationists' needs were included in the development of land management plans, and all fences will allow recreation access to the river through well-planned fence placement, addition of smooth wire openings, and cross channel fencing that also accommodates unimpeded access for canoes and small boats. Walkovers or walkthroughs will be placed at strategic locations within fencing to allow easy access for recreationists. Any proposed river crossings that are implemented, if at all, will be of the "Arizona crossing" type to limit the obstruction of stream flow in the river channel.

Management recommendations presented in this plan are based upon the best data available on the current condition of the range, and upon the conditions anticipated by restoration rewatering flows for the Lower Owens River. Land management plans will be monitored and improvements made through adaptive management interventions that are based upon baseline assessment of conditions followed by trend monitoring in the uplands. Riparian areas will also be monitored and analyzed as flows are restored to the

river. It is expected that benefits to habitat vegetation conditions and biomass in riparian areas may create conditions that will warrant adaptations to the current management recommendations. Through development of the baseline vegetation inventory, more accurate upland assessments will improve or validate the already acquired 1984-86 vegetation data.

Monitoring and evaluation of future land uses will be based upon documented riparian-riverine habitat and upland habitat reactions. Evaluation of monitoring information will allow for needed adaptive management modifications and interventions to accomplish riverine-riparian and upland management objectives.

Five of the six leases included in the LORP area are cow/calf-grazing operations, and the sixth lease is grazed by a group of three separate packhorse operations. The six leases were planned individually in order to implement improved grazing strategies that are practically applicable for each lessee. Existing grazing strategies were evaluated based upon the best estimates of existing upland and riparian conditions and new pastures; altered prescriptions for grazing have been recommended where needed.

An assessment of upland range conditions was conducted from existing information based upon: (1) potential species composition associated with different soil types and conditions, which were mapped by the Natural Resource Conservation Service and documented in digital maps and linked tabular information; and (2) existing plant species composition and communities, which were mapped and described by Inyo County and LADWP (Green Book). Evaluations of *arid* ecological sites were based upon percent cover of all grass species, which indicated that "higher and drier" areas are more susceptible to livestock damage than lower *mesic* ecological sites.

A fundamental management objective of each land management plan is to establish and maintain riparian vegetation along the Owens River and within the LORP area. To accomplish this management objective, new fencing strategies and altered grazing management practices were identified. Changes in grazing management will be implemented with a series of newly developed riparian pastures that are designed to meet riverine-riparian needs and to minimize negative effects to the lessee's livestock operations.

Grazing within riparian pastures in this Plan will differ from the past in timing and intensity. Grazing will cease and cattle will be removed from riparian area pastures when the average utilization of herbaceous forage on benchmark riparian sites has reached 40 percent. This prescribed utilization standard will ensure survival of riparian shrubs and trees during their first three years of growth and also includes elk use. The prescribed season of use, level of utilization, several months of non-grazing each year, and each lessee's commitment to good range management provide an excellent probability of attaining Owens River riparian goals. Grazing capacity under the new management system will be determined by practice, observation, attainment of prescribed utilization, and monitoring of conditions and trends; adaptive management will ensure that changes can be made to current recommendations as needed.

The basis for utilization rates for riparian pastures were set to ensure survival of riparian shrubs and trees during the first three years of growth, when they are most susceptible to grazing influences. The utilization time is also short—only 1-2 months—between March and May, which provides opportunity for late spring and summer regrowth. Utilization standards fall within the light to moderate category, but with ample

time allowed for regrowth before winter dormancy. The 40% prescribed level of riparian herbaceous forage utilization, and several months of non-grazing each year (particularly in the summer and fall months) will allow attainment of the LORP riparian Actions. Through monitoring and comparisons with the control, utilization rates can be adjusted under adaptive management guidelines, depending upon the science and what the use level demonstrates. Off and on grazing dates can vary slightly each year to respond to climactic conditions, forage development, livestock management practices, and will be contingent upon attainment of riparian Actions.

Grazing within upland areas where riparian considerations are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer, with the condition that an adequate non-use period is built in (no season-long grazing).

The lessees are an integral part of the LORP, and the changes in management have been designed to minimally affect the lessee in the short-term while possibly benefiting them in the long-term. It will be necessary that all future LORP land use changes offer adaptive management recommendations that can be cooperatively implemented, with each lessees' needs considered in balance with other stakeholders' needs. A brief description of each of the six major grazing leases and planning recommendations designed to meet LORP management objectives are as follows:

TWIN LAKES LEASE

The Twin Lakes lease covers 4,912 acres and is presently managed as a single unit or pasture (map 2). The Owens River channel through this lease holding is approximately 4.5 miles and, for the most part, is currently dry. Currently there are no flows through this section of the river channel, but some areas are wetted from sub-surface water sources. The Twin Lakes lease is just south of the LADWP aqueduct intake; a distinguishing feature is Twin Lakes, which is located at the southern end of the lease.

Management Objective 1: Establish a healthy, functioning riparian pasture, while also providing for sustainable grazing uses, water diversion, recreation and agriculture.

> Action 1-1: Protect the river and riparian habitat by developing a separately managed riparian pasture of 1,667 acres with approximately 4 miles of new fencing. The addition of 2 cattle guards and 3 new gates will allow for continued access to the river and surrounding areas by recreationists. Elk will continue to have access to this leased area, and there will be up to 8 accessible recreationists' crossings on the lease holding.
>
> Action 1-2: Control the timing of grazing and vegetation utilization by managing livestock numbers and distribution. Essential grazing prescriptions for cattle grazing in river-riparian areas are: allow grazing only for a short period in the early spring. Grazing will begin April 1 and end about mid-May; however, prescribed beginning and ending target dates are flexible depending on conditions

of the pasture. Monitoring of vegetation and adaptive management strategies will determine any necessary changes to control timing and vegetation utilization. Grazing can and will vary from year-to-year in response to changing climactic conditions, forage development and livestock needs.

Action 1-3: Manage the intensity of riparian vegetation grazing utilization. As river flows are introduced in the LORP area, riparian vegetation growth will improve, sometimes dramatically. To ensure that riparian vegetation needs are met, a grazing prescription allows for all grazing to cease and cattle to be removed from the riparian pasture when utilization of herbaceous forage has reached 40 percent on benchmark sites. This prescribed degree of use is designed to ensure survival of riparian shrubs and trees during the initial three years of growth when tender new plants are most susceptible to over-grazing. This prescription applies to elk use as well as cattle.

Action 1-4: Monitor the utilization of herbaceous forage in riparian pastures. Annual monitoring of riparian pastures will rely on utilization cages and photo points to determine forage use and to assess changes in the riparian pasture. When standing forage measurement comparisons inside and outside of cages indicate that cattle have consumed 40% of herbaceous forage, cattle will be removed from the pasture.

Action 1-5: An existing rare plant exclosure for Nevada oryctes (*Orcytes nevadensis*) will be reconstructed, requiring 0.25 miles of new fence.

Action 1-6: Sustain continued recreational use of the LORP area. The addition and reconstruction of riparian pasture fencing has been designed so recreationists can continue to have easy access to the LORP area. New fences will be constructed primarily on the outer side of existing roads away from the river. Cattle guards will be placed where recreation traffic is greatest, and walk through points will be provided on both sides of the river. Provisions for boat and canoe access will be available where fences cross the river.

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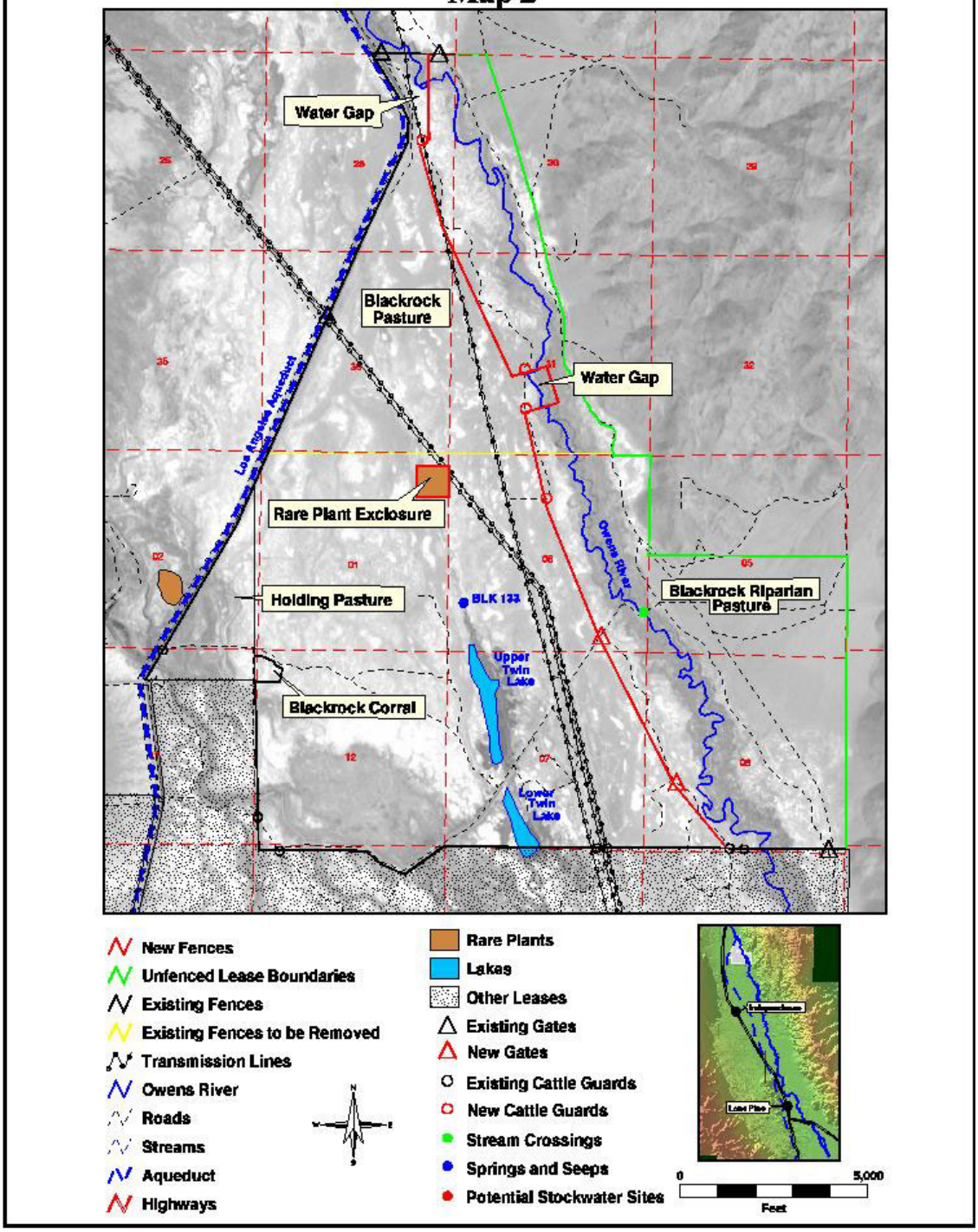
Twin Lakes Lease
Map 2



Management Objective 2: Upland pasture management objective: sustain livestock grazing and productive wildlife habitat through efficient use of dormant forage during winter periods. An upward trend in vegetative vigor and diversity will be maintained.

Action 2-1: Continue existing upland pasture grazing management in those pastures west of the riparian pasture to the aqueduct. Winter grazing as currently practiced will continue from November 1st through May 15th, and, generally, bulls will be allowed to graze during summer periods.

Action 2-2: Grazing within upland areas where riparian considerations are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer, with the condition that an adequate non-use period is built in (no season-long grazing).

Action 2-3: Improve water distribution and stockwater provisions to provide for sustainable livestock grazing. Two water gaps will be provided on the upland pasture to encourage cattle use outside of the Owens River riparian corridor, and which will offer better distribution of livestock. The water gaps will be provided as a part of the fencing project that will be completed prior to introduction of water into the river. Water will also be provided for waterfowl needs in the southwest corner of the lease to allow for additional grazing vegetation during periods when livestock will be kept off the river.

Action 2-4: Continue use of grazing supplements in areas where existing forage is high.

Action 2-5: No change to current seeps and springs management. The site that has been identified as a spring on this lease is not an actual spring but is part of the Twin Lakes area that is currently supplied with water from the Blackrock ditch. No fencing or change in current grazing management is recommended in this area at this time because livestock are currently causing no deleterious effects.

BLACKROCK LEASE

The Blackrock lease area encompasses 32,657 acres and is divided into 20 management units or pastures (Map 3). The Blackrock lease is the largest LADWP grazing lease within the LORP area. The lease lies (except for 2 small pastures) to the east of the LADWP aqueduct, and extends from the Blackrock Fish Hatchery and the Blackrock Ditch in the north to 2 miles south of Manzanar Road.

Management Objective 1: Establish healthy riverine-riparian pastures as part of the greater ecosystem while providing for sustainable water diversion, recreation, livestock grazing and agriculture.

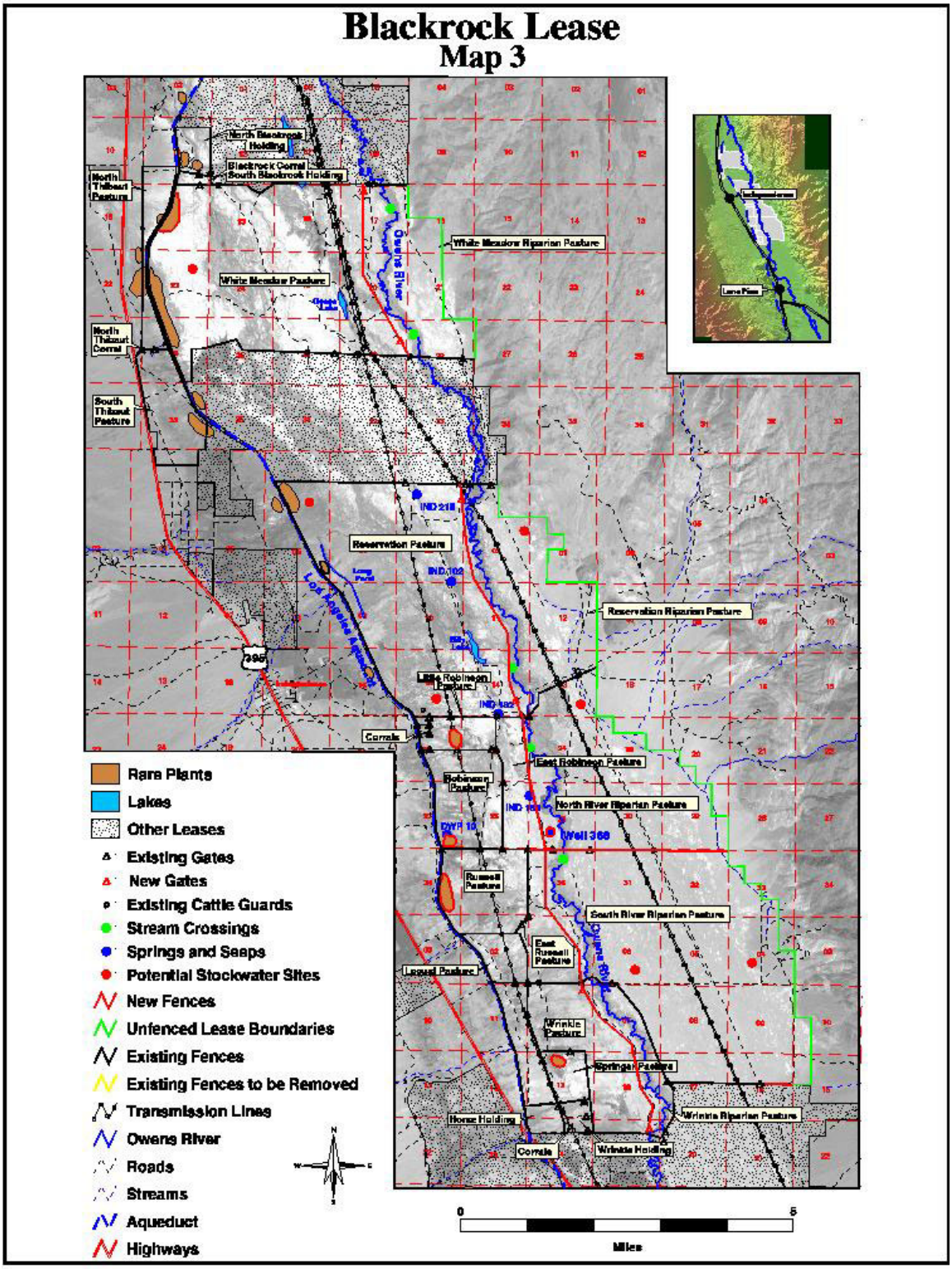
Action 1-1: Separately manage riparian pastures to protect the river and riparian habitat functions. Five riparian pastures totaling 14,540 acres will be created using 20 miles of new fencing, the addition of at least 8 new gates and cattle guards. Fencing will be constructed to allow continued recreational access to the river with at least 8 walkthrough gates.

Action 1-2: Control the timing and amount of vegetation use. The primary grazing prescription for cattle is to allow grazing of river-riparian areas only for a short period each spring. In one pasture grazing will begin March 1st and end April 30th. In all other pastures grazing will begin April 1st and end in mid-May, or by the end of May. Beginning and ending grazing target dates are flexible and can be altered to fit climactic conditions, changes in forage condition or livestock needs. Adaptive management will be used to determine if future changes are needed.

Action 1-3: Control the intensity of riparian vegetation use as river flows are re-introduced and riparian vegetation improves. Grazing prescriptions will ensure this improvement, as grazing will cease and cattle will be removed from riparian pastures when herbaceous utilization reaches 40 percent on benchmark sites. The prescribed degree of use ensures survival of riparian shrubs and trees during their first three years of growth, when they are most susceptible to grazing pressures. The 40% use includes grazing by elk.

Action 1-4: Monitor forage use in riparian pastures. Annual monitoring of grazing influences will rely on utilization cages and photo points. When vegetation measurements inside and outside utilization cages show cattle have consumed 40% of herbaceous forage, cattle will be removed from the pasture. Each riparian pasture will have three utilization cages. Long-term monitoring will use non-grazed controls to evaluate riverine-riparian response; this will also help identify wildlife effects on riparian vegetation, particularly elk and deer.

Action 1-5: Sustain continued recreational use of the river. The addition and reconstruction of riparian pasture fencing will be designed to continue recreational access. New fences will generally be on the outer side of existing roads in order to provide direct access to the river. Cattle guards will be installed where recreation traffic will be greatest. Walkthroughs will be available on both sides of the river and boat and canoe traffic will not be inhibited where fences cross the river.


Blackrock Lease
Map 3
North Blackrock Holding
Blackrock Corral
South Blackrock Holding
North Thibaut Pasture
White Meadow Riparian Pasture
White Meadow Pasture
Owens River
North Thibaut Corral
South Thibaut Pasture
IND 218
Reservation Pasture
IND 102
Long Pond
Los Angeles Aqueduct
Reservation Riparian Pasture
395
Little Robinson Pasture
IND 432
Corrals
East Robinson Pasture
Robinson Pasture
North River Riparian Pasture
IND 10
DWR 10
Well 366
Russell Pasture
South River Riparian Pasture
East Russell Pasture
Leased Pasture
Wrinkle Pasture
Springer Pasture
Wrinkle Riparian Pasture
Horse Holding
Corrals
Wrinkle Holding
Rare Plants
Lakes
Other Leases
Existing Gates
New Gates
Existing Cattle Guards
Stream Crossings
Springs and Seeps
Potential Stockwater Sites
New Fences
Unfenced Lease Boundaries
Existing Fences
Existing Fences to be Removed
Transmission Lines
Owens River
Roads
Streams
Aqueduct
Highways
N
W
E
S
0
5
Miles

Management Objective 2: Upland pasture management objective: sustain livestock grazing and productive wildlife habitat through efficient use of dormant forage during winter periods. An upward trend in vegetative vigor and diversity will be maintained.

Action 2-1: Continue existing grazing management in pastures west of the river and east of the aqueduct. Current winter grazing will continue from November 1st through May 15th. Only bulls will be allowed to graze during summer periods. Riparian pasture fencing within the river pasture has created two new upland pastures that will be included in the grazing rotation.

Action 2-2: Set utilization criteria for vegetation use on terraces and other uplands on the eastside of the river. Grazing within upland areas where riparian considerations are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer with the condition that an adequate non-use period is built in (no season-long grazing).

Action 2-3: Provide for a continuation of sustainable livestock grazing through improved water distribution and improved stockwater. To encourage cattle to use upland habitats rather than riparian habitats, and to better distribute livestock on the uplands, at least five stock water sources will be developed. These water sources will be developed prior to installation of riparian pasture fencing. Additional water will be provided for waterfowl needs in the White Meadow pasture as outlined in the waterfowl plan.

Action 2-4: Continue supplemental feeding to gain better animal distribution and better forage use. First calf heifers will continue to be managed separately and will receive supplemental hay in the Wrinkle pasture. Increased riding, proper supplement placement, new stock water sources, and higher forage production from sub-irrigation (due to elevated Owens River base flows) will allow an upward trend in vegetation to develop in upland pastures.

Action 2-5: Integrate seeps, springs and rare plants into grazing plans. Five areas have been identified as springs within the lease, according to the selected list provided for the springs and seeps inventory: (1) three springs are dry with no impact from livestock grazing; (2) one spring is actually an artesian well with no apparent impact from cattle grazing; and (3) the last spring-seep is a large sub-irrigated pasture with no grazing impacts. Rare plants include the Inyo County star-tulip, *Calochortus excavatus,* and Owens Valley Checkerbloom, *Sidalcea covillei* (map 3). Of the two species, the star-tulip has wider distribution and is generally more abundant. Four of the rare plant sites will be fenced to exclude livestock grazing during the flowering period. One exclosure will be closed to grazing, and the other three will have drop down fence panels to allow grazing during winter months. A second artesian well located on the lease (well 368) has a thriving pupfish population and will be protected by fencing.

THIBAUT LEASE

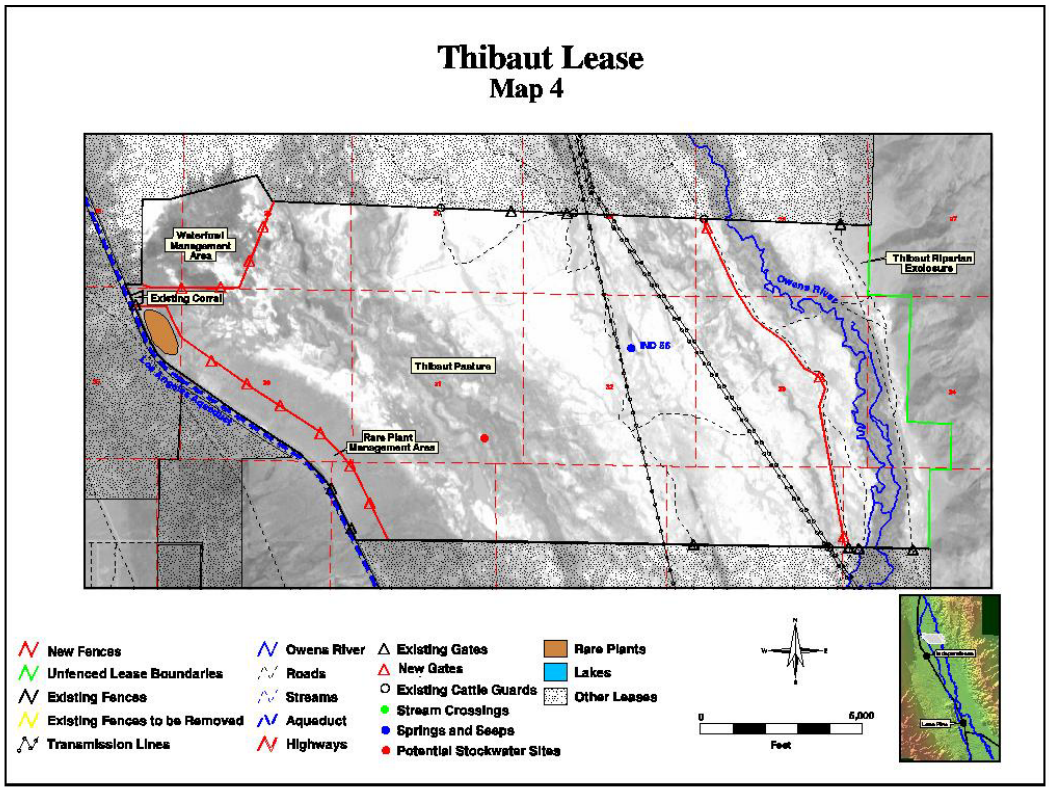
Three separate pack operations in the Sierra mountains graze horses and mules in the Thibault lease. When the summer mountain recreation season closes in mid-September, the horses and mules are brought to graze the Thibaut lease until recreation season reopens the following June. The lessees' grazing action is to efficiently graze the dry plant material during fall and winter months. Supplemental hay is fed from December until spring when new plant growth again provides sufficient forage. The 5,050-acre lease is sandwiched between the Blackrock Lease on the north and the remainder of the Blackrock Lease on the south. The lease lies east of the aqueduct (Map 4) and contains a two-mile section of the Owens River. The pasture is fenced on all sides except for the east boundary along the top of the Inyo-White Mountains.

Management Objective 1: Establish a healthy riparian pasture in a functioning riverine-riparian ecosystem while also providing for the continuation of sustainable water diversion, recreation, livestock grazing and agriculture.

Action 1-1: Protect the river and adjacent riparian habitat with a riparian exclosure. An 847-acre riparian exclosure will be developed and all livestock grazing will be deferred for at least 10 years. This will be accomplished with three miles of new fencing, the addition of 15 new gates and cattle guards. After 10 years of rest, pasture conditions will be evaluated and adaptive management changes made if necessary. Fencing will be constructed so that recreational access to the river is maintained and continued elk can continue to use the area. A total of four recreational walkthrough openings will be provided on the Thibaut/Blackrock boundary fences where they cross the river.

Action 1-2: Reduce the intensity of riparian vegetation use. The introduction of flows will improve conditions for riparian vegetation and will ensure needed riparian vegetation improvement; grazing deferments for at least 10 years will also greatly enhance vegetation conditions.

Action 1-3: Preserve continued recreational use of the river and adjacent lands. The addition and reconstruction of riparian pasture fencing will be designed to provide continued access for recreationists. New fences will be constructed on the outer side of existing roads away from the river, cattle guards will be placed where recreation traffic will be greatest, walkthroughs will provide access on both sides of the river, and boat and canoe traffic will be allowed unobstructed access.



Management Objective 2: Upland pasture management objective: sustain livestock grazing and productive wildlife habitat through efficient use of dormant forage during the winter periods. An upward trend in vegetative vigor and diversity will be maintained.

Action 2-1: Continue existing grazing management in the main pasture west of the river; exceptions will be the rare plant and the waterfowl areas. Winter grazing as currently practiced will continue in the main Thibaut upland pasture from September 15 through June 15. Early fall snows in the Sierras will at times necessitate moving stock as early as mid-September into the lease. Similarly, late snowmelt in the Sierras will occasionally cause lessees to hold stock in pastures as late as mid-June.

Action 2-2: Protect vegetation on both sides of the river from grazing, including the terraces and uplands above the east side of the river. Grazing on riparian and upland areas east of the river will not be allowed for a minimum of 10 years. Grazing within upland areas where riparian considerations are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer with the condition that an adequate non-use period is built in (no season-long grazing).

Action 2-3: Manage the timing and use of forage in the waterfowl management (247 acres) and rare plant areas (211 acres). This will be accomplished with 2.5

miles of new fence construction that will create two new pastures with deferred grazing. Grazing will occur every other year in the waterfowl area, and release water will be managed as stipulated in the waterfowl management plan. Waterfowl habitat will be evaluated every year and the prescription altered by adaptive management strategies if needed to promote desired conditions. The rare plant area will be grazed only from October 1st to March 1st and will be excluded from grazing March 1st to the end of September. Each area will have 4-6 large gates that are to be left open during the time of year when grazing is allowed.

Action 2-4: Provide for sustainable livestock grazing through improved water distribution and stockwater. At least one stock water source will be developed in order to better distribute livestock on the uplands. Water sources will be developed prior to functional riparian pasture fencing. Additional water will be provided to the waterfowl management area.

Action 2-5: Continue to provide supplemental feeding as necessary with hay from December 1st until April 15th. Compensate for forage deficiencies on dry years by feeding more hay.

Action 2-6: Integration of seeps and springs into grazing plans. The area identified as a spring is in a dry low area (map 4). This area gets very little use so there are no livestock impacts. No fencing or change in current grazing management is required.

ISLANDS LEASE

The Islands lease is named for the large island (currently about 1,000 acres in size) at the northern toe of the Alabama Hills where two major channels flowed prior to de-watering (Map 5). The western channel defining the Islands boundary is now an obscure and intermittent stream, but increased river flows under the LORP will redefine the island's boundaries. The entire Islands lease is approximately 18,970 acres that is divided into five major management units or pastures. The lease extends from a point two miles south of the Manzanar Road to the Depot Road just north of Lone Pine.

Meadow vegetation dominates the Island's irrigated and sub-irrigated areas, while the proportion of desert shrubs increases with increasing site dryness. Salt cedar (tamarix) is abundant along the Owens River channel, and willows are sparse but present.

Management Objective 1: Establish a healthy riparian pasture in a healthy, functioning riverine-riparian ecosystem while providing for sustainable water diversion, recreation, livestock grazing and agriculture.

Action 1-1: Protect the river and riparian habitat through development of separately managed riparian pastures. Two riparian pastures (1,638 acres) will be created with 5.5 miles of new fencing, the addition of a minimum of six new gates and two cattle guards. Fencing will be constructed to minimally affect the lessee's livestock management, provide continued access to the river for recreationists,

and allow continued elk use. The existing grazing management of the Islands area will continue as currently practiced because the area has not been negatively affected.

Action 1-2: Control the timing and amount of vegetation use. The keystone grazing prescription is to allow cattle to graze for only a short period in the spring in the newly created fenced riverine-riparian areas. Grazing will be allowed from March 1st to April 30th in one pasture, and April 1st to May 1st in the other pasture. Beginning and ending dates are flexible from year-to-year in response to changing climactic conditions, forage development and livestock needs.

Action 1-5: Continue recreational use of the river. The addition and reconstruction of riparian pasture fencing has been designed for continued access by recreationists. New fences will mainly be located on the outer side of existing roads away from the river. Cattle guards will be placed where recreation traffic will be greatest, and walkthroughs will be located on both sides of the river. Boat and canoe traffic will be unimpeded where fences cross the river. Fences that have not been maintained and are no longer used will be removed.

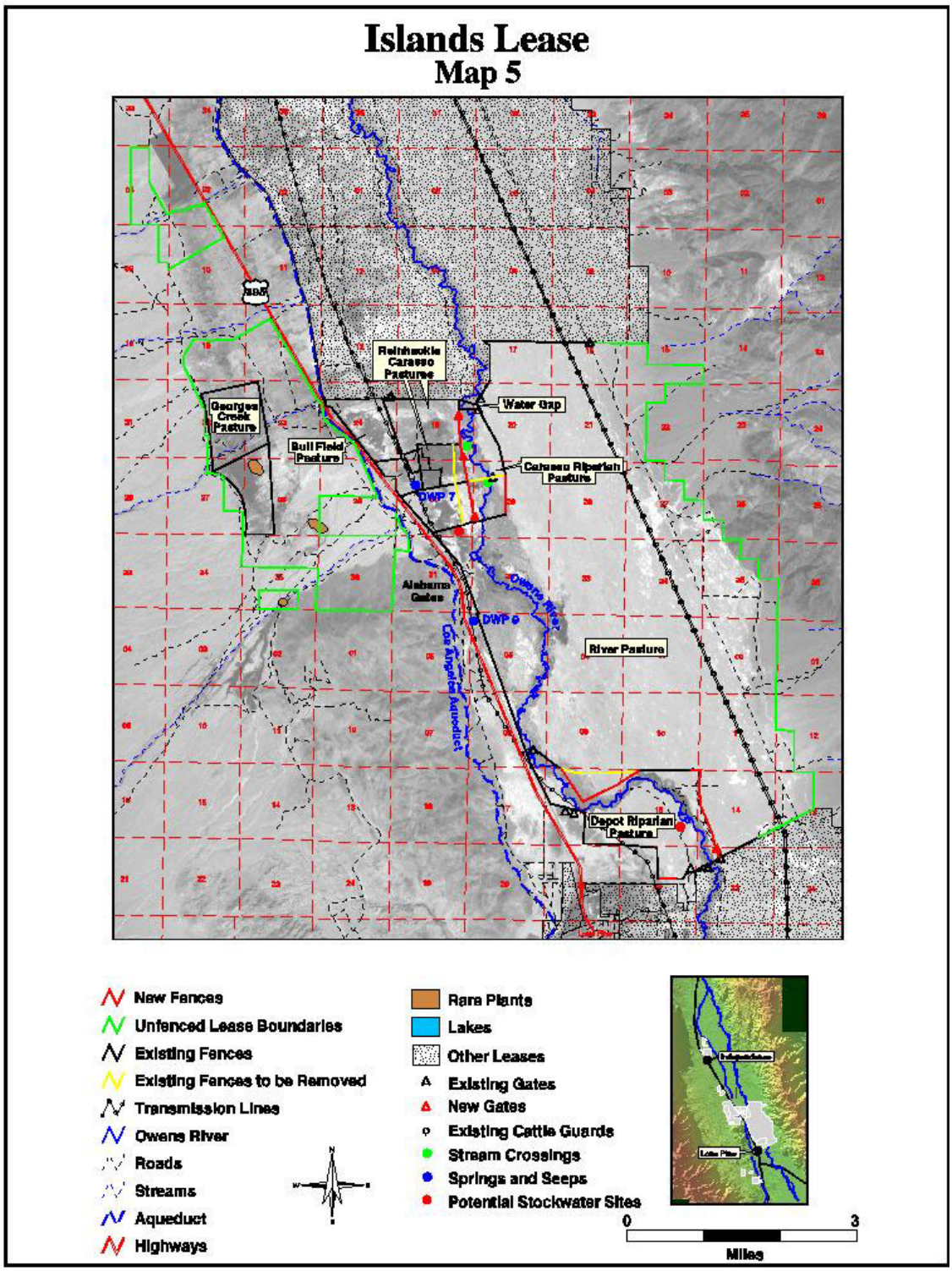
Management Objective 2: Upland pasture management objective: sustain livestock grazing and productive wildlife habitat through efficient forage use during dormant winter periods. The management objective will be to gain an upward trend in vegetation conditions.

Action 2-1: Continue present management practices in those pastures between the river and the aqueduct. Current winter grazing of mainly dormant vegetation will continue from November 1st through May 31st, however, bulls will continue to graze during the summer periods. The Reinhackle-Carasco Meadow Pasture will continue to be used from May 1st through October 31st. Upland areas west of the river will be grazed to gain an upward trend in vegetation condition.

Action 2-2: Set utilization criteria for forage use on terraces and other uplands on the east side of the river. Grazing within upland areas where riparian considerations are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer with the condition that an adequate non-use period is built in (no season-long grazing).

Action 2-3: Continue sustainable livestock grazing by improving water distribution and stockwater location. To encourage cattle use outside of the riparian habitats and to better distribute livestock on the uplands, at least one new stock water source will be developed. This water source will be developed prior to development of functional riparian pasture fencing. A water gap on the river at the north end of the lease will remain unfenced so that livestock will have access to water while grazing the uplands east of the river.

Action 2-4: Manage seeps and springs. Reinhackle spring currently irrigates areas north and east of the spring, but water from the spring does not reach the river. The bank above Reinhackle spring will be protected from any future damage by a fence that completely surrounds the spring.



LONE PINE LEASE

The Lone Pine lease is located in and around the city of Lone Pine and surrounds the airport (Map 6). The northern boundary of the lease is the Lone Pine narrow gauge road and the southern boundary is State Highway 136 to Keeler. The western boundary is the aqueduct and the eastern property line is just east of the Owens River. The 3.5 mile-section of river in this lease holding has a flow of between 8-15 cfs.

The nine major pastures of the Lone Pine lease surround the city of Lone Pine, its airport sewage ponds and landfill to create a total lease holding of approximately 5,128 acres. Meadow vegetation dominates irrigated and sub-irrigated areas. The proportion of desert shrub increases with increasing site dryness, and willows in the riparian area are sparse. The driest portions of the lease are the uplands on either side of the river, and the true desert sites produce little forage most of the year. However, spring rains produce short-term green-up conditions to produce annual vegetation that is highly preferred by cattle.

Management Objective 1: Establish a healthy riparian pasture in a riverine-riparian ecosystem while providing for sustainable water diversion, recreation, livestock grazing and agriculture.

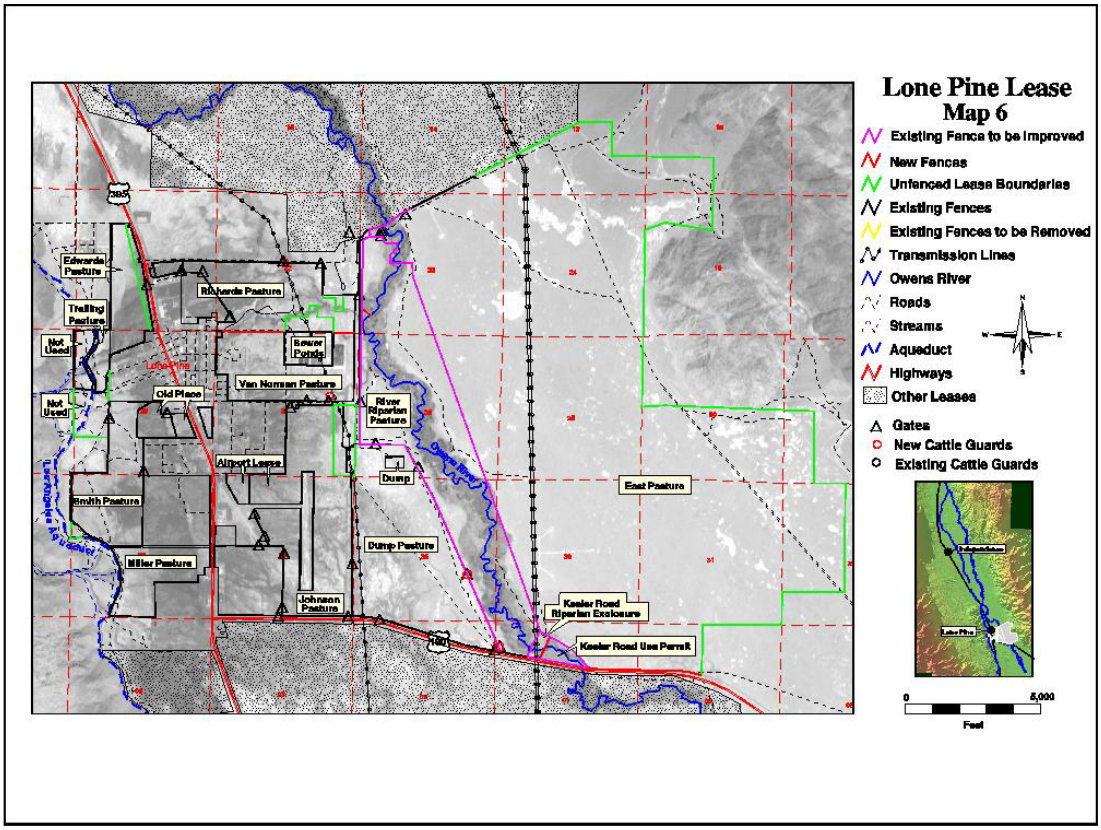
Action 1-1: Protect the riverine and riparian habitat through proper grazing of riparian pastures. A riparian pasture of 838 acres will be established by reconstructing eight miles of existing fence, new construction of one mile of fence, and the addition of six cattle guards and four new gates. Approximately one-mile of new fence will run along the highway east of the Keeler Bridge. Also, approximately one-half mile of new fence will be put in from the river east on the northern end of the riparian pasture. These fences will serve to prevent drift out of the pasture onto the road and will improve management. Fencing will be constructed to provide continued access to the river by recreationists. All reconstructed or newly constructed fences will allow continued elk use in the area. The reconstructed fence will be a five-strand fence with posts 12-feet apart and three stays between posts. The top wires will be smooth and without barbs.

Action 1-2: Control the timing and amount of vegetation use by livestock. Cattle will graze the riverine-riparian areas from January 1st to March 30th with the contingency that at 40% forage utilization, livestock will be removed from the pastures. Prescribed beginning and ending dates are flexible depending on climactic conditions and livestock needs. Adaptive management will be used to determine if there are any needed changes in the future.

Action 1-3: Manage the intensity of riparian vegetation use. As the river receives new flow regimes, riparian vegetation grows and biomass improves, grazing prescriptions that have been established will assist in the creation of a healthy riparian system. Grazing will cease and cattle will be removed from riparian pastures when herbaceous forage utilization has reached 40 percent in the riparian pasture. This degree of use ensures survival of riparian shrubs and trees when they are most susceptible to grazing during their first three years of growth; utilization also includes elk grazing.

Action 1-4: Monitor forage utilization in riparian pastures. Annual monitoring of the riparian pastures will use utilization cages and photo points to determine forage use. A total of 5-7 utilization cages will be employed. Long-term monitoring will compare riparian vegetation in riparian pastures with non-grazed controls. This will also help identify wildlife effects on riparian vegetation, particularly elk and deer.

Action 1-5: Preserve continued recreational use of the river and adjacent lands. Riparian pasture fencing is designed for continued access by recreationists. Cattle guards will be placed where recreation traffic is the greatest, and walkthroughs will be located on both sides of the river. Boat and canoe traffic will be provided where fences cross the river.



Management Objective 2: Upland pasture management objective: sustain livestock grazing and productive wildlife habitat through efficient use of dormant forage during winter periods. Grazing will be conducted to gain an upward trend in range health.

Action 2-1: Continue existing management in pastures between the river and the aqueduct. Winter grazing as currently practiced will continue from November 15th through June 12th.

Action 2-2: Set utilization criteria for vegetation use on terraces and uplands east of the river. Grazing upland areas east of the river where riparian considerations are not a factor will be managed so forage utilization does not exceed 65% of the annual grass standing crop.

Action 2-3: Provide for sustainable livestock grazing through improved water distribution. Improved water distribution (particularly in the Johnson pasture) and limited burning will provide additional vegetative growth for grazing during periods when livestock are not allowed to graze the riparian pasture. The current two-week grazing period in late May and early June will no longer be available to livestock grazing under this Plan.

Action 2-4: Grazing within upland areas where riparian considerations are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer with the condition that an adequate non-use period is built in (no season-long grazing).

Action 2-5: Continue use of supplements. Continue using current practices by placing supplements in areas where adequate forage exists.

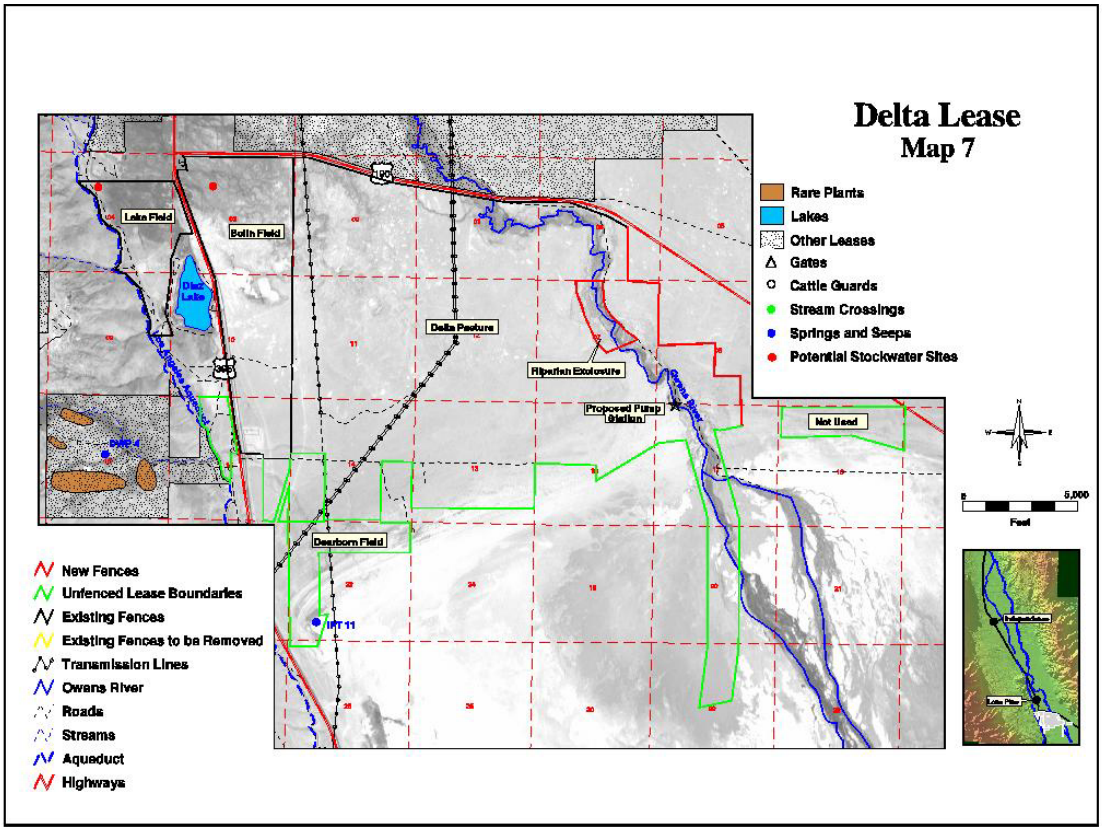
DELTA LEASE

State Highway 136 forms the northern boundary of the Delta lease (Map 7). The Delta lease's southern boundary is the dry Owens lakebed (once the large Owens River delta at the margin of Owens Lake), giving the Delta lease its name. The northern end of the Delta where the river channels separate is heavily vegetated and has similar characteristics to the "Island Bosque" area. The delta area is much smaller, however, and is heavily utilized by elk because of the moistness of the site (particularly irrigated areas) that currently produces abundant livestock forage. Dry sites, such as the desert shrub lands east of the river, produce negligible forage much of the year. These desert shrub lands, however, produce important short-term green-up forage in the spring that is preferred by both stock and wildlife that have wintered on forage that is nutritionally sparse.

Management Objective 1: Establish a healthy riparian pasture in the riverine-riparian ecosystem while providing for sustainable water diversion, recreation, livestock grazing and agriculture.

Action 1-1: Protect the river and riparian habitat. A riparian exclosure of 10 acres will be created in the northern end, with livestock grazing deferred for at least 10 years—this exclosure will function as the control designed in the plan. This Action will be accomplished with 1.5 miles of new fencing that will form an exclosure that takes in both sides of the river. The exclosure will serve as a control for monitoring the grazed riverine-riparian areas. Long-term monitoring will compare vegetation response in grazed riparian pastures with non-grazed riparian pastures; if long-term monitoring determines that desired riparian communities are not developing along the river sections, grazing management will be altered to attain a desired condition.

Currently, grazing does not negatively affect the delta from the point where water fans out and downstream; management therefore will remain as currently practiced. During and after the next 10-year period, condition and trend data will be evaluated and management directions will be adapted if conditions warrant.



Action 1-2: Preserve continued recreational use of the river. Riparian pasture fencing will be designed to provide continued access for recreationists. Walk through points will be installed on both sides of the river. Boat and canoe traffic will access where fences cross the river. The proposed new fence along the Delta Lease eastern property line is purely for controlling livestock movement onto the highway east of Keeler bridge and to protect the Owens River. Since it would be more appropriate to locate the fence along the highway, LADWP will work with Cal Trans to fence along the south side of Keeler Road.

Management Objective 2: Upland pasture management objective: sustain livestock grazing and productive wildlife habitat through efficient use of dormant forage during winter periods. Pastures will be managed to gain an upward trend.

Action 2-1: Set forage utilization criteria for vegetation use on dry uplands. Grazing in upland areas (primarily west of the river) where riparian considerations are not a factor are not a factor will be conducted as follows: (a) 65% utilization if grazing is during the fall/winter period (dormancy), and (b) 50% utilization rate if grazing is spring or summer with the condition that an adequate non-use period is built in (no season-long grazing).

In addition to the six major leases discussed there are two very small parcels at either end of the LORP area that are also grazed by livestock.

INTAKE LEASE

This small lease is located around the intake to the LADWP aqueduct. The riparian pasture lease is fenced, but the fence is in poor condition and will be reconstructed. Because of the poor fence condition, livestock from other leases have had access. The lease is managed as a single pasture with livestock grazing only once in every four years. The Owens River channel that passes through this lease is mainly dry.

To achieve riparian and river Management Objectives, the existing grazing of one year with three rest years following will remain the same. To successfully graze this lease requires reconstruction of the entire fence and yearly maintenance by the lessee. If livestock are allowed to graze the lease more than one in every four years to greater than 40% utilization, then a new rotation sequence of three years of rest must follow. Yearly maintenance should keep livestock from accidental use between rotations. Over time, this one in four year grazing strategy must average out.

KEELER ROAD USE-PERMIT

The Keeler Road use permit is located just north of the Owens River/Keeler Road Bridge and is approximately 26 acres in size. The use permit is for four horses and has

been grazed year around. To establish a healthy riverine-riparian system, this use permit will be grazed as in the past, but with only two instead of four horses. In addition, 10 acres of this use permit will be fenced off and used as a long-term monitoring exclosure. The exclosure will be used to compare riparian vegetation response in non-grazed conditions with grazed riparian pastures. This will help identify wildlife effects, particularly elk and deer, on riparian vegetation. The use permit holder will be able to graze the remaining 16-acre parcel with up to 2 horses. Fence reconstruction and maintenance for the 16-acre use permit will be the responsibility of the use permit holder.

Adaptive Management

Management recommendations are based on the best current information available on range condition, livestock needs and riparian areas. Changing conditions in the riparian areas will be tracked and analyzed as flows are provided to the river. Effects of flows and management of the river and riparian area by methods such as beaver control will also be monitored and adjustments recommended as necessary. Benefits to vegetation condition in the riparian area may warrant modification of the current management recommendations if future upland assessments indicate that conditions are different than what has been shown through existing data.

The land management plan can be modified and adjusted based upon justification from additional information. Modifications to current proposed fencing changes, grazing dates and forage utilization rates may be adjusted if conditions indicate changes in strategy are warranted.

Concerns about grazing riparian areas during spring nesting season for birds, which has been found to cause impacts to some nesting birds through trampling and destruction of nests, have been considered. Grazing can potentially have adverse direct and indirect effects on several riparian and wetland bird species. Direct mechanical impacts to nesting birds is limited to ground nesting species and species that use lower herbaceous and woody vegetation (.2m), including willow flycatcher, yellow warblers, yellow-breasted chat, and many others.

A far greater threat to riparian bird species during nesting season is the potential indirect impacts posed by unmanaged grazing. Grazing can impact riparian areas through direct consumption of plant material and trampling. Soil compaction affects vegetation by reduced infiltration, percolation, root growth and plant production. Probably the most negative impacts from livestock grazing in riparian areas include reduction of survivorship of young stands of woody riparian plants, and reduction of the structural and floristic diversity (i.e., habitat quality) of the under-story vegetation in established stands. The total volume of vegetation foliage and the richness and pattern of vegetation layers are important attributes to riparian and wetland bird species.

Livestock grazing in the LORP will be monitored for several types of impacts. Utilization monitoring in riparian pastures will be an important component of land management in the LORP. If habitat conditions are below expectations or proposed management objectives do not result in the expected responses, management objectives will be reevaluated through adaptive management and plans will be revised as necessary.

CHAPTER 5 – LORP CONSERVATION PLAN

INTRODUCTION

The management of threatened and endangered species (T&E) and their habitats is one of many programs contributing to the entire Owens Valley watershed management effort performed by LADWP and other agencies on an ecosystem-wide basis. Currently, sanctuaries and protected areas for T&E species are widely scattered throughout the valley. The U.S. Fish and Wildlife Service (USFWS), U.S. Department of the Interior (USDI), and the California Department of Fish and Game (CFG Code Section 2080.1 requires biological opinion and analysis) jointly have the responsibility to manage T&E species' *populations*. Proper management of T&E *habitat* within the LORP is the responsibility of LADWP.

While the USFWS's Multispecies Recovery Plan (MSRP) identifies potential sanctuaries and conservation areas throughout the Owens Valley and within the LORP, the purpose of the LORP Conservation Plan is to provide short-term protection and/or creation of habitat for T&E species. At this time the LORP conservation plan complements the MSRP in some respects, and like the MSRP, the LORP will be subordinate to a future valley-wide Habitat Conservation Plan (HCP) on all LADWP lands.

In 2002, LADWP will initiate the preparation of a comprehensive HCP. The term HCP refers to a specific federal process that is provided for in a 1982 amendment to the Endangered Species Act (section 10[a][1][B]), and its implementing regulations and amendments (50 CFR, parts 17 and 222; 63 FR 8859).

In this specific and formal process, the federal government makes agreements with nonfederal landowners that assure, among other things, that appropriate measures will be taken to compensate for any "take" of a species. This is a formal process between the USFWS and LADWP to address T&E species and their habitat on all LADWP owned lands throughout the Owens River Valley. Successful implementation of an HCP allows LADWP to continue water delivery and land management operations while also offering protection for T&E species. An HCP will incorporate LORP and MSRP fish sanctuaries, plant protection areas and wildlife protection areas into one comprehensive plan that will ensure long-term protection and recovery for T&E species. The LORP Conservation Plan is not intended to ensure T&E species recovery, replace the MSRP, or substitute for the formal HCP process.

FISHERIES

Fish Species

Within the Lower Owens River ecosystem there are two fish species that are listed as T&E—Owens pupfish and Owens tui chub; one fish species listed as of Special Concern—Owens speckled dace; and one snail species listed as of Special Concern—the Owens Valley springsnail[1].

Several fish sanctuaries have been established throughout the Owens River Valley for T&E species. The only special management area, or sanctuary, within the LORP is for Owens pupfish at Well 368. (Note that well 368 has been provided protection from grazing because it contains the endangered Owens pupfish. Other potential sanctuaries do not have T&E species and at this point are still only proposed. Grazing management for sanctuaries that may be selected for potential use will become part of a long-term management plan for that particular sanctuary, if selected).

In the past, native fish species management programs have had limited success; one example is the Owens Valley Native Fish Sanctuary, where attempts have been made to isolate the native species by using barriers. The use of barriers to create isolation has had limited success, largely due to repeated intentional and accidental introductions of exotic fish species. Sanctuaries that isolate T&E species create additional problems by encouraging genetic introgression and hybridization and reducing the viability of native fish species.

Native fish habitat within the LORP area will be restored and enhanced through re-watering the Lower Owens River channel and floodplains, and shallow flooded areas. Predation and competition with exotic fish species are the principle hindrances to the recovery of native species into the future. Predation threats within the LORP can be avoided in the near future by confining native fish species to sanctuaries that allow recovery of viable reproducing populations. But when T&E fish populations reach recovery population levels that will allow them to be delisted, they will only then be released from the sanctuaries to access restored habitat areas throughout the LORP area. In time T&E fish species will recolonize in suitable habitat throughout the entire Lower Owens River ecosystem.

Once T&E species have reached viable population levels that allow recolonization into the restored Lower Owens River ecosystem, greater habitat complexity and diversity will lessen competition and predation by exotic species

The demise of native fish populations throughout the Owens River Valley is the result of both habitat loss and the introduction of exotic species. Continued survival and sustainability of native fishes will depend upon total aquatic habitat diversity of the LORP area. Habitat diversity and complexity that is necessary for the recovery of T&E species will be a natural consequence of the increased riparian vegetation growth and maturation in the LORP area. New access to off-channel lakes, ponds and corridors that have been created by the LORP will also help to minimize competition and predation from exotic species.

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[1] See the U.S. Fish and Wildlife Services' Owens Basin Wetland and Aquatic Species Recovery Plan (Region 1, USFWS, Portland, OR.) for detailed descriptions of biology and status.

The MSRP identifies locations such as the Blackrock Waterfowl Area and the Owens Delta that could be used as suitable native fish habitat. Pupfish can successfully utilize shallow water habitat with high water temperatures, low dissolved oxygen and dense aquatic plant biomass. While Owens pupfish do well in such habitats, shallow habitat corridors of low dissolved oxygen and high temperatures will be less desirable to largemouth bass, bluegill and other fish predators.

By establishing sanctuaries and creating one-way connections between some of the sanctuaries and the newly established habitat, substantial improvements in native fish populations can be achieved in the future. Suitable habitat for native species is expected to be developed and/or to improve in the following areas within the LORP area:

- X River channel and riverine/riparian corridor
- X Lakes, ponds, and sloughs along the fault line adjacent to the river
- X Ditches and canals
- X Blackrock waterfowl area, including Thibaut ponds
- X "Island Reach", just south of Reinhackle springs and Alabama gates
- X Owens River Delta
- X Oxbows and other created sloughs

Native fish species will be able to move out of sanctuaries and into the restored Lower Owens River and off-river system at some time in the future. When such reintroduction will occur will depend upon the status of the T&E fish species and the level of risk to species recovery. Sanctuaries should remain protected until it is determined that restored river and off-channel habitat can sustain viable reproducing populations of native species.

Fish Sanctuaries

Current populations of Owens tui chub and Owens pupfish are too fragile and few in numbers to successfully reintroduce them at the present time to the LORP area. Sanctuaries within the LORP area are currently necessary for these T&E fish species to be able produce adequate numbers to reach a constant supply. When T&E fish species reach sustainable populations within sanctuaries, recovery into habitat that has developed as a result of rewatering the Lower Owens River can be initiated.

Criteria for selecting appropriate sanctuary sites for the LORP include: (1) quality of the habitat; (2) manageability of the water body, including water supply and discharge elements; and (3) assessment of potential for eventual connection to the greater Lower Owens River ecosystem. Based upon the criteria, appropriate LORP fish sanctuaries have been selected (Table 1). The USFWS's multispecies recovery plan identifies other potential sanctuaries and conservation areas within the LORP, but many of these locations lack water control or predator protection at this time. Other USFWS's potential sites, such as the Blackrock Waterfowl Area, are in conflict with other LORP ecosystem goals[2] at this time.

[2] Periodic drawdown and drying of wetland cells in the Blackrock waterfowl area could constitute a "take" on any T&E fish species stocked there at this time.

The Blackrock Waterfowl Area is considered a key pupfish conservation area by the USFWS and CDFG. How the Blackrock area is used, in relation to LORP wetland management goals for the recovery of pupfish and tui chub, will require conservation biology input and decisions by the responsible agencies. For example, substantial pupfish mortality may be acceptable with wetland water drawdowns if adequate escapement of sufficient breeding pairs to other Blackrock wetland cells or corridors is provided. The Blackrock Waterfowl Area will be included in the HCP where decisions and plans of this importance are better addressed.

Selected sanctuary sites must be predator-free at the outset of the reintroduction of flows into the LORP area. Therefore, some sanctuaries may require a limited amount of construction (i.e., flow control structures and screens) to ensure that they remain predator-free and that they can prevent exotic fish migration into the sanctuary. At the same time, control structures should allow native species' movement out of the sanctuary and into habitat below if desired.

LORP management of T&E fish species will require the establishment and maintenance of proper sanctuary habitat. Transferring and stocking of T&E species will be under the authority of the USFWS and the CDFG, with the approval of the landowner, LADWP. LADWP, however, must be assured that establishing T&E sanctuaries will not impact city water supplies or prevent the Department from performing aqueduct, or any other maintenance and operations. The three agencies will jointly determine what fish stocks will be transferred, to which sanctuaries, the degree of population recovery, and the timing of fish releases from sanctuaries to the greater aquatic ecosystem. Individual sanctuary management plans will be developed when the responsible parties indicate a need to implement them. The sanctuaries can be used prior to completion of the HCP as interim sites for fish recovery.

Whether delisted as T&E species or not, species in sanctuaries and associated corridors may not be able to expand into the river system as self-sustaining populations because non-native aquatic species that are deleterious to native species are distributed throughout the system. Sanctuaries for native species will remain protected at least until it is seen that river and off-channel habitat areas can sustain viable reproducing populations of native species.

Table 1. Proposed sanctuary sites for T&E fish species in the LORP area.

Location	Species		
	Owens pupfish	Owens tui chub	Owens speckled dace
Little Blackrock Springs	X	X	X
Big Seeley Springs	X		
Little Seeley Springs Pond	X	X	X
Artesian Well 368[3] *	X		
Reinhackle Spring	X	X	X

Management Objective 1: Establish and maintain sanctuaries for Owens pupfish, Owens tui chub, and Owens Speckled Dace in the Lower Owens River conservation area.

Action 1-1: Development and use of sanctuaries will be done in consultation with the CDFG, integrated with CDFG's species recovery and management plans, and coordinated with future HCPs.

Action 1-2: Survey each proposed sanctuary site to determine if predator fish are present and what other fish species utilize the sanctuary.

Action 1-3: Eliminate predator species, if possible; needed predator removal will be performed by CDFG.

Action 1-4: Examine sanctuary sites to determine what type of water control structures and/or fish screens are required to prevent escape or allow movement of T&E species, and to control predator species' access. Control devices will be designed and installed before any T&E species are transferred to sanctuaries, and will be monitored to ensure that they are properly functioning in order to develop, maintain and operate the sanctuary.

Action 1-5: Install permanent flow gauges on fish sanctuaries as required under the specific plan for the sanctuary. Temporary gauges will be established at the downstream extent of corridors and monitored at the same frequency as river gauges. Permanent gauges and temporary gauges will be used to monitor surface flows released into sanctuaries, adequacy of flow for fish migration and movement, and water quality as required under the specific plan for the sanctuary.

[3] Well 368 is temporary in that the status and continuation of artesian flows is unknown.

Action 1-6: Establish maintenance programs for established and stocked sanctuaries. Maintenance programs will monitor and maintain integrity of control structures, prevent impacts from land uses, control tule encroachment and angling, and address other issues pertinent to each sanctuary.

WILDLIFE

Wildlife Species

Based on the literature for special status wildlife species that occur in or adjacent to the LORP, brief species accounts were developed in Technical Memorandum No. 20. These accounts provide some basic information regarding species legal status, distribution, abundance and occurrence in California, the Owens Valley and the LORP area, primary habitat associations, and relevant life history information. Specific occurrence information is given where available. An evaluation of the expected response of each species to the LORP is given in the technical memorandum. Species response is relative to existing conditions versus future long-term conditions. The expected response of a species is based on an assessment of habitat changes and specific land use issues that are addressed and incorporated within the design of the LORP.

The actual response of a specific species (frequency of occurrence, abundance and productivity, etc.) to positive environmental changes that will occur in the LORP is a far more difficult prediction. Many of these special status species use vast geographic areas during their life cycles. The influence of the LORP relative to all other factors is unknown, especially to those species that are somewhat atypical or do not have a strong association to riparian and wetland areas in California east of the Sierra Nevada mountains. However, the LORP will have many positive direct and indirect impacts on some species (i.e., the white-faced ibis, who migrate through the Owens Valley and have been reported at the Owens River delta), and more extensive habitat that will be created by the LORP may allow migrant species to use the area for resting and, perhaps, breeding.

Several of the special status species addressed in this document occur infrequently or in very low numbers in the LORP. Some of these species are not presently influenced and will not be influenced in the future by the LORP. Some of these species include prairie falcon (*Falco mexicanus*), American peregrine falcon (*Falco peregrinus anatum*), burrowing owl (Speotyto cunicularia), Vaux's swift (*Chaetura vauxi*), brown-crested flycatcher (*Myiarchus tyrannulus*), and bank swallow (*Riparia riparia*).

Another group of special status species pass through the area only have not been observed in the Valley for many years and/or infrequently use the margins of the LORP. They include the Least Bell's vireo (Vireo bellii pusillus), California gull (*Larus californicus*), black tern (*Chlidonias niger*), American white pelican (*Pelecanus erythrorhynchos*), and the Virginia warbler (*Vermivora virginiae*).

The most common and significant theme linking all the special status species is the loss and degradation of their habitat. For the majority of species the primary cause of endangerment is loss of riparian and wetland areas. Most of the special status species are associated with riparian areas and various types of wetlands, depending upon whether the

species is nesting, feeding, resting or attempting to meet some other basic need. A few species are most closely aligned with various types of uplands.

The overall management goal for special status species is, to the extent possible, to maintain and enhance habitat conditions for special status species in order to help ensure the long-term viability of populations. Management of special status species incorporates four primary actions: (1) avoid potential future impacts; (2) increase the extent and quality of habitat; (3) designate specific management zones such as livestock exclosures, special pastures and management areas (i.e., the Blackrock Waterfowl Habitat Area and the Lower Owens River Delta Habitat Area); and (4) monitor habitat and species. As pointed out in Chapter 1 of this Plan, the two most important management tools for the Lower Owens River ecosystem are stream flow (i.e., the interaction of surface water and groundwater) and land use management.

For a brief description of suitable habitat for Western yellow-billed cuckoos and other T&E species (i.e. Southwestern willow flycatcher, Swainson's hawk, Least Bell's vireo) the reader is referred to Technical Memoranda No. 16, No. 19, and No. 20. The Draft Riparian Bird Conservation Plan of 1998 was consulted and is referenced in several technical memoranda. The purpose of technical memoranda is to provide background materials, discuss and evaluate various management topics, provide a foundation for conclusions and recommendations, and finally to develop and propose a management strategy. In contrast, this Ecosystem Management Plan is the essence of what is required for future management, including Management Objectives, Actions and monitoring requirements.

Population goals for the western yellow-billed cuckoo in the Owens Valley are presented in Technical Memorandum No. 20. The only realistic conservation and recovery strategy for a species such as the cuckoo, with such extensive habitat needs, is to consider and evaluate as much habitat as possible within the range of a geographic population. The value of Baker and Hogback Creeks to the cuckoo population is extremely limited, unless the riparian habitat in the LORP, and even the middle and upper Owens River, are also considered. The management strategy for western yellow-billed cuckoos will consider and will be consistent across the entire watershed. (A brief description of habitat requirements for the Least Bells vireo has been added to technical memorandum No. 20.).

The reader is also referred to several other documents: Evaluation of existing and future wildlife values in the Blackrock Management Area, using HEP and Habitat Suitability Index (HIS) models. In: Evaluation of Flows on Wildlife Habitat Quality and Quantity for the Lower Owens River, California. City of Los Angeles Department of Water and Power, Ahlborn, G. 1994; Technical Memorandum No.4, Mapping Existing Vegetation Types for the Blackrock Waterfowl Habitat Area; Technical Memorandum No. 8, Owens River Delta Habitat Area; and Technical Memorandum No. 15, Resource Management in the Blackrock Waterfowl Habitat Area.

Table 2. Special status wildlife species that use the Lower Owens River Project area.[1]

Species	Species Primary Orientation in LORP		
American white pelican (*Pelecanus erythrorhynchos*)[3]	Open riparian	Open Water	
Great blue heron (*Ardea herodias*)	Riparian	Wetland	
Great egret (*Casmerodius albus*)	Riparian	Wetland	
Western least bittern (*Ixobrychus exlilis hesperis*)	Riparian	Wetland	
Black-crowned night heron (*Nycticorax nycticorax*)	Riparian	Wetland	
White-faced ibis (*Plegadis chihi*)		Wetland	
Cooper's hawk (*Accipiter cooperi*)	Riparian		Upland
Sharp-shinned hawk (*Accipiter striatus*)	Riparian		Upland
Golden eagle (*Aquila chrysaetos*)			Upland
Ferruginous hawk (*Buteo regalis*)			Upland
Swainson's hawk (*Buteo swainsoni*)	Riparian	Wetland	Upland
Northern harrier (*Circus cyaneus*)	Riparian	Wetland	
White-tailed kite (*Elanus caeruleus*)	Riparian	Wetland	
Bald eagle (*Haliatus leucocephalus*)	Riparian	Wetland	Upland
Osprey (*Pandion haliatus*)	Riparian	Open water	
Merlin (*Falco columbarius*)	Riparian	Wetland	Upland
Prairie falcon (*Falco mexicanus*)			Upland
American peregrine falcon (*Falco peregrinus anatum*)		Wetland	Upland
Long-billed curlew (*Numenius americanus*)		Wetland	Upland
Western snowy plover (*Charadrius alexandrinus nivosus*)			Playa
California gull (*Larus californicus*)[3]		Open water	
Black tern (*Chlidonias niger*)[3]		Open water/wetlands	
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Riparian		
Short-eared owl (*Asio flammeus*)		Wetland	
Long-eared owl (*Asio otus*)	Riparian	Wetland	
Burrowing owl (*Speotyto cunicularia*)			Upland
Vaux's swift (*Chaetura vauxi*)	Riparian[2]	Wetland [2]	Upland
Willow flycatcher (*Empidonax traillii*)	Riparian		
Brown-crested flycatcher (*Myiarchus tyrannulus*)	Riparian/cut-banks		
Bank swallow (*Riparia riparia*)	Riparian		
Loggerhead shrike (*Lanius ludovicianus*)			Upland/edges
LeConte's thrasher (*Toxostoma lecontei macmillanoura*)			Upland
Least Bell's vireo (*Vireo bellii pusillus*)[3]	Riparian		
Virginia warbler (*Vermivora virginiae*)[3]	Riparian		
Yellow warbler (*Dendroica petechia brewsteri*)	Riparian		
Yellow-breasted chat (*Icteria virens*).	Riparian		
Summer tanager (*Piranga rubra*)	Riparian		

Table 2. Continued.[1]

Species	Species Primary Orientation in LORP		
Pallid bat (*Antrozous pallidus*)	Riparian[2]	Wetland [2]	Upland
Spotted bat (*Euderma maculatum*)	Riparian[2]	Wetland [2]	Upland
Yuma myotis (*Myotis yumanensis*)	Riparian[2]	Wetland [2]	Upland
Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*)	Riparian[2]	Wetland [2]	Upland
Owens Valley vole (*Microtus californicus vallicola*)		Wetland	Upland

[1] see Technical Memorandum # 20 Special Status Wildlife and Plants Species Accounts, Technical Memorandum #19, Riparian Wildlife Management; Summary of Management Concepts and Priorities, Technical Memorandum #16, Revised Projections of Wildlife Habitat Units for the Lower Owens River Using Habitat Suitability Index (HSI) Models and Ecosystem Sciences and White Horse and Associates. 1997. Predicted future vegetation types in the Lower Owens River. report prepared for LADWP and Inyo County Water Department County.

[2] foraging and infrequent roosting.

[3] Species that pass through the area only, have not been observed in the Valley for many years and/or infrequently use the margins of the LORP.

Management Objective 1: Avoid potential impacts to Special Status Wildlife Species throughout the Lower Owens River Project area, especially in areas that will have a lot of activity (i.e., Riverine-riparian corridor, Blackrock Waterfowl Habitat Area, and Lower Owens River Delta Habitat Area).

Action 1-1: Reduce the level of disturbance to wildlife by scheduling maintenance activities at times that do not conflict with sensitive periods for wildlife, especially nesting. To the extent possible, construction and repair of water control structures, and roadside maintenance such as mowing and grubbing, should be scheduled during the least sensitive periods for wildlife.

Action 1-2: Prescribed burning should only be implemented as a last measure to reduce residual emergent vegetation in wetlands. Burns should only be conducted in wetlands and implemented during the least sensitive time for ground nesting birds (mid-September through January). No burns should be allowed within or adjacent to riparian areas.

Action 1-3: Snags and downed woody material are a very important special habitat element for many species of wildlife and should not be cut or removed. Most snags and woody material are restricted to riparian areas and the areas around springs and seeps. LADWP's present policy prohibits cutting and removal of snags or downed woody material and other live vegetation.

Action 1-4: Any human activity, recreational or maintenance, that would be disruptive to nesting birds should generally be conducted as much as possible from mid-September to early January, which is the least sensitive time. For example, loggerhead shrike nests mid-January to early September, Le Conte's thrasher nests mid-January to early September, California quail nests April to August, mallard nests February to July, and northern harrier nests March to mid-

September, therefore mid-January to mid-September should restrict human intrusion as much as possible.

Action 1-5: Roadside vegetation and hedgerows are to be left undisturbed to the extent possible, because they provide valuable nesting areas for many birds and increase structural richness.

Action 1-6: Understory vegetation and plant structure, especially in riparian areas and wetlands (i.e., herbaceous, shrubs, young trees, tree branches, etc.) and in and around any forested areas (e.g., tree lots, riparian, lakeside, etc.) are to be left undisturbed to the extent possible. These areas provide valuable nesting, resting, roosting and habitat cover for many species and increase the structural richness of the site.

Action 1-7: Implement land and resource management recommendations specific to the California Yellow Billed Cuckoo and other riparian dependent wildlife species.

Management Objective 2: Maintain and enhance habitat conditions for Special Status Wildlife Species along the LORP riparian corridor in Blackrock Waterfowl Habitat Area and in the Lower Owens River Delta Habitat Area.

Action 2-1: Implement the LORP river management plan.

Action 2-2: Implement the Blackrock Waterfowl Habitat Area plan.

Action 2-3: Implement the Lower Owens River Delta Habitat Area plan.

PLANTS

Plant species of concern identified in the area covered by the land management plan are the Owens Valley checkerbloom (*Sidalcea covillei*) and the Inyo County mariposa lily (*Calochortus excavatus*). The Owens Valley checkerbloom is considered to be stable by the USFWS, and the Inyo County mariposa lily is considered stable or declining. The Inyo County mariposa lily usually occurs in grassy, alkali meadows and generally flowers in June to July, and the Owens Valley Checkerbloom occurs in alkali meadows near seeps and spring sites.

Land management plans call for fencing four of the twelve known sites (Table 3) where T&E plant species have been found; the other sites will be protected with compatible grazing strategies. Livestock grazing will be restricted during the flowering period for both of the T&E plant species (March 1 through October 1), but exclosures will have drop down panels to allow grazing access during winter periods. From March 1st of each year, sites will be closed to grazing until the following fall. Land management plans also call for fencing Well 368 and eliminating the exclosure area from grazing. Three grazing exclosures are also to be created along sections of the Lower Owens River.

Special status plant species will be grazed under tight prescriptions in four of the most significant population areas.

While the LORP is not obligated to create conditions for delisting and recovery of T&E plant species, the project will enhance and sustain suitable habitat in significant quantities. With special habitat measures and improvements in grazing and land management practices, there is significant potential for the enhancement and recovery of native T&E plant species.

Table 3. Location of T&E plant species in the LORP[1].

T&E Plant Location	Number Of Sites	Fencing Required
Blackrock Pasture in Twin Lakes Lease	1	Yes
North Blackrock Holding Pasture – Blackrock Lease	2	No
White Meadow Pasture – Blackrock Lease	2	Yes
Thibaut Lease	1	No
Reservation Pasture – Blackrock Lease	2	No
Little Robinson Pasture - Blackrock Lease	1	Yes
Robinson Pasture – Blackrock Lease	1	Yes
Springer Pasture – Blackrock Lease	1	No
Russell Pasture – Blackrock Lease	1	No

Management Objective 1: Protect known habitat by establishing a healthy functioning Lower Owens River riverine-riparian ecosystem. Successful application of special habitat measures, the creation of sanctuaries and exclosures, and improvements in grazing practices enhances the potential of native T & E habitat.

Action 1-1: Implement grazing management methods and grazing exclosures to preserve contiguous preferred habitat areas for T&E plants in the LORP area. Four rare plant areas are to be created for special management of T&E plant species: (1) within the Thibaut lease is a large area of suitable habitat for special status plant species, and, therefore, will have nearly two miles of new fencing; (2) three smaller rare plant population areas will be fenced and given spring rest—the areas will also be used as comparison monitoring sites for rare plant areas not receiving spring rest. Depending on future population trends, future management will be adjusted as necessary. Because of the fragile nature of the watercourse around and below the well, the wellhead area and a downstream portion will be fenced to protect the area from livestock grazing. Because of the artificial nature of the water supply, the well could run dry if flow is changed through accidental damage; installation of a tamper-proof casing arrangement is recommended.

[1] See maps 2, 3, and 4 in the Land Management chapter.

Action 1-3: Exclosures, springs and new rare plant pastures' fences will be repaired and maintained annually by the lessee before livestock are brought on.

CHAPTER 6 – RECREATION PLAN

INTRODUCTION

The recreation plan for the LORP area will continue existing guidelines for all human activity other than livestock grazing, agriculture and water diversion during the restoration of the Lower Owens River ecosystem. As recreational interest and use increases, additional guidelines and methods for effective public participation and possible conflict resolution may be required through adaptive management strategies.

The LORP area is a widely acknowledged "commons" area where fairly unrestricted access and use has been in effect by local recreational users for half a century. Currently there is unrestricted recreational day-use, except where posted, throughout nearly all of the LORP area; recreational access even by leaseholders cannot be restricted to more than 25% of the lease holding, except for irrigated pastures.

Though access can be denied to recreational users in irrigated pastures, most leaseholders do not deny such access. A casual system has been in use for many years that asks recreational users to always use a "good neighbor" policy of making sure they have left gates as they find them–either open or closed–and treat agricultural, grazing and water diversion areas with respect. With few exceptions, this casual guideline has worked effectively in the LORP area for many years.

To continue to enjoy access to the LORP area for a variety of recreational activities, stakeholders do not need to substantially change their recreational habits from current uses during the restoration efforts of the LORP. Most stakeholders in the Owens valley are willing to cooperate and to accept a possible increase in rules and regulations of use, set asides for threatened and endangered fish and wildlife species, and closures of sensitive areas during critical seasons. But during the initial two to three years of the project changes in current rules for recreational use and access are not necessary. Currently there is only light recreational use and pressure in the LORP area; therefore, recreation management will remain relatively unchanged from current practices until, or if, increased demand and/or conflicts require increased management.

As Lower Owens River tourism and recreational use increases with the restoration of the river and increases in fish and wildlife, more rules of use and methods to enforce those rules may become necessary. But, as in all other aspects of the LORP plan, a passive approach to human use and activities is preferred. If anticipated increases in recreational activity occur, less intrusive interim actions may be more appropriate. As recreational use increases to the point where conflicts and negative environmental impacts begin to be felt, it is advised that a Citizen Advisory Committee (CAC), made up of representatives of recreational interest groups, be formed to address and recommend preferred interventions to lessen the conflicts and impacts. The CAC's task would be to first determine and establish methods of self-enforcement of recreational users through awareness programs and/or other educational methods. A second task would be to explore ways to have tourism and recreational users contribute monetarily toward the restoration efforts of the LORP, development of educational materials, and in support of the area that is open to them for recreational use at no cost.

The intent of LADWP management is not to initially impose unwarranted recreation rules and controls at this stage, but to encourage stakeholder ownership in restoring and maintaining a natural ecosystem so that both locals and tourists can enjoy a natural outdoor environment. Management would prefer to devise and adapt practical solutions if problems and conflicts arise. Clearly, at this time, stakeholders do not want rules or actions that would restrict use or hinder access to the LORP area. When, and only if, enforcement becomes necessary, would policies and procedures be implemented in the LORP area to restrict use or hinder current access.

EXISTING GUIDELINES

The following are guidelines for recreational use in the LORP area and will remain the policies of the LADWP for recreational use.

Camping

Overnight camping is allowed only in designated campgrounds, all of which are located outside the LORP area, but within walking and or driving distance to the Lower Owens River. Designated campgrounds are developed, maintained and operated by Inyo County, and most provide fire rings or barbecues, trash disposal facilities, and rest rooms. There will be no overnight camping allowed within the Lower Owens River project area, but day-use picnicking, hiking, canoeing, fishing, hunting, and other outdoor activities that are currently enjoyed will continue unchanged from current guidelines.

Fires

To protect against wildfires and to allow for the restoration of a natural, scenic recreational area, no fires or fireworks are allowed in the LORP area. Fires are allowed only in designated campgrounds.

Off-Road Vehicles

To limit disturbance to plants and wildlife, and to minimize any further degradation to soils and landforms in the LORP area, all mechanized off-road vehicles (including motorcycles, ATV's, RV's, etc.) are restricted to existing roads that are away from residential areas. All off-road vehicle recreationists are expected to respect the concerns and needs of other recreational users; many may be using the LORP area to fish, hunt, hike, canoe, or observe birds and other wildlife. Noise and dust from off-road vehicles can be disturbing to wildlife, livestock, plants and soils. Care should be exercised to not use off-road vehicles near areas used by other recreationists seeking a natural outdoor experience away from residential and commercial noise and air problems, or in close proximity to grazing operations.

Leased Lands

Much of the LORP area will remain as lease-holdings for agricultural and livestock use, but at least 75% of leased lands will continue to remain open for recreational access and enjoyment. All lands not open to recreational use will be posted, and all recreational users are expected to respect the operational concerns and needs of lessees. All gates should be

left as found, either open or closed, and care should always be taken to not negatively impact or disturb agricultural or livestock operations; particularly in the use of firearms, off-road vehicles, or recreational activities that could potentially harm or disturb livestock or their pasturage.

Fishing

Fishing on LADWP land, whether in ponds, lakes or the Lower Owens River, will remain open to fishing enthusiasts. It is not anticipated that there will be any restricted areas in the initial re-watering of the LORP area. As the project progresses, sanctuaries will be established for T&E species—these sanctuaries will be posted and no angling will be allowed. All fishing activities in the LORP area will continue to be subject to the regulations of the State of California, Department of Fish and Game. Recreationists are expected to pack out any waste or trash.

Hunting

Hunting on LADWP land continues to be allowed except in areas that are posted. Hunting seasons for deer and game birds are under regulation of the State of California, Department of Fish and Game and will continue to be under their jurisdiction. Firearms are not to be discharged within 150 yards of occupied buildings, farm structures, livestock, public roads or highways. Careless use of firearms for target practice could cause a potentially very dangerous and damaging fire that would be detrimental to restoration of the LORP ecosystem.

Woodcutting

Woodcutting has been a casual activity in the LORP area that has continued without regulation in the past. With intense restoration efforts underway, any woodcutting should only be in carefully considered areas, and only with the permission and regulation of LADWP's Watershed Resources Manager in Bishop. Any removal of older growth willow and cottonwood could harm the seed source for restoration of riverine habitat along the newly rewatered Lower Owens River. Even careless removal of nuisance plants, like salt cedar or tules, might result in increases in these unwanted plants if cutting and removal is not carefully timed and controlled. At this time, any woodcutting or plant material removal could be potentially harmful and is prohibited in the LORP area until careful consideration can be given to resuming this activity.

Boating and Water Sports

Several ponds and lakes on LADWP lands, inside and outside the LORP area, will continue to provide and allow swimming, boating, water skiing and camping. Within the LORP area, waterways can accommodate small non-motorized fishing boats and/or canoes. It is anticipated that the newly restored Lower Owens River will be an excellent area to use non-motorized boats, such as canoes, rafts, kayaks, etc. The recreation map of the LORP area will identify the best take-out, portage, and put-in places along the Lower Owens River for small non-motorized watercraft. If recreationists use only the identified entry and exit areas, it will minimize any disturbance to new growth of riverine habitat and to the return of birds, fish and wildlife to the area.

Hiking and Biking

It is anticipated that the LORP area will become a superb hiking and biking day-use area that will appeal to all recreationists who enjoy bird watching, wildlife viewing or exercise in a natural and unique ecosystem. Areas that are off-limits for hiking or biking will be posted, and, as with other outdoor recreational activities in the LORP area, it is expected that hikers and bikers will be careful to not disturb plants, build fires or leave any trash behind. Pack it in and pack it out.

Artifact-Gathering or Pot-Hunting

It is prohibited by federal law to disturb or remove any artifacts from the LORP area. This includes not only removal of American Indian artifacts, but also disturbing or removing materials from old LADWP structures, old mining artifacts, or materials from old agricultural structures.

FUTURE GUIDELINES

The primary concern of recreation management in and around the LORP area is the natural ecosystem itself. Recreational activity that disturbs natural processes, the abundance or total mass of vegetation, soils, water quality, fish and wildlife habitat and diversity, or any activity that conflicts with other established recreational activities may need to be prohibited and/or regulated to certain areas and/or times of year. A sustainable recreation resource requires a healthy productive ecosystem and therefore demands recreation management as well as land and water management in order to continue to exist and provide opportunities for recreational users.

Management Objective 1: Recreation management is an on-going process with the primary goal of protecting the ecosystem and minimizing user conflicts. LADWP will adaptively manage recreational use of the LORP in line with the land and water use Management Objectives and Actions that result from resource management decisions.

> Action 1-1: Continue to define recreational management protocols with broad, loose and indirect guidelines that include multiple-use recreation in the LORP. Indirect guidelines provide motivation for recreationists to feel welcome to use the area, to take pride and partial ownership in maintaining the quality of the area, and to do no harm to the resources. As long as guidelines and protocols are effective to limit and alter high-impact activity and behavior, they are effective and sufficient.

CHAPTER 7 – MONITORING AND ADAPTIVE MANAGEMENT PLAN

INTRODUCTION

Successful adaptive management is dependent upon a monitoring program that provides a reliable measure of change in ecosystem components. The LORP monitoring program is focused upon primary components that reflect macro-scale cause and effect relationships: i.e., surface water flow, water quality, riparian vegetation, fisheries, wildlife, wetland vegetation and upland vegetation.

The emphasis in ecosystem self-design is on habitat development, knowing that natural forces help in ultimately designing the ecosystem by choosing the most appropriate species to fill niches, and to establish rates of recruitment, production and growth that trend toward a dynamic equilibrium. Monitoring must, therefore, track conditions that indicate the ecosystem is self-designing, or self-organizing.

The degree, frequency and timing of monitoring activities are determined by project goals and deadlines. Monitoring may be conducted frequently in the beginning and less frequently after trends have been determined. Frequent monitoring can be used to identify variables that inhibit ecological restoration efforts and can support mid-course corrections. Once it is clear that restoration is proceeding at an acceptable rate, monitoring may be conducted less frequently.

The further initial ecological conditions are from steady state, the longer it will take for the ecosystem to reach or approach a steady state, according to scientifically accepted ecological models. In the case of the Lower Owens River ecosystem, initial conditions are very far from steady state; before conclusions about the success of restoring the LORP's ecosystem can be made, a time horizon of 15 years is assumed. Fundamental ecological principles show that most biological systems, recruitment patterns and adult population patterns are usually mismatched--recruitment levels usually exceed ultimate adult population levels, and plant communities develop through several seral stages. The Lower Owens River's current state does not necessarily predict its current dynamics, and good management should be based upon dynamics rather than state because dynamics determine tomorrow's state.

MONITORING

Habitat is the focus of monitoring efforts in the LORP. Habitat is directly responsive to changes in ecosystem management; therefore, it is a descriptive and reliable indicator of change over time. Furthermore, management of the LORP ecosystem is keyed to adaptive actions aimed at interventions at the habitat level, and not at the species population level. An ecosystem must first have suitable habitat before species can fill niches and establish rates of recruitment, production and growth that trend toward equilibrium.

Though it is financially and physically impossible to monitor the entire river corridor, wetland and transition zones, and uplands, changes in habitat, nevertheless, will be quite variable from one area to another. In order to detect and quantify habitat changes, or possibly no change in some areas, and make decisions on appropriate interventions, managers must recognize not only how the whole ecosystem is responding to rewatering and

land management, but must also have reliable and quantifiable information and data to support decisions.

LORP monitoring relies upon habitat mapping from aerial imagery and reconnaissance surveys at the macro-scale to observe major habitat changes and early detection of problem areas. Specific habitat features for riparian vegetation, wetlands, fish and wildlife habitat, flow and water quality are measured at the micro-scale that are spatially representative of key ecosystem types (i.e., river, riparian, wetland, and upland habitats throughout the LORP). An adequate number of sites are monitored so that trend analysis identifies biologically significant changes.

Macro-scale monitoring can confirm whether changes measured at the micro-scale are indeed representative of the entire LORP; conversely, trends measured at the macro-scale are correlated with and substantiated by micro-scale monitoring. Managers will thereby have a good picture of how the ecosystem is responding through time, and where and what interventions would be most effective. Figure 1 summarizes the basic LORP monitoring elements.

LORP monitoring will span 15 years. The primary monitoring years include years 2, 5, 7, 10, and 15 in which more intensive, micro-scale monitoring is performed. Secondary monitoring years at a macro-scale include years 1, 3, 4, 6, 8, and 9. In this manner habitat trends in the LORP are monitored each year for the first 10 years.

FIGURE 1. MONITORING SUMMARY BY LORP ECOSYSTEM COMPONENT

RIVERINE-RIPARIAN HABITAT

Base Flows

- Base flow compliance
- Water quality
- Fish condition

Seasonal Habitat Flows

- Seasonal habitat flow compliance
- Pre-flow survey and preparation
- Flooding extent
- Water quality
- Fish condition

Habitat

- Rapid assessment surveys
- Riparian habitat development (primary)
- Riparian habitat development (secondary)
- Habitat mapping
- Fish habitat surveys
- Contingency monitoring

BLACKROCK WATERFOWL HABITAT AREA

- Wetland compliance monitoring
- Rapid assessment surveys
- Wetland habitat development
- Habitat mapping
- Contingency monitoring

DELTA HABITAT AREA

- Delta flow compliance
- Rapid assessment surveys
- Wetland habitat development
- Habitat mapping
- Seasonal habitat flow and aerial surveys
- Contingency monitoring

OFF-CHANNEL LAKES AND PONDS

- Compliance monitoring
- Rapid assessment surveys

LAND USE

- Utilization rate and timing
- Photo points
- Field evaluation

VOLUNTEER-BASED MONITORING

- Angler surveys
- Bird survey

TREND ANALYSIS[1]

A number of problems are encountered when designing and implementing a biological monitoring plan. For example, one of the most difficult problems is choosing adequate sample sizes to detect biologically important changes. Another problem is the lack of adequate controls. Some statistical methods under these constraints may lead to statistically significant results that are biologically irrelevant. Statistical models may also be necessarily complex to account for all the sources of variation, and statistical complexity may lead to problems in analysis and interpretation of data.

There are two problems with applying statistical tests like two-sample or paired t-tests to monitoring ecosystem restoration. First is a philosophical problem--these tests were designed for experimental situations and do not apply to data collected in real-life recovery projects (this problem is referred to in the ecological literature as pseudoreplication). In typical experimental design, a researcher has control over the way the treatments are allocated in experimental units and the way that experimental units are selected; the researcher does not have this control in restoration projects because the treatment is the restoration process. One criticism of this approach is that if more and more samples are taken at each site, differences will eventually emerge because no two sites are identical. Use of multiple control sites is not feasible because of enormous expense, and it is foolish to spend money on control sites when the recovering site is of much more interest. Replication costs are so high they can cause a reduction in frequency of sampling and a weakening of effort, and control sites may be statistically different from the recovery site but the difference may not be biologically important.

The second problem with the testing approach is that the methods do not test for recovery. Testing for recovery requires a specific definition of recovery. As recovery is often dynamic, and recovered systems are not fixed systems, it may be difficult to specify recovery in terms of the value of a single parameter, or to define recovery in simple measurable terms.

When no control sites are available, but measurements are taken a number of times before and after restoration, changes can be evaluated (if there are a large enough number of times) using methods of time series analysis--specifically, trend analysis. This approach is used when there are no data prior to the restoration, or if any prior data would be of no consequence. For example, when creating a wetland, prior data may not exist or information taken when the site was not a wetland probably won't provide usable data about restoration success, only that it is different.

Trend analysis assumes that the trend is linear, although nonlinear trend analysis and other models for analysis of change, such as analysis of covariance, can also be useful. Trend analysis, however, is the most common approach for assessing change in recovering biological systems.

Episodic events typical of ecosystem restoration are commonly associated with a type of effect called the "step change," or trend. Step change occurs when data are collected before and after the start of the restoration process; the data prior to the change are used to set the standard for the post change data. Step change is often thought of in

[1] See Loeb, S.L. and A. Spacie, eds. 1994. Biological monitoring of aquatic systems. Lewis Publishers, Boca Raton, LA. For a detailed presentation of monitoring programs and mathematical resolution.

terms of the hypothesis that the mean of the measurements in the “before” period are the same as the mean in the “after” period.

Systems that are created or restored often undergo succession change, which may be toward a climax state in some cases. The climax state can be compared with stable control systems by using standard statistical approaches if the change toward climax is rapid, but in many cases the system does not reach a climax and the evaluation process is more difficult.

A critical factor to properly evaluate habitat suitability is habitat sustainability. If a riparian/wetland community and its vegetation types are not self-sustaining, resource values that are gained at one point in time will not last and will not be sustainable. A static system is not preferred, desirable, or even possible. Ecosystems do not exhibit an undisturbed "state" that can be maintained indefinitely; rather, they exhibit a suite of behaviors over all space and time scales and the processes that generate these behaviors should be maintained. Site-specific habitat losses and gains will occur. The long term overall net change of the riparian/wetland habitat in the Lower Owens River and its functioning connection to the larger ecosystem is a far more important evaluation.

Trends show sustained movement towards desired conditions. An ecosystem that can be sustained in a healthy condition through time is the goal to be attained in the Lower Owens River. Natural rivers and wetlands are often in a state of flux, and the state of the system depends strongly on external factors, primarily hydrologic. Furthermore, stability is not the same for aquatic habitats as for terrestrial habitats, but is instead a “pulsed stability.” What is most important in the LORP restoration is the ability of the ecosystem to respond to fluctuating environmental conditions and adjust, rather than reach a successional climax state and remain static. The goal of restoration is not to duplicate a hypothetical model, but to make the created habitat a functioning sustainable ecosystem.

ADAPTIVE MANAGEMENT

Adaptive management is widely recognized as an intelligent, if not essential, approach to the management of natural resources under uncertainty. As originally conceived, adaptive management can be defined as the systematic acquisition and application of reliable information to improve management over time.

The essential idea of adaptive management is to recognize explicitly that management policies can be applied as experimental treatments. A crucial implication of this thesis is that monitoring activities must be integrated with management actions. Under adaptive management, monitoring is not the last chapter of a plan; rather, monitoring and management plans are developed concurrently to form a single adaptive-management approach.

Fundamental ecological principles show us how nature continuously and adaptively responds within biological systems. Recruitment and adult population patterns are usually mismatched, with recruitment levels often exceeding ultimate adult population levels, and plant communities developing through several seral stages. Current biological conditions at any point in time often do not predict or illustrate the unseen biological and social dynamics that create change in the system. Wise management is based upon knowledge and understanding of these covert dynamics, as

well as current conditions, in order to anticipate the dynamics that will determine tomorrow's biological conditions.

To realistically manage the dynamics of ecosystem restoration means we must adapt objectives to changes overtime that cannot be predicted or even adequately anticipated today. Adaptive management is the singular comprehensive approach for managing the river ecosystem in order to reach the desired goals of a healthy and functional ecosystem. To achieve the goals of the LORP means using management tools over time in unique and flexible ways to adapt to changing ecosystem conditions. It also means adopting new tools and approaches from scientific advances over the course of the restoration process to constantly improve our understanding of ecology and the effects of management actions.

Procedures

The LADWP and Inyo County will jointly manage the LORP. Signatory groups to the MOU will have an oversight role to ensure that agreements made in the MOU are fulfilled. The core organization for day-to-day management, decision-making, and modification of the LORP management plans will be the Inyo/Los Angeles Technical Group with city and county representatives. Above the Technical Group is the Inyo/Los Angeles Standing Committee, responsible for resolving impasses or disputes arising from the Technical Group. The Technical Group will review monitoring data, evaluate problems, and resolve issues related to the LORP. The Technical Group will meet as needed with the MOU Signatory Group to discuss progress, decisions and changes in management plans that are in line with the MOU.

Managing the LORP will require the LADWP and Inyo County to work closely and cooperatively with the CDFG and LRWQCB; these agencies will make decisions in regards to fish and wildlife management, water quality and T&E species. Effective coordination between these agencies will require on-going and cooperative interaction to implement Actions and attain certain Management Objectives.

Management Objectives

Implementation of the LORP Management Plan will include many different actions that will provide more and higher quality riparian and wetland habitat for the LORP wildlife indicator species, special status wildlife species, and an array of resident and migrant wildlife species that directly and indirectly use the LORP area.

The two most important management tools for the LORP ecosystem are stream flow (i.e., the interaction of surface water and groundwater) and land use management. Together water and land use management exert the greatest influence on the river's biotic and abiotic components and, ultimately, the degree of functional state attained by the total ecosystem. Whether the fishery reaches the desired Management Objective of a healthy warm water community, T&E species recover, or land use activities are sustainable, depends to a large degree upon how successful water and land use management interventions are to restore the river to a functional ecosystem.

Natural recovery often occurs if areas are protected from over grazing in livestock areas and other destructive effects. Natural revegetation may be most practical if a remnant composition of desirable plants remains, but artificial revegetation normally

should not be employed unless satisfactory recovery cannot be achieved by natural means within an acceptable period. Table 1 describes the adaptive management tools for the LORP.

The most prominent actions include changes to the duration, magnitude and frequency of riverine flows and manipulation of water to both the Delta Habitat area and the Blackrock Waterfowl Habitat area. Land and resource management will be changed as necessary to avoid potential impacts to wildlife species and their habitat throughout the LORP area. Other land management activities will help protect the integrity and quality of riparian and wetlands habitat, and monitoring of the extent and quality of important habitat characteristics will provide a means of tracking changes and will allow for an evaluation of trends.

The following tables describe specific monitoring activities as they relate to project goals. Adaptive management actions and the triggers that will determine intervention are described in separate tables for each ecosystem component.

Table 1
Riverine-Riparian System
Monitoring

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Baseflow Monitoring					
Achieve MOU-required baseflows of approximately 40 cfs from the Intake to the pump station, with seasonal habitat flows up to 200 cfs in general proportion to the forecasted runoff in the watershed. A continuous flow in the river channel will be maintained to sustain fish during periods of temporary flow modifications. LORP management should be consistent with applicable water quality laws, standards, and regulations.	Baseflow compliance	Achieve approximately 40 cfs baseflows throughout the river.	Document compliance with MOU baseflow requirements, detect significant losses or gains.	Collect data from continuous recorders at 18 temporary gauging stations (to be reduced to no fewer than 4 once it has been determined that a stable flow of approximately 40 cfs has been achieved throughout the river). Until a stable flow of approximately 40 cfs has been achieved throughout the river, flow rates will be monitored and reported weekly or bi-weekly as needed. Once flows have stabilized, continuous flow data will be reported quarterly.	Data will be collected from continuous recorders at the18 temporary gauging stations until it has been determined that a stable flow of approximately 40 cfs has been achieved throughout the river. Thereafter, data will be collected quarterly from continuous recorders at the permanent gaging stations for the life of the project..

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
	Baseflow water quality	Avoid, minimize, and manage water quality degradation during the establishment of base flows, within the constraints of the flow requirements of the MOU.	Measure water quality parameters related to RWQCB designated beneficial uses and Actions and track trends in water quality over time.	Measure water quality conditions at 9 locations and other locations along the river channel, including DO, pH, EC, temperature, turbidity, ammonia, hydrogen sulfide, and tannins and lignins, and ambient air measurements for hydrogen sulfide, methane, and ammonia. During the month prior to the commencement of Phase I flows, monitoring data will be reported once. During Phase I releases, monitoring will be reported weekly or bi-weekly. During Phase II releases, monitoring will be reported weekly.	During the month prior to the commencement of Phase I flow monitoring will occur once to establish baseline conditions. During Phase I releases, monitoring will be performed weekly or bi-weekly as needed. During Phase II releases, monitoring will be performed weekly or bi-weekly 5 days per week for 6 months, as necessary, then 1 day per week for 6 months. Thereafter, water quality monitoring will cease (except during seasonal habitat flow releases-see below.
	Baseflow fish conditions	Same as above.	Assess fish conditions (evidence of stress such as excessive jumping, lying motionless near the surface, rapid gill movement and poor coloring or body appearance) and mortality.	Visual observations of river to detect fish conditions or fish kills at 9 water quality monitoring locations.	Same duration & frequency as water quality monitoring.

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Seasonal Habitat Flows					
Achieve seasonal habitat flows up to 200 cfs in general proportion to the forecasted runoff in the watershed. The purpose of the habitat flow is the creation of a dynamic equilibrium for riparian habitat, the fishery, water storage, water quality, animal migration and biodiversity, which results in resilient productive ecological systems. To achieve and maintain riparian habitats in a healthy ecological condition, and establish a healthy warm water recreational fishery with habitat for native species, the plan will recommend habitat flows of sufficient frequency, duration and amount that will: (1) minimize the quantity of muck and other river bottom material that is transported out of the riverine-riparian system, but will cause this material to be redistributed on floodplains and terraces	Seasonal habitat flow compliance	Release up to 200 cfs seasonal habitat flows in accordance with the schedule and nomograph contained in the LORP plan.	Document compliance with MOU seasonal habitat flow requirements, detect significant losses or gains, and determine travel time for seasonal habitat flows.	During the first release of flows, collect data from continuous recorders at 18 temporary gauging stations During two subsequent releases of flows, collect data from the permanent monitoring stations	During the first release of flows, data from the 18 stations will be collected five times per week during the flow and for up to two weeks following the flow release. During subsequent releases of the flow, data will be collected from the permanent stations five times per week during the flow and for up to two weeks following the flow release.

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
within the riverine-riparian system and the Owens River delta for the benefit of the vegetation; (2) fulfill the wetting, seeding, and germination needs of riparian vegetation, particularly willow and cottonwood; (3) recharge the groundwater in the streambanks and the floodplain for the benefit of wetlands and the biotic community; (4) control tules and cattails to the extent possible; (5) enhance the fishery; (6) maintain water quality standards and Actions; and (7) enhance the river channel.	Flooding extent	Achieve the purposes identified in the MOU for the seasonal habitat flows.	Assess extent and duration of flooding during seasonal habitat flows and determine the ability of these flows to accomplish the Management Objectives established in the MOU.	Aerial survey – From LADWP helicopter, survey and video/photograph seasonal habitat flows at peak flows. Field survey – Visit key sites during seasonal habitat flows. Document observations and take photos. Immediately report any observed problems. By August 1, prepare report describing observations and presenting photo documentation.	First 5 years of seasonal habitat flows – During peak of seasonal habitat flows.
LORP management should be consistent with applicable water quality laws, standards, and regulations.	Seasonal habitat flow water quality	Avoid and minimize water quality degradation during seasonal habitat flows, within the constraints of the flow requirements of the MOU.	Measure water quality parameters related to RWQCB-designated beneficial uses and Actions, track trends in water quality over time, and identify options to protect water quality.	Measure water quality conditions at 9 locations, and other locations as needed, along the river channel, including DO, pH, EC, temperature, turbidity, ammonia, hydrogen sulfide, and tannins and lignins, and ambient air measurements for hydrogen sulfide, methane, and ammonia. Compile data and submit to LADWP & Inyo County at least weekly during seasonal habitat flows.	During the first three releases of flows, data from the 9 locations will be collected five times per week during the flow and for up to two weeks following the flow release. After the first 3 flow releases, water quality monitoring will be discontinued.
	Seasonal habitat flow fish conditions	Same as above.	Assess fish conditions (evidence of stress such as excessive jumping, lying motionless near the surface, rapid gill movement and poor coloring or body appearance) and mortality	Observations of river to detect fish conditions or fish kills at 9 water quality monitoring locations	Same duration and frequency as water quality monitoring

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Habitat Monitoring					
Create and maintain healthy and diverse riverine, riparian, and wetland habitats through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for the river. These habitats will be as self-sustaining as possible. Create and sustain a healthy warmwater recreational fishery with healthy habitat suitable for native fish. Comply with state and federal laws that protect Threatened and Endangered species. Control deleterious species whose presence within the LORP area interferes with the achievement of the Management Objectives of the LORP. These control measures will be implemented jointly with other responsible agency programs. Manage livestock grazing and recreational use consistent with the other Management Objectives of the LORP.	River channel rapid assessment surveys	Develop corridor of native riparian and wetland habitats dominated by willow, cottonwood, and wet meadow vegetation, consistent with 1993 model predictions (WHA 1993), that exhibits healthy age structure.	Track trends in habitat development, observe woody plant recruitment and plants of concern to Native Americans, assess beaver activity and beaver dam conditions, assess presence of exotic plants, assess recreational impacts, observe fish habitat characteristics (e.g. large organic debris, bank erosion, and pool formation).	Walk the river along designated route from the intake to the pump station, with stops at permanent monitoring points. Take photos. GPS locations of noteworthy observations for future monitoring or evaluation. Enter data in GIS and spreadsheet.	First 15 years -- Annually, in August - September
	Riparian habitat develop-ment	Develop native riparian and wetland habitats consistent with the suitability curves for 14 habitat characteristics important to the "habitat indicator species" and special status species	Measure trends in habitat characteristics that relate to the "habitat indicator species" and special status wildlife species, including plants of concern to Native Americans.	Measure 14 habitat characteristics at approximately 200 plots to assess habitat development along the river. By September 1 of primary years, prepare report summarizing results and making recommendations for adaptive management.	First 15 years – During growing season in years 2, 5, 7, 10, and 15
	Understory develop-ment	Develop native riparian and wetland habitats consistent with the suitability curves for 9 of the 14 habitat characteristics important to the "habitat indicator species" and special status species	Measure trends in habitat characteristics that relate to understory structure and composition and recruitment that are important to the "habitat indicator species" and special status wildlife species, including plants of concern to Native Americans.	Measure 9 habitat characteristics at approximately ½ of the riparian plots to assess habitat development along the river. By September 1 of secondary years, prepare report summarizing results and making recommendations for adaptive management.	First 15 years – During growing season in years 1, 3, 4, 6, 8, 9, and 11-14

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
	Habitat mapping	Develop corridor of native riparian and wetland habitats dominated by willow, cottonwood, and wet meadow vegetation, consistent with 1993 model predictions (WHA 1993), that exhibits healthy age structure.	Measure large-scale vegetation trends and habitat extent, document tule development, beaver dams, and open water areas.	Acquire and interpret satellite imagery of the river and map habitats. By September 1 of primary years, prepare report summarizing interpretation, presenting mapping results (including CD with digital copies of imagery and attributed GIS maps), and making recommendations for adaptive management.	First 15 years – During growing season in years 2, 5, 7, 10, and 15
	Fishery habitat surveys	Develop riverine habitats consistent with the needs of the "habitat indicator" fish species specified in the MOU.	Measure habitat characteristics important to "habitat indicator" fish species identified in the LORP plan. These habitat characteristics are important for spawning (substrate), early rearing (bank undercut and organic debris), and adult feeding and resting (widths and depths). Measurements will be taken of channel width, wetted perimeter width, average and thalweg depths, substrate, canopy cover, organic debris, bank undercut.	Measure 7 habitat characteristics at approximately 27 transects in each of four reaches of the river (excluding the Islands reach). By September 1 of each monitoring year, prepare report summarizing results and making recommendations for adaptive management.	Years 3, 6, and 9
	Contin-gency monitoring		Rapid assessment surveys or other monitoring could indicate a need for additional monitoring focused on areas or resources of particular interest (e.g. recruitment, rare species).	Additional monitoring may be incorporated into the monitoring program during the first 15 years of project operation.	To be determined as needed

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
	Data analysis, report preparation, recom-mendations			Analyze, synthesize, and report on data collected during riverine-riparian field efforts, report on observed trends, problems, and successes, document compliance with MOU requirements, recommend adaptive management measures or changes to monitoring.	First 15 years – By October 1 of each year submit report to LADWP and the County.

Table 2
Riverine-Riparian System
Adaptive Management Measures

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
Modification of releases during establishment of baseflows	Hold rate of releases steady and/or release higher quality water from spillgates. Stabilization of the release rate will be for a short period in order to achieve a flow of approximately 40 cfs throughout the river within one month of the commencement of Phase II releases. Any such releases from spillgates will continue until the water quality has improved above the water quality triggers.	Attempt to avoid or reduce a fish kill	Evidence is observed of fish stress such as excessive jumping, lying motionless near the surface, rapid gill movement, poor coloring or body appearance or mortality. Also: (1) a decrease in dissolved oxygen to less than 90 percent of the baseline condition, (2) a 10 percent increase in hydrogen sulfide concentration above ambient baseline levels, and/or (3) a 10 percent increase in ammonia concentration above ambient baseline levels.
Modification of releases to maintain baseflows	Increase releases rates from the River Intake and/or from spillgates to increase flow in the river to approximately 40 cfs.	Maintain a flow of approximately 40 cfs throughout the river	Monitoring data indicate that a flow of approximately 40 cfs is not being maintained at any one of the 4 permanent monitoring stations.
Releasing higher quality water from spillgates during the first three releases of seasonal habitat flows	During the first three releases of a seasonal habitat flow, if necessary, release higher quality water from spillgates. Any such releases from spillgates will continue until the water quality has improved above the water quality triggers (There will be no such releases made from spillgates after the release of the third seasonal habitat flow.)	Attempt to improve water quality and avoid or reduce a fish kill. Improve water quality.	Evidence is observed of fish stress such as excessive jumping, lying motionless near the surface, rapid gill movement, poor coloring or body appearance or mortality. Also: (1) a decrease in dissolved oxygen to less than 90 percent of the baseline condition, (2) a 10 percent increase in hydrogen sulfide concentration above ambient baseline levels, and/or (3) a 10 percent increase in ammonia concentration above ambient baseline levels. Monitoring data indicate that 7-day average water quality criteria for dissolved oxygen, pH, temperature, and gases established by the RWQCB are not being met.
Modification of the timing of seasonal	Adjust timing of seasonal habitat flows to maximize seed dispersal and germination	Better achieve habitat Management	Monitoring data indicate that seasonal habitat flows are being released outside of

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
habitat flows	and avoid seeding period of exotic species	Objectives	the peak time of seed development and/or flows need to be adjusted to account for variable seed development between upper and lower river reaches. A determination that the habitat Management Objectives are not being achieved will be based upon monitoring data that show no trends in habitat characteristics that relate to understory structure and composition and recruitment that are important to the "habitat indicator species" and special status wildlife species, including plants of concern to Native Americans.
Modification of the magnitude of seasonal habitat flows	Adjust amount of seasonal habitat flow released at River Intake and/or release water from spillgates	Achieve habitat Management Objectives if the Management Objectives are not being met because the seasonal flow release is insufficient. Conserve water if habitat Management Objectives won't be compromised.	Monitoring data indicate that vegetation Management Objectives are not being achieved because the flow release is of insufficient magnitude. A determination that the vegetation Management Objectives are not being achieved will be based upon monitoring data that show riparian plants are not being recruited (within the first five years) or sustained through time (within the fifteen year monitoring period) in areas subject to out-of-channel flooding from seasonal habitat flows. A determination that the habitat Management Objectives are not being achieved will be based upon monitoring data that show no trends in habitat characteristics that relate to understory structure and composition and recruitment that are important to the "habitat indicator species" and special status wildlife species, including plants of concern to Native Americans.
Modification of the duration of seasonal habitat flows	Adjust the length of time during which seasonal habitat flows are released	Better achieve habitat Management Objectives. Conserve	Habitat Management Objectives are not being achieved because the flow release is of insufficient duration. A determination

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
		water if habitat Management Objectives won't be compromised	that the habitat Management Objectives are not being achieved will be based upon monitoring data that show riparian plants are not being recruited (within the first five years) or sustained through time (within the fifteen year monitoring period) in areas subject to out-of-channel flooding from seasonal habitat flows.
Modification of schedules for maintenance and mechanical intervention activities	Adjust timing of when maintenance activities or mechanical intervention activities	Minimize interference with bird nesting or migration, plant seeding, etc.	Maintenance and/or mechanical intervention activities are interfering with bird nesting, or migration, plant seeding, etc. Interference will be avoided by scheduling maintenance during non-critical periods.
Planting native vegetation species	Encourage the establishment of vegetation at specific sites	Augment natural revegetation processes where necessary	Natural revegetation is not occurring to the extent expected even after adjustments of seasonal habitat flows and/or adjustments to grazing management. A determination that sufficient natural revegetation is not occurring will be based upon monitoring data that show suitable sites support less than half of the vegetation on similar or adjacent sites.
Dispersal of native plant species seeds during seasonal habitat flows	Disperse seeds of native vegetation into the river during seasonal habitat flows and/or into areas that will be inundated by seasonal habitat flows	Augment natural revegetation processes where necessary	Natural revegetation is not occurring to the extent expected. A determination that sufficient natural revegetation is not occurring will be based upon monitoring data that show suitable sites support less than half of the vegetation on similar or adjacent sites.
Conducting exotic plant control activities	Increase any ongoing activities to control saltcedar and/or other exotic plant species	Limit invasion of exotic plant species	Growth of exotic plant species is hindering achievement of habitat Management Objectives. A determination that exotic plant control activities is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show exotic plants are growing in concentrations that prevents or inhibits the

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
			growth of native species.
Modification of tule removal activities	Increase efforts to maintain stream flow by controlling tules	Mechanically remove tules from the stream channel	Tule growth is hindering stream flow or achievement of habitat Management Objectives. A determination that tule growth is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show flows are blocked to the extent that seasonal habitat flows are not spreading out-of-channel and/or base flow are attenuated below the tule growth.
Modification of beaver and beaver dam control activities	Increase ongoing efforts to control beavers and/or to remove beaver dams	Mechanically remove beaver dams and/or trap beavers	Beaver activity is hindering achievement of habitat Management Objectives. A determination that beaver activity is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show flooding due to beaver dams is causing the death of tree species and/or preventing the growth or development of new trees in suitable riparian areas.
Modification of fencing, or addition of new fencing, for riparian and upland pastures	Add additional fencing and/or move existing fencing	Better manage livestock grazing	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth or riverine-riparian vegetation in riparian pastures is prevented or inhibited to the extent that more stringent management is needed.
Modification of utilization rates and timing within riparian and upland pastures	Alter utilization rates employed to manage livestock grazing and/or alter timing of livestock grazing	Better achieve habitat Management Objectives by improvement riparian vegetation recruitment and growth	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth or riverine-riparian

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
			vegetation in riparian pastures is prevented or inhibited to the extent that more stringent management is needed.
Installation of grazing exclosures	Add new grazing exclosures	Better protect areas of sensitive, threatened or endangered species, and/or promote site specific recovery	Livestock grazing may adversely affect sensitive, threatened or endangered plants. A determination that livestock grazing could adversely affect sensitive, threatened or endangered plants will be based upon monitoring data that show a potential for loss of T&E plant species.
Modification of livestock management following wildfire	Temporarily eliminate livestock grazing, reduce utilization rates and/or change timing of grazing following a wildfire	Promote recovery of habitat following a wildfire	Wildfire affects a portion of the project area.
Modification of the river channel	Mechanically alter the river channel	Protect property, facilities, or better achieve project Management Objectives	River channel configuration is causing adverse impacts to property or facilities or hindering achievement of project Management Objectives. A determination that river channel configuration is hindering the achievement of project Management Objectives will be based upon monitoring data that show excessive erosion, bank sloughing, or headcutting.
Modification of recreational and human use management	Increase efforts to regulate recreational activities and other human use of the project area	Regulate human activities within the project area as necessary to achieve to Management Objectives of the project	Human activities are hindering the achievement of project Management Objectives. A determination that human activity is hindering the achievement of project Management Objectives will be based upon monitoring data that show trampling of recruiting vegetation on streambanks or cutting of new roads or trails from ATV use.

Table 3
Delta Habitat Area
Monitoring

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Release an annual average of 6 to 9 cfs below the LORP pump station, not including water that is not captured by the station during periods of seasonal habitat flows.	Delta flows	Release an annual average of 6 to 9 cfs below the LORP pump station, not including water that is not captured by the station during periods of seasonal habitat flows.	Document compliance with MOU flow requirements and wetland Management Objectives.	Flows released to the delta will be managed and documented as part of pump station management. Data, as to the amount of water released from the pump station, will be documented by a continuous recorder module. The data will be reported weekly. Data from stream gages established to continuously monitor outflow from the Delta will be reported every 14 days for one few year after project implementation.	Monitoring of releases to the delta from the pump station will occur over the life of the project. Data from the stream gages will be reported monthly.

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Enhance and maintain existing habitat and establish and maintain new habitat consisting of riparian areas and ponds suitable for shorebirds, waterfowl, and other animals.	Delta flows during establishment of baseflows (first year following project Implementation	Within the annual average of 6 to 9 cfs, establish the seasonal baseflow to be released to the delta in the years after the first year following the implementation of the project.	Document that a continuous, combined flow of at least 0.5 cfs is passing the two gaging stations on the east and west branches of the delta.	Flows released to the delta will be managed and documented as part of pump station management. Data, as to the amount of water released from the pump station, will be documented by a continuous recorder module. The data will be reported weekly. Stream gages will be established to continuously monitor outflow from the delta from the east and west branches for a one year period after project implementation. Stream gage data will be reported every 14 days.	Monitoring of releases to the delta from the pump station will occur over the life of the project. Data from the stream gages will be reported monthly. Stream gages will continuously monitor outflow from the delta from the east and west branches for a one-year period after project implementation.
Create and maintain diverse natural habitats through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for this element of the	Delta flows after the first year following project implemen-tation	Adjust the seasonal baseflow and/or the pulseflows to be released to the delta after the first year following the implementation of the project (within the annual average of 6 to 9 cfs required by the MOU)	Achievement of the Management Objectives for the delta.	Annual monitoring, using estimates from satellite images, shows an average decrease in vegetated wetland of 10 percent during any 3 year period (relative to 2000 conditions). Monitoring shows a 20 percent reduction in habitat suitability (acres + conditions) at the end of the the first 15 years following project implementation.	These monitoring activities will occur during the first 15 years following implementation of project.

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
LORP. These habitats will be as self-sustaining as possible. Comply with state and federal laws that protect Threatened and Endangered species.	Delta rapid assessment surveys	Create, enhance, and sustain a diverse complex of wetland riparian areas and ponds suitable for shorebirds, waterfowl, and other animals. LADWP's Management Objective for the delta habitat will be to enhance and maintain the wetland resource (on its lands) that exists at the time the project is implemented and within this area, to establish and maintain habitat consisting of riparian areas and ponds-suitable for shorebirds, waterfowl, and other animals.	Document trends in habitat development and wetland response to flows; observe aerial extent of shallow flooding, wetland vegetation, including plants of concern to Native Americans, and woody plant recruitment; make incidental observations of birds (semi-quantitative inventory); assess tule and beaver dam conditions; assess presence of exotic plants; assess recreational impacts.	Semi-quantitative assessment of wetland conditions and woody riparian recruitment along a pre-determined route, with photo documentation of wetland response to flows. Enter data in GIS and spreadsheet.	First 15 years – Four times per year (one survey timed to occur during seasonal habitat flows from the river)

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
	Wetland habitat development	Develop native riparian, wetland and open water habitats consistent with the suitability index curves for the habitat characteristics important to the "habitat indicator species" and special status species.	Measure trends in habitat characteristics that relate to the "habitat indicator species" and to special status wildlife species, including plants of concern to Native Americans (Attachment 2)	Measure 8 habitat characteristics along 6 transects containing 60 plots to assess habitat development at the delta. Input transect data to HGM model to measure changes in habitat suitability for indicator species. By September 1, prepare report presenting data, summarizing results, and making recommendations for adaptive management.	First 15 years –Annually

MOU Management Objectives (as stated verbatim in the MOU)	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Manage livestock grazing and recreational use consistent with the other Management Objectives of the LORP.	Habitat mapping	Create, enhance, and sustain a diverse complex of wetland riparian areas and ponds suitable for shorebirds, waterfowl, and other animals.	Measure aerial extent of shallow flooding and wetland and riparian vegetation, including tules; identify beaver dams; measure open water areas	Acquire and interpret remote sensing imagery as with other LORP features in primary years. Annual mapping may be discontinued after year 5, if it is determined to not be needed. Prepare attributed GIS map of habitat types at delta area.	Years 3, 4, 6, 8, 9, and 11-14
	Seasonal habitat flow aerial survey	Same as above	Estimate aerial extent of shallow flooding and wetland and riparian vegetation, including tules; identify beaver dams; measure open water areas	Aerial survey – From LADWP helicopter, survey and video/photograph seasonal habitat flows at peak flows.	Years 2-6, During seasonal habitat flows.
	Contingency monitoring		Rapid assessment surveys or other monitoring could indicate a need for additional monitoring focused on areas or resources of particular interest (e.g. recruitment)	Additional monitoring may be incorporated into the monitoring program during the first 15 years of project operation.	To be determined as needed
	Data analysis, report preparation, recommendations			Analyze, synthesize, and report on data collected during delta efforts, report on observed trends, problems, and successes, document compliance with MOU requirements, recommend adaptive management measures or changes to monitoring.	First 15 years – By October 1 of each year submit report to LADWP and the County.

Table 4
Delta Habitat Area
Adaptive Management Measures

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
Modification of baseflow release of 5.3 cfs in the first year following project implementation when baseflows are being established	During the first year of baseflow releases from the pump station, adjust the initial amount of baseflow released at the pump station from 5.3 cfs (while maintaining a flow within the 6 to 9 cfs) to result in 0.5 cfs outflow from the delta habitat area These flow modifications will be used to establish the permanent seasonal releases in subsequent years (within the annual average of 6 to 9 cfs) necessary to achieve the Management Objectives for the delta.	Maintain existing vegetated wetland	Monitoring shows that during any 14 day period there has been less than a continuous combined flow from the east and west branched of the delta the release to the delta will be immediately modified to achieve a combined, continuous flow of 0.5 cfs.
Modification of baseflow release of in the years after the first year following project implementation	Adjust the amount of baseflow released at the pump station (while maintaining a flow within the 6 to 9 cfs annual average requirements of the MOU) to better achieve the Management Objectives for the delta.	Better achieve the Management Objectives for the delta	Annual monitoring, using estimates from satellite images, shows an average decrease of 10 percent in vegetated wetland (relative to 2000 conditions) during any three-year period. Monitoring shows a 20 percent reduction in habitat suitability (acres + conditions) at the end of the first 15 years following project implementation.
Modification of magnitude of pulseflows	Adjust amount of pulseflow released at pump station (within the 6 to 9 cfs annual average required by the MOU)	Better achieve habitat Management Objectives.	Annual monitoring, using estimates from satellite images, shows an average decrease of 10 percent (relative to 2000 conditions) in vegetated wetland during any three-year period. Monitoring shows a 20 percent reduction in habitat suitability (acres + conditions) at the end of the first 15 years following project implementation.

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
Modification of duration of pulseflows	Adjust the length of time during which a pulseflow is released from the pump station	Better achieve habitat Management Objectives.	Annual monitoring, using estimates from satellite images, shows an average decrease of 10 percent in vegetated wetland (relative to 2000 conditions) during any three-year period. Monitoring shows a 20 percent reduction in habitat suitability (acres + conditions) at the end of the first 15 years following project implementation
Berming/excavating to direct flow or contain flow	Construction of berms and/or excavation	Better achieve habitat Management Objectives	Observations indicate that a portion of either the pulseflows or the seasonal habitat flows released to the delta from the pump station are not reaching the primary delta habitat area because the flows are escaping the river channel upstream of the primary habitat area. As a result, monitoring data indicate that habitat Management Objectives are not being achieved because the flows reaching the primary habitat area are insufficient.
Planting native vegetation species	Plant native vegetation to encourage the establishment of vegetation at specific sites	Augment natural revegetation processes where necessary	Natural revegetation is not occurring to the extent expected even after adjustments of baseflows and pulseflows and/or adjustments to grazing management. A determination that sufficient natural revegetation is not occurring will be based upon monitoring data that show suitable sites support less than half of the vegetation on similar, adjacent sites.
Dispersal of native plant species seeds during seasonal habitat flows	Disperse seeds of native vegetation into the river during seasonal habitat flows and/or into areas that will be inundated by seasonal habitat flows	Augment natural revegetation processes where necessary	Natural revegetation is not occurring to the extent expected. A determination that sufficient natural revegetation is not occurring will be based upon monitoring data that show suitable sites support less than half of the vegetation on similar, adjacent sites.
Conducting exotic plant control activities	Increase any ongoing efforts to control salt cedar and/or other exotic plant species	Limit invasion of exotic plant species	Growth of exotic plant species is hindering achievement of habitat Management Objectives. A determination that exotic plant control activities is hindering the achievement of habitat Management Objectives will be based upon

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
			monitoring data that show exotic plants are growing in concentrations that prevents or inhibits the growth of native species.
Modification of tule removal activities	Increase ongoing efforts to control tules to maintain stream flow	Mechanically remove tules	Tule growth is hindering stream flow or achievement of habitat Management Objectives. A determination that tule growth is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show flows are blocked to the extent that seasonal habitat flows are not spreading out-of-channel and/or baseflows are attenuated below the tule growth.
Modification of beaver and beaver dam control activities	Increase ongoing efforts to control beavers and/or to remove beaver dams	Mechanically remove beaver dams and/or trap beavers	Beaver activity is hindering achievement of habitat Management Objectives. A determination that beaver activity is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show excessive flooding is inhibiting the growth or development of vegetation.
Modification of fencing, or addition of new fencing, for riparian and upland pastures	Add additional fencing and/or move existing fencing	Better manage livestock grazing	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth of vegetation in wetland pastures is prevented or inhibited to the extent that more stringent management is needed.
Modification of utilization rates and timing within riparian and upland pastures	Alter utilization rates employed to manage livestock grazing and/or alter timing of livestock grazing	Better achieve habitat Management Objectives by improvement riparian vegetation recruitment and	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth of vegetation in wetland pastures is prevented or inhibited to the extent that more stringent management is needed.

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
		growth	
Installation of grazing exclosures	Add new grazing exclosures	Better protect areas of sensitive, threatened or endangered species, and/or promote site specific recovery	Livestock grazing may adversely affect sensitive, threatened or endangered plants. A determination that livestock grazing could adversely affect sensitive, threatened or endangered plants will be based upon monitoring data that show the potential for loss of T&E plant species.
Modification of livestock management following wildfire	Temporarily eliminate livestock grazing, reduce utilization rates and/or change timing of grazing following a wildfire	Promote recovery of habitat following a wildfire	Wildfire affects a portion of the project area.
Modification of recreational and human use management	Increase efforts to regulate recreational activities and other human use of the project area	Regulate human activities within the project area as necessary to achieve to Management Objectives of the project	Human activities are hindering the achievement of project Management Objectives. A determination that human activity is hindering the achievement of project Management Objectives will be based upon monitoring data that show cutting of new roads or trails from ATV use or other adverse impacts.

Table 5
Blackrock Waterfowl Habitat Area
Monitoring

MOU Management Objectives	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Approximately 500 acres of the area will be flooded at any given time when runoff is forecasted to be average or above average. In years of less than average runoff, the water supply to the area will be reduced in general proportion to the forecasted runoff in the watershed. Even in the driest years, available water will be used in the most efficient manner to maintain the habitat. Provide the opportunity for the establishment of resident and migratory waterfowl populations and provide habitat for other native species. Create and maintain healthy and diverse natural habitats through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for this element of the LORP. These habitats will be as self-sustaining as possible.	Blackrock wetland compliance	Flood approximately 500 acres at any given time	Document compliance with MOU requirements and consistency with LORP Plan.	Record spillgate discharge, flows at diversions, and staff gage elevations that serve as indicators of a real extent of flooding. Change datalogger modules weekly.	Project life
	Blackrock rapid assessment surveys	Create, enhance, and sustain a diverse and productive "managed wetland" community for the "habitat indicator species" and special status species	Document compliance with MOU requirements and consistency with LORP Plan, assess trends in habitat development and wetland response to flows, observe aerial extent, depth, and duration of shallow flooding, and rate of flood level changes, wetland vegetation, including plants of concern to Native Americans, and woody plant recruitment, assess the extent of the presence of tules and exotic plants, assess recreational impacts	Perform semi-quantitative assessment of wetland conditions along a pre-determined route, with photo documentation of wetland conditions due to flooding regime in different units	First 15 years – 4 times per year
	Wetland habitat development	Develop wetland habitats consistent with the suitability index curves for the habitat characteristics important to the "habitat indicator species" and special status species.	Measure trends in habitat characteristics that relate to the "habitat indicator species" and to special status wildlife species, including plants of concern to Native Americans (Attachment 3)	Measure 10 habitat characteristics (e.g. emergent cover, flooded area, residual wetland vegetation) at 25 permanent plots per unit to assess habitat development at representative sampling sites	First 15 years – Annually, during growing season, in active areas

MOU Management Objectives	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Comply with state and federal laws that protect Threatened and Endangered species. Control deleterious species whose presence within the LORP area interferes with the achievement of the Management Objectives of the LORP. These control measures will be implemented jointly with other responsible agency programs. Manage livestock grazing and recreational use consistent with the other Management Objectives of the LORP.	Habitat mapping	Create, enhance, and sustain a diverse and productive "managed wetland" community for the "habitat indicator species" and special status species	Measure trends in habitat development and wetland response to flows; measure aerial extent of shallow flooding and wetland and riparian vegetation, including tules	Acquire and interpret remote sensing imagery. (Annual mapping may be discontinued after year 5, if it is determined to not be needed.) Prepare attributed map of habitat types at delta area.	Years 3, 4, 6, 8, 9, and 11-14
	Contingency monitoring	Rapid assessment surveys or other monitoring could indicate a need for additional monitoring focused on areas or resources of particular interest (e.g. recruitment, rare species)		Additional monitoring may be incorporated into the monitoring program during the first 15 years of project operation.	To be determined as needed
	Data analysis, report preparation, recommendations			Analyze, synthesize, and report on data collected during delta efforts, report on observed trends, problems, and successes, document compliance with MOU requirements, recommend adaptive management measures or changes to monitoring. By October 1 of each year submit report to LADWP and the County.	First 15 years

Table 6
Blackrock Waterfowl Habitat Area
Adaptive Management Measures

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
Modification of timing and/or duration of wet/dry cycles	Alter the drying and wetting cycle for the management units	Better achieve the Management Objectives this element of the project	The drying and wetting cycle can be altered as necessary if monitoring indicates shorter or longer cycles are better for management of the wetlands.
Use of controlled burning	Burn areas of the Blackrock area	Improve plant diversity and reduce monocultures	Monitoring data indicate plant diversity is low and a monoculture is developing.
Conducting exotic plant control activities	Increase any ongoing efforts to control salt cedar and/or other exotic plant species	Limit invasion of exotic plant species	Growth of exotic plant species is hindering achievement of habitat Management Objectives. A determination that exotic plant control activities is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show exotic plants are growing in concentrations that prevents or inhibits the growth of native species.
Modification of beaver and beaver dam control activities	Increase efforts to control beavers and/or to remove beaver dams	Mechanically remove beaver dams and/or trap beavers	Beaver activity is hindering achievement of habitat Management Objectives. A determination that beaver activity is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show excessive flooding is inhibiting the growth or development of vegetation.
Modification of fencing, or addition of new fencing, for riparian and upland pastures	Add additional fencing and/or move existing fencing	Better manage livestock grazing	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth of vegetation in wetland pastures is prevented or inhibited to the extent that more stringent management is needed.
Modification of utilization rates and timing within riparian and upland	Alter utilization rates employed to manage livestock grazing and/or alter timing of livestock grazing	Better achieve habitat Management Objectives by	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth of

MEASURE	DESCRIPTION	PURPOSE	MONITORING TRIGGER
pastures		improvement riparian vegetation recruitment and growth	vegetation in wetland pastures is prevented or inhibited to the extent that more stringent management is needed.
Installation of grazing exclosures	Add new grazing exclosures	Better protect areas of sensitive, threatened or endangered species, and/or promote site specific recovery	Livestock grazing may adversely affect sensitive, threatened or endangered plants. A determination that livestock grazing could adversely affect sensitive, threatened or endangered plants will be based upon monitoring data that show the potential for a loss of T&E plant species.
Modification of livestock management following wildfire	Temporarily eliminate livestock grazing, reduce utilization rates and/or change timing of grazing following a wildfire	Promote recovery of habitat following a wildfire	Wildfire affects a portion of the project area
Modification of recreational and human use management	Increase efforts to regulate recreational activities and other human use of the project area	Regulate human activities within the project area as necessary to achieve to Management Objectives of the project	Human activities are hindering the achievement of project Management Objectives. A determination that human activity is hindering the achievement of project Management Objectives will be based upon monitoring data that show cutting of new roads or trails from ATV use or other adverse impacts.

Table 7
Off-River Lakes and Ponds
Monitoring

MOU Management Objectives	Monitoring Component	Project Actions	Monitoring Actions	Monitoring, Data Analysis, and Reporting	Duration and Frequency
Maintain and/or establish these lakes and ponds to sustain diverse habitat for fisheries, waterfowl, shorebirds, and other animals. Create and maintain healthy and diverse natural habitats through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for this element of the LORP. These habitats will be as self-sustaining as possible. Comply with state and federal laws that protect Threatened and Endangered species. Control deleterious species whose presence within the LORP area interferes with the achievement of the Management Objectives of the LORP. These control measures will be implemented jointly with other responsible agency programs. Manage livestock grazing and recreational use consistent with the	Lakes and ponds compliance	Maintain the existing lakes and ponds identified in the MOU	Document compliance with MOU requirements.	Record staff gage elevations.	Project life
	Lakes and ponds rapid assessment surveys	Maintain the off-river lakes and ponds to sustain diverse habitat for fisheries, waterfowl, shorebirds, and other animals.	Document trends in habitat development and wetland response to flows, observe aerial extent of ponded areas, wetland vegetation, including plants of concern to Native Americans, and woody plant recruitment, make incidental observations of birds, assess presence of tules and exotic plants, assess recreational impacts	One-day semi-quantitative survey of birds and wetland conditions along a pre-determined route, with photo documentation of changes in wetland conditions. Summarize observations quarterly in spreadsheet format.	First 15 years – Two times per year

other Management Objectives of the LORP.	Data analysis, report preparation, and recommenda-tions			Analyze, synthesize, and report on data collected. Report on observed trends, problems, and successes; document compliance with MOU requirements; recommend adaptive management measures or changes to monitoring.	First 15 years – By October 1 of each year submit report to LADWP and the County.

Table 8
Off-River Lakes and Ponds
Adaptive Management Measures

MEASURE	DESCRIPTION	PURPOSE	TRIGGER
Modification of releases to maintain lakes	Alter amount of water supplied to lakes	Better maintain lake levels	Staff gages and habitat mapping of open water levels show that lake levels are not being maintained.
Conducting exotic plant control activities	Increase any ongoing efforts to control salt cedar and/or other exotic plant species	Limit invasion of exotic plant species	Growth of exotic plant species is hindering achievement of habitat Management Objectives. A determination that exotic plant control activities is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show exotic plants are growing in concentrations that prevents or inhibits the growth of native species.
Modification of fencing, or addition of new fencing	Add additional fencing and/or move existing fencing	Better manage livestock grazing	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth of vegetation in wetland pastures is prevented or inhibited to the extent that more stringent management is needed.
Modification of utilization rates and timing within pastures	Alter utilization rates employed to manage livestock grazing and/or alter timing of livestock grazing	Better achieve habitat Management Objectives by improvement riparian vegetation recruitment and growth	Livestock grazing is hindering achievement of habitat Management Objectives. A determination that livestock grazing is hindering the achievement of habitat Management Objectives will be based upon monitoring data that show recruitment or growth of vegetation in wetland pastures is prevented or inhibited to the extent that more stringent management is needed.
Installation of grazing exclosures	Add new grazing exclosures	Better protect areas of sensitive, threatened or endangered species, and/or promote site specific recovery	Livestock grazing may adversely affect sensitive, threatened or endangered plants. A determination that livestock grazing could adversely affect sensitive, threatened or endangered plants will be based upon monitoring data that show the potential for loss of T&E plant species.

Modification of livestock management following wildfire	Temporarily eliminate livestock grazing, reduce utilization rates and/or change timing of grazing following a wildfire	Promote recovery of habitat following a wildfire	Wildfire affects a portion of the project area
Modification of recreational and human use management	Increase efforts to regulate recreational activities and other human use of the project area	Regulate human activities within the project area as necessary to achieve to Management Objectives of the project	Human activities are hindering the achievement of project Management Objectives. A determination that human activity is hindering the achievement of project Management Objectives will be based upon monitoring data that show cutting of new roads or trails from ATV use or other adverse impacts within the project area.

Land Use Monitoring

Land use monitoring will focus on grazing utilization. Two implicit assumptions are made setting utilization criteria. One, key vegetation species, grazed appropriately, will improve in vigor and recruitment. The second assumption is related to soil protection; if proper amounts of vegetation remain after the grazing season, the soil is adequately protected from erosion.

- Monitor utilization of herbaceous forage on benchmark riparian sites. Monitoring riparian pasture utilization will be done by the lessee and LADWP. Adherence to target on-off grazing dates in the spring will be monitored. Forage utilization will be determined by comparing ungrazed controls in the form of utilization cages placed on key sites, and utilization cages in the grazed riparian sites. Three to six utilization cages will be used in each riparian pasture, depending on diversity. A report will be prepared by September 1 of the primary years summarizing interpretation and presenting results. Adaptive management recommendations will be made in the report.

- Use of annual photo points to document changes, if any, in riparian habitats containing key willow species. Photo points will be shot annually and taken during the same period of each year. Permanent locations will be established and suitably marked, so the same location can be found each year. Both landscape and close-up photo points in each riparian pasture near the north, south and center locations of the pasture will be taken. LADWP and the lessee will be responsible for taking and maintaining the photographic record.

- Conduct annual field inspections of riparian pasture condition. Annual field evaluations will be completed every year for the first 3 years. Thereafter, a field inspection will be done every 3rd year until the desired set of riparian conditions is attained. Field evaluations will be done at the end of the grazing period to be better able to determine grazing influences. A report will be prepared by September 1 of the primary years summarizing interpretation and presenting results. Adaptive management recommendations will be made in the report.

- Long-term, ungrazed riparian control areas will be compared with annually grazed riparian areas. The primary monitoring tool will be photographic comparison between controls and test pastures. Photographs taken consistently over the years provide convenient and inexpensive methods to establish visual representation to monitor any possible change. Both landscape and close-up photographs will be shot. Inspection visits to ocularly compare controls with test pastures will be made in years 2, 5, 7, 10, and 15.

Volunteer-Based Monitoring

Angler Surveys

In order to acquire information on relative distribution and abundance of fish throughout the LORP, a directed creel census technique can be used with volunteer anglers. Ten anglers are assigned a specific reach of river or an area of lakes and ponds and assigned a certain fishing technique (flies, lures, live bait) for a specified period of time (about 2 days each). The volunteer creel survey can be performed as frequently as the volunteers are willing to participate.

Each angler records daily fishing results on creel census forms. Fisherman number, reach number, number of fish caught, species caught, individual total length, fish condition, and how many fish were observed during each fishing period are recorded. The length of each fish caught is visually estimated to the nearest inch. Fish length is the total length of the fish from tip of nose to end of tail. The condition of each fish caught is recorded. If the fish is healthy and robust, the fish is recorded as being in good condition. If the fish is overly thin, looks sick, or contains any body damage or lesions, the fish is recorded as being in poor condition. Each angler will abide by all State of California fishing rules and regulations. At the end of each fishing period, each angler estimates how many different fish were observed within his or her assigned reach, but were not caught, during his or her fishing period.

Bird Surveys

Data and information on occurrence, breeding status, nesting, abundance, and temporal variability of waterfowl and birds can be acquired through a volunteer census effort. LADWP and Inyo County can assist the Audubon Society or other local wildlife organizations in organizing an annual census in the river corridor, Blackrock and the Delta. Volunteers would follow a recognized protocol used by the Audubon in their annual census work, or develop a protocol specific for the LORP. Results of the census work should correlate with the habitat surveys to provide a picture of species use of the available habitat.

Bird surveys on the river will take place in May and June in the five designated reaches. Surveys in the Delta and Blackrock will be performed four times a year to coincide with seasonal breeding and migration periods.

GLOSSARY

Lower Owens River Project Glossary

Abiotic – Non-living, basic elements and compounds of the environment.

Aerobic Organism – An organism that thrives in the presence of oxygen.

Algae – Simple plants, many microscopic, containing chlorophyll. Most algae are aquatic and may produce a nuisance when environmental conditions are suitable for prolific growth.

Allocation – The process of legally dedicating specific amounts of the water resource for application to beneficial uses by means of water rights.

Alluvial stream – A stream whose boundary is composed of appreciable quantities of the sediments transported by the flow and which generally changes its bed forms as the rate of flow changes.

Ambient – the natural conditions (or environment) at a given place or time.
Ameliorated -

Anaerobic Organisms – Microorganisms that thrive best, or only, when deprived of oxygen.

Aquifer – An underground bed or status of earth, gravel, or porous stone which contains water. A geological rock formation, bed, or zone that may be referred to as a water-bearing bed.

Armoring – The formation of a resistant layer of relatively large particles by erosion of the finer particles.

Base Flow – As defined in the Water Resources Act of 1971 (Ch. 90.54 RCW), base flows are the flows administratively established "“necessary to provide for the preservation of wildlife, fish, scenic, aesthetic and other environmental values, and navigational values.”

Bed-load – Material moving on or near the stream bed by rolling and sliding with brief excursions into the flow three of four diameters above the bed.

Bed-load discharge – The quantity of bed-load passing a cross section of a stream in a unit of time.

Benthos – Bottom dwelling organisms.

Bio-assay – A determination of the concentration of a given material by comparison with a standard preparation, or the determination of the quantity necessary to affect a test animal under stated laboratory conditions.

Biochemical Oxygen Demand (BOD) – the amount of oxygen required to decompose a given amount of organic compounds to simple, stable substances within a specified time at a specified temperature. BOD serves as a guide to indicate the degree of organic pollution in water.

Biomass – the weight of all life in a specified unit of environment or an expression of the total mass or weight of a given population, both plant and animal.

Biota – All living organisms of a region.

Biotic – Of or having to do with life or living things; produced by or involving living organisms.

BMP's - Best management practices.

Canopy – the vertical projection downward of the aerial portion of shrubs and trees, usually expressed as percent of ground so occupied.

CDFG – California Department of Fish and Game.

Channel – A natural or artificial waterway that periodically or continuously contains moving water, or which forms a connecting link between two bodies of water.

Climax – the highest ecological development of a plant community capable of perpetuation under the prevailing climatic and edaphic conditions.

Consumption Use – The amount of water used in such a way that it is no longer directly available. Includes water discharged into the air during industrial uses, or given off by plants as they grow (transpiration), or water which is retained in the plant tissues, or any use of water which prevents it from being directly available.

Control Station – Any stream flow measurement site at which a regulatory base flow has been established.

Cover – (1) the combined aerial parts of plants and mulch. (2) Shelter and protection for animals and birds.

Cover, Percent – The area covered by the combined aerial parts of plants and mulch expressed as a percent of the total area.

Degradation – the geologic process by which streambeds, floodplains, and the bottoms of other water bodies are lowered in elevation by the removal of material by water.

Delta – A sediment deposit formed where moving water is slowed by a body of standing water.

Deposition – The mechanical processes through which sediments settle out.

Dissolved load – The part of the stream load that is carried in solution.

Dissolved Oxygen (DO) – Amount of oxygen dissolved in water.

Dissolved solids – The mass of dissolved constituents in water determined by evaporating a sample to dryness, heating at 105°C for 2h desiccating and weighing.

Diversion – The physical act of removing water from a stream or other body of surface water.

Drainage Area – The area of land drained by a stream, measured in the horizontal plane. It is the area enclosed by a drainage divide.

Drainage Basin – A part of the surface of the earth that is occupied by a drainage system consisting of a surface stream of a permanent body of water together with all tributary streams and bodies of impounded water (lakes, ponds, reservoirs, etc.)

Ecology – The science of the interrelations between living organisms and their environment.

Ecosystem – An ecological system; the interaction of living organisms and the nonliving environment producing an exchange of materials between the living and the nonliving.

Edaphic – Refers to the soil.

Effluent – A discharge or emission of a liquid gas, usually waste material.

Endangered Species – Any species which, as determined by the Fish and Wildlife Service, is in danger of extinction throughout all or a significant portion of its range other than a species of the class Insecta determined to constitute a pest whose protection would present an overwhelming and overriding risk to man.

Ephemeral – Transitory or of short duration.

Escapement – Adult fish that “escape” fishing gear to migrate upstream to spawning grounds.

Eutrophication – The intentional of unintentional enrichment of water.

Exotic – An organism or species which is not native to the region in which it is found.

Flood Plain – Lowland bordering a river, subject to flooding when stream overflows.

Fluvial sediment – particles derived from rocks or biological materials that are transported by, suspended in, or deposited by streams.

Graded stream – A stream in which a steady state has been reached such that, over a period of time the discharge and load entering the system are balance by the discharge and load leaving the system.

Groundwater – Water in the ground lying in the zone of saturation. Natural recharge includes water added by rainfall, flowing through pores or small openings in the soil into the water table.

Habitat – The natural abode of a plant or animal, including all biotic, climatic, and edaphic factors affecting life.

Hydrography – The science of the measurement and description of seas, lakes, rivers, and other bodies of water.

Impoundment – A body of water formed by confining and storing the water.

Indicator species – (1) Species that indicate the presence of certain environmental conditions, seral stages or previous treatment. (2) One or more plant species selected to indicate a certain level of grazing use.

Introgression - The introduction, through hybridization and chance backcrossing, of a gene of one species into another species.

LADWP – Los Angeles Department of Water and Power.

LORP – Lower Owens River Project.

LRWQB – Lahotan Regional Water Quality Board

Macro-scales – A scale or standard involving large units or measurements.

Meander – One of a series of sinuous curves, bends, or loops produced in the flood plain of a mature stream.

Mesic – Characterized by or requiring a medium supply of moisture.

Micro-scale – A scale or standard involving very small units or measurements.

MOU – Memorandum of Understanding

Nomograph – A chart from which one can determine by alignment of scales the value of a dependent variable for any given value of the independent variable.

Oxbow lake – Cutoff portion of meander bends.

Particle size – The diameter of a particle measured by settling, sieving, micrometric, or direct measurement methods.

Playa – (1) The basin floor of an undrained desert which contains water at irregular periods. (2) A plain of silt or mud, covered with water during the wet season.

Point bar – One of a series of low accurate ridges of coarse sediment deposited on the inner (convex) side of river curves.

Point sample – Sample of water-sediment mixture taken at a single point, either with an instantaneous or a point-integrated sampler.

Ramping – Rate at which water flow is increased or decreased.

Regimen of a stream – Characteristics of a stream with respect to flow duration, form of and changes in channel capacity to transport sediment and amount of material supplied for transportation.

Riparian – Pertaining to the banks of streams, lakes, or tidewater.

Ripple – Small triangular-shaped bed forms that are similar to dunes but smaller.

Runoff – That part of precipitation appearing in surface streams.

Scour – The enlargement of a flow section by the removal of the boundary material by the motion of the fluid.

Sediment – Particles derived from rocks or biological materials that are or have been transported by water.

Sediment discharge – The mass or volume of sediment passing a stream cross section in a unit of time.

Sediment load – The weight of solid matter being moved by a stream through a cross section per unit of time. (Bed-material load plus wash load.)

Seral stages – Of or having to do with sere.

Sere – The complete series of ecological communities occupying a given area over hundreds or thousands of years from the initial to the final or climax stage.

Stochastic – Having to do with a random variable or variables; involving chance or probability.

Stream discharge – The quantity of flow passing through a cross section in a unit of time.

Succession – The gradual replacement of one type of community or ecosystem by another, involving a series of changes in the plant and animal life that may result in a climax.

T & E Species – Threatened and Endangered Species.

Thalweg – The line connecting the lowest or deepest points along a stream bed, valley, or reservoir, whether underwater or not.

Tracer study – Using a dye or marker to follow a pathway.

Turbidity – An expression of the optical properties of a sample which causes light rays to be scattered and absorbed rather than transmitted in straight lines through the sample. (Turbidity of water is caused by the presence of suspended and dissolved matter such as clay, silt, finely divided organic matter, plankton, other microscopic organisms, organic acids and dyes.)

Turbulence – The irregular motion of a flowing fluid.

Watershed – The area from which water drains to a single point. In a natural basin, the area contributing flow to a given place on a stream.

Wet Meadow – A meadow where the surface remains wet or moist throughout the summer, usually characterized by sedges and rushes.