RECLAMATION
Managing Water in the West

Walker River Basin Acquisition Program Draft Environmental Impact Statement

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DEPARTMENT OF ADMINISTRATION
OFFICE OF THE DIRECTOR
BUDGET AND PLANNING DIVISION

Dear Interested Party:

The Bureau of Reclamation has made available for public review and comment the Draft Environmental Impact Statement (EIS) for the Walker River Basin Acquisition Program. **The public comment period for the Draft EIS ends September 14, 2009.** Reclamation is directed in Public Law 109-103 Section 208(a) to provide funding to the University of Nevada, Reno, to acquire from willing sellers, land, water appurtenant to the land, and related interests in the Walker River Basin, Nevada for the purpose of providing water to Walker Lake. The Draft EIS evaluates the environmental impacts of the Acquisition Program.

Four public hearings will be held to receive verbal and written comments on the Draft EIS. The hearing format includes a presentation followed by a formal public comment session. Meeting locations and dates are as follows:

- **Reno**: Monday, August 17, 6-8 p.m., Rancho San Rafael County Park, Main Ranch House, 1595 N. Sierra Street
- **Yerington**: Tuesday, August 18, 6-8 p.m., Casino West Convention Center, 11 North Main Street
- **Wellington**: Wednesday, August 19, 6-8 p.m., Smith Valley Community Center, 2783 Highway 208
- **Hawthorne**: Thursday, August 20, 6-8 p.m., Mineral County Public Library, First & "A" Street

The Draft EIS may be viewed at http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=2810 (blank spaces in the web address are underscores). For copies of the Draft EIS or if you encounter problems accessing the documents online, please contact Caryn Huntt DeCarlo at 775-884-8352 or e-mail chunttdecarlo@usbr.gov

Copies of the Draft EIS may also be viewed at the following locations:

- Lyon County Main Office – 27 S. Main Street, Yerington, NV
- Lyon County Library –22 Day Lane, Smith Valley, NV
- Lyon County Library – 20 Nevin Way, Yerington, NV
- Mineral County Library – First & "A" Street, Hawthorne, NV
- Walker River Paiute Tribe – 1022 Hospital Road, Schurz, NV
- Yerington Paiute Tribe – 171 Campbell Lane, Yerington, NV
- Bureau of Reclamation, Denver Office Library, Building 67, Room 167, Denver Federal Center, 6th and Kipling, Denver, CO

(CONTINUED ON BACK PAGE)

- Natural Resources Library, U.S. Department of the Interior, 1849 C Street NW, Main Interior Building, Washington, DC
- Bureau of Reclamation, Mid-Pacific Regional Office Library, 2800 Cottage Way, W-1825, Sacramento, CA

Written comments on the Draft EIS should be sent by close of business Monday, September 14, 2009, to:

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Public Law 109-103 Section 208(a) directs Reclamation to provide funding to the University for the Acquisition Program. The University is currently exploring how the Acquisition Program will be implemented, including the potential involvement of other entities that have experience in developing and implementing environmental water transaction programs. (An amendment to the legislation would be required if any part of the funding provided through Reclamation were to go directly to another entity). However, the potential impacts of the Acquisition Program described in the Draft EIS are expected to be the same no matter what entity(s) implements the Program.

A Record of Decision (ROD) is the final step in the National Environmental Policy Act (NEPA) process for an EIS. The ROD is the federal decision made on the range of alternatives addressed in the EIS. Throughout the EIS process, Reclamation has evaluated whether a NEPA document was required for the action of providing federal funding as directed in the legislation, since there is no federal decision to be made.

In late 2008, DOI revised its regulations for implementing NEPA (43 CFR Part 46 "Implementation of the National Environmental Policy Act (NEPA) of 1969 Final Rule); the rule was finalized on November 14, 2008. Section 46.100 (a) of these regulations states in part ***"If Federal funding is provided with no Federal agency control as to the expenditure of such funds by the recipient, NEPA compliance is not necessary."***

Reclamation does not have decision-making authority for the Acquisition Program, is not authorized to approve the Program implementation, and does not have control over the expenditure of federal funds by the recipient. There are no environmental consequences that result from a federal agency decision. **In looking more closely at the legislation in light of the new DOI regulations, Reclamation has determined that issuing a ROD for the EIS as part of the NEPA process is neither required nor appropriate.** However, the decision was made to continue to hold public hearings on the Draft EIS and all public comment received will be addressed in a Final EIS; Reclamation decided that developing a Final EIS was appropriate to disclose potential adverse and beneficial impacts of the Acquisition Program and to allow for public comment to be incorporated into the EIS for consideration by Program implementers.

RECLAMATION

Managing Water in the West

Walker River Basin Acquisition Program

Draft Environmental Impact Statement

Photo by Tom Lopes

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U.S. Department of the Interior
Bureau of Reclamation

July 2009

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms and Abbreviations

af	acre-feet
BAQP	Bureau of Air Quality Planning
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BP	Before Present
California Native Plant Society	CNPS Inventory
California Natural Diversity Data Base	CNDDB
CARB	California Air Resources Board
CCCC	California by the California Climate Change Center
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
Colony	Yerington Paiute Tribe Colony
DOI	U.S. Department of the Interior
DRI	Desert Research Institute
EIS	Environmental Impact Statement
ET	evapotranspiration
GIS	geographic information system
GRR	groundwater recharge and return
ITAs	Indian trust assets
LCT	Lahontan cutthroat trout
mg/L	milligrams per liter
msl	mean sea level
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Department of Wildlife
NDWP	Nevada Division of Water Planning

NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act
Nevada Natural Heritage Program	NNHP database
NOI	Notice of Intent
NPS	National Park Service
NRCS	Natural Resources Conservation Services
NRS	Nevada Revised Statutes
NSE	Nevada State Engineer
NVCRIS	Nevada Cultural Resources Information System
PL	Public Law
PM10	particulate matter greater than 10 microns in size
PM2.5	particulate matter smaller than 2.5 microns in size
Proposed Project	Walker River Basin Acquisition Program
Pub. L	Public Law
Reclamation	The U.S. Department of the Interior, Bureau of Reclamation
ROD	Record of Decision
SHPO	State Historic Preservation Officer
SWRCB	California State Water Resources Control Board
TCPs	traditional cultural properties
TDS	total dissolved solids
TMDL	total maximum daily load
TSS	total suspended solids
University	University of Nevada System of Higher Education
USBWC's	U.S. Board of Water Commissioners
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Walker Tribe	Walker River Paiute Tribe
WMA	Wildlife Management Area
WRID’s	Walker River Irrigation District’s
WRPT	Walker River Paiute Tribe
Yerington Tribe	Yerington Paiute Tribe

Executive Summary

Introduction

The U.S. Department of the Interior (DOI), Bureau of Reclamation (Reclamation) has prepared a Draft Environmental Impact Statement (EIS) for the proposed Walker River Basin Acquisition Program (Acquisition Program). This Draft EIS examines a Proposed Project and other alternatives for the Acquisition Program. Reclamation is providing funding to the University of Nevada System of Higher Education (University) for their Acquisition Program and research. The funding is provided through Reclamation's Desert Terminal Lakes Program, established in 2002 by Public Law (PL) 101-171.

In the past several years, Congress passed three pieces of legislation related to desert terminal lakes, which provide the foundation for the Purpose and Need statement for this Draft EIS:

- PL 107-171 Section 2507 provided $200,000,000 to Reclamation to provide water to at-risk natural desert terminal lakes with the provision that the funds not be spent to purchase or lease water rights;
- PL 108-7 Section 207 clarified that the money provided in PL 107-171 could only be used for Pyramid, Summit, and Walker Lakes in Nevada; and
- PL 109-103, Title II, Section 208(a) established the purposes for which $70 million in funds provided through Reclamation are to be used by the University:

  (A) to acquire from willing sellers land, water appurtenant to the land, and related interests in the Walker River Basin, Nevada; and

  (B) to establish and administer an agricultural and natural resources center, the mission of which shall be to undertake research, restoration, and educational activities in the Walker River Basin relating to–

  (2) In acquiring interests under paragraph (1)(A), the University of Nevada shall make acquisitions that the University determines are the most beneficial to–

  (A) the establishment and operation of the agricultural and natural resources research center authorized under paragraph (1)(B); and

  (B) environmental restoration in the Walker River Basin.

As noted, the legislation directs Reclamation to provide funding to the University for the Acquisition Program. The University is currently exploring how the Acquisition Program will be implemented, including the potential involvement of other entities that have experience in developing and implementing environmental water transaction programs. However, the potential impacts of the Acquisition

Program described in this Draft EIS are expected to be the same no matter what entity(s) implements the Acquisition Program. Accordingly, wherever the term "University" is used in this Draft EIS, it refers to the University as well as any other potential entities that may be involved in implementation efforts.

Background

The Walker River originates in the eastern portion of the Sierra Nevada in California, flows into eastern Nevada, and empties into Walker Lake, an at-risk natural desert terminal lake that has no outlet.

From 1882 to present, diversions from the river, primarily for upstream irrigated agriculture, have resulted in a 149-foot drop in the lake's surface elevation and a corresponding reduction in volume from about 10 million acre-feet (af) to less than 2 million af of water. As a result, in most years there is little or no inflow into Walker Lake.

Consequent changes from the decline in the elevation of Walker Lake over time have resulted in causing the Total Dissolved Solids (TDS) concentration to increase from approximately 2,500 milligrams per liter (mg/l) in 1882 to nearly 16,000 mg/l in by 2008. The existing high TDS concentration has threatened the lake's viability as a fishery, including the federally listed threatened Lahontan cutthroat trout, and has far-reaching impacts on the health of the lake and its associated ecosystems.

Draft EIS Process

- **Step 1: Notice of Intent in The Federal Register**
- **Step 2: Public Scoping**
- **Step 3: Impact Analysis of the Alternatives (adverse and beneficial)**

  Mitigation measures for adverse impacts were not developed for the Draft EIS because the legislation does not give Reclamation express decision-making authority for design of the Acquisition Program; therefore, the impacts displayed in this Draft EIS are the impacts that would occur without any mitigation. However, mitigation measures may be implemented under the University's Acquisition Program. Details of potential mitigation measures have not yet been formulated.

- **Step 4: Draft EIS**
- **Step 5: Final EIS**

A Record of Decision (ROD) is the final step in the National Environmental Policy Act (NEPA) process for an EIS. The legislation for the EIS directs that the University determine how the Acquisition Program is to be implemented. Reclamation's directed role is to provide funding to the University for those purposes. Reclamation has determined that issuing a ROD for the EIS as part of the NEPA process is neither required nor appropriate. This decision is supported by 2008 DOI revised regulations for implementing NEPA that state in part: ***"If Federal funding is provided with no Federal agency control as to the expenditure of such funds by the recipient, NEPA compliance is not necessary."***

While NEPA compliance is therefore not required per the new DOI regulations, Reclamation decided that completing the EIS would be appropriate and responsible given the high level of public interest and the commitment by Reclamation throughout the EIS process to disclose potential impacts and provide the opportunity for public comment.

Public hearings on the Draft EIS will still be held and public comment will be incorporated into a Final EIS. The Draft EIS will be completed to provide information on analysis of impacts for both public interest and for consideration by the University that is designated in the legislation to make the decisions on the implementation of the Acquisition Program.

Purpose and Need Statement

Reclamation developed the following Purpose and Need statement for this Draft EIS, responding to direction in the applicable Desert Terminal Lakes Public Laws for the University's Acquisition Program:

> *The purpose of the Walker River Basin Acquisition Program is to provide water to Walker Lake, an at-risk natural desert terminal lake in Nevada, by acquiring, from willing sellers, land, water appurtenant to the land, and related interests in the Walker River Basin in Nevada; and to make acquisitions that are the most beneficial to environmental restoration in the Walker River Basin. The Acquisition Program is needed to implement section 208(a) of P.L. 109-103 in accordance with section 2507 of P.L. 101-171 (as amended) and section 207(a)(1) of P.L. 108-7.*

Organization of the Draft EIS

The Draft EIS analyzes the impacts of implementing the University's Acquisition Program in accordance with the stated Purpose and Need. The Proposed Project and alternatives were developed to implement acquisitions from willing sellers for the Acquisition Program in a manner consistent with the designated legislation. These alternatives are discussed below. The impacts of the Proposed Project and other alternatives are also briefly outlined below with a full discussion provided in

the text of the Draft EIS. The Draft EIS contains information on specific resource categories arranged in individual chapters.

As designated in the legislation, acquisitions would occur only in the portion of the Walker River Basin located in Nevada. The impact analyses therefore focuses on those portions of the basin that will be affected by implementing the Acquisition Program. This area is located primarily in Lyon and Mineral Counties in Nevada.

Alternatives

Three alternatives that meet the Purpose and Need identified for the Proposed Action are analyzed in this Draft EIS. The Proposed Action of providing funding is the same for each alternative; however, the alternatives differ in the way the Acquisition Program would be implemented. Alternatives were developed with input from public comment, tribal consultation, and Cooperating Agencies. A No Action Alternative is also identified.

The objective of all action alternatives is to acquire sufficient water from willing sellers to increase average inflow to Walker Lake by 50,000 acre-feet per year (af/yr). This objective was selected for impact analysis purposes based on several prior studies, which indicated that additional inflow of approximately this amount (over and above period-of-record inflow) would lead to significant reductions in Walker Lake TDS concentration.

For the action alternatives, the existing distribution of irrigated lands and information about acquisition trends were used to determine the expected percentage distribution by geographic area of water or water rights to be acquired. Percentages of irrigated acres by geographic area are shown in Table ES-1. Land, water appurtenant to land, and related interests in California would not be acquired because the enabling legislation only authorizes acquisitions of water rights appurtenant to land in Nevada.

Table ES-1. Distribution of Irrigated Lands

	Mason Valley	Smith Valley	East Walker	Total
Irrigated Acres	34,972	17,452	4,015	56,439
Percent	62%	31%	7%	100%

Note: Acreages represent 6-year averages for the years 1986, 1992, 1995, 1998, 2000, and 2002. (Yardas 2007)

Using these data, and considering the location of lands with appurtenant surface water rights that have been the subject of discussions with and offers by potential willing sellers to date, the following ranges of anticipated water acquisitions by subarea have been assumed:

- Mason Valley: 60 to 85%
- Smith Valley: 10 to 30%
- East Walker: 5 to 10%

These percentages represent the approximate portions of the 50,000 af/yr average additional Walker Lake inflow that are expected to be obtained from the respective geographic areas.

To further limit the potential impacts of Alternative 1 (Proposed Project) on agricultural land use and the agricultural economy in Mason Valley, Smith Valley, and the East Walker area, the University has stated they intend to make acquisitions that would result in no more than a 33% reduction in the irrigated acreage within each of these three geographic areas and Reclamation has prepared this Draft EIS to be consistent with that intent. It is also possible that a mix of alternatives could eventually be implemented, in which case the 50,000 af/yr increased inflow objective would be satisfied by a combination of fee purchases, water leases, and appropriate efficiency measures.

No Action Alternative

Under the No Action Alternative, land, water appurtenant to the land or related interests would not be acquired by the University. Water diversions would remain the same as under current operations, and the University would not use funds from Reclamation for an Acquisition Program to increase inflow of water to Walker Lake.

Alternative 1 (Proposed Project)

Alternative 1 (Proposed Project) would fund the University to provide water to Walker Lake by acquiring land, water appurtenant to land, and related interests from willing sellers in the Walker River Basin in Nevada. It is estimated that, on average, approximately 82,000 af/yr of surface water would need to be acquired from willing sellers in Mason Valley, Smith Valley, and the East Walker area in order to provide, on average, 50,000 af/yr of additional inflow to Walker Lake. The difference of 32,000 af/yr represents the combined effects of hydrologic losses (e.g., reduced contributions from groundwater, losses to riparian vegetation, and channel losses).

With the $56 million currently available for acquisitions, it is estimated that, on average, Alternative 1 (the Proposed Project) would secure approximately 11,900

af/yr in perpetuity at existing points of diversion on the Walker River, which in turn would increase inflow to Walker Lake by approximately 7,300 af/yr.

Based on inquiries and offers made to date, expected acquisitions from willing sellers can be grouped into the following general categories: whole farms or ranches, provisional water cards, stand-alone water rights, and other types of offers.

As of June 1, 2009, the University had entered into a total of seven option and purchase agreements with willing sellers to acquire water and water rights (and related interests) appurtenant to lands in Nevada.

To limit the potential impacts of Alternative 1 on agricultural land use and the agricultural economy in Mason Valley, Smith Valley, and the East Walker area, the University has stated they intend to make acquisitions that would result in no more than a 33% reduction in the irrigated acreage within each of these three geographic areas. Alternatively, or in addition, it is possible that a mix of alternatives could eventually be implemented, in which case the 50,000 af/yr increased inflow objective would be satisfied by a combination of fee purchases, water leases, and appropriate efficiency measures.

Alternative 2 (Leasing Alternative)

Alternative 2 (Leasing Alternative) is adapted from a program described conceptually by the Walker River Irrigation District (WRID) (Spooner pers. comm.). For this alternative, the WRID program would be modified to feature centrally administered surface water leases from individual willing sellers derived from water rights appurtenant to lands in Nevada. Although WRID's suggested program would lease water from willing participants throughout the Walker River Basin upstream of the Walker River Indian Reservation, Alternative 2 as presented in this Draft EIS would be limited to water derived only from water rights appurtenant to lands in Nevada, exclusive of reservation lands. In addition, WRID's proposal includes the concept of banking leased water (i.e., credit storing water acquired by lease for later release), but water banking is excluded from Alternative 2 in this Draft EIS because of uncertainties in how this concept would be implemented. Alternative 2, as evaluated in this Draft EIS, would involve surface storage, but with operations similar to those of the other action alternatives.

Alternative 2 would focus on purchases of water, not water rights. Water rights would be retained by existing owners, but all or a specific portion of the water associated with the rights would be committed for the duration of the lease period according to the terms of binding voluntary agreements. The agreements would involve individual water rights holders, WRID, and the leasing program administrator (if different from WRID); and all water leased would revert to the original rights holder following the end of the agreed-upon lease period.

Alternative 3 (Efficiency Alternative)

Alternative 3 (Efficiency Alternative) would involve program funding for conservation and water management improvements that could make water available for subsequent movement to Walker Lake. This alternative could include a variety of potential water conservation and efficiency measures at both the farm and system level that would reduce the amount of surface water conveyed or applied to lands with appurtenant surface water rights in the Walker River Basin in Nevada.

System efficiency measures would reduce losses in the conveyance of surface water from the point of diversion to the land where the water is used (i.e., to the farm headgate). On-farm efficiency measures would reduce the amount of water needed to serve crop evapotranspiration (ET) needs (and/or to reduce crop ET itself) from the farm headgate to the point of final demand. Some of these measures are already in effect in the Walker River Basin.

Summary of Impacts

The major adverse and beneficial impacts that would occur as a result of implementing the Proposed Project and other alternatives are summarized below. Minor impacts are not included. In addition, impacts are described generally and differences in duration of impacts between alternatives and differences caused by full versus existing funding are not discussed here, but can be found within the individual chapters of this Draft EIS. Table ES-2 summarizes and compares the impacts of the action alternatives. Differences in duration of impacts between alternatives and differences caused by full versus existing funding are not included.

Water Resources

Implementations of the Proposed Project and other alternatives, in combination with other related actions in the Walker River Basin, would result in impacts on water supply, groundwater, and water quality as described below.

Water Supply

Adverse impacts on water supply resulting from the Proposed Project and alternatives include reduced irrigation, reduced water supplies for remaining canal users from reduced canal flows, and reduced incidental availability of water from field runoff, seepage, or return flows. A decrease in groundwater recharge could affect water availability by decreasing the amount of water in storage in the groundwater basin. Beneficial impacts could occur to Walker Lake from increased inflow and to Walker River from increased river flow.

Groundwater

The Proposed Project and other alternatives could result in a decrease in groundwater recharge in the Walker River Basin. While recharge is expected to increase along the margins of the Walker River itself, decreased recharge is associated with reduced irrigation water application and is considered an adverse impact.

Water Quality

Land retirement and water conservation associated with the Proposed Project and other alternatives is expected to have an overall beneficial impact on water quality in Walker River as a result of higher instream flow, lower water temperature, increased dilution of poor quality inflow, decreased poor quality return flow, and reduced transport of nutrients and pesticides into receiving waters. Water quality in Walker Lake would be improved by increased inflow. Adverse impacts on water quality could occur from altering the movement of the Anaconda Mine groundwater or as a result of change in groundwater recharge, introduction of poor quality water (e.g., geothermal), and sedimentation from increased erosion from increased river flow and exposed soils.

Biological Resources – Vegetation and Wetlands

Implementation of the Proposed Project and other alternatives would result in the potential loss of riparian habitat in some areas (canals and drainage ditches) and a gain in valuable riparian habitat along the Walker River. Wetland areas associated with farmland and the south end of Walker Lake could decrease under the action alternatives; however, the loss would be somewhat offset by an increase in wetland habitat along the river as a result of increased flow. Wetland habitat below Schurz would especially benefit.

Implementation of the Proposed Project and other alternatives could result in the permanent or temporary conversion of cropland over time and could result in the spread of weeds and invasive plant species.

Biological Resources – Fish

Implementation of the Proposed Project and other alternatives would improve native fish habitat as a result of increased flow, reduced temperature, and increased Lahontan cutthroat trout (LCT) spawning habitat in the Walker River. The Proposed Project and other alternatives would also increase the survival of LCT and tui chub as a result of improved water quality in Walker Lake.

Biological Resources – Wildlife

Implementation of construction-related elements of Alternative 3, along with other projects such as WRID gage improvements and Weber Dam repair and

Table ES-2. Impact Summary for Proposed Project and Other Alternatives

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative		
			1	2	3
CH 3: Water Resources					
No Action Alternative	**Hydrologic Change HC-1: Alter Walker Lake Storage and Surface Area (Decrease)** Under the No Action Alternative, water resources in the Walker River Basin would likely change. For example, farmers may become more efficient with their use of water and groundwater levels may decline. If groundwater levels decline, river flows could also decline. Future hydrologic conditions will be affected by global warming (see Chapter 15, Climate Change). The effect of climate change on total runoff is uncertain, but it is likely to reduce the portion of precipitation falling as snow, cause the runoff pattern to shift to earlier in the year, and result in higher peak flows. A shift toward earlier runoff and/or higher seasonal peak flows could reduce surface water available for diversion during the irrigation season, but could be beneficial to Walker Lake because it may cause a greater percent of the runoff to reach the lake as a result of decreased river losses and decreased ability of water rights holders to divert flow. Climate change (warming) could also increase lake surface evaporation rates as well as both crop and non-crop ET rates, leading to increased demand for surface water and groundwater. Because the magnitude of each of these changes remains uncertain at this time, future water availability for irrigation and river flow was assumed to be similar to past water availability in this impact analysis. For this Draft EIS, the key changes associated with the No Action Alternative would be decreased storage, elevation, surface area, and water quality in Walker Lake. These hydrologic changes and impacts are discussed below.				

Table ES-2. Continued

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
	Impact WI-1: Alter Walker Lake Water Quality as a Result of Change in Lake Storage	D	Beneficial	Beneficial	Beneficial
	Impact WI-2: Decrease Down-Cutting in Lower Walker River as a Result of Increased Lake Surface Elevation	D	Beneficial	Beneficial	Beneficial
	Impact WI-3: Increase Erosion as a Result of Increased River Flow and Increased Exposed Soil	D	Adverse	Adverse	Adverse
	Impact WI-4: Increase Localized Flooding as a Result of Increased River Flow	D	Minor	Minor	Minor
	Impact WI-5: Improve River Water Quality as a Result of Increased Dilution of Poor Quality Inflows	D	Beneficial	Beneficial	Beneficial
	Impact WI-6: Diminish River Water Quality as a Result of Introduction of Water with Poor Quality	D	Minor	Minor	No Impact
	Impact WI-7: Reduce River Water Temperature as a Result of Increased Flow	D	Beneficial	Beneficial	Beneficial
	Impact WI-8: Reduce Groundwater Recharge and Elevation as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact)	I	Adverse	Minor	Adverse
	Impact WI-9: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge	I	Minor	Minor	Minor
	Impact WI-10: Reduce Water Supplies for Remaining Canal Users as a Result of Reduced Canal Flow	I	Minor	Minor	Minor

Table ES-2. Continued

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
	Impact WI-11: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flow	I	Minor	Minor	Minor
	Impact WI-12: Improve River Water Quality as a Result of Reduced Return Flow	I	Beneficial	Beneficial	Beneficial
	Impact WI-13: Decrease Quality of Stormwater Runoff as a Result of Construction-Related Activities	I	NA	NA	Minor
Hydrologic Changes					
HC-1	Alter Walker Lake Storage and Surface Area		Increase	Increase	Increase
HC-2	Reduce Irrigation as a Result of Acquisitions		Decrease	Decrease	No Change
HC-3	Increase River Flow		Increase	Increase	Increase
HC-4	Change in Amount of Groundwater Pumping		Increase or Decrease	Increase or Decrease	No Change

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
CH 4: Biological Resources—Vegetation and Wetlands					
No Action Alternative	Lake area and elevation would continue to decline and recede from wetlands at the south end of the lake. Erosion of the area along Walker River below Schurz would continue, causing wetland and riparian communities to decline further. Noxious weed invasion of riparian habitat in the lower Walker River, particularly the establishment of tamarisk, would likely increase.				
VEG-1	Loss of Wetland Communities at Alkali Lake WMA Caused by Acquisitions in Smith Valley	I	Adverse	Adverse	Adverse
VEG-2	Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Water Flow	I	Minor	Minor	Minor
VEG-3	Loss of Wetlands at South End of Walker Lake Caused by Increased Lake Surface Elevation	I	Minor	Minor	Minor
VEG-4	Loss of Wetland Communities in Irrigated Lands Caused by Curtailed Irrigation	I	Minor	Minor	Minor
VEG-5	Increase in Riparian and Wetland Habitat along the Mainstem Walker River Downstream from Schurz as a Result of Increased Flow	I	Beneficial	Beneficial	Beneficial
VEG-6	Loss of Special-Status Plants Caused by Changes in Hydrology	I	No Impact	NA	No Impact
VEG-7	Spread of Noxious and Invasive Weeds Caused by Reduction of Irrigated Agricultural Land	I	Adverse	No Impact	Adverse
VEG-8	Spread of Tamarisk Caused by Increased Flow in Walker River	I	Minor	Minor	Minor
VEG-9	Loss of Riparian and Wetland Habitat along Irrigation Canals and Drains Caused by System Efficiency Measures	D	NA	NA	Adverse

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
VEG-10	Loss of Riparian Habitat along Irrigation Canals and Drains Caused by System Efficiency Measures	I	NA	NA	Minor
VEG-11	Loss of Wetland Communities within Irrigated Lands Caused by On-Farm Efficiency Measures	I	NA	NA	Minor
CH 5: Biological Resources— Fish					
No Action Alternative	Lake volume and surface elevation would continue to decline and TDS concentration would continue to increase, likely surpassing 20,000 mg/l before 2050 and ultimately reaching well over 35,000 mg/l by the 2200. These TDS concentrations would cause mortality of LCT and tui chub.				
FISH-1	Improved Native Fish Habitat as a Result of Increased Flow in Walker River	D	Beneficial	Beneficial	Beneficial
FISH-2	Increase in Survival of LCT as a Result of Improved Water Quality in Walker Lake	D	Beneficial	Beneficial	Beneficial
FISH-3	Decrease in Water Temperature as a Result of Increased Flow in Walker River	D	Beneficial	Beneficial	Beneficial
FISH-4	Increase in Survival of Tui Chub as a Result of Improved Water Quality in Walker Lake	D	Beneficial	Beneficial	Beneficial
FISH-5	Increase in LCT Spawning Habitat as a Result of Reconnection of Walker Lake to Walker River	D	Beneficial	Beneficial	Beneficial
FISH-6	Increase in Growth and Survival of LCT as a Result of Increased Abundance of Prey Species	I	Beneficial	Beneficial	Beneficial
FISH-7	Potential Construction-Related Temporary Impairment of Fish Survival, Growth, or Reproduction by Accidental Spills or Polluted Runoff	D	NA	NA	Adverse

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
CH 6: Biological Resources—Wildlife					
No Action Alternative	Continued increase of TDS concentration would likely result in a decrease in the Walker Lake fishery, which provides important feeding grounds for migratory birds that feed on fish, such as special-status common loon and American white pelican. The collapse of the Walker Lake fishery would have an adverse impact on these bird species.				
WILD-1	Loss of Foraging Habitat for Wildlife Species as a Result of Fallowing, Field Rotation, or Retirement of Agricultural Lands	I	Adverse	Adverse	No Impact
WILD-2	Loss of Bird Nests along the Shore of Walker Lake and in Wetlands at the Southern End of Walker Lake Caused by Increased Lake Elevations	I	No Impact	No impact	No Impact
WILD-3	Impacts on Bird Species that Feed on Fish in Walker Lake	I	Beneficial	Adverse	Adverse
WILD-4	Increased Habitat for Wildlife Species Using Riparian and Wetland Habitat along the Mainstem Walker River Downstream of Schurz as a Result of Increased Flows	I	Beneficial	Beneficial	Beneficial
WILD-5	Impacts on Wildlife Species as a Result of the Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Flows	I	Minor	Minor	Minor
WILD-6	Potential Creation of Habitat for Pygmy Rabbit and Greater Sage Grouse as a Result of Retiring Agricultural Land	I	Beneficial	No Impact	No Impact
WILD-7	Loss of Foraging Habitat for Shorebirds and Wading Birds at Alkali Lake WMA as a Result of Acquisitions in Smith Valley	I	Adverse	Adverse	Adverse

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
CH 7: Land Use and Agriculture					
No Action Alternative	Population in Lyon County is expected to grow, which could change land use in Lyon County because increases in population sometimes create pressure to develop agricultural land. Population in Mineral County is expected to continue to decrease, which could reduce the number of occupied residences and commercial businesses. Use of public facilities would also be expected to decline. Land use conditions at the Walker Lake SRA would also be expected to decline as the lake elevation dropped.				
LU-1	Conflict with Requirements of the Farmland Protection Policy Act	D	No Impact	No Impact	No Impact
LU-2	Conflict with Lyon County and City of Yerington Land Use Policies	D	Adverse	No Impact	No Impact
LU-3	Conflict with Lyon County Master Plan Policies on Retaining Water Resources	D	Adverse	Adverse	Adverse
LU-4	Affect Productivity of Irrigated Agricultural Land	D	Adverse	Adverse	No Impact
LU-5	Comply with Land Use Goals in the Mineral County Master Plan	D	Beneficial	Beneficial	Beneficial
LU-6	Create Incompatible Land Uses as a Result of Invasive Plant Species Colonization on Retired Agricultural Land	I	Adverse	Adverse	No Impact
CH 8: Air Quality					
No Action Alternative	**Impact AIR-1: Change in Fugitive Dust Emissions from Declining Lake Elevation and Exposed Walker Lake Bed (Adverse)** Walker Lake elevation would decline further, exposing more submerged lake bed and creating the potential for increased windblown dust compared to the action alternatives.				

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
AIR-1	Change in Fugitive Dust Emissions from Declining Lake Elevation and Exposed Walker Lake Bed	D	Beneficial	Beneficial	Beneficial
AIR-2	Increase Fugitive Dust as a Result of Reduced Irrigation	D	Adverse	Minor	No Impact
AIR-3	Short-Term Increase in Vehicle Exhaust Emissions as a Result of Construction	D	NA	NA	No Impact
AIR-4	Short-Term Increase in Fugitive Dust as a Result of Construction and Vegetation Removal	D	NA	NA	No Impact
CH 09: Cultural Resources					
No Action Alternative	The elevation of Walker Lake would continue to drop to an estimated 3,900 feet by 2200. Cultural resources would remain relatively unchanged from present conditions. Alternative 1: no direct or indirect impacts Alternative 2: no direct or indirect impacts Alternative 3: impacts from construction measures would be identified after construction activities were determined. All activities would be reviewed to determine impacts on historic properties or archaeological resources.				
CH 10: Socioeconomics					
No Action Alternative	As indicated in the discussion of agricultural production in Lyon County above, the total cropland and acres planted with forage crops has remained relatively constant between 1987 and 2007 and a significant change to cropland acreage or crops is not expected under the No Action Alternative. However, within that same time period, the market value of agricultural products has increased substantially and will likely continue to increase especially if the recent growth in production and/or processing of onions, lettuce, and other higher-valued crops continues.				

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
	As indicated in Chapter 7, Land Use and Agriculture, land uses in the study area are not expected to change under the No Action Alternative. This conclusion, combined with the historic trend data, suggests that the amount of land under agricultural production in Lyon County is not expected to change substantially under the No Action Alternative. Because the amount of land under agricultural production is not expected to substantially increase or decrease, substantial changes in agriculture-related employment, personal income, or tax revenues are not expected. Because the condition of Walker Lake would continue to decline, economic activity in the vicinity of Hawthorne and Walker Lake attributable to recreation opportunities is expected to continue to decrease. As indicated in Chapter 11, Recreation, recreation opportunities associated with fish and wildlife at Walker Lake would continue to be adversely affected if the lake's elevation and water quality continue to decline. This would be an adverse socioeconomic impact. The continued decline in recreation-related opportunities at Walker Lake would result in an adverse impact on employment, personal income, and sales tax revenues in Mineral County.				
SOC-1	Change in Total Employment as a Result of Changes in Agricultural Production (Minor Adverse)		Minor	Minor	Beneficial
SOC-2	Change in Agricultural Employment as a Result of Changes in Agricultural Production (Adverse)		Adverse	Adverse	No Impact
SOC-3	Change in Employment as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial with Full Funding; No Impact with Existing Funding)		Beneficial	Beneficial	Beneficial
SOC-4	Change in Income as a Result of Changes in Agricultural Production (Minor Adverse)		Minor	Minor	No Impact

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
SOC-5	Change in Income as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial)		Beneficial	Beneficial	Beneficial
SOC-6	Change in Tax Revenues (Minor Adverse)		Minor	Minor	Beneficial
CH 11: Recreation					
No Action Alternative	The No Action Alternative would result in adverse impacts on recreation at Walker Lake in several ways: TDS concentration would continue to increase, which would further reduce the Walker Lake fishery, and LCT could no longer be stocked in the lake, effectively ending all sport fishing in Walker Lake; the collapse of the fishery would reduce the food supply for migratory birds, such as common loon, which would negatively affect festivals and recreation activities that center on fishing and migratory birds; higher TDS concentration would make recreational activities involving water contact, such as swimming, less desirable; and as more lake bottom became exposed the scenic quality of the lake environment would deteriorate, fugitive dust would negatively affect the recreation experience at the lake, and access to recreation facilities on the west shore would become more difficult. The No Action Alternative also would undermine progress toward and achievement of Mineral County's recreation-related goals.				
REC-1	Increase Consistency with Mineral County Recreation Policies	D	Beneficial	Beneficial	Beneficial
REC-2	Improve Sport Fishing Opportunities in Walker Lake as a Result of Improved Water Quality	I	Beneficial	Beneficial	Beneficial
REC-3	Improve Boating Access as a Result of Increased Flow to Walker Lake	I	Beneficial	No Impact	No Impact
REC-4	Improve Shoreline Recreational Use as a Result of Increased Flow to Walker Lake	I	Beneficial	Beneficial	Beneficial
REC-5	Increase in Other Recreational Experiences and Activities as a Result of Increased Flow to Walker Lake	I	Beneficial	Beneficial	Beneficial

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
REC-6	Improve Sport Fishing Opportunities in East Walker River, West Walker River, and Mainstem Walker River as a Result of Increased Flow to Walker Lake	I	Beneficial	Beneficial	Beneficial
CH 12: Indian Trust Assets					
No Action Alternative	Under the No Action Alternative, the trends of decreasing water elevation and increasing TDS concentration in Walker Lake would continue. This would adversely affect natural resources that WRPT has historically relied upon (i.e., vegetation, fish, and wildlife). Affected resources are described in detail in Chapter 4, Biological Resources – Vegetation and Wetlands; Chapter 5, Biological Resources – Fish; and Chapter 6, Biological Resources – Wildlife. The No Action Alternative would not affect water rights as established under the C-125 Decree, or land assets such as farmland, rangeland, or recreational land.				
ITA-1	Improve Habitats of Indian Trust Assets as a Result of Increased Flow to Walker Lake (Beneficial Impact)	D	Beneficial	Beneficial	Beneficial
ITA-2	Potentially Reduce Flexibility to Manage Weber Reservoir for Irrigation Purposes (No Impact)	D	No Impact	No Impact	No Impact
ITA-3	Reduce Groundwater Recharge and Elevation as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact) (See Alternative 1 Impact WI-5 in Chapter 3, Water Resources)	I	Adverse	Adverse	Adverse
ITA-4	Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact) (See Alternative 1 Impact WI-6 in Chapter 3, Water Resources)	I	Minor	Minor	Minor
ITA-5	Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flows (Minor Impact) (See Alternative 1 Impact WI-8 in Chapter 3, Water Resources)	I	Minor	Minor	Minor

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
CH 13: Environmental Justice					
No Action Alternative	**Impact EJ-1: Affect Employment of Minority and Low-Income Groups in Lyon County (No Impact)** There would be no direct environmental justice impacts under the No Action Alternative.				
EJ-1	Affect Employment of Minority and Low-Income Groups in Lyon County (No Impact)	I	Adverse	Adverse	Beneficial
EJ-2	Affect Use of Renewable Natural Resources for Subsistence (No Impact)	I	No Impact	No Impact	No Impact
CH 15: Climate and Climate Change					
No Action Alternative	**Direct Impacts:** Under the No Action Alternative, no development or transferring of land or water rights would occur in the Walker River Basin. Current operations of water pumping and delivery to land uses in the Walker River Basin would continue and could increase with anticipated increased water demands by the land uses, primarily agricultural land. Because GHG emissions are associated with the energy used for the current pumping or diverting of river water to land uses in the region, GHG emissions could increase, and a minor impact could occur. **Indirect Impacts:** Under the No Action Alternative water pumping and delivery from the Walker River system to land uses in the Walker River Basin				

Chapter/ Impact Number	Impact Title	Type of Impact (Direct or Indirect)	Alternative 1	Alternative 2	Alternative 3
	would continue and could increase with anticipated increased water demands by the land uses, primarily agriculture. Because natural carbon sinks are primarily related to the carbon uptake potential of the ocean and vegetation, no net increase or decrease in carbon sinks would result. Regional carbon sinks, therefore, are not anticipated to change. There would be no impact. Because albedo is connected to the reflectivity of land and its vegetated state, no net increase or decrease in albedo value would result. There would be no impact.				
CC-1	Change Emissions of Greenhouse Gas	D	Undetermined	Undetermined	Undetermined
CC-2	Change Regional Carbon Sinks Contributing to Global Climate Change	I	Minor	No Impact	No Impact
CC-3	Change Regional Albedo Contributing to Global Climate Change	I	Minor	No Impact	No Impact

modification, would result in some temporary construction-related impacts on wildlife. However, it is unlikely that these construction activities, which would be in different locations, would occur at the same time. Therefore, these temporary impacts would not result in adverse cumulative impacts.

Acquisitions that would temporarily or permanently remove cropland would result in a loss of foraging habitat for many wildlife species. Some habitat would also be lost that has been provided by existing farmland and riparian corridors along canals, in wetlands at the southern end of Walker Lake as that wetland submerges, and at Alkali Wildlife Management Area (WMA) if return flows are diminished. The Proposed Project and other alternatives would increase and improve wildlife habitat for birds and other species in other areas, primarily along the river corridor and Walker Lake itself.

Land Use and Agriculture

The Proposed Project and other alternatives conflict with Lyon County and City of Yerington land use policies for agricultural preservation, and conflict with the Lyon County Master Plan policy on retaining water resources within the county. Overall agricultural productivity is expected to decrease in the study area and weeds and invasive plant species could increase on retired or fallowed farmland. The Proposed Project and other alternatives would comply with land use goals in the Mineral County Master Plan to preserve and improve outstanding natural, historic, or scenic features in the county and to restore health and functioning to the county's natural resources.

Air Quality

Air quality impacts associated with the Proposed Project and other alternatives would include less fugitive dust at Walker Lake. While permanently retired agriculture lands would increase the amount of vacant land, which could become a potential source of fugitive dust during high wind events, current agricultural activities also result in the release of fugitive dust as a result of planting, plowing, burning, and off-road vehicle travel (e.g., tractors). Conversely, irrigated crops also tend to suppress dust erosion. Under Alternative 3, on-farm or construction activities for efficiency measures could increase temporary short-term dust emissions.

Cultural Resources

Implementation of Alternatives 1 and 2 would not result in ground-disturbing activity beyond current conditions or those that existed in recent history. Lake elevations would not exceed those recorded in the 1960s; therefore, cultural resources not previously inundated historically, or in the recent past, would not be newly inundated or adversely affected as a result of the Proposed Project and Alternative 2. Under Alternative 3, construction activities may affect cultural

resources. Conservation activity projects would be reviewed on a case-by-case basis to determine if these activities have the potential to affect historic properties should they be present and Reclamation cultural resources staff would determine what steps to take to comply with Section 106 of the National Historic Preservation Act (NHPA).

Socioeconomics

The Proposed Project and other alternatives would reduce agricultural and other employment, income, and tax revenues as a result of changes in agricultural production in Mason and Smith Valleys and the East Walker area. The Proposed Project and other alternatives could also result in an increase in public recreation opportunities, income from recreation, and recreation employment in the Walker Lake area. These impacts vary from temporary to permanent, depending on which alternative would be implemented.

Recreation

The Proposed Project and other alternatives would increase consistency with Mineral County recreation policies; and improve sport fishing opportunities, boating access, and other recreational activities at Walker Lake. Increased flow would improve other recreational activities such as sport fishing opportunities in East Walker River, West Walker River, and mainstem Walker River. Recreational resources that could be affected by the Proposed Project and other alternatives include camping, boating, fishing, hunting, hiking, and wildlife viewing in the proximity of the Walker River, Walker Lake, various WMAs (including the Mason Valley WMA and Alkali Lake WMA), public lands managed by Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service (USFWS), and the Walker River Indian Reservation.

Indian Trust Assets

The Proposed Project and other alternatives would improve habitats of fish, wildlife, and vegetation Indian trust assets (ITAs) in the lower Walker River on the present-day Walker River Indian Reservation and at Walker Lake, and would improve the Walker Lake ecosystem. However, adverse impacts on ITAs of the Yerington Paiute Tribe (YPT) could potentially occur as a result of reducing groundwater recharge and elevation, potential movement of the Anaconda Mine groundwater plume, and reducing incidental availability of water as a result of reduced field runoff, seepage, or return flows.

Environmental Justice

The Proposed Project and other alternatives could affect minority and low-income groups in Lyon County, including localized losses of agricultural employment and other services and employment for minority and low-income populations.

Chapter 1 Purpose of and Need for Action

Introduction

The U.S. Department of the Interior (DOI), Bureau of Reclamation (Reclamation) has prepared a Draft Environmental Impact Statement (EIS) for the proposed Walker River Basin Acquisition Program (Acquisition Program). This Draft EIS examines a Proposed Project and other alternatives for the Acquisition Program. Reclamation is providing funding to the University of Nevada System of Higher Education (University) for their Acquisition Program and research. The funding is provided through Reclamation's Desert Terminal Lakes Program, established in 2002 by Public Law (PL) 101-171.

In the past several years, Congress passed three pieces of legislation related to desert terminal lakes: PL 107-171 Section 2507; PL 108-7 Section 207; and PL 109-103 Section 208. The three public laws described below, together with the deteriorated environment of Walker Lake, provide the foundation for the Purpose and Need statement for this Draft EIS.

- PL 107-171 Section 2507 provided $200,000,000 to Reclamation to provide water to at-risk natural desert terminal lakes with the provision that the funds not be spent to purchase or lease water rights;
- PL 108-7 Section 207 clarified that the money provided in PL 107-171 could only be used for Pyramid, Summit, and Walker Lakes in Nevada; and
- PL 109-103, Title II, Section 208(a) established the purposes for which $70 million in funds provided through Reclamation are to be used by the University:

  TITLE II, DEPARTMENT OF THE INTERIOR
  Bureau of Reclamation
  General Provisions, Department of the Interior
  SEC. 208.

  (a) (1) Using amounts made available under section 2507 of the Farm and Security Rural Investment Act of 2002 (43 U.S.C. 2211 note; Public Law 107-171), the Secretary [of the Interior] shall provide not more than $70,000,000 to the University of Nevada–

  (A) to acquire from willing sellers land, water appurtenant to the land, and related interests in the Walker River Basin, Nevada; and

  (B) to establish and administer an agricultural and natural resources center, the mission of which shall be to undertake research, restoration, and educational activities in the Walker River Basin relating to–

  (i) innovative agricultural water conservation;

(ii) cooperative programs for environmental restoration;

(iii) fish and wildlife habitat restoration; and

(iv) wild horse and burro research and adoption marketing.

(2) In acquiring interests under paragraph (1)(A), the University of Nevada shall make acquisitions that the University determines are the most beneficial to–

(A) the establishment and operation of the agricultural and natural resources research center authorized under paragraph (1)(B); and

(B) environmental restoration in the Walker River Basin.

Background

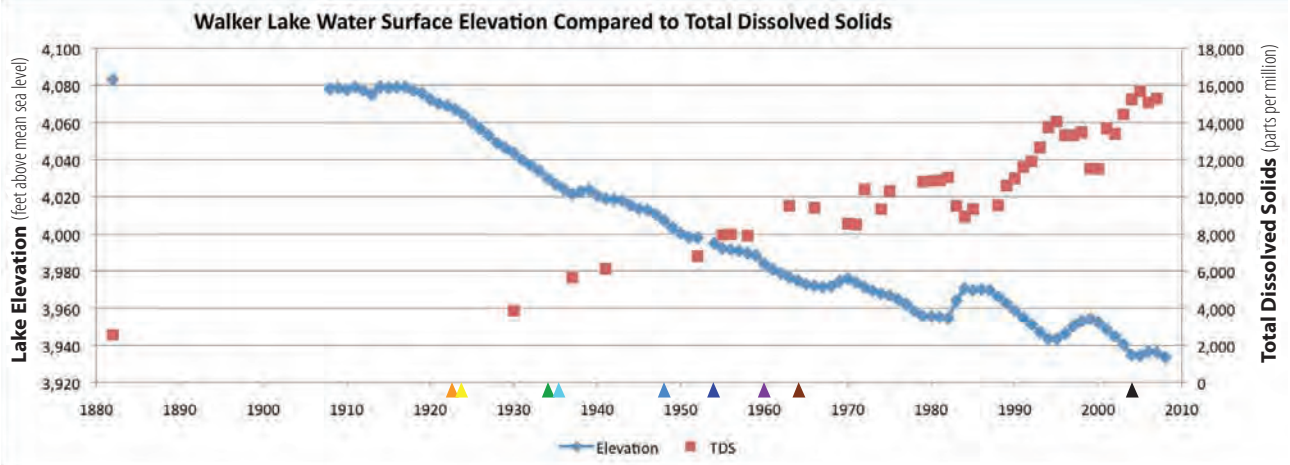
Walker River originates in the eastern portion of the Sierra Nevada in California, flows into eastern Nevada, and empties into Walker Lake in Nevada. Walker Lake is a terminal lake; i.e., it has no outlet. The lake is located in a watershed that supports significant agriculture activity.

From 1882 to present, diversions from the river, primarily for upstream irrigated agriculture, have resulted in a 149-foot drop in the lake's surface elevation and a corresponding reduction in volume from about 10 million acre-feet (af) to less than 2 million af of water (Figure 1-1). The river is over-allocated, meaning that not all demands on the river can be met, even in normal water years, and irrigated agriculture consumes a significant part of the river upstream. As a result, in most years there is little or no inflow into Walker Lake.

Consequent changes in Walker Lake over time have resulted in generally poor water quality, with very high total dissolved solids (TDS), alkaline pH, and major ion chemistry (University of Nevada, Reno and Desert Research Institute 2009). The decline in lake elevation has caused the TDS concentration to increase from approximately 2,500 milligrams per liter (mg/l) in 1882 to nearly 16,000 mg/l in December 2008. Walker River has very low TDS and increased river flow over a sufficiently long period of time should lower Walker Lake TDS (University of Nevada, Reno and Desert Research Institute 2009).

The existing high TDS levels in Walker Lake have threatened the lake's viability as a fishery and have far reaching impacts on the health of the lake and its associated ecosystems. Public concern over the declining lake elevation and resulting declines in the water quality and ecology of the lake led to Congressional legislation intended to address the lake's problems, as described above in the Introduction section of this chapter.

Under the language of PL 109-103 Section 208 (a), Reclamation is directed by Congress to provide funding to the University for the Acquisition Program and



Source: Data gathered by USGS

Year	Event
1852	Irrigation Begins
▲ **1922**	Topaz Reservoir Completed
▲ **1923**	Bridgeport Reservoir Completed
▲ **1934**	Weber Reservoir Completed
▲ **1936**	C-125 issued
▲ **1948**	Carp die out
▲ **1953**	C-125 adopted; Lahontan Cutthroat Trout (LCT) stocked
▲ **1960**	Designated groundwater
▲ **1963**	Perch die out
▲ **2004**	100% mortality of acclimated stocked Lahontan Cutthroat Trout (LCT); Tui chub unable to spawn 2004

Source: Sharpe et al. 2008, 8.

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Figure 1-1
Timeline for Walker Lake from 1882 to 2008

research. Reclamation anticipated that the Acquisition Program could have significant impacts in the Walker River Basin and began preparation of an EIS with public review and comments to provide for full public disclosure of potential adverse and beneficial impacts. The scope of this Draft EIS is limited to reflect the specific direction given Reclamation in the Public Law. A range of acquisition alternatives that meet the Public Law direction were developed for analysis.

As noted, the legislation directs Reclamation to provide funding to the University for the Acquisition Program. The University is currently exploring how the Acquisition Program will be implemented, including the potential involvement of other entities that have experience in developing and implementing environmental water transaction programs. (The University has already entered into agreements with other entities to assist in development of the Acquisition Program; however, an amendment to the legislation would be required if any part of the funding provided through Reclamation were to go directly to another entity.) However, the potential impacts of the Acquisition Program described in this Draft EIS are expected to be the same no matter what entity(s) implements the Acquisition Program. Accordingly, wherever the term "University" is used in this Draft EIS, it refers to the University as well as any other potential entities that may be involved in implementation efforts.

Purpose and Need Statement

The lead federal agency preparing an EIS must prepare a Purpose and Need statement per 40 Code of Federal Regulations (CFR) § 1502.13. The requirements are that "the statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action."

Reclamation developed the following Purpose and Need statement for this Draft EIS responding to direction in the applicable Desert Terminal Lakes Public Laws:

> *The purpose of the Walker River Basin Acquisition Program is to provide water to Walker Lake, an at-risk natural desert terminal lake in Nevada, by acquiring, from willing sellers, land, water appurtenant to the land, and related interests in the Walker River Basin in Nevada; and to make acquisitions that are the most beneficial to environmental restoration in the Walker River Basin. The Acquisition Program is needed to implement section 208(a) of PL. 109-103 in accordance with section 2507 of PL 101-171 (as amended) and section 207(a)(1) of PL 108-7.*

Draft EIS Process

The primary purposes of this Draft EIS are to inform the public and the Acquisition Program implementers about the potential adverse and beneficial environmental impacts associated with the Acquisition Program and to provide a forum for public input. The steps involved in this Draft EIS process are described briefly below.

- **Step 1: Notice of Intent—**The Notice of Intent (NOI) was published in the *Federal Register* to inform the public and other agencies that an EIS would be prepared (Appendix 1A).
- **Step 2: Public Scoping—**During public scoping, agencies, Tribes, and the public were asked to comment on the Proposed Project, alternatives to the Proposed Project that meet the established Purpose and Need, and what elements of the environment should be analyzed in the EIS. Public scoping meetings held for this Proposed Project are described in Chapter 16, Consultation and Coordination.
- **Step 3: Impact Analysis—**The objective of the impact analysis is to estimate the nature, severity, and duration of adverse and beneficial impacts that might occur from the alternatives and to compare the impacts of each. Alternatives are actions, including the Proposed Project, that meet the identified Purpose and Need of the Acquisition Program. A No Action Alternative (i.e., not implementing the Proposed Project or other alternative) is also included for analysis and comparison of impacts.

  Mitigation measures for adverse impacts were not developed for the Draft EIS because the legislation does not give Reclamation express decision-making authority for design of the Acquisition Program; therefore, the impacts displayed in this Draft EIS are the impacts that would occur without any mitigation.

  The University has indicated they plan to implement the Acquisition Program in a manner that maximizes the potential for increasing inflow to Walker Lake while minimizing the potential for adverse impacts on agricultural communities. Details of likely mitigation measures have not yet been formulated. Many of the University and Desert Research Institute (DRI) Walker Basin Project studies were specifically designed to inform the Acquisition Program implementation in a manner to help sustain the economy, ecosystem, and lake. These studies are discussed below under Related Research Projects. Examples of such research include studying low-water-use alternative crops, re-establishing desirable vegetation on lands that may no longer be irrigated for agriculture, and formulating economic development actions that could help mitigate potential adverse economic impacts.

- **Step 4: Draft EIS—**The Draft EIS is provided for public review so that the public and other interested parties are given an opportunity to comment on the content of the EIS before it is finalized. A Notice of Availability is issued in the *Federal Register* for the Draft EIS with notification of public hearings. Public hearings are held to provide information on the Draft EIS to affected communities and other interested parties and gather comments on the Draft EIS analysis.
- **Step 5: Final EIS—**When the Final EIS is published, it includes responses to the comments made on the Draft EIS. Changes may be made to the EIS based on these comments if determined appropriate by Reclamation.

A Record of Decision (ROD) is the final step in the National Environmental Policy Act (NEPA) process for an EIS. The ROD is the federal decision made on the range of alternatives addressed in the EIS. During the EIS process the authorizing legislation limits Reclamation's decision-making discretion for development of alternatives and mitigation requirements, design of the Acquisition Program, and selection of an alternative. The legislation directs that the University determines how the Acquisition Program is to be implemented. Reclamation's directed role is to provide funding to the University for those purposes.

Throughout the EIS process, Reclamation has evaluated whether a NEPA document was required for the action of providing federal funding as directed in the legislation, since there is no federal decision to be made. A federal agency can decide to do a NEPA document even when it is not required. Reclamation decided that developing an EIS was appropriate to disclose potential adverse and beneficial impacts of the proposed Acquisition Program. and to allow for public comment to be incorporated into the EIS for consideration by implementers of the Program.

In late 2008, DOI revised its regulations for implementing NEPA (43 CFR Part 46 "Implementation of the National Environmental Policy Act (NEPA) of 1969 Final Rule); the rule was finalized on November 14, 2008. Section 46.100 (a) of these regulations states:

> *"A bureau proposed action is subject to the procedural requirements of NEPA if it … is subject to bureau control and responsibility (40 CFR 1508.18). The determination of whether a proposed action is subject to the procedural requirements of NEPA depends on the extent to which bureaus exercise control and responsibility over the proposed action and whether Federal funding or approval are necessary to implement it.* ***If Federal funding is provided with no Federal agency control as to the expenditure of such funds by the recipient, NEPA compliance is not necessary.*** *" [Emphasis added]*

This Draft EIS was prepared by Reclamation for the action of providing funding to the University for their implementation of the Acquisition Program. Reclamation does not exercise control or responsibility over the proposed action, is not approving the action, and does not have control over the expenditure of federal funds by the recipient. While NEPA compliance is therefore not required per the new DOI regulations, Reclamation decided that completing the EIS would be appropriate and responsible given the high level of public interest and the commitment by Reclamation throughout the EIS process to disclose potential impacts and provide the opportunity for public comment.

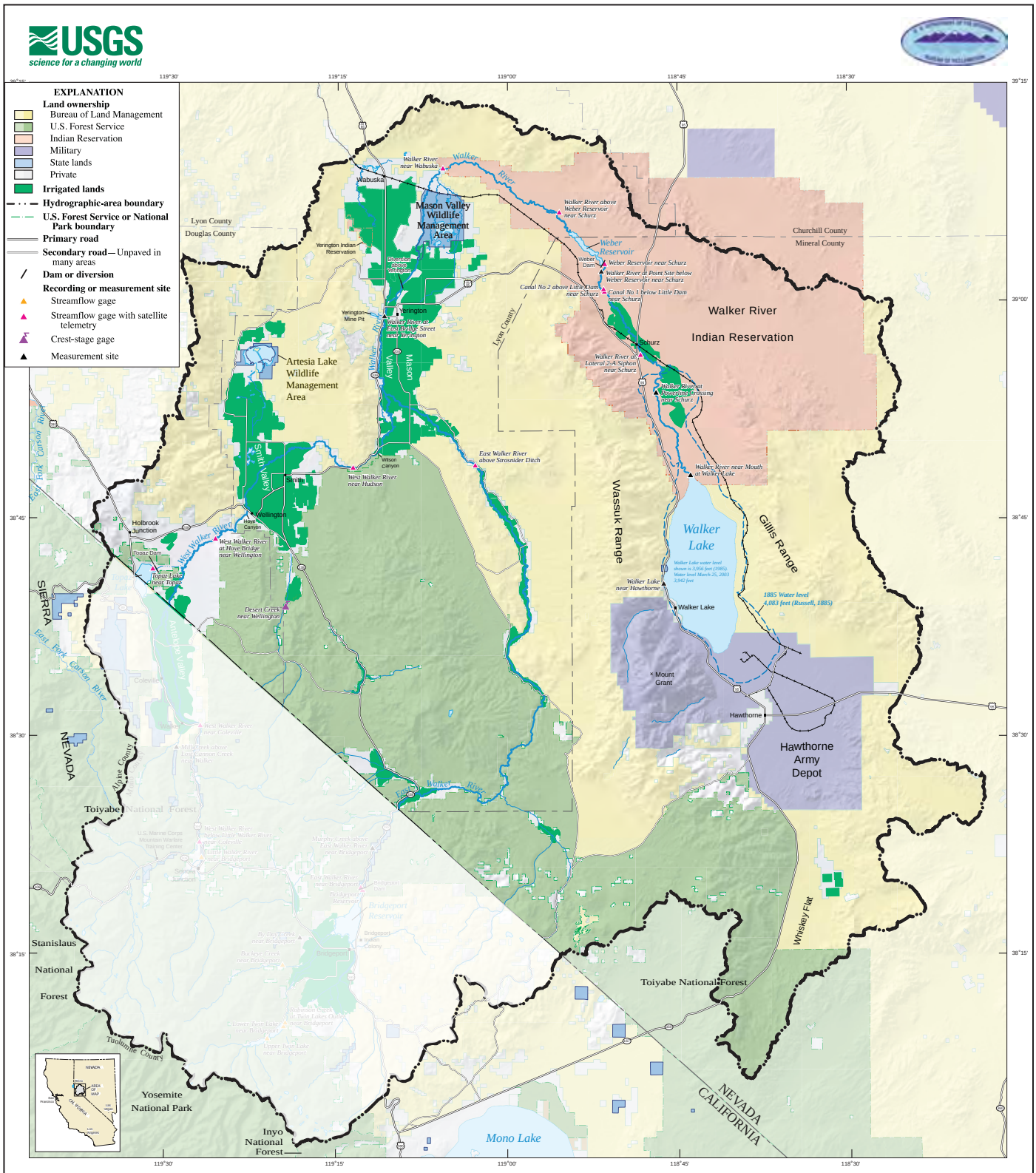
In looking more closely at the legislation in light of the new DOI regulations, Reclamation has determined that issuing a ROD for the EIS as part of the NEPA process is neither required nor appropriate. The decision was made that Reclamation does not have decision-making authority for the Acquisition Program, does not have an ability to meaningfully influence the action, and is only the funding conduit for the entity that does. There is no federal agency discretion involved in the design or implementation of the Acquisition Program, nor are there any environmental consequences that result from a federal agency decision.

Public hearings on the Draft EIS will be held and public comment will be incorporated into a Final EIS. The Draft EIS will be completed to provide information on analysis of impacts for both public interest and for consideration by the University that is designated in the legislation to make the decisions on the implementation of the Acquisition Program.

Geographic Scope and Setting of the Acquisition Program

The Walker River Basin encompasses approximately 4,050 square miles in east-central California and west-central Nevada (Lopes and Smith 2007) (Figure 1-2 and Figure 1-3). The basin is situated in five counties: Mono County in California; and Douglas, Lyon, Mineral, and Churchill Counties in Nevada. The Walker River consists of the West Walker River (the larger fork), East Walker River, and mainstem Walker River, which flows into Walker Lake. Water diversions from the Walker River, primarily for irrigation, sustain the agricultural economies and communities in the basin.

The project area as described in the Draft EIS refers to the Nevada portion of the Walker River Basin. The California portion of the basin accounts for 25% of the basin area (Lopes and Smith 2007), and is not part of the project area or included in the Acquisition Program. No land in California, water appurtenant to that land, or related interests would be acquired through the Acquisition Program. This Draft EIS addresses the environmental setting and environmental impacts for



SELECTED FEATURES OF THE WALKER RIVER BASIN, CALIFORNIA AND NEVADA
2003

Figure prepared for Bureau of Reclamation by U.S. Geological Survey
Note: Although acquiring water rights from California is not a part of the project, impacts on California will be analyzed.

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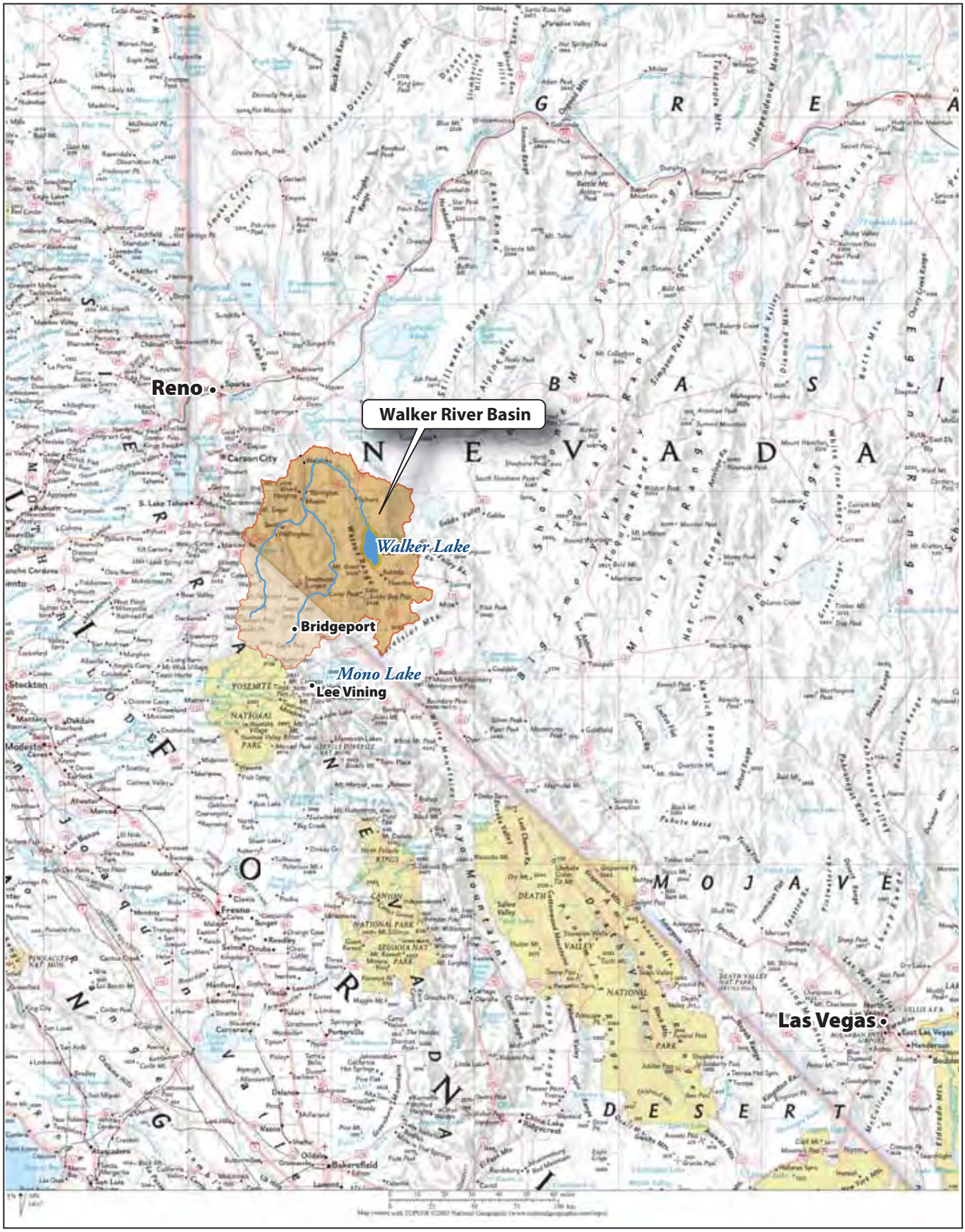
Figure 1-2
Walker River Basin
(only Nevada portion is in the Project Area)



00516.07 Walker River Basin Restoration Project

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Figure 1-3
Project Vicinity

Lyon and Mineral Counties in Nevada. Douglas and Churchill counties would not be affected by the Proposed Project or other alternatives.

West Walker River and Valleys

The West Walker River originates in the Sierra Nevada in Antelope Valley near the town of Walker in Mono County, California. From its headwaters it flows north and then east past Topaz Lake Reservoir, an off-stream reservoir that straddles the California-Nevada state line. From there it flows across the southern corner of Douglas County, Nevada and then into Hoye Canyon in Lyon County. The West Walker River enters Smith Valley near the towns of Smith and Wellington (Yardas 2007).

From Wellington the West Walker River enters Wilson Canyon and exits at the southern end of Mason Valley. From there it flows north to its confluence with the East Walker River near Yerington, which is the county seat of Lyon County (Yardas 2007).

East Walker River and Valley

The East Walker River originates in the Sierra Nevada south of Bridgeport, California and flows in a northeasterly direction through Bridgeport Valley and Bridgeport Reservoir. Downstream of Bridgeport Reservoir it flows into Lyon County in Nevada, and from there through the East Walker River Canyon to its confluence with the West Walker River in southern Mason Valley (Yardas 2007).

Mainstem Walker River

From the confluence of the East and West Walker Rivers, the mainstem Walker River flows north through Mason Valley, including the Mason Valley Wildlife Management Area (WMA), to its northernmost point near the town of Wabuska. From there it turns abruptly east, then south, as it flows around the northern end of the Wassuk Range and then enters the Walker River Indian Reservation. It continues downstream into Weber Reservoir, which straddles the Lyon-Mineral County line, and then flows past Schurz to its terminus at Walker Lake near Hawthorne (Yardas 2007).

Walker Lake

Walker Lake is a desert terminal lake located near Hawthorne, Nevada. It is bounded on the west by the steeply rising Wassuk Range and on the east by the Gillis Range. The lake is formed by a depression in a broad north-northwest trending fault zone called Walker Lane (Lopes and Smith 2007).

The lake’s elevation was 3,934 feet above mean sea level (msl) in December 2007, compared to 4,083 feet above msl in 1882 (Sharpe et al. 2008). Decreased lake volume and depth have adversely affected the Walker Lake ecosystem, while

increased TDS concentration, increased water temperature, and decreased dissolved oxygen have contributed to changes in nutrient cycling, biotic communities, and the extent and quality of fish habitat (Sharpe et al. 2008). Walker Lake currently supports stocked populations of Lahontan cutthroat trout (LCT) (*Oncorhynchus clarkii henshawi)*, a federally listed threatened fish species once native to the lake and the Walker River system. There is a self-sustaining resident population of Lahontan tui chub (*Gila bicolor)*, a critical food source for the lake's LCT population and for migratory fish-eating birds like the common loon (*Gaver immer*) and white pelican (*Pelicanus erythrophynchos*) (Sharpe et al. 2008). If conditions continue to decline, neither LCT nor tui chub will be able to survive in Walker Lake, and eventually the lake could become like Mono Lake, hosting brine flies and brine shrimp (Sharpe et al. 2008).

Related Research Projects

Several agencies are conducting research related to the Acquisition Program and the Walker Basin's ecology and economy. These research projects are described below. Other projects occurring in the Walker River Basin that are not primarily research are described in the Chapter 14, Cumulative Impacts.

Desert Research Institute and University of Nevada, Reno

A large-scale integrated research program was established by DRI and the University in order to enact an ecologically and economically sustainable program of water acquisitions. The $11 million research program was funded by the Reclamation Desert Terminal Lakes Program. The goal this Walker River Basin research was to provide the hydrologic, ecologic, economic, and agricultural data needed to inform decisions related to water acquisitions (University of Nevada, Reno and Desert Research Institute 2009).

The research program was developed in response to direction provided in the federal legislation. Specifically, DRI and the University were funded to 1) develop a method to optimize the purchase of water rights in the Walker River Basin, 2) evaluate options for practicing alternative agricultural practices, and 3) evaluate the impacts that water removal from crop-irrigated lands would have on the spread of invasive plants, aquatic and terrestrial ecosystems, and the local economy.

A brief summary of the research conducted under the Walker Basin Project is summarized below.

- Health of Walker River and Lake—Evaluate and establish a benchmark for the environmental and ecological health of Walker Lake and Walker River and develop decision tools to analyze the efficacy of different water acquisitions.

- Alternative Agriculture and Vegetation Management—Identify the economic potential and cultural practices necessary for low-water-use crops and evaluate methods to re-establish desirable vegetation on lands that may no longer be irrigated.
- Plant, Soil, and Water Interactions—Assess responses by soils and vegetation to changes in water application and use. Information will aid managers in the preservation of air and water quality adjacent to and within the river and lake itself.
- Project Historical Account—Provide an overview of the political and historic context for the acquisition of land and associated water rights for ecosystem restoration in the Walker River system.
- Health of River Channel and Lake Water with Increased Flows—Develop recommendations to minimize further sediment and salt loading to Walker Lake and degradation to the lower Walker River under increased water flows.
- Water Flow Model—Develop a decision-support model as a tool to evaluate the effectiveness of acquisition of water rights from willing sellers to increase water delivery to Walker Lake.
- Water Conservation Practices for Agriculture Producers—Determine the most economically effective use of water on agricultural lands and provide producers with an estimate of the potential amount of water rights they may be able to offer to the market for lease or sale.
- Economic Impact and Strategies—Develop estimates of the economic impacts projected to occur from the acquisition of water rights and changes in agricultural production and land use and formulate economic development actions to mitigate the projected economic impacts.
- GIS Database Development—Develop a geographic information system (GIS) framework for linking water rights with water distribution networks and points of diversion for the Walker River Basin. The GIS database includes properties, businesses, and local demographics close to the Walker River and its tributaries.

U.S. Fish and Wildlife Service Research

The U.S. Fish and Wildlife Service (USFWS) is also conducting research related to the Walker River Basin using funding provided under PL 109.103 Section 208 (c) for the Desert Terminal Lakes Program.

- USFWS Walker River Restoration Program—USFWS is conducting research in the Walker River system to understand the current and historic ecological conditions. The research will be compiled in a Biophysical Assessment of

the Walker River system and will help guide and prioritize future restoration actions and be used to monitor the impacts of restoration activities.

- USFWS Walker Lake Fishery Improvement Program— USFWS, Walker River Paiute Tribe (WRPT), and Nevada Department of Wildlife (NDOW) are developing and implementing a monitoring plan to understand how the lake's ecosystem and native fishery are responding to changes in lake surface elevation, river inflow, and salinity. Year two of the 5-year monitoring plan is underway.

U.S. Geological Survey Research

The Walker River Basin Study, USGS Nevada Water Science Center, was developed because a watershed-based understanding of the quantity and hydrology of water resources in the Walker River Basin is necessary to evaluate alternatives for supplemental flows. Currently, there are large unknowns in some portions of the hydrologic system, including ungaged tributaries, evapotranspiration (ET) losses from riparian vegetation, the water budget for Walker Lake, and interactions between surface water (streams and rivers, canals, drains) and groundwater. This study is designed to further constrain these unknowns so that the consequences of water management alternatives to Walker Lake can be better predicted.

The study addresses the following objectives:

- Quantify the volume of natural streamflow in the Walker River Basin and determine the percentage of that streamflow by hydrographic area.
- Determine ET losses from natural riparian vegetation.
- Develop an improved water budget for Walker Lake.
- Develop the capability to predict how changes in irrigation practices in and below Mason Valley will affect flow in the lower Walker River.

To accomplish these objectives, USGS is studying the Walker River Basin, with emphasis on the river stretch in the northern part of the basin, downstream from Wabuska to Walker Lake. The study includes the following tasks:

- Task 1: Establish new and improved surface water stations.
- Task 2: Measure ET.
- Task 3: Develop a water budget for Walker Lake.
- Task 4: Model surface water and groundwater interactions.

Issues Identified during Public Scoping

During the EIS scoping process, public comments were received covering many areas of issues and concerns regarding the Acquisition Program. These issues, which were used to establish the scope of the analysis in this Draft EIS, are summarized below.

- **Groundwater Impacts**—Issues related to recharge and losses from additional streamflow, lack of recharge as a consequence of removing water from currently irrigated lands, and lack of recharge in currently used delivery canals when water is removed. These issues relate to availability of water for domestic users and farmers reliant on groundwater, already lowered water tables causing additional loss of transferred water, and impacts on the environment along unused delivery systems.
- **Economic Impacts**—Issues ranging from the impacts of decreasing agricultural production in Smith and Mason Valleys to the impacts on communities around Walker Lake from not taking action to provide water to the lake. Concerns about impacts on agriculture varied; however, most commenters asked that impacts that accrue on Mason and Smith Valley communities as a whole also be addressed. These impacts include agricultural production as a whole, farm labor, farm equipment and related maintenance businesses, fuel businesses, power service businesses, seed and fertilizer businesses, grocery stores, other service-based businesses, county tax revenues, and community services like police and fire protection. Comments also addressed the economic impacts on communities that rely on Walker Lake and the taxes and revenues generated from tourism and recreation that would be lost if additional flow is not provided to the lake.
- **Ability of Acquisition Program to Meet Goals and Potential Hidden Agendas**—Issues pertaining to the questions of the usefulness of providing water to the lake, quantity of water needed to restore Walker Lake, what will happen to the acquired water if the Acquisition Program is not successful, what assurances are in place to ensure the acquired water makes it to Walker Lake once it is transferred, who will own and maintain the acquired water, and whether the water would be legally transferred under Nevada water law. Concerns regarding the ability of the Acquisition Program to account for acquired water under the existing management and water accounting structure were raised. Concerns also were raised about whether short-term leasing would be more beneficial than the permanent acquisition of water rights. Concerns were also raised about whether the water is really intended for Las Vegas or Los Angeles.
- **Physical Environment Issues in Mason and Smith Valleys and Lyon County**—Issues relating to increased dust and its control, increased noxious weeds, loss of wildlife habitat for wildlife using agricultural fields and irrigation ditches, water quality impacts attributable to lowering groundwater

tables, sedimentation rates and changes in channel geomorphology, changes in delivered volumes of water because of changes to number of users on a particular ditch system, changes in riparian vegetation densities and distribution, changes in hydrology and water resources, and impacts of global warming on future water availability.

- **Physical Environment Issues near Walker Lake and in Mineral County**—Issues relating to declining environmental conditions for fish in the Walker River and Walker Lake and migratory waterfowl that depend on Walker Lake, worsening conditions from windblown dust at Walker Lake as the lake elevation decreases, and worsening water quality in Walker Lake.
- **Impacts in California**—Issues related to impacts that might occur in California if the distribution of water rights were changed.
- **Statutory Authority**—Issues regarding statutory authority focused on the need to address all desert terminal lakes legislation as amended in a more comprehensive manner. This included analyzing all of PL 109-103 Section 208, rather than just the Acquisition Program, including establishment and operation of an agricultural and natural resource center. In addition, commenters asked that Reclamation clarify who is in charge of the Acquisition Program and its relation to NEPA. Additional comments asked that Reclamation define environmental restoration as included in PL 109-103, and questioned the development of the Purpose and Need statement and authority for water-only acquisitions versus land and water acquisitions.
- **Consider Other Sources than Acquiring Agricultural Water or other Methods to Provide Water or Improve Conditions of Walker Lake**—Issues related to other means of improving the ecology of Walker Lake, including importing groundwater from other basins (e.g., Whiskey Flats, Rawhide Flats), importing surface water (e.g., Cottonwood Canyon), using wastewater or geothermal or mining effluent, leasing water upstream in California, incorporating water acquisitions from Ammunition Depot, acquiring water rights in the Hawthorne area only, allowing private purchase, including all communities in the Walker River Basin, including California water, considering Walker River Irrigation District's (WRID's) lease/water bank alternative, rotating fields and let fallow every 7 years, developing a water market using a local/state/water contractors partnership to enhance management of water, developing reservoirs for capturing flood event flows for future use, implementing water conservation measures, upgrading the delivery system to prevent loss to groundwater, installing a dike across a portion of the lake to create a salinity barrier, enforcing and monitoring all water diversions and wells and provide saved water to Walker Lake, cementing the riverbed, implementing water harvesting techniques such as desalination and cloud seeding, mandating that WRPT share water, creating an outlet to Walker Lake so the lake can clean itself, and oxygenating Walker Lake.

- **Miscellaneous Issues Raised**—Comments suggested mandating two federal water masters rather than one and locating them in an office other than WRID, defining restoration as water for WMAs and wetlands, mandating that farmers who will not share water live at Walker Lake for 4 years, declaring emergency status for addressing the Walker Lake surface elevation, exclude bed and banks from going back to Walker River Paiute Tribe, add pipeline to Las Vegas, and reduce lake elevation.

Organization of Draft EIS

The organization of this Draft EIS is outlined below.

- The **Executive Summary** provides a condensed comparison of the alternatives and summarizes the major conclusions, areas of controversy, and issues to be resolved.
- **Chapter 1, Purpose of and Need for Action** provides project background, describes the EIS process, and defines the Purpose of and Need for the Proposed Project. The chapter also lists related research and identifies public scoping issues.
- **Chapter 2, Alternatives** describes the No Action Alternative, the Proposed Project (Alternative 1), and two other action alternatives: the Leasing Alternative (Alternative 2) and the Efficiency Alternative (Alternative 3). This chapter lists the alternatives eliminated from further consideration and identifies why they were eliminated. Chapter 2 also describes the Walker River Decree and the process for acquiring water rights in the Walker River Basin.
- **Affected Environment and Environmental Impacts** are described for each resource section in the chapters below:
  - **Chapter 3, Water Resources**
  - **Chapter 4, Biological Resources—Vegetation and Wetlands**
  - **Chapter 5, Biological Resources—Fish**
  - **Chapter 6, Biological Resources—Wildlife**
  - **Chapter 7, Land Use and Agriculture**
  - **Chapter 8, Air Quality**
  - **Chapter 9, Cultural Resources**
  - **Chapter 10, Socioeconomics**
  - **Chapter 11, Recreation**
  - **Chapter 12, Indian Trust Assets**

Chapter 2 Alternatives

Introduction

Reclamation is directed in PL 109-103, Title II, Section 208(a) to provide funding to the University for their Acquisition Program and associated research. As noted in Chapter 1, Purpose of and Need for Action, wherever the term "University" is used in this Draft EIS, it refers to the University as well as other potential entities that may be involved in implementation of the Acquisition Program. The University's Acquisition Program would provide water to Walker Lake by acquiring water from willing sellers in the Walker River Basin in Nevada. Alternatives that meet the purpose and need identified for the Acquisition Program are discussed in this chapter. Funding for acquisitions is assumed to be the same for each alternative; however, the alternatives differ in the method by which water (and related interests) would be acquired. Alternatives were developed with input from public comment, tribal consultation, and Cooperating Agencies. A No Action Alternative is also identified.

No Action Alternative

Under the No Action Alternative land, water appurtenant to the land, or related interests would not be acquired by the University. Water diversions would remain the same as current operations, and the University would not use funds from Reclamation for an Acquisition Program to increase inflow of water to Walker Lake.

Action Alternatives

Objective of All Action Alternatives

The objective of all action alternatives is to acquire sufficient water from willing sellers to increase average inflow to Walker Lake by 50,000 af/yr. This objective was selected based on several prior studies, which indicated that additional inflow of approximately this amount (over and above period-of-record inflow) would lead to significant reductions in Walker Lake TDS concentration. Please see Chapter 3, Water Resources, for additional information.

Assumptions Applicable to All Action Alternatives

Acquisitions would be negotiated by the University from offers from willing sellers. It cannot be determined in advance where specific acquisitions would occur. Although several purchase option agreements described below are now in place, there is no guarantee that they will all be implemented either in whole or in part. In order to analyze potential impacts of the Acquisition Program, Reclamation developed the assumptions described below.

Acquisition Trends

Most of the willing sellers who have expressed interest to the University are located in Mason Valley and, to a lesser extent, in the East Walker area and Smith Valley.

Expressions of interest have come from agricultural and geothermal water users and a developer. Based on interest expressed to date, this analysis assumes that nonagricultural acquisitions would be minimal, although the geothermal offer represents a potentially sizeable amount of water.

Geographic Distribution of Acquisitions

The existing distribution of irrigated lands and information about acquisition trends were used to determine the expected distribution by geographic area of water or water rights to be acquired. Using satellite imagery collected periodically between 1986 and 2002 (Yardas 2007, Appendix A), DRI estimated the acreage of irrigated lands in the East Walker, Smith Valley, and Mason Valley subareas of the Walker River Basin in Nevada. Percentages of irrigated acres by geographic area are shown in Table 2-1. Land, water appurtenant to land, and related interests in California would not be acquired because the enabling legislation only authorizes acquisitions of water rights appurtenant to land in Nevada.

Table 2-1. Distribution of Irrigated Lands

	Mason Valley	Smith Valley	East Walker	Total
Irrigated Acres	34,972	17,452	4,015	56,439
Percent	62%	31%	7%	100%

Note: Acreages represent 6-year averages for the years 1986, 1992, 1995, 1998, 2000, and 2002. (Yardas 2007)

Using these data, and considering the location of lands with appurtenant surface water rights that have been the subject of discussions with and offers by potential willing sellers to date, the following ranges of anticipated water acquisitions by subarea are assumed:

- Mason Valley: 60 to 85%
- Smith Valley: 10 to 30%
- East Walker: 5 to 10%

These percentages represent the approximate portions of the 50,000 af/yr average additional Walker Lake inflow that are expected to be obtained from the respective geographic areas. Although it is theoretically possible that acquisitions could be made in areas of the Walker River Basin in Nevada that lie outside of Mason Valley, Smith Valley, and the East Walker areas (such as underground water in basins near Walker Lake, and water from Mt. Grant), this is not expected and is not analyzed in this Draft EIS.

Measurement and Monitoring

Under all action alternatives, it is assumed that institutional arrangements would be put in place, in coordination with the federal Water Master and other jurisdictional entities, to measure and monitor surface water diversions and groundwater withdrawals associated

with acquisition transactions and agreements. Costs associated with implementing such arrangements would be covered as necessary by existing and/or future acquisition funding.

Program Administration

As noted in Chapter 1, Purpose of and Need for Action, the legislation directs Reclamation to provide funding to the University for the Acquisition Program; however, other potential entities may be involved in implementation efforts. Wherever the term University is used in this chapter it refers to the University as well as the other potential entities. Administration of the Acquisition Program would involve all aspects of program implementation, including but not limited to negotiating and exercising acquisition agreements, seeking all necessary water rights change approvals and agreements, and making decisions about the utilization of acquired water rights.

Acquisition Considerations

The University could consider the following factors in their acquisitions should the potential water offers exceed available funding:

- type, seniority, and constraints of the water rights involved in the acquisition;
- proximity of point of diversion to Walker Lake;
- amount of water offered;
- costs and potential difficulties involved in acquiring and making use of the land, water appurtenant to the land, and related interests;
- potential benefits to environmental restoration in the Walker River Basin;
- potential for conflict with other owners or users of property and water rights;
- potential for conversion from agricultural to urban land uses within one year of acquisition of appurtenant water rights; and
- other potential risks or liabilities associated with the offer.

Change in Point of Diversion, Place, or Purpose of Use

The process to formally change the point of diversion, place, or purpose of use of acquired water rights would depend on the type of water or water rights involved. For example, changes for decreed natural flow diversion rights would require the University to get approvals from Nevada State Engineer (NSE) and the U.S. District Court of Nevada, which has continuing jurisdiction under the Walker River Decree. Changes for storage water would likely require WRID, NSE, and federal court approvals as well as California State Water Resources Control Board (SWRCB) approvals. Changes for state-permitted groundwater would require NSE approvals. Changes for state-permitted water that is surface water would require NSE approval and WRID concurrence.

Once a change has been approved, the federal Water Master and/or WRID would be responsible for administering those rights. The Water Master has day-to-day

responsibilities for apportioning and distributing natural flow and storage waters in coordination with WRID, ditch companies, and other water right holders.

Coordination or agreements with Bureau of Indian Affairs (BIA) and WRPT would also be needed to ensure that water acquired upstream of the Walker River Indian Reservation would benefit Walker Lake. The University would work with the Water Master, WRPT, and BIA to provide for timely releases of acquired water from Weber Reservoir and to ensure that the water is delivered to Walker Lake. Effective implementation of the Acquisition Program would require development and employment of an operations plan for Weber Reservoir to ensure that use of decreed water rights in the Walker River Indian Irrigation Project are not impaired and to protect the safety of the downstream community.

Reservoir Operations

Under all action alternatives, Bridgeport Reservoir and Topaz Lake Reservoir operations would not change significantly because acquired storage water rights would still be expected to be exercised during the irrigation season in accordance with past patterns of use. Operating criteria for these reservoirs would not be changed by the Acquisition Program, and the reservoirs would continue to be operated in accordance with the WRID Operations Manual, California water rights licenses (as amended for the new proposed place and purpose of use), and the Walker River Decree C-125.

An operating agreement would be required for Weber Reservoir to manage both acquired and other water (including water associated with WRPT's decreed water rights and any flows in excess thereof) from the expected point of delivery at the Wabuska gage to the lower Walker River and Walker Lake. An operating agreement for Weber Reservoir would likely include the following concepts (Strekal pers.comm.):

- purpose, principles, objectives;
- governance, communication, and coordination;
- physical and safety constraints of hydraulic infrastructure and downstream river channel;
- dam safety and flood control operating criteria;
- emergency response procedures;
- relationships between inflow and releases under specified conditions;
- timing of releases for delivery to Walker River Indian Irrigation Project;
- timing of releases of water dedicated to Walker River Basin environmental restoration or Walker Lake;
- timing considerations for delivery efficiency (i.e., minimizing channel losses);
- maximum release rate to limit potential downstream erosion;
- storage targets for irrigation season; and
- water accounting, points of delivery, measurement, monitoring, and reporting.

Alternative 1 (Proposed Project)

Alternative 1 (Proposed Project) would fund the University to provide water to Walker Lake by acquiring land, water appurtenant to land, and related interests from willing sellers in the Walker River Basin in Nevada.

Potential Types of Acquisitions

Based on inquiries and offers made to date, expected acquisitions from willing sellers can be grouped into the following general categories: whole farms or ranches, provisional water cards, stand-alone water rights, and other types of offers.

Whole Farms or Ranches

These acquisitions would involve the sale of an entire farm or ranch; i.e., offers that include land, water appurtenant to the land, and related interests (including improvements).

Provisional Water Cards

Provisional water cards are maintained by WRID for individual water users for WRID assessment purposes. Typically, provisional water cards describe the different types, amounts, and priority dates of the surface water rights associated with particular parcels of land, including decreed natural flow direct diversion rights and apportioned storage water rights. Provisional water cards also identify the major ditches through which surface waters are diverted to serve the associated water rights, as well as legal descriptions, claim numbers, user numbers, recorded document histories, and comments. While the information included on provisional water cards is no substitute for adequate chain-of-title analyses to confirm the ownership of offered water rights, the cards are used by most sellers to represent the water rights they believe they own as well as which of those rights (if not all) they are willing to sell.

Stand-Alone Water Rights

Water rights that are not grouped together with other types of rights (e.g., primary groundwater rights) could be offered with or without the land to which they are appurtenant.

Other Types of Offers

The University would consider other types of acquisition opportunities not yet encountered, such as long-term agreements to lease water appurtenant to the land, if and when such offers were made.

Any of the above types of acquisitions could include a variety of related interests such as wells, pumps, equipment, irrigation works, water conveyance or drainage infrastructure, buildings, or other improvements, as well as easements or rights-of-way.

Types of Water Rights That Could Be Acquired

Potentially, offers could include one or more of the following types of water rights or water derived from those rights:

- decreed natural flow diversion rights appurtenant to lands in Nevada, such as rights to divert water for irrigation purposes;
- storage rights held by WRID for supplemental use on lands with decreed natural flow diversion rights and for primary use on other "New Lands" in Nevada (New Lands are lands within WRID boundaries [Figure 2-1] without appurtenant decreed natural flow diversion rights);
- primary or supplemental groundwater rights appurtenant to lands in Nevada for which NSE has issued permits and certificates to individual landowners;
- state-certified surface water rights held by WRID and exercised when available for distribution to individual users within its boundaries to supplement other water supplies (the water associated with these rights is generally referred to as "state permit water", but does not appear on WRID water cards; these supplies are also referred to as flood, surplus, or excess water);
- drainage or tailwater rights appurtenant to lands in Nevada that have been issued to individual land owners by NSE, offered in conjunction with primary water rights, although it is unlikely that such rights could be changed for use at Walker Lake; and
- geothermal groundwater rights documented by permits and certificates issued by NSE.

Option Agreements

As of June 1, 2009, the University had entered into a total of seven option and purchase agreements with willing sellers to acquire water and water rights (and related interests) appurtenant to lands in Nevada (Figure 2-2). These agreements involve the potential acquisition of up to:

- 43.6 cfs of decreed natural flow direct diversion water and water rights appurtenant to 3,549 acres of land,
- 1,366 af/yr of supplemental storage water and water rights appurtenant to the same 3,549 acres of land,
- 854 af/yr of New Land storage water and water rights appurtenant to 514 acres, and
- 7,000 af/yr of geothermal groundwater and water rights.

Appendix 2A provides additional details on each of these agreements, which are summarized in Table 2-2 below.

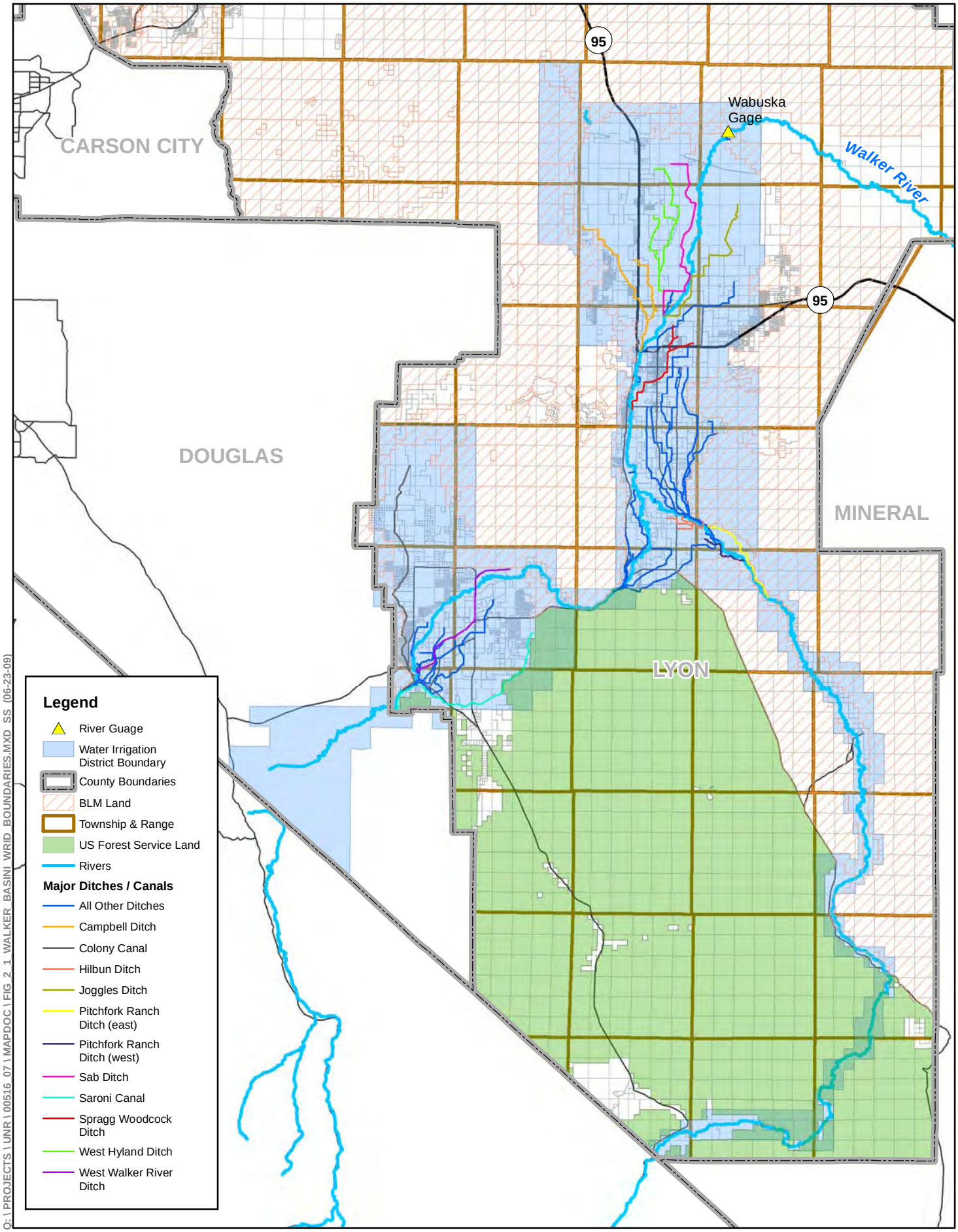

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Figure 2-1
Walker Basin Project
WRID Boundary

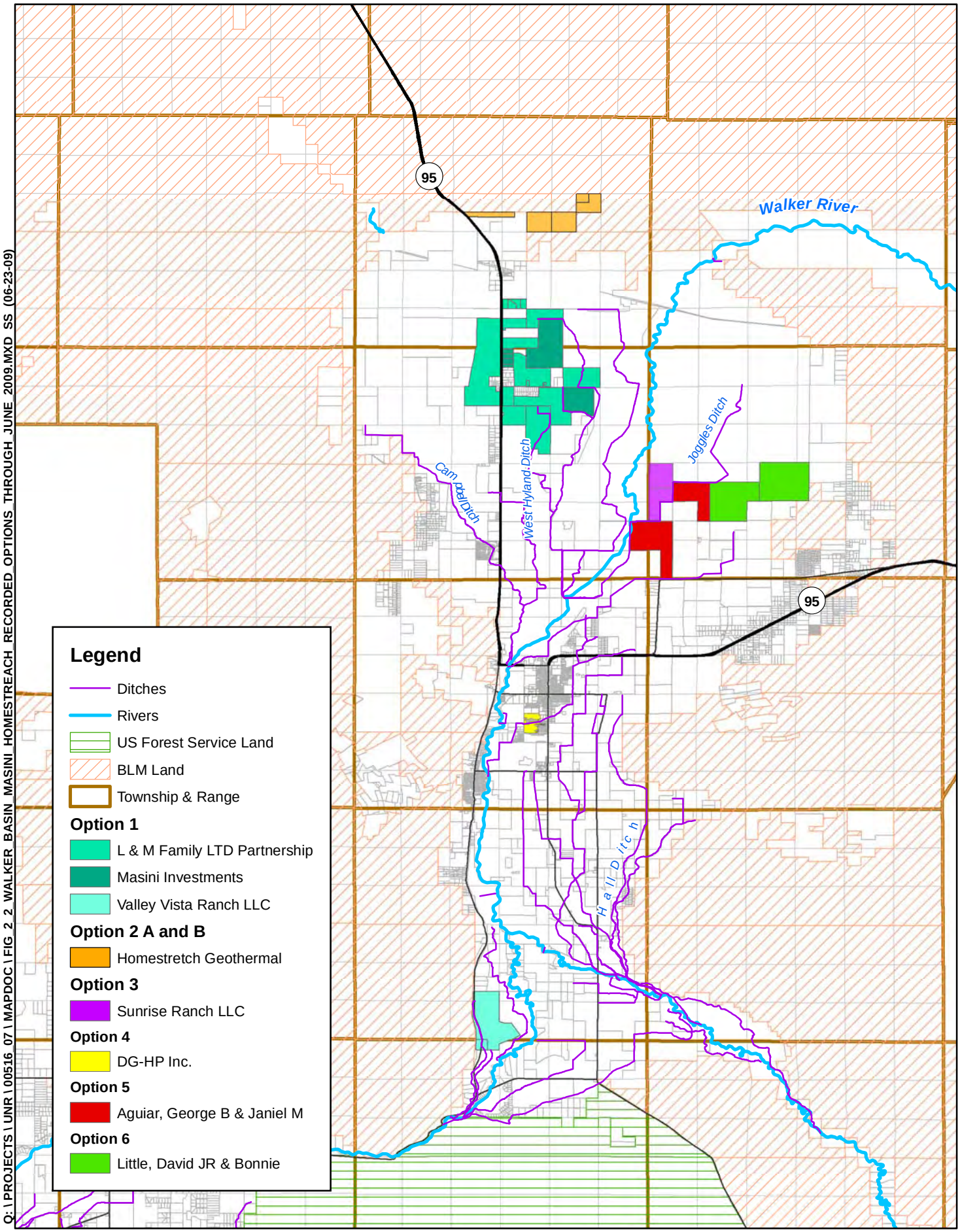

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Figure 2-2
Walker Basin Project
Recorded Option Agreements through June 2009

Table 2-2. Summary of Alternative 1 Water Rights Purchase Options

	Offered				Not Offered	
	NF Decree cfs	Sup Storage af/yr	New Land af/yr	Primary GW af/yr	Decree Acres	New Land Acres
Option 1	19.751	474.3	484.1	–	1,561	263
Option 2A-B	–	–	–	7,000	–	–
Option 3	3.312	149.2	191.5	–	276	124
Option 4	1.808	37.9	7.5	–	150	5
Option 5	8.844	359.3	170.8	–	738	122
Option 6	9.888	345.6	–	–	824	–
	43.603	1,366.3	854.0	7,000	3,549	514

Walker Lake Inflow Associated with Acquisitions and Funding

As discussed in Chapter 3, Water Resources, it is estimated that, on average, approximately 82,000 af/yr of surface water would need to be acquired from willing sellers in Mason Valley, Smith Valley, and the East Walker area in order to provide, on average, 50,000 af/yr of additional inflow to Walker Lake. The difference of 32,000 af/yr represents the combined effects of hydrologic losses (e.g., reduced contributions from groundwater, losses to riparian vegetation, and channel losses).

Chapter 1, Purpose of and Need for Action, describes the legislative origins of the Acquisition Program and indicates that $70 million was provided for acquisitions and research. Of this amount, the University allocated not more than $14 million for research and related program development, and reserved not less than $56 million for acquisitions from willing sellers and related costs.

With the $56 million currently available for acquisitions, it is estimated that, on average, Alternative 1 (the Proposed Project) would secure approximately 11,900 af/yr in perpetuity at existing points of diversion on the Walker River, which in turn would increase inflow to Walker Lake by approximately 7,300 af/yr. This estimate is based on the assumptions listed below and described more fully in Appendix 2B.

- Approximately 10% of acquisition funds would be reserved for transactional support activities and other related costs.
- Acquired surface water rights would yield, on average, approximately 50% of their maximum face value across all types and priorities at existing points of diversion.
- Unit fee acquisition costs would equal, on average, the negotiated offer prices described in public summaries of recorded provisional water card option agreements (all subject to appraisal).

- NSE and the U.S. District Court would allow the transfer of up to the average amount of water historically diverted per irrigated acre of water rights acquired as described in the full transfer scenario in Chapter 3, Water Resources.
- Various estimated physical losses would occur between the existing points of diversion and Walker Lake (see Chapter 3, Water Resources).

An alternative basis for estimating increased Walker Lake inflow under existing funding would be to limit changes to acquired natural flow rights to a consumptive use component, with changes to storage rights based on the full amount of the water right acquired less an amount needed to keep ditch systems whole. Using the average acquisition cost assumptions noted above, it is estimated that existing funds would allow for the acquisition of natural flow water rights appurtenant to approximately 3,876 decree acres, along with primary storage rights from approximately 561 New Land acres. If average annual consumptive use rates for irrigated lands average about 2.77 af/acre across all three subareas, and a 20% loss rate or ditch system charge is assumed for New Land storage rights with a weighted-average allocation of 1.66 af/acre, Alternative 1 would secure approximately 11,500 af/yr in perpetuity at existing points of diversion. This consumptive use-based estimate is only 3% less than the average yield-based estimate noted above, a difference that is likely within the range of uncertainty associated with either method of analysis. (See Appendix 2B for additional details.)

It should be noted that the above estimates are derived from cost and yield assumptions based exclusively on provisional water card offers under existing option agreements. If optioned geothermal groundwater effluent is included in the above calculations, the expected amount of water available at existing points of diversion (and/or at a point of delivery near the Wabuska gage) would increase to almost 15,000 af/yr under current funding. Both this factor and other considerations (e.g., the possibility that average unit acquisition costs could end up lower than those assumed depending on the results of appraisals) could lead to a higher inflow at Walker Lake than the 7,300 af/yr average noted above.

Finally, sufficient funding to purchase enough water to increase Walker Lake inflow by an average of 50,000 af/yr is referred to as “full funding” in this Draft EIS. Applying the quantitative relationships between funding and increased inflow at Walker Lake described above, it is estimated that full funding of Alternative 1 would require up to $385 million in 2008 dollars. This estimate, described more fully in Appendix 2B, was developed to facilitate analysis of environmental consequences in this Draft EIS. Actual funding cost would depend on many variables.

Limit on Reduction in Irrigated Lands

To limit the potential impacts of Alternative 1 on agricultural land use and the agricultural economy in Mason Valley, Smith Valley, and the East Walker area, the University intends to make acquisitions that would result in no more than a 33% reduction in the irrigated acreage within each of these three geographic areas (James pers. comm.). This Draft EIS is consistent with that intent. Alternatively, or in addition, it is possible that a mix of alternatives could eventually be implemented, in which case the 50,000 af/yr increased inflow objective would be satisfied by a combination of fee purchases, water leases, and appropriate efficiency measures.

Program Administration

All water rights acquired by the University would be managed and administered for the benefit of Walker Lake subject to any conditions or requirements imposed by approving regulatory authorities.

Required Applications, Agreements, and Approvals

Under Alternative 1, the place of use for the acquired water rights would be transferred by the University or its designee to the lower Walker River and Walker Lake in order to best accommodate deliveries to the new expected point of diversion at the Wabuska gage. Depending on the type of water rights acquired, such transfers may involve:

- submitting change applications to NSE, the Walker River decree court, WRID, and/or the California SWRCB as appropriate with regard to the point of diversion and the place, manner, and purpose of use of the particular rights at issue;
- obtaining a discharge permit from Nevada Division of Environmental Protection (NDEP) for the discharge of cooled geothermal effluent to the Walker River; and
- negotiating agreements with BIA, WRPT, and other parties as needed to ensure the delivery of water to satisfy the exercise of the water rights acquired for the benefit of Walker Lake (see Reservoir Operations, above).

While Alternative 1 would only involve the acquisition of water rights that are already permitted for use in Nevada, any proposed use of stored water from Bridgeport or Topaz Lake Reservoirs that would occur outside of WRID boundaries, or for purposes other than irrigation (or recreation in the case of Bridgeport Reservoir, or domestic use in the case of Topaz Lake Reservoir), would require approval by SWRCB, WRID, and the U.S. District Court for the District of Nevada. Compliance with the California Environmental Quality Act (CEQA) would also be required.

Alternative 2 (Leasing Alternative)

Alternative 2 (Leasing Alternative) is adapted from a program described conceptually by WRID (Spooner pers. comm.). For this alternative, the WRID program would be modified to feature centrally administered surface water leases from individual willing sellers derived from water rights appurtenant to lands in Nevada. Although WRID's suggested program would lease water from willing participants throughout the Walker River Basin upstream of the Walker River Indian Reservation, Alternative 2 as presented in this Draft EIS would be limited to water derived only from water rights appurtenant to lands in Nevada, exclusive of reservation lands. In addition, WRID's proposal includes the concept of banking leased water (i.e., credit storing water acquired by lease for later release), but water banking is excluded from Alternative 2 in this Draft EIS because of uncertainties in how this concept would be implemented. Alternative 2, as evaluated in this Draft EIS, would involve surface storage, with operations similar to those of the other action alternatives.

Similar to WRID's water leasing proposal(s), Alternative 2 would focus on purchases of water, not water rights. Water rights would be retained by existing owners, but all or a

specific portion of the water associated with the rights would be committed for the duration of the lease period according to the terms of binding voluntary agreements. The agreements would involve individual water rights holders, WRID, and the leasing program administrator (if different from WRID); and all water leased would revert to the original rights holder following the end of the agreed-upon lease period.

Funding for Alternative 2 is assumed to be similar to Alternative 1, and estimates have been prepared that indicate how long water could be leased under both available and full funding in order to achieve the same increased inflow objective. Program funding will also be driven by federal appropriations, which are only available for expenditure as authorized, so the use of financial arrangements to perpetuate funding into the future, as has been suggested, has not been analyzed in this Draft EIS.

Types of Water Rights for Leased Water

Potentially, all types of surface water (e.g., water derived from the exercise of decreed natural flow diversion rights and storage water rights) would be eligible for enrollment under agreements for renewable or rotating terms of 3 to 5 years each. Leases of surplus or excess water associated with WRID's state permit water rights might also be possible; however, these rights would be leased directly from WRID (if offered) and would not be included in the annual participation agreements with individual willing sellers.

Walker Lake Inflow Associated with Acquisitions and Funding

As indicated above for Alternative 1, an estimated 82,000 af/yr would need to be acquired at the point of diversion to increase Walker Lake inflow by an average of 50,000 af/yr. This estimate, based on analysis of average water flows and diversions, applies equally to Alternative 2 and the results are not expected to vary significantly whether based on the average expected yield analysis or the consumptive use analysis described under Alternative 1 above.

As discussed more fully in Chapter 3, Water Resources, with existing funding of $56 million, less an estimated 10% for indirect costs, approximately 250,000 af of surface water could be purchased, based on an average assumed lease cost of slightly over $200 af/yr in 2008 dollars at existing points of diversion. This unit price is an estimate based on best currently available information and does not reflect actual costs that may be paid. Based on these assumptions, and applying the average physical loss rates from above (i.e., 5,000 af/yr at Walker Lake for every 8,200 af/yr acquired upstream), existing funding would be sufficient to implement Alternative 2 for about 3 years while continuing to achieve the objective of increasing average inflow by 50,000 af/yr. If average lease costs were closer to $100 af/yr, the leasing program could last for nearly 6 years while providing an average of 50,000 af/yr of increased inflow at Walker Lake. Conversely, if average lease costs were closer to $300 af/yr, the leasing program could only last for about 2 years while meeting the 50,000 af/yr objective.

If the $385 million full funding amount described above for Alternative 1 (inclusive of the assumed 10% set-aside) were instead available to implement Alternative 2, the leasing program would be expected to last for approximately 20 years at an average lease cost of $200 af/yr.

Limit on Reduction in Irrigated Lands

The self-imposed limit by the University on reduction of irrigated land, described above for Alternative 1, also would apply in the aggregate to Alternative 2. It should, however, be noted that individual leases would be based on temporary agreements, and thus participating lands would only be enrolled (i.e., not irrigated) for 3- to 5-year periods at a time, at which point newly enrolled lands would replace those that return to irrigated production so long as sufficient funds and willing sellers remained to support such new enrollments.

Program Administration

The amount of water produced by the leases on a year-to-year basis would depend on factors such as spring snowpack, storage conditions, and projected runoff. Annual lease payments would be based on the amount of water actually provided, rather than on the face value or average yield of the water rights. Annual payments would be structured to provide for an initial payment early in the year based on projected deliveries, and a final payment or adjustment at the end of the year would be based upon actual deliveries under the program.

The leasing program administrator would:

- develop and oversee enrollment in the program to achieve program objectives, including maintaining a waiting list of any willing sellers to replace those who may wish to opt out;
- be responsible for determining both the expected and actual amount of water leased by the program each year and for making lease payments to participants;
- coordinate with the federal Water Master and WRID to ensure upstream reservoirs are operated in a manner consistent with the purpose and objectives of the program within the constraints of existing operating requirements; and
- coordinate with BIA, WRPT, and other parties as needed to ensure the delivery of leased water to Walker Lake.

Required Applications, Agreements, and Approvals

It is anticipated that temporary changes in the point of diversion or the place, manner, and purpose of use of water rights involved in the leasing program would be sought based upon relevant provisions of Nevada water law (e.g., NRS 533.345 and/or NRS 533.0243), along with annual approvals from WRID. Because there is no provision for temporary changes to water rights under U.S. Board of Water Commissioners (USBWC's) 1996 Administrative Rules and Regulations, modifications to the Decree (e.g., recurrent 1- to 3-year changes) would also likely be needed. The potential to enter into programmatic approvals based on conformance with Nevada water law and USBWC's 1996 Administrative Rules and Regulations likely would be explored to facilitate implementation of Alternative 2.

Alternative 3 (Efficiency Alternative)

Alternative 3 (Efficiency Alternative) would involve program funding for conservation and water management improvements that could make water available for subsequent movement to Walker Lake. This alternative would feature a variety of potential water conservation and efficiency measures that would reduce the amount of surface water conveyed or applied to lands with appurtenant surface water rights in the Walker River Basin in Nevada.

Types of Efficiency Measures

There are two general categories of potential measures: system efficiency measures and on-farm efficiency measures.

System efficiency measures would reduce losses in the conveyance of surface water from the point of diversion to the land where the water is used (i.e., to the farm headgate). These measures could include:

- upgrading delivery systems to reduce water conveyance losses;
- lining canals with concrete,;
- replacing surface conveyances with underground conveyances;
- consolidating canals, laterals, and ditches;
- automating head gates to maintain constant and reliable flows;
- improving and consolidating diversion works; and
- implementing phreatophyte control measures, including the removal of vegetation such as tall whitetop and tamarisk in or along ditches and canals.

On-farm efficiency measures would reduce the amount of water needed to serve crop ET needs (and/or to reduce crop ET itself) from the farm headgate to the point of final demand. These measures could include:

- lining farm ditches with concrete;
- replacing farm ditches with underground pipelines;
- laser-leveling farm fields;
- changing from flood to sprinkler or drip irrigation;
- shifting to crops that use less water;
- improving irrigation management and scheduling; and
- installing tailwater pump-back, recovery, and recycling systems.

Some of the above measures are already in effect in the Walker River Basin. For example, as of early 2007, Natural Resources Conservation Services (NRCS) had entered into more than 85 conservation program agreements with Lyon and Mineral County landowners to implement land, irrigation, and other farm system improvements under a

variety of conservation programs authorized by the 1996 and 2002 Farm Bills (Yardas 2007). While similar agreements with individual landowners could play an important role going forward, it may also be the case that improved system efficiencies would present the greatest opportunities for conserving significant quantities of water, in part because large system efficiencies would be easier to administer and manage than numerous small farm-by-farm measures.

Walker Lake Inflow Associated with Increased Efficiencies

As discussed in Chapter 3, Water Resources, the water balance analysis developed for this Draft EIS indicates that an average of 50,000 af/yr of additional inflow to Walker Lake could only be achieved through agricultural water conservation and efficiency measures if all water withdrawals were translated into existing crop use with 100% efficiency in Mason Valley, Smith Valley, and the East Walker areas. This level of efficiency is unrealistic as it means there would be no losses of water in conveyance or irrigation throughout these agricultural areas. The existing overall level of water efficiency in the three acquisition areas, defined as the ratio of crop ET to the amount of surface water diverted and groundwater pumped, is approximately 50%. Assuming that a more reasonable, but still ambitious, 75% level of water efficiency could be achieved, it is estimated that, on average, Alternative 3 could deliver 32,300 af/yr of additional inflow to Walker Lake, based on existing crop ET rates. It is estimated that achieving this amount of additional inflow with Alternative 3 would require water savings in Mason Valley, Smith Valley, and the East Walker area totaling slightly more than 100,000 af/yr, assuming no change from existing crop ET rates.

As suggested above, and as supported by research conducted by Curtis et al. (2009), there may be considerable potential in the Walker River Basin for converting from existing conventional crops such as alfalfa to alternative crops that use less water, as a means to make water available for Walker Lake without taking the land out of production. For example, by reducing total crop ET by an estimated 15% in Mason Valley, Smith Valley, and the East Walker River area, it would be possible to build on the water efficiency improvements assumed above in order to meet the average 50,000 af/yr increased inflow objective at Walker Lake. There are, however, concerns with the economic viability of most alternative crops for Walker Basin growers. Even the alternative crops that appear most promising raise questions about the availability of dependable markets and verifiable yields, required investments, time needed to fully develop the crop, and the risk profile of the grower (Curtis et al. 2009). In light of such uncertainties, the potential water savings associated with reduced crop ET resulting from the cultivation of low water use alternative crops has not been included in the Draft EIS analysis of Alternative 3.

Using the 2004 water conservation investment program funded by Reclamation at NDOW's Mason Valley WMA as a proxy, it appears that the cost of conserved water for a variety of efficiency investments would range from $2,430-3,410 per af of water conserved in 2008 dollars (Appendix 2B). Applying the upper end of this range to the approximately 102,000 af of conserved water assumed to be acquired upstream (see Chapter 3, Water Resources), a total Alternative 3 investment cost of approximately $348 million can be inferred. Because Alternative 3 as analyzed would only provide about 32,000 af/year of increased inflow to Walker Lake (even if conserved water was

fully transferrable), and because annual maintenance costs have not been included, the effective full costs of Alternative 3 are expected to be substantially greater than $348 million, particularly if crop switching or other measures needed to reach the average additional inflow of 50,000 af/year at Walker Lake were to be implemented. Finally, using the unit costs estimated above, and assuming comparable rates of physical loss and transferability between existing points of diversion and Walker Lake, approximately 4,600 to 6,500 af/year of additional inflow could be provided within the limits of existing funds.

Program Administration

Conservation agreements would be established by the program administrator with willing water rights holders. Potentially, surface water with all types of rights could be included. These agreements would identify the conservation or efficiency measures that would be implemented with program funding in exchange for conveyance or assignment of the associated water rights in amounts commensurate with the expected water savings. All or a portion of the applicable water rights would then be transferred to the lower Walker River and Walker Lake.

Participants would either:

- implement the identified measure(s) directly, with payments to landowners to implement specific on-farm improvements; or
- agree to have those measures implemented by others, such as ditch companies, with payments to those entities to implement specific conveyance system improvements within their respective service areas and jurisdictions.

Required Applications, Agreements, and Approvals

Water saving measures would be implemented in conjunction with the approval of water rights changes by NSE and/or the Walker River Decree court, which would require involvement by WRID. Although Nevada water law has established mechanisms for transferring water rights in their entirety away from the lands to which they are appurtenant (and thus requiring the cessation of irrigation for the duration of the transfer), the NSE's office has indicated a willingness to consider a number of potential approaches to the transfer of conserved water derived from existing water rights within the Walker River Basin that would allow for continued irrigation of at least a portion of the lands to which those water rights are appurtenant (Gallagher pers. comm.). While rulings on applications to change water rights will always be based upon specific facts and circumstances, in general the ability to account for the water savings and various types of water rights involved will be important for potential approval. Because USBWC's 1996 Administrative Rules and Regulations do not directly address many of the issues surrounding the potential transfer of rights to conserved water, it is not known how the U.S. District Court might address these kinds of water rights changes.

Alternatives Proposed During Scoping

During the public scoping process held early in the development of this Draft EIS, many suggestions were made regarding potential project alternatives. Some actions were eliminated from further analysis, while others were incorporated into each of the action alternatives.

Actions Eliminated from Further Analysis

The following suggested actions were eliminated from detailed analysis in this Draft EIS because they did not meet the purpose and need for the project and/or they were not considered to be reasonable for environmental, legal, financial, or technical reasons.

- Install a dike across a portion of the lake to create a salinity barrier
- Cement the riverbed
- Declare emergency status for addressing elevation of Walker Lake
- Oxygenate Walker Lake
- Add pipeline to Las Vegas and reduce lake elevation
- Create outlet to lake so lake can clean itself
- Use desalination
- Allow private purchase
- Mandate that WRPT share water
- Import groundwater from another basin (e.g., Whiskey Flats, Rawhide Flats)
- Import surface water from the Pacific Northwest
- Define restoration as water for WMAs and wetlands
- Mandate that farmers who will not share water live at Walker Lake for 4 years
- Exclude bed and banks from going back to WRPT
- Use cloud seeding
- Develop reservoirs for capturing flood event flows for future use
- Mandate two federal Water Masters rather than one and locate in an office other than WRID
- Include willing sellers in all communities in the Walker River Basin (include California water)
- Acquire water rights in the Hawthorne area only
- Use mining effluent and mine remediation effluent
- Enforce and monitor all water diversions and wells and provide saved water to Walker Lake
- Restore channel to increase river efficiency

Actions Incorporated into Alternative 1

The following suggested actions were incorporated into Alternative 1 as sources of water from potential willing sellers. Whether the suggested water sources actually would provide water through implementation of Alternative 1 would depend on the willingness of the owners of the land, water appurtenant to the land, and related interests.

- Use wastewater effluent
- Use geothermal effluent
- Include water from Hawthorne Naval Ammunition Depot
- Consider buying water (such as water rights from marginal farmland) that would benefit a wide variety of resources in addition to the lake

Actions Incorporated into Alternative 2

The following suggested actions were incorporated into Alternative 2. Some of the ideas were modified to better fit the project's purpose and need (e.g., limit the geographic scope to the Nevada portion of the Walker River Basin) or to enhance their viability as a reasonable alternative.

- Lease upstream water
- Use a lease/water bank alternative (WRID)
- Use a lease/bank alternative (including basin-wide program)
- Rotate fields and fallow every 7 years and provide conserved water to Walker Lake
- Develop a water market using a local and state water contractor partnership to enhance management of water

Actions Incorporated into Alternative 3

The following suggested actions were incorporated into Alternative 3.

- Conserve water
- Upgrade delivery system to prevent loss to groundwater.

Chapter 3 Water Resources

Introduction

This chapter describes the affected environment for water resources in the study area and the potential impacts on water resources that would result from the Proposed Project and other alternatives. This chapter summarizes the technical data, which can be found in Appendix 3A, and provides a more complete description of impacts. The structure and headings for both this chapter and Appendix 3A are parallel, so more detailed information on a topic presented in this chapter can be found under the same heading in the appendix.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below by topic. Full references can be found in Chapter 17, References.

- **Surface water diversions:** 1931-1991 data from a Nevada Division of Water Planning (NDWP) summary of surface water irrigation diversions (2000), and 1992-2007 data received from Jim Shaw, Walker River Federal Watermaster (pers. comm. 2008).
- **Groundwater pumping:** Estimated annual groundwater pumping for 1994-2004 (Gallagher 2006).
- **Groundwater levels:** data collected by Nevada Division of Water Resources (NDWR), http://water.nv.gov/well%20net/download_data.cfm (Nevada Division of Water Resources 2009).
- **Evapotranspiration rates:** Communication with Kip Allander and Tom Lopes of U.S. Geological Survey (USGS) regarding net evapotranspiration (ET) in the Walker River Basin (Allander pers. comm. 2008a and Lopes pers. comm. 2008), USGS report 2005-5288 (Maurer et al. 2006) on ET in the Carson Valley, and information on ET rates for a variety of crops (Food and Agricultural Organization 1986).
- **Irrigated acres:** Appendix A (Desert Research Institute 2006) of the Great Basin Land and Water Study (Yardas 2007). This appendix also includes estimates of combined riparian and wetland acres.
- **River flow:** USGS flow data from multiple gages (Figure 3-1) (U.S. Geological Survey 2008a).
- **Groundwater-surface water interaction:** Myers hydrologic modeling of Smith and Mason Valleys (2001A and 2001B).
- **Walker Lake water balance and total dissolved solids (TDS):** USGS Walker Lake budget fact sheet (Thomas 1995), water balance spreadsheet from Randy Pahl (Pahl pers. comm. 2008), USGS bathymetry data (Lopes

and Smith 2007, Appendix A), historic Walker Lake elevation and TDS concentration data compiled by USGS (Allander pers. comm. 2008b), preliminary data from the USGS quarterly report to U.S. Bureau of Reclamation (Lopes 2009), and total maximum daily load (TMDL) for Walker Lake TDS (Nevada Division of Environmental Protection 2005a).

Affected Environment

This section describes the Affected Environment related to water resources in the study area. The federal, state, and local regulations relevant to water resources in the study area are described in the Appendix 1B of the Draft EIS**.**

Introduction to Affected Environment for Water Resources

The Walker River Basin is approximately 4,050 square miles and encompasses parts of California and Nevada; approximately 1,002 square miles of the basin are in California (Lopes and Smith 2007). The river and its watershed originate in the eastern Sierra Nevada and terminate at Walker Lake.

Most precipitation in the basin occurs as snow in the Sierra Nevada. Snowmelt from the Sierra Nevada and other ranges flows down the East Walker River and the West Walker River, which merge into the mainstem Walker River in Mason Valley, Nevada. The river continues flowing downstream into the northern end of Walker Lake. Walker Lake is bounded on the west by the Wassuk Range and on the east by the Gillis Range.

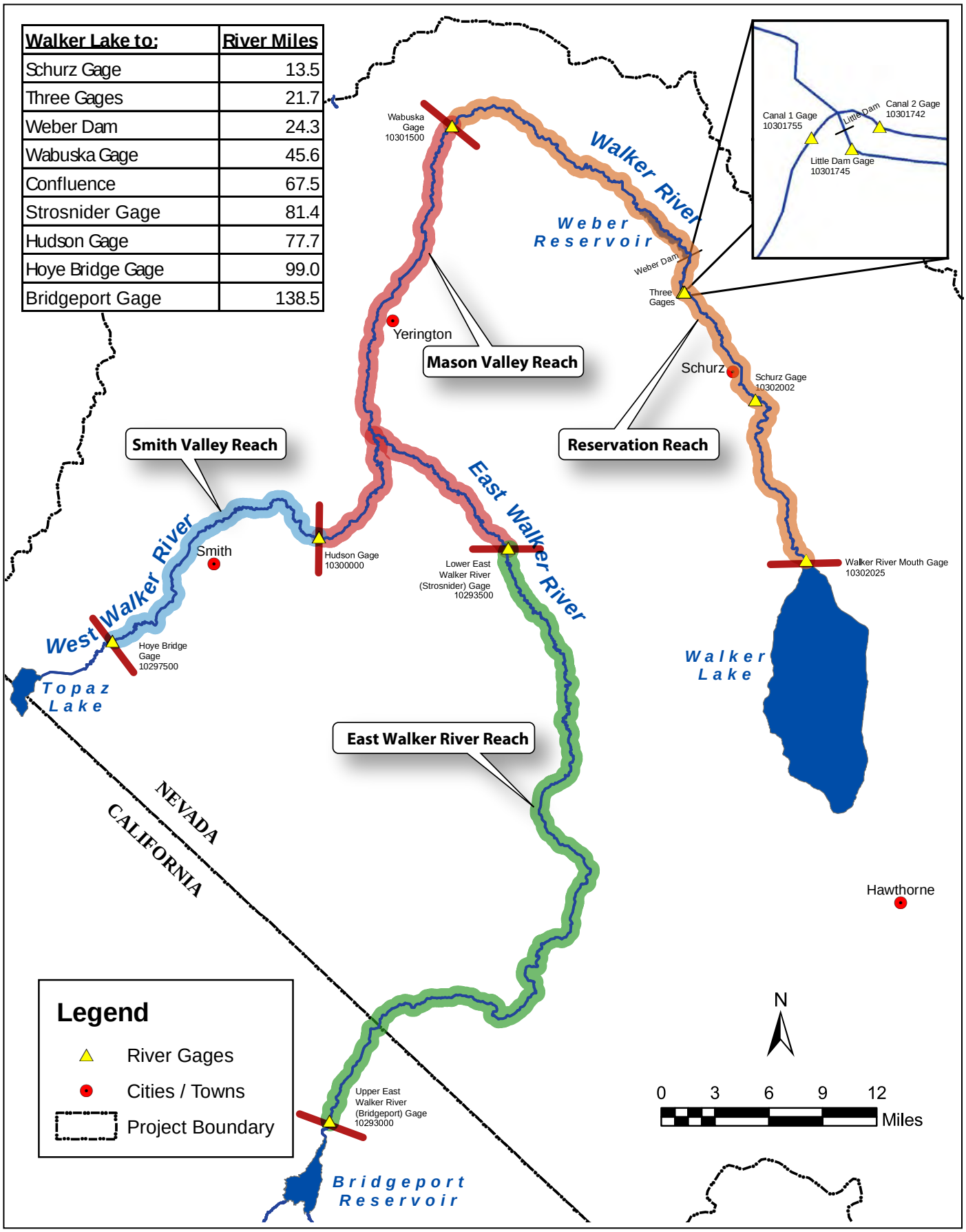
The study area for the water resources analysis incorporates five key hydrologic areas in the Walker River Basin: East Walker reach, Smith Valley reach, Mason Valley reach, Reservation reach and Walker Lake. For the purposes of the Draft EIS water resources analysis, the boundaries of these areas are defined using the USGS gage locations shown in Figure 3-1.

Other geographic terms used in this chapter are:

- East Walker area—the East Walker reach and all flatlands along the East Walker River and Sweetwater Creek between the California border and Mason Valley. Water resources upstream of the study area are not expected to be affected by the Proposed Project and other alternatives.
- Upstream of Wabuska—the three most upstream reaches (East Walker reach, Smith Valley reach, and Mason Valley reach).
- Downstream of Wabuska—same as the Reservation reach.

The Affected Environment describes the water resources within the study area that would be affected by the Proposed Project and other alternatives, and key aspects of them. The discussion focuses on surface water, groundwater, the water

Walker Lake to:	River Miles
Schurz Gage	13.5
Three Gages	21.7
Weber Dam	24.3
Wabuska Gage	45.6
Confluence	67.5
Strosnider Gage	81.4
Hudson Gage	77.7
Hoye Bridge Gage	99.0
Bridgeport Gage	138.5



00516.07 Walker River Basin Restoration Project/EIS/Chp 3/SS (06-09)

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Figure 3-1
Walker River Basin
River Gages and Reaches

balance for the Walker River system upstream of Wabuska, and water quality. Flow into and through the Reservation reach (including losses) are discussed in the surface water section that follows; and the water balance for Walker Lake is discussed under Walker Lake Analysis in the Environmental Consequences section below.

Surface Water

Key surface water topics discussed below include Walker Lake water surface elevations, Walker River flows both above and below Wabuska, surface water diversions, and acreages of irrigated land and riparian and wetland vegetation.

Walker Lake Water Surface Elevation

The volume of water in Walker Lake has a direct relation to water surface elevation (elevation) and surface area. This relation has been well defined by UGSG (Lopes and Smith 2007, Appendix A). Surface area affects the volume of water that leaves the lake through evaporation, and changes in lake elevation expose or cover portions of the lake bed, which can affect resources addressed in other chapters of this Draft EIS, such as recreation and air quality. In addition, lake volume has a strong influence on water quality.

Over millennia, Walker Lake has fluctuated well above and below the present lake elevation as a result of climate fluctuation and changes in the course of the Walker River. About 4,700 years ago the lake filled quickly after having been dry or very low for at least 8,000 years (Benson 1988; Bradbury et al. 1989). During the past 3,500 years, lake elevation may have fluctuated between about 3,900 and 4,100 feet (Adams 2007**,** Sharpe et al. 2008).

Water surface elevation in Walker Lake has been on a declining trend since the late 1800s, when the diversion of water to irrigate agricultural crops began in the Walker River Basin (Figure 3-2). With the drop in lake elevation, the concentration of TDS has increased (see Walker Lake Water Quality, Total Dissolved Solids, below).

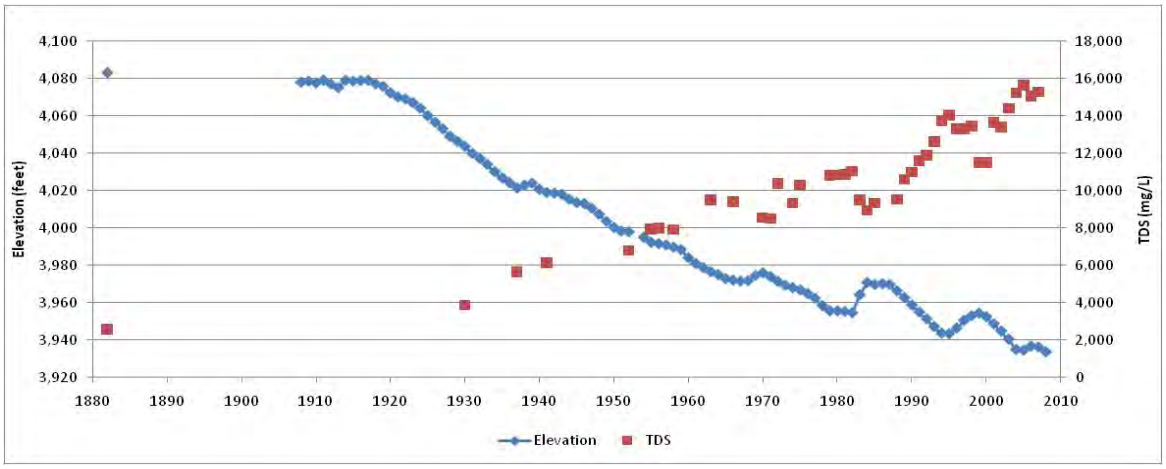


Figure 3-2. Walker Lake Water Surface Elevation and Concentration of Total Dissolved Solids since 1880

Volume of Walker Lake depends on inflow from Walker River, groundwater inflow, local surface water inflow, precipitation, and evaporation. The volume of water associated with evaporation and direct precipitation depends largely on the surface area. The volume of groundwater inflow may change in response to change in lake elevation, but groundwater inflow is understood to be relatively small (less than 15%) compared to Walker River inflow and much of the groundwater inflow may be derived from the river (Thomas 1995).

River Flow

River flow is a major factor in Walker Lake water budget (presented later in this chapter) as well as other water supplies and influences habitat conditions. The change in river flow from upstream to downstream ends of a reach (defined above) indicates the potential magnitude of accretions and depletions (i.e., inflow/gains and losses).

Three types of flow are presented in this section: inflow to the study area, daily flow, and average flow. First, inflow to the study area is presented to show the total amount of surface water entering the system. Then daily flows for wet and dry years are presented for several locations in the study area to show the seasonal differences between these types of years. Finally, average monthly and annual flows are presented to provide a basis for understanding the system over the long term. In addition, average annual values are used in the water balance upstream of Wabuska, and for the flow losses downstream of Wabuska (discussed later in this section).

Inflow to Study Area

Inflow at the upstream end of the East Walker reach is measured at the USGS gage downstream of Bridgeport Reservoir and inflow at the upstream end of the Smith Valley reach is measured at the USGS gage at Hoye Bridge. Because the Proposed Project and alternatives assume no major changes in reservoir operations upstream of these sites, the sum of the flow at these two gages provides a good estimate of the historic variability in flow entering the potentially affected valleys (Figure 3-3). Between water years 1960 and 2007, inflow to the two valleys ranged from about 100,000 to 800,000 af/yr.

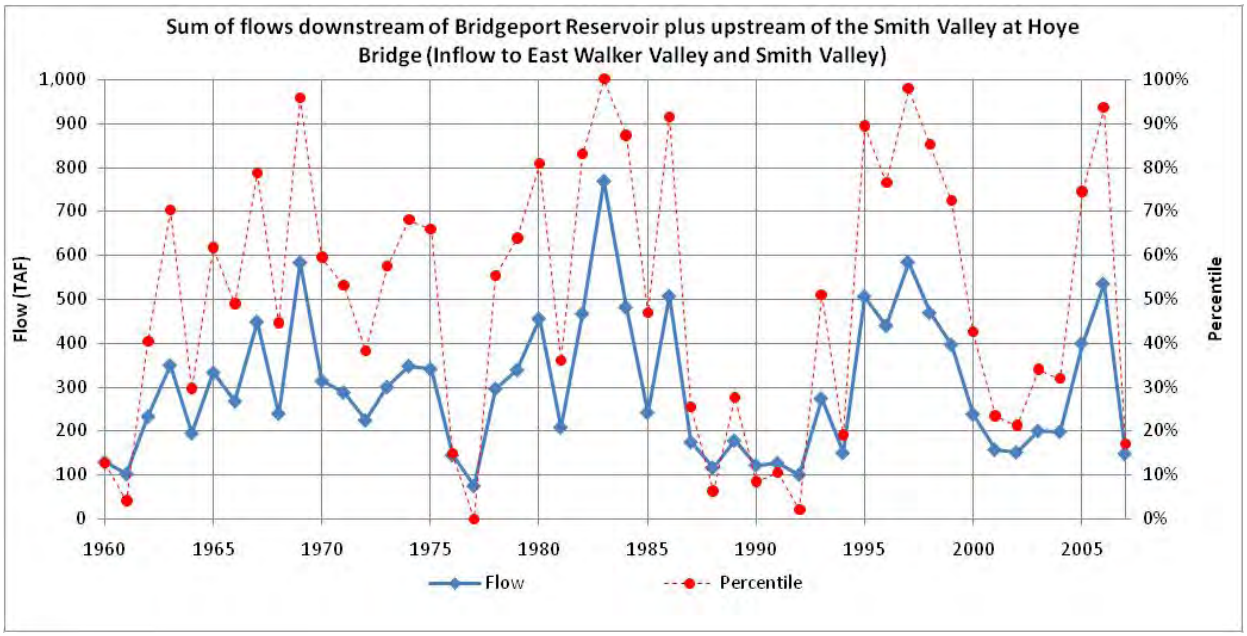


Figure 3-3. Flow Entering the Study Area for Water Years 1960–2007 with Percentiles Shown to Characterize the Extremity of Each Inflow Value

Daily Flow

To illustrate the flow patterns for a wet year and a dry year, daily flow for water year 1997 (98th percentile) and water year 2007 (17th percentile) are shown in Figures 3-4 through 3-7. These figures show flow at the upstream and downstream ends of the East Walker, Smith Valley, and Mason Valley reaches.

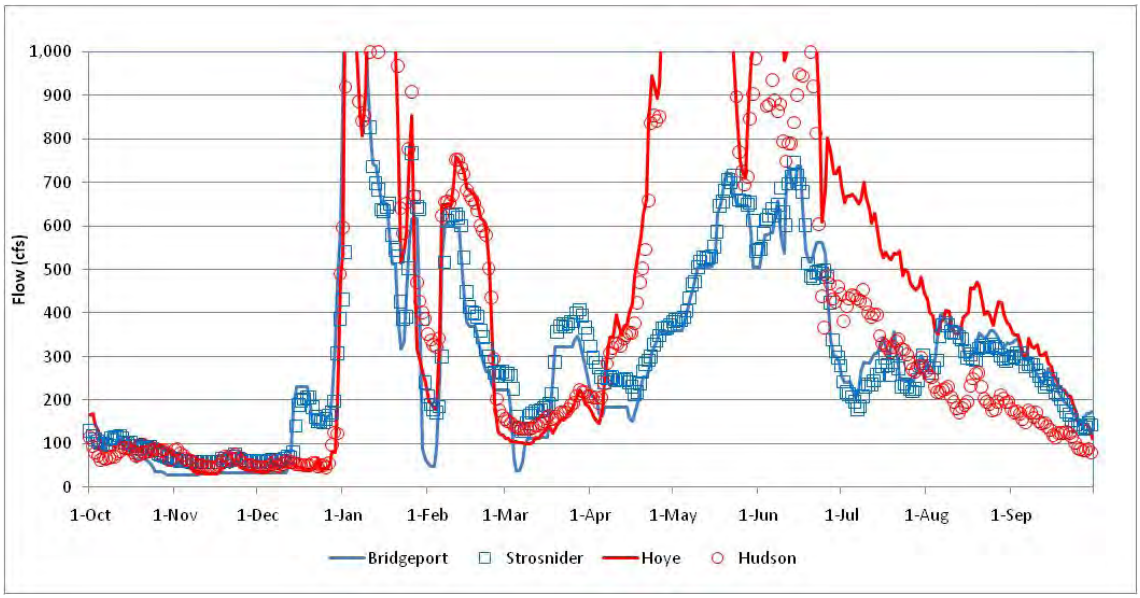


Figure 3-4. Daily Flow in the Smith Valley Reach and along the East Walker Reach during a Wet Water Year, 1997

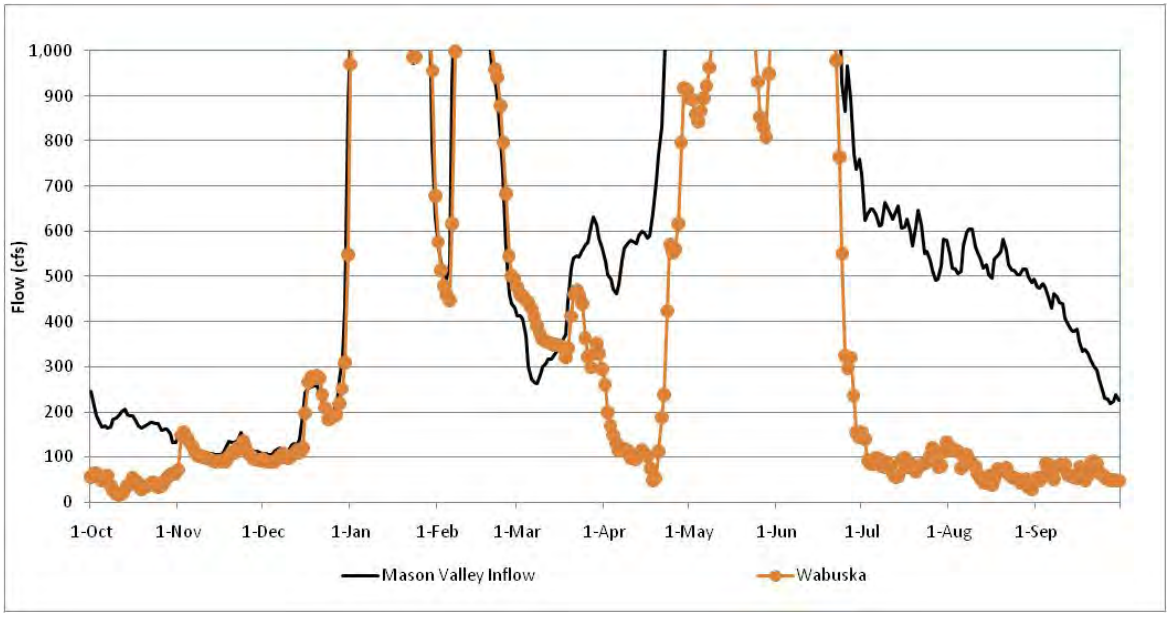


Figure 3-5. Daily Flow at the Upstream and Downstream Ends of the Mason Valley Reach during a Wet Water Year, 1997

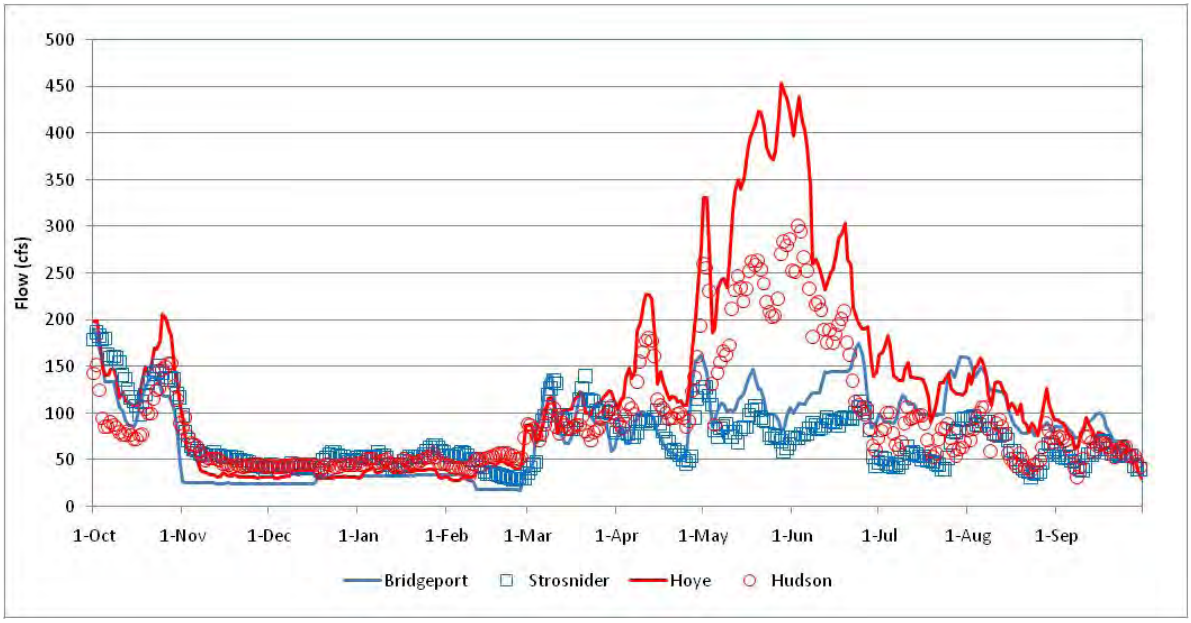


Figure 3-6. Daily Flow in the Smith Valley Reach and along the East Walker Reach during a Dry Water Year, 2007

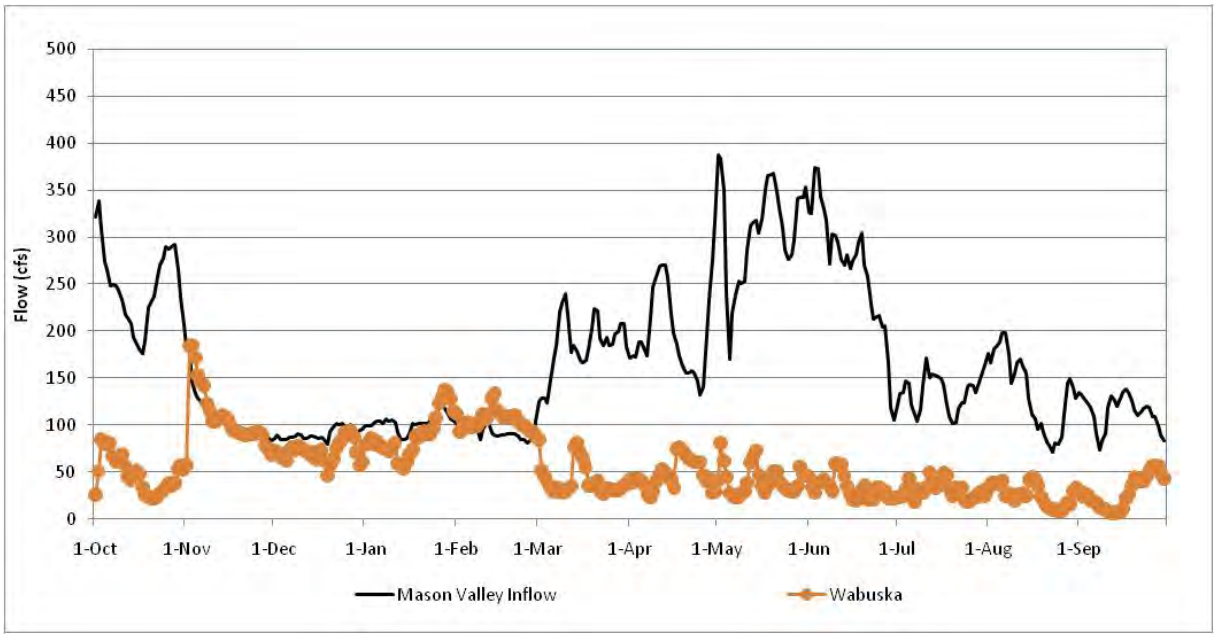


Figure 3-7. Daily Flow at the Upstream and Downstream Ends of the Mason Valley Reach during a Dry Water Year, 2007

Changes in flow through the reaches as seen in the daily measurements from the upstream and downstream ends of the reaches during a wet and dry year are summarized in Table 3-1.

Table 3-1. Upstream to Downstream Change in Flow during a Wet Year and Dry Year

Reach	Wet Year (1997)		Dry Year (2007)	
	Winter	Irrigation Season	Winter	Irrigation Season
East Walker	Slight increase	Slight loss	Slight increase	Loss
Smith Valley	Slight increase	Loss	Slight increase	Loss
Mason Valley	Loss (??)[a]	Loss	Slight increase to slight decrease	Loss

[a] May be result of peak flow leaving the channel or spreading out over length of river

Average Flow Upstream of Wabuska

To evaluate flow through the valleys, monthly average flow of the East Walker, Smith Valley, and Mason Valley reaches were compared. The evaluation focused on 1981 through 2007 when supplemental groundwater pumping was more likely to be greater than past periods (Myers 2001b). Peak flow generally occur during June in response to spring snow melt (Figure 3-8). Average June flow downstream of Bridgeport Reservoir was about 350 cfs, half of the approximately 700 cfs at the upstream end of the Smith Valley reach (Hoye gage). Flow at Wabuska, averaged 500 cfs for June, or half of the flow (1,050 cfs) entering the East Walker and Smith Valley reaches. These flows are summarized in Table 3-2.

Table 3-2. Average June (Peak) and Annual Flow Into and Out of the Agricultural Valleys upstream of Wabuska

Location	Average Daily June Flow (cfs)	Average Annual Flow (af)
downstream of Bridgeport Reservoir	350	118,000
upstream end of the Smith Valley reach (Hoye gage)	700	191,000
Total entering system	**1,050**	**309,000**
Wabuska	500	139,000

The pattern of flow losses and gains during the rainy season (approximately November through April) and irrigation season (Figure 3-8) is similar to the pattern described for the 1997 and 2007 daily flow in Table 3-1.

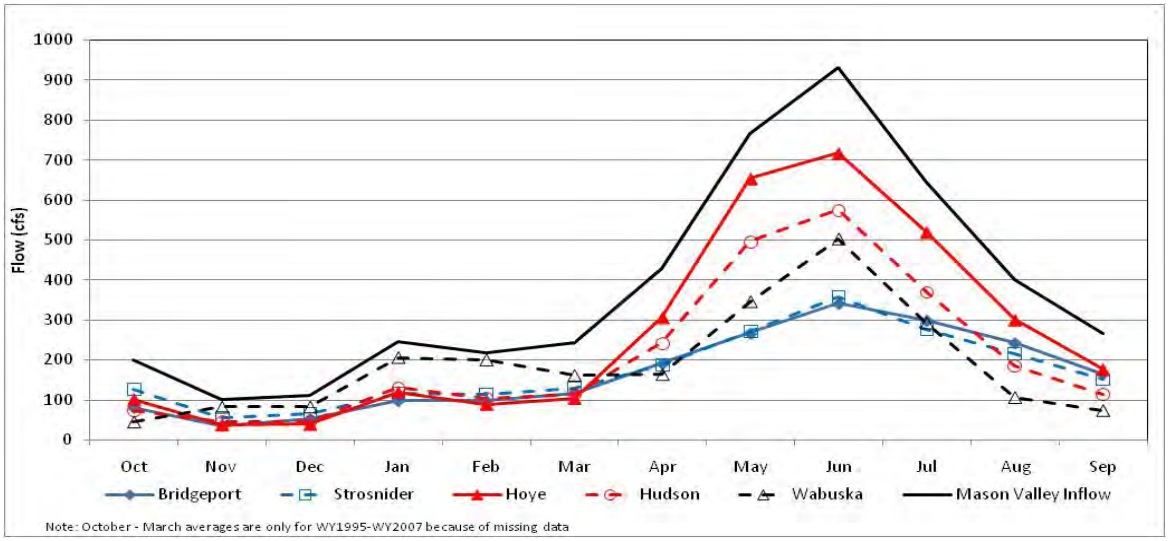


Figure 3-8. Average Monthly Flow in the Walker River Basin, 1981-2007

Average annual flow volumes are summarized in Table 3-2. Note that the total average annual flow volume at Wabuska (139,000 af) is 45% of the total inflow to the system (309,000 af).

Average Flow in Reservation Reach

Downstream from Wabuska, the Walker River flows through Weber Reservoir, then downstream to Canals 1 and 2 (located just upstream of Little Dam on the Walker River Indian Reservation), then approximately 22 miles further to Walker Lake. Upstream of Weber Reservoir and downstream of Schurz, the river is braided. Flow measurements just upstream of Weber Reservoir are unreliable because the channel is unstable, beaver structures can affect the channel depth, and some of the flow can bypass the gaged channel, sometimes as subsurface flow (Allander, pers. comm. 2008b).

Figure 3-9 shows the monthly flow measured at the Schurz gage. Flow at this location has been highly variable, ranging from 0 cfs to more than 1,000 cfs, with the highest occurring in June. The pattern of flow volumes for the irrigation season is similar to the annual pattern (Figure 3-10).

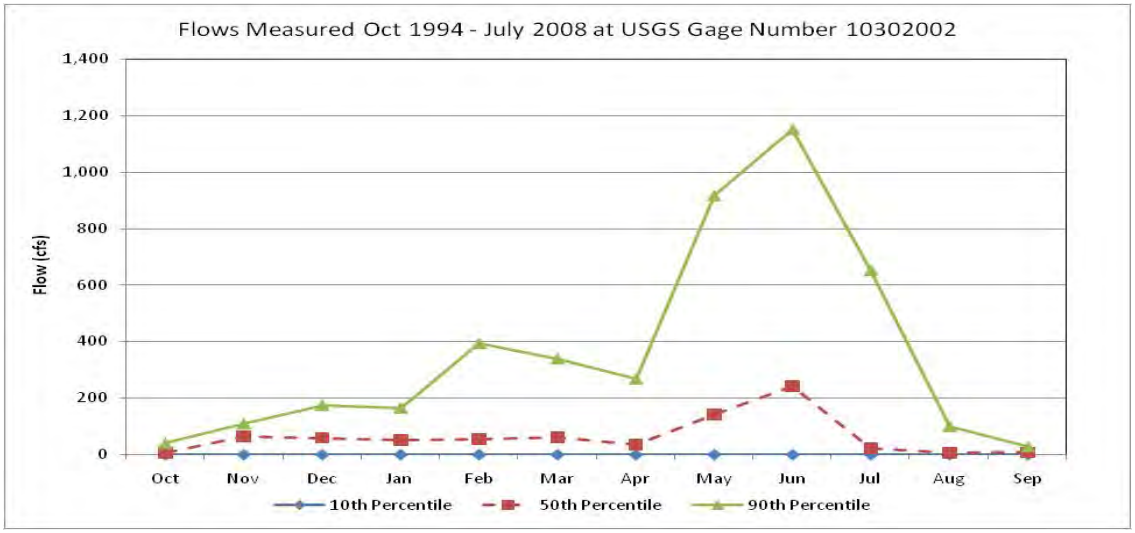


Figure 3-9. Distribution of Monthly Average Flow in the Walker River near Schurz

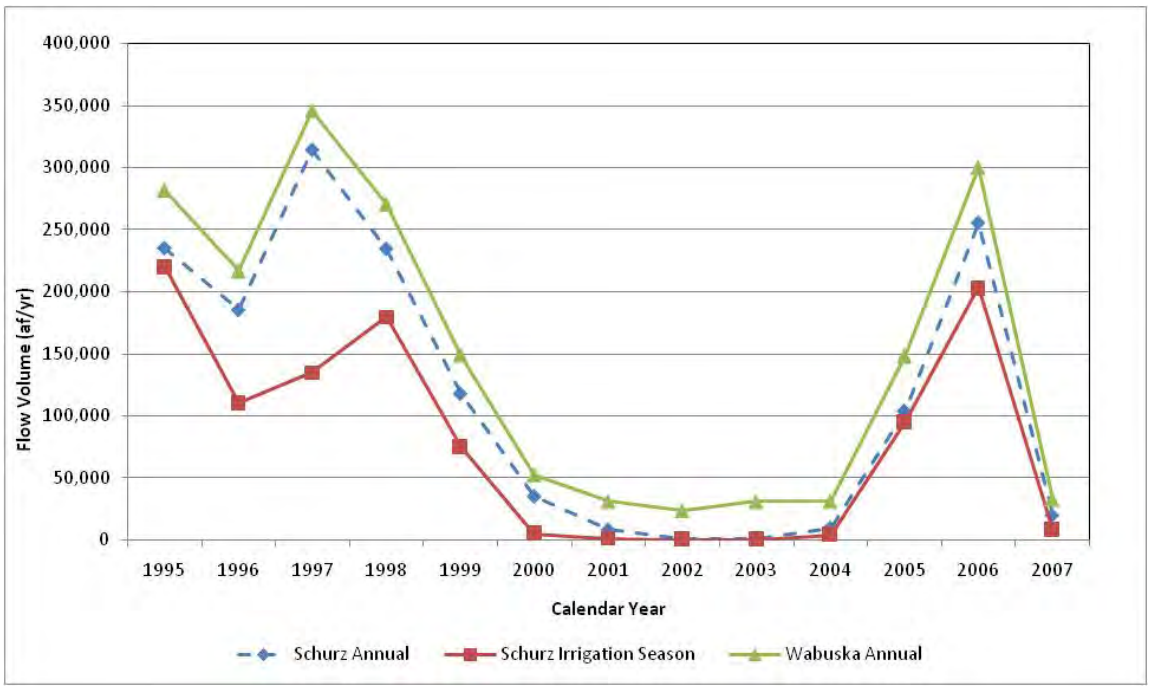


Figure 3-10. Annual and Irrigation-Season Flow in the Walker River near Schurz Compared to Annual Flow at Wabuska

Flow Loss in Reservation Reach

The riverine losses between Wabuska and Walker Lake are of interest for the purposes of assessing the loss of any acquired flow. As described in Chapter 2, Alternatives, it is assumed that the Walker River Paiute Tribe, BIA, and the University (or other implementing entities) will develop an agreement for the

management of acquired water through the Reservation for delivery to Walker Lake. Therefore, the only reduction in volume of the acquired flow would be caused by loss to groundwater or evapotranspiration. These losses are influenced by travel time, the width of the channel, and local groundwater pumping. Increases in flow caused by the acquisition of water will increase width, but decrease travel time. The presence of acquired water is not expected to change groundwater pumping on lands within the Walker River Indian Reservation.

Walker River flow losses between Wabuska and Walker Lake were evaluated for two subreaches of the Reservation reach: Wabuska to Schurz, and Schurz to Walker Lake.

Flow Loss between Wabuska and Schurz

To evaluate river losses between Wabuska and Schurz, inflow at the upstream end of this reach were compared to the flow at the downstream end. The amount of water lost does not respond greatly to the amount of flow. Rather, river water losses are dependent on ET of riverine vegetation and infiltration to groundwater. These losses do not increase in direct proportion to river flow because there is a fixed amount of vegetation for ET and because the river width does not increase in direct proportion to river flow. As a result, the river loss volume is not highly variable from year to year (Figure 3-11), indicating that an increase in flow may not incur a large increase in loss. However, the percent of flow lost does vary greatly, with higher percent losses occurring during the drier years (Figure 3-12). Because these years contribute less to the filling of Walker Lake, these higher percents have less impact on lake volume than the lower percent losses that occur during the high flow years.

For water years 1998 through 2007, 24% of the Wabuska flow disappeared before Schurz. The percentage of loss varied widely, from 4% in 1999 to 55% in 2002. The data suggest that in years of greater water availability, when annual river inflow is greater than 50,000 af, the loss is typically less than 10%.

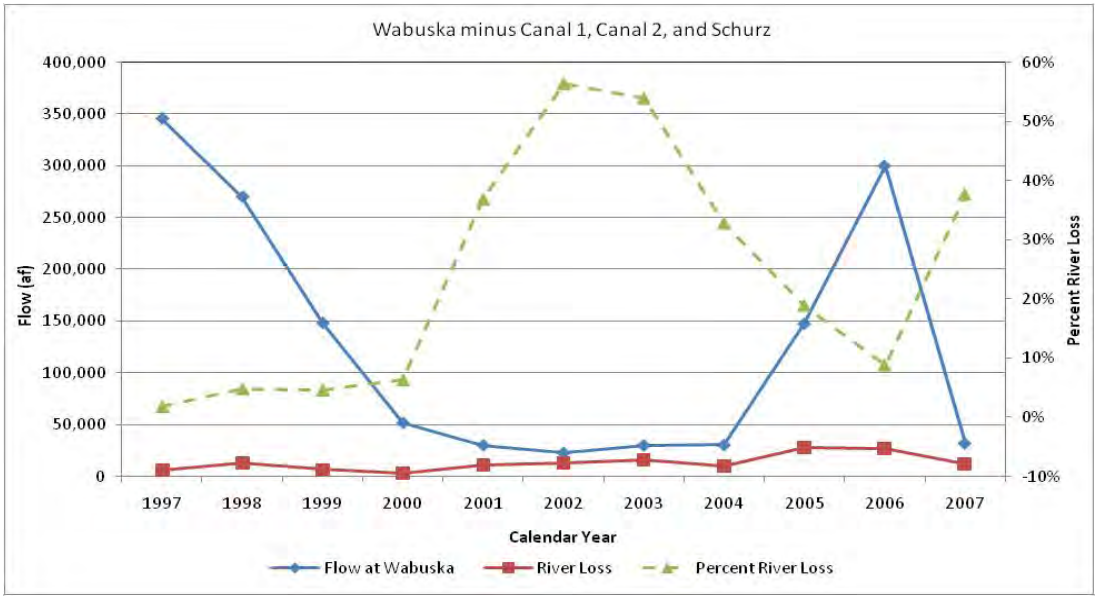


Figure 3-11. Annual River Flow and Losses Measured between Wabuska and Schurz

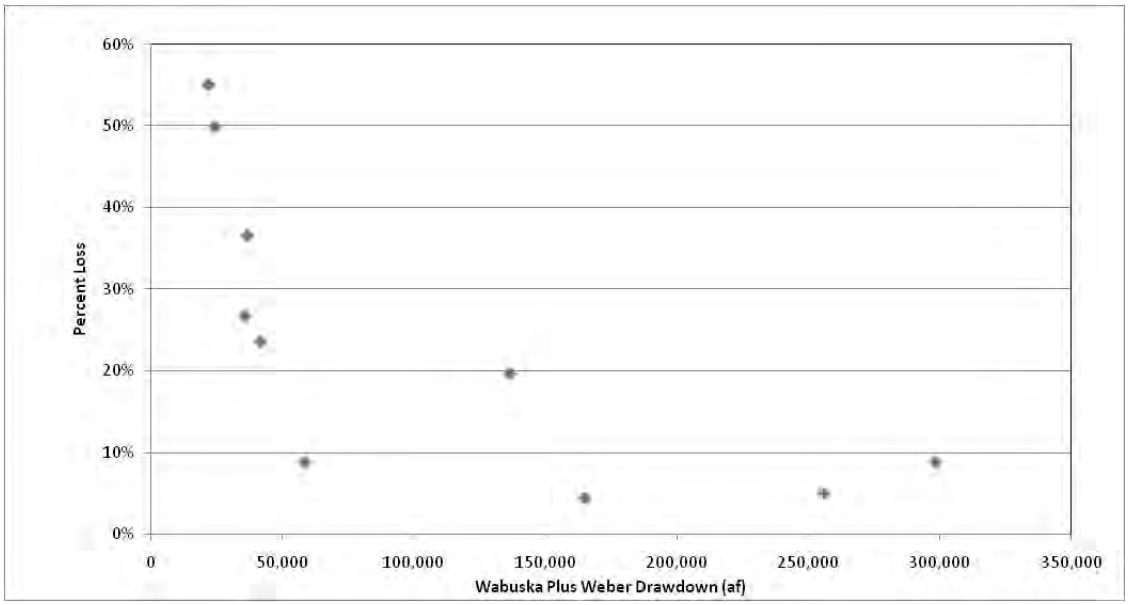


Figure 3-12. Percent Flow Loss between Wabuska and Schurz in Relation to Reach Inflow for Water Years 1998 - 2007

The relationship between reach inflow and river loss from Wabuska to Schurz was also analyzed (Figure 3-13). The data indicate that as inflow increases, the volume lost may increase at a rate of approximately 4% of the reach inflow.

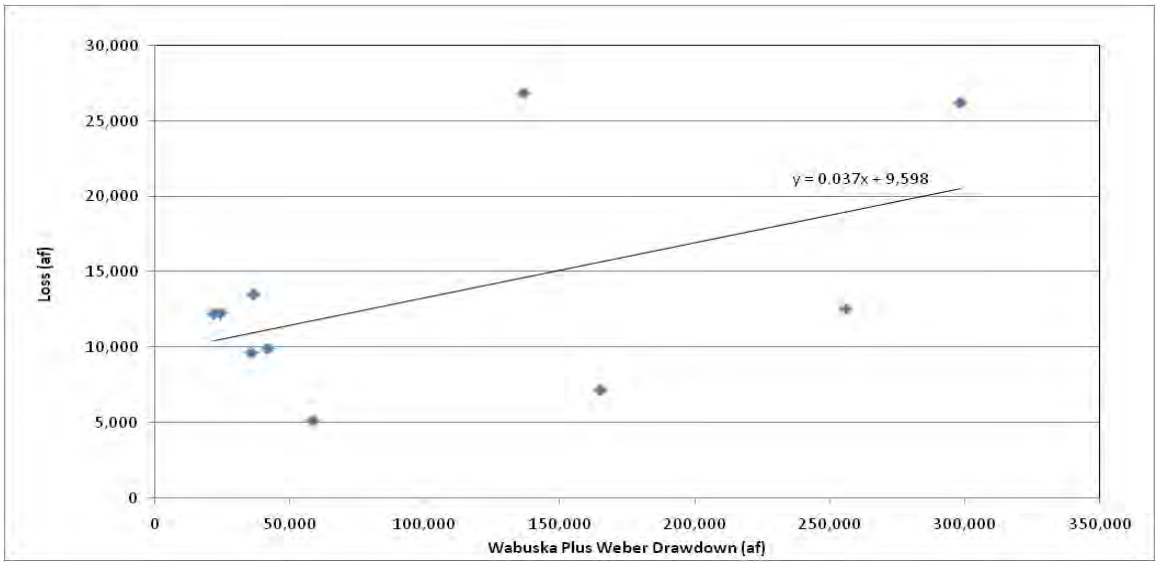


Figure 3-13. Correlation between Annual Flow and Flow Loss between Wabuska and Schurz (Water Years 1998–2007)

Losses may increase as a result of increased ET or increased infiltration to groundwater. In this reach, some of the water infiltrating to groundwater likely flows subsurface into the lake, so some of the riverine losses may not be lost to Walker Lake.

Flow Loss between Schurz and Walker Lake

Flow losses in this reach are uncertain because of limited data and periods of no flow reaching Walker Lake. USGS measured flow intermittently between 1994 and 2007 and made a preliminary finding that little flow was lost between Schurz and the lake (Lopes 2007). More intensive flow measurements in this reach have occurred for relatively short periods. Figure 3-14 shows the monthly flow and losses that were measured by the USGS between Schurz and the lake. During water year 2005, total flow loss between Schurz and the lake was measured as 8,600 af, 6% of the river inflow to the Reservation reach (i.e., flow at Wabuska plus Weber Reservoir drawdown).

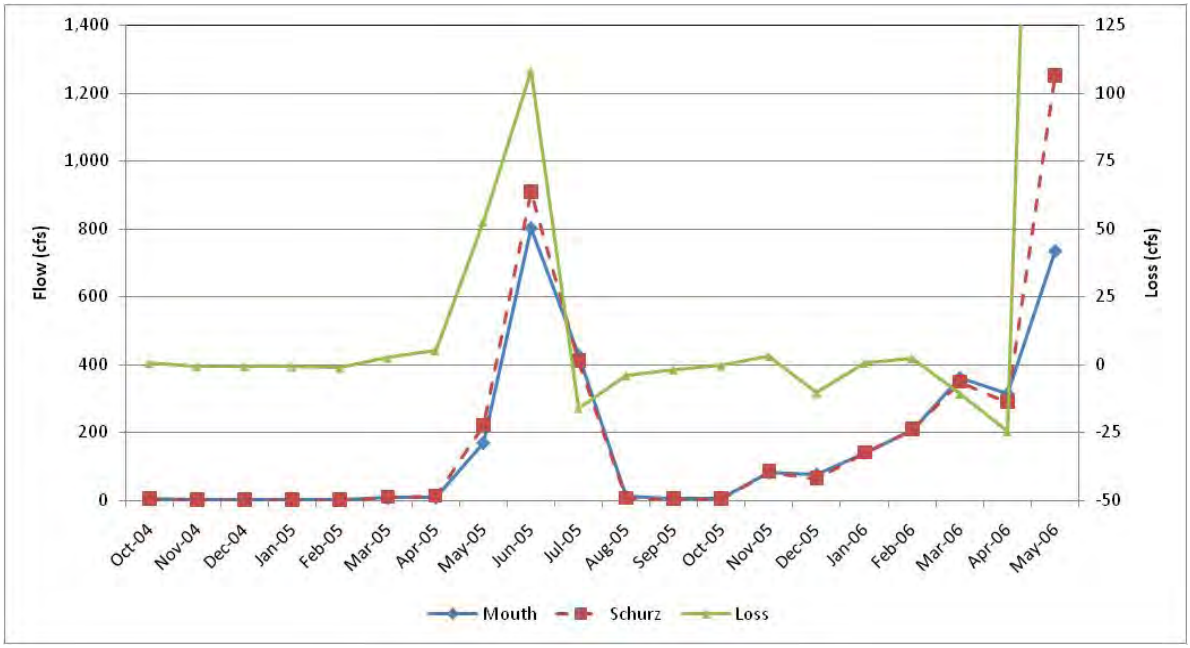


Figure 3-14. Monthly Difference between Flow Measured at Schurz and the Mouth of the Walker River

Once water infiltrates the substrate, it can then either be used by riparian and wetland vegetation or be pumped for irrigation. Water that remains in the aquifer may move through the substrate to the lake or head east out of the Walker Basin towards Double Springs (Lopes 2008a).

Surface Water Diversions for Irrigation

Surface water diversions provide an indication of how much water may be available for purchase. The compiled diversions are summarized in Table 3-3 for the period 1931 through 2007 as well as a subset reflecting more recent groundwater usage (1981 through 2007). These data exclude Walker River diversions in California, Antelope Valley, and the Walker River Indian Reservation.

The data indicate that total surface water diversions for the East Walker, Smith Valley, and Mason Valley reaches averaged about 225,000 af/yr for the period 1931-2007, with considerable annual variation.

Table 3-3. Summary of Walker River Surface Water Diversions Between 1931 and 2007

Year	Smith Valley Reach	East Walker Reach	Mason Valley Reach	Total [a]
1931-2007				
Minimum	14,400	6,800	35,035	57,245
Average	69,110	21,588	137,598	224,781
Maximum	119,142	37,394	219,412	365,560
1981-2007				
Minimum	14,400	7,125	35,719	57,245
Average	59,095	21,913	125,707	206,715
Maximum	117,147	37,394	202,924	344,992

This summary excludes diversions from streams tributary to the Walker River reaches.

[a] Only years with a full complement of data for each reach were included in the calculation. The calculation of minimum, average, and maximum values was based on totals for each year, not the reach components.

Surface water rights are divided into three major types:

- Decree rights are rights to divert natural river flow (i.e., flow without support from upstream storage)
- Storage rights are rights (allocated by WRID) to use water previously stored in upstream reservoirs (specifically Bridgeport and Topaz Lake Reservoirs), and
- Flood water rights are rights (allocated by WRID) to make use of natural river flow when there is excess or surplus water in the River (i.e., no unmet demand for decree rights)

Myers (2001c) differentiated diversion data obtained from NDWP into water rights type (Table 3-4).

Table 3-4. Surface Water Diversions for 1931-1995 Categorized by Water Right Type

	Average Decree Diversion	Average Storage Diversion	Average Flood Water Diversion	Total
Acre-Feet Per Year				
East Walker	40,023	22,043	7,422	69,488
Mason Valley	55,076	9,975	3,195	68,246
Smith Valley	30,765	27,499	13,208	71,472
Tunnel Section	12,663	6,426	2,339	21,428
Total	138,527	65,943	26,164	230,634
Percent of Total for Region				
East Walker	58%	32%	11%	
Mason Valley	81%	15%	5%	
Smith Valley	43%	38%	18%	
Tunnel Section	59%	30%	11%	
Total	60%	29%	11%	

Source: Myers 2001c

BIA diverts water for agricultural purposes out of the Walker River at Canals 1 and 2 which are located downstream of Weber Reservoir and immediately upstream of Little Dam, and delivers this water to 2,100 acres of Indian trust land within the Walker River Indian Irrigation Project. The direct flow water right for the project is 26.25 cfs diverted upon or above the Reservation for 180 days during the irrigation season, or about 9,400 af/yr, which the federal Water Master administers at Wabuska. Additionally, for over 60 years, BIA has stored water in Weber Reservoir and used the stored water to regulate and deliver the direct flow water right. The federal claim for this use of the water stored and released from Weber Reservoir is pending in the Walker Decree proceeding. Capacity of Weber Reservoir is approximately 10,700 af. During water years 1997 through 2006, annual diversions into Canals 1 and 2 averaged about 16,000 af. During 2007 and 2008, WRPT offered fallowing agreements to the landowners of the 2,100 acres in the Walker River Indian Irrigation Project, which were accepted by the landowners and approved by BIA, and BIA did not divert water through Canals 1 and 2.

Land Coverage

Amounts of irrigated land and riparian and wetland vegetation in the study area are relevant to the upstream water balance presented later in this section. Total acreage in the valley floors is presented for context.

Acreage of Valley Floors

Acres of the flat portion of each valley indicate potential surface area of the aquifers and can be used to assess the relative magnitude of groundwater impacts. USGS topographic maps were used with GIS data to estimate the relatively flat areas of the East Walker area and Smith and Mason Valleys as:

- East Walker area (including the valley of Sweetwater Creek)—26,000 acres
- Smith Valley—81,000 acres
- Mason Valley—114,000 acres

Acreage of Irrigated Land and Riparian/Wetland Vegetation

Vegetated land coverage can be used to estimate the consumptive use of irrigated lands and the incidental use of water by non-riverine riparian and wetland vegetation. The Desert Research Institute (DRI) has used GIS evaluation of remote sensing results to estimate the number of irrigated and riparian/wetland acres in Smith Valley, Mason Valley, the East Walker River between Mason Valley and the California border, and the region of the Walker River Indian Reservation between Wabuska and Walker Lake during late summer in six sample years between 1986 and 2002 (Desert Research Institute 2006). Their data are summarized in Table 3-5.

Table 3-5. Estimated Acreage of Irrigated Land and Riparian/Wetland Land

	Estimated Irrigated Lands (acres)						
Region	1986	1992	1995	1998	2000	2002	Average
Mason Valley	35,853	29,963	33,412	37,503	39,459	33,641	34,972
Smith Valley	19,446	13,554	17,562	18,002	18,843	17,306	17,452
East Walker River	5,108	2,731	4,990	3,979	4,033	3,248	4,015
Reservation	2,495	2,245	2,574	2,847	2,815	2,155	2,522
	Estimated Riparian/Wetland Vegetation (acres)						
Mason Valley	10,707	5,828	7,518	7,912	6,507	6,129	7,434
Smith Valley	5,259	2,659	3,165	4,401	2,358	2,012	3,309
East Walker River	3,156	3,001	2,863	3,466	2,924	2,631	3,007
Reservation	6,075	2,890	4,613	4,476	3,918	3,045	4,170

Source: Desert Research Institute 2006, Appendix A

The UNR-DRI assessment of irrigated land for 2006-2007 (Bonnenfant et al. 2009) was not used in this analysis because the estimated irrigated acres were very similar to the values shown here and because there were no corresponding estimates of riparian/wetland area.

Acreage of Riverine Vegetation

The riparian/wetland acres were divided into riverine and non-riverine acres using GIS analysis of maps from the GAP program (U.S. Geological Survey National Gap Analysis Program 2004). Because most vegetation growing along the Walker River occurred within 1,000 feet of the river, it was assumed that vegetation within 1,000 feet of the river channel was dependent on shallow groundwater provided by the river. Riparian/wetland vegetation farther from the river was assumed to be dependent on irrigation, either directly or indirectly by being dependent on shallow groundwater maintained by irrigation. It was estimated that 88%, 33%, and 34% of the riparian/wetland vegetation within the East Walker Valley, Smith Valley, and Mason Valley, respectively, is riverine (i.e., within 1,000 feet of the Walker River).

Groundwater

Key groundwater topics include hydrogeology, groundwater levels, groundwater pumping, and the river-groundwater connection.

Hydrogeology

Surface water is the primary source for groundwater in the Walker River Basin. Groundwater inflow occurs via infiltration into alluvial aquifers from both water bodies (primarily Walker River and Walker Lake) and crop irrigation water (Sharpe et al. 2008, p. 22). The volume of surface water infiltration in the valleys of the Walker River Basin is dependent on Walker River flow, amount of irrigation, and the volume of groundwater pumping in the valleys (Myers 2001a and 2001b). There is little groundwater movement between the groundwater basins (Thomas 1995). In this Draft EIS, groundwater recharge refers to groundwater recharge from all sources, whereas incidental groundwater recharge refers to groundwater recharge resulting from the conveyance and use of irrigation water.

The major characteristics of aquifers in the study area are described in Appendix 3A. The soils of the study area aquifers (East Walker area, Smith Valley, Mason Valley, Walker Lake area, and Whiskey Flat-Hawthorne area) are composed mostly of alluvial deposits of unconsolidated to consolidated gravel, sand, silt, and clay. Each of the aquifers is bounded by low-permeability consolidated rock.

Water in the aquifers generally moves in roughly the same direction of the river and either moves toward (East Walker and Smith Valley) or away (downstream

end of Mason Valley and Reservation reach) from the river. In the Smith Valley north of the Walker River there is a groundwater divide. North of the divide, water moves toward Alkali Lake and south of the divide it moves toward the Walker River (Myers 2001a).

For more information specific to each aquifer, see Appendix 3A.

Groundwater Withdrawals

There are generally two types of groundwater rights:

- Primary groundwater rights: The holder of these rights can apply water only to specific pieces of land. The land to which these rights are appurtenant does not receive surface water.
- Supplemental groundwater rights: The holder of these rights can use groundwater to supplement water derived from surface water rights or other groundwater rights; however, the combination of the surface water diversions and supplemental groundwater is not to exceed a specified amount.

Groundwater pumping can be combined with surface water diversions and other information to estimate total water withdrawals and water efficiency.

Groundwater pumping records have been compiled for Smith and Mason Valleys for 1994 through 2004 by NDWR (Gallagher 2006). As river flow increases (and the availability of surface water increases), the amount of groundwater pumping decreases (Lopes 2008a). Annual groundwater pumping in Smith Valley ranged from 10,000 to 33,000 af, with an average of 24,000 af (Table 3-6). Annual groundwater pumping in Mason Valley ranged from 40,000 to 122,000 af, with an average of 79,000 af. Myers (2001) estimates that, on average, about 50% of all groundwater withdrawals involve supplemental pumping, with considerable year-to-year variability.

Table 3-6. Groundwater Pumping in Smith and Mason Valleys from 1994 through 2004

Year	Smith Valley (acre-feet)	Mason Valley (acre-feet)
1994	33,204	122,001
1995	10,340	41,427
1996	17,249	51,302
1997	15,901	43,264
1998	13,391	39,645
1999	16,957	48,856
2000	29,579	83,888
2001	31,313	116,016
2002	32,518	114,809
2003	30,959	101,512
2004	32,805	108,495
Average	24,020	79,201

Source: Gallagher 2006

NDWR has not collected groundwater pumping records for the East Walker River upstream of Mason Valley, nor for the Walker River Indian Reservation (Beutner pers. comm. 2008).

Smith Valley, Mason Valley, and Whiskey Flat-Hawthorne (Walker Lake) groundwater sub-basins have been designated by the Nevada State Engineer (NSE) and are closed to new groundwater appropriations for irrigation purposes.

Groundwater Levels

Measurements of groundwater levels over time indicate that ground water levels have generally been dropping. Well data collected over the last 30 years show an average drop of 0.5 feet/year for Smith Valley and 0.4 feet/year for Mason Valley, although there is significant variation between wells and between yearly hydrologic conditions. Additional details can be found in Appendix 3A.

River-Groundwater Connection

There is a strong relation in the study area between groundwater recharge and extraction and Walker River flow. Information from two studies by Myers (2001a and 2001b) was used for this Draft EIS to assign a quantitative value to the link between groundwater recharge and river flow. Recent modeling work by the University indicates a degree of river-aquifer connection may be comparable to the Myers work (Boyle et al 2009), although future use of the University model could indicate that adjustments in the assumptions would be appropriate.

Smith Valley

The Smith Valley aquifer contains clay layers that tend to slow the vertical movement of groundwater (Myers 2001a) as well as the response of the river to changes in groundwater recharge and pumping. Nevertheless, there is a strong connection between the Walker River and the Smith Valley aquifer; it is strongest close to the river and weakest north of the groundwater divide.

Myers used groundwater-surface water modeling to estimate that if groundwater pumping were reduced within 2 miles of the river, river flow would increase by about 80 % of the amount of the pumping reduction (Myers 2001a). As another example, on a valley-wide basis, it was simulated that a reduction in recharge could lead to a reduction in river flow equal to about 52% of the recharge reduction within 25 years (Myers 2001a).

Mason Valley

The Mason Valley aquifer contains some silt/clay layers that could slow the vertical movement of groundwater as well as the response of the river to changes in groundwater recharge and pumping (Myers 2001b). Nevertheless, there is still a strong connection between the Walker River and the Mason Valley aquifer; it is strongest close to the river (Myers 2001b).

Myers used groundwater-surface water modeling to estimate that if groundwater pumping were reduced near the river, river flow would increase by 40 to 90% of the amount of the pumping reduction (Myers 2001b). As another example, on a valley-wide basis, it was simulated that a reduction in recharge could lead to a reduction in river flow equal to about 82% of the recharge reduction within 25 years (Myers 2001b).

Reservation Reach

There is also a strong connection between the river and groundwater aquifer in the Reservation reach. Preliminary results from the USGS found that as flow increases, the water level in wells adjacent to the river increase almost immediately (Lopes and Allander 2006, Lopes 2008a).

Water Balance for Study Area Upstream of Wabuska

This water balance assessment focuses on the East Walker Valley, Smith Valley, and Mason Valley. Current losses of water from the Walker River downstream of Wabuska are addressed above in the Surface Water subsection. A separate water balance for Walker Lake is described in the Environmental Consequences section.

To understand the flow of water through the Walker River system, flow along the river is compared to diversions and consumptive use in order to estimate some of the flow that is not measured. There is some uncertainty in the values used in this upstream water balance, particularly associated with ET rates, the acres of land to which different ET rates should apply, and the amount of groundwater pumping in the East Walker area above Mason Valley.

The water balance assessment presented here is based on average values. Although river flow, water demands, and reservoir operations change daily, an assessment based on averages is appropriate for determining the long-term impacts that are pertinent for evaluating the potential for increasing inflow to Walker Lake. Ideally the average values that are used would represent the same long time span. However, because of data limitations, this was not always possible. Table 3-7 presents some of the values used in the assessment.

Water extracted by diversions (from the river) and pumping (from the aquifer) has three possible fates:

- **Evapotranspiration (ET)** – water can be "lost" through evaporation or transpiration.

  Note: for the purposes of this Draft EIS, net ET equals total ET minus precipitation and consumptive use equals net ET from irrigated land.
- **Incidental groundwater recharge** – water can seep through the soil and contribute to recharging the local groundwater aquifer.
- **Return flow** – water can return to the Walker River either via surface drains or groundwater flow. Water that drains off fields and is used elsewhere (e.g., in other fields or WMAs) is not counted as return flow unless it eventually returns to the Walker River.)

Table 3-7. Data Sources for Walker River Basin Upstream of Wabuska Water Balance

Variable	Data Source	Time Period	Average Values
Surface Water Diversions (af)	Pahl 2000 and Shaw pers. comm. 2008	1981–2007	E. Walker: 22,000 Smith: 59,000 Mason: 126,000
Groundwater Pumping (af)	Gallagher 2006	1994–2004	Smith: 24,000 Mason:79,000
Groundwater Pumping (af)	Estimate[a]		E. Walker: 0
Irrigated Area (ac)	DRI 2006	1986, 1992, 1995, 1998, 2000, 2002	E. Walker: 4,015 Smith: 17,452 Mason: 34,972
Riparian/Wetland Area (ac)	DRI 2006	1986, 1992, 1995, 1998, 2000, 2002	E. Walker: 3,307 Smith: 3,309 Mason: 7,434
Percent of riparian/wetland that is considered riverine[b]	GIS analysis of GAP data (U.S. Geological Survey National Gap Analysis Program 2004)		E. Walker: 88% Smith: 33% Mason: 34%
Annual Flow East Walker downstream of Bridgeport Reservoir (af)	USGS 2008a	1981–2007	118,000
Annual Flow East Walker upstream of Strosnider Ditch (af)	USGS 2008a	1981–2007	125,000
Annual Flow West Walker at Hoye Bridge (af)	USGS 2008a	1981–2007	191,000
Annual Flow West Walker near Hudson (af)	USGS 2008a	1981–2007	151,000
Annual Flow at Wabuska (af)	USGS 2008a	1981–2007	139,000

[a] East Walker groundwater pumping was estimated based on ratios for Smith and Mason Valleys of overall water use (surface water diversions plus groundwater pumping) to irrigated plus non-riverine riparian acreage.

[b] This evaluation assumed all riparian/wetland vegetation within 1,000 feet of the river channel to be riverine (directly linked to the river). Riparian/wetland vegetation that is farther from the river channel is assumed to be dependent on irrigation or incidental groundwater recharge resulting from irrigation.

In the following evaluation, evapotranspiration is estimated and the combination of incidental groundwater recharge and return (GRR) flow are calculated as the sum of diverted and pumped water minus evapotranspiration.

Evapotranspiration

The amount of water that disappears through ET can be approximated using measured net ET rates for typical vegetation, where net ET equals total ET minus precipitation. Net ET was estimated for irrigated lands, riverine vegetation, and non-riverine riparian and wetland vegetation. Riverine vegetation was assumed to draw water indirectly from river flow. Non-riverine riparian and wetland vegetation was assumed to obtain water incidentally from surface water diversions and groundwater extractions.

Measured ET rates can be quite variable. For alfalfa, which makes up more than half of the irrigated lands (see DRI acreage summaries in Chapter 7, Land Use and Agriculture), net ET measurements in the Walker and Carson basins have ranged between 31 and 45 inches (Allander pers. comm. July 29, 2008 and Maurer et al. 2006). Net ET rates for irrigated pasture have ranged between 28 and 46 inches. Riparian and wetland areas have relatively high ET, but other crops grown in the Walker River basin, such as onions and garlic, probably have lower ET rates (Allander pers. comm. July 29, 2008). For this analysis, the average values measured for alfalfa in the Walker and Carson River Basins were adjusted downward to estimate the ET for other crops.

The ET rates used in this analysis are included within Table 3-8 below. Additional discussion about ET assumptions for crops, riverine and riparian vegetation, and phreatophytic vegetation can be found in Appendix 3A.

Incidental Groundwater Recharge and Return Flow

Water that is diverted or pumped and not lost to ET will either go to incidental groundwater recharge or return the river. GRR flow was calculated as the residual of diverted and pumped water minus evapotranspiration of agricultural crops and non-riverine riparian and wetland vegetation. The combined estimated annual GRR volumes are:

- East Walker River: 9,000 af
- Smith Valley: 25,000 af.
- Mason Valley: 94,000 af

There is a groundwater divide in Smith Valley. GRR north of the divide flows toward Alkali Lake instead of the Walker River. The estimate provided here is for the entire Smith Valley, both north and south of the divide.

Water Efficiency

The amount of water diverted from surface water and groundwater and the estimated consumption by crops can be used to produce an estimate of water efficiency (i.e., consumptive use divided by diversions and pumping). Some of the water that is applied runs off the field or seeps into the ground. In addition, there are conveyance losses, which either provide water for the ET of non-riverine vegetation or add to GRR flow.

For the East Walker reach, Smith Valley, and Mason Valley, the estimated water efficiency is 53%, 60%, and 46%, respectively, with an overall value of 50% (see Appendix 3A for the underlying calculations). Note that these efficiency rates include the effect of conveyance losses. The water that is not used consumptively is either used by riparian/wetland vegetation or contributes to incidental GRR flow.

Upstream Water Balance Results

Table 3-8 provides a summary of the average flow volumes in the East Walker, Smith Valley, and Mason Valley reaches. These numbers are presented graphically in Figure 3-15. The river inflow and river outflow for each reach in Table 3-8 are based on gaged river flow. The river inflow to each reach minus the surface water diversions and the estimated riverine ET will not equal the river outflow because there can be numerous unmeasured small local inflow and outflow such as return flow, tributary flow, and interaction with groundwater. In Mason Valley, the estimated GRR is large (94,000 af/yr), but on average there is a small measured loss in river flow (3,000 af/yr), suggesting a slight net loss to groundwater.

Table 3-8. Estimated Average Annual Flow Volumes in Three Subareas of the Walker River Basin

	East Walker[d]	Smith Valley[d]	Mason Valley[d]
Inflow (af)	118,000	191,000	276,000
Surface Water Diversion (af)	22,000	59,000	126,000
Groundwater Pumping (af)	0	24,000	79,000
Irrigated Acres	4,015	17,452	34,972
Riparian/Wetland Acres	3,007	3,309	7,434
Fraction of Riparian/Wetland Acres Supported by Irrigation	0.12	0.67	0.66
Estimated Riparian/Wetland Acres Supported by Irrigation	353	2,217	4,906
Estimated Acreage Supported by Irrigation[a]	4,367	19,669	39,877
Acre-Feet per Acre [b]	5.0	4.2	5.1
Agricultural ET Rate (inches)	34.5	34.5	32.4
Non-Riverine ET Estimate (af) [c]	13,000	58,000	111,000
Agricultural ET Estimate (Consumptive Use) (af)	12,000	50,000	94,000
Percent of Diversions and Pumping Used Consumptively	53%	60%	46%
Riverine ET Estimate (af)	9,000	4,000	9,000
Riverine ET as % of Inflow	8%	2%	3%
Incidental groundwater recharge and return (af)	9,000	25,000	94,000
Inflow minus surface water diversion minus riverine ET (af)	87,000	128,000	141,000
Outflow (af)	125,000	151,000	139,000
Flow change within reach (af)	38,000	23,000	-3,000

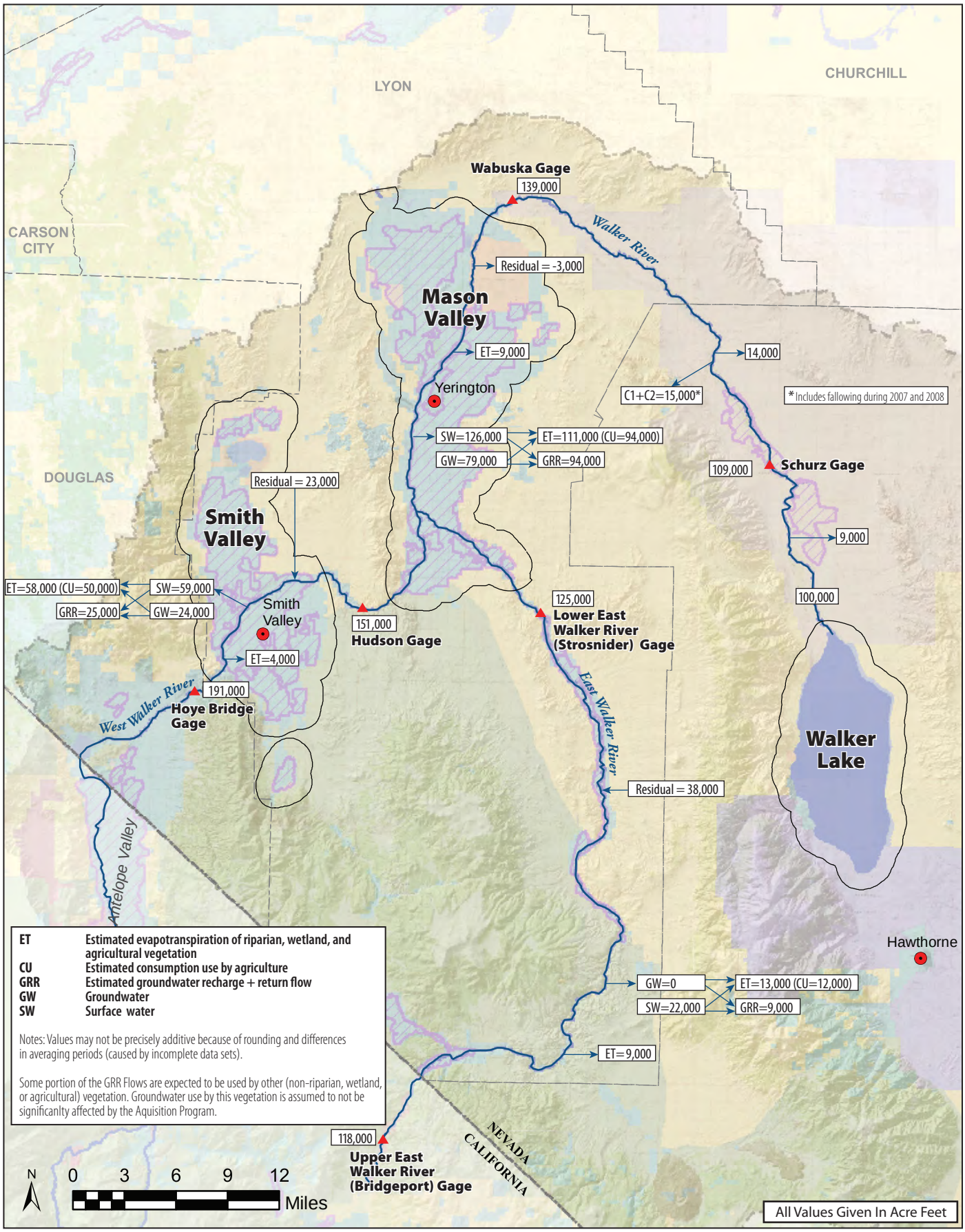
Note: This table does not include water budget values not expected to change, such as ET from natural phreatophytic vegetation or evaporation from the Anaconda Mine Pit lake or Alkali Lake.

[a] This value is the irrigated acres plus the riparian/wetland acres supported by irrigation (e.g., from canal seepage, tailwater runoff, or shallow groundwater).

[b] Surface Water diversions plus groundwater pumping divided by estimated acreage dependent on irrigation

[c] Combined ET from crops and non-riverine riparian vegetation

[d] Water volumes are rounded to the nearest 1,000 af.



ET	Estimated evapotranspiration of riparian, wetland, and agricultural vegetation
CU	Estimated consumption use by agriculture
GRR	Estimated groundwater recharge + return flow
GW	Groundwater
SW	Surface water

Notes: Values may not be precisely additive because of rounding and differences in averaging periods (caused by incomplete data sets).

Some portion of the GRR Flows are expected to be used by other (non-riparian, wetland, or agricultural) vegetation. Groundwater use by this vegetation is assumed to not be significanlty affected by the Aquisition Program.

00516.07 Walker River Basin Restoration Project/Average Flow Volumes (12-08)

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Figure 3-15
Average Annual Flow Volumes for the Walker River Basin for all Data Available from 1981 to 2008

Water Quality

Key water quality topics are water quality of Walker River and Walker Lake, groundwater quality, and the plume of contaminated groundwater from the Anaconda Mine site.

While several water quality constituents are of concern in the Walker River Basin, this Draft EIS focuses on TDS because of its impacts on the ecosystem of Walker Lake. TDS is a measure of all dissolved solids in water, including salts, metals, and all organic and inorganic components of water that are dissolved or extremely small (small enough to pass through a fine-mesh filter).

Walker River Water Quality

The water quality of rivers is determined largely by interaction of water with the landscape and human activities. Water moving across and through the landscape is exposed to different minerals within the soils and rocks of different geomorphic regions. Human activities that alter the land, consume and use water, or discharge material to a water body further modify water quality. It is common to find differences in surface water quality across a large region like the Walker River Basin, which encompasses urban, rural, and undeveloped desert areas.

Under section 303(d) the federal Clean Water Act, Nevada is required to develop a list of water bodies requiring action to achieve water quality standards. Water bodies that do not meet established water quality standards and are listed on a state's 303(d) list are considered impaired. An impaired water body is a water body that has concentrations of pollutants or contaminants that exceed the threshold to support its beneficial uses (e.g., irrigation, or municipal and domestic water supply). The East and West Walker Rivers and the mainstem Walker River are listed as impaired waters on Nevada's 303(d) list, as shown in Table 3-9. Nevada's 2004 303(d) Impaired Water Bodies List (Nevada Division of Environmental Protection 2005b) is the most recent EPA-approved 303(d) list for the state. Nevada's draft 2006 303(d) list, published in 2008, has not yet been approved by the EPA (Sertic pers. comm. 2008).

Table 3-9. 303(d) Impaired Waters List for Walker Lake and Tributaries

Water Body	Location	Parameter	TMDL Priority
West Walker River	At the state line	Zinc	Low
Topaz Lake Reservoir	Topaz Lake Reservoir (Nevada Portion)	Phosphorus (Total)	Low
		Temperature	Low
West Walker River	From CA state line to Wellington	Temperature	Low
West Walker River	From Wellington to confluence with the E. Walker River	Temperature	Low
East Walker River	East Fork of Walker River at state line	pH	Low
		Temperature	Low
East Walker River	East Walker River at Bridge B-1475 to the East Walker at the state line	Phosphorus (Total)	Low
		Temperature	Low
		pH	Low
East Walker River	East Walker River above the confluence with the West Walker to Bridge B-1475	Temperature, water	Low
		Iron	Low
Mainstem Walker River	From the confluence of the East and West River to the inlet of Weber Reservoir	Iron	Low
Mainstem Walker River	From the outlet of Weber Reservoir to the inlet of Walker Lake	pH	Low
Walker Lake	Entire lake	Arsenic	Low
		Cadmium	Low
		Molybdenum	Low
		Phosphorus	Low
		Selenium	Low
		TDS	High

Source: Nevada's 2006 303 (d) Impaired Waters List—Draft (Nevada Division of Environmental Protection 2008a)

Sediment, nutrients, and metals are the most widespread pollutants contributing to the exceedance of water quality standards in the major rivers of Nevada (Nevada Department of Conservation and Natural Resources 2008). In the East and West Walker River, phosphorus is the nutrient found most consistently at elevated concentrations. Possible sources of phosphorus to these rivers include fertilizers from agricultural runoff, animal feedlots (manure), and natural sources such as soil and rock formations. Historic mining activities and natural sources, such as metal-bearing rock formations and geothermal springs, are associated with high metal concentrations in surface water.

Sediment has been a concern for all branches of the Walker River (East, West, and Mainstem). Sediment transported in a stream or present in the water column of a standing body of water is commonly measured as total suspended solids (TSS). TMDL criteria for TSS have been established for the East Walker River in Nevada (U.S. Environmental Protection Agency 2008a) and the Walker River upstream of the Walker River Indian Reservation (Nevada Division of Environmental Protection 2005b).

In the Walker River upstream of Wabuska, active sediment transport occurs. Recent University research employing multiple methods of analysis found that sediment transport would be expected to occur at essentially all flow conditions. Their analyses were consistent with field observations (Dennett et al. 2009).

Since 1998, when elevated concentrations of mercury were found in common loons from Walker Lake (Seiler et al. 2004), mercury has been a concern in the Walker River Basin. Weathering of naturally occurring minerals, mining activities in the basin (i.e., Aurora, Bodie, and Yerington), geothermal springs, and atmospheric deposition of mercury from regional and global sources are all potential sources of mercury in the basin.

A summary of water quality data recently collected by the University are provided in Table 3-10 (Hershey et al. 2009). These data were collected between April 2007 and September 2008 during the months of February, April, August, and September. The data show that electrical connectivity (EC) and TDS concentration generally increase as water flows downstream. As expected, water temperature was also found to generally increase as the river moves downstream (Davis et al. 2009). At the downstream end of the Walker River, water temperature is approximately equal to average air temperature (Stone et al 2009).

TDS at Walker River near Schurz had a median concentration of 337 mg/L, whereas TDS in the East and West Walker Rivers had a median TDS concentration of 156 and 121 mg/L, respectively. These concentrations are below the 500 milligrams per liter (mg/L) annual average maximum limit for water supply, irrigation, and livestock uses set by the Nevada Administrative Code. Generally, TDS concentration tends to be lower in headwaters and increase

downstream. Seasonal changes in stream flow also affect TDS; TDS concentration generally decreases as flow increases.

Table 3-10. Summary of Select Water Quality Measurements 2007-2008

Reach	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)
East Walker				
Minimum	8.05	192	116	4.2
Median	8.17	238	156	15.1
Maximum	9.33	317	206	73.6
West Walker				
Minimum	7.64	62	34	0.6
Median	8.11	200	121	3.8
Maximum	8.61	571	345	67.0
Mainstem				
Minimum	8.03	235	150	1.1
Median	8.20	435	253	14.2
Maximum	8.82	644	394	59.0
Schurz				
Minimum	8.05	472	283	1.1
Median	8.22	539	337	4.8
Maximum	8.82	644	394	12.2

Source: Hershey et al. 2009

West Walker River

See Appendix 3A for more information particular to this reach.

East Walker River

See Appendix 3A for more information particular to this reach.

Mainstem Walker River

It was stated above that sediment is a water quality issue in all branches of the Walker River. It was also indicated that TSS levels measured at Schurz were

found by University researchers to be relatively low (Table 3-10). Nevertheless, the lower main stem Walker River channel near and downstream of Schurz is unstable and, as a result, substantial amounts of sediment can be eroded during high flow events. For example, in June 2005 when flow reached as high as 1400 cfs, approximately 477,000 metric tons of sediment were eroded from the banks of the lowermost 1.5 kilometers (0.9 mile) of the Walker River (Adams and Chen 2009).

The instability of the lower Walker River can be attributed greatly to the recession of Walker Lake. As the lake recedes, the topographic gradient increases, leading to substantial down-cutting of the river channel. This down-cutting propagates upstream as the gradient becomes more severe. As of early 2009, the head cut had propagated as far upstream as the defunct siphon that crosses the river near Lateral 2A about a mile below Schurz and had begun undercutting the siphon. As the lake recedes, the river also extends through terrain that formerly was river delta or lake bottom with deposits of finely grained sediment that are highly erodible (Adams and Chen 2009).

Walker River contributes an annual average TDS load of approximately 21,000 tons per year (Thomas 2004, as cited in Nevada Division of Environmental Protection 2005a). TDS concentration tends to be slightly higher at Schurz than at Wabuska. From May 1998 to March 2001, the period of data overlap for the two locations, TDS concentrations from grab samples ranged from 111 to 412 mg/L at Wabuska (average of 241 mg/L) and from 132 to 476 mg/L near Schurz (average of 274 mg/L) (Nevada Division of Environmental Protection 2008b). Recent studies by UNR/DRI found that TDS in the Walker River near Schurz is typically 300 to 400 mg/L (Hershey et al. 2009).

Walker Lake Water Quality

Walker Lake is listed as an impaired water body on Nevada's draft 2006 303(d) list for TDS, selenium, and phosphorus (Nevada Division of Environmental Protection 2008a). A TMDL for TDS has been established for Walker Lake and approved by the EPA (Nevada Division of Environmental Protection 2005a). Mercury concentration in Walker Lake has also been a concern (Seiler et al. 2004).

Walker Lake Limnology

Walker Lake is monomictic; it is thermally stratified from May or June to November and undergoes a period of complete mixing in late fall (Beutel 2001, Sharpe et al. 2008). The boundaries of the epilimnion and hypolimnion, and consequently, the metalimnion, undergo broad shifts during the warmer months of the year (Sharpe et al. 2008). Summer water temperature in the epilimnion ranges from 68° to 78° F and from 50° to 54° F in the hypolimnion (Beutel et al. 2001).

Late winter water temperatures ranges from 43° to 46° F throughout the water column (Beutel et al. 2001).

The hypolimnion of Walker Lake becomes anoxic following thermal stratification. Decomposition of organic matter, primarily algae, depletes the oxygen, making it an unsuitable habitat for fish. Hypolimnetic anoxia in Walker Lake results in the accumulation of ammonia and sulfide in the hypolimnion. The ammonia enters the epilimnion during summer wind mixing events and by diffusion across the thermocline. Ammonia within the hypolimnion then promotes eutrophication (Beutel et al. 2001).

Walker Lake is limited in nitrogen and rich in phosphorus, a characteristic common to lakes in semi-arid environments (Beutel et al. 2001). This characteristic has promoted spring and summer blooms of nitrogen-fixing cyanobacteria, particularly of the genus *Nodularia* (Acharya et al. 2009). *Nodularia* dominates the phytoplankton community in summer, and consequently reduces phyto- and zooplankton diversity (Sharpe et al. 2008). Another type of cyanobacteria, *Synechococcus*, which can grow in anaerobic conditions, was found to bloom in the hypolimnion (Acharya et al. 2009).

Predominant zooplankton species include the cladoceran *Monia hutchinsoni*, the calanoid copepod *Leptodiaptomus sicilis*, and the rotifer *Hexarthra fennica*; *M. hutchinsoni* is most abundant from July through October, *L. sicilis* is perennial in the lake, and *H. fennica* abundance exhibits yearly variations (Beutel et al. 2001).

Walker Lake Total Dissolved Solids

As Walker Lake elevation has declined, TDS concentration has increased (See Affected Environment, Walker Lake Surface Elevations, above). TDS concentration has increased from 2,560 mg/L in 1882 (Russell 1885, compiled by USGS) to 16,081 mg/L on March 4, 2008 (Heggeness pers. comm. 2008), a net increase of approximately 13,500 mg/L over 126 years (an average increase of about 110 mg/L per year).

The increase in TDS concentration is a function of reduced freshwater inflow and evaporation. As water evaporates, dissolved solids are left behind; with less dilution (and lake volume) from reduced inflow, concentration of TDS in the lake increases.

Based on available data, an equation was developed to estimate TDS concentration in Walker Lake as a function of lake volume and time (Appendix 3A). The calculated values match the measured data fairly well (Figure 3-16).

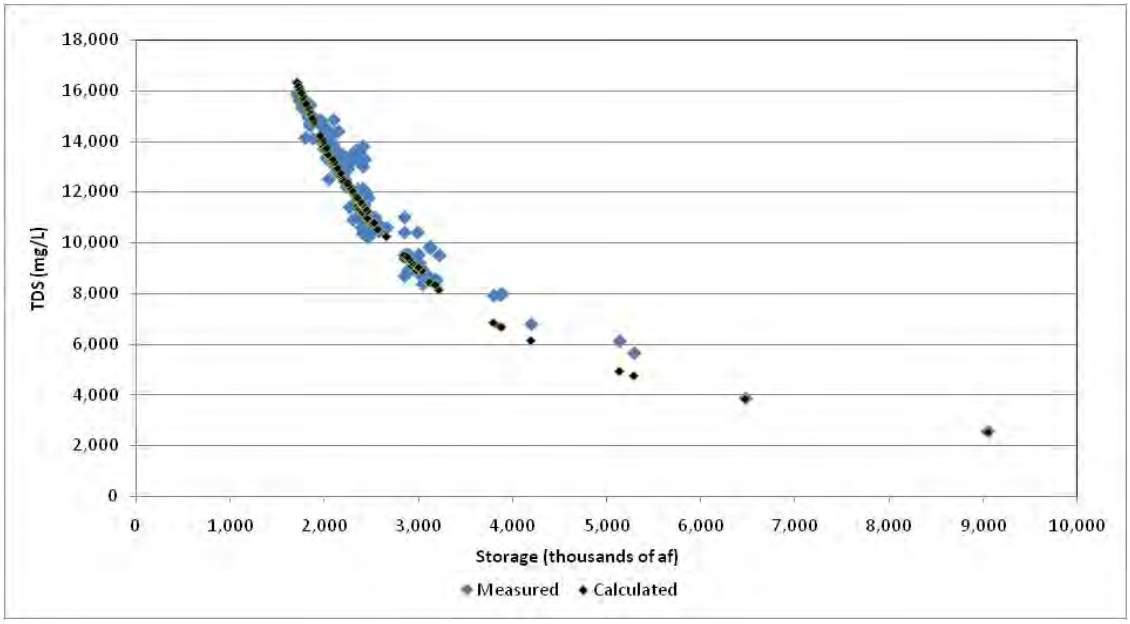


Figure 3-16. Walker Lake Volume Compared to Concentration of Total Dissolved Solids

Groundwater Quality

Groundwater quality is important for determining whether there might be issues associated with the purchase of groundwater to augment Walker Lake inflow or with groundwater recharge.

Total Dissolved Solids

The concentration of TDS in groundwater is an indicator of the general quality of the water. In groundwater, much of the TDS originates from natural sources such as mineral springs, and carbonate and salt deposits in rock. Other sources include stormwater and agricultural runoff, and point/nonpoint wastewater discharges. High TDS concentration may indicate aquifer contamination from agricultural drainage, industrial wastes, or geothermal water (Thodal 1996).

The quality of groundwater in the Walker River Basin is variable. In general, the TDS concentration in recharge areas in the mountains is low and increases closer to discharge areas in the lower parts of the valley (Everett and Rush 1967). In the Schurz area, groundwater TDS concentration derived from specific conductance values average around 2,361 mg/L (U.S. Geological Survey 2008b). The federal recommended drinking water standard for TDS is 500 mg/L. NDEP currently uses federal Safe Drinking Water Act standards for groundwater quality. In the Whiskey Flat-Hawthorne area, the average TDS concentration in wells, derived from specific conductance values, is 860 mg/L (U.S. Geological Survey 2008b).

Anaconda Mine Site

In Mason Valley, a plume of contaminated groundwater from the site of the Anaconda Copper Mine is moving north, in the direction of local groundwater flow. This site, also known as the Yerington Mine, covers more than 3,400 acres just west of Yerington. Portions of the site are owned by Arimetco (now in bankruptcy) and portions are public lands managed by BLM (U.S. Environmental Protection Agency 2008b). When open-pit mining ceased on the property, the groundwater pumping that had been used to keep the pit dry also stopped, and Pit Lake was formed. The lake volume is around 40,000 acre-feet. The water has filled approximately 500 feet of depth out of the total pit depth of 800 feet. The lake surface elevation increases at the rate of 10 feet/year (U.S. Environmental Protection Agency 2008b). At this rate, the lake would fill in roughly 30 years, but the rate of increase will probably decline as the water elevation approaches the ground surface elevation.

Although the site is not on the National Priorities List, the EPA Region 9 Superfund Program does have the lead for the site as a special project (Seter pers. comm. 2008). EPA has spent approximately $6 million at the Anaconda Mine site since 2000 investigating and addressing environmental issues. Actions include capping 100 acres of mine tailings to prevent erosion and fugitive dust, constructing and lining a new pond to prevent overflow of mine drainage, and completing other upgrades to the system.

ARCO is conducting response actions at the site, including broad investigation of the nature and extent of groundwater contamination (Trout 2008). Wells have been placed in the path of the contaminated groundwater plume to create a “pump back” system that is used for monitoring water quality and for restricting the movement of the plume by pumping contaminated groundwater into lined evaporation ponds (U.S. Environmental Protection Agency 2009).

Although groundwater monitoring data are limited, six contaminants were detected in drinking water wells north of the mine site: arsenic, boron, fluoride, uranium, radium, and gross alpha radioactivity. In some wells, arsenic and uranium concentrations and gross alpha activity have exceeded federal water standards of the Safe Drinking Water Act (U.S Dept. of Health and Human Services 2006, U.S. Environmental Protection Agency 2008c).

Geothermal Water

As indicated in Chapter 2, Alternatives, there is an existing option to purchase water from the Homestretch Geothermal Power Plant (operated by Homestretch Geothermal), which is located immediately upstream of the Wabuska gage. If secured, discharge to the River from this source would occur via pipeline at a suitable point of delivery near the Wabuska gage in accordance with the terms of

a water quality discharge permit from the Nevada Division of Environmental Protection and all other necessary approvals. NDEP has issued a draft discharge permit for public review (Nevada Division of Environmental Protection 2009). Spent geothermal water from the power plant is currently discharged to an alkali flat east of the power plant and to a basin west of the power plant.

Water quality data from the power plant from 2003 to 2005 indicate arsenic, boron, copper, fluoride, sulfate and TDS concentration in excess of water quality criteria (Nevada Division of Environmental Protection 2006), with fluoride being of greatest concern (Pahl pers. comm. 2008). Arsenic, boron, copper, and fluoride make up a tiny fraction of the TDS from the site (Nevada Division of Environmental Protection 2006), and sulfates constitute about 40% of the TDS. A recent report by the U.S. Bureau of Reclamation (2009) indicates that aluminum, arsenic, boron, fluoride, sulfates, TDS, and the sodium absorption ratio all exceeded state water quality standards in a significant percentage of samples, that adequate dilution flows will limit the frequency and duration of the allowable Homestretch discharge, and that when dilution flows are adequate to meet the fluoride standard all other constituents of concern would be in compliance with their respective water quality standards.

Environmental Consequences

This section describes the impact analysis relating to water resources for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assessment Methods

Some potential water resources impacts were assessed qualitatively based on existing processes and issues in the Walker River Basin and how they may change in response to the Proposed Project and alternatives. These are listed below.

- Improved Walker River water quality due to dilution of low quality inflow to the river as a result of increased river flow.
- Introduction of warm or poor quality water to Walker River.
- Reduction in Walker River water temperature.
- Change in the migration of contaminated groundwater from the Anaconda Mine site.
- Change in the amount of groundwater pumping.
- Reduction of water supplies for remaining canal users as a result of reduced canal flow.

- Reduction in water availability for water users dependent upon incidental field runoff, seepage, and return flow from neighboring farms.
- Improved water quality resulting from reduced return flow.
- Increased erosion resulting from greater river flow and from more exposed soil (i.e., fallowed or retired lands) that could be susceptible to erosion during rainstorms.
- Construction-related stormwater impacts (short-term impact potentially associated with construction under Alternative 3).

Conflicts with policies and goals in the master plans of Lyon and Mineral Counties that relate to water resources are addressed in Chapter 7, Land Use and Agriculture.

Quantitative evaluations of impacts are based upon two distinct analyses: one for the portion of the study area upstream of Walker Lake, and one for Walker Lake. The methods employed in these analyses are described below. Hydrologic impacts evaluated quantitatively for the upstream area are:

- a reduction in surface water diversions,
- a reduction in irrigated lands (a potential indirect impact of reduced surface water diversions), and
- the estimated impact of reduced irrigation on groundwater recharge.

Hydrologic impacts evaluated quantitatively for Walker Lake are:

- the change in Walker Lake elevation and storage as a result of increased inflow, and
- the change in Walker Lake TDS concentration as a result of increased inflow

Average annual values were used for the quantitative analyses. Because the impacts of Alternatives 1 and 3 would take many years to reach fruition, the use of average annual values is appropriate. The duration of Alternative 2, as analyzed, would be shorter, but because it is impossible to predict year-to-year variations in future hydrologic conditions, average annual values are still considered an appropriate way to estimate impacts.

The University has recently developed three integrated models and data for assessing hydrologic conditions in the basin (Boyle et al. 2009). The three models simulate:

- runoff in response to precipitation,
- groundwater –surface water interactions, and

- operations and water rights allocation.

The models have not yet been used to estimate hydrologic impacts associated with the Acquisition Program, but they may eventually help to improve the estimated project impacts described below in this Draft EIS.

Upstream Analysis

Purpose

The purpose of the upstream analysis is to estimate the effect of the alternatives on the flow of water to Walker Lake, on remaining water supplies for agriculture, and on incidental recharge of groundwater. To these ends, and to provide input to the Walker Lake analysis, the upstream analysis was used to estimate the following parameters

- the amount of water to be acquired from the East Walker area, Smith Valley, and Mason Valley to achieve an additional 50,000 af/yr of additional inflow to Walker Lake, on average, under Alternatives 1 and 2;

- the portion of acquired water that would reach Walker Lake under Alternatives 1 and 2. This result was then used together with information from Chapter 2, Alternatives, to determine the amount of additional lake inflow that could be achieved with existing funding for Alternative 1;

- the potential increase in Walker Lake inflow under Alternative 3;

- the reduction in irrigated acres under Alternatives 1 and 2; and

- the effect of each alternative on groundwater recharge.

The analysis assumes that sufficient funds are or will become available to obtain, in perpetuity, an average additional 50,000 af/yr at Walker Lake under Alternative 1 (the Proposed Project). A comparable amount of total funding is then assumed to be available for Alternative 2 (the Leasing Alternative), however the need for recurrent expenditures to sustain a leasing program means that funding will eventually run out, and the effects of Alternative 2 would only be temporary. If only partial funding were available, the effects described here would be expected to be proportional to the funding. For example, if only 50% of the total funding needed for Alternative 1 were available, Alternative 1 would only yield an average of half as much water to the lake (25,000 af/yr) and effects on irrigation and groundwater recharge would also be half of that expected for the fully-funded project. If the funding for Alternative 2 were diminished by 50%, the increased inflow to Walker Lake and effects on irrigation and groundwater recharge would only last half as long. Finally, for Alternative 3 (the Efficiency Alternative), the

analysis assumes that sufficient funding would be available to increase water efficiency to a high level. Estimated funding requirements for full implementation of the action alternatives, existing allocated funding levels, and assumed level of efficiency for Alternative 3 are discussed further in Chapter 2, Alternatives.

General Approach to Upstream Analysis

The upstream analysis uses the baseline water balance for the portion of the study area upstream of Wabuska (see Affected Environment, above) combined with estimates of additional river losses that would occur in the Reservation reach as a result of flow augmentation.

The main approach of the upstream analysis is to estimate how the movement of water would deviate from existing conditions in response to a reduction in irrigation diversions resulting from acquisitions. This includes estimating changes in water use by vegetation, changes in incidental groundwater recharge associated with irrigation, and changes in the hydrologic interaction between the river and the groundwater aquifer in each valley. The effect of each alternative on groundwater recharge was estimated by evaluating current incidental recharge, potential changes to incidental recharge, and how much extra water the river would contribute to groundwater recharge if there were a reduction in incidental groundwater recharge as a result of reduced surface water diversions.

The upstream analysis is based upon actual water use, i.e., it evaluates potential changes to the existing water balance based on historic average diversions, groundwater withdrawals, consumptive use by crops, and other variables. A discussion of the conversion between water rights and actual water appears in Chapter 2, Alternatives; however, this conversion is not needed for the upstream analysis discussed herein.

The analysis does not separately account for the different types of surface and groundwater rights that may be appurtenant to irrigated lands, but is instead based on analysis of average total surface water diversions, average total groundwater withdrawals, and average total irrigated land within each valley. While important for day-to-day operations, these distinctions by type should not matter for determining the long-term average annual relationships between water application, irrigated land, and GRR flow. Future use of the University hydrologic models (Boyle et al 2009) may further refine the assessment of impacts associated with the Acquisition Program by incorporating smaller time steps and more fine-scale evaluation of water right types and locations.

In this analysis, incidental GRR flow is estimated as the difference between the amount of irrigation water diverted and pumped and the amount of irrigation water consumed by agricultural crops and non-riverine riparian/wetland vegetation. The two components of GRR cannot be readily separated because it is

unknown how much of the irrigation water drains to the river either directly in canals or via subsurface flow, nor is it known how much is reapplied by another user. (Return flow can be estimated using upstream to downstream changes in flow, but other uncertain factors such as riverine ET and river infiltration to groundwater also affect river flow.)

To estimate the amount of acquired water that would reach Walker Lake each year, on average, over the long term, the upstream analysis includes estimates of additional losses that could occur as a result of the action alternatives. When acquired or saved water is left in the river instead of being diverted into a canal, there are several ways that the additional volume of water could be reduced before it reaches Walker Lake:

- **Return flow** – Return flow includes surface water returns and shallow groundwater returns to the river that are associated with the application of irrigation water from both surface and groundwater sources. If there had been return flow associated with water obtained through any of the three alternative actions, that return flow would no longer be contributing to river flow.
- **Groundwater** – If incidental groundwater recharge from irrigation is reduced, then the groundwater table could drop. If this happens, river flow would be reduced because either there would be less groundwater inflow to the river or there would be more seepage from the river to groundwater.
- **Loss downstream of Wabuska** –Increases in flow in this area might produce an increase in river losses associated with groundwater infiltration or riparian ET.

Two other possible sources of additional loss were considered, but not included in the analysis because they are likely to be insignificant: increased ET upstream of Wabuska and increased infiltration to groundwater resulting from increases in river flow.

Additional information on the general approach to this analysis is presented in Appendix 3A.

Assumptions

Because of uncertainties in the upstream analysis, the following assumptions were made.

- Acquisitions would be evenly distributed within each valley (distribution between valleys is expected to differ and is described later).
- Non-riverine riparian and wetland vegetation is dependent on irrigation water.

- ET of native phreatophytic vegetation would not significantly change in response to project actions.
- Pumping of groundwater would not change substantially. However, the potential for acquisitions to cause a change in groundwater pumping is discussed qualitatively in the Impacts section.
- All water acquisitions would be derived from irrigation supplies. This assumption was made for the purposes of the upstream hydrologic analysis and to estimate the amount of irrigated land that could be affected by the alternatives. Impacts on existing irrigated lands could be lessened by the purchase of non-agricultural water (e.g., geothermal).
- Acquired water would not be diverted by downstream water users, but the flow augmentation would be reduced as a result of river losses.
- The river would partially compensate for reductions in GRR by increased infiltration to groundwater, reducing the magnitude of the incremental increase in river flow caused by the action alternatives.
- No transit losses were assumed for water passing from East Walker Reach or Smith Valley Reach through Mason Valley. The basis for this assumption is described below.
- Approximately 10% of the incremental flow increase at Wabuska would be lost between Wabuska and the lake. The basis for this assumption is described below.
- ET by riparian vegetation near the river would not substantially increase upstream of Wabuska, but may increase downstream from Schurz where the channel is now often dry.
- For Alternatives 1 and 2, water efficiency (crop ET divided by diverted and pumped water) would remain unchanged.
- For Alternative 3, the same level of water efficiency would be attained in all valleys.
- For Alternative 3, total ET from irrigated lands would not change.

Transfer Scenarios for Alternatives 1 and 2

The effects of water right acquisitions on agricultural lands and groundwater are dependent on how much of the acquired water would be allowed to be transferred. Depending on the specific circumstances involved with a particular acquisition, it is possible that NSE or another agency whose approval of a water transfer is sought, could determine that some portion of the acquired water should remain in canals to avoid harm to other existing water right holders. If this were the case, additional water would need to be acquired to compensate for the portion not transferred.

Two scenarios, the Full Transfer Scenario and the 33% Scenario were established to represent likely extremes for evaluating Alternatives 1 and 2. These scenarios bound the range of potential impacts, such as the amount of irrigated land needed to implement the Acquisition Program. For Alternative 3, the amount of irrigated land involved in acquisitions was not considered to be critical because the alternative would not cause irrigated land to be retired or fallowed. Consequently, no specific transfer scenario was developed for Alternative 3.

Full Transfer Scenario

The Full Transfer Scenario assumes that all acquired water could be left in the river to flow downstream, and that no supplemental groundwater rights would be retired. Supplemental groundwater would be available to the seller, potentially to supplement other primary rights; however, it is assumed that supplemental groundwater pumping would not increase, based on expected conditions of NSE approval.

The Full Transfer Scenario minimizes future reductions in irrigated land resulting from acquisition of appurtenant water rights (identified as the "best case" for irrigated land in Table 3-11) but has the greatest impact on groundwater because existing incidental groundwater recharge associated with an acquisition would be eliminated and pumping of supplemental groundwater could continue ("worst case" for incidental groundwater recharge in Table 3-11). This scenario also would cause the greatest reduction in surface or sub-surface return flow to the river.

The amount of water to be acquired from each valley was adjusted until the irrigated lands required for acquisitions were similar in proportion for each valley, yet the amounts of increased inflow at Walker lake associated with each acquisition subarea still fell within the subarea percentages indicated in Chapter 2, Alternatives (i.e., of the 50,000 af/yr average additional inflow to Walker Lake that is expected to accrue as a result of upstream water acquisitions, 60-85% would come from Mason Valley, 10-30% from Smith Valley, and 5-10% from East Walker.). In reality, the percent reduction in irrigated land would likely differ among the valleys because of the willing–seller requirement.

33% Scenario

Out of concern for impacts on other existing water right holders, NSE could impose restrictions on transfers, such as limiting transfers to the consumptive use portion of the water right (i.e., only the amount of water consumed by crops, quantified as ET). NSE indicated such restrictions have been imposed in the past, but such issues could be addressed on a case by case basis (Yardas pers. comm. 2008). If NSE were to limit all transfers to the consumptive use portion of the purchased water rights and require that all supplemental groundwater rights

previously associated with those rights be retired, the amount of irrigated land needed for acquisitions would be substantially larger than for the Full Transfer scenario. To limit the potential impact, the University has stated that it intends to make acquisitions that would result in no more than a 33% reduction in the irrigated acreage within Mason Valley, Smith Valley, or the East Walker area (James pers. comm. 2009). Consequently, the 33% Scenario was developed to fit the assumption that no more than 33% of the irrigated land in each valley would be retired or fallowed as a consequence of Alternatives 1 or 2 (the "worst case" for irrigated land in Table 3-11). Under the 33% Scenario, effects on incidental groundwater recharge would be minimized by restrictions that may require some of the acquired water to remain in canals ("best case" for incidental groundwater recharge in Table 3-11). Consequently, more irrigated land would be required than under the Full Transfer Scenario but groundwater effects and reductions in return flow would be smaller.

Whether the Full Transfer Scenario or the 33% Scenario could actually deliver 50,000 af/yr of additional inflow to Walker Lake depends most fundamentally upon the extent of viable offers from willing sellers, although other factors also influence them both, such as the extent to which restrictions are imposed on transfers of acquired water and whether supplemental groundwater rights are retired. The likelihood of the 33% Scenario providing an average additional inflow of 50,000 af/yr to Walker Lake also depends heavily upon the geographic distribution of offers from willing sellers, to a greater extent than does the Full Transfer Scenario. If nearly all acquired water does come from irrigated agriculture but minimal offers come from Smith Valley or the East Walker area, the 33% limit would prevent sufficient acquisitions from being made to provide 50,000 af/yr of additional inflow to Walker Lake.

Transfer Scenario for Alternative 3

For Alternative 3 it is assumed that mechanisms would be developed to allow conserved water to pass downstream without being diverted by downstream and/or junior priority rights holders. For example, diversion rights might be reduced in amounts commensurate with the conservation savings to ensure that conserved water can be administered like a water right and thus protected from simply becoming part of the available water supply.

Approach for Specific Alternatives

A qualitative description of the transfer scenarios for each action alternative is provided in Table 3-11.

The upstream analysis for Alternative 1, the Proposed Project, also applies to Alternative 2, the Leasing Alternative. Both of these alternatives were evaluated with the Full Transfer Scenario as well as the 33% Scenario, and both of these

alternatives result in the same estimated reduction in irrigated lands and incidental groundwater recharge. The distinction between these two alternatives is that, under Alternative 1, some land would be permanently removed from irrigated agricultural production and the resulting flow changes would be permanent, whereas under Alternative 2, as analyzed, fallowing would likely be rotated between different land parcels over time and the resulting flow changes would be temporary (i.e., until funds are exhausted). Alternative 3 (Efficiency Alternative) differs in that irrigation of existing irrigated lands is assumed to continue.

For Alternative 3, a scenario of 100% efficiency was evaluated to assess the theoretical maximum yield of this alternative. In practice, absolute efficiency is not achievable, so a more realistic overall efficiency value of 75% was used to assess impacts from Alternative 3.

This 75% overall efficiency value roughly represents a 90 to 95% conveyance efficiency combined with an 80 to 85% on-farm or application efficiency. Literature indicates that application efficiency rates ranging from 60% to 90% are attainable with a variety of irrigation technologies (Howell 2003 pp 467 - 472; Solomon 1988). Attaining an efficiency of 90% would require a very large investment in conveyance infrastructure improvements such as canal lining and piping.

Alternative 3 has fairly large impacts on incidental groundwater recharge because a large portion of current losses contributes to groundwater recharge. Because of feasibility concerns, crop switching was not considered as part of the quantitative assessment for Alternative 3. However, if crop switching measures were to be included as part of Alternative 3, it could result in potentially significant water savings with less impact on GRR flow.

Table 3-11. Qualitative Evaluation of Transfer Scenarios for the Action Alternatives

Alternative	Best Case for Irrigated Land	Worst Case for Irrigated Land	Best Case for Incidental Groundwater Recharge	Worst Case for Incidental Groundwater Recharge
1	Full Transfer	33% Scenario	33% Scenario	Full Transfer
2	Full Transfer	33% Scenario[a]	33% Scenario	Full Transfer
3	NA	NA	Elimination of incidental ET	75% Overall Efficiency

[a] For Alternative 2, the reduction in irrigated land is assumed to result from the temporary fallowing of land rather than permanent retirement of parcels.

Alternatives 1 and 2 were evaluated assuming that the percent reduction in irrigated land in each of the three valleys (East Walker, Mason Valley, and Smith Valley) would be relatively similar, while the percent of total acquisitions for each valley would fall within the ranges described in Chapter 2, Alternatives. For Alternative 3, it was assumed that the same level of water efficiency would be attained in each valley.

Please see Appendix 3A for additional information on assumptions and methods specific to the Full Transfer scenario, the 33% scenarios, and Alternative 3.

Assumptions and Methods for Additional Losses

Whatever portion of acquired water is eventually approved for transfer, additional physical losses will occur between the existing points of diversion and Walker Lake. Losses related to a potential decrease in GRR flow, which are particular to the alternative being evaluated, are discussed above. This section describes how potential additional losses were assessed for all alternatives.

Riverine Evapotranspiration Upstream of Wabuska

Because it is unclear whether riverine ET would increase beyond existing levels and because, if there were an increase, it would represent a small percent of the total acquired water, riverine ET was assumed to remain at existing levels in the upstream valleys (upstream of Wabuska). The existing riverine ET is supported by existing flow and would not reduce the volume of a flow increase.

Mason Valley Transit Losses

No transit losses were assumed for water passing from East Walker Reach or Smith Valley Reach through Mason Valley. As water flows through Mason Valley a certain amount of water is lost to ET (discussed above) and infiltration. As river flow increases, there is an increase in the wetted perimeter, which theoretically could increase the amount of infiltration to groundwater. However, most infiltration, which is largely dependent on local groundwater conditions, already occurs under base flow conditions and would not reduce the amount of acquired water moving through the valley. There is no clear significant relationship between groundwater infiltration and mere increases in flow within the Mason Valley. Any increases in infiltration associated with increases in flow (transit losses) are likely to be insignificant compared to the losses estimated to be associated with reductions in GRR flow.

Incremental Increase in Losses between Wabuska and Walker Lake

A discussion of existing losses in this reach, as well as the relationships between losses in the reach and flow at Wabuska, is included in the Affected Environment

section above. The analysis described below and described in more detail in Appendix 3A builds upon that Affected Environment information.

Wabuska to Schurz

There are sufficient flow measurements from Wabuska and Schurz to estimate how riverine losses in this reach may increase in response to increases in flow. Based on the analysis in the Affected Environment section, the incremental loss associated with a flow increase over and above existing flow is assumed to be 4% of the additional flow at Wabuska.

Schurz to Walker Lake

The flow measurements taken at Schurz and near the lake indicate the magnitude of the existing flow losses in this reach. However, it is difficult to say how much the losses in this reach may increase if river flow is increased as a result of the Acquisition Program. See Appendix 3A for more discussion on this topic.

Wabuska to Walker Lake

For the purposes of estimating the incremental losses associated with increased flow between Wabuska and Walker Lake, a composite value of 10% of flow at Wabuska was used. This 10% represents a combination of the estimated 4% increase in losses between Wabuska and Schurz, along with an additional 6% loss. The additional 6% roughly accounts for incremental increased losses between Schurz and the lake that might result from occasionally providing flow when there are no baseline flow as well as for increases in ET from additional growth of riparian and wetland vegetation made possible by the increased flow from the action alternatives.

Upstream Analysis Results

Results of the upstream analysis are summarized in Table 3-12.

Table 3-12. Estimate of Hydrological Effects Upstream of Walker Lake

	Alternative 1[a]		Alternative 2[a]		Alternative 3[b]
	Full Transfer Scenario	33% Scenario	Full Transfer Scenario	33% Scenario	75% Water-Use Efficiency
Acquisition of Real Water (average af/yr)					
East Walker	6,000	Not Analyzed[c]	Same as Alternative 1 but temporary	Same as Alternative 1 but temporary	7,000
Smith Valley	20,000	Not Analyzed[c]			16,000
Mason Valley	56,000	Not Analyzed[c]			79,000
Total	82,000	Not Analyzed[c]			102,000
Increase in Walker Lake Inflow (average af/yr)					
East Walker	3,500	<=FTS[d]			1,600
Smith Valley	15,000	<=FTS[d]			8,700
Mason Valley	31,500	<=FTS[d]			21,900
Total	50,000	<=FTS[d]			32,200
Maximum Reduction in Irrigated Land (acres)[e]					
East Walker	1,100	1,300			0
Smith Valley	4,200	5,800			0
Mason Valley	9,500	11,500			0
Total	14,800	18,600			0
Maximum Percent Reduction in Irrigated Land[e]					
East Walker	27	33			0
Smith Valley	24	33			0
Mason Valley	27	33			0
Weighted Average	26	33			0
Reduction in Groundwater Level (inches/year)					
East Walker	0.2	<FTS			0.5
Smith Valley	0.4	<FTS			0.9
Mason Valley	0.5	<FTS			1.3
Weighted Average	0.4	<FTS			1.0

Notes: Many assumptions were used in generating these estimates. See description of assessment methods above and in Appendix 9A.

FTS = Full Transfer Scenario

a. Estimates for Alternatives 1 and 2 assume that funding would be sufficient to attain an average increase in Walker Lake inflow of 50,000 af/yr under Alternative 1.

b. Water savings were assumed to result from reductions in ET from riparian/wetland vegetation and reductions in incidental groundwater recharge, not reductions in ET from irrigated lands (as may result from crop switching).

c. It was not necessary and there was too little information to develop detailed numerical estimates for the 33% Scenario (see Appendix 9A).

d. The amount of additional water reaching Walker Lake under the 33% Scenario may or may not be as high as an average 50,000 af/yr, depending on the extent of water transfer restrictions and the geographic distribution of acquisitions.

e. The estimated reduction in irrigated land for Alternatives 1 and 2 assumes no increase in water-use efficiency.

Under the Full Transfer Scenario, an estimated 59%, 76%, and 56% of the water acquired from the East Walker, Smith Valley, and Mason Valley reaches, respectively would arrive at Walker Lake. These percentages were used to estimate the amount of water needed from each valley to provide an additional 50,000 af/yr of inflow, on average, to Walker Lake. The resulting estimate is one of the most important findings from the upstream analysis; for Alternatives 1 and 2, 82,000 af/yr, approximately, would need to be acquired in order to deliver 50,000 af/yr to Walker Lake (an average of 61% of acquired water arriving at the lake). This estimate uses the upstream flow loss rates associated with the Full Transfer Scenario. If the transfer of water were to be restricted as in the 33% scenario, more water would need to be acquired in the agricultural areas. (See Appendix 3A for additional discussion of this point.)

Under Alternative 3, an estimated an estimated 25%, 54%, and 28% of the water acquired from the East Walker, Smith Valley, and Mason Valley reaches, respectively would arrive at Walker Lake. The percent of flow augmentation estimated to reach the lake is much lower for Alternative 3 because a large proportion of the water savings for this alternative come at the expense of a reduction in GRR flow that helps to sustain river flow. As a result of these low yields, it is estimated that 102 af/yr would need to be acquired in order to deliver maximum savings of 32,300 af/yr to Walker Lake (an average of 32% of the acquired water arriving at the lake).

It may seem counterintuitive that more water acquired from Mason Valley would be lost on the way to Walker Lake than would be lost from water acquired from Smith Valley. Most of the estimated loss is caused by the river response to a reduction in GRR flow. This loss would result directly from acquisitions within the valley. If no water were acquired within a valley, then there would be almost no incremental increase in losses within the valley. For that reason, water acquired in Mason Valley would be reduced in response to the connection between the river and the aquifer in Mason Valley and water acquired in Smith Valley would be reduced in response to the connection between the river and the aquifer in Smith Valley. The primary reason for the seemingly odd result of losing more Mason Valley water than Smith Valley water is the presence of the groundwater divide in the Smith Valley. The presence of the groundwater divide in Smith Valley has the effect of reducing the valley-wide average connection between the river and the aquifer in Smith Valley. As a result, more of the water acquired from Smith Valley would stay in the river (and there would be a larger reduction in groundwater).

Additional information about the results of the upstream analysis can be found in the impact section below, and in Appendix 3A under the following headers.

- Percent of Flow Augmentation Reaching Lake
- Irrigated Land Affected and Groundwater Recharge Lost

- Alternatives 1 and 2
  - Impacts on Irrigated Land
  - Incidental Groundwater Recharge and Return Flow
- Alternative 3
  - Feasibility
  - Impacts on Irrigated Lands.
  - Impacts on Non-Riverine Riparian and Wetland Habitat
  - Incidental Groundwater Recharge and Return Flow
- Discussion of Key Uncertainties
  - Uncertainties Relevant to All Alternatives
    - Transfer restrictions
    - Connection between River and Aquifers
    - Water Accounting
    - Natural Vegetation
    - Protection of Acquired Water
  - Uncertainties Relevant to Alternatives 1 and 2
  - Uncertainties Relevant to Alternative 3
  - Summary of Uncertainties

Appendix 3A includes a discussion of multiple uncertainties associated with the upstream analysis. Two key uncertainties warrant summarizing:

Transfer Restrictions. The largest restriction likely to be placed on a water transfer would be to limit the transfer to the consumptive use component of the water right. Such a restriction could be limited to estimated actual consumptive use or could be limited to ideal consumptive use (i.e., maximum consumptive use, which would result from ideal watering conditions). If all water for the Acquisition Program were to come from irrigation water and all of that water were to be subject to a consumptive use restriction, then it is possible that the 33% limit on reduction to irrigated lands could prevent the full 50,000 af/yr from reaching Walker Lake. Table 3-13 shows two estimates of the amount of water that might be obtained at existing points of diversion under these circumstances (all water from irrigation supplies and consumptive use restriction placed on all acquisitions). The resulting amount of water is 52,000 af/yr with estimated actual consumptive use and 65,800 af/yr with ideal consumptive use, both less than the 82,000 af/yr needed for the Full Transfer Scenario. However, if all transfers were

restricted to consumptive use, GRR flow would be minimally affected and losses would be much less than under the Full Transfer Scenario.

Table 3-13. Estimated Water Transferred if Consumptive Use Restriction Applied to 33% of Irrigated Lands

Valley	Average Irrigated Acres[a]	33% of Irrigated Acres	Estimated Actual Consumptive Use (ft/yr)[b]	Water Allowed to be Transferred (af/yr)	Estimated Ideal Consumptive Use (ft/yr)[c]	Water Allowed to be Transferred (af/yr)
East Walker	4,015	1,325	2.88	3,812	3.5	4,637
Smith	17,452	5,759	2.88	16,569	3.5	20,157
Mason	34,972	11,541	2.70	31,163	3.5	40,392
Total	56,439	18,625		51,543		65,187

a) From Table 3-5
b) From water balance analysis
c) Huntington pers. comm. 2008

Connection between River and Aquifers. The calculations for the interrelationship between river flow and groundwater GRR recharge and return flow are very dependent on the work performed by Myers, which showed a strong connection between groundwater recharge and river flow (Myers 2001a and 2001b). Work by DRI and UNR researchers through the UNR-DRI Walker Basin Project has provided some support to the conclusion that river diversions left in the river would be lost to infiltration as a result of decreased irrigation. However, future use of the University models could result in adjustments to these conclusions. If river flow is, in reality, not so responsive to incidental groundwater recharge, less water would need to be acquired, leased, or saved to meet a given increased inflow objective. However, groundwater impacts would be larger.

Even if the valley-wide long-term estimates for the connection between incidental groundwater recharge and river flow are accurate, the actual effect of the project would depend on the locations of agricultural land that is fallowed or retired, or the locations of any efficiency-increasing actions. Furthermore, short-term effects of reduced groundwater recharge on river flow would probably be less than the long-term effects. This is particularly pertinent to Alternative 2, which would only last as long as there is funding. River infiltration could also be affected by decreasing groundwater levels under existing trends (see Affected Environment) and the No Action Alternative. In the absence of the Acquisition Program, decreasing groundwater levels have the potential to increase river infiltration, thereby reducing base flow.

Walker Lake Analysis

The analysis of Walker Lake includes hydrologic and water quality (TDS) components. The TDS component is dependent on the hydrologic evaluation. A water balance of the lake was developed using two different baseline inflow scenarios (low and high). The lake water balance was then used to estimate future lake elevations and TDS concentrations for all alternatives.

Walker Lake Hydrologic Analysis Methods

To develop the Walker Lake water balance, lake storage values at the end of each water year were used to calculate the change in storage. The amounts of water entering the lake as direct precipitation and leaving as gross evaporation were calculated to determine net evaporation (i.e., outflow). The change in storage that was not attributable to evaporation or precipitation was assigned to the net inflow from Walker River, groundwater, and local surface water.

Use was made of prior Walker Lake hydrologic analyses (see Table 3-14). Water balance calculations initiated by Pahl in 1999 (Pahl pers. comm. 2008) were updated to include more recent data including a recent average precipitation value from Allander and Lopes (2008) and storage data from the USGS (Allander pers. comm. 2008). (Collectively, the information from Pahl, Allander and Lopes, and USGS are referred to below as the updated NDWP analysis.) A range of lake evaporation rates was used to evaluate changes in Walker Lake conditions. (USGS is working on a water balance analysis publication that is expected in 2009.)

Table 3-14. Estimated Average Annual Values for Walker Lake Water Balance Parameters by various authors

Parameter	Everett and Rush 1967 (1908-1965)	Thomas 1995 (1939-1993)	Allander and Lopes 2008 (1995-2007)	Lopes 2009 (1988-1994)	Kleinfelder 2007 (1939-1993; 1926-2004)
Evaporation (feet)	4.1	4.1	4.9[d]	4.3[e]	4.3[c]
Precipitation (inches)	4	4.9	3.8		
Walker River inflow (af)	140,000	76,000	117,000[b]	0 during 1988-1994	77,200, 1939-93; 89,000, 1926-2004
Local Surface Water (af)	3,000	3,000			
Ground Water (af)		11,000[a]			3,000 local, 8,000 from Walker River

[a] Cited as coming from Schaefer, 1980

[b] Average flow at Schurz gage (13.5 miles upstream of Walker Lake) for water years 1995–2007.

[c] Based on Topaz pan evaporation 0.75; estimate may be low because value did not compensate for missing December–March data (Allander and Lopes pers. comm. 2008).

[d] Based on measurements of evaporation

[e] Preliminary result based on water balance assessment for the 1988-1994 drought after determining that evaporation measurements were too high

Projection of No Action Alternative

The inflow and evaporation values can be used to project future lake elevations. High and low average inflow and evaporation scenarios were used to produce a range of future lake storages.

Estimated inflow and evaporation must correspond in order to explain observed changes in storage. For example, if a relatively high value for evaporation is assumed, there must be a relatively high inflow to meet the observed sequence of historic storage values. Consequently, projections of future lake elevation similarly must use inflow and evaporation rates that correspond with each other.

The selected net inflow and evaporation values used in the two scenarios are:

- **Low inflow/low evaporation scenario:** average annual net inflow = 90,000 af and net evaporation = 3.7 feet (Thomas 1995).

- **High inflow/high evaporation scenario:** average annual net inflow = 106,100 af and net evaporation = 4.0 feet. The inflow value is the estimated average for the period 1960 to 2007 using the updated NDWP analysis and evaporation is a preliminary USGS estimate (Lopes 2009). The period of record is relatively long and reflects recent historic conditions that involve substantial groundwater pumping in addition to surface water diversions.

Projection of Action Alternatives

If average annual inflow to Walker Lake is increased by 50,000 af, lake surface elevation will increase relative to current conditions. The extent of this expected increase was assessed by adding 50,000 af/yr to the low and high lake inflow scenarios described above. The selected net inflow values were:

- Low lake inflow: average annual net inflow = 90,000 af (base) + 50,000 af (flow augmentation) = 140,000 af (net evaporation = 3.7 feet).
- High lake inflow: average annual net inflow = 106,100 af (base) + 50,000 af (flow augmentation) = 156,100 af (net evaporation = 4.0 feet).

To assess lake elevation for Alternative 1 under currently available funding, it was assumed that an additional 7,300 af/yr reached Walker Lake (as described above) instead of 50,000 af/yr.

For Alternative 2, it was assumed that enough water could be leased to increase average annual lake inflow by 50,000 af. Such increase, however, is only expected to last 3 years (as analyzed) with current funding, or about 20 years with full funding.

Alternative 3 was evaluated by assuming that an average of 32,300 af/yr would reach Walker Lake (as described above) in addition to baseline inflow, in a manner similar to that used for Alternative 1.

Groundwater inflow to the lake was assumed to remain constant for each action alternative, although it could increase (by aquifer augmentation) or decrease (by reduced gradient) in response to increased lake inflow.

The increased inflow to the lake was assumed to start instantaneously in water year 2008. In reality, it would take some unknown amount of time to fully implement each of the alternatives. The start date would have little effect on the end results of Alternatives 1 and 3 because the effects would be long-term.

However, because the effect of Alternative 2 would be more transient, the estimated lake elevation when the leasing program ends would depend on the start date as well as the hydrologic conditions. None of the action alternatives was

implemented in water year 2008 as was assumed in the evaluation, and deviations from the average increased inflow of 50,000 af/yr would have a pronounced effect for actions lasting a limited number of years. As a result, the lake water surface elevations estimated for years 3 and 20 for Alternative 2 are not expected to be accurate. However, the change in lake elevation and TDS should be close to correct if Alternative 2 is initiated relatively soon and average hydrologic conditions prevail.

Walker Lake TDS Analysis Methods

To assess future concentration of TDS in Walker Lake under the No Action Alternative, the equation for TDS as a function of time and lake storage, described above under Affected Environment, was applied for a given year and lake elevation. The equation was adjusted to account for increased TDS flux from the river, and then used to calculate TDS that would correspond to the change in lake elevations estimated with the future inflow values described above.

For future conditions, the low and high average annual inflow were assumed to occur each year. This assumption yields smooth curves for future conditions. In reality, flow would vary greatly from year to year and the long-term equilibrium values would not be constant but fluctuate about a mean.

Lake Analysis Results

Results of the lake assessment for water surface elevation and TDS concentration are summarized for all alternatives in Table 3-15. In addition, they are discussed below under impacts and are discussed in Appendix 3A under the following headings:

- No Action Alternative: Walker Lake Storage and Surface Area
- No Action Alternative: Walker Lake TDS
- Alternative 1: Walker Lake Storage and Surface Area
- Alternative 1: Walker Lake TDS
- Alternative 2: Walker Lake Storage and Surface Area
- Alternative 2: Walker Lake TDS
- Alternative 3: Walker Lake Storage and Surface Area
- Alternative 3: Walker Lake TDS

Impact Criteria

An impact on water resources would be considered adverse if implementation of the Proposed Project or an alternative would:

- conflict with existing water rights;
- substantially alter the existing drainage pattern of the study area, including changes that result in substantial erosion, siltation, or flooding;
- substantially reduce groundwater supplies or interfere with recharge to the extent that it substantially lowers groundwater elevations; or
- violate local regulations or guidelines pertaining to water resources.

A substantial change is one that would be noticeable and measurable and that would have either a short-term or long-term beneficial or detrimental effect.

An impact on water resources would be considered adverse if it would exacerbate or create an impairment of surface water or groundwater. It would be considered beneficial if it would diminish impairment.

Impacts

Environmental impacts were determined by evaluating projected future conditions under each alternative versus the baseline of existing conditions and trends. Impacts are discussed in comparison to existing conditions as well as in comparison to future conditions estimated for the No Action Alternative. In determining the nature of an impact (beneficial, minor, or adverse), the No Action Alternative is compared to existing conditions and the Alternatives are compared to the No Action Alternative. The magnitude of impact is the difference in value for a given parameter or resource for a given alternative compared to that for baseline condition.

Some of the potential hydrologic changes associated with Alternatives 1 through 3 are not considered to be either adverse or beneficial by themselves. However, these changes could be adverse or beneficial to other resources. For example, a change in lake elevation by itself is neither adverse nor beneficial, but it may affect fish in the lake. This type of project-related change is labeled as a *hydrologic change* instead of an *impact*. The environmental consequences of hydrologic changes are discussed in other resource chapters. Hydrologic changes are labeled HC, whereas water resource impacts are labeled WI. Changes to river flows, lake elevations, irrigation, and amount of groundwater pumping are considered to be hydrologic changes (which could affect other resources) and are not considered to be water resource impacts.

Table 3-15. Estimated Future Water Surface Elevation and TDS Concentrations for Walker Lake for All Alternatives

	Estimated Future Lake Elevation (feet)						Estimated Future TDS (mg/L)				
	At High Point[a]	Approximate Year of High Point[b]	At Year 2200	At High Point-Change from September 2007 [c]	At Year 2200-Change from September 2007	At Year 2200-Change from No Action Alternative	at Low Point	Approximate Year of Low Point[b]	at Year 2200	At Low Point-Change from September 2007 [c]	At Year 2200-Change from No Action Alternative
No Action Alternative											
High Average Inflow	NA	NA	3,906	NA	-29		NA[d]	NA[d]	39,500		
Low Average Inflow	NA	NA	3,898	NA	-37		NA[d]	NA[d]	51,000		
Alternative 1 - Proposed Project											
Current Funding (average additional 7,300 af/yr)											
High Average Inflow	NA	NA	3,915	NA	-20	9	NA[d]	NA[d]	31,600		-7,900
Low Average Inflow	NA	NA	3,905	NA	-30	7	NA[d]	NA[d]	40,700		-10,300
Full Funding (average additional 50,000 af/yr)											
High Average Inflow	NA	NA	3,970	NA	35	64	11,300	2090	12,400	-4,319	-27,100
Low Average Inflow	NA	NA	3,965	NA	30	67	12,300	2090	13,500	-3,319	-37,500
Alternative 2 – Leasing Alternative											
Current Funding (additional 50,000 af/yr for 3 years)[a]											
High Average Inflow	3,937	2011	3,906[d]	2	-29[d]	0[d]	15,400	2011	39,500[d]	-219	0[d]
Low Average Inflow	3,936	2011	3,898[d]	1	-37[d]	0[d]	15,600	2011	51,000[d]	-19	0[d]
Full Funding (additional 50,000 af/yr for 20 years)[a]											
High Average Inflow	3,948	2028	3,906[d]	13	-29[d]	0[d]	13,200	2028	39,500[d]	-2,419	0[d]
Low Average Inflow	3,945	2028	3,898[d]	10	-37[d]	0[d]	13,900	2028	51,000[d]	-1,719	0[d]
Alternative 3 - Efficiency Alternative											
75% Efficiency (average additional 32,300 af/yr)											
High Average Inflow	NA	NA	3,948	NA	13	42	14,800	2060	16,800	-819	-22,700
Low Average Inflow	NA	NA	3,939	NA	4	41	16,000	2030	19,600	381	-31,400

a. Lake elevations for Alternatives 1 and 3 are expected to generally tend towards their equilibrium values, which are estimated to be attained after year 2100. However, because the increased inflow for Alternative 2 would be temporary, lake level would be expected to rise to a high point and then tend towards the same equilibrium as the No Action Alternative.

b. Assumes that the Walker Lake Acquisition Program was initiated at the beginning of water year 2008 (fall 2007).

c. Fall 2007 was used as a basis of comparison (elevation of 3,935 feet and TDS concentration of 15,600 mg/L in September 2007) because calculations assumed the Acquisition Program was initiated at the start of water year 2008 (October 1, 2008 - September 30, 2008). Because the actions of Alternatives 1 and 3 could continue indefinitely, the lake elevation would change until it eventually would fluctuate about a particular equilibrium value that is independent of the starting elevation. Because Alternative 2 would be temporary, the starting elevation is more important. Because the exact start date of the Acquisition Program is unknown, the short-term results for Alternative 2 are best evaluated not in terms of elevations and TDS concentrations, but in terms of change from the starting point used in the assessment.

d. No low point for TDS because lake level continues to drop from current elevation

e. Alternative 2 was evaluated using the year 3 and year 20 values from the analysis for the fully-funded Alternative 1 (all these scenarios assume an additional average inflow of 50,000 af/yr). Whether the increased inflow was ended at year 3 or 20, the eventual lake levels would be the same as for the No Project Alternative, it would just take 3-20 years longer to reach the equilibrium, and the TDS concentration at year 2200 would be similar to that for the No Project Alternative.

Future conditions under each of the alternatives are estimates and dependent on the validity of the assumptions that were made to conduct the analyses.

No Action Alternative

Under the No Action Alternative, water resources in the Walker River Basin would likely change. For example, farmers may become more efficient with their use of water and groundwater levels may decline. If groundwater levels decline, river flows could also decline.

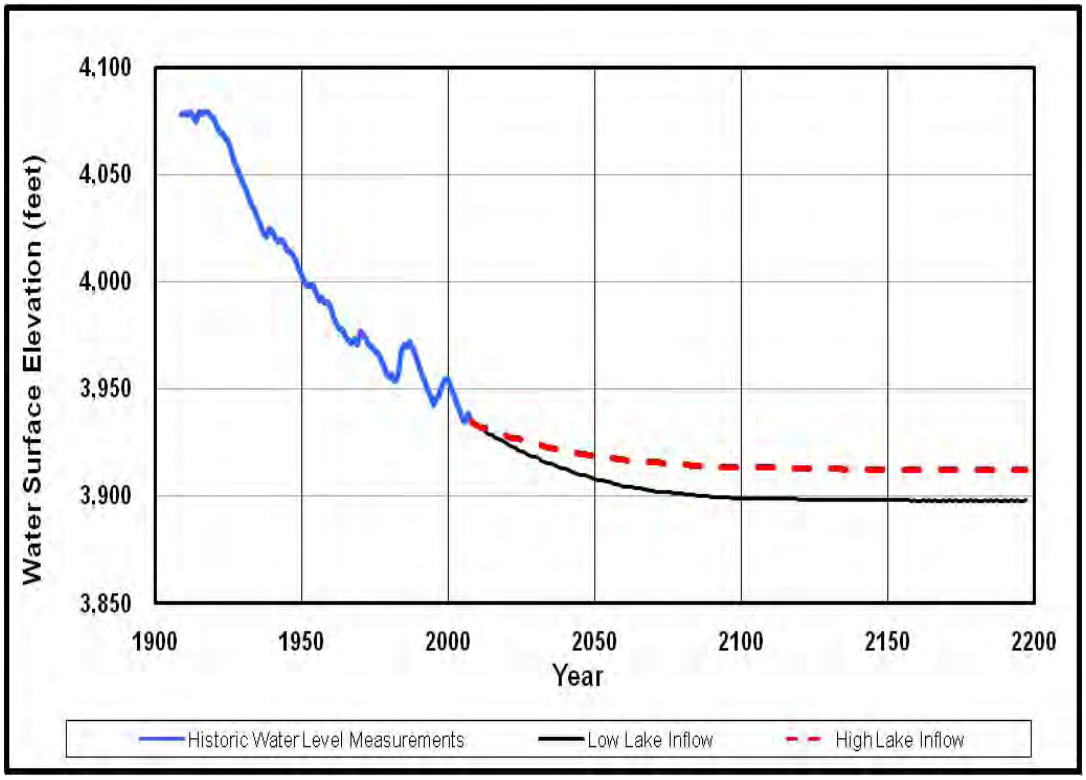
Future hydrologic conditions may be affected by global warming (see Chapter 15, Climate and Climate Change). The effect of climate change on total runoff is uncertain, but it is likely to reduce the portion of precipitation falling as snow, cause the runoff pattern to shift to earlier in the year, and result in higher peak flows. A shift toward earlier runoff and/or higher seasonal peak flows could reduce surface water available for diversion during the irrigation season, but could be beneficial to Walker Lake because it may cause a greater percent of the runoff to reach the lake as a result of decreased river losses and decreased ability of water rights holders to divert flow. Climate change (warming) could also increase lake surface evaporation rates as well as both crop and non-crop ET rates, leading to increased demand for surface water and groundwater. Because the magnitude of each of these changes remains uncertain at this time, future water availability for irrigation and river flow was assumed to be similar to past water availability in this impact analysis.

For this Draft EIS, the key changes associated with the No Action Alternative would be decreased storage, elevation, surface area, and water quality in Walker Lake. These hydrologic changes and impacts are discussed below.

Hydrologic Changes

Hydrologic Change HC-1: Alter Walker Lake Storage and Surface Area (Decrease)

Figure 3-17 shows past and projected lake elevations for the high and low inflow scenarios described in the methods section above. The equilibrium lake elevation range is 3,898 feet to 3,906 feet (Table 3-15). These elevations correspond to storages of 701,900 af to 906,000 af and represent elevation decreases of approximately 37 to 29 feet, from the September 2007 elevation of 3,935 feet. Based on lake bathymetry data (USGS bathymetry report), this would represent a decrease in lake surface area of approximately 7,300 to 5,100 acres.



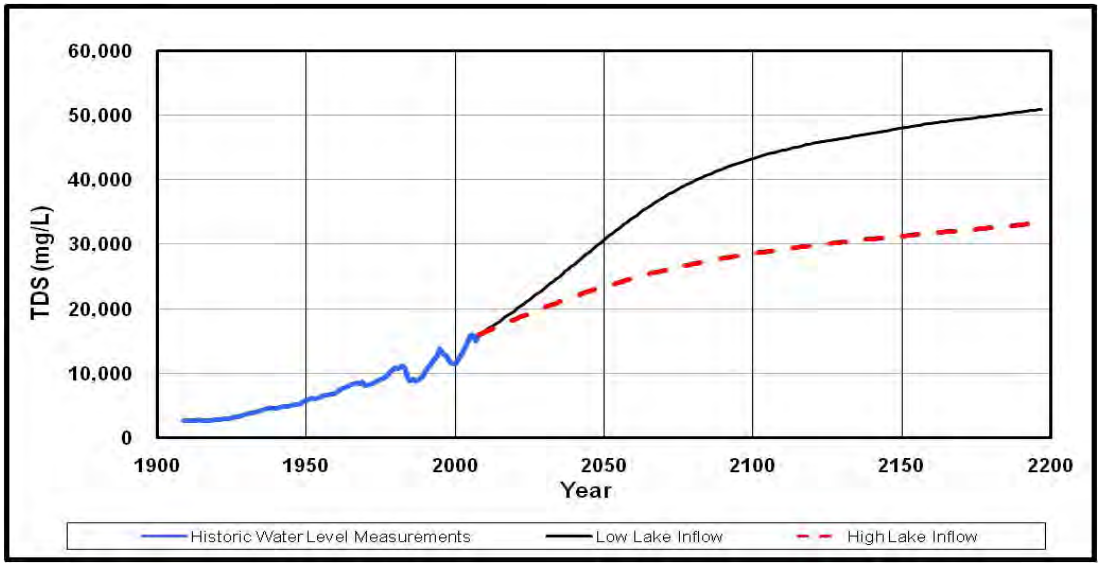
Note: Lines representing the future are smooth because they are based on average annual inflow values. Actual lake elevation would fluctuate around these values.

Figure 3-17. Historic and Projected Water Surface Elevation of Walker Lake under the No Action Alternative based on a High and Low Inflow Scenarios

Direct Impacts

Impact WI-1: Alter Walker Lake Water Quality as a Result of Change in Lake Storage (Adverse)

Projected TDS concentrations for the high and low inflow scenarios for the No Action Alternative are shown in Figure 3-18.



Note: Lines representing future conditions are smooth because they are based on average annual inflow. Actual TDS concentrations would fluctuate around these values.

Figure 3-18. Historic and Projected TDS Concentration in Walker Lake under the No Action Alternative based on High and Low Inflow Scenarios

The projected TDS values under the No Action Alternative range from 39,500 to 51,000 mg/L by 2200 (Table 3-15), compared to 15,600 mg/L in September 2007 and 16,100 mg/L in March 2008. Unlike the estimated lake storage, TDS concentration would continue to increase over time because of the continual influx of salts and other dissolved solids, although this might be offset to some extent by other factors (e.g., mineral precipitation, wind/wave dispersal, and decrease in evaporation rate resulting from high concentration of TDS). In addition, as lake volume changes, TDS flux to and from bed sediments could change.

Under the No Action Alternative, lake water quality may be degraded in additional ways. For example, concentrations of other water quality constituents would increase as lake elevation decreases under the No Action Alternative. In addition, changes in lake storage and TDS would likely cause changes in the thermal stratification of the lake. The volume of cool water at the bottom of the lake would likely decrease. Eventually thermal stratification may cease to occur and there may be times when cool fresh water rests on top of warmer denser water with high TDS concentration. An increase in TDS concentration would likely become problematic before other limnologic effects.

The decrease in lake volume under the No Action Alternative would result in increased concentration of many water quality constituents. There would be a deterioration of water quality. This would be an adverse impact.

Impact WI-2: Decrease Down-Cutting in Lower Walker River as a Result of Increased Lake Level (Adverse)

Currently, the Walker River below Schurz is unstable, with dramatic erosion and down-cutting occurring downstream of the siphon near Lateral 2A partially as a result of dropping lake surface elevation. This down-cutting creates steep channel edges which contribute substantial volumes of sediment to Walker River and Walker Lake as lateral migration of the channel occurs, especially through terrain composed of deposits of former river delta and lakebed. Currently, sediment loads on the order of hundreds of thousands of tons per year are delivered to Walker Lake from a combination of vertical and lateral erosion (Adams and Chen 2009).

With no reduction in upstream water diversions, erosion problems in the lower Walker River would intensify. The existing incision is expected to migrate further upstream if existing trends continue. As indicated in recent University research, this would likely lead to the siphon being dislodged during a flood event and the erosive incision progressing rapidly upstream. This would affect roads, bridges, and other infrastructure in the Schurz area, in addition to the riparian ecology. It would also lead to the geomorphic destabilization of the river between the siphon and Weber reservoir (Adams and Chen 2009).

Alternative 1

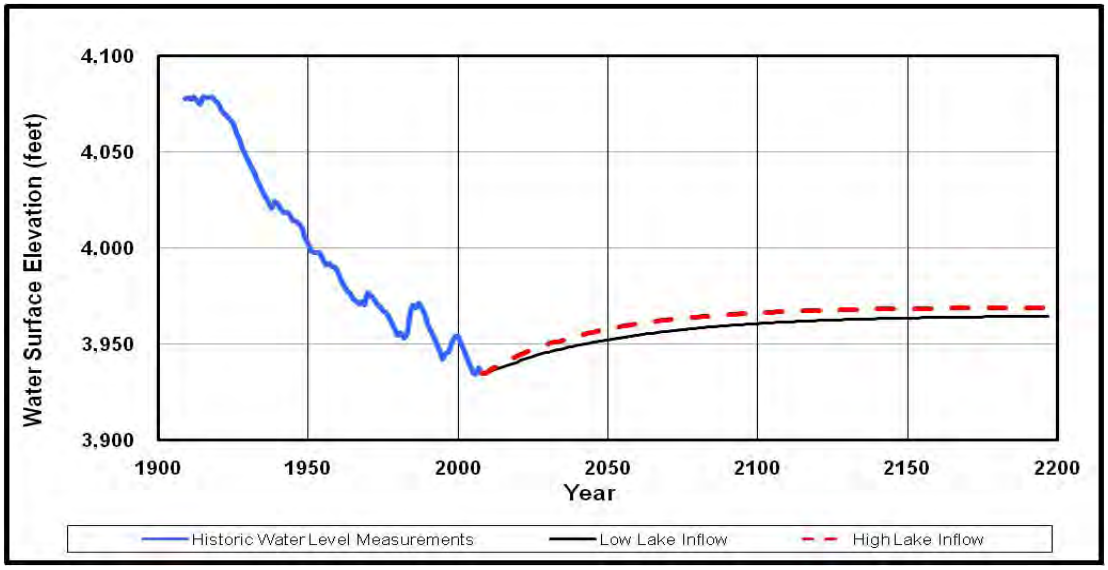
This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that water rights acquired would increase the average annual inflow to the lake by the full 50,000 af/yr. For all hydrologic changes and impacts other than HC-1 and WI-1, if the full amount of water rights was not acquired, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact), but of less magnitude. Hydrologic change HC-1 and impact WI-1, however, are dependent on the change in Walker Lake storage. Under full funding, Walker Lake storage would increase and water quality would improve. If acquisitions were limited to current funding, however, the project would have limited benefit to the lake. Walker Lake storage would continue to decrease and water quality would diminish (albeit at a slower rate than for the No Action Alternative).

Hydrologic Changes

Hydrologic Change HC-1: Alter Walker Lake Storage and Surface Area (Increase with Full Funding; Continue to Decrease with Existing Funding)

Figure 3-19 shows past and projected lake elevations for the high and low inflow scenarios with an average additional 50,000 af/yr. Under Alternative 1, the equilibrium lake elevation ranges from 3,965 feet to 3,970 feet (Table 3-15).

These elevations correspond to lake storages of 2,801,700 af and 3,000,000 af. Compared to recent elevation of 3,935 feet in September 2007, these lake elevations would represent long-term elevation increases of 30 to 35 feet (i.e., 64 to 67 feet higher than for the No Action Alternative). Based on lake bathymetry data (Lopes and Smith 2007), this represents an increase in lake surface area of 6,200 to 7,100 acres.



Note: Lines representing future conditions are smooth because they are based on average annual inflow values. Actual lake elevation would fluctuate around these values.

Figure 3-19. Historic and Projected Future Water Surface Elevation of Walker Lake under Alternative 1 based on a High and Low Average Annual Lake Inflow

With current funding and average inflow increase of 7,300 af/yr, lake water surface elevation would be expected to continue to decline, to 3905 to 3915 feet (7 to 9 feet higher than under the No Action Alternative).

Hydrologic Change HC-2: Reduce Irrigation as a Result of Acquisitions (Decrease)

The effect of the Proposed Project on the amount of irrigated land is expected to be between that estimated for the Full Transfer Scenario and the 33% Scenario, although the effect could be lessened by acquisitions of non-agricultural water or by increased water efficiency.

Under the Full Transfer Scenario, when the portion of irrigated lands in each valley required for acquisitions is similar and the share of acquired water reaching Walker Lake falls within the ranges indicated in Chapter 2, Alternatives (i.e., 60-85% from Mason Valley, 10 to 30% from Smith Valley, and 5 to 10% from East Walker), then the percent reduction in irrigated land for each valley is 27%, 24%,

and 27%, respectively (average of 26%). This corresponds to a reduction in irrigated lands of 9,500 acres for Mason Valley, 4,200 acres for Smith Valley, and 1,100 acres for East Walker, with a combined reduction of 14,800 acres (Table 3-12).

Under the 33% Scenario, the reduction in water use and irrigated land would be 33% for each valley, corresponding to a reduction in irrigated lands of 11,500 acres for Mason Valley, 5,800 acres for Smith Valley, and 1,300 acres for East Walker, a combined reduction of 18,600 acres.

Hydrologic Change HC-3: Increase River Flow (Increase)

Flow augmentation that is based on water right acquisitions would most likely occur during the irrigation season (March through October). If 50,000 af were spread evenly across this period, it would represent an increase of 103 cfs at the downstream end of the river. (Similarly, if the 7,300 af for existing funding were spread evenly across this period, it would represent an increase of 15 cfs at the downstream end of the river). However, it is unlikely that increases in flow would remain constant through the irrigation season. Based on historic irrigation season flow patterns, the greatest flows and increases in flow would be expected to occur during May, June, and July. The increase in flow would likely be greatest at the point of diversion for the most downstream acquisition, with flows at other locations being dependent on instream flow losses and the location of the acquisitions. The percent flow increase would be greatest between Schurz and the lake, where existing summer flows can be zero.

Weber Reservoir may provide an opportunity to manage river flows and discharge to Walker Lake. To the extent that there is available capacity, it may be possible to store acquired water in the reservoir in order to focus releases during a particular period and benefit aquatic and riparian resources or minimize flow losses downstream of the reservoir, provided that reservoir operating criteria are met. Such reservoir operations would be secondary to those for irrigation and flood control and require agreement with BIA and WRPT. Changes in Weber Reservoir operation would require development and implementation of an operations plan to assure that use of decreed water rights on Walker River Indian Irrigation Project would not be impaired and to protect the safety of the downstream community.

If some acquisitions come from sources other than irrigation water, increased flow could occur outside of the irrigation season. For example, potential discharge from the Homestretch Geothermal option might occur year-round.

In addition, it may be possible to store a portion of the acquired water in Weber Reservoir for release during the non-irrigation season (November through February), depending on the management considerations described above, and

any potential to carry acquired water over from the fall to the spring would be limited by flood control criteria and by the relatively small storage capacity of the reservoir, 10,700 af (U.S. Geological Survey 2009).

Hydrologic Change HC-4: Change in Amount of Groundwater Pumping (Increase or Decrease)

Potential project effects on the two types of groundwater rights are described below.

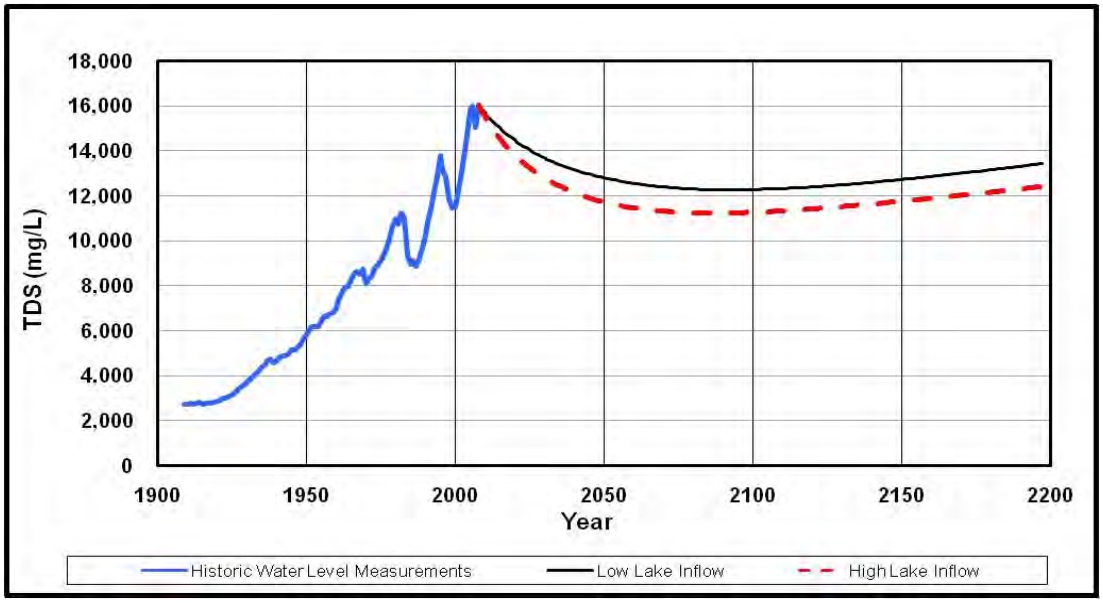
- Primary groundwater rights: The use of primary groundwater rights is not expected to change in response to the Proposed Project, except in the case of a willing sale of such a right.
- Supplemental groundwater rights: If a surface water right with an associated supplemental groundwater right is purchased, the supplemental groundwater right would either need to be retired (resulting in less groundwater pumping) or transferred. To avoid the potential for increased groundwater pumping, the NSE only would allow supplemental groundwater rights to be transferred to or used with a surface water right that is equal or more senior in priority to the prior surface water right.

Theoretically, someone who sold their surface water rights could continue to farm the land to which those rights were previously appurtenant by transferring water rights from another location onto the subject parcel(s). For example, a seller involved with one of the recorded options described in Chapter 2, Alternatives, reportedly wishes to keep in production the appurtenant agricultural land whose water rights are offered for sale, by transferring primary groundwater rights from another property onto the property at issue. Another possibility is that farmers who sold water rights could begin to farm remaining land more intensively, potentially increasing groundwater use, although this action could be taken with or without the Proposed Project. On the whole, for the Proposed Project, the potential for decreased groundwater pumping, resulting mostly from the retirement of supplemental groundwater rights, appears to be greater than the potential for increased groundwater pumping.

Direct Impacts

Impact WI-1: Alter Walker Lake Water Quality as a Result of Change in Lake Storage (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Estimated TDS concentrations corresponding to the high and low inflow scenarios are shown in Figure 3-20.



Note: Lines representing future conditions are smooth because they are based on average annual inflow. Actual TDS concentrations would fluctuate around these values.

Figure 3-20. Historic and Projected TDS Concentration in Walker Lake under Alternative 1 based on a High and Low Lake Inflow Scenarios

If an additional 50,000 af/yr reached Walker Lake on an average annual basis, the estimated TDS concentration would decline until about the year 2090. At that point, TDS would range between approximately 11,300 mg/L (high inflow scenario) and 12,300 mg/L (low inflow scenario) (Table 3-15). With time, however, these values would creep upward so that by 2200, TDS would be approximately 12,400 mg/L to 13,500 mg/L (27,100 to 37,500 mg/L less than under the No Action Alternative).

This upward creep would depend on the TDS flux into the lake. For example, as lake volume increases, TDS flux to and from bed sediments could change. Other factors could also influence TDS concentration (e.g., mineral precipitation, wind/ wave dispersal). In addition, for this action alternative, the TDS flux (load) from the river was estimated to increase in proportion to the flow increase, which could be a slight overestimate because TDS concentration tends to decrease as flow increases. However, this tendency could be counteracted by any acquired water that had a higher TDS concentration (e.g., Homestretch Geothermal) than the river.

If increased inflow were limited to what could be purchased with available funding, it is estimated that the additional inflow would not reduce lake TDS concentration compared to existing conditions. TDS concentration would increase, although not as much as under the No Action Alternative. With existing funding for Alternative 1, TDS in Walker Lake is estimated to reach 31,600 to

40,700 mg/L by the year 2200 (7,900 to 10,300 mg/L less than under the No Action Alternative).

If funding were limited to what is currently available, water quality would be better than under the No Action Alternative, but would not be sufficient to sustain or improve the current lake ecology. However, the improved water quality under the fully-funded Proposed Project would be a beneficial impact.

Impact WI-2: Decrease Down-Cutting in Lower Walker River as a Result of Increased Lake Surface Elevation (Beneficial Impact)

Increased inflow to Walker Lake would decrease vertical erosion in the lower Walker River. With sufficient inflows to raise the surface elevation of Walker Lake (i.e., full funding of Alternative 1), the topographic gradient of the Walker River below Weber Reservoir would be improved, and portions of the river which now pass through highly erodible deposits of former lake bed and river delta would be shortened. This would decrease vertical erosion that now occurs and prevent further upstream migration of the incision. Compared to both existing conditions and the No Action Alternative, this would be a beneficial impact.

If acquisitions do not raise the lake surface elevation but reduce the lake's decline (i.e., with existing funding for Alternative 1), there would be less vertical erosion downstream of Weber Reservoir than under the No Action Alternative.

Impact WI-3: Increase Erosion as a Result of Increased River Flow and Increased Exposed Soil (Adverse Impact)

As river flow increases, the potential for erosion and greater sediment transport also increases. The potential for erosion increases because the velocity of the flow increases, as does the amount of river channel in contact with flowing water (the wetted perimeter). A recent University study of sediment transport in the Walker River system upstream of Wabuska concluded that increased sediment transport would be expected to occur with essentially any increase in flow (Dennett et al. 2009).

Soil erosion caused by rain on fields could also increase under Alternative 1 and contribute additional sediment load to Walker River. The greatest reduction in irrigated land would be 33% for each valley. This would be approximately 1,300 acres for East Walker Valley, 5,800 acres for Smith Valley, and 11,500 acres for Mason Valley (see Hydrologic Change HC-2). Land that is currently covered with crops or crop stubble could be left bare under Alternative 1 and could contribute additional sediment to the Walker River during intense storm events. This dynamic could be stronger in Smith Valley, where fields have greater slope, but the amount of exposed land and the drainage patterns would also have a strong influence. However, in general, erosion from fields is likely to be minimal

because the fields are mostly flat and there is relatively little total precipitation in the valleys (on the order of a few inches per year). In addition, weeds or natural vegetation may grow on land involved in acquisitions, and this would help retain soil.

In sum, Alternative 1 could increase erosion and sediment load in the river by increasing river flow and increasing the amount of exposed earth. In reaches of the river where TSS concentration is relatively low, some increase in TSS concentration could probably be tolerated and the impact might be minor. However, the portion of the Walker River between the confluence of the East and West Walker Rivers and the Walker River Indian Reservation was listed as impaired for TSS in Nevada's 2004 303(d) list and a TMDL was established for it. A TMDL for TSS has also been established for the East Walker River in Nevada. Consequently, an increase in the sediment load that affects these portions of the river would be an adverse impact.

Impact WI-4: Increase Localized Flooding as a Result of Increased River Flow (Minor Impact)

Increasing flow in the Walker River system during the irrigation season could result in increased localized flooding. Upstream of where acquisitions are made, the Proposed Project is not expected to affect the frequency or magnitude of flooding. However, downstream of where acquisitions are made, at locations where the river channel's flow capacity is limited, the increase in river flow would likely result in more frequent localized flooding and greater depth of overbank flow compared to existing conditions.

A recent University study team developed a hydraulic model of the Walker River system upstream of Wabuska using the U.S. Army Corps of Engineers' HEC-RAS software program and determined locations and depths of over-bank flow for a range of river flows that are well within the historical record. For example, at a flow of 500 cfs, about 25 locations were identified in the agricultural valleys of Lyon County where overbank flow would occur. Depths of overbank flow at all locations in the system that the model helped identify ranged from 0.3 to 2.8 feet (Dennett et al. 2009).

A flow of 500 cfs is comparable to the peak annual flows typically seen on the Walker River system during the summer in the agricultural valleys of Lyon County. The peak average monthly flows at the USGS gages on the lower West Walker River near Hudson, the lower East Walker River upstream of Strosnider Ditch, and the mainstem Walker River near Wabuska range from about 350 cfs to about 575 cfs. The peak median daily flows at these same locations range from about 200 cfs to 400 cfs (Dennett et al. 2009).

Consequently, the HEC-RAS results for a flow of 500 cfs provide a fair indication of the extent of overbank flooding that might be expected to occur in association with the Proposed Project if the flows were maintained throughout the irrigation season, including times of peak flow. Overbank flow attributable to the Proposed Project would only be the incremental effect caused by the portion of flow that was acquired water. If the acquired flows were managed so as to avoid periods of peak flow, the impacts would be somewhat less than if they were spread out evenly over the annual hydrograph during the irrigation season. With full funding, Alternative 1 would add about 103 cfs to the river flow at Wabuska if spread out uniformly during the irrigation season. With existing funding, Alternative1 would add about 15 cfs if managed the same way.

It should be recognized that the locations where some additional overbank flow could be expected to occur are already subjected to flooding in many years at times of peak flow. In addition, the type of flooding that would occur is not the catastrophic type with a relatively low probability of occurring. For example, a peak flow event of 500 cfs at the USGS gage near Wabuska has a greater than 1 in 2 chance of occurring in any single year (Adams and Chen 2009, p. 10). By comparison, the January 1997 flood had peak flows of about 2500 cfs at Wabuska .U.S. Geological Survey 2008, as cited in Dennett et al 2009) and its probability of occurrence is about 1 in 10 (Adams and Chen 2009). Consequently, the incremental flooding that might occur as a result of Alternative 1 would probably not be considered substantial or greatly damaging.

In summary, at areas downstream of the historic diversion points of the acquired water, flow increases in Walker River could cause some overbank flow to occur that would not have otherwise occurred. However, the increased localized flooding that could occur as a result of the implementation of Alternative 1 would be considered a minor impact.

Impact WI-5: Improve River Water Quality as a Result of Increased Dilution of Poor Quality Inflow (Beneficial Impact)

Acquisitions would increase flow in Walker River and help to dilute concentrations of problematic water quality constituents such as phosphorous that are contributed by river inputs that are of relatively poor water quality, such as irrigation drainage or runoff from grazing and feeding areas. Increased river flow would help to reduce the fraction of the flow coming from sources with poor water quality. This would be a beneficial impact.

Impact WI-6: Diminish River Water Quality as a Result of Introduction of Water with Poor Quality (Minor Impact)

It is possible that some of the acquired water would be of lower quality than river water. For example, water quality data from Homestretch Geothermal indicate

that aluminum, arsenic, boron, fluoride, sulfates, TDS, and the sodium absorption ratio all exceeded state water quality standards in a significant percentage of samples (U.S. Bureau of Reclamation 2009). However, any discharge to the river would be subject to a discharge (NPDES) permit that would minimize water quality impacts.

The temperature of water discharged from Homestretch Geothermal to cooling ponds is approximately 170º F. Were this water to be used to increase flows in the Walker River, it would be cooled to ambient temperature before release into the river in order to meet state requirements for the temperature of water entering the Walker River (NAC 445A.167).

Homestretch Geothermal effluent water TDS concentration is approximately 1,000 mg/L (Nevada Division of Environmental Protection 2006). This is greater than the typical TDS concentration in the Walker River of about 240 mg/L at Wabuska. This is not a concern for water quality in the river because TDS from Homestretch would be subject to an NPDES permit that would ensure that TDS discharged to the river would be adequately diluted by river flow.

Although the Homestretch Geothermal water contains higher concentrations of TDS than river water, it would still help to dilute TDS concentration in Walker Lake, where the concentration was measured at approximately 16,100 mg/L in March 2008 (Heggeness pers. comm. 2008). Because the Homestretch TDS concentration is greater than that of the lower Walker River, flow augmentation with Homestretch Geothermal water could increase very slightly the rate at which TDS concentration in the lake would creep upward over the long run.

This impact is considered minor because the project would not degrade water quality substantially. Most acquisitions would involve surface water that would remain in the Walker River, not water that would be introduced from other sources. Additionally, before any point source water could be discharged into the river, it would be necessary to obtain an NPDES permit and comply with effluent limits based on applicable technology- and water quality-based standards. Furthermore, the introduction to the river of water from other sources likely would undergo separate environmental review. For example, the permanent acquisition of Homestretch Geothermal water could occur only after the pilot project is implemented, which is being reviewed separately under a NEPA Environmental Assessment process (see Chapter 14, Cumulative Impacts, for additional discussion.)

Impact WI-7: Reduce River Water Temperature as a Result of Increased Flow (Beneficial Impact)

Increased flow could reduce water temperature in the Walker River. As flow increased, velocity would increase and travel time would decrease and cooler

water from the upstream reaches could flow farther downstream before reaching equilibrium temperature. The magnitude of this impact would depend on the volume, timing, and location of increased flow. However, because most flow increases would occur in the lower watershed, where water temperatures are likely already fairly warm, this benefit may be small.

Increased flow would also help improve water temperature by increasing the depth of flow. When depth increases, the diurnal temperature variation decreases, thus reducing the daily maximum temperature.

Most portions of the East Walker and West Walker Rivers are impaired with respect to water temperature (303d list 2008). As a result, a decrease in river water temperature, even if small, would be an improvement. This would be a beneficial impact.

Indirect Impacts

Impact WI-8: Reduce Groundwater Recharge and Elevation as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact)

A reduction in diversions of water for irrigation under Alternative 1 could cause a reduction in groundwater recharge and elevation.

The extent of the effect on groundwater recharge depends on whether or not conveyance and irrigation inefficiencies would be maintained by restrictions on water right transfers, as distinguished by the 33% Scenario versus the Full Transfer Scenario in the upstream analysis. Under the 33 % Scenario, groundwater impacts would not occur if transfer restrictions required the maintenance of conveyance losses and incidental groundwater recharge. Groundwater would be most affected under the Full Transfer Scenario, where all of the available acquired water is left in the river rather than contributing incidentally to groundwater recharge.

For the Full Transfer Scenario, the gross reduction in incidental GRR flows could be fairly large. For example, based on the upstream analysis, the reduction in incidental GRR flows in Mason Valley could be as much as 25,500 af/yr if the Mason Valley flow acquisition were 56,000 af/yr. However, the strong link between the river and groundwater would help minimize the reduction in net groundwater recharge. Initially, reduced groundwater recharge would have little effect on river flows, but eventually average river infiltration would increase (or groundwater inflow would decrease) in response to dropping groundwater levels as a result of reductions in incidental recharge. Increased river flows might lead to groundwater levels rising slightly near the river. However, the area of decreased groundwater levels would likely be greater than the area of increased groundwater levels.

For the Full Transfer Scenario, 20,800 af/yr of the reduction in GRR flows would be offset by increased infiltration from the river, resulting in only a 4,700 af/yr decrease in net groundwater recharge in Mason Valley. This offset was estimated with the upstream analysis (described above). Under the Full Transfer Scenario, the long-term average annual reduction in net groundwater recharge could be 500 af for East Walker Valley, 2,900 af for Smith Valley, and 4,700 af for Mason Valley based on the flow acquisition volumes described for HC-2, above. This would represent between 5% and 11% of the existing incidental GRR flows. Effects on groundwater recharge would be reduced if some acquisitions came from water supplies that did not currently replenish the aquifer (e.g., water from Homestretch Geothermal).

Although there are some clay layer aquetards in the Smith Valley and Mason Valley, the groundwater aquifers in the agricultural areas from which acquisitions would be made are mostly alluvial and unconfined, not artesian and confined. Consequently, a net reduction in groundwater recharge in these areas would be expected to lead to a decline in water table elevations. Spread over the estimated surface areas of each of the three valleys, these annual volumes of decreased recharge would represent 0.2 inch/year for the East Walker area, 0.4 inch/year for Smith Valley, and 0.5 inch/year for Mason Valley (Table 3-12).

These estimated average rates of groundwater decline are much less than those estimated for existing conditions: 6 inches/year for Smith Valley and 5 inches/year for Mason Valley (see Affected Environment). In other words, Alternative 1 would exacerbate existing rates of groundwater decline by 7 to 10%. Eventually, the groundwater aquifer would be expected to stabilize at a volume corresponding to a point in which inflow from the river and other smaller sources could maintain the amount of water extracted by wells and deep-rooted vegetation. However, it is not known how far groundwater levels may decline before this stabilization point would be reached. Because acquisitions would be permanent, the total decline caused by Alternative 1 over time could be substantial. This would be an adverse impact.

The percent reduction in groundwater recharge would be higher in Smith Valley (11% of existing incidental GRR flows) compared with Mason Valley because the groundwater divide in the Smith Valley reduces the extent to which the river would compensate for a reduction in incidental recharge. There is also some potential for the groundwater divide to move in response to changes in groundwater recharge. A reduction in recharge associated with irrigation could move the divide closer to the river, which would be more similar to conditions prior to irrigation. However, any response of the groundwater divide would depend upon the specific location of acquisitions, which is unknown.

For the East Walker reach, groundwater impacts may be highly localized because of the river gradient and the isolation of the relatively flat portions of the valley.

For example, groundwater in the upper portion of the reach is unlikely to be affected by acquisitions made lower in the reach.

Any changes in groundwater levels would vary across each valley, with the largest drops most likely to occur farthest from the influence of the river, although impacts may vary depending on local groundwater dynamics and geologic profiles. For example, any relatively shallow local aquifers that are supplied by water use inefficiencies could be more profoundly affected by Alternative 1 than the aquifer for the valley as a whole if the supply water is reduced by acquisitions. Groundwater levels could also be more greatly impacted if the river does not replenish the aquifer as much as expected.

Impact WI-9: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact)

Under Alternative 1, change in groundwater recharge near the Anaconda Mine cleanup site could modify the movement of the contaminated groundwater plume by affecting the local hydraulic gradient. Unless extensive acquisitions are made in the vicinity of the mine site, however, it is expected that this impact would be small. This is considered a minor impact.

Impact WI-10: Reduce Water Supplies for Remaining Canal Users as a Result of Reduced Canal Flows (Minor Impact)

Acquisitions under Alternative 1 could cause a reduction in canal flow. As canal flow is reduced, the percent that is lost would increase and conveyance losses that are borne by remaining canal users could increase. In addition, acquisitions could reduce the ability of farmers to maintain adequate canal head (height of water in the canal) for easily diverting water from the canal.

In some circumstances there may be little or no influence on other canal users. This might be the case if the conveyance distance from the point of diversion was very short, if only a small portion of flow was associated with the exercise of acquired water rights along the ditch or canal at issue, or, at the other extreme, the entire flow in a canal was acquired.

Even if these circumstances did not develop, NSE is expected to restrict or refrain from approving transfers that would conflict with other existing water rights. The NSE would condition or not approve transfers that would otherwise injure other rights holders. Consequently, this impact would be minor.

Impact WI-11: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flow (Minor Impact)

As a result of reduced irrigation, Alternative 1 could cause a reduction in field runoff, seepage, and groundwater recharge. This could result in reduced soil

moisture from neighboring lands involved in acquisitions and reduced return flows.

Reduced return flow to the river is not expected to affect water users because a reduction in river return flows would reduce the amount of the flow augmentation and not the amount of water available to other users.

However, farmers who rely in part on seepage or return flows from neighboring land or nearby field runoff could be affected. This effect is not expected to be substantial, however, because neighboring irrigators not involved in an acquisition can be expected to depend primarily upon other more reliable sources of supply. Furthermore, there is no established right to this incidental water because its availability is dependent on the exercise of water rights by, and/or inefficiencies of, other water right holders. This would be a minor impact.

Impact WI-12: Improve River Water Quality as a Result of Reduced Return Flow (Beneficial Impact)

The Proposed Project is expected to reduce the volume of return flows from Mason Valley, Smith Valley, and the East Walker area. Because return flows tend to be of lower water quality than river flows, this impact should help to improve water quality in the river. This would be a beneficial impact.

This impact is similar to WI-5, except that the mechanism is different. WI-5 is a direct impact resulting from increased river flow, whereas WI-12 is an indirect impact resulting from decreased return flows to the river.

Alternative 2

Because Alternative 2 involves recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted.

Environmental Effects Similar to Those under Alternative 1 But Temporary

The following effects of Alternative 2 would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, but temporary:

Hydrologic Change HC-3: Increase River Flow (Increase)

Hydrologic Change HC-4: Change in Amount of Groundwater Pumping (Increase or Decrease)

Impact WI-4: Increase Localized Flooding as a Result of Increased River Flow (Minor Impact)

Impact WI-5: Improve River Water Quality as a Result of Increased Dilution of Poor Quality Inflows (Beneficial Impact)

Impact WI-6: Reduce River Water Quality as a Result of Introduction of Water with Poor Quality (Minor Impact)

Impact WI-7: Reduce River Water Temperature as a Result of Increased Flow (Beneficial Impact)

Impact WI-10: Reduce Water Supplies for Remaining Canal Users as a Result of Reduced Canal Flow (Minor Impact)

Impact WI-11: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flow (Minor Impact)

Impact WI-12: Improve River Water Quality as a Result of Reduced Return Flow (Beneficial Impact)

Environmental Effects Different Than Under Alternative 1- Hydrologic Changes

Environmental effects of Alternative 2 that differ in important ways from those of Alternative 1 are discussed below.

Hydrologic Change HC-1: Alter Walker Lake Storage and Surface Area (Temporarily Increase)

Under Alternative 2, initially storage in Walker Lake would increase. However, storage would stop increasing in approximately 3 to 20 years under existing funding and full funding, respectively. Because the estimated rise for Alternative 2 is not based upon an ultimate equilibrium value but on a comparison of temporary elevations in specific years, the water surface elevation and lake surface area are not exact. Elevations attained at the end of the leasing period would depend greatly on when acquisitions under Alternative 2 are initiated as well as actual hydrologic conditions. Assuming average hydrologic conditions prevailed during the leasing program, Alternative 2 would result in approximately a 1- to 2-foot rise in lake water surface elevation over 3 years and a 10- to 13-foot rise over 20 years (Table 3-15). This is 31 to 38 feet higher than under the No Action Alternative. The particular elevations reached would depend on when acquisitions would be fully initiated as well as actual hydrological conditions. Once Alternative 2 runs out of funding, however, the lake would tend toward the same water surface elevation expected under the No Action Alternative.

Hydrologic Change HC-2: Reduce Irrigation as a Result of Acquisitions (Decrease)

The percent reduction in irrigated land for Alternative 2 would be approximately the same as for Alternative 1. However, under Alternative 1, much land would likely be permanently retired from agriculture, whereas for Alternative 2, it could be temporarily fallowed.

Environmental Effects Different Than Under Alternative 1-Direct Impacts

Impact WI-1: Alter Walker Lake Water Quality as a Result of Change in Lake Storage (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under Alternative 2, it is expected that initially TDS concentration in Walker Lake would drop. However, this beneficial effect would cease in approximately 3 to 20 years for existing funding and full funding, respectively. Assuming average hydrologic conditions, Alternative 2 would result in an estimated drop in TDS of 200 mg/L in 3 years and 1,700 to 2,400 mg/L in 20 years (Table 3-15). The exact concentration would depend on when acquisitions would be initiated as well as actual hydrologic conditions. Once Alternative 2 runs out of funding, TDS in the lake would be expected to eventually reach the same concentration as under the No Action Alternative.

Improved water quality in Walker Lake resulting from the actions of Alternative 2 would be a temporary beneficial impact. However, if funding were limited to what is currently available, the benefit would be negligible.

Impact WI-2: Decrease Down-Cutting in Lower Walker River as a Result of Increased Lake Surface Elevation (Beneficial Impact)

With Alternative 2, increased inflow to Walker Lake would decrease vertical erosion in the lower Walker River temporarily.

With full funding, the lake surface elevation could rise substantially during the period of implementation (but it would not reach the same elevation as for Alternative 1). The topographic gradient of the Walker River below Weber Reservoir would be improved, and portions of the river which now pass through highly erodible deposits of former lake bed and river delta would be shortened. This would decrease vertical erosion that now occurs and prevent further upstream migration of the incision for the duration that the leasing program is funded. Compared to both existing conditions and the No Action Alternative, this would be a beneficial impact, but temporary.

With existing funding, the decline of Walker Lake's surface elevation would be arrested temporarily, assuming average hydrologic conditions. Compared to existing conditions there would be little difference during the few years that the

leasing program operated, but it would be an improvement compared to the No Action Alternative.

Impact WI-3: Increase Erosion as a Result of Increased River Flow and Increased Exposed Soil (Adverse Impact)

Potential erosion effects under Alternative 2 could be less than those under Alternative 1 because, although river flows would still increase, the reduction in irrigation is expected to result in fallowing instead of retirement of currently irrigated lands involved in acquisitions. Farmers in the Walker Basin generally conserve topsoil on fallowed fields by leaving some protective vegetative cover such as crop stubble. As a result, it is expected that there would be less exposed earth on existing irrigated agricultural lands under Alternative 2 than under Alternative 1. The magnitude of the impact therefore would be somewhat less, but increased sediment transport caused by greater river flows would still aggravate an impaired reach of the Walker River to some degree. Consequently, this would be an adverse but temporary impact.

Environmental Effects Different Than Under Alternative 1-Indirect Impacts

Impact WI-8: Reduce Groundwater Recharge and Elevations as a Result of Reduced Infiltration from Fields and Canals (Minor Impact)

Under Alternative 2, groundwater elevation would be expected to drop similar to Alternative 1, due to decreased recharge. However, the impact would be temporary and of less magnitude than under Alternative 1. Because Alternative 2 would last only until funding is exhausted, the aquifer would not drop as much over time as with a fully-funded Alternative 1. Consequently, the hydraulic gradient would not be affected as much as for Alternative 1, and the amount of infiltration from the river to groundwater would be less than for a fully-funded Alternative 1.

As with Alternative 1, any changes in groundwater levels for Alternative 2 would vary across each valley, with the largest drops most likely to occur farthest from the influence of the river, although impacts may vary depending on local groundwater dynamics and geologic profiles. For example, any relatively shallow local aquifers that are supplied by water use inefficiencies could be more profoundly affected by Alternative 1 than the aquifer for the valley as a whole if the supply water is reduced by acquisitions.

For Alternative 2, it is estimated that groundwater elevation would decline on average by 0.2 inch/year for the East Walker area, 0.4 inch/year for Smith Valley, and 0.5 inch/year for Mason Valley. This would exacerbate existing rates of decline by 7 to 10%. Over the estimated 20 year period of full funding, this would represent a decline of less than 1 foot. With existing funding, the estimated

decline in groundwater elevation would be less than 2 inches over 3 years. This would be a minor impact.

Impact WI-9: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact)

For Alternative 2 this impact would be similar in nature (i.e., minor) to that under Alternative 1, but temporary and of less magnitude. Because the duration of the influence of the project would be temporary, the total change in plume movement occurring over time caused by the project, if any, would likely be less under Alternative 2 than under Alternative 1.

Alternative 3

The impacts for Alternative 3 are not expected to be as large as for Alternative 1 because it is estimated that Alternative 3 would produce less than an additional 50,000 af/yr of inflow, on average, to Walker Lake. Based on the analysis of Alternative 3 (see Assessment Methods), it is estimated that water efficiency would have to be nearly 100% in order to have an additional 50,000 af/yr reach Walker Lake, meaning almost no loss of water in conveyance or application. Using a more realistic maximum efficiency value of 75%, the estimated average increase in flow to Walker Lake is 32,300 af/yr (Table 3-12).

Crop switching could increase the yield of Alternative 3. A reduction in crop ET of less than 15% (see Appendix 3A) probably could be attained by crop switching and would likely be sufficient to bring an average additional 17,700 af/yr to Walker Lake (bringing the average total increase to 50,000 af/yr). However, because of feasibility concerns, crop switching was not included in the Alternative 3 assessment.

Unless otherwise noted, the hydrologic changes and impacts of Alternative 3 would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1 with full funding, but of less magnitude. Hydrologic changes or impacts of Alternative 3 that would be comparable to those of Alternative 1 are listed below first. Those that would differ in important ways from the effects of Alternative 1 are subsequently discussed in more detail.

Environmental Effects Similar to Those Under Alternative 1 But of Less Magnitude

Hydrologic Change HC-3: Increase River Flow (Increase)

Impact WI-4: Increase Localized Flooding as a Result of Increased River Flow (Minor Impact)

Impact WI-5: Improve River Water Quality as a Result of Increased Dilution of Poor Quality Inflows (Beneficial Impact)

Impact WI-7: Reduce River Water Temperature as a Result of Increased Flow (Beneficial Impact)

Impact WI-12: Improve River Water Quality as a Result of Reduced Return Flows (Beneficial Impact)

Environmental Effects Different Than Under Alternative 1 – Hydrologic Changes

Hydrologic Change HC-1: Alter Walker Lake Storage and Surface Area (Increase)

Based on the methods described for the upstream analysis above, average annual inflow to Walker Lake would increase by 32,300 af/yr if Alternative 3 is fully implemented at 75% combined conveyance and on-farm water efficiency. This additional inflow is projected to increase lake surface elevation to a range of 3,939 to 3,948 feet (Table 3-15). This would be 4 to 13 feet higher than the September 2007 level of 3,935 feet and 41 to 42 feet higher than under the No Action Alternative.

Hydrologic Change HC-2: Reduce Irrigation as a Result of Acquisitions (No Change)

Alternative 3 would have no direct effect on the amount of land that is irrigated.

Hydrologic Change HC-4: Change in Amount of Groundwater Pumping (No Change)

Alternative 3 would be unlikely to affect the volume of groundwater pumping.

Environmental Effects Different Than Under Alternative 1 – Direct Impacts

Impact WI-1: Alter Walker Lake Water Quality as a Result of Change in Lake Storage (Beneficial Impact)

With the increased inflow of 32,300 af/yr estimated for Alternative 3, Walker Lake water surface elevation is projected to rise, as indicated in HC-1. However, TDS would not be greatly reduced compared to existing conditions. Initially, for a period of approximately 20 to 50 years, TDS would change little from existing levels, reaching concentrations of 14,800 to 16,000 mg/L (Table 3-15), and then gradually increasing because of evaporation. Concentrations for the year 2200 would be approximately 16,800 mg/L to 19,600 mg/L. There would be essentially no benefit compared to existing conditions. However, this result would be beneficial to the lake in comparison to future conditions under the No Action Alternative, which would result in projected a TDS concentration in the range of 39,500 to 51,000 mg/L. Alternative 3 would result in a TDS concentration 22,700 to 31,400 mg/L less than under the No Action Alternative. Because Alternative 3 could help maintain TDS concentration at a level similar to current conditions, this would be a beneficial impact when compared to the No Action Alternative.

Impact WI-2: Decrease Down-Cutting in Lower Walker River as a Result of Increased Lake Surface Elevation (Beneficial Impact)

With Alternative 3, the lake surface elevation would rise substantially, but less than under Alternative 1. The topographic gradient of the Walker River below Weber Reservoir would be improved, and portions of the river which now pass through highly erodible deposits of former lake bed and river delta would be shortened. This would decrease vertical erosion that now occurs and prevent further upstream migration of the incision. Although the magnitude of the effect would be less than under full funding of Alternative 1, this would be a beneficial impact.

Impact WI-3: Increase Erosion as a Result of Increased River Flow and Increased Exposed Soil (Adverse Impact)

The maximum potential amount of exposed earth generated by Alternative 3 would equal the acres of vegetation that currently depend on the inefficiencies of irrigation. This area would be less than the acres of non-riverine riparian/wetland vegetation (approximately 350 acres for East Walker, 2,200 acres for Smith Valley, and 4,900 acres for Mason Valley). These areas are less than the potential amount of previously irrigated land generated by Alternative 1. Walker River flows would also be somewhat less under Alternative 3 than Alternative 1. The magnitude of the impact therefore would be somewhat less, but increased sediment transport caused by greater river flows would still aggravate an impaired

reach of the Walker River to some degree. Consequently, this would be an adverse impact.

Impact WI-6: Reduce River Water Quality as a Result of Introducing Water with Poor Quality (No Impact)

Alternative 3 would not introduce water from other sources to Walker River.

Environmental Effects Different Than Under Alternative 1 – Indirect Impacts

Impact WI-8: Reduce Groundwater Recharge and Elevations as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact)

Under Alternative 3, only an estimated 25%, 54%, and 28% of the water savings would reach Walker Lake from the East Walker, Smith Valley, and Mason Valley reaches, respectively. Most of the rest of the acquired water savings would be lost to the river through increased infiltration from the river to groundwater and reduced return flows to the river. The percent of acquired water estimated to reach the lake is much lower for Alternative 3 because a larger portion of the water savings would come at the expense of a reduction in GRR flows that help to sustain the river.

Under Alternative 3, assuming 75% efficiency is attained, estimated average annual total GRR flows for the three valleys could drop from 128,100 af/yr for existing conditions to 42,900 af/yr. However, the strong link between the river and groundwater would help to minimize the reduction in net groundwater recharge. It is estimated that 65,800 af/yr of the reduction in incidental GRR flows would be compensated for by a reduction in river flow, resulting in a net reduction of groundwater recharge of only 19,300 af/yr for all three valleys (1,100 af/yr for East Walker, 5,900 af/yr for Smith Valley, and 12,300 af/yr for Mason Valley). This represents 12%, 23%, and 13%, respectively, of the existing incidental GRR flows for East Walker, Smith Valley, and Mason Valley. The percent reduction in existing groundwater recharge would be higher in Smith Valley because its groundwater divide reduces the extent to which the river would compensate for a reduction in incidental recharge.

If these volumes are spread over the surface areas of the three valleys, these net reductions in groundwater recharge would represent 0.5 inches/year for East Walker Valley, 0.9 inches/year for Smith Valley, and 1.3 inches/yr for Mason Valley (Table 3-12). Changes in groundwater levels would vary across each valley with the largest drops likely to occur farthest from the influence of the river. Effects may vary locally depending on groundwater dynamics and geologic profiles. These estimated rates of groundwater decline associated with Alternative 3 are much less than those estimated for existing conditions, 6 inches/year for

Smith Valley and 5 inches/year for Mason Valley (see Affected Environment). Alternative 3 could exacerbate existing rates of groundwater decline by 15 to 26%.

Eventually, the aquifer would stabilize at a volume corresponding to a point in which inflow from the river and other smaller sources could maintain the amount of water extracted by wells and deep-rooted vegetation. However, it is not known how far groundwater levels may decline before this point would be reached. Because improvements would be permanent, the decline caused by Alternative 3 over time would likely be substantial. This would be an adverse impact.

Impact WI-9: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact)

Under Alternative 3, impacts on groundwater are expected to be greater than for Alternative 1. Nevertheless, unless Alternative 3 involved large scale efficiency measures in the immediate vicinity of the mine site, any effects on the movement of the Anaconda Mine plume would be small. This is considered a minor impact.

Impact WI-10: Reduce Water Supplies for Remaining Canal Users as a Result of Reduced Canal Flow (Minor Impact)

Under Alternatives 1 and 2, there is potential for water rights holders along canals to be affected by increases in the percent of water lost during conveyance and reduced canal head. Canal conveyance losses would be greatly reduced under Alternative 3; however the savings would be transferred downstream. Consequently, there could be a reduction in head that affects some farmers. This would be a minor impact.

Impact WI-11: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flow (Minor Impact)

Similar to Alternatives 1 and 2, Alternative 3 could cause a reduction in field runoff and seepage. This could result in reduced soil moisture from neighboring lands directly involved in acquisitions as well as in reduced return flows. The mechanism, however, would be different. Under Alternatives 1 and 2 there would be a reduction in irrigated land and under Alternative 3, efficiency measures would reduce runoff and seepage.

As described for WI-11 under Alternative 1, reduced return flow to the river associated with the action alternatives is not expected to affect water users because a reduction in river return flows would reduce the amount of the flow augmentation and not the amount of water available to other users.

However, farmlands that use soil moisture from neighboring land or nearby field runoff could be affected by this type of impact. This type of impact may be greater for Alternative 3 than for Alternatives 1 and 2 because reduction in the amount of incidentally available water not used by irrigated vegetation is the main target of an efficiency-based program.

Nevertheless, this effect is not expected to be substantial because neighboring irrigators not involved in an acquisition can be expected to depend primarily upon other more reliable sources of supply. Furthermore, there is no established right to this incidental water because its availability is dependent on the exercise of water rights by, and/or inefficiencies of, other water right holders. This would be a minor impact.

Impact WI-13: Decrease Quality of Stormwater Runoff as a Result of Construction-Related Activities (Minor Impact)

Under Alternative 3, construction activities may be necessary to improve conveyance and irrigation efficiency. These activities could include lining canals with concrete; replacing surface conveyances with underground pipelines; consolidating canals, laterals and ditches; and improving diversion works. These activities have the potential to degrade the quality of local stormwater runoff through spill of contaminants such as petroleum products (e.g., diesel fuel or oil used by construction equipment) or as a result of temporary ground disturbances that could increase erosion and sediment transport during construction.

This impact, however, would be minor because a large-scale project would require a general construction permit that would require implementation of a SWPPP and utilization of BMPs to control runoff and the potential discharge of pollutants during construction; the impact also would be short-term.

Chapter 4 Biological Resources—Vegetation and Wetlands

Introduction

This chapter describes the affected environment for vegetation and wetland resources in the study area and the potential impacts on vegetation and wetland resources that would result from the Proposed Project and other the alternatives.

Descriptions of vegetation cover and community types are provided in Appendix 4A. Additional information on noxious weeds is provided in Appendix 4B.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below.

- Nevada Natural Heritage Program's Nevada SynthMap (Peterson 2008a)
- Provisional digital land cover map for the southwestern United States (U.S. Geological Survey National Gap Analysis Program 2004)
- Southwest Regional Gap Analysis Project—Land Cover Descriptions (U.S. Geological Survey National Gap Analysis Program 2005)
- Classification of terrestrial systems (Comer et al. 2003)
- Southwest Regional Gap Analysis Project mapping methods (Lowry et al. 2005)
- NNPS status lists (Nevada Native Plant Society 2008)
- Recorded endangered, threatened, candidate, and at-risk plant lists (Nevada Natural Heritage Program 2008)
- Rare plant fact sheets (Nevada Natural Heritage Program 2001)
- Nevada noxious weed list (Nevada Department of Agriculture 2008a)
- CNNDB (California Natural Diversity Data Base 2008)
- CNPS Inventory of Rare and Endangered Plants in California (California Native Plant Society 2008)

No field survey or vegetation mapping was performed for this analysis. Vegetation mapping for the study area is based on the Southwest Regional Gap

Analysis Project[1] (U.S. Geological Survey National Gap Analysis Program 2004, Lowry et al. 2005).

Affected Environment

This section describes the environmental setting related to vegetation communities and drainages, special-status plant species, and invasive and noxious plant species in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for vegetation and wildlife was defined as the following areas in Lyon and Mineral Counties: the mainstem Walker River, the East Walker River, and the West Walker River in Nevada; Walker Lake; irrigation canals that connect to the Walker River system; irrigated land adjacent to the canals; and a 1-mile zone around each of these areas. Study area boundaries were defined based on the areas that could be affected by the acquisition alternatives.

California and Douglas County, Nevada, were not included in the study area. Although the Walker River watershed originates in Mono County, California, the Proposed Project would not change any operations or acquire land, water appurtenant to the land, and related interests in California or Douglas County, Nevada. Operating criteria for upstream reservoirs would not be changed. The California and Douglas County, Nevada, portions of the basin would not be affected directly or indirectly by the Proposed Project.

Vegetation Communities

Most of the Walker River watershed is located in the Great Basin Province, which extends from the region south of Lake Tahoe across Nevada, east of the Sierra Nevada. The region supports sagebrush steppe, pinyon/juniper woodland, and riparian cottonwood communities (Hickman 1993). Riparian and wetland communities are considered sensitive because of their high species diversity, high productivity, and limited and declining distribution. Nevertheless, not all riparian and wetland communities are of equal species composition and habitat density. As described in Chapter 2, Alternatives, there are three proposed acquisition areas: Mason Valley, Smith Valley, and East Walker. The distribution

[1] The Nevada Natural Heritage Program has a recent, more detailed vegetation map, called the Nevada SynthMap, that uses southwest regional Gap data as a base map with additional more specific and local data (Grossman et al. 1998; Peterson 2008a, 2008b). The SynthMap cover types are based on the International Vegetation Classification (IVC) system. This map may be useful for future analysis of the Proposed Project, but many new vegetation types proposed on the SynthMap that currently do not have a corresponding IVC classification and description Because of the preliminary nature of the SynthMap, it was not used for the analysis in this document. A more detailed vegetation map, which incorporates field mapping, aerial imagery and light detecting and ranging (LiDAR) imagery is being completed by USFWS. This information is expected to be finalized in fall of 2009 and will be publicly available.

of irrigated lands and riparian and wetland communities where acquisitions are expected to occur is shown in Table 4-1.

Table 4-1. Distribution of Irrigated Lands and Riparian/Wetland Habitat in Study Area

	Mason Valley	Smith Valley	East Walker	Total
Irrigated Acres	34,972	17,452	4,015	56,439
Riparian/Wetland Acres	7,434	3,309	3,007	13,750
Total Acres	42,406	20,761	7,022	70,189

Note: Acreages represent averages for 6 years between 1986 and 2002.
(Yardas 2007)

Vegetation mapping for the study area, as shown on Figure 4-1, is based on the Southwest Regional Gap Analysis Project (U.S. Geological Survey National Gap Analysis Program 2004, Lowry et al. 2005). The land cover types on the Gap Analysis Program maps are based on the ecological systems classification system (Comer et al. 2003), and the basic unit for each type is the ecological system. Ecological systems are groups of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients (Comer et al. 2003). For this analysis, ecological systems are equated with vegetation communities, although these types can be divided into more specific types based on dominant plant species that occur together.

The approximate minimum mapping unit for the Southwest Regional Gap Analysis Project map is slightly less than 0.25 acre. Because of the minimum unit size, the vegetation mapping might not include all existing areas of vegetation because some areas of habitat, including riparian and wetland habitats, are smaller than 0.25 acre.

Detailed descriptions of the vegetation communities and cover types shown on Figure 4-1 are provided in Appendix 4A.

Distribution of Vegetation Communities in the Study Area

This section describes the general distribution of vegetation communities in each part of the study area. To facilitate the analysis in this document, the study area is divided into the East Walker River, West Walker River, mainstem Walker River, and Walker Lake, with their associated irrigation canals and drains and adjacent lands

East Walker River

At the Nevada/California border, the East Walker River flows through a mountainous area of mostly pinyon-juniper woodland and big sagebrush shrubland. Intermixed with these two communities are areas of xeric mixed sagebrush shrubland and semi-desert grassland. Small areas of montane sagebrush steppe and mixed salt desert scrub are present. Riparian vegetation grows adjacent to the river.

In low-gradient river reaches, the dominant surrounding vegetation transitions to mostly mixed salt desert scrub and numerous areas of agriculture (Chapter 7, Land Use and Agriculture) near the river channel, although the adjacent area supports riparian habitat. Within the transition zone from mountain to basin are patches of Sierra cliff and canyon vegetation or basin cliff and canyon at lower elevations. There are also minor areas of mesic mixed conifer forest, dry-mesic mixed conifer forest, semi-desert shrub steppe, and montane sagebrush steppe. Small herbaceous areas of semi-desert grassland and perennial grassland are present.

At lower elevations mixed salt desert scrub is still dominant, but there are inclusions of big sagebrush shrubland, semi-desert shrub-steppe, semi-desert grassland, forbland, and greasewood flat. Areas of agriculture are more extensive along the downstream part of the East Walker River (Chapter 7, Land Use and Agriculture). Immediately adjacent to the river are small areas of emergent marsh and a continuous riparian corridor. Close to its confluence with the West Walker River, the surrounding area is primarily agriculture with only small inclusions of the other community types. Mixed salt desert scrub borders the edges of agricultural land.

West Walker River

In contrast with the East Walker River, the West Walker River flows through a more level area at the Nevada/California border that is predominantly big sagebrush shrubland, xeric mixed sagebrush shrubland, and agriculture (Chapter 7, Land Use and Agriculture). Along the river is riparian vegetation and emergent marsh, with patches of greasewood flat, semi-desert grassland, and forbland outside the riparian border. Small inclusions of mixed salt desert scrub and pinyon-juniper woodland are also present. Areas of montane sagebrush steppe are scattered in this region. At the south end of Smith Valley, foothills support pinyon-juniper woodland, xeric mixed sagebrush shrubland, semi-desert shrub steppe, and Sierra and basin cliff and canyon.

Between Smith Valley and Mason Valley, the West Walker River supports riparian vegetation, with mostly mixed salt desert scrub outside of the riparian corridor. Near the confluence with the East Walker River, the West Walker River supports a mix of riparian, big sagebrush shrubland, and greasewood flat.

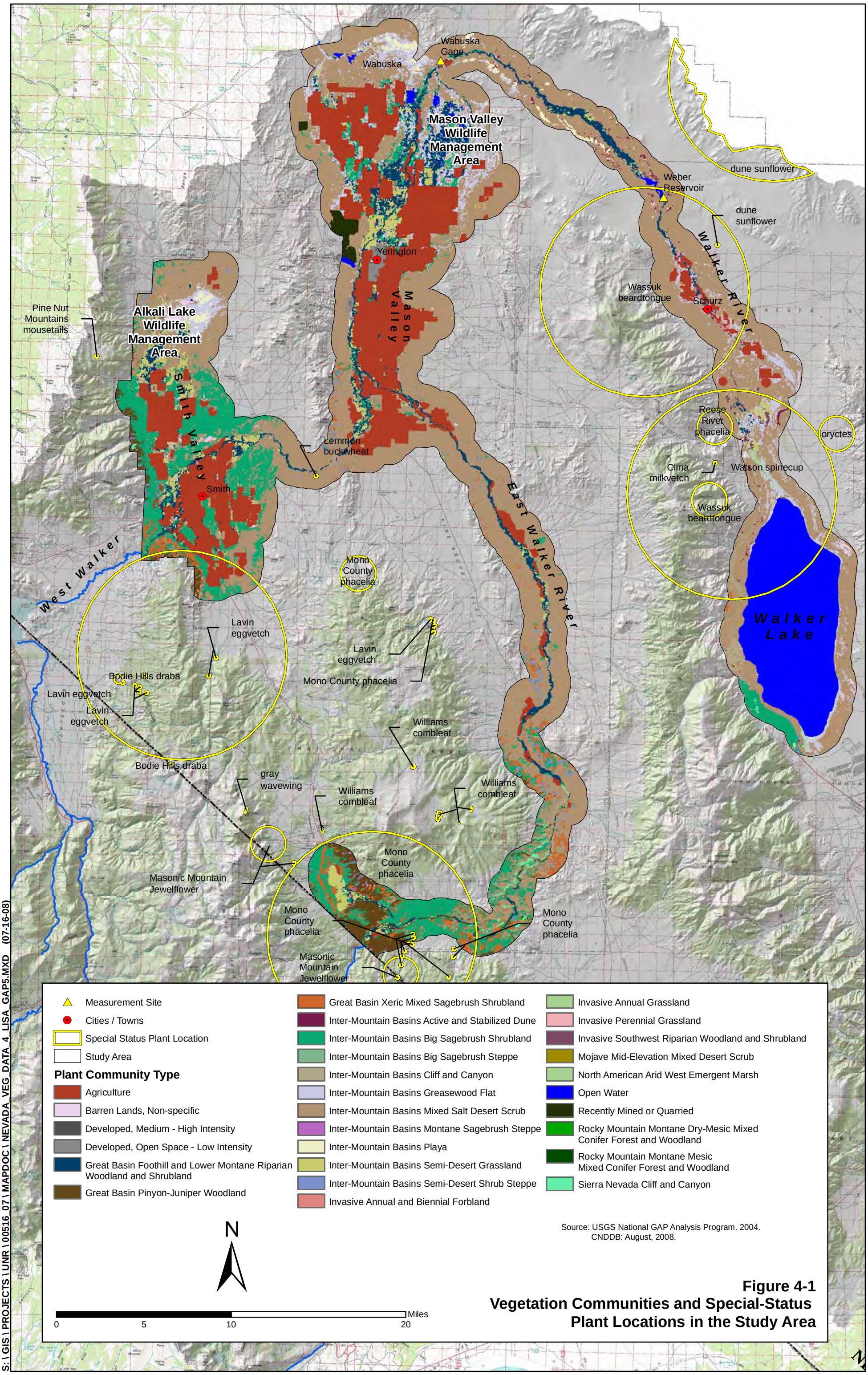


Figure 4-1
Vegetation Communities and Special-Status Plant Locations in the Study Area

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Smith Valley

Smith Valley supports large areas of agriculture (Chapter 7, Land Use and Agriculture) and big sagebrush shrubland. Riparian communities extend along most of the West Walker River through the valley and in scattered areas around irrigation canals and drains. Riparian and wetland habitats associated with irrigation canals and drains are more likely to support nonnative species and invasive species such as tamarisk (*Tamarix* sp.). Some irrigation supply canals in Smith Valley support species such as coyote willow (*Salix exigua*), cattail (*Typha* sp.), and bulrush (*Schoenoplectus acutus*), most of which are native species (Bull pers. comm.). Irrigated pasture that has not been laser leveled can also support patches of wetland habitat in low-lying areas (Bull pers. comm.). Valley edges in the south support mixed salt desert scrub. The western foothills include a mix of pinyon-juniper woodland, montane sagebrush steppe, and big sagebrush shrubland. Throughout the valley, there are minor inclusions of other communities, such as forbland, barren areas, semi-desert grassland, and greasewood flat. The primary vegetation communities of two specific parts of Smith Valley, the Alkali Lake WMA and the Valley Vista Ranch, are discussed below.

Alkali Lake Wildlife Management Area

The Alkali Lake WMA is adjacent to the northernmost part of Smith Valley and is bordered by large areas of mixed salt desert scrub. The WMA supports a mosaic of riparian and semi-desert grassland outside of agricultural areas, with inclusions of big sagebrush shrubland, greasewood flat, forbland, and mixed salt desert scrub. Several small areas of open water are within the WMA. The northern part of the WMA is a large playa area that includes barren land and greasewood flat with an agricultural area further north. The playa is surrounded by mixed salt desert scrub. The primary water sources for the WMA include agricultural tailwater from the surrounding fields and meadows and mountain runoff. However, these water sources have dwindled over the past 20 years as a result of limited precipitation, reduced snowmelt from the Pine Nut Mountains, and reduced agricultural tailwater caused by water conservation measures for agriculture. The WMA has only small dedicated water rights, and the lake level has gone down significantly. In dry years, the lake typically is dry by the end of the summer (Bull pers. comm.).

Option 1, Valley Vista Ranch LLC

The Valley Vista Ranch property in the southern Mason Valley (Valley Vista Ranch LLC) is along the West Walker River and is agricultural land surrounded by mixed salt desert scrub, semi-desert grassland, and greasewood flat.

Mainstem Walker River

At the confluence of the East and West Walker Rivers, the mainstem Walker River area is heavily agricultural (Chapter 7, Land Use and Agriculture) with vegetation along the river similar to that described for the West Walker River upstream of the confluence.

Between the Wabuska gage and Weber Reservoir, the Walker River supports a broad riparian corridor with mostly mixed salt desert scrub outside the corridor. Areas of greasewood flat, big sagebrush shrubland, semi-desert grassland, playa, and scattered dunes are intermixed with the desert scrub in this area.

Downstream from Weber Reservoir, the Walker River is buffered by a riparian corridor for several miles, but agricultural land is present for nearly 10 miles. This land is bounded by greasewood flats, forbland, and mixed salt desert scrub. There is an area of development at Schurz.

The study area surrounding Schurz and this part of the Walker River is primarily mixed salt desert scrub and greasewood flat, with emergent marsh along the river channel and some areas of invasive riparian and semi-desert grassland. Small areas of forbland, playa, and barren land are present. The section of Walker River immediately downstream of Schurz is deeply incised as a result of the historic lowering of the water level in Walker Lake (University of Nevada, Reno and Desert Research Institute. 2008). The area in the lowermost section of the river currently erodes in response to the ongoing drop in lake level and supports little vegetation. This part of the river is wide, shallow, braided, and has sandy substrate. The banks are lined with tamarisk, and a tamarisk eradication program, as described below in the Invasive Plants section, is currently underway (Wright pers. comm. 2008). For details about the tamarisk eradication program, see Chapter 14, Cumulative Impacts.

The primary vegetation communities of several specific parts of the mainstem Walker River basin are described below.

Mason Valley

Mason Valley includes the downstream parts of the East and West Walker Rivers and the mainstem Walker River to the area near the Wabuska gage. Agriculture is the dominant cover type on the east side of the Walker River (Chapter 7, Land Use and Agriculture), with mixed salt desert scrub outside the agricultural zone. Agricultural areas include irrigation canals and drains, some of which support riparian vegetation and native plant species (Bull pers. comm.). As mentioned for Smith Valley, irrigated pasture land can support patchy wetland vegetation in low-lying areas. West of the Walker River, the mixed salt desert scrub is adjacent to the riparian corridor. Areas of semi-desert grassland, big sagebrush shrubland, and greasewood flat are interspersed along the river corridor. Yerington and a

smaller area south of Yerington and west of the river are mapped as developed open space. The Yerington Mine (Anaconda Copper Mine) pit is at the western edge of the study area. A mix of riparian and semi-desert grassland, with small areas of emergent marsh, forbland, and big sagebrush shrubland, occurs north of Yerington.

Mason Valley Wildlife Management Area

Mason Valley WMA is located in the northeast section of Mason Valley. The WMA is a complex mosaic of open water, riparian, and emergent marsh with upland areas of greasewood flat, big sagebrush shrubland, semi-desert grassland, and mixed salt desert scrub. The WMA also has approximately 1,200 acres of agriculture farmed for wildlife habitat (Bull pers. comm.).

Option 1, Masini Investments and L&M Ltd Partnership

The Masini Investments and L&M Ltd Partnership properties along the Wabuska Drain support agriculture bounded by big sagebrush shrubland, mixed salt desert scrub, and greasewood flat. Small inclusions of riparian communities may be present.

Option 2, Homestretch Geothermal

The Homestretch Geothermal property is in the northernmost part of the study area, north of the Wabuska Drain. This area is mapped as agriculture cover type adjacent to the playa and greasewood flat, and the area is grazed by cattle. The property includes a cooling pond system that was constructed for use in the energy conversion process. Water is cooled through a series of ditches and ponds then surface discharged for wildlife habitat purposes. The ditches and ponds are open water areas with a narrow band of wetland vegetation around the edges (Homestretch Energy undated).

Weber Reservoir

Weber Reservoir is a broad open water area created by Weber Dam along the mainstem Walker River. At the upstream end of the reservoir the riparian community is interspersed with emergent marsh and semi-desert grassland. The surrounding area is mixed salt desert scrub, dunes, and greasewood flat.

Walker Lake

Walker Lake is a large open water area surrounded by mixed salt desert scrub with greasewood flat, basins, cliff and canyon, and playa along much of the lake edge. Areas of xeric mixed sagebrush shrubland, dune, Sierra cliff and canyon, and big sagebrush shrubland are scattered on the west side of the lake, with barren land, dune, and semi-desert shrub steppe on the east side. On the south side of the

lake an area of emergent marsh extends out from the lake edge for approximately 1 mile (Espinoza and Tracy 1999).

Special-Status Plants

Based on the search of the NNHP database (Nevada Natural Heritage Program 2008), NNPS status lists (Nevada Native Plant Society 2008), the CNDDB (California Natural Diversity Data Base 2008), the CNPS Inventory (California Native Plant Society 2008), and the USFWS list (U.S. Fish and Wildlife Service 2007), 47 special-status plant species were identified as occurring in the project region, which generally includes the Walker River watershed (Table 4-2 and Figure 4-1). Five special-status species are recorded as occurring in or adjacent to the study area: Lavin eggvetch, Watson spinecup, Wassuk beardtongue, Reese River phacelia, and Mono County phacelia.

Lavin Eggvetch

Lavin eggvetch (*Astragalus oophorus* var. *lavinii*) is a perennial herb in the *Fabaceae* (pea family) and on the Bureau of Land Management (BLM) Nevada special-status species list and the NNHP at-risk list. This species has not been thoroughly surveyed in Nevada but is known from Douglas and Lyon Counties, and possibly Mineral County in Nevada, as well as in California. It grows on dry, fairly barren areas on gravelly clay soils, usually on northeast- to southeast-facing slopes in pinyon-juniper or sagebrush communities. Lavin eggvetch blooms in late spring from May to June (Nevada Natural Heritage Program 2001).

Watson Spinecup

Watson spinecup (*Oxytheca watsonii*) is an annual herb in the *Polygonaceae* (buckwheat family) and is on the NNHP watch list. This species has not been thoroughly surveyed in Nevada but is known from Eureka, Lander, Mineral, and Nye Counties, as well as in California. Watson spinecup grows on dry sandy soils in desert scrub communities in association with saltbush species, greasewood, and spiny hopsage. It tolerates light disturbance and can occur on roadsides. Watson spinecup blooms from March to September (Nevada Natural Heritage Program 2001).

Wassuk Beardtongue

Wassuk beardtongue (*Penstemon rubicundus*) is a perennial herb in the *Scrophulariaceae* (figwort family) and on the NNHP at-risk list. It is endemic to Nevada and is known from Douglas, Mineral, and possibly Esmeralda Counties. This species grows on open, rocky to gravelly soils in recovering disturbed areas with adequate runoff, such as rocky slopes, drainage bottoms, roadsides, and recently burned areas. Wassuk beardtongue occurs in pinyon-juniper woodland, sagebrush, and cliff and canyon vegetation communities. This species blooms

Table 4-2. Special-Status Plants with Potential to Occur in the Walker River Acquisitions Program Study Area

Common and Scientific Name	Nevada Status[a]	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period[b]	Potential for Occurrence in the Study Area
Bodie Hills rockcress *Arabis bodiensis*	A	Mineral County in NV, Wassuk Range, Brawley Peaks, and Bodie Hills; east of Sierra Nevada: Fresno, Inyo, Mono, and Tulare Counties in CA	Alpine boulder and rock field, Great Basin scrub, pinyon and juniper woodland, subalpine coniferous forest; 2,085–3,530 m	Jun–Jul	Recorded in the Walker River watershed, both California and Nevada
Tiehm's rock cress *Arabis tiehmii*	A	Northern high Sierra Nevada: Mount Rose area in the northern Carson Range, NV; near Tioga Crest in Mono County, CA	Granitic soils in alpine boulder and rock field; 2,970–3,590 m	Jul–Aug	Recorded in the California part of Walker River watershed
Cima milkvetch *Astragalus cimae* var. *cimae*	A	Mineral and Nye Counties in NV; eastern desert mountains in San Bernardino County, CA	Clay soils in pinyon-juniper woodland, Great Basin scrub, Joshua tree "woodland"; 890–1,850 m	Apr–May	Recorded in the Nevada part of Walker River watershed
Long Valley milkvetch *Astragalus johannis-howellii*	A	Mineral County, NV; east of Sierra Nevada in Mono County, CA	Sandy loam soils in Great Basin scrub, usually in swales near hot springs; 2,040–2,530 m	Jun–Aug	Recorded in the Walker River watershed, both California and Nevada
Lavin eggvetch *Astragalus oophorus* var. *lavinii*	A	Douglas, Lyon, and possibly Mineral Counties, NV; Bodie Hills in CA	Great Basin scrub, pinyon and juniper woodland; 2,450–3,050 m	Jun	Recorded in the Walker River watershed, both California and Nevada
Bodie Hills draba *Cusickiella quadricostata*	A	Douglas, Lyon, and Mineral Counties, NV; Mono County, CA	Great Basin scrub, pinyon and juniper woodland on clay soils or rocky areas; 2,000–2,800 m	May–Jul	Recorded in the Walker River watershed, both California and Nevada
Gray wavewing *Cymopterus cinerarius*	A	Esmeralda, Lyon, and Mineral Counties, NV, in Wassuk and Sweetwater Ranges; high Sierra Nevada in CA	Rocky slopes; 2,500–3,500 m	Jul–Aug	Recorded in the Walker River watershed, both California and Nevada
Lemmon buckwheat *Eriogonum lemmonii*	W	Churchill, Lyon, Pershing, Storey, and Washoe Counties, NV (endemic)	Shadscale scrub on bluffs and badlands; 1,280–1,650 m	May–Jun	Recorded in the Nevada part of Walker River watershed
Desert sunflower *Helianthus deserticola*	A	Churchill, Clark, Mineral, and possibly Lyon Counties, NV; not recorded in CA	Sand dunes, generally alkaline; 410–1,490 m	May–Jul	Recorded in the Nevada part of Walker River watershed
Pine Nut Mountains ivesia *Ivesia pityocharis*	A	Douglas County, NV (endemic to Pine Nut Mountains)	Decomposed granite soils or sod in moist grasslands; 2,130–2,600 m	Jul–Sep	Recorded in the Nevada part of Walker River watershed
Oryctes *Oryctes nevadensis*	A	Churchill, Humboldt, Mineral, Pershing, Washoe, and possibly Esmeralda and Storey Counties, NV; Inyo County, CA	Sandy soils in chenopod scrub and Mojavean desert scrub; 1,100–2,535 m	Apr–Jun	Recorded in the Nevada part of Walker River watershed

Table 4-2. Continued

Common and Scientific Name	Nevada Status[a]	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period[b]	Potential for Occurrence in the Study Area
Shevock's bristle moss *Orthotrichum shevockii*	W	Known from Kern, Mono, and Tulare Counties, CA	On granitic rock in Joshua tree woodland, pinyon and juniper woodland; 750–2,100 m	—	Recorded in the California part of Walker River watershed
Watson spinecup *Oxytheca watsonii*	W	Eureka, Lander, Mineral, and Nye Counties, NV; Inyo and Nevada Counties, CA	Sandy soils in Joshua tree "woodland" and Mojavean desert scrub; 1,200–2,000 m	May–Jul	Recorded in the Nevada part of Walker River watershed
Wassuk beardtongue *Penstemon rubicundus*	A	Douglas, Mineral, and possibly Esmeralda Counties, NV (endemic)	Rocky to gravelly soils in pinyon and juniper woodland, sagebrush, and shadscale scrub, usually recovering disturbed areas; 1,290–2,090 m	May–Sep	Recorded in the Nevada part of Walker River watershed
Reese River phacelia *Phacelia glaberrima*	W	Churchill, Lander, Lincoln, Mineral, and Pershing Counties, NV (endemic)	Alkaline clay soils in shadscale-greasewood scrub, sagebrush, and pinyon and juniper woodland; 1,220–1,830 m	May–Jun	Recorded in the Nevada part of Walker River watershed
Mono County phacelia *Phacelia monoensis*	A	Esmeralda, Lyon, and Mineral Counties, NV; Inyo and Mono Counties, CA	Clay soils in Great Basin scrub and pinyon and juniper woodland, often roadsides; 1,900–2,900 m	May–Jul	Recorded in the Walker River watershed, both California and Nevada
Mason's sky pilot *Polemonium chartaceum*	A	Esmeralda County, known only from near the summit of Boundary Peak in the White Mountains, NV; Inyo, Mono, Siskiyou, and Trinity Counties in CA	On serpentinite, granitic, or volcanic substrates in alpine boulder and rock field, subalpine coniferous forest, rocky areas; 1,800–4,200 m	Jun–Aug	Recorded in the California part of Walker River watershed
Williams combleaf *Polyctenium williamsiae*	CE	Douglas, Lyon, Mineral, Nye, and Washoe Counties, NV; Lassen and Mono Counties, CA	Sandy, volcanic soils in Great Basin scrub, marshes and swamps, pinyon and juniper woodland, playas, vernal pools, lake margins; 1,347–2,700 m	Mar–Jul	Recorded in the Walker River watershed, both California and Nevada
Masonic Mountain jewelflower *Streptanthus oliganthus*	A	Esmeralda, Lyon, and Mineral Counties, NV; Inyo, Mono, and Tuolumne Counties, CA	Pinyon and juniper woodland, volcanic or granitic, rocky; 1,980–3,050 m	Jun–Jul	Recorded in the Walker River watershed, both California and Nevada

[a] Status explanations:
Note: No species listed, proposed for listing, or candidate species under the Federal ESA was found.
Nevada Status
CE = Critically endangered in Nevada
A = At risk list
W = Watch list

[b] Blooming period is based on the "most frequent survey months" listed in the Nevada Natural Heritage Program Rare Plant Fact Sheets (Nevada Natural Heritage Program 2001) for most species; for Tiehm's rock cress and Mason's sky pilot, blooming period is based on months given in the CNPS Inventory (2008).

from late spring to summer in May to September (Nevada Natural Heritage Program 2001).

Reese River Phacelia

Reese River phacelia (*Phacelia glaberrima*) is a small annual herb in the *Hydrophyllaceae* (waterleaf family) and is on the NNHP watch list. It is endemic to Nevada and is known to occur in Churchill, Lander, Lincoln, Mineral, and Pershing Counties. This species grows on alkaline clay soils on sparsely vegetated or scree-covered slopes. It occurs in greasewood, sagebrush, pinyon-juniper woodland, and cliff and canyon vegetation communities. Reese River phacelia blooms in late spring from May to June. (Nevada Natural Heritage Program 2001).

Mono County Phacelia

Mono County phacelia (*Phacelia monoensis*) is a small annual herb in the *Hydrophyllaceae* (waterleaf family) and is on the BLM Nevada and California special-status species lists and NNHP at-risk list. This species is known to occur in Esmeralda, Lyon, and Mineral Counties, as well as in California. Mono County phacelia grows on alkaline soils in areas that are sparsely vegetated to barren. It favors disturbed areas, including road berms in pinyon-juniper or sagebrush communities. Threats to this species include road construction and maintenance and mineral exploration and development. Mono County phacelia blooms in late spring from May to June (Nevada Natural Heritage Program 2001).

Noxious and Invasive Weeds

Noxious weeds are regulated by the Nevada Department of Agriculture, which maintains a list of noxious weeds in the state (Nevada Department of Agriculture 2008a) (Appendix 4B). The Walker River watershed is identified as having noxious weed infestations (Nevada Department of Agriculture 2008b) and requires control of specific noxious weeds. Nevada has 30 weed management areas (see map in Appendix 4B) and nine weed districts (not all active) (Nevada Cooperative Weed Management Areas 2006).

A noxious weed of high concern in riparian habitats is tamarisk, also known as salt cedar. Reduction of tamarisk along the Walker River was the number one riparian weed goal cited by a special focus group, along with reducing other noxious weeds such as knapweed (University of Nevada, Reno 2001). Tamarisk consumes groundwater and can cause a lowering of the water table and drying of groundwater-fed surface water (Wiesenborn 1996). Current legislation and funds for tamarisk treatment are being used to control the tamarisk infestation along the mainstem Walker River upstream of Walker Lake and reduce its spread.

Perennial pepperweed (*Lepidium latifolium*), also called tall whitetop, is another noxious weed that invades many habitat types, including pastures, agricultural

fields, irrigation canals, and riparian areas (Morisawa 1999). Perennial pepperweed competes with native species, reduces biodiversity, and increases erosion potential in infested stream banks. Perennial pepperweed propagates quickly and is able to exploit nutrients under favorable soil moisture conditions.

Hoary cress (*Lepidium draba* ssp. *draba* [*Cardaria draba*]) is another noxious weed that colonizes disturbed areas.

Invasive weeds have the ability to alter habitats and multiply rapidly, and are difficult to control. However, these weeds are not specifically regulated by the state of Nevada. Kochia (*Kochia scoparia*) and tumbleweed (*Salsola tragus*) are commonly found invasive weeds. Similar to noxious weeds, these species can reduce the quality of wildlife habitat, increase potential for fire and soil erosion, and reduce crop value and yield. Without suitable land management, native grass and shrub communities are extremely slow to re-establish on agricultural lands that have been taken out of cultivation, increasing the potential for these lands to become infested with kochia and tumbleweed (Langsdorf pers. comm.). Halogeton (*Halogeton glomeratus*) is another invasive weed that commonly colonizes disturbed areas (Bull pers. comm.).

Environmental Consequences

This section describes the impact analysis relating to vegetation and wetlands for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assessment Methods

The assessment of project impacts on vegetation and wetlands focuses on riparian and wetland habitat types located along water conveyances or on agricultural land in the study area. The only areas expected to experience a loss of wetland or riparian vegetation as a result of the Proposed Project or other alternatives are along water conveyances that currently support wetland or riparian vegetation or within agricultural wetlands. Upland areas not affected by agricultural operations are not expected to be affected by the Proposed Project or other alternatives and are not analyzed further.

For the purposes of this analysis, impacts relating to the spread of noxious weeds under the Proposed Project are based on a worst-case scenario (i.e., maximum acreages that could be retired or converted from active cultivation without weed control). It should be noted, however, that farmers could also continue agricultural practices through fallowing, growing low-water crops, or improving water efficiency, which could be done using less water. In addition, retired land could be brought back into agricultural use if access to water is re-established on the land through another source. Under Alternative 2, this issue would not occur

because the water leases and potential cessation of active cultivation would be temporary.

Assumptions

The following assumptions informed the impact analysis for vegetation and wetlands.

- Both Alternative 1, which would permanently acquire water, and Alternative 2, which would lease water, would deliver an average additional inflow of 50,000 af/yr to Walker Lake with full project funding. Alternative 1 would provide the water permanently, and Alternative 2 would provide water until funding for the leasing program runs out. Alternative 3, which would implement water conservation and efficiency measures, is not expected to provide the average inflow of 50,000 af/yr to Walker Lake (see Chapter 3, Water Resources, for additional discussion of expected water deliveries).
- Individual water rights leases under Alternative 2 would be in effect for 3 to 5 years, after which properties would rotate out of the lease program. Alternative 2 could affect more properties over a larger area than Alternative 1, impacts would occur over a shorter period of time.
- With full funding, as much irrigated land would be involved in the implementation of Alternative 3 as in Alternative 1.
- Changes in Walker River water flow upstream of the Wabuska gage as a result of the action alternatives would be within the range of existing variation.
- Results from a University of Nevada/Desert Research Institute study on the effects of increased flows on river basin ecology would be used to develop recommendations for the management of water in the Walker River in order to minimize erosion and sediment transport and minimize degradation of the lower river (University of Nevada Reno and Desert Research Institute 2008).
- Under Alternatives 1 and 2, the magnitude of impacts on riparian vegetation in each part of the study area would be proportional to the proposed acquisitions or leases in each area (Chapter 7, Land Use and Agriculture; Table 7-10).
- Under any of the action alternatives, the potential increase in recreation as a result of increased lake elevations is not anticipated to affect plant species of special use to YPT, because there is little vegetation on most of the lake shore. See Chapter 11, Recreation, for the list of these plant species and a discussion of project impacts on recreation.
- If water is purchased or leased from the Option 1, Masini Investments and L&M Ltd Partnership properties, agricultural practices would be

continued on these properties using water obtained from another source, as explained in Chapter 3, Water Resources (Hydrologic Change HC-4).

- The analysis for Alternative 1 assumes that the Homestretch Geothermal pilot project will be constructed and that no additional impacts from infrastructure construction or water delivery to Walker River would occur under Alternative 1. Water delivery begun under the pilot project, which would last for 5 years, would continue. Vegetation and wetland conditions would not change.

Impact Criteria

Impacts on vegetation and wetlands would be considered adverse if implementation of the Proposed Project or an alternative would:

- cause temporary or permanent removal, filling, grading, or disturbance of waters of the United States regulated under the Clean Water Act ;
- cause any loss of habitat that is sensitive or rare, such as native riparian woodland and shrubland, and wetlands;
- cause substantial loss of natural vegetation that is slow to recover;
- cause substantial loss of populations or habitat of a species that is
  - a Nevada state listed species,
  - regionally rare, or
  - otherwise so sensitive as to jeopardize the continued existence of the species in the region;
- cause substantial loss of diversity of species or natural communities;
- be incompatible with local, state, or federal land management plans; or
- spread or introduce noxious weed species into new areas within the project area.

Impacts on vegetation and wetlands would be considered beneficial if implementation of the Proposed Project would:

- increase habitat that is sensitive or rare in the region in question, such as native riparian woodland and shrubland, and wetlands;
- substantially increase populations or habitat of a species that is
  - a Nevada state listed species,
  - regionally rare, or
  - otherwise so sensitive as to jeopardize the continued existence of the species in the region; or

- substantially increase the diversity of species or natural communities;

Impacts

No Action Alternative

Under the No Action Alternative, no additional water would accrue to the Walker River to flow to Walker Lake, and lake area and elevation would continue to decline and recede from wetlands at the south end of the lake. Erosion of the area along Walker River below Schurz would continue, causing wetland and riparian communities to decline further. Noxious weed invasion of riparian habitat in the lower Walker River, particularly the establishment of tamarisk, would likely increase. These would be adverse impacts in these areas.

Alternative 1 (Proposed Project)

Water rights acquired under Alternative 1 are expected to add an average of 50,000 af/yr to Walker Lake. It is possible, however, that less than the average 50,000 af/yr would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the annual average inflow to the lake would increase by only 7,300 af.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that water rights acquired would increase the average inflow to the lake by 50,000 af/yr. Unless otherwise noted, if the full amount of water rights were not acquired, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Direct Impacts

Alternative 1 would not result in any construction activities or ground disturbance as part of the proposed water rights acquisitions. Because no direct disturbance is proposed under this alternative, no direct impact on vegetation and wetlands attributable to acquisitions of land or water rights is anticipated.

Indirect Impacts

Riparian and Wetland Impacts

Impact VEG-1. Loss of Wetland Communities at Alkali Lake WMA Caused by Acquisitions in Smith Valley (Adverse Impact)

Acquisitions of irrigated agricultural land adjacent to Alkali Lake WMA would result in the reduction of water delivery to the area and subsequent reduction of tailwater that reaches Alkali Lake. The reduction of playa wetland habitat supported by this water source would be an adverse impact.

Impact VEG-2. Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Water Flow (Minor Impact)

Acquisition of irrigated agricultural land could result in the reduction or cessation of water transport in associated irrigation canals and drains. The loss of water transport could cause the loss of riparian and wetland habitat in and adjacent to the existing irrigation canals and drains.

The maximum water acquisitions would affect approximately 33% of the existing irrigated land in each of the three acquisition areas—Mason Valley, Smith Valley, and East Walker River.

Although some irrigation supply canals in Mason Valley and Smith Valley support native species (Bull pers. comm.), riparian habitat supported by irrigation features generally has lower habitat value in comparison to riparian communities along natural streams because it is narrow and patchy and is more likely to support nonnative and invasive plant species, such as tamarisk. Existing riparian areas that are dominated by tamarisk would be more likely to persist under low flow conditions than native riparian vegetation. Tamarisk is a facultative phreatophyte (not solely reliant on groundwater) and is more tolerant of reductions in surface water and groundwater levels than native riparian or marsh community types. Nevertheless, based on available vegetation mapping (Figure 4-11), minimal amounts of riparian woodland occur outside of the river corridor in the study area in comparison to the extent of riparian habitat along the West Walker, East Walker, and mainstem Walker Rivers. Therefore, the projected potential loss of native riparian habitat along irrigation canals would be relatively small. Moreover, because of regular maintenance of canals and drains by burning or cutting vegetation, many canals and drains support little riparian or wetland habitat (Langsdorf pers. comm.).

This impact would be offset to some extent by an increase in riparian habitat along the mainstem Walker River that is expected with increased flows, as described in Impact VEG-5. Loss of riparian vegetation along canals and drains would result in a local decline of this habitat, but no net loss is anticipated for the project as a whole, if the average 50,000 af/yr is supplied to Walker Lake. Therefore, this would be a minor impact.

Impact VEG-3. Loss of Wetlands at South End of Walker Lake Caused by Increased Lake Surface Elevation (Minor Impact)

Although most of the shoreline is unvegetated, a marsh wetland area occurs at the southeast end of the lake. This wetland area formed as a result of the decline in lake elevation. Because the area is subject to the seasonal and annual variation of inflow to the lake, it is not a stable feature. The proposed acquisitions in the Walker Basin would increase water delivery to Walker Lake and, if the Proposed Project is fully funded, the additional average inflow of 50,000 af/yr would raise

the lake surface elevation (see additional detailed discussion in Chapter 3, Water Resources). The higher lake elevation would then inundate wetland habitat at the southeast lake edge. Wetland communities are rare, and loss would add to the decline of this community type and the diversity of natural communities in the area. This impact would be indirectly offset to some extent by an increase in wetland habitat along the mainstem Walker River that is expected with increased flows (Impact VEG-5). In addition, the higher lake surface elevation would return this area to its natural condition. This would be a minor impact.

If the Proposed Project is not fully funded, the lake surface elevation would continue to drop, and the wetland would receive less water from the lake. However, this wetland is primarily springfed from groundwater (Espinoza and Tracy 1999) and is not fully dependent on water from Walker Lake. It is anticipated that while there could be a short-term impact, the wetland would ultimately re-establish and there would be no net loss of wetlands in this area. This would be a minor impact.

Impact VEG-4. Loss of Wetland Communities in Irrigated Lands Caused by Curtailed Irrigation (Minor Impact)

Wetlands can occur on irrigated pasture land that has not been laser-leveled. Wetlands in these pasture areas are artificially created by the presence of irrigation water, generally disturbed by agricultural practices, and likely to support nonnative species. These features, therefore, are of lower habitat quality than naturally occurring wetlands. Although too small for the minimum map unit size on the vegetation community figure (Figure 4-1), wetland vegetation that relies on irrigation water can occur in low-lying parts of agricultural fields and along the field edges. Reducing or eliminating irrigation would cause wetlands to dry up and the vegetation community to return to a more natural upland type or possibly noxious weed communities. This impact might be avoided on properties where irrigation and agricultural cultivation would continue from an alternative source (e.g., on Option 1 Masini Investments and L&M Ltd Partnership properties).

Although wetland communities are generally rare, the loss of artificially created wetlands dominated by nonnative species would be of less concern than loss of natural wetlands. In addition, this impact would be indirectly moderated to some extent by enhanced wetland habitat along the mainstem Walker River with increased flows, as described in Impact VEG-5. This would be a minor impact.

Impact VEG-5. Increase in Riparian and Wetland Habitat along the Mainstem Walker River Downstream from Schurz as a Result of Increased Flow (Beneficial)

Acquisitions to increase flows to Walker Lake would pass through the mainstem Walker River. Although flows would begin to increase at the highest upstream acquisitions, the greatest percent flow increase would be in the downstream part

of Walker River between Schurz and the lake, where summer flows can drop to zero. That reach of the river is bordered primarily by shrublands (greasewood flat and mixed salt desert scrub) and agricultural land, with emergent marsh along the river channel and some areas of invasive riparian and semi-desert grassland.

In the Walker River downstream of Schurz, increased flows to Walker Lake would help establish and sustain riparian and wetland vegetation, which, depending on the actual flows that result, may help to stabilize the lower portion of the Walker River and reduce erosion in that area. The increased flow would also contribute to an increase in natural community diversity. Depending on the timing of flow, the depth to groundwater or river stage, and the soil conditions, the increased flow could favor the establishment of native riparian trees such as cottonwood and willow. In addition, increased flows may improve habitat quality along the Walker River and provide suitable locations for special-status plants to establish. This would be a beneficial impact.

This beneficial impact would be commensurate with the level of funding. If Alternative 1 does not receive full funding and the average 50,000 af/yr of water, the river channel would not be expected to stabilize completely and the potential area for establishment of riparian and wetland communities would be smaller.

Special-Status Plant Impact

Impact VEG-6. Loss of Special-Status Plants Caused by Changes in Hydrology (No Impact)

No special-status plant species is expected to be affected by Alternative 1. Acquisitions in the Walker Basin would increase flows to Walker Lake, and those flows would pass through the mainstem Walker River. No special-status plant species is known to occur near the Walker Lake shoreline; therefore, no impacts on special-status plants are anticipated in this area. Alteration of existing hydrology in the mainstem Walker River may change the vegetation types and habitat for some special-status plants.

Three special-status plant species (Wassuk beardtongue, Reese River phacelia, and Watson spinecup) are documented in the area of the Walker River between Weber Reservoir and Walker Lake. These species grow in upland habitats, which would be unaffected.

Lavin eggvetch is a special-status plant documented in the West Walker River area and in southern Smith Valley. Although water rights acquisitions are planned for the Smith Valley area, Lavin eggvetch grows in scrub and woodland communities that would not be affected by changes in hydrology as a result of Alternative 1.

Mono County phacelia is a special-status plant documented in the East Walker River area near the Nevada/California border. This species is located outside of the area that would be affected by acquisition of water rights. In addition, Mono County phacelia grows in upland areas away from the river or irrigation canals and would not be affected by Alternative 1.

The five special-status species documented in the study area occur in upland habitats. It is unlikely that Alternative 1 would affect these habitats or the known locations of special-status plants. There would be no impact on any special-status species under this alternative.

Noxious Weed Impacts

Impact VEG-7. Spread of Noxious and Invasive Weeds Caused by Reduction of Irrigated Agricultural Land (Adverse Impact)

Acquisitions involving irrigated agricultural land could result in the conversion or retirement of agricultural land. Although the NRS require landowners or occupants to control noxious weeds (Chapter 555 sections .005–.217), loss of active cultivation without weed control could result in establishment of noxious weeds in these areas and/or higher soil erosion if vegetation is sparse. Common invasive weeds that establish in areas where natural vegetation has been removed for development or agriculture include kochia, tumbleweed, and halogeton (Langsdorf pers. comm., Bull pers. comm.).

It is not certain how many acres of land would be retired from agricultural production as a result of acquisitions. However, based on the maximum water acquisitions (33% of existing irrigated land) in each of the three acquisition areas, up to 11,541 acres of agricultural land could be affected in Mason Valley, up to 5,759 acres in Smith Valley, and up to 1,325 acres in the East Walker area.

Some noxious weed species regulated under NRS 555.005-.217 spread via water conveyance in irrigation canals and drains. Perennial pepperweed, a common noxious weed in the Walker River Basin, is one such species. Therefore, reduced irrigation may reduce the transmission of some noxious weed species. In general, the spread or introduction of noxious and invasive weed species to lands in the study area would be an adverse impact.

This adverse impact would be commensurate with the level of funding. If Alternative 1 does not receive full funding and deliver an average of 50,000 af/yr of water, less agricultural land would likely be converted or retired, providing a lower potential for the spread or introduction of invasive and noxious weed species in the project area.

Impact VEG-8. Spread of Tamarisk Caused by Increased Flow in Walker River (Minor Impact)

Increased flows to Walker Lake would pass through the mainstem Walker River, providing a water source for establishment of riparian vegetation, which could include tamarisk, a noxious weed regulated under NRS 555.005-.217. Tamarisk is present in some riparian areas, particularly areas mapped as invasive southwest riparian woodland and shrubland. The area between Schurz and Walker Lake is colonized by weeds and tamarisk. The type of vegetation that would become established in these areas depends on two factors: timing of flow and the depth to groundwater or river stage relative to exposed sediments.

If the timing of flows in lower Walker River is controlled to reach a low point and expose sediment during seed dispersal season in early summer for cottonwood or willow, those species are likely to become established (Zouhar 2003). However, if flows are low and sediment is exposed during the fall, tamarisk is likely to persist as the dominant vegetation. Increased flows resulting from the fully funded Alternative 1 are not expected to be at low levels during the irrigation season, which occurs from March through October, and may not obviously favor either the native riparian species or tamarisk. The flow regime likely would follow this pattern because storage in Weber Reservoir limited, and substantial releases are required in average and wet years. To the extent that there is available storage capacity in the reservoir, it may be possible to store acquired water in early summer and benefit riparian resources, subject to applicable operating criteria. See Hydrologic Change HC-3 in Chapter 3, Water Resources, for additional details of expected flows between Schurz and Walker Lake.

If groundwater and river levels drop too far below the root zone of cottonwoods and willows, plant mortality would begin to occur, opening gaps for tamarisk and other species to establish. However, depth to groundwater is expected to decrease and river stage is expected to increase as a result of Alternative 1, favoring the survival of cottonwoods and willows if these species become established. In addition, flood flows late in the growing season and prolonged inundation may increase tamarisk mortality (Zouhar 2003).

The potential for spread of tamarisk in the lower Walker River is unknown because of the uncertainty of seasonal flows in this area.

Alternative 2 (Leasing Alternative)

Because Alternative 2 involves water leases, the proposed action would be temporary and continue only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average of 50,000 af/yr, the existing funding is estimated to last 3 years and full funding would last an estimated 20 years.

Some of the impacts of Alternative 2 (both adverse and beneficial) would be similar to those of Alternative 1, but temporary, of less magnitude, or both.

Direct Impacts

Alternative 2 would not result in any construction activities or ground disturbance as part of the proposed water leases or land acquisitions. Because no direct disturbance is proposed under this alternative, no direct impacts on vegetation and wetlands attributable to water leases or land acquisitions are anticipated.

Indirect Impacts

The following impacts under Alternative 2 would be similar to the impacts under Alternative 1, but temporary:

- *VEG-1 Loss of Wetland Communities at Alkali Lake WMA Caused by Acquisitions in Smith Valley (Adverse Impact)*
- *VEG-3 Loss of Wetlands at South End of Walker Lake Caused by Increased Lake Surface Elevation(Minor Impact)*
- *VEG-5 Increase in Riparian and Wetland Habitat along the Mainstem Walker River Downstream from Schurz as a Result of Increased Flow (Beneficial Impact)*

  This impact would be of less magnitude with existing funding only because the habitat that does establish in 3 years would be less mature and of a lesser extent than the habitat supported for 20 years.
- *VEG-8 Spread of Tamarisk Caused by Increased Flow in Walker River (Minor Impact)*

The following impacts under Alternative 2 would be similar to the impacts under Alternative 1, but temporary and of less magnitude:

- *VEG-2 Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Water Levels (Minor Impact)*
- *VEG-4 Loss of Wetland Communities within Irrigated Lands Caused by Curtailed Irrigation (Minor Impact).*

The following impact of Alternative 2 differs from that of Alternative 1 in other important ways:

- *VEG-7 Spread of Noxious and Invasive Weeds Caused by Reduction of Irrigated Agricultural Land (No Impact)*

  Impact VEG-7 is unlikely to occur under Alternative 2 because the agricultural land would be out of cultivation only temporarily. It would not be in a landowner's interest to allow invasive and noxious weeds to establish. In addition, landowners could lease a portion of their water rights and rotate fields or otherwise reduce the level of cultivation to accommodate less water use. NRS require landowners or occupants to control noxious weeds (Chapter 555 sections .005–.217).

Alternative 3 (Efficiency Alternative)

As discussed in Chapter 3, Water Resources, full implementation of Alternative 3 would yield an average additional inflow of 32,300 af/yr.

The following impact of Alternative 3 would be similar to that of Alternative 1:

- *VEG-1 Loss of Wetland Communities at Alkali Lake WMA Caused by Water Acquisitions in Smith Valley (Adverse Impact)*

The following impacts of Alternative 3 would be similar in nature to those of Alternative 1, but of less magnitude:

- *VEG-3 Loss of Wetlands at South End of Walker Lake Caused by Increased Lake Surface Elevation (Minor Impact)*
- *VEG-5 Increase in Riparian and Wetland Habitat along the Mainstem Walker River Downstream from Schurz as a Result of Increased Flow (Beneficial Impact)*
- *VEG-6 Loss of Special-Status Plants Caused by Changes in Hydrology (No Impact)*
- *VEG-8 Spread of Tamarisk Caused by Increased Flow in Walker River (Minor Impact)*

The following impacts of Alternative 3 differ from those of Alternative 1 in other important ways:

- *VEG-2 Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Water Levels (Minor Impact)*

Impact VEG-2 would not apply to Alternative 3 because there would be no acquisition or lease that would reduce water transportation in canals and drains.

Loss of habitat could occur through other mechanisms discussed in Impacts VEG-9 and VEG-10.

- *VEG-4 Loss of Wetland Communities within Irrigated Lands Caused by Curtailed Irrigation (Minor Impact)*

Impact VEG-4 would not occur under Alternative 3 because water delivery to irrigated fields is not expected to cease. Loss of wetland habitat could occur through other mechanisms discussed in Impact VEG-11.

- *VEG-7 Spread of Noxious and Invasive Weeds Caused by Reduction of Irrigated Agricultural Land (Adverse Impact)*

Impact VEG-7 would not apply to Alternative 3 because there would be no reduction of irrigated lands.

Direct Impacts

Impact VEG-9. Loss of Riparian and Wetland Habitat along Irrigation Canals and Drains Caused by System Efficiency Measures (Adverse Impact)

System efficiency measures could include lining canals with concrete; replacing canals with underground pipelines; consolidating surface conveyances in the Mason and Smith Valleys, which would involve construction of new facilities; consolidating diversion works; and removing vegetation in or along ditches and canals. Any of these measures would result in direct, site-specific impacts, including filling, grading, or disturbance of existing wetlands and removal of wetland and riparian vegetation for construction or control of phreatophytes (plants that obtain water from groundwater).

Irrigation canals in the study area could include features that were once natural streams as well as features that were wholly constructed in uplands. Natural streams could potentially qualify as waters of the United States, which are under Corps jurisdiction. Because of the varied circumstances for canals in the study area, the determination of Corps jurisdiction for individual canals would be made on a case-by-case basis under the current guidance for Clean Water Act jurisdiction (U.S. Environmental Protection Agency and U.S. Army Corps of Engineers 2008). Similarly, drains in the study area that return water to the Walker River could be under jurisdiction of the Corps, but final determinations would be made on a case-by-case basis. Placement of fill in irrigation canals or drains that are classified as waters of the United States would require a CWA Section 404 permit. Placement of fill in irrigation canals or drains that are not waters of the United States could still result in loss of ecological functions such as groundwater recharge and wildlife habitat.

Loss of riparian and wetland habitat would be offset to some degree by the increase in riparian and wetland habitat along the mainstem Walker River that would be anticipated with increased flows, as described in Impact VEG-5. However, because more land could potentially be affected under Alternative 3 than under Alternatives 1 or 2, and less water would be expected to reach the mainstem of Walker River, a net loss of riparian and wetland habitat could result under this alternative, although the magnitude is uncertain. Because this impact would directly result in the permanent removal, filling, grading, or disturbance of waters of the United States and/or nonjurisdictional wetlands and woody riparian vegetation, it would be an adverse impact.

Indirect Impacts

Impact VEG-10. Loss of Riparian Habitat along Irrigation Canals and Drains Caused by System Efficiency Measures (Minor Impact)

System efficiency measures would result in decreased subsurface flow and probable loss of riparian vegetation adjacent to the canals (Walker River Basin Advisory Committee 2000). Riparian habitat supported by irrigation features has generally lower habitat value than riparian communities along natural streams and is also more likely to support nonnative species and potentially invasive species, such as tamarisk. In Mason Valley and Smith Valley, however, some irrigation supply canals support native species such as coyote willow, cattail, and bulrush (Bull pers. comm.).

This indirect impact would be offset by an increase in riparian habitat along the mainstem Walker River with increased flows, as described in VEG-5. Loss of riparian vegetation along ditches would result in a local decline of this habitat, but no net loss is anticipated. Because the loss would be primarily of low quality riparian habitat and no net loss is anticipated, this would be a minor impact.

Impact VEG-11. Loss of Wetland Communities within Irrigated Lands Caused by On-Farm Efficiency Measures (Minor Impact)

Implementation of on-farm conservation and efficiency measures that could make water available for purchase and subsequent movement to Walker Lake would result in loss of wetlands on those agricultural parcels. Irrigation provides the water source for wetlands that can occur within irrigated agricultural areas. Although too small for the minimum map unit size on the vegetation community figure (Figure 4-1), wetland vegetation that relies on irrigation water can occur in low-lying parts of agricultural fields and along the field edges. Decreased irrigation could cause these wetlands to dry up, and the vegetation community could transition to an upland type, establish undesirable vegetation, or become infested with noxious weeds. Alternatively, vegetation could die back as a result of the lack of irrigation, and topsoil could erode from the site, making revegetation difficult. While high quality wetlands can occur on agricultural land,

wetlands in habitat adjacent to canals and drains are likely to support more nonnative species than naturally occurring or designed and managed wetlands and, therefore, are of lower habitat quality. Although wetland communities are generally rare, and loss would add to the decline of this community type and the diversity of natural communities in the area, the loss of wetlands dominated by nonnative species would be a less important impact. In addition, this impact would be indirectly moderated by increased wetland habitat along the mainstem Walker River with increased flows, as described in VEG-5. Therefore, the loss of some on-farm wetland habitat would be a minor impact.

Chapter 5 Biological Resources—Fish

Introduction

This chapter describes the affected environment for fish species (including special-status species) and fish habitat in the study area and the potential impacts on fish species and habitat that would result from the Proposed Project and other alternatives.

Impacts on fish species in the study area would be beneficial as a result of the increased water flow in the mainstem Walker River and increased inflow to Walker Lake. Water quality indicators such as TDS concentration would be improved, increasing survival of LCT and tui chub, the only fish species in Walker Lake. Temporary construction impacts of Alternative 3 would be minimized by an SWPPP and other BMPs that would reduce release of sediment and contaminants into Walker River.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- The Walker Basin, Nevada and California: Physical Environment, Hydrology, and Biology (Sharpe et al. 2008)
- Lahontan Cutthroat Trout, *Oncorhynchus clarki henshawi*, Recovery Plan. (U.S. Fish and Wildlife Service 1995)
- Short-Term Action Plan for Lahontan Cutthroat Trout (*Oncorhynchus clarki henshawi*) in the Walker River Basin. (Walker River Basin Recovery Implementation Team 2003)

Affected Environment

This section describes the environmental setting related to fish resources, including special-status fish species, and fish habitat in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for fish species and their habitat includes the Nevada portions of the East and West Walker Rivers and the mainstem Walker River, up to and including Weber Reservoir and Walker Lake. The discussion focuses on Walker Lake and the mainstem Walker River upstream of Weber Dam.

Habitat Conditions, Fish Species Composition, and Distribution in the Walker River Basin

Table 5-1 lists fish species observed in the Walker River Basin, along with their associated habitats. Nonnative species are stocked (historically and/or currently) in the reservoirs of the Walker River Basin and also the rivers.

Irrigation diversions, dams, berms, and levees have been constructed throughout the Walker River Basin. Many of these structures fragment the basin and act as complete or partial barriers to fish migration, limiting the ability of adults, juveniles, and fry to migrate to required habitats (Deacon and Minckley 1974, Behnke 1992). Fry and juveniles may be injured or killed during downstream migration and passage over obstructions. When access to spawning areas is limited, fish may spawn in and use suboptimal habitats.

Natural channel formation results in more complex habitat features such as pools, riffles, meandering channels, different sizes of gravel substrate, and riparian vegetation. Healthy, intact riparian zones provide hydraulic diversity, add structural complexity, buffer the energy of runoff events and erosive forces, moderate temperatures, and provide a source of nutrients (Harris 1989). Riparian zones provide cover for fish species in the form of woody debris (Triska 1984**)**.

Regulated flow in the Walker River Basin has disrupted the natural channel-forming processes that create and maintain river and stream habitats. Flows diverted for agriculture and releases of water during months when natural precipitation and runoff would not occur disrupt channel processes, resulting in channelization (straight channel). The river downstream of Weber Reservoir seasonally becomes braided and shallow. The reduction or elimination of upstream riparian vegetation results in excessive erosion (Walker River Basin Recovery Implementation Team 2003). The introduction of nonnative plant species has disrupted hydrologic processes. The combined effects of these actions result in a loss of habitat required to sustain a diverse community of native fish and invertebrate species (Gerstung 1988, Hicks et al. 1991, Behnke 1992, Church 1995).

West Walker River

The headwaters of the West Walker River lie east of the Sierra Nevada crest just south of Sonora Pass, California, and originate from Kirkwood and Tower Lakes. Four of the six remaining LCT populations in the Walker River Basin are found in the West Walker River tributaries of Slinkard Creek, Silver Creek, Mill Creek, and Wolf Creek (Sharpe et al. 2008).

Other native fish species occurring in the West Walker River include mountain whitefish, Lahontan redside, Lahontan speckled dace, Tahoe sucker, Lahontan mountain sucker, Paiute sculpin, and Lahontan tui chub (Stockwell 1994).

Table 5-1. Fish Species of the Walker River Basin

Species	Scientific Name	Native or Introduced	Abundance	Current Distribution	Habitat
Lahontan cutthroat trout	*Oncorhynchus clarki*	Native	Uncommon /Stocked	Walker River, Walker Lake	River type fish: pools with cover (instream woody material, undercut banks) and velocity breaks, and riffle-run habitats with clear water and rocky substrate (U.S. Fish and Wildlife Service 1995, 19). Lake fish: water temperatures less than 22°C, pH values of 6.5 to 8.5, TDS concentrations less than 11,000 mg/l, and dissolved oxygen concentrations greater than 8 mg/l (Moyle 2002, 290).
Lahontan tui chub	*Siphateles bicolor*	Native	Uncommon	Walker River, Walker Lake	Quiet alkaline water with well-developed aquatic vegetation and fine substrate. Summer temperatures in excess of 20°C (Moyle 2002, 124).
Lahontan redside	*Richardsonius egregius*	Native	Uncommon	Walker River	Pools and slow riffles and alkaline lakes. Swim close to the surface during summer months and in the winter descend to lake bottoms in deep water (Moyle 2002, 135).
Lahontan speckled dace	*Rhinichthys osculus robustus*	Native	Unknown	Walker River	Clear, well-oxygenated water, with abundant cover such as woody debris, submerged aquatic plants, and moving water from stream currents, springs, or wave action (Moyle 2002, 162).
Tahoe sucker	*Catostomus tahoensis*	Native	Common	Walker River	Abundant in natural lakes. Also inhabit small streams with pools and runs and heavy cover. Can be found in waters exceeding 25ºC in the summer (Moyle 2002, 192).
Lahontan mountain sucker	*Catostomus platyrhynchus*	Native	Uncommon	Walker River	Clear streams with moderate gradients and substrate of rubble, sand, or boulders. Also live in large rivers and turbid streams. Found in waters ranging from 1-28ºC (Moyle 2002, 180).
Mountain whitefish	*Prosopium williamsoni*	Native	Unknown	Walker River	Clear, cold streams with large pools and mountain lakes. Can be found in summer water temperatures of 11-21 ºC (Moyle 2002, 244).
Paiute sculpin	*Cottus beldingi*	Native	Uncommon	Walker River	Clear, cold mountain streams (< 20ºC) with shallow, rocky riffles, in association with trout (Moyle 2002, 358).

Table 5-1. Continued

Species	Scientific Name	Native or Introduced	Abundance	Current Distribution	Habitat
Rainbow trout	*Oncorhynchus mykiss*	Introduced	Common/ Stocked	Walker River	Well-oxygenated, cool, riverine habitat with water temperatures from 7.8 to 18°C (Moyle 2002). Habitat types are riffles, runs, and pools.
Smallmouth bass	*Micropterus dolomieu*	Introduced	Common/ Stocked	Walker River, Weber Reservoir	Large, clear lakes and clear rivers with abundant cover and summer water temperatures 20-27ºC (Moyle 2002, 402).
Largemouth bass	*Micropterus salmoides*	Introduced	Common/ Stocked	Walker River, Weber Reservoir	Warm, shallow, low-velocity waters of moderate clarity and dense aquatic plants. Optimal temperatures of 25-30 ºC (Moyle 2002, 398).
Sacramento perch	*Archoplites interruptus*	Introduced	Unknown	Weber Reservoir	Lakes and reservoirs. Associated with aquatic vegetation and submerged objects. Prefer summer water temperatures range from 18-28ºC (Moyle 2002, 378).
Brown trout	*Salmo trutta*	Introduced	Common/ Stocked	Walker River	Medium to large slightly alkaline streams with riffles and large, deep pools. Prefer water temperatures of 12 to 20°C (Moyle 2002, 294).
Mosquitofish	*Gambusia affinis*	Introduced	Uncommon	Walker River	Many habitats. Can tolerate high water temperatures (up to 35ºC), various salinities, and low dissolved oxygen (Moyle 2002, 318).
Yellow perch	*Perca flavescens*	Introduced	Common/ Stocked	Weber Reservoir	Lakes associated with heavy growth of aquatic plants. Prefer warm water (22-27ºC) and can tolerate low dissolved oxygen concentrations (Moyle 2002, 412).
Black crappie	*Pomoxis nigromaculatus*	Introduced	Common/ Stocked	Weber Reservoir	Large warmwater lakes and reservoirs with water temperatures up to 29ºC. Associate with large submerged objects (Moyle 2002, 396).
White crappie	*Pomoxis annularis*	Introduced	Common/ Stocked	Weber Reservoir	Warm, turbid lakes and reservoirs. Can tolerate high turbidity, alkaline water, high temperatures (up to 31ºC), and lack of aquatic vegetation and cover (Moyle 2002, 394).
Black bullhead	*Ameiurus melas*	Introduced	Common/ Stocked	Walker River, Weber Reservoir	Ponds, small lakes, river backwaters, sloughs, and pools of low-gradient streams with slow currents, warm turbid water (35ºC), and muddy bottoms (Moyle 2002, 209).

Table 5-1. Continued

Species	Scientific Name	Native or Introduced	Abundance	Current Distribution	Habitat
Brown bullhead	*Ameiurus nebulosus*	Introduced	Unknown	Walker River	Low velocity, low-gradient reaches with deep pools, high turbidity and aquatic vegetation. Optimum water temperatures of 20-33 ºC (Moyle 2002, 211).
Channel catfish	*Ictalurus punctatus*	Introduced	Common/ Stocked	Weber Reservoir	Main channels of large streams and in reservoirs. Optimal water temperatures are 24-30ºC (Moyle 2002, 216).
White catfish	*Ameiurus catus*	Introduced	Common/ Stocked	Weber Reservoir	Reservoirs in water temperatures exceeding 20ºC (Moyle 2002, 215).
Bluegill	*Lepomis macrochirus*	Introduced	Common/ Stocked	Weber Reservoir	Warm, shallow lakes, reservoirs, ponds, streams, and sloughs at low elevations. Associated with aquatic plants and substrate of silt, sand, or gravel. Optimal water temperature is 27-32ºC. (Moyle 2002, 382).
Green sunfish	*Lepomis cyanellus*	Introduced	Common/ Stocked	Weber Reservoir	Lakes and reservoir edges in shallow, weedy areas. Optimal water temperature is 26-30ºC (Moyle 2002, 390).
Asiatic/common carp	*Cyprinus carpio*	Introduced	Common/ Stocked	Walker River, Weber Reservoir	Eutrophic lakes, reservoirs, and sloughs with silty bottoms and submergent and emergent aquatic vegetation. Active in water temperatures of 4-24ºC. (Moyle 2002, 173).

Nonnative species such as common carp, largemouth bass, brown trout, rainbow trout, and others occur in the West Walker River (Sada 2000).

South of the town of Walker, the river channel becomes a network of boulders in the constraints of the Walker River canyon. This reach of the river was reconstructed by the Corps after the 1997 flood. Water is diverted from the main river channel downstream into Topaz Lake Reservoir. From Topaz Lake Reservoir, the West Walker River is predominantly bordered by sagebrush shrub-scrub and irrigated agricultural fields and flows through Smith Valley, Wilson Canyon, and Mason Valley. The West Walker River and East Walker River join in Mason Valley to form the mainstem Walker River (Sharpe et al. 2008).

East Walker River

The East Walker River originates in the Sierra Nevada above Twin Lakes outside of Bridgeport, California. LCT occurs in By-Day Creek Reservoir and in Murphy Creek, approximately 4 miles downstream of Bridgeport Reservoir. Nonnative rainbow trout and brown trout from the Mason Valley Fish Hatchery are stocked in the East Walker River (Sharpe et al. 2008).

Downstream of Bridgeport Reservoir, the river is lined with high desert riparian woodland habitat and supports mountain whitefish, Lahontan redside, speckled dace, Tahoe sucker, Lahontan mountain sucker, tui chub, and nonnative species such as common carp, brown trout, and rainbow trout (Sada 2000).

Mainstem Walker River

The mainstem Walker River begins downstream of the convergence of the West and East Walker Rivers in Mason Valley and terminates at Walker Lake. Fish species found in the mainstem Walker River during recent surveys by UNR are Lahontan mountain sucker, Lahontan redside, smallmouth bass, brown bullhead, and common carp (Umek and Chandra pers. comm.). Paiute sculpin also occupy the Walker River. NDOW has found native fish species in the East and West Walker Rivers and the mainstem river between Yerington and Schurz (Wright pers. comm.); however, during recent sampling, only introduced warmwater fish species were found in the Walker River downstream from Weber Dam (Walker Lake Fisheries Improvement Team 2008).

The riparian zone along mainstem Walker River to Weber Reservoir is dominated by cottonwood and willows. The Walker River below Weber Reservoir has substantial tamarisk, an invasive species commonly known as saltcedar (Sharpe et al. 2008). The WRPT and USFWS have initiated Year 1 of a tamarisk removal and revegetation project on the Walker River Paiute Reservation. In addition, a 5-year plan for removal and management of tamarisk on the lower portion of the Walker River is being developed. Historically, the mainstem Walker River was part of the migratory corridor for LCT to reach their spawning grounds (U.S. Fish and Wildlife Service 1995). The river reach from Weber

Reservoir to Walker Lake does not provide quality migratory, spawning, or rearing habitat for LCT. This reach is wide, shallow, braided, and has sandy substrate (Walker Lake Fisheries Improvement Team 2008).

A fish survey conducted on May 28, 2008, between Weber Reservoir and Schurz found no LCT at any of four sampling sites. All captured fish were warmwater nonnative species such as bluegill, largemouth bass, and common carp (Walker Lake Fisheries Improvement Team 2008). Cooper and Koch (1984) reported that LCT and Tahoe suckers no longer spawn in the mainstem Walker River.

Weber Dam and Reservoir

Weber Dam and Reservoir are located approximately 25 river miles upstream of Walker Lake on the Walker River Indian Reservation (Figure 1-2). Weber Dam currently is the upstream migration limit for LCT when they are able to access the river from Walker Lake. Weber Dam has recently been repaired and modified; the reservoir capacity is 10,700 af. This facility is operated primarily to store and release water for irrigation on the reservation and also for flood control.

Weber Reservoir is not stocked; fish move into the reservoir from the river upstream where they are stocked (Table 5-1). Resident warmwater species include brown bullhead, channel catfish, carp, largemouth bass, and white crappie (Miller Ecological Consultants 2005).

Future plans for the reservoir include building a fishway to provide passage for LCT upstream of Weber Dam into Walker River (Figure 1-2) (Walker River Paiute Tribe 2008). The fishway would also permit downstream migration of juvenile and adult fish (Miller Ecological Consultants 2005). BIA has scheduled to install a fishway at Weber Dam during 2009 and 2010 (Walker River Paiute Tribe 2008).

Walker Lake

Walker Lake is the terminus of the Walker River Basin (Figure 1-2). Five fish species are native to Walker Lake: LCT, Lahontan tui chub, Tahoe sucker, Lahontan redside, and Lahontan speckled dace (Sigler and Sigler 1987, LaRivers 1962, Page and Burr 1991). All but Lahontan speckled dace are currently found in Walker Lake and Tahoe suckers are rare (Walker Lake Fishery Improvement Plan 2007).

LCT was once abundant in the Walker River system and supported an extensive fishery (LaRivers 1962). However, the decline of lake surface elevation and loss of access to spawning habitat led to the near loss of this fishery by the 1950s (Koch et al. 1979, Cooper and Koch 1984). LCT has been produced by Lahontan National Fish Hatchery and Mason Valley Hatchery since the 1960s. The 1995 LCT Recovery Plan (U.S. Fish and Wildlife Service 1995) identifies the importance of maintaining these populations while recovery strategies are

developed and Lahontan National Fish Hatchery Complex provides production to support recovery and recreational fishing. In November 2005, Congress appropriated money for the Desert Terminal Lakes Program. This program is a collaborative partnership between NDOW, WRPT, and USFWS to design and implement fishery improvements in the State of Nevada with an emphasis on the Walker River Basin. The Walker Lake Fishery Improvement Program emphasizes improving understanding of the fishery in Walker Lake and lower Walker River, helping to improve the stocking and survivability of LCT, and refining strategies for establishing a self-sustaining, lacustrine LCT population. This allows adaptive management for long-term recovery and maintenance of a healthy recreational fishery (Walker Lake Fisheries Improvement Team 2008).

Nonnative fish species (Kokanee salmon [*Oncorhynchus nerka kennerlyi*], brown and rainbow trout, and carp) have been stocked in Walker Lake in the past, but none was able to establish a self-supporting population. (LaRivers 1962 and Moyle et al. 1995).

The decrease in lake surface elevation and depth has changed the entire lake ecosystem— physically, chemically, and biologically. Increasing TDS concentration and water temperature and decreasing dissolved oxygen concentration have played a role in altering nutrient cycling, changing biotic communities, and affecting the extent and quality of fish habitat, particularly in summer months. As a result, Walker Lake is experiencing eutrophication, a degradation of lake water quality (Sharpe et al. 2008). Insufficient freshwater inflow to Walker Lake may result in aquatic conditions that are inhospitable to LCT, its prey base, and possibly other lake-dependent faunal species. See Chapter 3, Water Resources, Walker Lake Limnology, for a detailed description of Walker Lake processes and resulting water quality.

Special-Status Fish Species

LCT is the only special-status fish species in the study area. Lahontan tui chub also is discussed because of its importance as a prey base for LCT.

Lahontan Cutthroat Trout

LCT is currently listed as threatened by USFWS (40 FR 29864, 1975) and is a Nevada protected species (U.S. Fish and Wildlife Service 2008). It is also listed as at-risk (Nevada Natural Heritage Program 2007). No critical habitat has been designated (U.S. Fish and Wildlife Service 1995, 2009).

There are two forms of LCT: fluvial (stream-dwelling) and lacustrine (lake-dwelling). Fluvial type fish prefer pools with cover (instream woody material, undercut banks) and velocity breaks, and riffle-run habitats with clear water and rocky substrate (U.S. Fish and Wildlife Service 1995). Optimal riverine habitat consists of clear cold water, well-vegetated streambanks, abundant instream

cover, stable water flow, and approximately 1:1 pool-to-riffle ratio (Hickman and Raleigh 1982). Fluvial LCT can tolerate water temperatures up to 25°C, but growth ceases at 24°C. High mortality occurs at water temperatures of 26°C and above (Dickerson and Vinyard 1999a).

Lacustrine type LCT can tolerate high alkalinity and TDS concentration (U.S. Fish and Wildlife Service 1995) within limits. Numerous studies have examined optimal water quality conditions for lacustrine type LCT. Studies have shown that 20% of acclimated LCT survived when TDS concentration exceeded 15,000mg/l and that only 4 to 5% of acclimated LCT survived when TDS concentration reached 16,000 mg/l (Nevada Department of Wildlife 2006). Best survival and growth occur with water temperatures less than 22°C, pH values of 6.5 to 8.5, and dissolved oxygen greater than 8 mg/l (Moyle 2002) (Table 5-2).

Table 5-2. LCT and Tui Chub Water Quality Parameter Tolerance Limits

Species	Life Stage	Water Temperature (ºC)		Dissolved Oxygen (mg/l) (preferred)	Total Dissolved Solids (ppm) (preferred)
		Acceptable Range	Optimal		
Lahontan cutthroat trout	Spawning (river)	8 to 16	Unknown	≥5	Unknown
	Eggs (river)	6 to 12	10	≥8	Unknown
	Juveniles (river)	9 to 20	15	≥8	Unknown
	Adults (lake)	9 to 20	Unknown	≥8	<15,467
Tui chub	Spawning	13 to 16.5	Unknown	Unknown	Unknown
	Eggs	18 to 24	Unknown	Unknown	<15,532
	Larvae	18 to 24	Unknown	>2	<16,000
	Juveniles	15 to 30	Unknown	>2	Unknown
	Adults	15 to 30	Unknown	>2	Unknown

Sources: Hickman and Raleigh 1982, Moyle 2002, U.S. Fish and Wildlife Service 1995, Cooper 1978.

Optimal TDS concentration for survival of lacustrine LCT is unknown and not defined by Moyle (2002). In a laboratory study, LCT ranging in size from 2 to 3 inches tested at 10,300 mg/l TDS had a survival rate of approximately 78%. LCT tested at 15,467 mg/l TDS and above all died (Dickerson and Vinyard 1999b). The next lowest concentration of TDS tested was 130 mg/l, which was the control group. The fish in the control group had 100% survival. No fish were tested for TDS concentration between 130 and 10,300 mg/l, so the threshold TDS concentration for inducing LCT mortality is not known. Susceptibility to TDS concentration in Walker Lake seems to be affected by fish size or age as smaller fish experienced higher mortality in Walker Lake water.

The results from the previously mentioned studies are consistent with observations from the Lockheed Ocean Science Laboratories (1982) that 10-month-old LCT were able to tolerate a higher TDS concentration in Pyramid Lake water than were 2-month-old fish. In this study, LCT of different sizes were placed in aquaria of varying concentrations of Pyramid Lake water. The objective of the testing was to determine concentration values that resulted in LC_{50} mortality (this represents the point where 50% of the test fish expire) in 96-hour exposure tests. The concentrations reported from that study may not be indicative of mortality caused by long-term exposure to TDS concentrations lower than the 96-h LC_{50} threshold concentrations. Comparison of the 2-month-old (50 mm), and the 10-month-old (175 mm) LCT shows major differences in their sensitivity and response to TDS concentrations. The 96-h LC_{50} value for the smaller trout was 14,305 mg/l. At a concentration of 19,152 mg/l, there was no mortality of the larger trout. A mortality of 100% occurred at a TDS concentration of 21,487 mg/l with the smaller trout, and at 29,837 mg/l with the larger trout. These studies suggest that options such as spring freshets and timing and durations of flow may be used to lessen the impacts of high TDS concentration.

Both types of LCT spawn in stream habitats from April to July. The timing and success of spawning depend on streamflow, surface elevation, and water temperature. Lacustrine type fish migrate into tributaries to spawn. Spawning occurs in riffle habitat over gravel substrate. Migration to spawning areas is observed in water temperatures ranging from 5°C to 16°C (Table 5-2). Eggs hatch in 4 to 6 weeks, depending on water temperature, and fry emerge 13 to 23 days later. Fry typically will move out of tributary spawning locations in the fall and winter when flows increase, but some stay in their natal streams for 1 to 2 years (U.S. Fish and Wildlife Service 1995).

Fluvial fish are opportunistic feeders, typically feeding on drift such as aquatic and terrestrial invertebrates. Lacustrine fish feed on insects and zooplankton when small, and other fish when the larger fish exceed the smaller-sized fish by 25% percent (U.S. Fish and Wildlife Service 1995, Bigelow pers. comm.). In Walker Lake, LCT feed primarily on *Odonata* nymphs (damselflies and dragonflies) and tui chub (Nevada Department of Wildlife 2007).

Historically, LCT was distributed throughout northern Nevada. The fluvial form inhabits the Humboldt River system, isolated streams in northwestern and central Nevada, and tributaries of the Truckee, Carson, and Walker Rivers (Nevada Natural Resources 2008).

In the Walker River Basin, six populations exist in the tributaries of the East and West Walker River (Murphy, Mill, Slinkard, Silver, Wolf, and By-Day Creeks). By-Day Creek has the only endemic population, and its fish have been introduced into the other creeks (U.S. Fish and Wildlife Service 1995). The population of LCT in Walker Lake is maintained by annual NDOW and USFWS stocking

programs (U.S. Fish and Wildlife Service 1995). All stocked LCT are produced at either Mason Valley Hatchery or Lahontan National Fish Hatchery.

Lahontan Tui Chub

Lahontan tui chub is listed as a subspecies of special concern by the Endangered Species Committee of the American Fisheries Society (Williams et al. 1989), but it is not protected by law. Tui chub is self-sustaining in Walker Lake and is a prey item for LCT. Some mortality of embryos and eggs occurs in the range of 8,759 to 9,342 mg/l TDS. Tui chub eggs experienced 80% and 100% mortality at TDS concentrations of 12,379 and 15,532 mg/l, respectively (Stockwell unpublished) (Table 5-2). Although TDS concentration reached approximately 16,000 ppm in 2005, netting and hydroacoustic data indicate that tui chub spawned and produced a year class that year (Jellison and Herbst 2008). TDS concentration for more recent years also has been near 16,000 ppm. The capture of young tui chub in gill and trap nets set in Walker Lake from 2002 through 2007 indicates that recruitment into the population can occur when lake TDS concentration is elevated.

Environmental Consequences

This section describes the impact analysis relating to fish and fish habitat for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assessment Methods

Impacts were determined by evaluating expected future conditions with each alternative versus the baseline of existing conditions and trends. An alternative's impact is the future change from baseline conditions that is attributable to the alternative.

LCT and other fish species occurring in Walker River and Walker Lake are considered to be affected by an alternative if the quality of their habitat would be affected. Potential impacts on LCT and tui chub are assessed qualitatively, based on predicted water quality conditions, such as water temperature and TDS concentration, quality of existing habitat, and known environmental thresholds (Table 5-2). Graphs showing predicted TDS concentration (Chapter 3, Water Resources) were compared to tolerance thresholds of LCT and tui chub to determine impacts on those species.

Impact Criteria

Impacts on fish or fish habitat would be considered adverse if the alternative would:

- cause a substantial loss of fish habitat, including a substantial decrease in the quantity or quality of fish habitat;
- substantially disturb special-status fish species as a result of human activities;
- cause fish to avoid important habitat for substantial periods, which can increase mortality or reduce reproductive success;
- disrupt natural movement corridors; or
- substantially reduce local population size of species that are federally or state-listed or proposed for listing as threatened or endangered as a result of direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation.

Also considered in determining whether an impact on fish would be adverse or beneficial were:

- federal or state legal protection of the resource;
- federal, state, and local agency regulations and policies regarding the resource;
- documented local or regional scarcity and sensitivity of the resource; and
- local and regional distribution and extent of the resource.

An alternative was considered to have a beneficial impact if it would result in an increase in the quantity or quality of aquatic habitat for fish species.

Impacts

No Action Alternative

The No Action Alternative would result in no increased flow to Walker Lake. Lake volume and surface elevation would continue to decline. TDS concentration would continue to increase and would be expected to surpass 20,000 mg/l before 2050 and ultimately reach well over 35,000 mg/l by the year 2200 (Chapter 3, Water Resources). LCT appears to have low survival rates at a TDS concentration above 16,000 mg/l, even those fish that are acclimated prior to stocking in Walker Lake. Eventually, TDS would reach a concentration that would preclude stocking. As TDS concentration continued to increase, tui chub would also be unable to survive in the lake. Other water quality issues are

discussed in Chapter 3, Water Resources, under No Action Alternative, Impact WI-1: Improvement in Walker Lake Water Quality.

Alternative 1 (Proposed Project)

Water rights acquired under Alternative 1 are expected to add an average of 50,000 af/yr of water to Walker Lake. It is possible, however, that less than an average of 50,000 af/yr would be provided to the lake either because of funding limitations or because there would not be enough willing sellers. With current funding, it is estimated that the average inflow to the lake would increase by7,300 af/yr.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that water rights acquired would increase the average annual inflow to the lake by 50,000 af/yr. Unless otherwise noted, if acquisitions were limited to those achievable only with the existing funding allocation, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Direct Impacts

Impact FISH-1: Improved Native Fish Habitat as a Result of Increased Flow in Walker River (Beneficial Impact)

Under the Proposed Project, an increase in flows in the Walker River would improve water quality and increase fish habitat for native fish species that reside in the Walker River Basin. An increase in average flow to 50,000 af/yr (full funding) or 7,300 af/yr (existing funding) would enhance the potential for decreased water temperatures and increased spawning and rearing habitat area for native fish species.

Impact FISH-2: Increase in Survival of LCT as a Result of Improved Water Quality in Walker Lake (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, a flow of an average of 50,000 af/yr to Walker Lake would increase lake volume. An increase in volume would decrease TDS concentration, resulting in an overall beneficial impact on water quality for LCT. If river inflow to the lake is increased by an average of 50,000 af/yr, lake surface elevation would increase and TDS concentration would be expected to be between 12,400 mg/l and 13,500 mg/l by the year 2200 (Chapter 3, Water Resources, Table 3-12). This would increase the survival rate of LCT stocked in the lake. This would be a beneficial impact.

If less than an average of 50,000 af/yr of additional inflow is acquired, some benefit might still accrue in the short term, depending upon the timing of releases of acquired water. Data recently collected indicate that spring freshets provide

opportunities for stocked LCT to acclimate in the lake when a short-term decrease in TDS concentration occurs. With existing funding, however, Walker Lake surface elevations would continue to decline, despite the contribution by Alternative 1 of an average 7,300 af/yr of additional inflow. TDS concentration would rise over the long term to a projected concentration of over 30,000 mg/l in 2200. This is slightly better than the No Action Alternative, but not sufficient to improve the long-term prospects for LCT survival.

The additional inflow that would be provided by Alternative 1 with existing funding might benefit LCT in the short term, but in the long term it would not enhance prospects for survival of LCT.

Impact FISH-3: Decrease in Water Temperature as a Result of Increased Flow in Walker River (Beneficial Impact)

Under the Proposed Project, an increase in flow of an average of 50,000 af/yr to Walker Lake could slightly decrease water temperature throughout the mainstem of the Walker River, depending on the source location of water being transferred. More flow would result from an average of 50,000 af/yr of water and therefore water temperatures may be lower than if only 7,300 af/yr of flow was obtained. Water temperature in the river downstream of Schurz and in Walker Lake during low-flow water years is a limiting factor for LCT (Walker Lake Fisheries Improvement Team 2008).

If the proposed acquisition of geothermal water from Homestretch Energy is successful, the water may be used to increase flows from the river into the lake. Because of the hot temperatures of the geothermal effluent (220°F) (Minor pers. comm.), the water would be cooled to ambient temperature before being released into the river. A separate environmental assessment under NEPA is being conducted to determine the effects of acquiring water from the geothermal facility.

Impact FISH-4: Increase in Survival of Tui Chub as a Result of Improved Water Quality in Walker Lake (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, increases in flows to Walker Lake of an average of 50,000 af/yr would improve water quality. As discussed above under Impact FISH-2, TDS concentration in Walker Lake is expected to decrease with substantially increased inflow to the lake. Hydroacoustic and netting data confirm that tui chub have spawned and produced year classes in Walker Lake with TDS concentration ranging from 12,000 to 16,000 mg/l (Jellison and Herbst 2008). With full funding, TDS concentration would be expected to decrease to 12,300 mg/l or less by the year 2090 (Chapter 3, Water Resources). Benefits to tui chub reproduction would be seen compared to existing conditions.

If less than an average of 50,000 af/yr of additional inflow is acquired, benefits might still accrue in the short term, depending upon the timing of releases from Weber Reservoir of acquired water. Data recently collected indicate that spring freshets provide opportunities for tui chub reproduction and recruitment, when a short-term decrease in TDS concentration occurs. However, with an increase in average inflows of approximately 7,300 af/yr using existing funding, Walker Lake surface elevations would continue to decline. TDS concentration would rise over the long term to over 30,000 mg/l in the year 2200. This concentration is less than would occur with the No Action Alternative, but it still exceeds the threshold for tui chub survival.

The additional inflow that would be provided by Alternative 1 with existing funding might benefit tui chub in the short term, but in the long term it would not enhance prospects for its survival.

Impact FISH-5: Increase in LCT Spawning Habitat as a Result of Reconnection of Walker Lake to Walker River (Beneficial Impact)

Currently, Walker Lake LCT is unable to spawn in the Walker River because low river flows prevent its access to suitable spawning habitat. Under the Proposed Project, if an average of 50,000 af/yr of additional Walker Lake inflow were released from Weber Reservoir consistently over the months of the irrigation season (March to October), an increase of 103 cfs over the baseline flow would occur at the downstream end of the river. This would benefit several aspects of life history for LCT such as reproduction, survival, and upstream migration. The relative flow increase would be greatest between Schurz and the lake, because existing summer flows can be as low as zero. Assuming flows would be sufficient in the mainstem Walker River to permit upstream passage of LCT to possible spawning habitat between Weber Reservoir and Walker Lake, fish passage would depend on the timing and magnitude of the released flows, and water temperatures would have to be low enough to facilitate spawning. The potential benefit to LCT spawning, recruitment, and rearing also would depend on the quality of the habitat between Walker Lake and Weber Reservoir. The Walker Lake Fisheries Improvement Team will be assessing habitat conditions throughout the basin as restoration work begins.

With existing funding and an average of 7,300 af/yr of additional Walker Lake inflow, approximately 15 cfs would flow through the river to Walker Lake if released evenly from Weber Reservoir during the irrigation season. Depending on the passage condition of the channel at the confluence of the river and lake (no beaver dams, no sand accretion), LCT might be able to move upstream.

Indirect Impacts

Impact FISH-6: Increase in Growth and Survival of LCT as a Result of Increased Abundance of Prey Species (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, if an average of 50,000 af/yr is acquired and released to Walker Lake and TDS concentration decreases to approximately 12,000 mg/l, the survival of tui chub eggs and embryos would increase. The increased population of tui chub would provide more prey for LCT, which would have better growth and survival as a result of increased food sources. This would be a beneficial impact.

If an average of 7,300 af/yr of additional inflow is acquired and released from Weber Reservoir to provide a spring freshet, TDS concentration could temporarily decrease and potentially provide some short-term benefit. As discussed above under Impact FISH-4, however, over the long run TDS concentration in Walker Lake would rise to over 30,000 mg/l in the year 2200, and tui chub would no longer reproduce there, affecting the LCT food supply. TDS concentration would be slightly better than under the No Action Alternative, but there would be no long-term benefit to LCT.

Alternative 2 (Leasing Alternative)

Direct Impacts

Because Alternative 2 requires recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase average inflow to Walker Lake by an average 50,000 af/yr, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years.

The analysis of impacts under Alternative 2 assumes that the Leasing Alternative would be fully funded and that acquired water would increase the average annual inflow to the lake by 50,000 af/yr for approximately 20 years. Unless otherwise noted, if acquisitions were limited to those achievable only with the existing funding allocation, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but temporary.

Similarly, unless otherwise noted, the impacts below of the fully funded Alternative 2 would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of the fully funded Alternative 1, only temporary.

Impact FISH-1: Improved Native Fish Habitat as a Result of Increased Flow in Walker River (Beneficial Impact)

Under Alternative 2, increased flow would generally improve native fish habitat. The improvement to fish habitat would be limited to the duration of the release of flows (3 to 20 years). This would be a beneficial impact, but temporary.

Impact FISH-2: Increase in Survival of LCT as a Result of Improved Water Quality in Walker Lake (Beneficial Impact)

Under a fully funded Alternative 2, the increase in inflows to Walker Lake would temporarily decrease TDS concentration to less than 14,000 mg/l and increase survival rate for LCT. This would be a beneficial impact, but temporary. After approximately 20 years, Walker Lake surface elevation would begin to decline again and TDS concentration would ultimately rise to over 35,000 mg/l in the year 2200, with no long-term benefit to LCT.

With existing funding, TDS concentration would drop slightly for a few years, temporarily benefiting LCT, then rise again. Ultimately, TDS concentration and direct impacts on LCT survival would be similar to those described for full funding of Alternative 2.

Impact FISH-3: Decrease in Water Temperature as a Result of Increased Flow in Walker River (Beneficial Impact)

Under Alternative 2, water temperatures would be reduced with an increased inflow of an average of 50,000 af/yr. The reduction in temperatures would be related to the amount of water provided and would be limited to the duration of the release of flows (3 to 20 years). This would be a beneficial impact, but temporary.

Impact FISH-4: Increase in Survival of Tui Chub as a Result of Improved Water Quality in Walker Lake (Beneficial Impact)

Under Alternative 2, the increased inflow of water to Walker Lake would temporarily decrease TDS concentration to less than 14,000 mg/l and increase survival of tui chub larvae. This would be a beneficial impact, but temporary. After approximately 20 years, Walker Lake surface elevation would begin to decline again and TDS concentration would ultimately rise to over 35,000 mg/l in the year 2200, with no long-term benefit to tui chub.

With existing funding, TDS concentration would drop slightly for a few years, temporarily benefiting tui chub, then rise again. Ultimately, TDS concentration and direct impacts on tui chub survival would be similar to those described for full funding of Alternative 2.

Impact FISH-5: Increase in LCT Spawning Habitat as a Result of Reconnection of Walker Lake to Walker River (Beneficial Impact)

Under Alternative 2, the reconnection of Walker Lake to Walker River would allow passage of LCT to possible spawning habitat. This would be a beneficial impact, but temporary.

Indirect Impacts

Impact FISH-6: Increase in Growth and Survival of LCT as a Result of Increased Abundance of Prey Species (Beneficial Impact)

Under Alternative 2 with full funding, the increased flow to Walker Lake would result in an increase in the abundance of prey species, thus providing a benefit to the growth and survival of LCT. This would be a beneficial impact, but temporary. After approximately 20 years, Walker Lake surface elevation would begin to decline again and TDS concentration would ultimately rise to over 35,000 mg/l in the year 2200, with no long-term benefit to tui chub or LCT.

With existing funding, TDS concentration would drop slightly for a few years, providing some temporary benefit, and then rise again. Ultimately, TDS concentration and indirect impacts on LCT predation would be similar to those described for full funding of Alternative 2.

Alternative 3 (Efficiency Alternative)

As discussed in the Chapter 3, Water Resources, full implementation of Alternative 1 would provide an average of 50,000 af/year of additional inflow to Walker Lake, while implementation of Alternative 3 would yield an average of 32,300 af/yr of additional inflow. Unless otherwise noted, the impacts of Alternative 3 would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of the fully funded Alternative 1, but of less magnitude.

Direct Impacts

Direct Impacts Similar In Nature to Alternative 1

Impact FISH-1: Improved Native Fish Habitat as a Result of Increased Flow in Walker River (Beneficial Impact)

Increased flow of an average of 32,300 af/yr to Walker Lake would generally improve native fish habitat. Decreased water temperature and the increase in spawning and rearing habitat would occur. This would be a beneficial impact.

Impact FISH-2: Increase in Survival of LCT as a Result of Improved Water Quality in Walker Lake (Beneficial Impact)

Increased inflow of an average of 32,300 af/yr to Walker Lake would increase lake surface elevation by an estimated 4 to 13 feet, resulting in a TDS concentration somewhat less than or close to existing conditions for 20 to 50 years (Chapter 3, Water Resources). This could result in a slight increase in LCT survival, which would be a beneficial impact. Eventually, because it is a terminal lake, TDS concentration in Walker Lake would gradually increase, with concentration of 16,800 mg/l to 19,600 estimated for 2200 (Chapter 3, Water Resources, Table 3-12). This may not provide a long-term benefit to LCT survival, although conditions would be better than the No Action Alternative.

Impact FISH-3: Decrease in Water Temperature as a Result of Increased Flow in Walker River (Beneficial Impact)

Water temperature would generally be reduced with an additional average inflow of 32,300 af/yr. This would be a beneficial impact.

Impact FISH-4: Increase in Survival of Tui Chub as a Result of Improved Water Quality in Walker Lake (Beneficial Impact)

As discussed above in Impact FISH-2, an average of 32,300 af/yr of additional inflow to Walker Lake could decrease TDS concentration somewhat. This could result in a slight increase in tui chub survival, which would be a beneficial impact. Eventually, however, TDS concentration would gradually increase, with potentially no long-term benefit to tui chub, although conditions would be better than with the No Action Alternative.

Impact FISH-5: Increase in LCT Spawning Habitat as a Result of Reconnection of Walker Lake to Walker River (Beneficial Impact)

Reconnection of Walker Lake to Walker River with an increased lake inflow of an average of 32,300 af/yr would allow passage of LCT to potential spawning habitat. If the additional inflow is released from Weber Reservoir evenly over the irrigation season, an estimated flow of 67 cfs would occur at the downstream end of Walker River. This could improve upstream passage of LCT to possible spawning habitat, especially if releases were timed to provide a spring freshet. However, fish passage would depend on the timing and magnitude of the released flows, water temperatures would have to be low enough to facilitate spawning, and adequate habitat quality would be needed. This could be a beneficial impact.

Direct Impacts Different from Alternative 1

Impact FISH-7: Potential Construction-Related Temporary Impairment of Fish Survival, Growth, or Reproduction by Accidental Spills or Polluted Runoff (Adverse Impact)

Under Alternative 3, construction activities such as lining canals with concrete, replacing surface conveyances with underground pipelines, and consolidating canals, laterals, and ditches in Mason and Smith Valleys could introduce contaminants or sediment into Walker River and adversely affect fish species and their habitat. Although such an event is unlikely, refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants such as concrete, sealants, and oil or fuel. Pollutants entering water bodies in the project area could cause reduced growth during egg, larvae, and juvenile life stages of fish, or cause mortality.

Implementation of requirements of an NPDES construction permit and its associated SWPPP, if applicable to the construction activity, would reduce the likelihood of construction-related discharges.

Indirect Impacts

Impact FISH-6: Increase in Growth and Survival of LCT as a Result of Increased Abundance of Prey Species (Beneficial Impact)

Under Alternative 3, the increased flow to Walker Lake could result in a slight increase in tui chub survival and provide a greater food supply for LCT, thus providing a benefit to LCT. TDS concentration would gradually increase. Although conditions would be better than with the No Action Alternative, they may not be sufficient to result in long-term benefit to tui chub or LCT.

Chapter 6 Biological Resources—Wildlife

Introduction

This chapter describes the affected environment for wildlife resources in the study area and the potential impacts on wildlife resources that would result from the Proposed Project and other alternatives.

A list of terrestrial and avian wildlife potentially occurring in the study area is provided in Table 6-1.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- Wildlife Action Plan (Nevada Wildlife Action Plan Team 2006)
- amphibiaweb.org (2008)
- *Sibley Guide to Birds* (2000)
- *The Mammals of North America* (1981)
- Phone conversation and emails with Elmer Bull of NDOW (pers. comm.)

Affected Environment

This section describes the environmental setting related to wildlife species and special-status wildlife species in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for wildlife is defined as the river corridors and associated riparian communities for the East Walker River and West Walker River in Lyon County, Nevada; the mainstem Walker River; Walker Lake; irrigation canals and drains in the Walker River Basin in Lyon and Mineral Counties, Nevada; and irrigated land adjacent to the canals. In addition, the study area includes a 1-mile zone around each of these areas.

California and Douglas County, Nevada were not included in the study area. The Proposed Project would not change any operations or acquire from willing sellers land, water appurtenant to land, or related interests in California, or in Douglas County, Nevada, and there would be no direct or indirect impacts on wildlife and their habitats in California or Douglas County, Nevada.

Table 6-1. Wildlife Species with Potential to Occur in the Study Area

Common Name	Scientific Name	Habitat
Amphibians		
Great basin spadefoot toad	*Spea hammondii*	Uplands
Pacific treefrog	*Hyla regilla*	Uplands, Agriculture, River
Western toad	*Bufo boreas*	Uplands
Reptiles		
Zebra-tailed lizard	*Callisaurus draconoides*	Uplands
Great basin collared lizard	*Crotaphytus bicinctores*	Uplands
Long-nosed leopard lizard	*Gambelia wislizenii*	Uplands
Desert spiny lizard	*Sceloporus magister*	Uplands
Western fence lizard	*Sceloporus occidentalis*	Uplands, Agriculture
Sagebrush lizard	*Sceloporus graciosus*	Uplands
Side-botched lizard	*Uta stansburiana*	Uplands
Desert horned lizard	*Phrynosoma platyrhinos*	Uplands
Western skink	*Eumeces skiltonianus*	Uplands
Western whiptail	*Cnemidophorus tigris*	Uplands, Agriculture
Rubber boa	*Charina bottae*	Uplands, Agriculture
Coachwhip	*Masticophis flagellum*	Uplands, Agriculture
Striped whipsnake	*Masticophis taeniatis*	Uplands, Wetland, Agriculture
Western yellow-bellied racer	*Coluber constrictor*	Uplands
Long-nosed snake	*Rhinocheilus lecontei*	Uplands
Common king snake	*Lampropeltis getula*	Uplands, Agriculture
Western patch-nosed snake	*Salvadora hexalepis*	Uplands, Agriculture
Great basin gopher snake	*Pituophis catenifer*	Uplands, Agriculture
Common garter snake	*Thamnophis sirtalis*	Uplands, Agriculture
Western terrestrial garter snake	*Thamnophis elegans*	Uplands, Agriculture
Western ground snake	*Sonora semiannulata*	Uplands
Night snake	*Hypsiglena torquata*	Uplands, Wetland
Western diamondback rattlesnake	*Crotalus atrox*	Uplands, Agriculture

Common Name	Scientific Name	Habitat
Birds		
Common loon	*Gavia immer*	Lake
Horned grebe	*Podiceps auritus*	Lake
Eared grebe	*Podiceps nigricollis*	Lake
Western grebe	*Aechmophorus occidentalis*	Lake, Wetland
Clark's grebe	*Aechmophorus clarkii*	Lake, Wetland
Pied billed grebe	*Podilymbus podiceps*	Lake, Wetland
American white pelican	*Pelecanus erythrorhynchos*	Lake
Double-crested cormorant	*Phalacrocorax auritus*	Lake
Great blue heron	*Ardea herodias*	Lake, Wetland, Agriculture
Green heron	*Butorides virescens*	Lake, Wetland, Agriculture
Great egret	*Ardea alba*	Lake, Wetland, Agriculture
Cattle egret	*Bubulcus ibis*	Lake, Wetland, Agriculture
Snowy egret	*Egretta thula*	Lake, Wetland, Agriculture
Black-crowned night heron	*Nycticorax nycticorax*	Lake, Wetland, Agriculture
Least bittern	*Ixobrychus exilis*	Wetland
American bittern	*Botaurus lentiginosus*	Wetland
White-faced ibis	*Plegadis chihi*	Wetland, Agriculture
Tundra swan	*Cygnus columbianus*	Lake, Agriculture
Canada goose	*Branta canadensis*	Lake, Agriculture
Greater white-fronted goose	*Anser albifrons*	Lake, Agriculture
Snow goose	*Chen caerulescens*	Lake, Agriculture
Ross's goose	*Chen rossii*	Lake, Agriculture
Mallard	*Anas platyrhynchos*	Lake, Wetland
Gadwall	*Anas strepera*	Lake, Wetland
Northern pintail	*Anas acuta*	Lake, Wetland
Green-wing teal	*Anas crecca*	Lake, Wetland
Blue-wing teal	*Anas discors*	Lake, Wetland
Cinnamon teal	*Anas cyanoptera*	Lake, Wetland
American wigeon	*Anas Americana*	Lake, Wetland
Northern shoveler	*Anas slypeata*	Lake, Wetland
Wood duck	*Aix sponsa*	Lake, Wetland
Redhead	*Arthya americana*	Lake, Wetland
Ring-necked duck	*Aythya collaris*	Lake, Wetland
Greater scaup	*Aythya marila*	Lake, Wetland

Common Name	Scientific Name	Habitat
Lesser scaup	*Aytha affinis*	Lake, Wetland
Canvasback	*Aythya valisineria*	Lake, Wetland
Common goldeneye	*Bucephala clangula*	Lake, Wetland
Barrow's goldeneye	*Bucephala islandica*	Lake, Wetland
Bufflehead	*Bucephala albeola*	Lake, Wetland
Ruddy duck	*Oxyura jamaicensis*	Lake, Wetland
Hooded merganser	*Lophodytes cucullatus*	Lake, Wetland
Common merganser	*Mergus merganser*	Lake, Wetland
Red-breasted merganser	*Mergus serrator*	Lake, Wetland
Turkey vulture	*Cathartes aura*	Uplands, Agriculture
Northern harrier	*Circus cyaneus*	Wetlands, Farm, Uplands
Cooper's hawk	*Accipiter cooperii*	Riparian, Agriculture, Uplands
Sharp-shinned hawk	*Accipiter striatus*	Riparian, Agriculture, Uplands
Northern goshawk	*Accipiter gentilis*	Uplands
Red-tailed hawk	*Buteo jamaicensis*	Riparian, Agriculture, Uplands
Swainson's hawk	*Buteo swainsoni*	Riparian, Agriculture, Uplands
Rough-legged hawk	*Buteo lagopus*	Uplands, Agriculture
Ferruginous hawk	*Buteo regalis*	Uplands, Agriculture
Golden eagle	*Aquila chrysaetos*	Uplands, Agriculture
Bald eagle	*Haliaeetus leucocephalus*	Lake, Riparian, Agriculture
Osprey	*Pandion haliaetus*	Lake, Riparian
Prairie falcon	*Falco mexicanus*	Uplands, Agriculture
Peregrine falcon	*Falco peregrines*	Uplands, Agriculture
Merlin	*Falco columbarius*	Uplands, Agriculture
American kestrel	*Falco sparverius*	Uplands, Agriculture
Greater sage-grouse	*Centrocercus urophasianus*	Uplands
Ring-necked pheasant	*Phasianus colchicus*	Uplands, Riparian, Agriculture
Chukkar	*Alectoris chucker*	Uplands, Agriculture
California quail	*Callipepla californica*	Uplands, Riparian, Agriculture
Mountain quail	*Oreortyx rictus*	Uplands
Wild turkey	*Meleagris gallopavo*	Uplands, Agriculture
Belted kingfisher	*Ceryle alcyon*	Riparian
Red-naped sapsucker	*Sphyrapicus nuchalis*	Uplands
Williamson's sapsucker	*Sphyrapicus thyroideus*	Uplands
Northern flicker	*Colaptes aurstus*	Uplands

Common Name	Scientific Name	Habitat
Hairy woodpecker	*Picoides villosus*	Uplands
Downy woodpecker	*Picoides pubescens*	Uplands
White-headed woodpecker	*Picoides albolarvatus*	Uplands
Black-backed woodpecker	*Picoides arcticus*	Uplands
Lewis's woodpecker	*Melanerpes lewis*	Uplands
Western kingbird	*Tyrannus verticalis*	Uplands, Agriculture
Cassin's kingbird	*Tyrannus vociferans*	Uplands, Agriculture
Ash-throated flycatcher	*Myiarchus cinerascens*	Uplands
Say's phoebe	*Sayornis saya*	Uplands, Riparian
Black phoebe	*Sayornis nigricans*	Uplands, Riparian, Agriculture
Pacific-slope flycatcher	*Empidonax difficillis*	Riparian, Uplands
Dusky flycatcher	*Empidonax oberholseri*	Riparian, Uplands
Gray flycatcher	*Empidonax wrightii*	Riparian, Uplands
Willow flycatcher	*Empidonax traillii*	Riparian, Uplands
Western wood-peewee	*Contopus sordidulus*	Riparian, Uplands
Olive-sided flycatcher	*Contopus cooperi*	Riparian, Uplands
Loggerhead shrike	*Lanius ludovicianus*	Uplands, Agriculture
Cassin's vireo	*Vireo cassinii*	Uplands
Plumbeous vireo	*Vireo plumbeus*	Uplands
Warbling vireo	*Vireo gilvus*	Uplands
Barn owl	*Tyto alba*	Farm
Western screech owl	*Otus kennicottii*	Uplands, Farm
California spotted owl	*Strix occidentalis*	Uplands
Great horned owl	*Bubo viginianus*	Uplands, Riparian, Agriculture
Flammulated owl	*Otus flammeolus*	Uplands
Long-eared owl	*Asio otus*	Uplands
Short-eared owl	*Asio flammeus*	Uplands, Agriculture
Northern pygmy owl	*Glaucidium gnoma*	Uplands, Agriculture
Burrowing owl	*Athene cunicularia*	Uplands, Agriculture
Common poorwill	*Phalaenoptilus nuttallii*	Uplands, Agriculture
Common nighthawk	*Chordeiles minor*	Uplands, Agriculture
Vaux's swift	*Chaetura vauxi*	Uplands
White-throated swift	*Aeronautes saxatalis*	Uplands, Riparian
Black-chinned hummingbird	*Archilochus alexandri*	Uplands, Riparian
Broad-tailed hummingbird	*Selasphorus platycerus*	Uplands, Riparian

Common Name	Scientific Name	Habitat
Rufous hummingbird	*Selasphorus rufus*	Uplands, Riparian
Calliope hummingbird	*Stellula calliope*	Uplands, Riparian
Orange-crowned warbler	*Vermivora celata*	Uplands, Riparian
Yellow warbler	*Dendroica petechia*	Uplands, Riparian
Nashville warbler	*Vermivora ruficapilla*	Uplands, Riparian
Yellow-rumped warbler	*Dendroica coronate*	Uplands, Riparian
Townsend's warbler	*Dendroica townsendi*	Uplands, Riparian
Black-throated gray warbler	*Dendroica nigrescens*	Uplands, Riparian
Macgillivray's warbler	*Oporornis tolmiei*	Uplands, Riparian
Wilson's warbler	*Wilsonia pusilla*	Uplands, Riparian
Common yellowthroat	*Geothlypis thrichas*	Uplands, Riparian
Western tanager	*Piranga ludoviciana*	Uplands, Riparian
Spotted towhee	*Pipilo maculates*	Uplands, Riparian
Savannah sparrow	*Passerculus sandwichensis*	Uplands
Lark sparrow	*Chondestes grammacus*	Uplands
Black-headed grosbeak	*Pheucticus melanocephalus*	Uplands, Riparian
Lazuli bunting	*Passerina amoena*	Uplands, Riparian
White crowned sparrow	*Zonotrichia leucophrys*	Uplands, Riparian, Agriculture
Golden-crowned sparrow	*Zonotrichia atricapilla*	Uplands, Riparian, Agriculture
Song sparrow	*Melospiza melodia*	Uplands, Riparian, Agriculture
Chipping sparrow	*Spizella passerine*	Uplands, Riparian, Agriculture
Tree sparrow	*Spizella arborea*	Uplands, Riparian, Agriculture
Brewer's sparrow	*Spizella breweri*	Uplands
Harris's sparrow	*Zonotrichia querula*	Uplands, Riparian, Agriculture
Dark-eyed junco	*Junco hyemalis*	Uplands, Riparian, Agriculture
American coot	*Fulica americana*	Lake, Wetland
Common moorhen	*Gallinula chloropus*	Wetlands
Virginia rail	*Rallus limicola*	Wetlands
Sora	*Porzana carolina*	Wetlands
Greater sandhill crane	*Grus canadensis tibida*	Wetlands, Agriculture
Semi-palmated plover	*Charadrius semipalmatus*	Uplands, Lake, Agriculture
Western snowy plover	*Charadrius alexandrines*	Uplands, Lake, Agriculture
Killdeer	*Charadrius vociferous*	Uplands, Lake, Agriculture
Mountain plover	*Charadrius montanus*	Uplands, Lake, Agriculture
Black-bellied plover	*Pluvialis squatarola*	Uplands, Lake, Agriculture

Common Name	Scientific Name	Habitat
American avocet	*Recurvirostra americana*	Lake, Wetland
Black-necked stilt	*Himantopus mexicanus*	Lake, Wetland
Common snipe	*Gallinago gallinago*	Lake, Wetland
Long-billed curlew	*Numenius americanus*	Lake, Wetland, Agriculture
Marbled godwit	*Limosa fedoda*	Lake, Wetland
Spotted sandpiper	*Actitis macularia*	Lake, Wetland
Solitary sandpiper	*Tringa solitaria*	Lake, Wetland
Greater yellowlegs	*Tringa melanoleuca*	Lake, Wetland
Lesser yellowlegs	*Tringa flavipes*	Lake, Wetland
Willet	*Catoptrophorus semipalmatus*	Lake, Wetland
Baird's sandpiper	*Calidris bairdii*	Lake, Wetland
Western sandpiper	*Calidris mauri*	Lake, Wetland
Least sandpiper	*Calidris minutilla*	Lake, Wetland
Dunlin	*Calidris alpine*	Lake, Wetland
Sanderling	*Calidris alba*	Lake, Wetland
Long-billed dowitcher	*Limnodromus scolopaceus*	Lake, Wetland
Short-billed dowitcher	*Limnodromus griseus*	Lake, Wetland
Wilson's phalarope	*Phalaropus tricolor*	Lake, Wetland
Red-necked phalarope	*Phalaropus lobatus*	Lake, Wetland
Herring gull	*Larus californicus*	Lake, Agriculture
California gull	*Larus argentatus*	Lake, Agriculture
Ring-billed gull	*Larus delawarensis*	Lake, Agriculture
Franklin's gull	*Larus pipixcan*	Lake
Bonaparte's gull	*Larus philadelphia*	Lake
Common tern	*Sterna hirundo*	Lake
Foster's tern	*Sterna fosteri*	Lake
Caspian tern	*Sterna caspia*	Lake
Black tern	*Chilidonias niger*	Lake
Mourning dove	*Zenaida macroura*	Uplands, Agriculture
Band-tailed dove	*Columba fasciata*	Uplands, Agriculture
Rock dove	*Columba livia*	Uplands, Agriculture
Steller's jay	*Cyanocitta stelleri*	Uplands
Scrub jay	*Aphelocoma californica*	Uplands, Agriculture
Common raven	*Corvus corax*	Uplands, Agriculture

Common Name	Scientific Name	Habitat
American crow	*Corvus brachyrhynchos*	Uplands, Agriculture
Black-billed magpie	*Pica hudsonia*	Uplands, Agriculture
Horned lark	*Eremophila alpestris*	Uplands, Agriculture
Tree swallow	*Tachycineta bicolor*	Riparian, Uplands, Agriculture
Violet-green swallow	*Tachycineta thalassina*	Riparian, Uplands, Agriculture
Bank swallow	*Riaparia riparia*	Riparian
Northern rough-winged swallow	*Stelgidopteryx serripennis*	Riparian, Uplands, Agriculture
Barn swallow	*Hirundo rustica*	Riparian, Uplands, Agriculture
Cliff swallow	*Petrochelidon pyrrhonota*	Riparian, Uplands, Agriculture
Purple martin	*Progne subis*	Riparian, Uplands, Agriculture
Juniper titmouse	*Baeolophus ridgwayi*	Uplands
Bushtit	*Psaltriparus minimus*	Uplands, Agriculture
White-breasted nuthatch	*Sitta carlinensis*	Uplands
Red-breasted nuthatch	*Sitta canadensis*	Uplands
Pygmy nuthatch	*Sitta pygmaea*	Uplands
Brown creeper	*Certhia americana*	Uplands
Canyon wren	*Catherpes mexicanus*	Uplands
Rock wren	*Salpinctes obsoletus*	Uplands
House wren	*Troglodytes aedon*	Uplands, Agriculture
Marsh wren	*Cistothorus palustris*	Marsh, Riparian
Bewick’s wren	*Thryomanes bewickii*	Uplands
Golden-crowned kinglet	*Regulus satrapa*	Uplands
Ruby-crowned kinglet	*Regulus calendula*	Uplands
Blue-gray gnatcatcher	*Polioptila caerulea*	Uplands
American robin	*Turdus migratorius*	Uplands, Riparian, Agriculture
Hermit thrush	*Catharus guttatus*	Uplands
Swainson’s thrush	*Catharus ustulatus*	Uplands
Townsends solitaire	*Myadestes townsendi*	Uplands
Western blue bird	*Sialia mexicana*	Uplands, Agriculture
Mountain bluebird	*Sialia currucoides*	Uplands
Northern mockingbird	*Mimus polyglottos*	Uplands, Agriculture
Sage thrasher	*Oreoscoptes montanus*	Uplands
European starling	*Sturnus vulgaris*	Agriculture, Riparian
American pipit	*Anthus rubescens*	Uplands, Agriculture

Common Name	Scientific Name	Habitat
Cedar waxwing	*Bombycilla cedrorum*	Uplands, Agriculture
Bohemian waxwing	*Bombycilla garrulous*	Uplands, Agriculture
Phainopepla	*Phainopepla nitens*	Uplands, Agriculture
Brown-headed cowbird	*Molothrus ater*	Uplands, Agriculture
Brewer's blackbird	*Euphagus cyanocephalus*	Uplands, Agriculture
Yellow-headed blackbird	*Xanthocehalus xanthocephalus*	Wetlands, Riparian
Red-winged blackbird	*Agelaius phoeniceus*	Wetlands, Riparian
Tricolor blackbird	*Agelaius tricolor*	Wetlands, Riparian
Great-tailed grackle	*Quiscalus mexicanus*	Uplands, Agriculture
Bullock's oriole	*Icterus bullockii*	Uplands, Riparian, Agriculture
Western meadowlark	*Sturnella neglecta*	Uplands, Agriculture
House finch	*Carpodacus mexicanus*	Uplands, Riparian, Agriculture
Cassin's finch	*Carpodacus cassinii*	Uplands, Riparian, Agriculture
Pine siskin	*Carduelis pinus*	Uplands, Riparian, Agriculture
Lesser goldfinch	*Carduelis psaltria*	Uplands, Riparian, Agriculture
American goldfinch	*Carduelis tristis*	Uplands, Riparian, Agriculture
Mammals		
Broad-footed mole	*Scapanus latimanus*	Uplands
Merriam's shrew	*Sorex merriami*	Wetland, Agriculture
Vagrant shrew	*Sorex vagrans*	Wetland, Agriculture
Northern water shrew	*Sorex palustris*	Wetland, Agriculture
Little brown myotis	*Myotis lucifugus*	Uplands, Riparian, Wetland
Small-footed myotis	*Myotis ciliolabrum*	Uplands, Riparian, Wetland
Long-legged myotis	*Myotis volans*	Uplands, Riparian, Wetland
Long-eared myotis	*Myotis evotis*	Uplands, Riparian, Wetland
Fringed myotis	*Myotis thysanodes*	Uplands, Riparian, Wetland
California myotis	*Myotis californicus*	Uplands, Riparian, Wetland
Yuma myotis	*Myotis yumanensis*	Uplands, Riparian, Wetland
Silvery-haired bat	*Lasionycteris noctivagans*	Uplands, Riparian, Wetland
Western pipistrel	*Pipistrellus hesperus*	Uplands, Riparian, Wetland
Big brown bat	*Eptesicus fuscus*	Uplands, Riparian, Wetland
Red bat	*Lasiurus blossevillii*	Uplands, Riparian, Wetland
Hoary bat	*Lasiurus cinereus*	Uplands, Riparian, Wetland
Spotted bat	*Euderma maculatum*	Uplands, Riparian, Wetland

Common Name	Scientific Name	Habitat
Townsend's big-eared bat	*Plecotus townsendii*	Uplands, Riparian, Wetland
Pallid bat	*Antrozous pallidus*	Uplands, Riparian, Wetland
Brazilian freetail bat	*Tadarida brasiliensis*	Uplands, Riparian, Wetland
Black bear	*Ursus americanus*	Uplands
Raccoon	*Procyon lotor*	Uplands, Riparian, Wetland
Short-tailed weasel	*Mustela ermine*	Riparian, Agriculture
Long-tailed weasel	*Mustela frenata*	Riparian, Agriculture
Mink	*Mustela vison*	Riparian
American martin	*Martes americana*	Uplands
River otter	*Lutra canadensis*	Riparian
Western spotted skunk	*Spilogale gracilis*	Riparian, Agriculture
Striped skunk	*Mephitis mephitis*	Riparian, Agriculture
American badger	*Taxidea taxus*	Uplands, Agriculture
Ringtail	*Bassariscus astutus*	Riparian, Uplands
Red fox	*Vulpes vulpes*	Uplands, Agriculture
Coyote	*Canis latrans*	Uplands, Agriculture
Cougar	*Felis concolor*	Uplands, Agriculture
Bobcat	*Lynx rufus*	Uplands, Agriculture
American pika	*Ochotona priceps*	Uplands
Pygmy rabbit	*Brachlagus idahoensis*	Uplands
Mountain cottontail	*Sylvilagus nuttallii*	Uplands
White-tailed jackrabbit	*Lepus townsendii*	Uplands
Black-tailed jackrabbit	*Lepus californicus*	Uplands, Agriculture
Least chipmunk	*Tamias minimus*	Uplands
Yellow-bellied marmot	*Marmota flaviventris*	Uplands
California ground squirrel	*Spermophilus beecheyi*	Uplands, Agriculture
White-tailed antelope ground squirrel	*Ammospermophilus leucurus*	Uplands
Golden mantled ground squirrel	*Spermophilus lateralis*	Uplands
Townsend's ground squirrel	*Spermophilus townsendii*	Uplands
Douglas's squirrel	*Tamiasciurus douglasii*	Uplands
Pocket mice species	*Perognathus* sp.	Uplands, Agriculture
Kangaroo rat species	*Dipodomys* sp.	Uplands
Dark kangaroo mouse	*Microdipodopd megacephalus*	Uplands

Common Name	Scientific Name	Habitat
Pinyon mouse	*Peromyscus truei*	Uplands
Deer mouse	*Peromyscus maniculatus*	Agriculture, Uplands, Riparian
Western harvest mouse	*Reithrodontomys megalotis*	Wetland, Uplands, Agriculture
Northern grasshopper mouse	*Onychomys leucogaster*	Uplands
Desert woodrat	*Neotoma lepida*	Uplands
Montane vole	*Microtus montanus*	Wetland, Uplands
Long-tailed vole	*Microtus longicaudus*	Uplands
Muskrat	*Ondatra zibethicus*	Uplands
Norway rat	*Rattus norvegicus*	Agriculture, Riparian
House mouse	*Mus musculus*	Agriculture
Northern pocket gopher	*Thomomys talpoides*	Uplands, Agriculture
Botta's pocket gopher	*Thomomys bottae*	Uplands
Bighorn sheep	*Ovis canadensis*	Uplands
Mule deer	*Odocoileus hemionus*	Uplands
Pronghorn	*Antilocapra americana*	Uplands

The Walker River Basin supports many habitat types. For this Draft EIS six general habitat types are described: lacustrine, riverine, riparian woodland, wetlands, uplands, and agricultural lands.

These six habitats types are used by wildlife species to varying degrees. The number of wildlife species occurring in the Walker River Basin is extensive because of the large area and the variety of habitats encompassed by the basin. Some wildlife species are associated with one specific habitat type, while others may use a variety of different habitats. Some wildlife species use specific habitats seasonally, such as migratory birds and migrating deer, and other wildlife species are year-round residents of specific habitats.

Federal and state agencies own and manage wildlife habitat throughout the Walker River Basin. NDOW is charged with restoring and managing fish and wildlife resources on all public lands throughout the state with the exception of tribal lands and lands withdrawn for military operations. The Nevada Department of Conservation and Natural Resources maintains the NNHP, which contains information on locations, biology, and conservation status of all endangered, threatened, sensitive, and at-risk species in Nevada.

Table 6-1 lists the wildlife species that either have been observed or are expected to occur in the study area, along with associated habitats. Identification of these species was based on information provided by NNHP, USFWS, NDOW, Nevada Wildlife Action Plan, Nevada Audubon (2008), amphibiaweb.org, natureserve.org

(2008), *Western Reptiles and Amphibians* (Stebbins 2003), *Sibley Guide to Birds* (Sibley 2000), *Birds of the Great Basin* (Ryser 1985), *The Mammals of North America* (Hall 1981), *Mammals of California* (Jameson and Peeters 2004), and Elmer Bull (NDOW).

Habitats

Lacustrine

Lacustrine habitats are associated with open waters. In the study area, these are defined as lakes and reservoirs. Lacustrine habitats in the study area are important to wildlife species, especially water birds, because there is relatively little freshwater habitat in the Great Basin (Ryser 1985). The water environments in lacustrine habitats include the shallow areas close to shore and the deeper mid-lake areas. The physical characteristics of these environments are not static and change daily, seasonally, and annually.

Walker Lake

Walker Lake is at the terminus of the Walker River. Walker Lake is an important water source for a number of wildlife species, especially water birds. The Lahontan tui chub is presently the most abundant fish species in the lake. Lahontan tui chub is a food source for the lake's LCT and migratory fish-eating species such as the common loon and white pelican (Wildlife Action Plan Team 2006).

Walker Lake is an important stopover for many birds on their migration routes. The use of Walker Lake by migratory birds changes seasonally. In the spring, shorebirds, waterfowl, and other water birds stop at Walker Lake for food and rest during their northward migration. In the summer, Walker Lake is used by resident birds. During the fall, migratory birds use Walker Lake for food and rest during their southward migration. Significant numbers of waterfowl, such as ducks and coots, may remain at Walker Lake in the winter. Very little waterfowl nesting occurs on Walker Lake because of the lack of suitable nesting habitat around the lake's edge (Bull pers. comm.).

Weber Reservoir

Reservoirs are similar to lakes in that they are predominantly aquatic habitats with varying extent and composition of shoreline vegetation. However, unlike natural lake elevations that fluctuate because of external environmental and climatic conditions, reservoir elevations fluctuate because of human controls in addition to environmental and climatic conditions. Discharge from reservoirs is regulated and controlled to accommodate downstream water requirements and reservoir holding capacities.

Weber Reservoir is the farthest downstream reservoir on Walker River before Walker Lake. Shorebirds and migrating waterfowl are common at the reservoir.

Topaz Lake Reservoir

Topaz Reservoir is located on the border of Nevada and California. The reservoir was completed in 1922 by diverting water from the West Walker River into an existing basin that contained a small natural lake. Topaz Lake Reservoir is stocked with trout. White pelicans, common loons, and gulls are common on the reservoir, and the reservoir is used as a stopover by waterfowl.

Riverine

The riverine system in the Walker River Basin provides important habitat value for wildlife species. The rivers, creeks, and associated wetlands provide habitat for aquatic invertebrates, fish, and amphibian species that are food sources for many wildlife species. Riparian and marsh habitats provide important nesting and foraging habitat for many species of birds and the understory of riparian habitat is used by mammals and reptiles. Refer to Chapter 4, Biological Resources—Vegetation and Wetlands, for a complete description of riparian woodland and marsh habitats.

West Walker River

The headwater of the West Walker River originates in the Sierra Nevada in California, just south of Sonora Pass. In Nevada, the West Walker River flows through Smith Valley, Wilson Canyon, and Mason Valley. In the vicinity of the California/Nevada border, the uplands adjacent to the West Walker River are predominantly big sagebrush shrubland, xeric mixed sagebrush shrubland, and agriculture. Along the river is riparian vegetation and emergent marsh, with patches of greasewood flat, semi-desert grassland, and forbland outside the riparian border. Small inclusions of mixed salt desert scrub and pinyon-juniper woodland are also present. Areas of montane sagebrush steppe are scattered in this region. At the south end of Smith Valley, foothills support pinyon-juniper woodland, xeric mixed sagebrush shrubland, semi-desert shrub steppe, and Sierra and basin cliff and canyon. Between Smith Valley and Mason Valley, the West Walker River supports riparian vegetation, with mostly mixed salt desert scrub outside of the riparian corridor. Near the confluence with the East Walker River, the West Walker River supports a mix of riparian, big sagebrush shrubland, and greasewood flat.

East Walker River

The headwaters of the East Walker River originate in the Sierra Nevada in California, west of the town of Bridgeport. Where the East Walker River crosses into Nevada, it enters the Pine Grove Hills and flows though canyons and more open valleys before entering Mason Valley, where it merges with the West

Walker River. In Nevada, the East Walker River flows through open sagebrush and irrigated agricultural lands. High desert riparian woodlands occur along the banks of the river for much of its stretch in Nevada.

Mainstem Walker River

The mainstem Walker River flows from the convergence of the West Walker River and the East Walker River through the Mason Valley to Walker Lake. At the confluence of the East and West Walker Rivers, the mainstem Walker River area is heavily agricultural with vegetation along the river similar to that described for the West Walker River upstream of the confluence. Between the Wabuska gage and Weber Reservoir, the Walker River supports a broad riparian corridor that provides important habitat for migrating birds and mammals. Downstream of Weber Reservoir, a riparian corridor persists for several miles along the Walker River. The delta region of the Walker River where it flows into Walker Lake is primarily mixed salt desert scrub and greasewood flat, with emergent marsh within the river channel and some areas of invasive riparian and semi-desert grassland.

Walker Lake

A freshwater marsh at the southern end of Walker Lake provides important habitat for many bird species. This freshwater marsh is fed by freshwater springs that flow into the lake. The dominant vegetation of the marsh is cottonwoods and cattails (Espinoza and Tracy 1999). This freshwater marsh provides important habitat for wildlife species, especially as feeding grounds for wading and shorebirds.

The shoreline of Walker Lake provides important foraging ground for bird species that feed on aquatic macroinvertebrates, such as white-faced ibis, western snowy plover, and American avocet. Western snowy plovers are also known to nest on the dry lakebed to the east side of Walker Lake (Stockwell 1999).

Uplands

Most of the area in the Walker River Basin is upland habitat. Upland habitats in the basin include sagebrush, pinyon-juniper forest, upland conifer forest, and subalpine habitats at the highest elevations. Refer to Chapter 4, Biological Resources—Vegetation and Wetlands, for a complete description of these upland habitats.

Upland habitats near Walker Lake support amphibian and reptile species. Western toad and Great Basin spadefoot occur along the southwest shore of the lake (Espinoza and Tracy 1999). Reptiles that occur close to Walker Lake include side-blotched lizard, zebra-tailed lizard, Great Basin collared lizard, western whiptail, desert horned lizard, long-nosed leopard, and common kingsnake (Stebbins 2003, Espinoza and Tracy 1999).

The predominant habitat in Smith Valley is sagebrush scrub and agricultural fields. In Mason Valley, habitats include mixed desert scrub, greasewood flat, semi-desert grassland, playa, scattered dunes, and agricultural fields.

Sagebrush occurs over large areas in the Smith Valley and provides habitat for many reptiles, birds, and mammals. Sagebrush lizard, Great Basin collared lizard, Great Basin gopher snake, common kingsnake, and western rattlesnake are common reptile species found in sagebrush habitats. Many species of passerine birds and small mammals occur in sagebrush habitat. Large mammals that inhabit sagebrush include mule deer, mountain lion, kit fox, and coyote. The pygmy rabbit occurs in sagebrush habitats throughout most of the Great Basin. Pygmy rabbit is usually found in areas with large dense stands of big sagebrush and deep friable soils. Rabbitbrush also can be an important component in areas where pygmy rabbit occurs (Ulmschneider 2004). The greater sage grouse is currently under status review by USFWS to determine if the species should be listed as threatened or endangered. Sagebrush habitats provide nesting, brooding, fall/winter cover, and forage for greater sage grouse throughout the year (Nevada Department of Wildlife 2004).

Pinyon-juniper woodlands are common in the mid-elevation areas (6,000 to 9,000 feet) and adjoin many other habitat types, such as sagebrush at lower elevations and eastside pine and Jeffery pine at higher elevations. Common wildlife species that occur in pinyon-juniper woodlands include juniper titmouse, pinyon jay, ferruginous hawk, pinyon mouse, and mule deer (Wildlife Action Plan Team 2006).

Coniferous forests and subalpine habitats dominate the higher elevation of the study area. Coniferous forests provide habitat for many bird and mammal species, including white-headed woodpecker, pygmy nuthatch, American marten, golden-mantled ground squirrel, and black bear (Wildlife Action Plan Team 2006).

Cliffs and canyons include barren and sparsely vegetated areas (less than 10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops. Bighorn sheep and American pika are mammals that are adapted to the rocky habitats. Golden eagle and prairie falcon use cliff areas for nesting (Wildlife Action Plan Team 2006).

Agricultural Lands

Native habitats in the Mason and Smith Valleys began to be converted to agriculture starting in the mid 1800s. Before the land in these valleys was irrigated, only a small fraction of these valleys supported riparian and wetland habitat. Irrigation in the Walker River Basin has allowed the expansion of riparian and wetland habitat in Mason and Smith Valleys, although these habitats still make up only a small fraction of these valleys.

Irrigated agricultural lands, such as alfalfa and grain fields, provide foraging habitat for a number of wading birds, such as egret, heron, and white-faced ibis, and waterfowl, such as migratory geese and ducks. Additionally, many upland species such as quail, mourning dove, pheasant, turkey, mule deer, and many species of small mammals have adapted to and commonly use agricultural lands. Agricultural lands also provide important foraging habitat for snakes, raptors, and owls that feed on small mammals and small birds.

Canals and drains transport water to and from agricultural fields. The water elevation in these canals and drains varies greatly during irrigation season. Riparian vegetation can become established on their banks and wetland vegetation can become established in the beds of the canals and drains, although this vegetation may be cleared periodically for maintenance.

Wildlife Management Areas

The State of Nevada, through NDOW, owns or has long-term leases on more than 117,000 acres of land incorporated into WMAs across the state, including two in the study area. Public uses include bird watching, hiking, fishing, and hunting. Hunting on WMAs includes migratory game bird, upland game bird, furbearer, and big game hunting (Nevada Department of Wildlife 2008). The primary charter of Nevada WMAs is to provide preservation, protection, management, and restoration of wildlife and wildlife habitats on state-owned lands (Nevada Revised Statutes [NRS] 501.105, 501, and 181).

Alkali Lake Wildlife Management Area

The Alkali Lake WMA is located at the north end of Smith Valley and is managed by NDOW. The WMA encompasses 3,447 acres, of which at least 3,000 acres form a playa lake. The remaining area is upland habitat. The WMA was once a significant resource when agricultural tailwater from the surrounding fields and meadows and mountain runoff were major sources of water. Now these water sources have dwindled as a result of 20 years of mostly dry water years, reduced snowmelt from the Pine Nut Mountains, and reduced agricultural tailwater caused by changing agricultural practices (such as laser-leveling; sprinkler, rather than flood, irrigation; and other water conservation measures). The WMA has only minor water rights from springs in the Pine Nut Mountains and relies almost solely on drain and return flows. In dry years, the lake is typically dry by the end of the summer (Bull pers. comm.).

When water is present in Alkali Lake, the playa lake provides wetland habitat and foraging habitat for shorebirds, wading birds, and waterfowl. When wet, the lake provides good hunting opportunities for ducks and geese (Bull pers. comm.).

Mason Valley Wildlife Management Area

Mason Valley WMA is located in Mason Valley and is managed by NDOW. It is 13,375 acres in size and encompasses wetland, alkali desert scrub, riparian woodland, agricultural lands, and open-water habitats. The Mason Valley WMA was originally purchased to preserve habitat for waterfowl, although the WMA also provides habitat for wading birds, shorebirds, passerine birds, and raptors. Twelve species of ducks have been recorded breeding in the WMA as well as eared grebe, pied-billed grebe, Forster's tern, short-eared owl, Cooper's hawk, American kestrel, Swainson's hawk, northern harrier, and osprey (Bull pers. comm.). Other bird species that are common include gull, blue heron, white-faced ibis, Wilson's phalarope, red-necked phalarope, Western/least sandpiper, long-billed curlew, spotted sandpiper, willet, American avocet, black-necked stilt, and killdeer.

Approximately 1,200 acres of the WMA are cooperatively farmed to enhance and increase wildlife habitat by growing grain and hay crops. The agricultural practices on the Mason Valley WMA are different from commercial farms in that the crops are selected for the benefit of wildlife, and they are harvested to maximize the benefit for wildlife species (Bull pers. comm.). Upland, agricultural, and riparian habitats are used by species such as California quail, ring-necked pheasant, mule deer, black-tailed jackrabbit, bobcat, coyote, long-tailed weasel, badger, and occasionally mountain lion.

The Mason Valley WMA receives most of its water from the Walker River. Other water sources are numerous wells that draw on groundwater supplies, drainwater from the Mason Valley Fish Hatchery, secondary-treated effluent from the City of Yerington Wastewater Treatment Plant, and cooling pond water that is piped from the adjacent Sierra Pacific Power Company (now NV Energy) power plant.

Wildlife Corridor

Nevada lies within the Pacific Flyway, the primary seasonal movement corridor for birds migrating west of the Rocky Mountains. This flyway adds significantly to the diversity of bird species in Nevada. Wetlands, lakes, rivers, riparian forests, and agricultural fields provide resting and foraging opportunities for migrating birds.

Special-Status Wildlife Species

Special-Status Species Known to Occur in the Study Area

Based on the search of the NNHP database (2008), CNDDB (2008), and USFWS list for the project region (2007), 30 special-status wildlife species were identified as having potential to occur in the study area (fish species are addressed in

Chapter 5, Biological Resources—Fish). Mountain yellow-legged frog, Yosemite toad, yellow-billed cuckoo, fisher, Sierra Nevada red fox, and Sierra Nevada bighorn sheep were considered for analysis based on information from USFWS, but were eliminated from further review for the following reasons.

- Mountain yellow-legged frogs are thought to be extirpated in Nevada and if they do occur, occur only in high mountain streams that will not be affected by the Proposed Project (Wildlife Action Team Plan 2006).
- Yosemite toads do not occur in Nevada (Stebbins 2003).
- Yellow-billed cuckoo have never been recorded along the Walker River (Neel pers. comm.).
- Fisher do not occur in the study area in Nevada (Hall 1981).
- Sierra Nevada red fox do not occur in the study area in Nevada (Wildlife Action Team Plan 2006).
- Sierra Nevada bighorn sheep do not occur in the study area in Nevada (U.S Fish and Wildlife Service 2008).

Five special-status wildlife species have been recorded as occurring in or adjacent to the study area and could be affected by the Proposed Project if present. These species are the common loon, American white pelican, bald eagle, white-faced ibis, and western snowy plover (Nevada Natural Heritage Program 2008). No specific surveys for special-status wildlife species were conducted for this Proposed Project.

Bald Eagle

Bald eagles, except for those that occur in the Sonora Desert in central Arizona, have been removed from protection under the Endangered Species Act. However, they are still protected under the Bald Eagle and Golden Eagle Protection Act and are listed as a protected species under NRS 501. Bald eagles nest in large trees and on cliffs, often near large water bodies. Winter roosts commonly are large trees and other sheltered sites. They feed primarily on fish but will prey on injured waterfowl, various small mammals, and carrion. Few nests sites have been recorded in northern Nevada and winter numbers are low across the state (Wildlife Action Team Plan 2006). Bald eagles are not known to nest around Walker Lake, although the fishery of Walker Lake and agricultural lands in Mason Valley may provide important hunting grounds for bald eagles.

Common Loon

The common loon is listed as a protected species under NRS 501. Common loons are large birds that breed in freshwater lakes located in the boreal and mixed conifer forests across North America. Their winter ranges include the coastal waters along California and Baja California in the Pacific and the coastal waters

of Virginia, the Carolinas, and the North Gulf Coast of Florida. In the west, most common loons migrate along the Pacific coast, although a significant number migrate through western Nevada (Mcintyre and Barr 1997). Walker Lake is an important stopover for the interior western continental migrants (Wildlife Action Team Plan 2006). Over 1,400 common loons have been observed at Walker Lake during their spring migration (Evers 2004). However, recent surveys have documented a significant decrease in loon numbers on Walker Lake. Fall survey counts between 2002 and 2005 averaged 262 loons and spring survey counts between 2003 and 2007 averaged 285 loons. A total of 179 loons were counted during the fall survey in 2008 (Jeffers pers. comm.).

American White Pelican

The American white pelican is listed as a protected species under NRS 501. American white pelicans occur mainly along the western and southern portions of North America. White pelicans breed on isolated islands in inland lakes and winter along the southern coasts. American white pelicans feed on a variety of fish that generally are captured in shallow areas of marshes or along the shorelines of deeper lakes (Knopf and Evans 2004). American white pelicans are not known to breed on Walker Lake, although Walker Lake is used for feeding, especially when the tui chub spawn (Bull pers. comm.).

White-Faced Ibis

The white-faced ibis is listed as a protected species under NRS 501. White-faced ibis inhabits freshwater wetlands, especially cattail and bulrush marshes, although it feeds primarily in flooded hay meadows, agricultural fields, and estuarine wetlands (Ryder and Manry 1994). White-faced ibis is known to breed in the Mason Valley WMA (Bull pers. comm.).

Western Snowy Plover

Western snowy plover is listed as a protected species under NRS 501. Western snowy plover occurs on dry mud or salt flats and on the sandy shores of rivers and lakes. It nests on the ground of dry mud or salt flats where vegetation is sparse or absent. Snowy plover feeds on insects and other invertebrates that are picked or probed from the substrate (Wildlife Action Team Plan 2006). Western snowy plover has been known to nest at the Alkali Lake WMA (Nevada Natural Heritage Program 2008) and on dry lake beds just to the east of Walker Lake (Stockwell 1999).

Special-Status Wildlife with Potential to Occur in the Study Area

Two special-status wildlife species, greater sage grouse and pygmy rabbit, have not been recorded in the study area, but could be affected by the Proposed Project if suitable habitat exists. No survey of the study area has been conducted for these wildlife species for this Proposed Project.

Greater Sage Grouse

The Mono Basin population of greater sage grouse, including those that occur in Lyon, Mineral, and Douglas Counties, Nevada and Mono County, California, is currently under status review by USFWS to determine if the species should be listed as threatened or endangered. Sage grouse is a sagebrush-obligate species, although wet meadow habitats located adjacent to or near sagebrush are also an important habitat component during certain seasons (Nevada Department of Wildlife 2004, Neel 1999). Sage grouse chicks rely heavily on insects for their diet (Nevada Department of Wildlife 2004) as well as asters, dandelion, and western yarrow seeds (Neel 1999). As sage grouse matures its ability to digest sagebrush leaves increases. Sagebrush leaves account for about 98% of an adult's diet. Hens typically nest under big sagebrush within 3.2 kilometers of active leks (Neel 1999). Sage grouse occurs throughout the northern two-thirds of Nevada in sagebrush-dominated vegetation communities. Sage grouse is known to occur in the project area and the study area.

Pygmy Rabbit

USFWS is currently reviewing information to determine if populations of pygmy rabbits occurring outside of the State of Washington should be listed as threatened or endangered. The Columbia Basin distinct population in the State of Washington was listed as endangered by USFWS. Pygmy rabbit is generally found throughout the Great Basin Desert in areas dominated by tall and dense big sagebrush. Other shrub species that may co-occur include bitterbrush, rabbitbrush, greasewood, and juniper. Another important aspect of suitable habitat is the presence of deep and friable soils (Ulmschneider 2004). The pygmy rabbit is the only rabbit species in the United States that digs its own burrows (Weiss and Verts 1984). Pygmy rabbit will use burrows abandoned by other species such as marmots and badgers (Hall 1981) In Nevada, pygmy rabbit is found in broad valley floors, drainage bottoms, alluvial fans, and other areas with friable soils (Ulmschneider 2004). Based on range maps from the Nevada Wildlife Action Plan (Wildlife Action Team Plan 2006, Hall 1981), the study area occurs within the pygmy rabbit range.

Environmental Consequences

This section describes the impact analysis relating to wildlife and their habitat for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assumptions

The following assumptions were made for this analysis.

- Increases in water elevation in Walker River would occur from the location of the furthest upstream water acquisition. However, the greatest percent increase in flows would occur downstream of Schurz and thus the greatest potential increase of riparian vegetation would occur downstream of Schurz.
- Shoreline wetlands at the south end of Walker Lake would be inundated by increased lake elevations. Dramatic inundation of Walker Lake from heavy rains and snowmelt can quickly raise the elevation of the lake. However, increases in lake elevations as a result of water acquisition and diversion would be gradual (Chapter 3, Water Resources).
- Full funding under Alternative 1 would add an average of 50,000 af/yr of water to Walker Lake. It is possible, however, that less than the average 50,000 af/yr would be provided. Existing funding under Alternative 1 would add an average of 7,300 af/yr of water to Walker Lake.
- The actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/yr, existing funding would last only 3 years, while full funding would provide the average 50,000 af/yr for an estimated 20 years.
- Under Alternative 2, lands would be fallowed or rotated, but would not be taken out of production.

Impact Criteria

Impacts on wildlife species or habitat would be considered adverse or beneficial, respectively, if implementation of the Proposed Project would:

- cause the loss or gain of individuals or populations of federally listed threatened or endangered species or their habitat, or species that are federally proposed for listing;
- cause the loss or gain of habitat that is sensitive or rare in the region, such as wetlands, riparian woodland, and surface water sources;
- cause substantial loss or gain of populations or habitat of a species that is
  - a federal candidate,
  - protected under NRS 501, or
  - regionally rare;
- cause loss, long-term disruption, or gain of wildlife nursery sites; or
- cause substantial loss or gain of diversity of species or natural communities and wildlife habitat.

Impacts

No Action Alternative

Current TDS concentrations in Walker Lake limit the survival of LCT and other fish species, such as tui chub. Under the No Action Alternative, the current volume of water would continue to be diverted from the river upstream of Walker Lake, and potential geothermal water would not be acquired. TDS concentration in Walker Lake would subsequently continue to rise (Chapter 3, Water Resources). This increase of TDS concentration would likely result in a decrease in the Walker Lake fishery (Chapter 5, Biological Resources—Fish). Currently, Walker Lake provides important feeding grounds for migratory birds that feed on fish, such as special-status common loon and American white pelican. The collapse of the Walker Lake fishery would have an adverse impact on these bird species.

Alternative 1 (Proposed Project)

Acquisitions under Alternative 1 would add an average inflow of 50,000 af/yr to Walker Lake. It is possible, however, that less than the average 50,000 af/year would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the annual average inflow to the lake would increase by only 7,300 af/yr.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that acquisitions would increase the average annual inflow to the lake by 50,000 af/yr. Unless otherwise noted, if an average 50,000 af/yr were not acquired, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Direct Impacts

No direct impact on wildlife species is anticipated as a result of the Proposed Project.

Indirect Impacts

Impact WILD-1: Loss of Foraging Habitat for Wildlife Species as a Result of Fallowing, Field Rotation, or Retirement of Agricultural Lands (Adverse Impact)

Under Alternative 1, acquisitions would reduce the amount of water available for agriculture. If the water supply is removed from the land, agricultural production could cease, or the land could be converted to uses other than agriculture (Chapter 7, Land Use and Agriculture, Table 7-10). Agricultural lands, especially alfalfa and grain crops, provide diverse foraging habitat for wading birds, waterfowl, and upland bird species, as well as small and large mammal species that occur in the study area.

Up to a third of agricultural land in Mason and Smith Valleys and the east Walker River could be retired or converted to other uses, as indicated in Chapter 7, Land Use and Agriculture (Table 7-10). This would make them less productive for foraging. Retiring or converting agricultural lands to other uses would reduce the amount of foraging habitat available to wildlife species that rely on agricultural lands, and thus could substantially reduce their numbers in the study area.

Impact WILD-2: Loss of Bird Nests along the Shore of Walker Lake and in Wetlands at the Southern End of Walker Lake Caused by Increased Lake Elevations (No Impact)

Many species of shorebirds forage along the shoreline of Walker Lake, and some species, including killdeer and spotted sandpiper, may nest along the shoreline of the lake. Additionally, many species forage and nest in wetland habitat at the lake edge. Under Alternative 1, acquisitions would increase flows to Walker Lake. An additional 50,000 af/yr of water could reach Walker Lake and raise the lake elevation. The increase in the lake elevation could inundate the shoreline and wetland habitat at the lake's southern end. If this were to occur suddenly, nests along the lake's edge would be flooded and lost. However, it is anticipated that the lake elevations would rise slowly as a result of redirection of water to Walker Lake. This would allow birds to adjust the location of their nests yearly along the lake's edge as the lake elevation increases. The wetland at the southern end of Walker Lake also would reestablish naturally at the new lake elevation. The rising elevation of Walker Lake is not expected to affect nesting birds.

Impact WILD-3: Impacts on Bird Species that Feed on Fish in Walker Lake (Beneficial Impact)

Walker Lake is an important stopover for migrating bird species, including double-crested cormorant, eared grebe, and Clark's grebe, as well as special-status bald eagle, common loon, and American white pelican that feed on the fish in Walker Lake. Under Alternative 1, an average of 50,000 af/yr of additional water could be delivered to Walker Lake. If 50,000 af/yr reach Walker Lake, TDS concentration is expected to decrease to a level that would be beneficial for LCT and tui chub. Decreased TDS concentration would enhance Walker Lake fish populations, which in turn would benefit bird species that feed on fish at Walker Lake.

Under existing funding, an average increase in flows of 7,300 af/yr is expected. It is estimated that 7,300 af/yr would not be sufficient to stop the decrease in lake elevation. Projected TDS concentration would be are over 30,000 mg/l in 2200 (Chapter 3, Water Resources). The impacts on bird species that feed on these fish would be the same as for the No Action Alternative.

Impact WILD-4: Increased Habitat for Wildlife Species Using Riparian and Wetland Habitat along the Mainstem Walker River Downstream of Schurz as a Result of Increased Flows (Beneficial Impact)

Under Alternative 1, increased flows to Walker Lake would be delivered via the mainstem Walker River. Although flows would increase beginning at the highest upstream acquisitions, with flows at various locations being dependent on the location of the acquisitions, the percent flow increase would be greatest below Schurz, where existing summer flows can be zero. Much of the mainstem Walker River is bordered by shrublands and agricultural land, with emergent marsh along the river channel.

In the river reach downstream of Schurz, increased inflow to Walker Lake would help establish and sustain riparian and wetland vegetation. The increased flow would contribute to an increase in riparian and wetland communities and an increase in natural community diversity. Increased riparian and wetland habitat in the study area would be beneficial to wildlife species that rely on or use these habitats.

However, in areas where cattle grazing occurs near the Walker River, grazing could negatively affect the amount of new vegetation and reduce the benefits to wildlife species.

Impact WILD-5: Impacts on Wildlife Species as a Result of the Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Flows (Minor Impact)

Acquisition of water rights from irrigated agricultural land could result in the reduction of flows in associated irrigation canals and drains. This could cause the loss of riparian and wetland habitat that relies on this water supply. Riparian and wetland habitats provide important foraging and nesting for many wildlife species in the Walker River Basin. The riparian habitat supported by irrigation features generally has lower habitat value in comparison to riparian communities along natural streams because it is narrow and patchy. Additionally, regular maintenance (i.e., burning or cutting vegetation) has further degraded the riparian or wetland habitat along the canals and drains (Langsdorf pers. comm.). Therefore, the Proposed Project would have only a minor impact on riparian or wetland habitat associated with irrigation features and would therefore have a minor impact on wildlife species that are associated with these habitats along irrigation canals and drains.

Impact WILD-7: Loss of Foraging Habitat for Shorebirds and Wading Birds at Alkali Lake WMA as a Result of Acquisitions in Smith Valley (Adverse Impact)

Acquisition of water from irrigated agricultural land adjacent to Alkali Lake WMA in Smith Valley would result in the reduction of agricultural tailwater that

reaches Alkali Lake. Under current conditions, irrigation tailwater that drains to Alkali Lake WMA provides part of the water source for playa wetlands at Alkali Lake. These playa wetlands provide foraging habitat for species of shorebirds, wading birds, and waterfowl. Loss of the tailwater could result in the loss of playa wetland habitat that relies on this water source, resulting in loss of foraging habitat. This would be an adverse impact.

Alternative 2 (Leasing Alternative)

Because Alternative 2 requires recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/yr, the existing funding would last 3 years, while full funding would last an estimated 20 years.

Direct Impacts

No direct impacts on wildlife species are anticipated as a result of Alternative 2.

Indirect Impacts

The following impacts would be the same as Alternative 1.

Impact WILD-2: Loss of Bird Nests along the Shore of Walker Lake and in Wetlands at the Southern End of Walker Lake Caused by Increased Lake Elevations (No Impact)

Impact WILD-7: Loss of Foraging Habitat for Shorebirds and Wading Birds at Alkali Lake WMA as a Result of Water Acquisitions in Smith Valley (Adverse Impact)

The following impacts would be the same as Alternative 1 but temporary.

Impact WILD-1: Loss of Foraging Habitat for Wildlife Species as a Result of Fallowing, Field Rotation, or Retirement of Agricultural Lands (Adverse Impact)

Impact WILD-4: Increased Habitat for Wildlife Species Using Riparian and Wetland Habitat along the Mainstem Walker River Downstream of Schurz as a Result of Increased Flows (Beneficial Impact)

Impact WILD-5: Impacts on Wildlife Species as a Result of the Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Flows (Minor Impact)

The following impact would be different than under Alternative 1.

Impact WILD-3: Impacts on Bird Species That Feed on Fish In Walker Lake (Adverse Impact)

While an additional 50,000 af/yr of water flowing into Walker Lake would be beneficial, the benefits would be short-lived under Alternative 2. Once funding was exhausted, flows into Walker Lake would likely return to pre-project levels and TDS concentration would increase. Eventually, this would result in the same impacts as discussed for the No Action Alternative.

Impact WILD-6: Potential Creation of Habitat for Pygmy Rabbit and Greater Sage Grouse as a Result of Retiring Agricultural Land (No Impact)

Under Alternative 2, lands from which leases are acquired would not necessarily cease agricultural production. On parcels that are fallowed, the amount of time that leases could be in effect (3 to 5 years) would not be sufficient to allow for the establishment of native sagebrush habitats on lands that have been retired or converted from agriculture. There would be no impact.

Alternative 3 (Efficiency Alternative)

As discussed in Chapter 3, Water Resources, full implementation of Alternative 1 would provide an average of 50,000 af/yr to Walker Lake, but it is estimated that full implementation of Alternative 3 would yield only an additional average inflow of 32,300 af/yr. Unless otherwise noted below, the impacts of Alternative 3 would be similar in nature (both adverse and beneficial) to those of Alternative 1, but of less magnitude.

Direct Impacts

No direct impact on wildlife species is anticipated as a result of Alternative 3.

Indirect Impacts

The following impacts would not apply to Alternative 3.

Impact WILD-1: Loss of Foraging Habitat for Wildlife Species as a Result of Fallowing, Field Rotation, or Retirement of Agricultural Lands (No Impact)

Under Alternative 3, land under agricultural production would not be retired from agricultural use. Therefore, the foraging habitat for wildlife species would not be diminished, and there would be no impact on wildlife species.

Impact WILD-6: Potential Creation of Habitat for Pygmy Rabbit and Greater Sage Grouse as a Result of Retiring Agricultural Land (No Impact)

The following impact would be the same as Alternative 1.

Impact WILD-2: Loss of Bird Nests along the Shore of Walker Lake and in Wetlands at the Southern End of Walker Lake Caused by Increased Lake Elevations (No Impact)

The following impacts would be the same as Alternative 1, but of less magnitude.

Impact WILD-4: Increased Habitat for Wildlife Species Using Riparian and Wetland Habitat along the Mainstem Walker River Downstream of Schurz as a Result of Increased Flows (Beneficial Impact)

Impact WILD-7: Loss of Foraging Habitat for Shorebirds and Wading Birds at Alkali Lake WMA as a Result of Water Acquisitions in Smith Valley (Adverse Impact)

Efficiency measures in Smith Valley could still deprive Alkali Lake WMA of tailwater inflow.

The following impact would be different than under Alternative 1.

Impact WILD-3: Impacts on Bird Species That Feed on Fish In Walker Lake (Adverse Impact)

Under Alternative 3, an average inflow of 32,300 af/yr is expected. The 32,300 af/yr may temporarily reduce TDS concentration, but the overall lake elevation would decrease over time, which would result in an increase in TDS concentration. Eventually, TDS concentration would exceed the threshold for tui chub survival. The impacts on bird species that feed on these fish would be the same as for the No Action Alternative.

Impact WILD-5: Impacts on Wildlife Species as a Result of the Loss of Riparian and Wetland Habitat Associated with Irrigation Canals and Drains Caused by Decreased Flows (Minor Impact)

Conservation measures would result in the reduction of water flow in irrigation canals and drains. This could cause loss of riparian and wetland habitat that relies on this water supply. The riparian habitat supported by irrigation features generally has lower habitat value in comparison to riparian communities along natural streams because it is narrow and patchy. Additionally, regular maintenance (i.e., burning or cutting vegetation) has further degraded the riparian or wetland habitat along existing canals and drains (Langsdorf pers. comm.). Alternative 3 would have only a minor impact on riparian or wetland habitat associated with irrigation features.

Chapter 7 Land Use and Agriculture

Introduction

This chapter describes the affected environment for land use and agriculture in the study area and the potential impacts on land use and agriculture that would result from the Proposed Project and other alternatives.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- ICF Jones & Stokes interpretation of USGS land use information (ICF Jones & Stokes 2008)
- Carson City Field Office Consolidated Resource Management Plan (Bureau of Land Management 2001)
- Lyon County Master Plan (Lyon County 1990)[1]
- Mineral County Master Plan (Mineral County Regional Planning Commission 2006)
- UNR/DRI's analysis of GIS data related to agriculture (Bonnenfant et al. 2009)

The USGS land use dataset was the foundation for this section because it provides the greatest amount of information in a single dataset, and most study area acreages were calculated from this dataset. For local descriptions, such as agricultural land in Mason Valley, newer and more detailed data were used when available. As a result, total acreages are not consistent. This is particularly true in the case of irrigated land—the USGS data include more land under this category than the newer and more detailed UNR/DRI data. Data sources are noted throughout this report.

Affected Environment

This section describes the environmental setting related to land use in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for the land use analysis was defined as the following areas in Lyon and Mineral Counties: West Walker River, East Walker

[1] The Lyon County Master Plan is under revision, and the revised plan will not be available until later in 2009.

River, mainstem Walker River, Walker Lake, irrigated land in the Mason and Smith Valleys, Mason Valley and Alkali Lake WMAs, and a 1-mile zone around this area (based on the USGS data). This study area was selected because it is the greatest extent of land that is expected to be affected by the Proposed Project.

Douglas County, Nevada, and California were not included in the study area. Douglas County was not included because no acquisitions would occur in the county. California was not included because there would be no change in operations in California and no acquisitions would occur in California, so there would be no land use impacts in Mono County. In addition, only the portion of the Walker River Paiute Reservation within the 1-mile zone around the Walker River and irrigated land is included in the study area. The entire Yerington Paiute Reservation and Colony is within the study area.

Land in the study area is under the ownership or administration of the following entities.

- BLM, Carson City Field Office
- USFS (Inyo, Stanislaus, and Humboldt-Toiyabe National Forests)
- DOD (Hawthorne Army Depot)
- BIA
- WRPT
- YPT
- State of Nevada (Alkali Lake and Mason Valley WMAs and Walker Lake SRA)
- Counties of Mineral and Lyon
- City of Yerington
- Unincorporated communities of Hawthorne, Schurz, Smith, and Wellington
- Private ownership

The land uses of these entities (Figure 7-1) are described below.

Bureau of Land Management, National System of Public Lands

Much of the land in the Walker River Basin is BLM land, including most of the land surrounding Walker Lake.

In the project area, 763,961 acres (ICF Jones & Stokes 2008) are administered by the BLM Carson City District Office. These lands are used for a variety of purposes, such as herd management areas for wild horses, recreation, mineral and energy leases, and grazing allotments. There are no known active mines in the

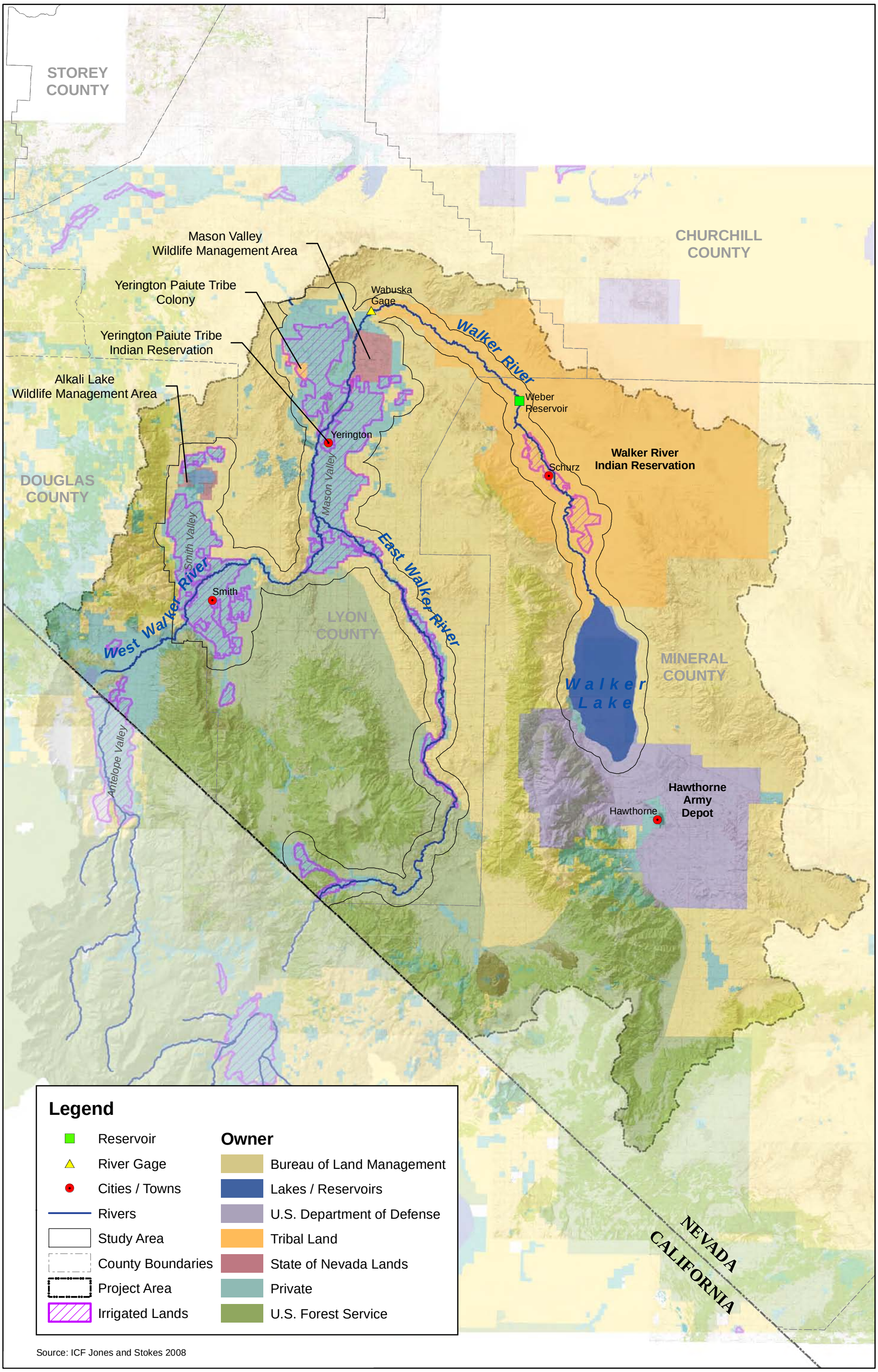

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Figure 7-1
General Land Use Map

project area, although there are numerous mining claims (Bureau of Land Management 2001, resource maps).

In the study area, 88,665 acres (ICF Jones & Stokes 2008) are BLM-administered lands. For the most part, these lands occur on the outskirts of Smith and Mason Valleys, along the West Walker River in the Wilson Canyon area, along the East Walker River downstream of the Humboldt-Toiyabe National Forest, and in and around much of Walker Lake (Bureau of Land Management 2007). BLM-designated land uses in the study area include multiple use public land, scenic areas, and mining.

Former mines in the area are the MacArthur Mine and the Anaconda Mine. The MacArthur Mine is an abandoned copper mine on BLM land 6 miles northwest of Yerington. The site was recently reclaimed as part of BLM's mining law program (Bureau of Land Management 2008). The Anaconda Mine (also known as the Yerington Mine) is also an abandoned copper mine, located west of Yerington. Half of the site is on BLM land, and the other half is on privately owned land (U.S. Department of Health and Human Services 2006).

BLM also leases public lands for a small airport, the Rosaschi Air Park, in Lyon County (AirNav 2008).

Some BLM lands in the Walker River Basin may be available for sale (disposal) if they are "uneconomic to manage or have been identified for community expansion or agricultural development and have little value for other resource uses" (Bureau of Land Management 2001). These lands are primarily in the vicinity of Yerington.

National Forest System Lands

There are approximately 484,575 acres of national forest lands in the project area and approximately 46,196 acres of national forest lands in the study area (ICF Jones & Stokes 2008). Most national forest lands in the study area are part of the 6.3-million-acre Humboldt-Toiyabe National Forest.

Department of Defense Lands

The DOD's Hawthorne Army Depot (also known as the Hawthorne Naval Ammunition Depot) is a 147,000-acre ammunition storage depot on the south end of Walker Lake. The DOD has jurisdiction over the southern portion of Walker Lake, and approximately 16,799 acres of the depot are in the study area (ICF Jones & Stokes 2008). The depot is operated by Day Zimmerman Hawthorne Corporation for the Army, which acquired the site from the Navy in 1977. Facilities include 2,427 munitions storage igloos, the Western Area Demilitarization Facility, and a 700-acre bomb disposal site 25 miles northeast of Hawthorne. The depot employs approximately 700 civilians and one military person (Center for Land Use Interpretation date unknown).

Several creeks run through the depot and eventually discharge into Walker Lake. The depot uses surface water from Cottonwood Creek, Rose Creek, and Cat Creek, and also has groundwater pumping rights.

Walker River Paiute Reservation

Walker River Paiute Reservation comprises 325,000 acres between the northeast end of Mason Valley and Walker Lake. The reservation, with a population of approximately 1,200, was established in 1874 by Executive Order and is under the General Allotment Act of 1887 (Walker River Paiute Tribe 2008a). Most of the land is held in trust by the United States for the benefit of the tribe (Miller Ecological Consultants 2005).

Approximately 10,000 acres of reservation land were divided into 20-acre allotments and distributed to individual Tribe members. These allotments are also held in trust by the United States, but for the benefit of the individuals (Miller Ecological Consultants 2005).

Most of the land is used for agriculture and is the county's major farming district (Mineral County 2008). Grazing is the primary land use, as well as some ranching (Walker River Paiute Tribe 2008a), but agricultural crops are also an important part of the economic base. Alfalfa is the primary crop grown, mainly along former riparian areas (Walker River Paiute Tribe 2008b). Approximately 2,800 acres are in agricultural production. Of this, approximately 2,100 acres are irrigated allotments, consisting mainly of alfalfa and grass hay, and 767 acres of tribal trust land irrigated by center pivots. In 2007 and 2008, however, the allotments were part of a fallowing program, in part because of repairs to Weber Dam (described in Chapter 3, Water Resources).

The unincorporated town of Schurz is located on the reservation at the intersection of U.S. Highways 95 and 95-A. Land uses in Schurz include commercial, such as a gas station with a convenience store, a smoke shop, and a fireworks outlet (Walker River Paiute Tribe 2008a and 2008c).

Reservation land makes up 268,378 acres of the project area and 60,352 acres of the study area (ICF Jones & Stokes 2008), including all irrigated agricultural land on the reservation and the town of Schurz. The Tribe has jurisdiction over the northern portion of Walker Lake (Schildt pers. comm.).

Yerington Paiute Tribe Reservation and Colony

The YPT Reservation and Colony consist of two land areas: the YPT Colony (Colony) and the YPT Reservation, which is also known as Campbell Ranch. The population of the Colony and Campbell Ranch is 400 tribal members, and the total number of enrolled tribal members is 1,100 (Emm pers. Comm..)

The Colony comprises 13.7 acres (as estimated from map provided by Emm pers. comm.) within the city limits of Yerington, Nevada. Land uses at the Colony are a mix of residential and commercial (Emm pers. comm.). The YPT also has the off-Reservation Arrowhead Market, a gas station and minimarket located on Campbell Lane (Emm pers. comm.).

Campbell Ranch comprises 1,162 acres (as estimated from map provided by Emm pers. comm.) 10 miles north of Yerington. Land uses at the Campbell Ranch are primarily agricultural and residential. Nine assignees farm on private land on the ranch and grow primarily alfalfa and onions. The Tribe grows alfalfa on 900 acres. A limited number of cattle are also grazed. Campbell Ranch also has residences (Emm pers. comm.).

Tribal members collect culturally significant plants and animals on both the Reservation and public land.

The Tribe has water rights dating to the early 1900s that are used for agricultural purposes. The water rights for the Colony have been transferred to the ranch for irrigation (Emm pers. comm.).

State of Nevada

Wildlife Management Areas

The State of Nevada, through NDOW, owns or has long-term leases on more than 117,000 acres of land incorporated into WMAs across the state. The management focus of most WMAs, including both the Alkali Lake and Mason Valley WMAs, is development of wetland- and waterfowl-related activities, including the use of these areas as public shooting grounds, with all other uses being secondary (Nevada Board of Wildlife Commission 2002). Public uses include bird watching, hiking, fishing, and hunting. Hunting on WMAs includes migratory game bird, upland game bird, furbearer, and big game hunting (Nevada Department of Wildlife 2008).

Two WMAs occur in the study area: Alkali Lake WMA and Mason Valley WMA. These WMAs are described below.

Alkali Lake Wildlife Management Area

The Alkali Lake WMA is located at the north end of Smith Valley and is approximately 3,448 acres, of which at least 3,000 acres are a playa lake and a small portion is upland habitat. The WMA was once a significant resource when agricultural tailwater from the surrounding fields and meadows and mountain runoff were major sources of water. Now these water sources have dwindled as a result of 20 years of mostly dry water years, reduced snowmelt from the Pine Nut Mountains, and reduced agricultural tailwater caused by changing agricultural practices (such as laser-leveling; sprinkler, rather than flood, irrigation; and other

water conservation measures). The WMA has only minor water rights from springs in the Pine Nut Mountains and relies almost solely on drain and return flows. In dry years, the lake is typically dry by the end of the summer. (Bull pers. comm.).

When water is present in Alkali Lake, the playa lake provides wetland habitat and shallow water for a wide variety of shorebirds and wading birds. When wet, the lake is also used by ducks and geese and provides good hunting opportunities. The lake does not support fishing (Bull pers. comm.).

Mason Valley Wildlife Management Area

The Mason Valley WMA is approximately 13,735 acres and includes 35 water bodies and a fish hatchery. The WMA is open to the public year-round, and seasonal fishing and hunting are permitted. Hunting includes waterfowl, upland bird, and deer. Camping is allowed (Nevada Department of Wildlife 2008, 1; Bull pers. comm.).

In addition, approximately 1,200 acres of the WMA are farmed to increase the quantity, quality and variety of wildlife habitat present on the area. Wheat, barley, corn, sorghum, other grain crops, and alfalfa hay are grown (Nevada Department of Wildlife 2008). Livestock grazing is permitted and is used to periodically stimulate green-up, provide succulent feed, and open overgrown areas for resting and feeding by waterfowl and other wildlife (Nevada Department of Wildlife 2008).

Water is supplied to the Mason Valley WMA from the Walker River, the Fort Churchill Cooling Pond (well water from Sierra Pacific Power Company), the Mason Valley Fish Hatchery (well water), the City of Yerington (treated effluent water), and irrigation wells located on the WMA. The Walker River decreed water rights dedicated to the WMA are some of the earliest priority rights on the river (Bull pers. comm.).

Walker Lake

Walker Lake occupies 35,520 acres (ICF Jones & Stokes 2008) and is managed by the state (Hull pers. comm.) (excluding the portions under the jurisdiction of DOD or WRPT). The lake provides wildlife habitat (Chapter 5, Biological Resources—Fish, and Chapter 6, Biological Resources—Wildlife) and is used for recreational purposes (Chapter 11, Recreation). Wildlife in the lake is managed by NDOW.

Walker Lake State Recreation Area

The State of Nevada, through the Division of State Parks, owns and maintains the Walker Lake SRA, located 11 miles north of Hawthorne, off of U.S. Highway 95. The SRA is 273 acres, with 40 of those acres adjacent to the lake and the

remainder across the highway. Management of the SRA is guided by the *Walker State Recreation Area Master Plan* (Nevada State Parks 1989). The goal of this plan is to provide a long-range management and development strategy for the SRA. The plan addresses the day-to-day management of recreational and natural resources. There are no immediate plans to update the Master Plan. Facilities at the SRA are described in Chapter 11, Recreation.

Lyon County

Lyon County is located in western Nevada and is bounded by Douglas County to the west, Storey and Washoe Counties to the northwest, Churchill County to the northeast, and Mineral County to the east. The Nevada State Demographer's Office estimates the population of Lyon County in 2007 as 55,903, and this population is expected to increase to 105,533 by 2028 (Nevada Small Business Development Center 2008).

Of the 786,012 acres of Lyon County in the project area, only 164,483 acres are under the jurisdiction of the county (ICF Jones & Stokes 2008). The remainder is tribal land or public lands managed by BLM or USFS.

Approximately 95,932 acres of county land in the study area are in agricultural use (Figure 7-2). Agriculture is described in more detail later in this chapter in Agricultural Lands in the Study Area.

The two main areas of Lyon County in the study area are Mason Valley and Smith Valley. The City of Yerington is the county seat. The remainder of the county located within the study area is described under BLM Lands.

Mason Valley

Mason Valley is a rural farm and ranch community located in the southeastern portion of the county between the Singatse Range and the Wassuk Range. The valley's population in 2006 was 8,740, which includes the City of Yerington and the communities of Mason, Nordyke, and Weed Heights (Lyon County 2006a).

The primary land use in the valley is agriculture (Lyon County 2006b) (Figure 7-3). See Agricultural Lands in the Study Area below for more information. Low-density residential is the next most abundant land use type, particularly along the eastern edge of the valley. Substantial blocks of industrial lands on the western edge of the valley (Lyon County 2006b) are used primarily for mining.

There are no active mines in the Walker River Basin portion of Lyon County, but there are several inactive or abandoned mines, including the MacArthur Mine (described above in Bureau of Land Management Lands) and the Anaconda Mine near Yerington (Environmental Protection Agency 2008). The Anaconda Mine is described in Chapter 3, Water Resources. There is also one mine, the Pumpkin

Hollow Mine, in the planning stages (Nevada Small Business Development Center 2008, Appendix A), and the City of Yerington is considering leasing water to the mine (Joyner 2008).

Smith Valley

Smith Valley is a rural farm and ranch community located in the southwestern portion of the county between the Singatse Range and the Pine Nut Mountains and Wellington Hills. The valley's population in 2006 was 1,977, which includes the communities of Wellington, Smith, and Simpson (Lyon County 2006a; Economic Development Authority of Western Nevada 2008).

The primary land use in the valley is agriculture (Figure 7-4) (Lyon County 2006c). See Agricultural Lands in the Study Area below for more information.

Low-density residential is the next most abundant land use type, particularly in the unincorporated towns of Smith and Wellington. The valley also has several business parks and industrial zones (Lyon County 2006a) and two post offices.

City of Yerington

The city of Yerington is located in north central Lyon County on Highway 95A and has an estimated population of 3,319 (Nevada Small Business Development Center 2007). Yerington was incorporated in 1907 and is the county seat. Land uses in the city include agriculture, low- and medium-density residential, commercial, and industrial uses (Lyon County 2006b) (Figure 7-5).

Mineral County

Mineral County is located in west central Nevada and is bounded by Churchill County on the north, Nye County on the east, Esmeralda County on the south, and Lyon County on the west. The county is 3,700 square miles (Mineral County Regional Planning Commission 2006). The Nevada State Demographer's Office estimated the population of Mineral County in 2007 as 4,377. This population is expected to decrease significantly over the next 20 years (Nevada Small Business Development Center 2008).

Of the 1,011,966 acres of county land in the project area, approximately 34,000 acres are under the jurisdiction of the county (ICF Jones & Stokes 2008). The remainder is tribal land or public lands managed by the BLM or USFS. Approximately 27,042 acres (35,520 acres occupied by Walker Lake plus 1,058 acres of dry land) are in the study area.

Much of the population lives in the county seat of Hawthorne, which is located at the southern end of Walker Lake and has an estimated population of 2,960 (Nevada Small Business Development Center 2007). Land uses in Hawthorne include residential and some commercial and public facilities. The town is almost

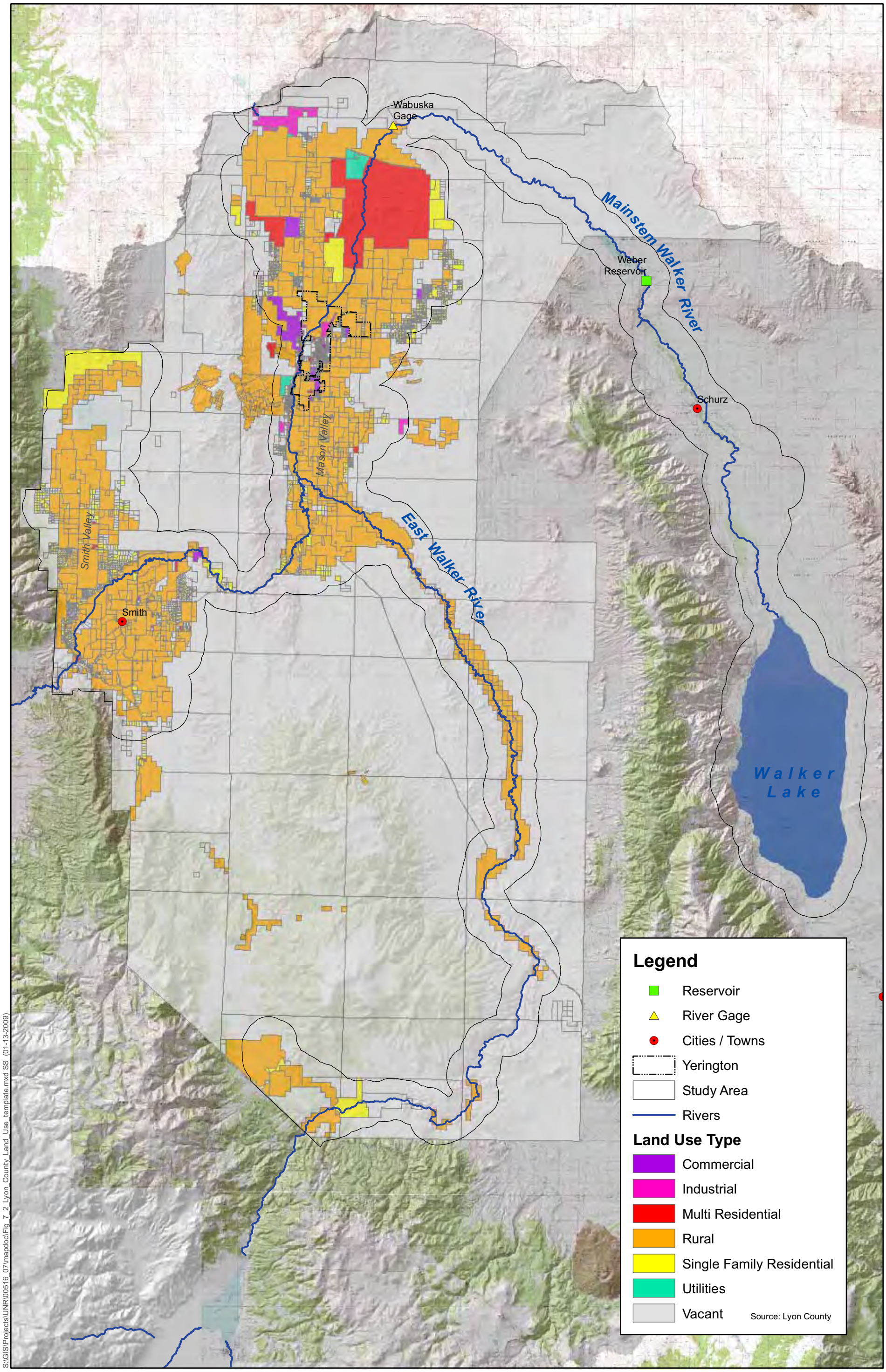

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Figure 7-2
Walker Basin
Lyon County Land Use Types

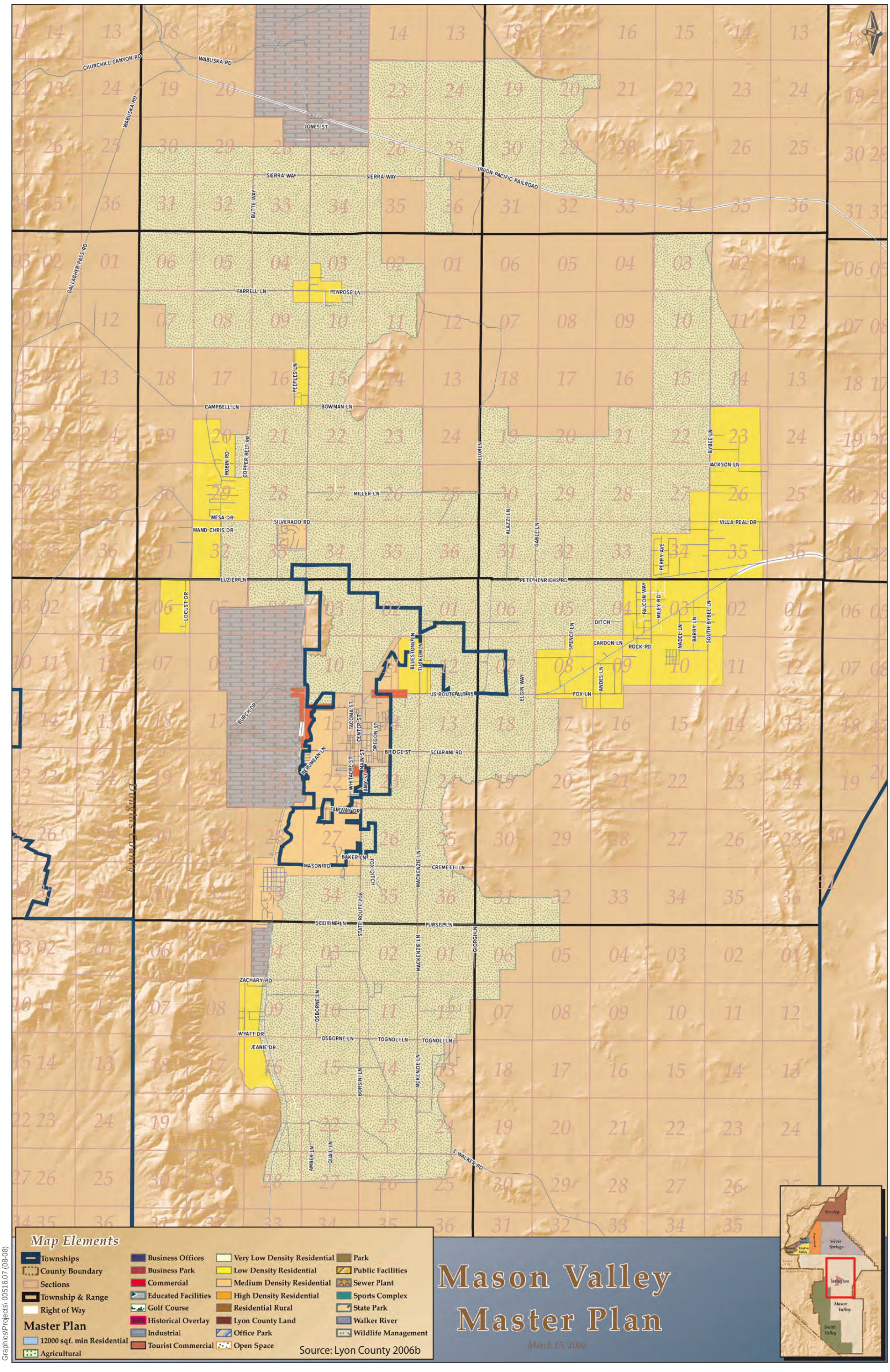

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Figure 7-3
Lyon County Land Use Zoning Map for Mason Valley

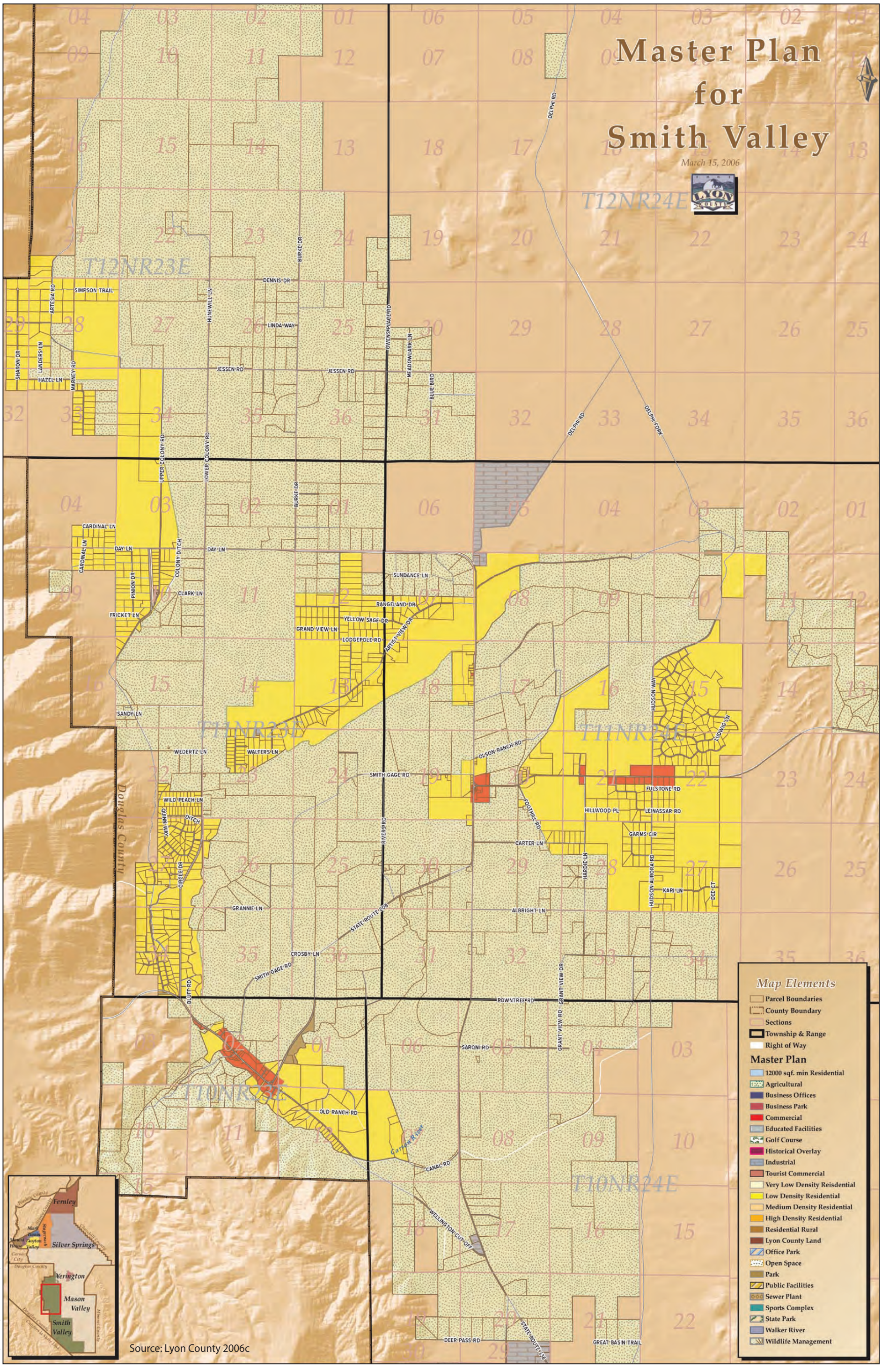

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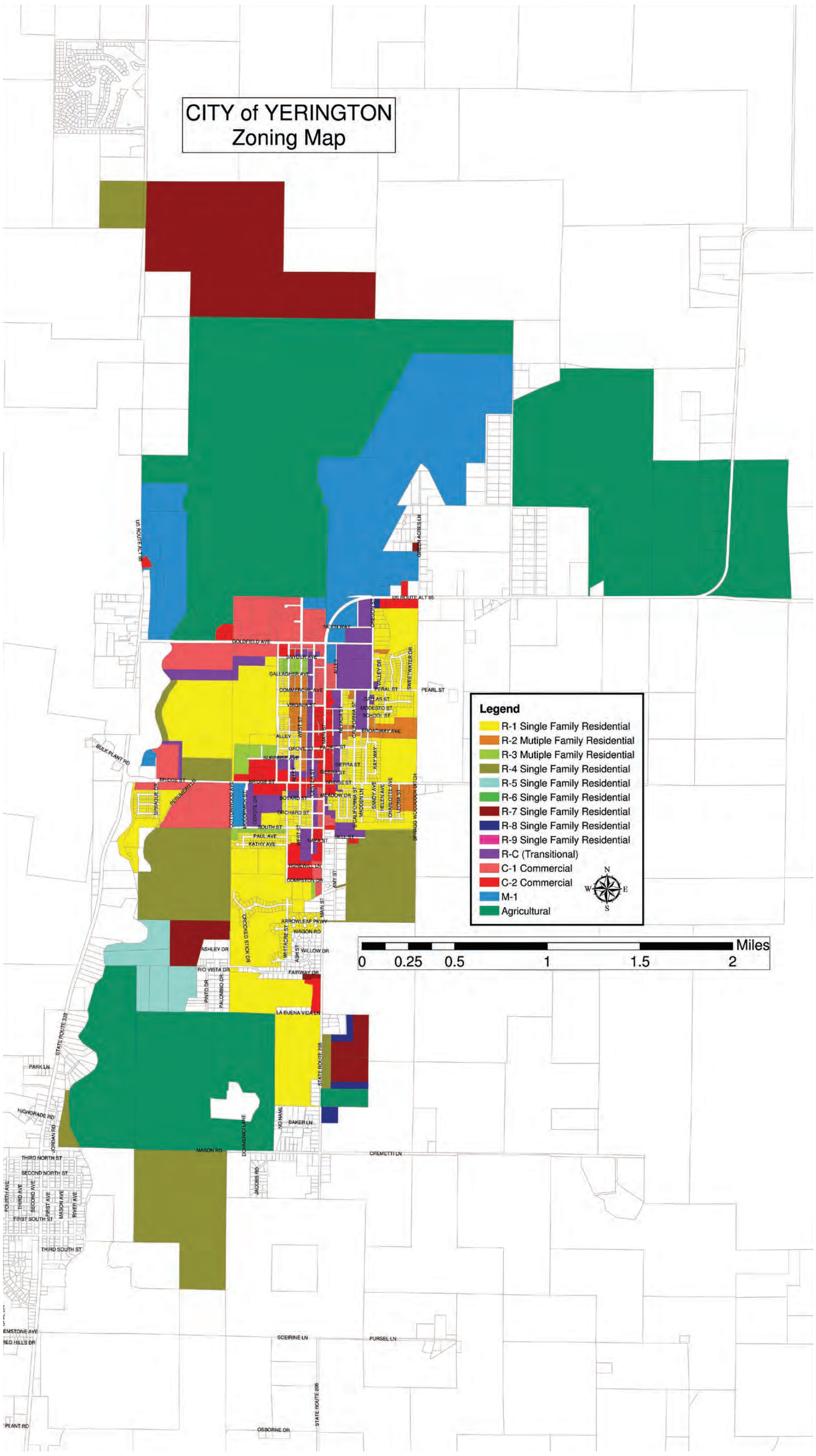
Figure 7-4
Lyon County Land Use Zoning Map for Smith Valley



Source: City of Yerington 2008a

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Figure 7-5
City of Yerington Zoning Map

completely surrounded by the Hawthorne Army Depot, which is discussed under Department of Defense Lands.

Other communities in the study area are the town of Walker Lake, which is located on the western edge of Walker Lake and has an estimated population of 299, and Schurz, which has an estimated population of 711 (Nevada Small Business Development Center 2000).

Mineral County is one of Nevada's oldest mining areas, with gold mines dating back to the Civil War era. Mining, however, is a cyclic industry, and mining activity in the county is currently at a low level. Minerals typically mined in Mineral County are silver, gold, tungsten, lead, and zinc (Mineral County Regional Planning Commission 2006).

Agricultural Lands in the Study Area

Agriculture is an important land use in the valleys of Walker Basin. The largest agricultural areas in the study area, Mason Valley and Smith Valley, are both in Lyon County (Table 7-1).

In Mason Valley, the predominant crop is alfalfa, and other important crops include onion, corn, and turf (Bonnenfant et al. 2009) (Table 7-2). Other agricultural industries include feedlots and dairies (Lyon County 1990).

In Smith Valley, alfalfa is the predominant crop grown in the valley (Bonnenfant et al. 2009) (Table 7-2). Other agricultural industries include cattle ranching, feedlots, and dairies (Lyon County 1990; Economic Development Authority of Western Nevada 2008).

Table 7-1. Irrigated Land in the Study Area by County

County	Acres in Agriculture
Lyon	
Mason Valley	51,973
Smith Valley	35,432
East Walker[a]	5,593
Total[b]	95,932
Mineral	7,850
Total	103,783

Source: ICF Jones & Stokes 2008.

[a] Does not include upper portion of East Walker River.
[b] Total for county, including upper portion of East Walker.

Recent crop information from DRI for Mason and Smith Valleys is presented in Table 7-2. In both valleys, more than half of the cultivated land is planted in alfalfa. Other important crops are onion and corn in Mason Valley and pasture and grass in Smith Valley. Agricultural land is also fallowed.

As described in the soil discussion provided in Chapter 8, Air Quality, most soils in the study area are suited for agriculture. In addition, some soils in the study area meet the requirements for prime farmland (i.e., land best suited for producing feed, forage, and oilseed crops) (Archer 1984, Natural Resources Conservation Service 2006). It is important to note that all farmland in Nevada is, at a minimum, classified as land of statewide importance.

Table 7-2. Cropping Patterns for Mason and Smith Valleys in 2007

Crop Type	Total Acres	Percentage of Valley
Mason Valley		
Alfalfa	25,942	68
Brush	347	0.9
Corn	1,891	5
Dry grass	107	0.3
Fallow	3,065	8
Forage crop	816	2
Feed lot	31	0.1
Grass	777	2
Garlic	213	0.6
Grapes	8	0
Grain	841	2
Lettuce	249	0.7
Onion	2,445	6.4
Oats	104	0.3
Pasture	1,064	2.8
Turf	260	0.7
Total	38,159	100.00
Smith Valley		
Alfalfa	11,404	56
Brush	43	0.2
Fallow	3,312	16
Feed lot	107	0.5
Grain	160	0.8
Grass	1,965	9.6
Garlic	159	0.77
Pasture	3,411	17
Total	20,400	100.00

Source: Bonnenfant et al. 2009.

Note: Acres planted vary from year, particularly the number of acres fallowed.

Environmental Consequences

This section describes the impact analysis relating to land use and agriculture for the Proposed Project and other alternatives. It also lists the criteria used to conclude whether an impact would be adverse or beneficial.

Assessment Methods

For land use and agriculture impacts, the Proposed Project and alternatives were qualitatively compared to existing land uses, planned land uses, and known trends in the study area.

For agricultural impacts, the estimated potential reduction in irrigated land that could result from implementation of the Acquisition Program is summarized in Table 7-3. Details of the estimates are described in Chapter 3, Water Resources. These acreages are in addition to land already fallowed in the study area.

The potential fate of the involved lands differs by action alternative. For Alternative 1 (Proposed Project), willing sellers of land, water appurtenant to the land, and related interests are typically offering for sale appurtenant water rights and related interests. (This is more fully described in Chapter 2, Alternatives.) Once the water rights are permanently transferred, the associated lands that currently are irrigated could be retired from agricultural production or be converted to other uses. However, it is also possible that some sellers may maintain their lands in agriculture by engaging in activities that do not require irrigation (e.g., dry land grazing) or by transferring water rights from another parcel.

For Alternative 2 (Leasing Alternative), water leases would be temporary and affected lands would not be expected to be permanently removed from agricultural production. It is assumed that, in the implementation of Alternative 2, landowners would not repeatedly lease their water from the same parcel beyond the expected 3- to 5-year lease period. However, lands are expected to be fallowed, and the overall reduction in irrigated acreage would be similar to that for Alternative 1.

It therefore is not certain how many acres of land would cease irrigated agricultural production as a result of implementing Alternatives 1 or 2. For the purposes of this analysis, however, the impacts were based on the maximum possible reduction in irrigated acreages (i.e., 33% each in Mason Valley, Smith Valley, and East Walker, as described in Chapter 2, Alternatives). It is expected that permanent acquisition of water rights would lead to retirement from agriculture of a substantial portion of the involved lands. Retirement is considered a land use change.

With Alternative 3 (Efficiency Alternative), water would be acquired through the implementation of water conservation and efficiency measures and lands involved in on-farm efficiency measures would be expected to continue practicing irrigated agriculture.

Other assumptions of the impact analysis are identified below.

- A policy conflict has no magnitude (i.e., either a policy conflict exists or it does not). As indicated in the impact criteria section below, an environmental impact that conflicts with adopted land use policies leads to a determination of an adverse impact.
- Incompatible land uses do have magnitude (i.e., a greater amount of land with incompatible uses is a greater impact). Also indicated below, environmental impacts that are incompatible with uses of adjacent lands are considered to be adverse impacts.

Table 7-3. Estimated Impacts on Irrigated Land

	Alternative 1[a]		Alternative 2[a]		Alternative 3[c]
	Full Transfer Scenario	33% Scenario	Full Transfer Scenario	33% Scenario	75% Water-Use Efficiency
Maximum Reduction in Irrigated Land (percent)[b]					
East Walker	27	33	27	33	0
Smith Valley	24	33	24	33	0
Mason Valley	27	33	27	33	0
Weighted Average	26	33	26	33	0
Maximum Reduction in Irrigated Land (acres)[b]					
East Walker	1,100	1,300	1,100	1,300	0
Smith Valley	4,200	5,800	4,200	5,800	0
Mason Valley	9,500	11,500	9,500	11,500	0
Weighted Average	14,800	18,600	14,800	18,600	0

Notes:

Many assumptions were used in generating these estimates. See Chapter 3, Water Resources, for a description of the assessment methods.

a. For Alternatives 1 and 2, it was assumed that the amount of money available would be sufficient to fully fund the Alternative.

b. Estimated reduction in irrigated land assumes no increase in water-use efficiency.

c. Water savings assume no change in crop evapotranspiration, as could result from crop switching.

The quality of farmland that could be affected by the project will be addressed in the LESA analysis, which will be prepared to comply with the requirements of the FPPA. This analysis will be incorporated into the Final EIS. (For further discussion, see Impact LU-1, below.)

Impact Criteria

Impacts on land use would be considered adverse if implementation of the Proposed Project or an alternative would:

- physically divide an established community or be incompatible with adjacent land uses in the short or long term;
- conflict with any applicable land use plan, policy, or regulation (e.g., a general plan or zoning ordinance) that has been adopted by an agency with jurisdiction in the study area;
- conflict with proposed or approved development plans or adopted zoning; or
- convert existing agricultural land to nonagricultural use or impair its agricultural productivity.

An impact was considered beneficial if it resulted in an increase in agricultural productivity.

Impacts

No Action Alternative

The population in Lyon County is expected to grow, even in the more rural southern portion of the county located in the study area. One factor affecting growth would be growth in industry, such as the opening of the Pumpkin Hollow Mine. Population growth likely could change land use in Lyon County because increases in population sometimes create pressure to develop agricultural land. In addition, according to the Planning and Issues Opportunities paper written for the Comprehensive Master Plan update (Lyon County 2007):

> Many younger generation people are opting to not continue farming and ranching. Many of the younger generation commute to work to Douglas and Washoe counties and to Carson City. This trend may contribute to potentially declining and changing agricultural lands in the county, and may eventually occur more in the Smith and Mason Valleys.

The plan also presents the intention of the county to retain agriculture and the rural feel of Smith and Mason Valleys as much as possible. Nevertheless, substantial conversions have occurred in the past, and some amount of land would be expected to convert from agriculture to other uses, such as commercial or

residential, but there are no known estimates for the study area of future agricultural land use conversion.

Despite growth pressures in that portion of Lyon County located in the study area, under the No Action Alternative agriculture would continue to be an important part of the economy and culture.

As described in the Affected Environment, the population in Mineral County is expected to continue to decrease. A population decrease could be expected to reduce the number of occupied residences and commercial businesses. Use of public facilities would also be expected to decline.

Under the No Action Alternative, land use conditions at the Walker Lake SRA would also be expected to decline as the lake elevation dropped.

Other currently unknown land uses changes unrelated to the Acquisition Program also could occur in the future on BLM, USFS, DOD, WMA, YPT, or WRPT lands, but no specific changes are anticipated.

Alternative 1 (Proposed Project)

Water rights acquired under Alternative 1 are expected to add an average of 50,000 af/yr of water to Walker Lake. It is possible, however, that less than the average 50,000 af/yr would be provided to the lake either because of funding limitations or because there would not be enough willing sellers. With current funding, it is estimated that average inflow to the lake would increase by 7,300 af/yr.

The analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that water rights acquired would increase the average annual inflow to the lake by 50,000 af/yr. Unless otherwise noted, if acquisitions were limited to those achievable only with the existing funding allocation, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Direct Impacts

Impact LU-1: Conflict with Requirements of the Farmland Protection Policy Act (No Impact)

Under Alternative 1, it is anticipated that most acquisitions would involve agricultural land, which could lead to a reduction in the number of acres in agricultural use in the study area. If sufficient appurtenant water is sold from the land, the land could be taken out of agricultural use, possibly resulting in retirement of that land or conversion to other uses (Table 7-3). This retirement or conversion would affect prime farmland and farmland of statewide importance in the study area, primarily in Mason, Smith, and East Walker Valleys. To comply

with FPPA, a programmatic LESA analysis is being developed for Mason, Smith, and East Walker Valleys, and impacts of Alternative 1 on these areas will be evaluated as part of the Final EIS. This study would meet the requirements of FPPA (Appendix 1A). FPPA does not require that an agency modify its project to protect farmland, only that it evaluate the impacts and consider alternatives. Therefore, the Proposed Project would not conflict with requirements of FPPA. There would be no impact.

There would be no conflict with either full or existing funding.

Impact LU-2: Conflict with Lyon County and City of Yerington Land Use Policies (Adverse Impact)

Under Alternative 1, the number of acres in agriculture would likely be reduced as a result of land retirement (i.e., land being taken out of agriculture) or conversion caused by acquisition of land, water appurtenant to the land, or related interests (see Table 7-3 and its preceding discussion).

The majority of acquisitions are expected to occur in Lyon County. This land use change would conflict with the agricultural preservation policies of the Lyon County Master Plan (Appendix 1A) and with the City of Yerington land use zoning map (Figure 7-5). This land use change would be an adverse impact.

This conflict would occur with either full or existing funding.

Impact LU-3: Conflict with Lyon County Master Plan Policies on Retaining Water Resources (Adverse Impact)

Under Alternative 1, water rights would be acquired and exported outside the county to Walker Lake in Mineral County (Table 7-3). This exportation would conflict with Lyon County Conservation and Natural Resources Goal 1 on retaining water resources within the county (Appendix 1A). This conflict would be an adverse impact.

This conflict would occur with either full or existing funding.

Impact LU-4: Affect Productivity of Irrigated Agricultural Land (Adverse Impact)

Under Alternative 1, it is anticipated that most acquisitions would involve agricultural land, which would lead to a reduction in the amount of water applied to agricultural lands in the study area (see Table 7-3 for maximum acres that could be affected). This reduction would impair agricultural productivity in the study area.

Agricultural productivity is equal to *agricultural output* (e.g., yield) minus the *agricultural input* (e.g., labor, capital, materials, including water) (U.S.

Department of Agriculture 2009). On active agricultural properties where water rights for irrigation are sold, agricultural production would halt, be replaced by dry land agriculture (e.g., used as dry pasture), or be sustained by transferring water rights (e.g., a primary groundwater right) from another parcel. As a result, agricultural productivity would decline on the land involved with the acquisition, except in the last case, which is expected to occur rarely because there are considerable prerequisites that must be met to complete a transfer. (See Chapter 3, Water Resources, for a discussion of transference of primary groundwater rights.) Given the scale of the Proposed Project and the likelihood that land would be retired, overall agricultural productivity is expected to decrease in the study area, primarily in the Mason, Smith, and East Walker Valleys. This would be an adverse impact.

The adverse nature of this impact would be the same with either full or existing funding, but the magnitude of the impact is expected to be proportional to the amount of allocated funding.

Impact LU-5: Comply with Land Use Goals in the Mineral County Master Plan (Beneficial Impact)

Under Alternative 1, the average increased inflow of 50,000 af/yr of water would improve conditions at Walker Lake. This improvement would support goals in the Mineral County Master Plan to preserve and improve outstanding natural, historic, or scenic features in the county and to restore health and functioning to the county's natural resources (Appendix 1A). This would be a beneficial impact.

It is estimated that acquisitions limited to existing allocated funding would increase average inflows to Walker Lake by approximately 7,300 af/yr. This increase would be insufficient to significantly improve the ecology of the lake, but it would begin the process of reversing the lake's decline. Existing allocated funding would not by itself achieve Mineral County's goals as they apply to Walker Lake, but it would contribute toward those goals to a greater degree than the No Action Alternative.

Indirect Impacts

Impact LU-6: Create Incompatible Land Uses as a Result of Invasive Plant Species Colonization on Retired Agricultural Land (Adverse Impact)

Under Alternative 1, land, water appurtenant to the land, or related interests would be acquired, and agricultural land could be retired or converted to nonagricultural uses. If invasive plant species were allowed to extensively colonize the land, this would threaten or actually cause the spread of these weeds to adjacent lands. (See Chapter 4, Biological Resources—Vegetation and Wetlands, for a discussion of invasive plants.) It is unknown exactly how lands involved in acquisitions would be managed after the sales are complete.

However, it is expected that invasive plants could colonize retired land. Invasive plant colonization on lands involved in acquisitions would constitute a land use that is incompatible with adjacent crop production. This would be an adverse impact.

The adverse nature of this impact would be the same with either full or existing funding, but the magnitude of the impact is expected to be proportional to the amount of allocated funding.

Alternative 2 (Leasing Alternative)

Because Alternative 2 requires recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/yr, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years.

Unless otherwise noted, the impacts of Alternative 2 would be similar in magnitude (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, only temporary.

Direct Impacts

Direct Impacts Similar to Alternative 1

Impact LU-1: Conflict with Requirements of the Farmland Protection Policy Act (No Impact)

Alternative 2 poses no potential for conflict with the FPPA because the FPPA applies only to federal projects that would convert farmland to nonagricultural uses (Appendix 1A). Under Alternative 2, appurtenant water would be leased from any particular parcel for only short periods of time as determined by the landowner and the parameters of the leasing program, and it is expected the land would remain in agricultural use. Therefore the FPPA would not apply. There would be no conflict with the FPPA and no impact.

There would be no conflict with either full or existing funding.

Impact LU-3: Conflict with Lyon County Master Plan Policies on Retaining Water Resources (Adverse Impact)

Under Alternative 2, the leasing program would be temporary. Whereas Alternative 1 would involve the permanent transfer of water rights to benefit Walker Lake, Alternative 2 would involve increased amounts of water leaving Lyon County for a limited period of time. Accordingly, the leasing program's conflict with Lyon County's policy on water resources (Appendix 1A) would also be temporary (ranging from 3 to 20 years, depending upon available funding). This would be an adverse impact but temporary.

This conflict would occur with either full or existing funding, but the duration of the conflict would be proportional to the amount of funding.

Impact LU-4: Affect Productivity of Irrigated Agricultural Land (Adverse Impact)

Under Alternative 2, it is anticipated that most acquisitions would involve agricultural land, which would lead to a reduction in the amount of water applied to agricultural lands in the study area. This reduction would impair the agricultural productivity of the land for the duration of the lease because it is expected that most land would be fallowed (see Table 7-3 for maximum acres that could be affected). The decrease would be an adverse impact.

The individual properties directly affected would change as fallowed land is brought back into production at the end of a lease and new leases are acquired on other lands. However, the impact in the study area would be similar in magnitude to that for the fully funded Alternative 1, for the duration of the leasing program.

The adverse nature of the impact would be the same with either full or existing funding of the Leasing Alternative, but the magnitude of the impact is expected to be proportional to the amount of allocated funding.

Impact LU-5: Comply with Land Use Goals in the Mineral County Master Plan (Beneficial Impact)

Under Alternative 2, an additional average inflow of 50,000 af/yr of water could be delivered to Walker Lake for the duration of the leasing program. Over an extended period of time such as 20 years, this water would substantially improve conditions at Walker Lake. This improvement would support goals in the Mineral County Master Plan to preserve and improve outstanding natural, historic, or scenic features in the county and to restore health and functioning to the county's natural resources (Appendix 1A). This would be a beneficial impact.

With existing allocated funding only, however, a 3-year leasing program would produce only slight benefit to Walker Lake compared to existing conditions and only slight progress toward these Mineral County goals. Nevertheless, it would provide some benefit compared to existing conditions and greater compliance with the Mineral County goals than the No Action Alternative.

Impact LU-6: Create Incompatible Land Uses as a Result of Invasive Plant Species Colonization on Retired Agricultural Land (Adverse Impact)

Under Alternative 2, irrigation water would be leased, which could result in the cessation of agricultural production for the duration of the lease. If invasive plant species were allowed to establish on that land and spread unchecked to adjacent and nearby agricultural fields, this would create an incompatible land use. It is unknown exactly how lands involved in acquisitions would be managed, but

invasive plants could colonize fallowed land. Invasive plant colonization on lands involved in acquisitions would constitute a land use that is incompatible with adjacent crop production. This would be an adverse impact.

The adverse nature of the impact would be the same with either full or existing funding of the Leasing Alternative, but the magnitude of the impact is expected to be proportional to the amount of allocated funding.

Direct Impacts Different from Alternative 1

Direct impacts of Alternative 2 that differ from those of Alternative 1 in important ways are discussed in more detail below.

Impact LU-2: Conflict with Lyon County and City of Yerington Land Use Policies (No Impact)

Under Alternative 2, there likely would be no change in land use, and therefore Alternative 2 would not conflict with Lyon County or Yerington land use policies (Appendix 1A). As indicated previously, it is assumed that Alternative 2 would be implemented in such a manner that landowners would not repeatedly lease the water for the same parcel for an extended number of years and thereby effectively retire the land. Thus, no change in land use is expected under this alternative because water would be leased for only a limited number of years and the land would then be returned to agricultural production. Alternative 2 would not conflict with Lyon County and Yerington land use policies. There would be no impact.

There would be no conflict with either full or existing funding.

Alternative 3 (Efficiency Alternative)

Full implementation of Alternative 3 would yield an average inflow of 32,200 af/yr to Walker Lake. Unless otherwise noted, the impacts of Alternative 3 would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, but of less magnitude.

Direct Impacts

Direct Impacts Similar to Alternative 1

Direct impacts under Alternative 3 that would be similar to those under Alternative 1 are discussed below.

Impact LU-1: Conflict with Requirements of the Farmland Protection Policy Act (No Impact)

Alternative 3 poses no potential for conflict with the FPPA because the FPPA applies only to federal projects that would convert farmland to nonagricultural uses (Appendix 1A). Under Alternative 3, efficiency measures would make irrigation water supplies available for acquisition but the land would remain in agricultural production. Therefore, the FPPA would not apply. There would be no conflict with the FPPA and no impact.

Impact LU-3: Conflict with Lyon County Master Plan Policies on Retaining the County's Water Resources (Adverse Impact)

Although Alternative 3 would enable sellers to maintain agricultural production, substantially more water would leave Lyon County to benefit Walker Lake than under existing conditions or under the No Action Alternative. This would conflict with Lyon County Conservation and Natural Resources Goal 1 for retaining the county's water resources within the county (Appendix 1A). This conflict would be an adverse impact.

Impact LU-5: Comply with Land Use Goals in the Mineral County Master Plan (Beneficial Impact)

Increased average inflows of 32,200 af/yr would improve conditions at Walker Lake. This improvement would support goals in the Mineral County Master Plan to preserve and improve outstanding natural, historic, or scenic features in the county and to restore health and functioning to the county's natural resources (Appendix 1A). This would be a beneficial impact.

Direct Impacts Different from Alternative 1

Indirect impacts of Alternative 3 that differ from those of Alternative 1 in important ways are discussed below.

Impact LU-2: Conflict with Lyon County and City of Yerington Land Use Policies (No Impact)

Under Alternative 3, there likely would be no change in land use, and therefore Alternative 3 would not conflict with Lyon County or Yerington land use policies (Appendix 1A). No change in land use is expected under this alternative because water would be acquired through conservation and the land would continue to be in agricultural land use. There would be no impact.

Impact LU-4: Affect Productivity of Irrigated Agricultural Land (No Impact)

Under Alternative 3, land involved in on-farm efficiency measures would remain productive. The impact of the alternative depends on whether water would be conserved by improving system efficiencies or on-farm efficiencies, and whether on-farm efficiency would be improved by crop switching or increased water efficiency using the same crops. For on-farm water efficiency measures,

agricultural productivity could increase if the agricultural output (e.g., yield) remained the same or declined only slightly while agricultural inputs are substantially decreased (by the reduction in water applied). However, because of the uncertainties related to how water would be conserved (i.e., system efficiencies vs. on-farm efficiencies and crop switching versus water efficiency), this is considered to be no impact.

Indirect Impacts

Indirect Impacts Different from Alternative 1

Indirect impacts of Alternative 3 that differ from those of Alternative 1 in important ways are discussed below.

Impact LU-6: Create Incompatible Land Uses as a Result of Invasive Plant Species on Retired Agricultural Land (No Impact)

Under Alternative 3, land involved in on-farm efficiency measures would remain in agricultural production. It is expected that land use practices would be similar to existing practices and that invasive plant species would not be allowed to establish on the land and spread unchecked to adjacent agricultural fields. Land use would be compatible with adjacent crop production. There would be no impact.

Chapter 8 Air Quality

Introduction

This section describes the affected environment for air quality and the potential impacts on air quality that would result from the Proposed Project and other alternatives.

The major air quality issue related to the Proposed Project and other alternatives would be fugitive dust generated from winds over the exposed lakebed of Walker Lake and newly retired farmland in the Walker River Basin. Windblown dust in Mineral and Lyon County resulting from the implementation of the Proposed Project and other alternatives would represent an adverse impact on regional air quality. The degree of impact for each alternative depends on the level of funding for acquisitions.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- EPA, Region 9 Air Plan Actions (U.S. Environmental Protection Agency 2009)
- EPA Monitor Value Reports—Criteria Air Pollutants (U.S. Environmental Protection Agency 2008)
- Nevada Bureau of Air Quality Planning (2003)
- Great Basin Unified Air Pollution Control District (2008)

Affected Environment

This section describes the environmental setting related to air quality in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for the analysis of air quality impacts includes only Lyon and Mineral Counties in Nevada. However, because air pollution may cross county lines and there is no pollutant monitoring within the study area, background information is obtained from beyond the study area.

Nevada Bureau of Air Quality Planning (BAQP) has jurisdiction over air quality issues in Nevada. It administers air quality regulations developed at the federal, state, and local levels. Applicable federal, state, and local air quality regulations are described in Appendix 1B.

Local Meteorology and Climate Conditions

Climate and weather affect air quality conditions. In particular, precipitation, temperature, and wind influence the potential formation of dust storms. According to historic climate information from the National Weather Service, there are weather monitoring stations in the study area, in Yerington and Hawthorne (Figure 8-1). There is also a weather monitoring station at Bridgeport, California. Precipitation and temperature data for the study area are presented in Chapter 15, Climate and Climate Change. Wind data are presented below.

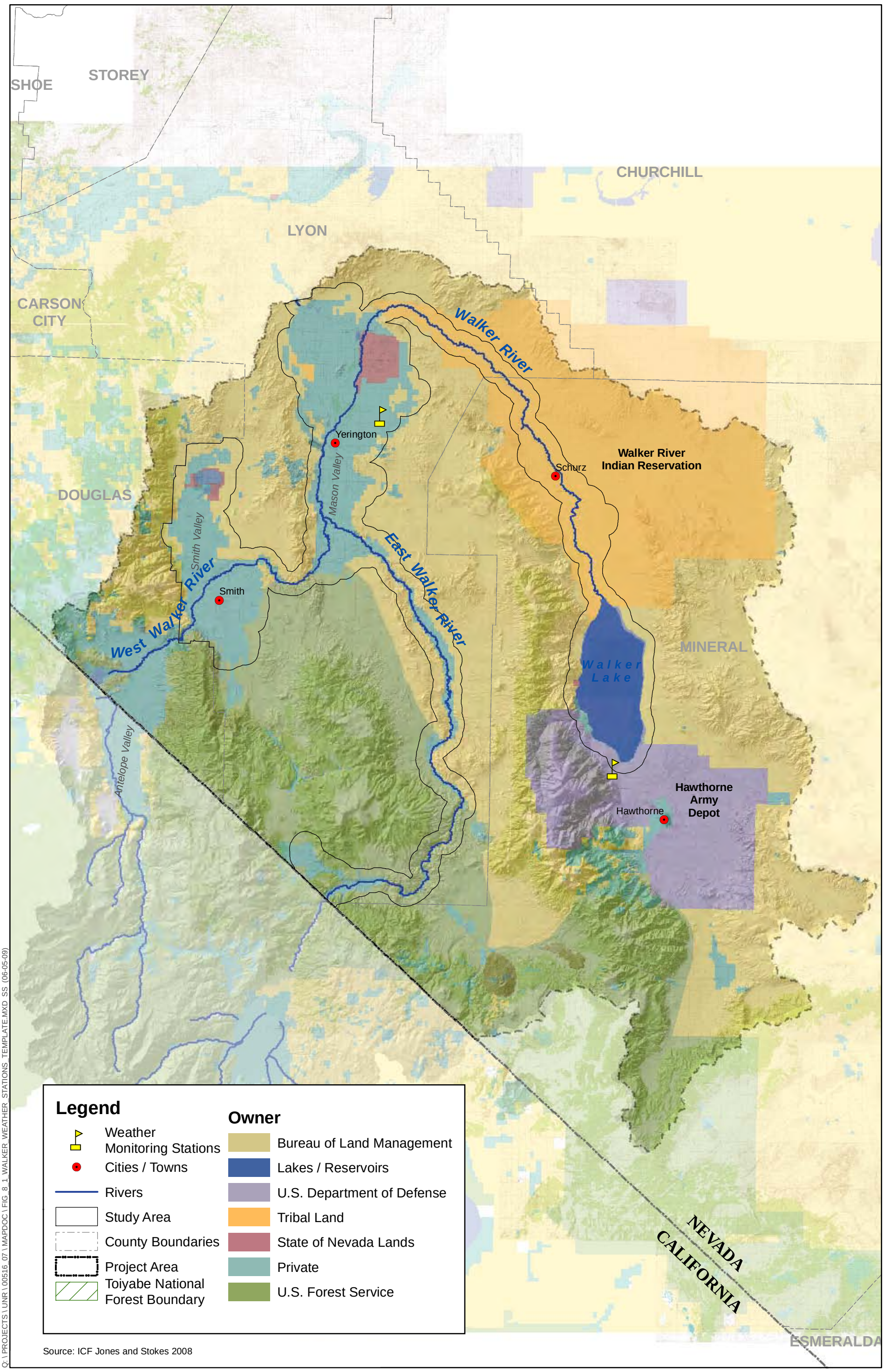
Wind Patterns

Walker River Basin topography has a dominating effect on wind patterns. Winds tend to blow somewhat parallel to the valley and mountain range orientation. In spring and early summer, thermal low-pressure systems develop over the interior basins east of the Sierra Nevada, and the Pacific high pressure cells move northward. These developments and the study area topography produce the high incidence of relatively strong northwesterly winds in the spring and early summer (Lopes et al. 2007).

Wind speed and direction data indicate that, during the summer, winds usually originate at the north end of the basin and flow southeasterly through the valleys. Wind speed and direction data indicate that, during the winter, winds occasionally originate from the west end of the basin and flow in a west-northwesterly direction. Steady winds are typical in the mountainous area.

National Weather Service operates wind monitoring stations in Hawthorne and Yerington. The prevailing wind directions at Hawthorne are from the west-northwest and north, although the station does experience southerly winds during the spring and summer. The prevailing wind direction at Yerington is from the west-southwest. The average annual wind speeds at the Yerington and Hawthorne stations are 2.9 and 7.4 mph, respectively (Western Regional Climate Center 2008). Thermal inversions are a regular occurrence in the desert southwest. Inversions can occur on any given day but are most common in the winter, evenings, and mornings. Inversions are affected by dry weather, changing air temperature, and changing ground temperature.

During 2008, the highest sustained wind speed at the Hawthorne Monitoring Station was recorded at 50 mph from the southwest, and the highest instantaneous wind gust speed of 71 mph was recorded from the west-southwest (Weather Underground 2009a). During 2008, the highest sustained wind speed at the Yerington Monitoring Station was 38.6 mph from the south-southeast, with a wind gust of 52.5 mph from the south. The prevailing wind direction over the entire year was from the west-northwest for Hawthorne and from the southwest for Yerington. Wind speeds are typically light, with most of the measurements below 10 mph. Data from the Yerington Mine site indicate that winds tend to



Source: ICF Jones and Stokes 2008

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an ICF International Company

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Figure 8-1
Weather Monitoring Stations within the Study Area

blow from the southwest or northeast, with a predominant southwest wind during high wind episodes (Atlantic Richfield Company 2008).

Table 8-1 presents a summary of wind speed and wind direction during 2008 for both the Walker Lake-Hawthorne Monitoring Site, located in Hawthorne at U.S. Highway 95 and operated by MesoWest under contract with the State of Nevada Department of Transportation; and the Yerington Monitoring Site, located north of U.S. Highway 95 on the Alpaca Mining Company property. Table 8-2 presents the summary of wind speed occurrence at both sites (Weather Underground 2009b).

Table 8-1. Wind Speeds and Direction in Study Area for 2008

Location	Maximum Wind Speed (mph) (Wind Direction)	Maximum Wind Gust (mph) (Wind Direction)	Average Wind Speed (mph)	Prevailing Wind Direction
Hawthorne	50.0 (SW)	71.0 (WSW)	6.8	WNW
Yerington	38.6 (SSE)	52.5 (S)	2.9	SW

Source: Weather Station Histories for MWLKNV station (Weather Underground 2009a) and KNVYERIN2 station (Weather Underground 2009b).

Table 8-2. Wind Speed Frequencies in Study Area

	Walker Lake – Hawthorne	Yerington – Lyon County	
Wind Speed Value Category (mph)	2008 Data (days)	2007 Data (days)	2008 Data (days)
≤ 10	148	81	56
11–15	100	124	120
16–21	60	67	118
22–29	45	27	44
30–49	9	13	18
≥ 50	3	1	1

Source: Weather Station Histories for MWLKNV station (Weather Underground 2009a) and KNVYERIN2 station (Weather Underground 2009b).

Note: Walker Lake-Hawthorne wind data only available for 2008.

Windblown dust in the Great Basin area is a significant air pollution concern. Long-term water diversions have led the alkaline, and now almost dry, Owens Lake to become the largest single source of windblown dust in the United States. Winds in the area often exceed 40 mph at a 33-foot height, which has led to particulate matter greater than 10 microns in size (PM10) concentrations often 80 times higher than NAAQS), and the highest concentrations are up to 133 times the NAAQS. Annual PM10 emissions caused by wind erosion of the Owens Lake bed are estimated at 76,000 tons per year (Great Basin Unified Air Pollution Control District 2008). Similarly, water diversion has led to similar wind erosion problems from Mono Lake, which has had 33 PM10 violations since 2005 (California Air Resources Board 2008).

Walker Lake elevations have declined 150 feet over the past 126 years, and the receding lake elevation has exposed outer portions of the lakebed making them susceptible to windblown dust. The drying of the shoreline at Walker Lake mimics the wind erosion and dust emissions conditions described above for Owens and Mono Lakes.

Soil Conditions

Because of the relatively low precipitation in the Walker River Basin, particularly in the lower elevations, direct precipitation contributes only sporadically to soil moisture. Groundwater conditions, agricultural irrigation, and proximity to surface water are the dominant influences on soil and sediment moisture conditions. The generally warm to hot air temperatures, along with low humidity and moderate winds, mean that soil surfaces are typically dry.

Soils determine the susceptibility of land to wind erosion (Western Regional Air Partnership 2006). For Lyon County, Table 8-3 shows the major soil associations that occur on irrigated lands in Mason Valley, Smith Valley, and East Walker Valley. Figure 8-2 shows the distribution of soil associations in the area. Most of the soil associations in Lyon County contain at least one soil series with high susceptibility to wind erosion.

Table 8-3. Major Soil Associations of Irrigated Land in Lyon County Portion of Study Area

Soil Association	Predominant Soils	Drainage Class	Permeability	Wind Erodibility Group[a]
Fallon-East Fork-Dithod-Dia (s5701)	East Fork, Dithod, Fallon, Appian	Primarily somewhat poorly drained	Moderately slow to moderately rapid	Primarily 5–6, but Fallon and Appian soils are more erodible (1–3)
Swingler-Sonoma-Sondoa-Isolde (s5702)[c]	Sondoa, Sonoma, Isolde, Swingler	Varied	Primarily moderately slow	1–4[b]
Wabuska-Voltaire-Lahontan (s5700)	Lahontan, Voltaire, Wabuska	Poorly drained	Slow	Primarily 4[b]

Soil Association	Predominant Soils	Drainage Class	Permeability	Wind Erodibility Group[a]
Yerington-Malpais (s5704)	Yerington, Malpais	Well drained	Moderately rapid	2–4
Smedley-Rawe-Perazzo-Cleaver (s5706)	Cleaver, Rawe, Perazzo, Smedley	Well drained	Slow	Greatly varied[b]
Veta-Hotsprings-Holbrook-Haybourne-Charlebois (s5705)	Veta, Holbrook, Hotsprings, Haybourne, Charlebois	Well drained	Moderate to rapid	Varied but mainly 4–6

Notes: Data based on compilation of information in Archer 1984, McKay pers. comm., and Natural Resources Conservation Service (2006b—g) data.

Map units listed according to relative extent in the study area.
Descriptions based on average characteristics.

[a] Wind erodibility groups are soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. Group 1 is most susceptible to wind erosion and Group 8 least.

[b] Data not found for some units.

[c] Natural Resources Conservation Service 2006 data unavailable.

In Mineral County, the main soil of interest is Typic Torriorthents, 4 to 15% slopes, because of its exposure to wind erosion caused by the receding Walker Lake elevation. This soil is in Wind Erodibility Group 3 and therefore is susceptible to wind erosion (Natural Resource Conservation Service 2006a).

Existing Air Quality Conditions

Douglas, Lyon, and Mineral Counties in Nevada are each currently in attainment or are unclassified for air quality. However, dust and sand storms occur on a regular basis throughout the year within the study area (Atlantic Richfield Company 2008). While outside of the study area, portions of Mono County, within the Great Basin Valleys Air Basin of California, are included for comparative purposes because these areas illustrate the impact of increasing the amount of erodible soils in a windy landscape. Portions of the Great Basin Valley are considered nonattainment areas for PM10, largely as a result of windblown dust from the exposed lakebeds of Mono and Owens Lake during high wind events. The Owens Lake, Mono Basin, Coco Junction, and Mammoth Lakes areas have PM10 attainment plans in place.

Nevada operates a series of air quality monitoring stations near large population centers. In addition, air quality monitoring occurs at and adjacent to the Anaconda Mine site, located just west of the town of Yerington, in Weed Heights, and operated by the Atlantic Richfield Company. There are PM10 air pollutant monitoring stations at Mono Lake and Lee Vining, in Mono County, California,

south of the study area. These stations are operated by the California Air Resources Board (CARB). There are air pollutant monitoring stations in Reno and Sparks, in Washoe County, north of the study area, operated by BAQP. Air pollution monitoring also occurred in the town of Fallon from 1993 to 1998 (Nevada Bureau of Air Quality Planning 2003).

Table 8-4 provides an indication of ambient air quality conditions in the vicinity of the study area. Only the Yerington Mine site is within the study area. Air monitoring data from outside of the study area is presented to provide an indication of the background air quality in the region. For example, air monitoring data from Mono Lake is representative of the potential fugitive dust (PM10) consequences of a drying lake bed. Air pollutant monitoring data collected at these nearby monitoring stations is presented for the years 2005 through 2008.

Table 8-4. Ambient Air Pollutant Concentrations Monitored in the Vicinity of Study Area

Pollutant Standards	**2005**	**2006**	**2007**	**2008**
Ozone—Carson City E. Long Street				
Maximum 1-hour concentration (ppm)	0.072	0.086	0.080	0.106[1]
Maximum 8-hour concentration (ppm)	0.066	0.075	0.072	0.079
Number of Days Standard Exceeded				
AAQS (1-hour) > 0.12 ppm	8	0	0	0
AAQS (8-hour) > 0.075 ppm	5	0	0	3
Particulate Matter (PM10) – Yerington Mine Site[3]				
Maximum 24-hour concentration ($\mu g/m^3$)	60.8	38.25	165.6	NA
Maximum 1-hour concentration ($\mu g/m^3$)	435[2]	918[2]	1,200	NA
Number of Days Standard Exceeded				
AAQS (24-hour) > 150 $\mu g/m^3$	0	0	1	NA
Particulate Matter (PM10) –Mono Lake North Shore				
Maximum 24-hour concentration ($\mu g/m^3$)	2,108	4,300	10,020	2,769
Second-highest 24-hour concentration	1,245	1,915	2,736	2,563
Annual average concentration ($\mu g/m^3$)	83.5	93.2	137.0	69.0
Number of Days Standard Exceeded				
AAQS (24-hour) > 150 $\mu g/m^3$	14	16	14	7
Particulate Matter (PM10) –Lee Vining				
Maximum 24-hour concentration ($\mu g/m^3$)	30	95	46	78
Second-highest 24-hour concentration	30	44	35	66
Annual average concentration ($\mu g/m^3$)	11.1	11.1	11.5	15

Pollutant Standards	2005	2006	2007	2008
Number of Days Standard Exceeded				
AAQS (24-hour) > 150 μg/m^3	0	0	0	0
Particulate Matter (PM2.5) –Reno- A Street				
Maximum 24-hour concentration (μg/m^3)	64	29	27	115
Annual average concentration (μg/m^3)	9.0	7.7	8.0	10.5
Number of Days Standard Exceeded				
AAQS (24-hour) > 35 μg/m^3	0	0	0	1
AAQS (annual) > 15 μg/m^3 exceeded?	No	No	No	No
Carbon Monoxide (CO)—Reno A Street				
Maximum 8-hour concentration (ppm)	3.0	2.9	2.2	1.3
Maximum 1-hour concentration (ppm)	4.3	3.6	3.7	2.1
Number of Days Standard Exceeded				
Carbon Monoxide (CO)—Sparks 4th Street				
Maximum 8-hour concentration (ppm)	3.3	3.5	3.2	2.1
Maximum 1-hour concentration (ppm)	4.5	4.9	4.7	4.2
Number of Days Standard Exceeded				
National AAQS (1-hour) ≥ 35 ppm	0	0	0	0
Nevada AAQS (8-hour) ≥ 9.0 ppm	0	0	0	0
Nevada AAQS (1-hour) ≥ 20 ppm	0	0	0	0

[1] 2008 Ozone monitoring data is from Carson City—3300 East Fifth St (City Yard)

[2] 2005 and 2006 1-hour Yerington Mine Site PM data was adjusted from 24-hour data

[3] Air pollution monitoring was conducted by the Atlantic Richfield Company

ppm parts per million

AAQS ambient air quality standards

μg/m^3 micrograms per cubic meter

mg/m^3 milligrams per cubic meter

> greater than

≥ equal to or greater than

Sources: U.S. Environmental Protection Agency 2009 and Atlantic Richfield Company 2008.

Air pollution monitoring at the Fallon – West End School monitoring station indicate that from 1993 through1998, PM10 did not exceed NAAQS, which led EPA to discontinue monitoring at this site (Churchill County 2005). Air pollution monitoring from the Yerington Mine site indicate that from 2005 to 2007, only once did the maximum 24-hour PM10 concentration exceed NAAQS. However, residents in the vicinity of the site have reported approximately five episodes per year of significant amounts of airborne dust. The primary mechanism for these dust events is wind erosion. However, not every high wind episode resulted in a dust event, suggesting that other factors also contribute to dust in the area (Atlantic Richfield Company 2008).

Particulate Matter

Suspended particulate matter represents a diverse mixture of solid and liquid material having size, shape, and density characteristics that allow the material to remain suspended in the air for meaningful time periods. The physical and chemical composition of suspended particulate matter is highly variable, resulting in a wide range of public health concerns. Many components of suspended particulate matter are respiratory irritants. Some components (such as crystalline or fibrous minerals) are primarily physical irritants. Other components are chemical irritants (e.g., sulfates, nitrates, and various organic chemicals). Suspended particulate matter also can contain compounds (such as heavy metals and various organic compounds) that are systemic toxins or necrotic agents. Suspended particulate matter or compounds adsorbed on the surface of particles also can be carcinogenic or mutagenic chemicals.

Current federal and state air quality standards for suspended particulate matter generally are designated as PM10 standards (for inhalable particulate matter) and particulate matter smaller than 2.5 microns in size (PM2.5) standards (for fine particulate matter). Public health concerns focus on the particle size ranges likely to reach the lower respiratory tract or the lungs. Inhalable particulate matter (PM10) is likely to reach either the lower respiratory tract or the lungs after being inhaled; fine particulate matter (PM2.5) is likely to penetrate to the lungs. Particles larger than 2.5 microns are referred to as the coarse fraction and those 2.5 microns and smaller are referred to as the fine fraction. Coarse particles (10 microns and less) come from a variety of sources, including geological (e.g., windblown fugitive dust), general mechanical operations (e.g., automobile tire wear), industrial processes (e.g., cutting and grinding), and the resuspension of particles from the ground or road surfaces by wind and human activities.

In contrast, particles smaller than 2.5 microns are derived mostly from fuel combustion sources, such as automobiles, trucks, and other vehicle exhaust, and from stationary combustion sources, such as power plants. These fine particulates are directly emitted or are formed in the atmosphere from gases that are emitted.

Particulate matter, in the form of fugitive dust, is the air pollutant of greatest concern in the Walker River Basin. Because most of the available surface water is diverted for human and agricultural uses in most years, Walker Lake elevation is expected to continue to decline and increase the potential for windblown fugitive dust storms during periods of high winds. As upstream surface water diversions continue, land surfaces that previously were wet or stabilized by vegetation will become increasingly susceptible to deflation (erosion by wind), resulting in desertification and dust storms.

Air monitoring at the Yerington Mine site indicates that dust storms are an infrequent by not uncommon occurrence within the area. These dust events primarily occur during high wind episodes, but not every high wind episode results in a dust event. This suggests that other factors, including soil moisture and seasonality, are also factors in producing dust events in the area. Since the Air Pollution Monitoring Program began in 2005, only once has 24-hour PM10 concentration exceeded the NAAQS (Atlantic Richfield Company 2008).

PM10 and fugitive dust sources within the area include mining activities, exposed soils, agricultural activities, and both paved and unpaved road dust.

Health Effects

PM10 and PM2.5 particles are small enough—about one-seventh the thickness of a human hair, or smaller—to be inhaled into and lodge in the deepest parts of the lung, evading the respiratory system's natural defenses. PM10 and PM2.5 can aggravate respiratory disease, and cause lung damage, cancer, and premature death (U.S. Environmental Protection Agency 2003).

Other Effects

In addition to public health effects, suspended particulate matter causes a variety of material damage and nuisance effects: abrasion; corrosion, pitting, and other chemical reactions on material surfaces; soiling; and transportation hazards resulting from visibility impairment. Non-health-related effects include reduced visibility and soiling of buildings.

Effects on the Environment

The fine particles that are linked to serious health effects are also a major cause of visibility impairment (regional haze) in many national parks. The term regional haze means haze that impairs visibility in all directions over a large area. Regional haze consists of sufficient smoke, dust, moisture, and vapor suspended in air to impair visibility. In the west, haze currently reduces natural visibility from approximately 140 miles to between 33 and 90 miles (U.S. Environmental Protection Agency 2007).

Environmental Consequences

This section describes the impact analysis relating to air quality for the Proposed Project and other alternatives. It lists the criteria used to conclude whether an impact would be adverse or beneficial.

Assessment Methods

Impacts were determined by evaluating expected future conditions with each alternative versus the baseline of existing conditions and trends. An alternative's impact is the future direction and magnitude of change from baseline conditions that is attributable to the alternative.

The primary pollutant-generating sources associated with the Proposed Project and other alternatives are:

- windblown fugitive dust,
- exhaust emissions from construction equipment and work vehicles, and
- fugitive dust emissions from construction activities for efficiency measures.

The approach to evaluating impacts for each of these sources is described below. Because all acquisitions would occur in the State of Nevada, the impact evaluation did not consider air quality standards specific to California. Only discussions of the impact methodology and significance criteria that are relevant within the State of Nevada are provided below.

Windblown Fugitive Dust

The potential for air quality problems associated with soils exposed on affected agricultural lands and from areas exposed by lowered Walker Lake water elevation were evaluated qualitatively. This evaluation was based on factors important to wind erosion processes:

- wind speed and wind direction patterns, and
- other meteorological data such as seasonal temperature patterns, seasonal precipitation patterns, and seasonal evaporation rate patterns.

The wind velocity necessary to initiate wind erosion processes depends on the characteristics of exposed soil and sediment materials and the surface moisture content of those materials. Where the surface material is dry and there is no cementing or crusting of the materials, threshold wind velocities depend primarily on particle size and density characteristics. Typical threshold wind speeds are in the range of 15 to 20 mph. Serious dust storm events generally require wind speeds above 20 mph. The World Meteorological Organization (1983) suggests

16 mph as a typical threshold wind speed for “everyday wind erosion” and 22 mph as a typical threshold wind speed for dust storm events. Those thresholds were adopted for this analysis.

Vehicle Exhaust Emissions

The potential exists for exhaust emissions from vehicles and construction equipment associated with efficiency measures. The magnitude of these emissions is not known because the extent of future construction activities is not yet known. Therefore, potential air quality impacts from on- and off-road exhaust emission sources are discussed in a qualitative manner.

Construction Fugitive Dust Emissions

Construction activities associated with any efficiency or conservation measures have the potential to result in fugitive dust emissions. The magnitude of construction activities is not yet known. Therefore, potential fugitive dust emissions are discussed in a qualitative manner.

Construction-related dust emissions would vary depending on the level of activity, length of the construction period, specific construction operations, types of equipment, number of personnel, wind and precipitation conditions, and soil moisture content. Despite this variability in construction emissions, a number of feasible control measures can be reasonably implemented to reduce PM10 and PM2.5 emissions during construction. These standard control measures include:

- watering active construction areas as needed or apply a nontoxic soil stabilizer,
- covering trucks hauling loose materials or maintain 2 feet of freeboard,
- applying soil stabilizers to or reclaim or revegetate inactive construction areas that will not undergo further activity for an extended period of time,
- covering or applying soil stabilizers to exposed stock piles, and
- limiting traffic speeds in the construction area and along access roads (Western Regional Air Partnership 2006).

The implementation of standard dust control measures would help to minimize fugitive dust from construction activities. It is assumed that these dust control measures would be implemented as part of any construction activity.

Impact Criteria

For the purposes of this air quality, actions that violate federal standards for criteria pollutants (i.e., primary standards designed to safeguard the health of people considered to be sensitive receptors while outdoors and secondary standards designed to safeguard human welfare) are considered adverse impacts.

Additionally, actions that violate state standards developed by BAQP or criteria of EPA General Conformity Rules, including thresholds for criteria pollutants, are considered adverse impacts. Because the study area is currently in attainment and/or unclassified under the EPA, no quantifiable thresholds were established for the Proposed Project and other alternatives. Impacts are discussed in a qualitative manner.

Impacts on air quality would be considered adverse if the Proposed Project or an alternative would directly or indirectly:

- produce emissions that would cause or measurably contribute to a violation of state or federal ambient air quality standards, or
- produce fugitive dust emissions that would reduce visibility and may cause human health effects.

Impacts

No Action Alternative

Impact AIR-1: Change in Fugitive Dust Emissions from Declining Lake Elevation and Exposed Walker Lake Bed (Adverse)

The No Action Alternative would allow the Walker Lake elevation to decline further, exposing more submerged lake bed and creating the potential for increased windblown dust compared to the action alternatives.

Dust storms and poor visibility events already occur in the study area. High winds combined with periods of dry weather can lead to dust storm events, as evidenced by the Yerington Mine Site. The prevalence of high winds in Mineral County (Tables 8-1 and 8-2) in combination with little precipitation and the dry lakebed suggests that serious dust storm and poor visibility events could occur in the Walker Lake area. As mentioned above, soils in the Walker Lake area are susceptible to wind erosion (Wind Erodibility Group 3), and increasing the acreage of exposed erodible lakebed soils would increase the potential for wind erosion during high wind events. In 2008, winds exceeded the threshold for both everyday wind erosion (16 mph) and dust storms (22 mph) 117 and 57 times, respectively (Table 8-2). Given this data for 2008, there is the potential for dust events to occur up to 117 times per year. This, combined with the background dust that already exists in the area during high wind events, could produce emissions that would lead to an exceedance of air quality standards and/or reduce visibility. This would represent an adverse air quality impact.

Under the No Action Alternative there would be no expected direct increase in dust emissions from retired farmland in Lyon County because current levels of irrigation would persist. However, as noted in Chapter 7, Land Use and Agriculture, agricultural land may be converted to nonagricultural uses in the

future. This could result in a short-term increase in fugitive dust emissions from construction activities, and a net decrease in long-term fugitive dust emissions from agricultural operations.

Alternative 1 (Proposed Project)

Water rights acquired under Alternative 1 are expected to add an average of 50,000 af/yr of water to Walker Lake. It is possible, however, that less than the average 50,000 af/yr would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the average inflow to the lake would increase by only 7,300 af/yr.

This analysis of Alternative 1 assumes that the Proposed Project would be fully funded and that water rights acquired would increase the average inflow to the lake by 50,000 af/yr. Unless otherwise noted, if acquisitions were limited to those achievable only with the existing funding allocation, the impacts would be similar in nature but of lesser magnitude.

Direct Impacts

Impact AIR-1: Change in Fugitive Dust Emissions from Declining Lake Elevations and Exposed Walker Lake Bed (Beneficial with Full Funding / No Impact with Existing Funding)

The Proposed Project would change the amount of water that flows into Walker Lake. However, the degree of change would depend on the amount of funding. Full funding to deliver an average of 50,000 af/yr of increased inflow to Walker Lake would increase future lake elevations between an estimated 30 to 35 feet, which would decrease the potential for windblown dust from the exposed lake bed. (See Chapter 3, Water Resources, for details on lake elevations.) This would be a beneficial impact.

With existing allocated funding, inflows to Walker Lake would increase by an average of 7,300 af/yr. In this case, lake elevations would continue to decline, although less than under the No Action Alternative. The amount of exposed lake bed would continue to increase as would the potential for more windblown dust emissions. With existing funding only, there would be no benefit to air quality in comparison to current conditions at Walker Lake.

Impact AIR-2: Increase Fugitive Dust as a Result of Reduced Irrigation (Adverse)

The Proposed Project would reduce the amount of water applied to irrigated land, which could cause a drying of the land and, potentially, associated canals and drains. Permanently retired lands would increase the amount of vacant land, which could become a potential fugitive dust source during high wind events

(Western Regional Air Partnership 2006). Existing crop cover would provide some temporary erosion stabilization, but as the vegetation decomposes the soil protection would cease.

Lands that are left vacant and not converted to other uses could become fugitive dust sources. The wind erosion potential of these vacant lands would depend on the degree of disturbance, as the susceptibility to wind erosion increases as disturbance increases (Western Regional Air Partnership 2006). As discussed in Chapter 4, Biological Resources—Vegetation and Wetlands, reduced irrigation could also lead to the spread of noxious weeds, which could lead to increased soil erosion and windblown dust erosion.

Current agricultural activities result in the release of fugitive dust as a result of planting, plowing, burning, and off-road vehicle travel (e.g., tractors). However, irrigated crops also tend to suppress dust erosion in wind erosion-prone high desert areas, such as the Walker River Basin (Putnam et al. 2007). Therefore, it is assumed that dust emissions from current agricultural production probably are relatively small in the agricultural valleys of the Walker River Basin in Nevada.

At this point, it is unknown which lands would be retired. Windblown dust emissions from open (vacant) land can vary depending on the climatic and physical characteristics of the site. There exists the potential for windblown dust emissions from retired lands if they become vacant and are not converted to other nonagricultural uses. The extent of these emissions is not known at this time, but the potential exists if conditions (i.e., disturbed and highly erodible soils) are present. Wind data for the previous 2 years indicate that winds exceeded everyday wind erosion potential on average 145 times per year and exceeded serious dust storm potential on average 52 times per year. Soils in the Mason and Smith Valleys are susceptible to erosion (Figure 8-2 and Table 8-4). Therefore, there is a potential for dust storm events to occur up to 145 times per year. This could lead to an exceedance of NAAQS and reduce visibility in the area. This would represent an adverse air quality impact.

Alternative 2 (Leasing Alternative)

Because Alternative 2 involves the recurring acquisition of water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/yr, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years.

While the air quality impacts associated with Alternative 1 would exist in perpetuity, the air quality impacts associated with Alternative 2 would be temporary and only exist for the period of the leasing program.

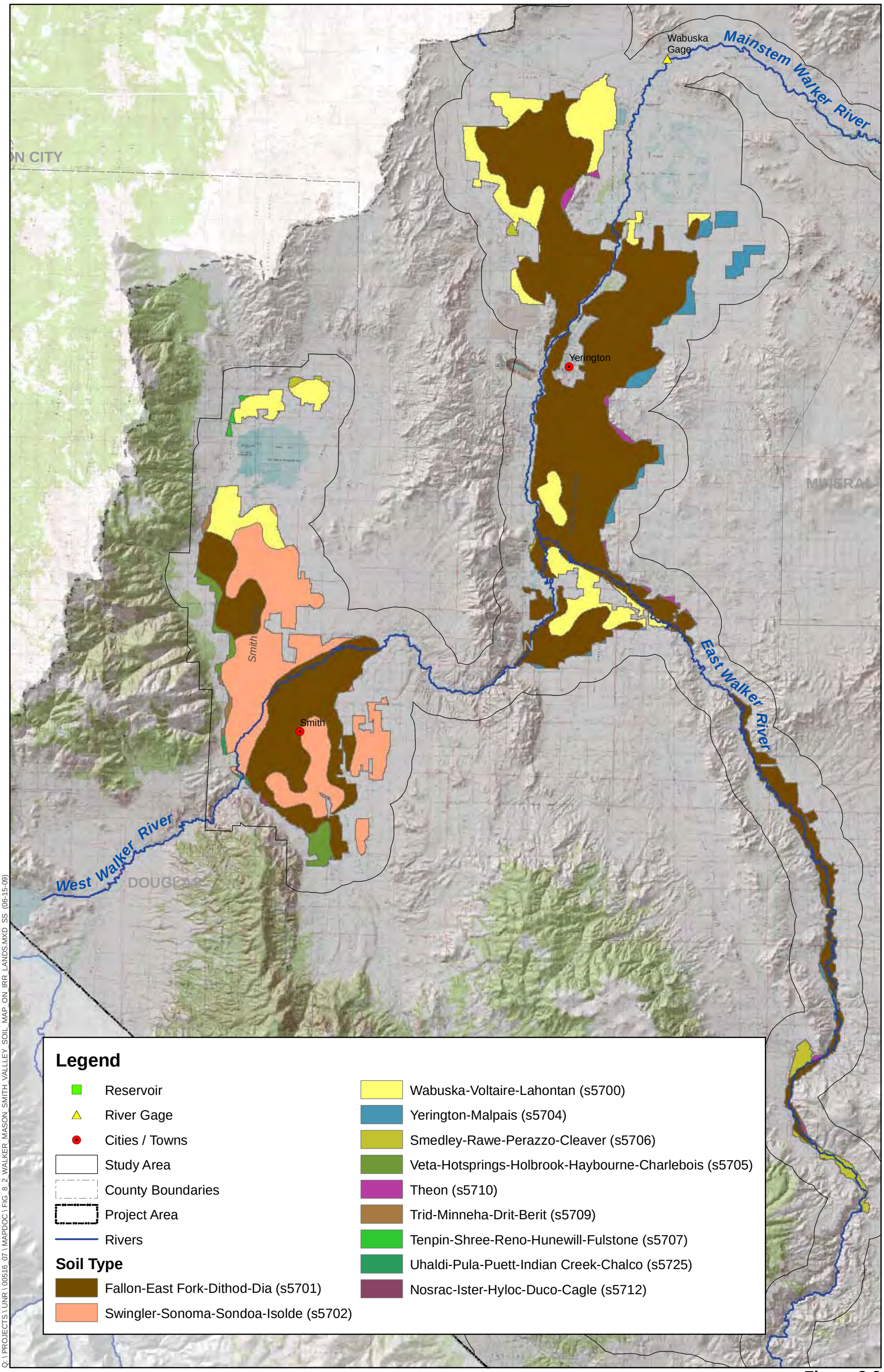

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Figure 8-2
Major Soil Associations Occuring on Irrigated Land in Lyon County Portion of Study Area

Direct Impacts

Impact AIR-1: Change in Fugitive Dust Emissions from Declining Lake Elevation and Exposed Walker Lake Bed (Beneficial with Full Funding / No Impact with Existing Funding)

With full funding of Alternative 2, Walker Lake's surface elevation would increase by approximately 10 to 13 feet and the area of exposed lake bed would decrease accordingly, decreasing the potential for windblown dust. This would be a beneficial impact. After the leasing activity ceases, however, the lake would again decline and environmental benefits would dissipate.

Under Alternative 2 with existing funding for acquisitions, Walker Lake's surface elevation, volume, and surface area would increase only slightly, yielding no substantial benefit compared to existing conditions. Compared to the No Action Alternative, this would temporarily avoid the creation of new wind erosion problem areas at Walker Lake. After approximately 3 years, however, the lake elevation would begin to decline again, exposing additional lake bed to the wind. Similar to the No Action Alternative, this would increase the likelihood of exceeding NAAQS and reducing visibility, but of less magnitude. Therefore, with existing funding there would be no impact.

Impact AIR-2: Increase Fugitive Dust as a Result of Reduced Irrigation (Minor Impact)

Under Alternative 2 with full funding, the impact on air quality from reduced irrigation would be similar to that from Alternative 1, but temporary and of less magnitude. The specific leased lands would vary from year to year, and temporarily fallowed land would be returned to production at the end of the lease. Over a 20-year period this would result in the development of less sparsely vegetated land than under Alternative 1 and the exposure of less bare surface to wind. Further, temporarily fallowing land would act as a dust control measure, because reduced agricultural practices would produce less dust emissions (Western Regional Air Partnership 2006).

Under Alternative 2 with existing funding, the leasing program would last about 3 years. This alternative would result in the creation of little if any sparsely vegetated land. Current vegetation would still act as a dust suppressant. As discussed under Alternative 1, soils in Mason and Smith Valleys are erodible, and any decrease in vegetation and soil moisture as a result of reduced irrigation could lead to increased wind erosion during high wind events on exposed and disturbed soils. This could increase the potential for wind erosion up to 145 times per year (based on 2007 and 2008 data). However, the potential for increased fugitive dust emissions would be temporary and would exist only while the leasing program exists. Therefore, this would most likely be a minor short-term impact under either scenario, and there would be no long-term adverse impact.

Alternative 3 (Efficiency Alternative)

Full implementation of Alternative 3 would yield an average of 32,300 af/yr of new inflow to Walker Lake, and would increase the lake elevation by about 4 to 13 feet.

Unless otherwise noted, the impacts of Alternative 3 would be similar in nature to those of Alternative 1 but of less magnitude. Impacts of Alternative 3 that differ from those of Alternative 1 are discussed below, as are impacts not previously discussed.

Direct Impacts

Impact AIR-1: Change in Fugitive Dust Emissions from Declining Lake Elevations and Exposed Walker Lake Bed (Beneficial)

Impact AIR-2: Increase Fugitive Dust as a Result of Reduced Irrigation (No Impact)

There would be no increase in windblown dust emissions from farmland because no farmland would be retired or fallowed under this alternative. There would be no impact on air quality.

Impact AIR-3: Short-Term Increase in Vehicle Exhaust Emissions as a Result of Construction (No Impact)

Constructing and operating water efficiency structures would result in temporary exhaust emissions from equipment used for grading, trenching, concrete paving of waterways, pipeline installation, weed removal from water channels, and field leveling. Emissions would vary daily based on the type of equipment used, duration of construction, and type of efficiency operations.

Construction activities would result in a short-term increase in exhaust emissions, which could result in temporary or intermittent health and nuisance air quality impacts on individuals in the immediate vicinity of construction sites. It is anticipated that these emissions would be negligible and intermittent in nature. Therefore, no adverse air quality impact would occur.

Impact AIR-4: Short-Term Increase in Fugitive Dust as a Result of Construction and Vegetation Removal (No Impact)

Fugitive dust would result from construction activities that disturb the ground, such as grading and excavation, canal construction, and other water-related construction. Fugitive dust could create temporary or intermittent health and nuisance air quality impacts on individuals in the immediate vicinity of construction sites. Air quality impacts associated with individual construction projects are temporary and short-term in nature, but the magnitude depends on

their scale and duration. However, these emissions would be negligible and intermittent in nature. The grading and altering of the land is anticipated to be a minimal air quality impact. With implementation of standard control measures, no adverse air quality impact from construction activities is anticipated.

Fugitive dust also could be generated by vehicles traveling on paved and unpaved roads during activities associated with conservation and efficiency measures. However, these vehicle emissions would be negligible and intermittent in nature. Therefore, no adverse impact is anticipated.

Removing vegetation from ditches and canals would increase the likelihood of loose soil particles along the banks becoming windblown dust. However, vegetation in canals and drains is already routinely controlled under existing practices and not all riparian vegetation would be removed. Therefore, this operational activity is anticipated to have no adverse impact on air quality.

Chapter 9 Cultural Resources

Introduction

This chapter describes the affected environment for cultural resources in the study area and the potential impacts on cultural resources that would result from the Proposed Project and other alternatives.

Cultural resources customarily include archaeological resources, ethnographic resources, and those of the historic built environment (architectural resources). Cultural resources include those aspects of the physical environment that pertain to the material culture of prehistoric, ethnographic, and historic period human culture. These resources include archaeological resources, as well as the locations of traditional cultural or religious importance to Native Americans.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- The prehistoric context is condensed from Bowers (2008) and is based on research by Elston (1982, 1986) and Thomas (1971, 1981, 1983) about the Great Basin in general and specifically the prehistory of western Nevada.
- The ethnographic context is based on the Smithsonian Institution's (1986) *Handbook of North American Indians Volume 11: Great Basin*. In particular, information on the Northern Paiute Indian Tribe is based on Fowler and Liljeblad's chapter, and the information on the Washoe Indian Tribe is based on D'Azevedo's chapter. Additional ethnographic information was obtained from Bengston's (2003) ethnographic and ethnohistoric overview of the Paiute and Shoshone in Nevada, written for BLM.
- The historic period context is adapted from contextual research on Nevada history by ICF Jones & Stokes (2008). Important secondary sources consulted for specific topics in western Nevada history were obtained from the State Historic Preservation Officer (SHPO) context on exploration and early settlement in Nevada (McBride 2002), from Hulse's history of Nevada (1991, 2004), and from the Nevada Department of Conservation and Natural Resources, Division of Water Resources (2008) website about the history of the Walker River.
- Information about previously recorded cultural resources in the vicinity of Walker River and Walker Lake is based on an electronic records search of the Nevada Cultural Resources Information System (NVCRIS), and on ethnographic data of Northern Paiute traditional cultural properties (TCPs) compiled by Bengston (2003).

Affected Environment

This section describes the environmental setting related to cultural resources in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for cultural resources was determined in consultation with Reclamation and consists of the Walker River, all irrigated lands where land, water appurtenant to the land, and related interests may be acquired as part of the Proposed Project, the current shoreline of Walker Lake, and a 1-mile perimeter around these areas. The study area is large enough to provide sufficient information to characterize the cultural resources in the study area, to determine the likelihood that they may be affected by the Proposed Project or alternatives, and to describe potential impacts on historic properties (significant cultural resources).

The actual area of impact would likely be much smaller than the cultural resources study area. The areas most likely to be affected are areas of future inundation or exposure at Walker Lake, and areas potentially affected by construction-related ground disturbance under Alternative 3.

Prehistoric Context

Archaeological evidence indicates that people have been using the western Great Basin region, including the Walker River watershed, for the past 11,000 years (Schmitt et al. 2006). The prehistory of the Great Basin is divided here into two major periods: the Pre-Archaic (11,500-7,500 BP [Before Present]) and Archaic (the last 7,500 years). The Archaic Period is further subdivided into Early, Middle, and Late periods (Elston 1982, 1986; Grayson 1993).

Pre-Archaic (11,500 – 7,500 BP)

Archaeological evidence of Pre-Archaic peoples is sparse and current understanding of the mobility and subsistence patterns of Pre-Archaic peoples in the western Great Basin is limited. The most current data indicate that populations were low, sparsely distributed, highly mobile, and organized as small groups that travelled together. This inference is based in large part on the paucity of milling equipment found in Pre-Archaic sites. Pre-Archaic sites are primarily found in lowland settings, on gravel bars or benches that, when occupied, would have been near shoreline deltas of Pleistocene lakes or valley marshes. The low elevation locations of most known Pre-Archaic sites have lead to the inference that Pre-Archaic peoples were adapted to lacustrine resources (Jones et al. 2003; Elston 1986; Thomas 1981. The diagnostic artifacts associated with the Pre-Archaic Period are large lanceolate and stemmed projectile points, and possibly fluted points similar to those of the Clovis Period. The toolstone resources of this period were probably of higher quality and required less processing than those used by later groups.

Archaic (7,500 BP – Contact)

The Archaic Period is further divided into the Early (7500-4000 BP), Middle (4000-1500 BP), and Late (1500 BP-Contact) Archaic Periods. The dominant behavioral trend during the Archaic was a greater diversity of food resources in the diet and a higher degree of sedentism from the Early to the Late Archaic Period (Elston 1982, 1986; Elston and Budy 1990; Thomas 1983).

Early Archaic (7500-4000 BP) adaptations are inferred to have been a response to middle Holocene climatic warming and drying (Elston 1986). The large pluvial lakes that Pre-Archaic peoples lived near had dried up and pinyon-juniper woodlands reached their modern distribution by 6000 BP (Elston 1986). Temporal markers of this period include Gypsum, Pinto, Northern Side-Notched, and Gatecliff projectile points (Elston 1986; Thomas 1981, 1983).

Middle Archaic (4000-1500 BP) settlement patterns focused on residential camps along the pinyon ecotone (Thomas 1971). "These habitation settlements were located in stands of Pinyon and Juniper trees, often on long, low ridges which fingered out onto the valley floor" (Thomas 1971). In addition, seasonal shifts in habitation types are apparent. Both summer and winter camps can be defined and appear to be occupied on a recurrent basis (Elston 1986; Elston and Budy 1990; Thomas 1971, 1983). Winter sites include storage pits, house pits with internal hearths, and burials (Elston 1986). In the western Great Basin, starting around 4,000 years ago, the dry conditions of the early Holocene began to shift to conditions of higher precipitation and lower temperatures, resulting in a greater abundance of food. At that time, the Walker River was flowing into Walker Lake Basin, rejuvenating the lake. Subsistence strategies during the Middle Archaic appear to have increased in variety. Upland resources were more intensively exploited, as were small mammals, although large mammals were still a significant portion of the diet (Elston 1986, Elston and Budy 1990). In general, settlement systems during this period took on a character similar to that described for ethnographic populations by Steward (1938) (see below). Temporal markers of the Middle Archaic include Elko Series projectile points. In addition, groundstone and other food processing tools became more common (Thomas 1981, 1983).

Late Archaic (1500 BP-Contact) settlement patterns continued to become more logistically oriented. Seasonal habitation sites continued to be definable but tool assemblages became more diverse, indicating increased reliance on a diverse set of resources. There was also a shift in hunting technology with the bow and arrow replacing the atlatl and dart. Two series of projectile points are diagnostic of this period: Rosegate and Desert Series. At the end of the Late Archaic, during the contact period with Euro-Americans, mobility patterns became severely constricted geographically as a result of pressures from white settlements. Two types of habitation sites are recognized in the archaeological record of the Late Archaic (Elston 1986). One type consists of substantial shelters and storage facilities. These sites can have multiple house structures and debris patterns

suggesting either long-term stays or repeated use of the site (Elston 1986, Elston and Budy 1990, Thomas 1983). The other habitation type is more ephemeral, consisting of hearth features and compacted floors (Elston and Budy 1990). The larger, more formal habitation sites resemble winter camps described by ethnographers; the smaller sites resemble summer camps. Other site types noted include hunting facilities (blinds and drive walls), specialized processing and procurement facilities, and caches (Elston 1986).

The appearance of Desert Series projectile points around 800 years ago is believed by some to be indicative of a migration of Numic-speaking peoples into the area. First formalized by Lamb (1958), and later by Bettinger and Baumhoff (1982), the idea that Numic-speaking peoples spread from the southwest Great Basin to the northeast Great Basin and beyond has continued to be a hotly contested research subject (e.g., Aikens 1994, Bettinger 1994).

Ethnographic Context

The majority of the study area is comprised of the ethnographic territory of the Northern Paiute Tribe. The far western portion of Nevada, from Antelope Valley north to the Honey Lake Region in California, is the ethnographic territory of the Washoe Tribe. A small portion of Washoe territory overlaps with that of the Northern Paiute, in the vicinity of the West Walker River in Antelope Valley (D'Azevedo 1986, Fowler and Liljeblad 1986).

The Northern Paiute

The Northern Paiute territory encompassed a large area including portions of Nevada, California, Oregon, and a segment of Idaho along the Oregon border. The Northern Paiute consist of many groups with distinct cultural and political units but with a shared common language, the Northern Paiute language. Northern and Southern Paiute languages (Northern Paiute and Mono) constitute the Western Numic language, an offshoot of the Uto-Aztecan linguistic family (Fowler and Liljeblad 1986).

Traditionally, the Northern Paiute were semi-nomadic groups who travelled seasonally to take advantage of hunting, gathering, and fishing grounds. They lived in small family units that fluctuated in size and among generations and kin members. Their winter villages constituted several families camping together, most of whom would have kinship ties. The houses were dome-shaped and covered with vegetation mat. The Northern Paiute did not recognize private land ownership; rather, the first family to arrive at a seasonal hunting or gathering territory was viewed by others as having priority. Their political organization consisted of groups of families with a headman who did not control the people but who gave advice and occasionally led communal activities such as rabbit drives. They did not have formal marriages; once the parents found suitable matches, the boy showed interest in the girl and when she was ready, he moved in with her. Intrafamilial or sibling exchange marriages were common, with matches between

two brothers/sisters of one household with two sisters/brothers of another household, strengthening group and family ties (Fowler and Liljeblad 1986).

Hunting could be an individual or a group activity. The Northern Paiute sought out large game animals such as deer, antelope, and desert bighorn sheep; typical small game animals were rabbits, hare, marmots, porcupines, and burrowing mammals. Mammals were hunted for their meat as well as their fur, and many items were fashioned out of the pelts of coyote, desert fox, bobcat, deer, mountain lion, antelope, or bear. Small animals were hunted individually and were caught with noose snares and deadfalls, or shot. The bow and arrow, traps, and corrals were the most common means of hunting large mammals, individually or in groups. In the Walker River region ground squirrel trapping may have been private property inheritable from father to son. Birds and waterfowl were an important resource for the Walker River area. Tule boats were used to collect duck eggs, hunting and fishing (Fowler and Liljeblad 1986).

In lacustrine environments, the Northern Paiute had a more specialized subsistence strategy focusing on abundant fish stocks. Walker Lake, fed from the Walker River, was a prime location for seasonal settlement where groups gathered for fishing, trading, feasting, and dancing. Fishing was a year-round activity in the Walker River and Walker Lake areas, with a focus on fishing for those species that were in season. Fishing platforms and weirs were considered private property, and fishing was conducted with nets, hooks, harpoons, or spears. On lake areas, fishing was conducted with lines and hooks, or with a spear or harpoon in shallow waters. Women also fished using their winnowing trays (Fowler and Liljeblad 1986).

Plant gathering was an important activity for the Northern Paiute. Several varieties of seeds, nuts, fruits, and roots were gathered with particular attention to the pinyon resources of the Great Basin. Several tool types were used for this activity, including conical baskets, twined trays, manos, metates, mullers, twined cooking baskets, twined seed beaters, straight sticks, stone or bone knives, and spoons, dishes, storage bags, stirring sticks, and hot rock lifters. Seeds and cakes were stored in grass- or bark-lined pits (Fowler and Liljeblad 1986).

The Northern Paiute were a culturally diverse group with many subgroups. Four of these are known to have inhabited the Walker River and Lake region: *Pakwidokado* (fish eaters), located on the southern area of Walker Lake, *Aga'idokado* (trout eaters) on the north and eastern region of Walker Lake and River, *Tovusidokado* (grass-nut eaters) on the East Walker Valley, and *Kamodokado* (jackrabbit eaters) and *Poo-zi Ticutta* (bulb eaters) in the vicinity of the Yerington Indian Reservation (Bengston 2003, Fowler and Liljeblad 1986).

Ghost Dance

Noted in historical accounts as the Ghost Dance of 1890, the Ghost Dance was a religious movement incorporated into numerous Native American belief systems.

The traditional ritual used in the Ghost Dance, the circle dance, has been used by many Native Americans since prehistoric times but was first performed in accordance with Jack Wilson's teachings among the Nevada Paiute in 1889. The practice swept throughout much of the American West, quickly reaching areas of California and Oklahoma. As the Ghost Dance spread from its original source, Native American tribes synthesized selective aspects of the ritual with their own beliefs, often creating change in both the society that integrated it and the ritual itself.

At the core of the movement was the prophet of peace Jack Wilson, known as Wovoka among the Paiute, who prophesied a peaceful end to white American expansion while preaching messages of clean living, an honest life, and cross-cultural cooperation.

The Washoe

The Washoe territory consists of a narrow stretch of land measuring approximately 120 miles long and 40 miles wide. The territory lies along the present central Nevada-California border with Lake Tahoe at its center. The southern portion of the Washoe territory includes the west Walker River area in Antelope Valley. The Washoe language is derived from the Hokan linguistic stock. Even though the Washoe are geographically included within the Great Basin population, they are the only people who do not speak the Numic language and share more cultural traditions and subsistence strategies with California tribes than with Great Basin tribes (D'Azevedo 1986).

Contrary to the Northern Paiute, the Washoe were a homogeneous group who inhabited a small territory and negotiated with neighbors over travel passages and hunting and gathering territories. The Washoe territory was self-contained and abundant in resources. The Washoe lived in semi-permanent settlements and procured diverse seasonal resources. The basic unit was the family, and families could live singly in seasonal camps or aggregate into villages that might have a hereditary chief (D'Azevedo 1986).

Fishing was the most reliable and consistent food source among the Washoe. The southern Washoe shared the Walker River and Walker Lake fishing areas with permission of the local Northern Paiute. Washoe groups gathered at the end of the year and fished in winter; in harsh winters they used ice-holes for fishing. The archaeological record of the Washoe contains several tools associated with these activities such as bone fishhooks, harpoons, spears, dams, nets and basketry, weirs, fish traps, and rafts of cedar bark or tule bundles. Fishing was done individually or in groups, and the surplus was taken back to camp and dried to be eaten throughout the winter (D'Azevedo 1986).

Early spring and late fall were occupied with the gathering of seeds, bulbs, roots, fruits and plants for food and medicinal use. In the south, the Washoe gathered pine nuts within proprietary territories. Each family had its own traditional plot

and sharing was allowed by permission only, based on friendship or kinship (D'Azevedo 1986).

The Washoe hunted primarily for mule deer, pronghorn antelope, and mountain sheep. The most abundant animal foods were hares and rabbits that could be caught by the thousands during organized group rabbit drives in the autumn (D'Azevedo 1986).

Federally Recognized Tribes in the Walker River Region

There are two federally recognized tribal reservations in the study area: the Walker River Indian Reservation and the Yerington Indian Reservation and Colony. Both are under federal government jurisdiction but are self governing and are associated with the Northern Paiute Tribe.

Yerington Paiute Tribe

YPT has historically and prehistorically occupied the entire Walker River Basin and areas beyond, such as Mono Lake, Bodie, Sweetwater, the Desert Creek area, and Aurora. During the early 20th Century, many Northern Paiute settled and established a colony near Yerington. The YPT Indian Reservation was set aside in 1916. YPT was recognized under the Indian Reorganization Act of June 1934, and the bylaws and constitution were approved in 1936 recognizing the tribal government (Sharpe et al. 2008). In 1939, the federal government granted land to the colony under the Indian Reorganization Act of 1935, recognizing the colony as an independent tribe (Fowler and Liljeblad 1986).

YPT's lands consist of YPT Colony (Colony) and YPT Indian Reservation (also known as Campbell Ranch). The Colony occupies 13.7 acres within the city limits of Yerington, Nevada. Land uses at the Colony are a mix of residential and commercial. The Colony has 46 homes, 12 apartments, and four tribal elders' apartments. Commercial uses include a tribal smoke shop, the Tribal Elder Center, Head Start, a three-office building that houses the EPA/General Assistance Program, the Law Enforcement Substations, and an education tutoring center. YPT leases 1.5 acres to a Subway sandwich franchise at 198 Goldfield Avenue; this property is not held in trust for YPT. YPT also owns Arrowhead Market, a gas station and mini-market located on Campbell Lane, off the reservation (Emm pers. comm.).

Campbell Ranch encompasses 1,162 acres 10 miles north of Yerington. Land uses at Campbell Ranch are primarily agricultural and residential. Nine assignees farm on private land on the ranch and grow primarily alfalfa and onions. YPT grows alfalfa on 900 acres. Campbell Ranch also has 84 homes, including nine tribal ranch assignees' residences. YPT leases 21.2 acres of ranch land to Rite of Passage, a school for troubled youth (Emm pers. comm.).

The final Walker River Decree (Decree C-125) provides water rights for the YPT Reservation and Colony, which are primarily used for agricultural purposes.

YPT's current decreed water right in a year with a full water supply is approximately 3,958 af with priority dates from 1864 to 1905 (Wilson pers. comm.). Some water rights for the Colony have been transferred to Campbell Ranch for irrigation (Emm pers. comm.). YPT also has permits to use approximately 1,200 af/yr of groundwater (Wilson pers. comm.).

Walker River Paiute Tribe

WRPT refers to itself as Agai-Dicutta (Trout Eaters) Band of Northern Paiute Nation (Walker River Paiute Tribe 2008a). The Walker River Indian Reservation is located on 325,000 acres between the northeast end of Mason Valley and Walker Lake and has a population of approximately 1,200. The reservation was set aside by federal action on November 29, 1859, and later affirmed by Executive Order in 1874. Over time the boundaries of the reservation were greatly altered by government policy changes (Hulse 2004). While the reservation accepted allotment and surrendered most of their land to the government in 1906, it later obtained other lands in the 1930s along the Walker River that were suitable for agriculture (Hulse 2004). The reservation's main community is Schurz, located along the Walker River. Water rights and the decline in fish supplies have been major points of contention between the reservation and non-Indians (Knack and Stewart 1984). Most of the land is held in trust by the United States for the benefit of WRPT (Miller Ecological Consultants 2005).

Approximately 10,000 acres of reservation land were divided into 20-acre allotments and distributed to individual WRPT members. These allotments are also held in trust by the United States, but are for the benefit of the individuals (Miller Ecological Consultants 2005).

Agriculture production on the reservation represents Mineral County's major farming district (Mineral County 2008). Grazing is the primary land use, as well as some ranching (Walker River Paiute Tribe 2008a), but agricultural crops are also an important part of the economic base. Alfalfa is the primary crop grown, mainly along formerly riparian areas (Walker River Paiute Tribe 2008b). Approximately 2,800 acres are in agricultural production. Of this, approximately 2,100 acres are irrigated allotments, consisting mainly of alfalfa and grass hay, and 125 acres of tribal trust land are irrigated by center pivots. Weber Dam and Reservoir provides storage and regulates the delivery of the reservation's direct flow water rights under the Walker Decree for irrigation water used on the Walker River Indian Irrigation Project. In 2007 and 2008, all the allotments on the reservation were part of a fallowing program funded by a Desert Terminal Lakes grant with the purpose of providing inflows to Walker Lake (Yardas pers. comm.).

The unincorporated town of Schurz is located on the reservation at the intersection of U.S. Highways 95 and 95-A. Land uses in Schurz include

commercial uses, such as a gas station with a convenience store, a smoke shop, and a fireworks outlet (Walker River Paiute Tribe 2008a and 2008c).

Community resources include the tribal administrative offices, health clinic, and police office; a volunteer fire department; and a school for kindergarten through 8th grade (Miller Ecological Consultants 2005).

Most housing on the reservation is single-family, detached houses (Miller Ecological Consultants 2005). Some of these houses are built on allotments and others on tribal land. WRPT's housing department administers two programs to help tribal members: a modified lease purchase program called the mutual help program and a rental program for the members with the lowest income. The department also operates programs to renovate existing homes. The department has built more than 280 housing units and operates a rental assistance program for low-income tribal members attending certain institutions of higher learning (Walker River Paiute Tribe 2008d).

Trust assets include, but are not limited to, the reservation, irrigated and unirrigated trust allotment lands, water rights, Weber Dam and Reservoir, and the fish, wildlife, and riparian vegetation in and along mainstem Walker River and Weber Reservoir (Miller Ecological Consultants 2005).

WRPT's water rights, which are provided under Decree C-125, are held in trust by BIA (Strekal pers. comm.). The Decree adjudicated to the United States a continuous flow right of 26.25 cfs with an 1859 priority date (the most senior water right in the system) for the irrigation of 2,100 acres of land within the Walker River Indian Reservation. This water may be diverted from the Walker River on or above the reservation over a 180-day irrigation season each year (*United States* v. *Walker River Irrigation District*, 104 F2d 334, 340, 9th Cir 1939).

WRPT asserts exclusive jurisdiction over groundwater in the Walker River Indian Reservation (Yardas 2007). In pending litigation (*United States* v. *WRID*, Case in Equity, C-125B), the United States and WRPT are claiming a federal reserved water right to groundwater, among other claims (Yardas pers. comm.).

Historic Context

Historically, the region has provided a natural route for travel from the east through the Great Basin to the west coast of the United States (Scrugham 1935). Although Europeans and Americans explored the region in the late 18th and early 19th Centuries, the harsh terrain did not welcome settlement; consequently the region remained largely uninhabited by Euro-Americans until the latter half of the 1800s following emigration to California and subsequent mining booms in the region. During that time, several towns developed in the region, including Wellington and Smith in Smith Valley, Yerington in Mason Valley, and Schurz in the Walker River Valley. Today, the vast majority of land within or directly

adjacent to the study area is sparsely populated with ranching, agriculture, mining, recreation, and military as primary economic activities. For a more detailed discussion on the history of the region please see Paher 1970, Hulse 1991, McBride 2002, and Kolvet and Ford 2006.

Early Exploration and Settlement

The Spanish were the first Europeans to explore and settle the southwest; Euro-American exploration of the Nevada region began in the early 1800s (Hulse 1991). In 1821, Mexico won its independence from Spain; this event helped open a significant portion of the West to exploration. Soon thereafter, rival Canadian, British, and American fur companies, competing for Great Basin resources in the West on behalf of their respective governments, began searching for North American beaver habitats in hopes of extracting pelts for the lucrative Atlantic fur trade. Exploring on behalf of the Rocky Mountain Fur Company in 1826, Jedediah Strong Smith became the most prominent American fur trader to cross into the southeastern Nevada region. In addition to searching for beaver-rich areas Smith also traveled north to establish a new route to the Pacific Ocean from Cache Valley, north of the Great Salt Lake. Beginning in August 1826, his group blazed a trail to Los Angeles that would eventually be incorporated into the Old Spanish Trail to San Bernardino, later known as the Mormon Road. During the venture Smith was detained in California by Mexican government officials; after his release he disregarded the government’s order to return by the same route and took his party northward into the San Joaquin Valley. Concerns over crossing the snow-covered Sierra Nevada led Smith to leave most of his party in California and proceed directly toward the Great Salt Lake with only two men. While the trail of this 1827 route is unknown in its entirety, it is generally accepted that Smith and his men crossed the Sierra Nevada approximately on the route of present-day U.S. Highway 89, followed West Walker River, and saw Walker Lake on their way toward the center of the Great Basin (Hulse 1991, 2004; McBride 2002).

At the time of Smith’s first trek the leading trapper of the Hudson’s Bay Company in this region was Peter Skene Ogden. He made six expeditions into the so-called Snake River Country between 1825 and 1831. Three of Ogden’s trips penetrated Nevada, including the lower Humboldt River, lower Carson River, Walker Lake area, and the desert between Walker Lake and the Colorado River on his way toward the eastern edge of the southern Sierra Nevada (Hulse 2004).

In 1833, Joseph Walker, chief lieutenant for Captain Benjamin Louis Eulale de Bonneville, both of whom were in the employ of the Hudson's Bay Company, led a party of explorers and trappers along Ogden's "Unknown River" (the Humboldt) all the way to California via the Humboldt Sink, the Carson Sink, and then up into the Sierra Nevada by either the Carson River or the Walker River (Nevada Division of Water Planning 2008).

Exploration routes and trapping trails in Nevada eventually became overland trade routes, the first being the Old Spanish Trail, opened by Antonio Armijo between Santa Fe and Los Angeles, passing through southern Nevada, in 1829. By 1830, the Old Spanish Trail became a major thoroughfare for organized caravans participating in extensive trade (Vlasich 1975). The next major expeditions into Nevada were under sponsorship of the United States government.

Between 1834 and 1871, the United States government sponsored expeditions to explore the geography and known trails of the western Great Basin. The government's philosophy of expansion, which came to be regarded as Manifest Destiny, was a motivating factor in exploring and mapping the western region of North America. Eventually, expansionism culminated in the annexation of Texas and participation in the Mexican-American War (1846-1848). At the conclusion of the war, the United States gained control of western territories, including all of present-day California, Utah, and Nevada, and parts of Colorado, Wyoming, New Mexico, and Arizona.

During the 1840s, John C. Fremont became a significant American explorer, being the first to scientifically map and describe the Great Basin. Fremont made three surveys of the American West for the U.S. Topographic Engineers. Fremont documented the Great Basin during his second and third surveys between 1843–1844 and 1845. Fremont traveled through northern portions of Nevada on his way to the Oregon Territory. His 1845 expedition included examination of the Great Salt Lake region in Utah, and a foray through northern and western Nevada. Fremont's men re-mapped the Walker River Basin, among others. In order to more fully understand the nature of Great Basin physiography, the expedition split up, with Joseph Walker guiding one team along Ogden's 1829 route down the Humboldt River, and meeting up with Fremont's team at Walker Lake in November 1845 (McBride 2002).

In-depth, federally sponsored exploration of Nevada did not begin until the 1850s. The combined events of the signing of the Treaty of Guadalupe Hidalgo in 1848, which signified the end of the war with Mexico, and the discovery of gold in California that same year led to more federal exploration of the far west. A key motivating factor of far west exploration was the need to determine transportation routes, specifically a possible route for the transcontinental railroad. Among a number of more well-known railroad surveys, a minor survey was led by John Ebbetts in 1854. Although the survey did not identify a practical railroad route, the party was able to further explore the area around Walker Lake (McBride 2002). More successful expeditions and surveys resulted in the establishment of important routes for future stage, freight, mail, and telegraph service between Utah and California (James 1981, Summit Envirosolutions 2001). However, none of these routes passed through the Walker River Basin because shorter and easily traversed routes were established north and south of the Walker River region.

After the discovery of gold in California a number of established trails were used increasingly for emigrant groups travelling from the east. During this period the main emigration routes were the Old Spanish Trail through southeastern Nevada, and the Humboldt and California Trails, which initially brought California-bound travelers across northern Nevada along the Humboldt River and through the Carson Valley. From 1848 through the 1850s, a number of branches, cut-offs, and alternate routes were developed along the California Trail, in an attempt to shorten the trip to California (McBride 2002).

Emigrants, noting the economic possibilities of the lush Carson Valley, and recognizing the opportunity to sell provisions to California-bound travelers, first began settling there in 1850. By this time the emigrant trails were well established, and the 1850s saw the development of a network of smaller roads into lesser-known areas, ushering in a period of settlement across western Nevada (Hulse 2004, McBride 2002). By the late 1850s, farmers and cattlemen settled Mason Valley, with its fertile valley soil and grazing lands, and other inhabitants of the Walker River area engaged in small-scale placer mining (McBride 2002). After the mining boom commenced following the discovery of the Comstock Lode in 1859, these areas became stable agricultural communities supporting the mining boomtowns, eventually supplying produce to mining towns such as Aurora and Bodie and others (Hulse 1991).

Environmental Consequences

This section describes the impact analysis relating to cultural resources for the Proposed Project and other alternatives. It lists criteria used to determine whether an impact would be adverse or beneficial.

Assessment Methods

As described above, information was gathered about cultural resources in the study area. Archaeological resources were identified and eligibility for inclusion in the NRHP was determined.

Impact Criteria

NEPA and NHPA require federal agencies to consider the effect of their actions on cultural resources. Resources determined to be eligible for inclusion in NRHP are known as historic properties. The significance of an archaeological site or an architectural resource is defined by NRHP. These criteria, defined in 36 CFR Part 60.4, state that a resource must be at least 50 years old (unless meeting exceptional criteria) and possess a quality of significance in American history, architecture, archaeology, engineering, or culture. The quality of significance is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, as

defined by the National Park Service (NPS) (National Park Service 1997). These sites meet one or more of the following criteria.

A. The site is associated with events that have made a significant contribution to the broad patterns of history.

B. The site is associated with the lives of persons significant in the past.

C. The site embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.

D. The site has yielded, or may be likely to yield, information important in prehistory or history.

If a particular resource meets any one of these criteria and retains integrity, it is considered NRHP-eligible and, therefore, a historic property.

Application of the Criteria of Adverse Effect

To comply with Section 106 of NHPA, any effects of the proposed undertaking on properties listed in or determined eligible for inclusion in NRHP must be analyzed by applying the Criteria of Adverse Effect [36 CFR Part 800.5(a)(1)(2)], as follows:

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of an historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of an historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Adverse effects on historic properties include, but are not limited to:

(i) physical destruction of or damage to all or part of the property;

(ii) alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties and applicable guidelines;

(iii) removal of the property from its historic location;

(iv) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

(v) introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(vi) neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

(vii) transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long term preservation of the property's historic significance.

Impacts

Impacts on cultural resources that were considered and dismissed from analysis include potential erosional and depositional impacts in the Walker River that might arise from increased flow resulting from acquisitions. Flow is expected to remain within the range of existing variation. Consequently, the impacts of sediment erosion and deposition along the Walker River are similarly expected to remain within the range of existing conditions. There would, therefore, be no impacts on cultural resources within the Walker River channel compared to existing conditions.

Additionally, projected changes in the elevation of Walker Lake would not be outside the recent historic range. As described in Chapter 3, Water Resources, in the last 3,500 years Walker Lake elevation may have fluctuated from 3,900 to 1,400 feet. In the late 1800s the elevation of Walker Lake started to decline primarily because of upstream diversions to support agricultural production. In 1882, the lake elevation was estimated to be 4,083 feet and in July 2008, the lake elevation was estimated to be 3,933 feet. The projected best case scenario of additional inflow to the lake under Alternatives 1 and 2 is an average of 50,000 af/yr, which would cause the lake elevation to rise a maximum of 37 feet from its July 2008 elevation. This would return Walker Lake to an elevation last recorded in the early 1960s. No cultural resources that were not previously inundated would be covered by the change in lake elevations under this scenario; therefore, there would be no impact on cultural resources as a result of implementing Alternatives 1 and 2.

Impacts on cultural resources would be determined on a site-specific basis under Alternative 3. Some activities have a greater potential to adversely affect cultural resources than other activities. Earthmoving activities (i.e., digging, grading, and dredging) have the highest potential to directly affect significant cultural resources through disturbance or destruction. Additionally, pedestrian traffic, vehicular traffic, and earthmoving activities may have an indirect impact on

cultural resources by promoting earth compaction or erosion. These activities would not occur under Alternatives 1 and 2, but could occur under Alternative 3.

In this section, the activities that could potentially affect cultural resources are described for each alternative.

No Action Alternative

Under the No Action Alternative, future conditions indicate the elevation of Walker Lake would continue to drop to an estimated 3,898 to 3,906 feet by 2200. Cultural resources would remain relatively unchanged from present conditions.

Alternative 1 (Proposed Project)

This analysis of impacts under Alternative 1 assumes that the acquisitions would be fully funded and that water rights acquired would increase the average annual inflow to the lake by 50,000 af/yr. Unless otherwise noted, if the full amount of water rights were not acquired, the impacts would be similar in nature (i.e. adverse, minor, beneficial, or no impact), but of less magnitude.

Under Alternative 1, no ground disturbance, increased vehicular and pedestrian traffic, increased soil erosion, or changes to viewshed beyond existing conditions or recent history are anticipated. Any water stored at Topaz Lake Reservoir or Bridgeport Reservoir would be managed in a manner consistent with existing operating criteria. Projected lake elevations under Alternative 1 (see Chapter 3, Water Resources) would not exceed those recorded in the early 1960s. Under the best case acquisition scenario, lake elevation is projected to reach 3,965 to 3, 970 feet. No cultural resources that were not previously inundated by the lake would be inundated under Alternative 1. There would be no direct or indirect impacts on cultural resources.

Alternative 2 (Leasing Alternative)

Under Alternative 2, no ground disturbance, increased vehicular and pedestrian traffic, increased soil erosion, permanent abandonment of a water conveyance system, or changes to viewshed beyond existing conditions are anticipated. Any water stored at Topaz Lake Reservoir or Bridgeport Reservoir would be managed in a manner consistent with existing operating criteria. Like Alternative 1, projected lake elevations would not exceed those recorded in the early 1960s. No cultural resources that were not previously inundated by the lake would be inundated under this alternative. There would be no direct or indirect impacts on cultural resources.

Alternative 3 (Efficiency Alternative)

As discussed in Chapter 3, Water Resources, full implementation of Alternative 3 would yield only an additional 32,300 af/yr. Under the best case acquisition scenario for this alternative, projected lake elevations would not exceed those

recorded in the early 1990s. No cultural resources that were not previously inundated by the lake would be inundated under Alternative 3. Any water stored at Topaz Lake Reservoir or Bridgeport Reservoir would be managed in a manner consistent with existing operating criteria.

Alternative 3 differs from the other action alternatives in that its implementation may require the following activities: water control system improvements, ditch lining or piping installation, utility realignments, or construction of access roads, storage areas, borrow sites, and disposal sites; however, at this time no specific activities or locations have been identified. Specific project activities and locations would be determined after conservation agreements are made with private landowners. Such activities could have direct or indirect impacts on cultural resources.

To fulfill Section 106 compliance, Reclamation cultural resources staff will review conservation activities on a case-by-case basis to determine if these activities have the potential to affect historic properties should they be present. If it is determined that the proposed conservation activity is the type of activity that has the potential to affect historic properties, Reclamation cultural resources staff will determine what steps the agency will take to comply with Section 106 of the NHPA. If it is determined that there will be adverse impacts on historic properties, Reclamation will consult with the SHPO to resolve adverse impacts pursuant to 36 CFR Part 800.6 and follow any agreed upon measures. Compliance efforts will be completed before Reclamation issues funds to applicants to implement any projects identified under Alternative 3.

Chapter 10 Socioeconomics

Introduction

This chapter describes the affected environment for socioeconomics in the study area and the potential impacts on socioeconomics that would result from the Proposed Project and other alternatives.

The focus of this assessment is to identify potential changes in employment, income, and tax revenues as a result of:

- a decrease in agricultural production, and
- an increase in recreation opportunities associated with increase in water inflow to Walker Lake.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references may be found in Chapter 17, References.

- Population data reported by the U.S. Census Bureau (2008)
- Income and employment data reported by the U.S. Department of Commerce, Bureau of Economic Analysis (2008a–f)
- Agricultural production data reported by the U.S. Department of Agriculture, National Agricultural Statistics Service (2002)
- Per acre employment estimates for agricultural activities and per acre crop production value within the study area reported by the University of Nevada, Reno (Bartholet et al. 2009)
- Population and employment in Mason and Smith Valleys as reported by the University of Nevada, Reno (Bonnenfant et al. 2009)

Affected Environment

This section describes the environmental setting related to social and economic conditions in the study area. Although the project area is the entire Nevada portion of the Walker River basin (Chapter 1), the study area for socioeconomics consists of Lyon and Mineral Counties, Nevada. Walker Lake is located in Mineral County. It is expected that acquisitions would be made from Mason Valley, Smith Valley, and the East Walker area, all of which are located in Lyon County. Lyon County is the leading agricultural county in Nevada, mostly a result of the water delivered from Walker River (Lesperance 2009). This section

provides an overview of employment, income, and agricultural production, with a focus on Mason and Smith Valleys, the areas from which water rights would be purchased. Population in Mason Valley totaled 8,583 in 2007 (Bonnenfant et al. 2009), of which 3,319 were in Yerington (Nevada Department of Taxation 2008). Population in Smith Valley totaled 1,840 in 2007 (Bonnenfant et al. 2009). A broader discussion of population characteristics is included in Chapter 7, Land Use and Agriculture.

Employment

Lyon County

Full- and part-time employment in Lyon County totaled 18,048 jobs in 2006, an increase of approximately 3,200 jobs from 2001(this shows a 5-year trend). Nonfarm employment represented about 96% of total employment in 2006, and farm employment accounted for the remaining 4%, or 665 jobs. The major farming businesses in Yerington and Smith Valley employ 220 positions (Sylvia Banta, Mason Valley Chamber of Commerce, as cited in Lesperance, 2009). Manufacturing was the largest single private employment sector, with 2,533 jobs, followed by retail trade, with 2,212 jobs. Employment in government and government enterprises totaled 2,270 jobs or nearly 13% of total employment (U.S. Department of Commerce, Bureau of Economic Analysis 2008a).

Employment in Mason Valley totaled 4,172 jobs in 2007. The retail trade sector accounted for 1,846 jobs, followed by the government sector with 651 jobs, and the entertainment, accommodation, and food services sector with 269 jobs. The agriculture and forestry sector accounted for 397 jobs (Bonnenfant et al. 2009).

Employment in Smith Valley totaled 254 jobs in 2007. The agriculture and forestry sector accounted for 85 jobs, followed by the construction sector with 33 jobs (Bonnenfant et al. 2009).

Mineral County

Full- and part-time employment in Mineral County totaled 2,284 jobs in 2006, a decrease of about 50 jobs from 2001. Nonfarm employment represented 98% of total employment, and farm employment accounted for the remaining 2%, or 45 jobs. Employment in government and government enterprises totaled 613 jobs, or nearly 27% of total employment (U.S. Department of Commerce, Bureau of Economic Analysis 2008b).

Income

Lyon County

Personal Income

Personal income totaled just over $1.3 billion in Lyon County in 2006, of which nonfarm income accounted for approximately 99% of the total. Per capita personal income totaled approximately $26,300 in 2006, substantially less than the statewide per capita personal income of $38,944 (U.S. Department of Commerce, Bureau of Economic Analysis 2008c).

Farm Income

Farm income totaled approximately $71.5 million in 2006. Income generated by the sale of livestock and livestock products was nearly the same as income generated by the sale of crops, totaling $32.8 million and $34.5 million, respectively. Total income increased by approximately $8.1 million from 2001 (U.S. Department of Commerce, Bureau of Economic Analysis 2008d).

Mineral County

Personal Income

Nonfarm personal income totaled just over $134.6 million in Mineral County in 2006. Total personal income totaled just over $132.7 million. The total personal income level is less than the total nonfarm personal income because of an approximate $1.9 million loss in farm income. Per capita personal income totaled approximately $27,863 in 2006, substantially less than statewide per capita personal income of $38,944 (U.S. Department of Commerce, Bureau of Economic Analysis 2008e).

Farm Income

Farm income totaled approximately $1.7 million 2006. Income from livestock and livestock products and crops totaled $413,000 and $807,000, respectively. Total income decreased by $854,000 from 2001 (U.S. Department of Commerce, Bureau of Economic Analysis 2008f).

Agricultural Production

Lyon County

Cropland in Lyon County totaled 78,910 acres in 2007. This included approximately 38,200 acres in Mason Valley and 20,400 acres in Smith Valley (Table 7-2 in Chapter 7, Land Use and Agriculture). The market value of agricultural products sold from farms in Lyon County was approximately $91.1 million in 2007. This represents about 18% of the total 2007 farm sales from the entire state. Livestock and poultry accounted for $29 million. Crop production accounted for $62.1 million of the total market value of agricultural products sold.

Of this amount, forage crops, including hay, accounted for approximately $49.2 million. The average sales per farm totaled approximately $280,000, substantially more than the statewide average of $164,000 (U.S. Department of Agricultural, National Agricultural Statistics Service 2007).

The market value of agricultural products sold by Lyon County farmers increased from approximately $45.9 million in 1987 to $91.1 million in 2007 (U.S. Department of Agriculture, National Agricultural Statistics Service 2007). The total acreage classified as cropland has remained relatively constant over this same period, ranging from a low of 72,000 acres in 2002 to a high of 79,000 acres in 1997 (U.S. Department of Agriculture, National Agricultural Statistics Service 1992, 1997, 2002, and 2007). Cropland in the county totaled approximately 78,900 acres in 2007 (U.S. Department of Agriculture, National Agricultural Statistics Service 2007). Acreage planted to forage crops also remained fairly constant between 1987 and 2007, ranging from a low of 40,100 acres in 2002 to a high of 49,200 acres in 2007 (U.S. Department of Agriculture, National Agricultural Statistics Service 1992, 1997, 2002, and 2007).

Mineral County

Cropland in Mineral County totaled 6,382 acres in 2007. The market value of agricultural products sold from farms in Mineral County was approximately $2.9 million in 2007 (U.S. Department of Agriculture, National Agricultural Statistics Service 2007). This represents less than 1% of the total 2007 farm sales in the state. The average sales per farm totaled approximately $35,035 in 2007, much less than the statewide average of $163,931.

Environmental Consequences

This section describes the impact analysis relating to socioeconomics for the Proposed Project and other alternatives. It lists the criteria used to conclude whether an impact would be adverse or beneficial.

Dr. Lesperance, Director of Agriculture at the Nevada Department of Agriculture provided a socio-economic evaluation paper for this chapter of the DEIS (Lesperance 2009). In addition to Dr. Lesperance, many of Cooperating Agencies for this Draft EIS also provided extensive comments on the Administrative Draft EIS and those comments are equally as important for evaluation in the Draft EIS. Dr. Lesperance's paper is specifically discussed here, however, because it has been publicly cited several times as being of particular importance to the agricultural communities.

Some of the statistics and data used in Dr. Lesperance's paper match those presented in this Draft EIS. The primary differences in the socioeconomic analyses are related to the factors discussed below.

Dr. Lesperance concludes that 80% of the total current water use for agriculture in Mason and Smith Valley would be acquired for Walker Lake (i.e., up to 132,500 af/yr out of 166,000 af/yr of "combined irrigation use" exclusive of approximately 126,000 af/yr of estimated groundwater use). As explained in detail in the analysis in Chapter 3, Water Resources, the Draft EIS analysis estimates that approximately 82,000 af of surface water would need to be acquired under the Proposed Project to deliver an average additional inflow of 50,000 af/yr to Walker Lake.

Another factor that affects the amount of water assumed to be acquired is the estimated loss rate in the reach from Wabuska to Walker Lake; Dr. Lesperance and the Draft EIS analysis use different loss rates in their analyses. Dr. Lesperance uses a total average loss rate of 40.6% inclusive of evaporation, channel leakage, and use by the Walker River Indian Reservation. The Draft EIS analysis addresses on-Reservation irrigation diversions as continued exercise of WRPT's decreed water right and not part of other physical losses based on USGS diversion data. For physical losses, the Draft EIS analysis uses a composite incremental loss rate of approximately 10%, which is explained and documented in detail in Appendix 3A.

The higher amounts of acquired water assumed to be needed, and the use of higher average loss rates below Wabuska, result in a much higher potential economic impact in Dr. Lesperance's paper than is demonstrated in the Draft EIS analysis.

Assessment Methods

Impacts were determined by evaluating expected future conditions with each alternative versus the baseline of existing conditions and trends. An impact is identified when the change from baseline is attributable to the implementation of the alternative.

Acquisition Scenarios

Agricultural production for Alternatives 1 and 2 is based, in part, on two acquisition scenarios. These scenarios relate to how much irrigated land might be directly affected by acquisitions, as discussed in Chapter 7, Land Use and Agriculture (Environmental Consequences, Assessment Methods subsection).

The total acreage of irrigated agricultural lands that could be involved in acquisitions from willing sellers is estimated to range between 14,800 acres and 18,600 acres. For Alternative 1, it was assumed that these lands would be retired from irrigated agricultural production (i.e., redirected to non-water consuming uses or left as open space). For Alternative 2, it was assumed that lands would be fallowed and would rotate in and out of irrigated agricultural production during the 20-year program.

For Alternative 3, it was assumed that no lands would be retired and that water conservation practices would be implemented that would only partially attain the goal of adding an average inflow of 50,000 af/yr. See Chapter 3, Water Resources, and Appendix 3A for a detailed description of the methods used to calculate these acreages.

Agricultural Production

Although most of the crop production in East Walker area and Smith and Mason Valleys is alfalfa or other forage crops, the specific agricultural lands that may be affected by the proposed acquisitions are not known. Therefore, a gross average per acre crop value for alfalfa grown in Lyon County (i.e., the predominant irrigated crop, and one more likely to be affected by water rights offered for sale than, say, onions or other high-investment crops) was used to estimate the potential loss in agricultural production value under each alternative. The average per acre value was determined to be $529. This represents a 7-year rotation for alfalfa, including fallowing for 1 year (Bartholet et al. 2009). This per acre value was then applied to the acreage of agricultural land that could be affected under each alternative. For purposes of this analysis, it was assumed that crop production would cease on the irrigated lands from which water rights are purchased.

Agriculture Employment and Personal Income

The potential changes in employment and personal income levels that may occur as a result of reduced agricultural production were estimated by applying the per acre employment and income multipliers developed by the University (Bartholet et al. 2009). Affected employment has three components: direct, indirect, and induced employment. Direct employment refers to people working on farms; indirect employment refers to people working in agricultural support industries (e.g., suppliers of seed, chemicals, and fuel, and suppliers and servicers of agricultural equipment); and induced employment refers to people employed in the broader economy that supply goods and services to people employed in agriculture. Tables 10-1 and 10-2 provide a summary of estimated losses in employment and income in Lyon County that would occur under the upper and lower estimates of acreage retired from irrigated agricultural production.

Table 10-1. Estimated Impacts on Employment in Lyon County as a Result of Changes in Agricultural Production

Employment	Employment Multiplier (jobs/acre)	Estimated Job Loss	Baseline Employment	Loss as Percent of County Total
Lower Limit Scenario (assumes production ceases on 14,800 acres)				
Direct	0.007	103	665	15.5%
Indirect	0.002	30		
Induced	0.001	15		
Total		148	18,048	0.8%
Upper Limit Scenario (assumes production ceases on 18,600 acres)				
Direct	0.007	130	665	19.5%
Indirect	0.002	37		
Induced	0.001	19		
Total		186	18,048	1.0%

Sources: Employment multipliers: Bartholet et al. 2009.

Table 10-2. Estimated Impacts on Personal Income in Lyon County as a Result of Changes in Agricultural Production

Type	Income Multiplier ($/acre)	Estimated Income Loss ($ million)	Total Personal Income ($ million)	Loss as Percent of County Total
Lower Limit Scenario (assumes production ceases on 14,768 acres)				
Direct	73	1.4		
Indirect	61	1.1		
Induced	17	0.3		
Total	151	2.8	1,300	0.22%
Upper Limit Scenario (assumes production ceases on 18,625 acres)				
Direct	73	1.1		
Indirect	61	0.9		
Induced	17	0.3		
Total	151	2.2	1,300	0.17%

Sources: Income multipliers: Bartholet et al. 2009.

The estimated changes in employment and income under each alternative were compared to total employment in the two-county study area, Lyon County, and the combined Mason Valley, Smith Valley, and East Walker area.

Changes in employment within the Mason Valley, Smith Valley, and East Walker area were estimated by first identifying the census tracts and blocks falling within each area, calculating the population for each area as reported at the census block level, and then calculating the percentage of the total Lyon County population residing within each area. (Smith Valley and East Walker were combined into one area because they are within the same census block.) These percentages were then applied to the total change in employment estimated for each alternative to estimate job loss in Mason Valley, Smith Valley, and the East Walker area.

Recreation Employment and Income

Employment and income resulting from changes in recreation opportunities at Walker Lake were qualitatively assessed and based on the changes reported in Chapter 11, Recreation.

Spending profiles developed to estimate expenditures made by visitors to national forests for selected activities were used as a proxy for potential expenditures on similar activities occurring at Walker Lake. Daily expenditures made by nonlocal anglers participating in overnight trips average $220.39 per party per trip, and expenditures made by nonlocal persons participating in nature-related activities average $223.46 per party per trip (Stynes and White 2006). Expenditures made by local anglers average $41.65 per day trip and expenditures made by locals participating in nature-related activities average $26.99 per trip (Stynes and White 2006). Information reported by FWS indicates that fishing trip expenditures made by Nevada residents and nonresidents totaled approximately $61.4 million in 2006 (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2006). Wildlife viewing trip expenditures made by Nevada residents and nonresidents totaled approximately $159 million in 2006 (U.S. Department of the Interior, Fish and Wildlife Service).

As reported in Chapter 11, Recreation, visits to Walker Lake State Recreation Area averaged approximately 36,700 annually between 2004 and 2007. Anecdotal information provided by Nevada Division of State Parks staff (Johnson pers. comm.) suggests that 70% of these visitors are anglers and 30% are using the park's facilities. It is also believed that most anglers are local. For purposes of this analysis, it was assumed that almost all expenditures associated with recreation at Walker Lake State Recreation Area are by local anglers.

Tax Revenues

Sales Taxes

Sales taxes generated within Lyon County could be adversely affected by changes in agricultural production and the resulting reduction in the purchase of taxable goods and services by farmers as well as a reduction in purchases attributable to a decrease in total personal income. Conversely, sales taxes generated within Mineral County may increase as a result of the additional purchase of goods and services attributable to an increase in recreation activity at Walker Lake. (There may also be interactions between the two counties, since goods and services for both local and out-of-area recreational uses will most likely be purchased in both areas.) The potential changes in sales tax revenues generated within Lyon and Mineral Counties were qualitatively assessed.

Property Taxes

The assessed value of property within Lyon County totaled approximately $1.4 billion in 2007. The assessed value of agricultural lands totaled approximately $25 million. Property taxes generated within Lyon County totaled approximately $28 million in 2007. Of the $28 million, $760,000 was generated from agricultural lands (Bartholet 2008). Property tax revenues generated from agricultural lands represented about 1.4% of the Lyon County's 2007 budget.

If agricultural lands are left vacant, property tax generated from these lands would most likely decrease; however, this decrease may not be substantial if these lands are valued as open space (Bartholet et al. 2009). As suggested above, the potential loss of property tax revenues from agricultural lands affected by the program would represent a small proportion of the total property tax revenues generated within Lyon County.

Because it is not known how property values would be affected by the program, potential changes in property tax revenues generated within Lyon County were qualitatively assessed.

Property Values

A study of the socioeconomic effects of water transfers within Sacramento Valley (Mann 2002) suggests that property values may decrease or increase in the area directly affected by a transfer. Irrigated lands may be viewed as an investment opportunity when a transfer program is in place. Conversely, some property values may decrease when the level of income and profits generated from an existing use are directly tied to the availability of water. This suggests the following outcomes.

- A long-term (or permanent) acquisition of water would likely result in a greater adverse impact on property values when compared to a short-term (or temporary) acquisition program.

- Changes in the demographic characteristics of a region may offset to some degree the adverse impact of a water transfer as other economic activities occur, such as residential or commercial development.
- Landowners receiving payments for their water may reinvest all or a portion of those payments in land improvements.

Many variables may affect regional property values. As indicated above, Alternative 1 may preclude irrigated agriculture from 14,800 to 18,600 acres in Mason and Smith Valleys. This represents 25 to 32% of irrigated agricultural land in these valleys (Chapter 7, Land Use and Agriculture, Table 7-2). Such a large decrease in irrigated agriculture would most likely reduce the value of those properties. This potential impact on property values may be less under Alternative 2 because lands would be fallowed and would rotate in and out of production during the 20-year program. Alternative 3 is not expected to adversely affect property values because it would not directly affect the acreage of irrigated lands in the study area.

Seller Expenditures

Studies on the impacts of water reallocation have concluded that beneficial regional socioeconomic impacts may accrue as increased income to landowners occurs as a result of purchasing water from willing sellers (Local Entity and San Diego County Water Authority 2004, Palo Verde Irrigation District 2002). These reports conclude that some portion of sellers typically increase expenditures in the local and regional economy. However, these expenditures are not typically large enough to offset the adverse socioeconomic impacts of lands withdrawn from agricultural production. These potentially attenuating increases in expenditures were considered qualitatively in the assessment.

Impact Criteria

The determination of impacts on employment and income was made at the county level for Mineral County and at both the county level and a subregional level for Lyon County (including Mason Valley and Smith Valley). Socioeconomic impacts were considered adverse if the Proposed Project or alternatives would:

- result in a substantial decrease in employment, personal income, or sales taxes generated in Lyon and Mineral Counties.

An increase in recreation-based employment was considered beneficial.

Impacts

No Action Alternative

As indicated in the discussion of agricultural production in Lyon County above, the total cropland and acres planted with forage crops has remained relatively

constant between 1987 and 2007 and a significant change to cropland acreage or crops is not expected under the No Action Alternative. However, within that same time period, the market value of agricultural products has increased substantially and will likely continue to increase especially if the recent growth in production and/or processing of onions, lettuce, and other higher-valued crops continues.

As indicated in Chapter 7, Land Use and Agriculture, land uses in the study area are not expected to change under the No Action Alternative. This conclusion, combined with the historic trend data, suggests that the amount of land under agricultural production in Lyon County is not expected to change substantially under the No Action Alternative. Because the amount of land under agricultural production is not expected to substantially increase or decrease, substantial changes in agriculture-related employment, personal income, or tax revenues are not expected.

Because the condition of Walker Lake would continue to decline, economic activity in the vicinity of Hawthorne and Walker Lake attributable to recreation opportunities is expected to continue to decrease. As indicated in Chapter 11, Recreation, recreation opportunities associated with fish and wildlife at Walker Lake would continue to be adversely affected if the lake's elevation and water quality continue to decline. This would be an adverse socioeconomic impact.

The continued decline in recreation-related opportunities at Walker Lake would result in an adverse impact on employment, personal income, and sales tax revenues in Mineral County.

Alternative 1 (Proposed Project)

Acquisitions under Alternative 1 are expected to add an average of 50,000 af/yr of water to Walker Lake. It is possible, however, that less than the full 50,000 af would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the annual average inflow to the lake would increase by 7,300 af.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that acquisitions would increase the average annual inflow to the lake by 50,000 af. Unless otherwise noted, if the full amount of water were not acquired, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Impact SOC-1. Change in Total Employment as a Result of Changes in Agricultural Production (Minor Adverse)

Implementing Alternative 1 would result in less agricultural production in Mason and Smith Valleys and the East Walker area. Acquisitions could result in an

estimated annual production loss ranging from $7.8 million to $9.9 million. As indicated in the Affected Environment section, it was assumed that most of the agricultural lands affected by acquisitions produce alfalfa or other forage crops. Depending on the acquisition scenario (14,768 to 18,625 acres), this would result in production losses ranging from approximately 33 to 42% of the total market value of hay and other forage crops grown in Lyon County. When compared to the total value of agricultural products sold from Lyon County, this loss would range from approximately 9 to 11%.

The per acre employment multiplier (Bartholet et al. 2009) indicates that the estimated direct, indirect, and induced losses in employment that may occur as a result of the loss in agricultural production in Lyon County would total between 148 and 186 jobs. This includes the estimated direct loss of 103 to 130 jobs. This estimated loss represents approximately 1% of total employment in Lyon County and less than 1% of total employment in the two-county study area (20,332 jobs).

Assuming that the direct, indirect, and induced losses in employment would occur only within Mason Valley (including Yerington) and Smith Valley, it can be further estimated that the total lost jobs may represent approximately 3 to 5% of employment in the Mason Valley and Smith Valley areas.

The loss of total employment as a result of implementing Alternative 1 is considered a minor impact because these losses would represent less than 1% of total employment occurring in the two-county study area and approximately 1% of employment occurring in Lyon County. The minor nature of this impact would be the same with either full or existing funding, but its expected magnitude would be proportional to the amount of allocated funding.

The total loss of employment would be considered an adverse impact if this loss would occur entirely within Mason and Smith Valley because it would represent 3 to 5% of total employment. This impact would be the same with either full or existing funding, but its expected magnitude would be proportional to the amount of allocated funding.

The loss in employment could be offset if landowners receiving payments choose to invest all or a part of those payments locally. This could include raising and/or processing alternative crops, dry farming, or other enterprises (Bartholet et al. 2009).

Impact SOC-2. Change in Agricultural Employment as a Result of Changes in Agricultural Production (Adverse)

The loss in annual production of $7.8 million to $9.9 million (see Impact SOC-1) would reduce farm employment in Lyon County by approximately 16 to 20%.

If these direct losses were to occur only within Mason and Smith Valleys, the impact would be much greater. The direct change in employment resulting from the loss in agricultural production would account for approximately 21 to 27% of total farm employment within Mason and Smith Valleys.

This would be an adverse impact. The adverse nature of this impact would be the same with either full or existing funding, but its expected magnitude would be proportional to the amount of allocated funding for acquisitions.

The loss in employment could be offset if landowners receiving payments choose to invest all or a part of those payments locally. This could include raising and/or processing alternative crops (Bartholet et al. 2009) or other enterprises.

Impact SOC-3. Change in Employment as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial with Full Funding; No Impact with Existing Funding)

As indicated in Chapter 11, Recreation, implementing Alternative 1 would result in a beneficial impact on recreation opportunities at Walker Lake. Based on spending profile information and visitation data collected by the Nevada Division of State Parks, existing spending to participate in recreation opportunities occurring at Walker Lake totals an estimated $1.1 million annually. This represents about 1.5% of total spending made by anglers in Nevada in 2006.

Increasing the surface elevation of the lake would have a beneficial impact on recreation opportunities by improving access and increasing the population levels of fish and wildlife. Enhancing these recreation opportunities would increase economic activity in Mineral County because out-of-region visitation to Walker Lake and associated expenditures on goods and services would increase (Seung et al. 1990, Fadali et al. 1998).

With full funding of Alternative 1, increased visitation to Walker Lake would be expected to have a beneficial impact on local employment as the demand for recreation-related services and products would increase.

As indicated in Chapter 11, Recreation, acquisitions from existing funding would not benefit sport fishing, birding, and associated recreational opportunities in the Walker Lake area in the long run. Similarly, existing funding would provide no benefit to shoreline recreation and boating access at Walker Lake compared to existing conditions. Lake surface elevation would continue to drop and TDS concentration would increase, though less than under the No Action Alternative.

Impact SOC-4. Change in Income as a Result of Changes in Agricultural Production (Minor Adverse)

As discussed under Impact SOC-1, Alternative 1 would result in the loss of agricultural production in Mason and Smith Valleys and the East Walker area. As a result of loss in agriculture-related employment, total personal income in Lyon County and in the study area would also decline.

The estimated loss in employment resulting from changes in agricultural production and losses in total personal income would range from $2.2 to $2.8 million. This loss represents approximately 0.17 to 0.22% of total personal income in Lyon County.

The loss in agricultural production would result in a minor impact on total personal income in the two-county study area and in Lyon County.

The minor nature of this impact would be the same with either full or existing funding, but its expected magnitude would be proportional to the amount of allocated funding.

The losses in income may be partially offset if landowners receiving payments choose to invest all or a part of those payments locally. This could include raising and/or processing alternative crops (Bartholet et al. 2009) or investing in other local business opportunities.

Impact SOC-5. Change in Income as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial)

As a result of potential increases in employment associated with enhanced recreation opportunities at Walker Lake, personal income is expected to increase slightly in Mineral County, with full funding of Alternative 1. Increased visitation to Walker Lake may have a beneficial impact on total personal income levels in Mineral County as a result of an increase in demand for recreation-related services and products.

With acquisitions from existing funding, recreational opportunities in the Walker Lake area would not benefit substantially in the long run, compared to existing conditions, as indicated above in Impact SOC-3. Lake surface elevation would continue to drop and TDS concentration would increase, although less than under the No Action Alternative. Corresponding impacts on recreation-related employment and personal income would be expected.

Impact SOC-6. Change in Tax Revenues (Minor Adverse)

As indicated in Impact SOC-1, implementing Alternative 1 would likely result in a reduction in agricultural production. This loss of production would result in a loss of employment and personal income in Lyon County. This reduction in

economic activity could also result in a reduction in sales tax revenues if purchase of taxable goods and services declines.

The potential change in sales tax revenues would be considered a minor impact because a large proportion of purchases made by landowners and employees (e.g., groceries and agricultural implements) are exempt from sales tax (Bartholet et al. 2009).

If formerly productive agricultural lands in Lyon County are left vacant as a result of implementing Alternative 1, it is likely that these properties would receive a lower property tax valuation than for agricultural lands (Bartholet et al. 2009). This lower valuation would result in a slight reduction in total property tax revenues generated within Lyon County.

The minor nature of this impact would be the same with either full or existing funding, but its expected magnitude would be proportional to the amount of allocated funding.

Alternative 2 (Leasing Alternative)

Because Alternative 2 involves recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/year, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years. Under full funding, it is expected that lands would be fallowed and would rotate in and out of production during the 20-year program.

Impact SOC-1. Change in Total Employment as a Result of Changes in Agricultural Production (Minor Adverse)

With full funding of Alternative 2, the impact on total employment would be the same as described for Alternative 1, but it would be temporary. Similar to Alternative 1, losses in employment could be offset if landowners receiving payments choose to invest all or a part of those payments locally.

With existing funding of Alternative 2, the initial impact on employment in Lyon County would be the same as described for Alternative 1 because the same amount of land would be fallowed. The long-term adverse impact on employment would be avoided, however, because existing program funding would only last approximately 3 years. At the end of this period, the water transfers would cease, and landowners would have the opportunity to, and it is expected they would, place fallowed agricultural lands back into production.

Impact SOC-2. Change in Agricultural Employment as a Result of Changes in Agricultural Production (Adverse)

With full funding, the impact of Alternative 2 on agricultural employment would be the same as described for Alternative 1; however, once funding ended, the fallowed agricultural land could be placed back into production. The agricultural-related employment could be offset if landowners receiving payments choose to invest all or a part of those payments locally.

Under an existing funding scenario, the initial impact on employment in Lyon County would be the same as discussed for Alternative 1 because the same amount of land would be removed from production. The long-term adverse impact on agricultural employment would be avoided, however, because existing program funding would only last approximately 3 years. At the end of this period, the leasing of water would cease, and landowners would have the opportunity to place fallowed agricultural lands back into production.

Impact SOC-3. Change in Employment as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial)

With full funding, the impact of Alternative 2 on recreation-related employment would be the same as described for Alternative 1. This beneficial impact is associated with recreation opportunities at Walker Lake. Once funding ends and if the environmental conditions at Walker Lake return to preproject conditions, it is expected that employment would also return to preproject conditions.

As indicated in Chapter 11, Recreation, Alternative 2 with existing funding would provide some temporary benefits to recreation opportunities, but nothing long-term. After approximately 3 years, lake surface elevation would drop and TDS concentration would increase, with no subsequent benefit to recreational opportunities. A corresponding initial increase and then decline in recreation-related employment and personal income would be expected.

Impact SOC-4. Change in Income as a Result of Changes in Agricultural Production (Minor Adverse)

With full funding, the impact of Alternative 2 on personal income resulting from changes in agricultural production would be expected to be essentially the same as for Alternative 1; however, once funding ends, the fallowed agricultural land could be placed back into production. The loss in income could be offset if landowners receiving payments invest all or a part of those payments locally.

Under an existing funding scenario, short-term minor impacts on personal income would occur as a result of loss in agricultural production, as under the full funding scenario; however, these impacts may be less because landowners may rotate lands in and out of production during the 20-year program period.

Impact SOC-5. Change in Income as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial)

With full funding, the impact of Alternative 2 on personal income would be the same as described for Alternative 1. Once funding ends and if the environmental conditions at Walker Lake return to preproject conditions, it is expected that income would also return to preproject conditions.

Impact SOC-6. Change in Sales Tax Revenues (Minor Adverse)

Under Alternative 2, the impact on sales tax revenues would be the same as described for Alternative 1, but may be temporary. Once funding ends and if the environmental conditions at Walker Lake return to preproject conditions, it is expected that sales tax revenues associated with recreation at Walker Lake would also return to preproject conditions.

Alternative 3 (Efficiency Alternative)

As discussed in Chapter 3, Water Resources, it is estimated that full funding of Alternative 1 would increase inflow to Walker Lake by 50,000 af/yr on average, while full implementation of Alternative 3 would yield 32,300 af/yr. Unless otherwise indicated, the impacts of Alternative 3 would be similar to those of Alternative 1 with full funding (i.e., no impact, minor, beneficial, or adverse), but less in magnitude because less water would be available for acquisition.

Impacts Similar in Nature to Alternative 1

Impact SOC-3. Change in Employment as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial)

Under Alternative 3, the magnitude of the beneficial impact on employment resulting from increased recreation opportunities at Walker Lake is not expected to be as great as under Alternative 1 because less water would reach the lake and there would be little improvement in boating access compared to existing conditions. However, other benefits to recreational opportunities attributable to Alternative 1 would also occur with Alternative 3.

Impact SOC-5. Change in Income as a Result of Changes in Recreation Opportunities at Walker Lake (Beneficial)

Under Alternative 3, the magnitude of the beneficial impact on personal income resulting from increasing recreation opportunities at Walker Lake is not expected to be as great as under Alternative 1 because less water is expected to reach the lake and there would be little improvement to boating access compared to existing conditions. However, other benefits to recreational opportunities attributable to Alternative 1 would also occur under Alternative 3.

Impacts Different from Alternative 1

Impact SOC-1. Change in Total Employment as a Result of Changes in Agricultural Production (Beneficial)

Under Alternative 3, no permanent change in employment would occur because implementing efficiency methods to conserve water would not necessitate reducing or fallowing agricultural lands.

Improvements to the water delivery systems in Mason and Smith Valleys and the East Walker area and initiating other efficiency improvements are expected to temporarily increase employment and income in the study area. Improvements would benefit the local economy. The magnitude of this benefit would be driven by the amount of expenditures made on improving the water delivery system, the duration of construction, and the extent to which local contractors and workers would be used to construct the improvements.

Impact SOC-2. Change in Agricultural Employment as a Result of Changes in Agricultural Production (No Impact)

Under Alternative 3, no permanent change in total employment would occur because implementing efficiency methods would not affect land status.

Impact SOC-4. Change in Income as a Result of Changes in Agricultural Production (No Impact)

Under Alternative 3, no adverse impact on personal income levels in Lyon County is expected because agricultural production would not decrease.

Improvements to the water delivery system in Mason and Smith Valleys and the East Walker area and other efficiency measures would temporarily increase income in the study area. These improvements and other efficiency measures would increase total personal income level in Lyon County and in the study area. The magnitude of this increase would be driven by the amount of expenditures, the duration of construction, and the extent to which local contractors and workers would be used.

Impact SOC-6. Change in Sales Tax Revenues (Beneficial)

Under Alternative 3, maintaining agricultural production and implementing water efficiency measures in the study area could result in a short-term beneficial impact on sales taxes generated in Lyon County for the duration of the project.

Chapter 11 Recreation

Introduction

This chapter describes the affected environment for recreation in the study area and the potential impacts on recreation that would result from the Proposed Project and other alternatives.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- BLM, Carson City Field Office Consolidated Resource Management Plan (Bureau of Land Management 2001)
- BLM, Walker Lake Recreation Management Plan (Bureau of Land Management 1979)
- Lyon County Master Plan (Lyon County 1990)
- Mineral County Master Plan (Mineral County 2006)

Affected Environment

This section describes the environmental setting related to recreation in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for recreation was defined as the following areas in Lyon and Mineral Counties: West Walker River, East Walker River, mainstem Walker River, Walker Lake, irrigated land in the valleys, Weber Reservoir, Mason Valley and Alkali Lake WMAs, and a 1-mile zone around each of these areas.

California and Douglas County, Nevada, were not included in the study area. Although the Walker River watershed originates in Mono County, California, the Proposed Project would not change any operations of acquire land, water appurtenant to the land, and related interests in California or Douglas County, Nevada. Operating criteria for upstream reservoirs would not be changed. The California and Douglas County, Nevada, portions of the basin would not be affected directly or indirectly by the Proposed Project.

Under all action alternatives, Topaz Lake Reservoir would continue to operate as required by existing water rights licenses, permits, and agreements; therefore, this reservoir has been excluded from the study area.

Key recreational activities addressed by this EIS are those that are water dependent or are influenced by their proximity to Walker River, Walker Lake, or WMAs. These include shoreline use, boating, sport fishing, hunting, Hiking, and

wildlife viewing. A map of recreation areas and facilities within the study area is provided in Figure 11-1

Recreation in the study area occurs on land owned or administered by the following entities:

- BLM, Carson City Field Office
- USFS (Humboldt-Toiyabe National Forest)
- DOD (Hawthorne Army Depot)
- WRPT
- YPT
- NDOW
- Mineral County
- Lyon County
- Private owners

Bureau of Land Management

BLM lands in the study area are managed by the Carson City District Office. These lands are used for multiple purposes, including wilderness, recreation, mining, herd management areas, mineral and energy leases, and grazing allotments (Bureau of Land Management 2001).

BLM owns and manages land on the west and east shores of Walker Lake. Three BLM recreation facilities are located on the west shore: Sportsman Beach, Tamarack Beach, and Twenty Mile Beach. Sportsman's Beach provides 31 individual camp sites plus two undeveloped camping areas that accommodate RV and tent campers. Facilities include vault toilets, covered picnic tables, barbeque grills, paved access roads, and a public boat ramp area (Bureau of Land Management 2008a). The public boat ramp at Sportsman's Beach no longer operates and is being removed by NDOW because declining lake level has caused the shoreline to recede, resulting in a shallow approach (Hull pers. comm.). Both Tamarack Beach and Twenty Mile Beach offer paved access to the lakeshore and have vault-style toilets. Primitive camping is allowed at both sites, but there is no developed camp site (Bureau of Land Management 1999). Between October 1, 1998, and September 20, 2007, approximately 291,973 combined visits were made to these three facilities (Hull pers. comm.).

On the west side of Walker Lake, OHV use is limited to designated roads and trails that provide access to 2,640 acres.

The east shore provides primitive camping, hiking, OHV use, and wildlife viewing and does not contain any constructed recreation facilities. There is

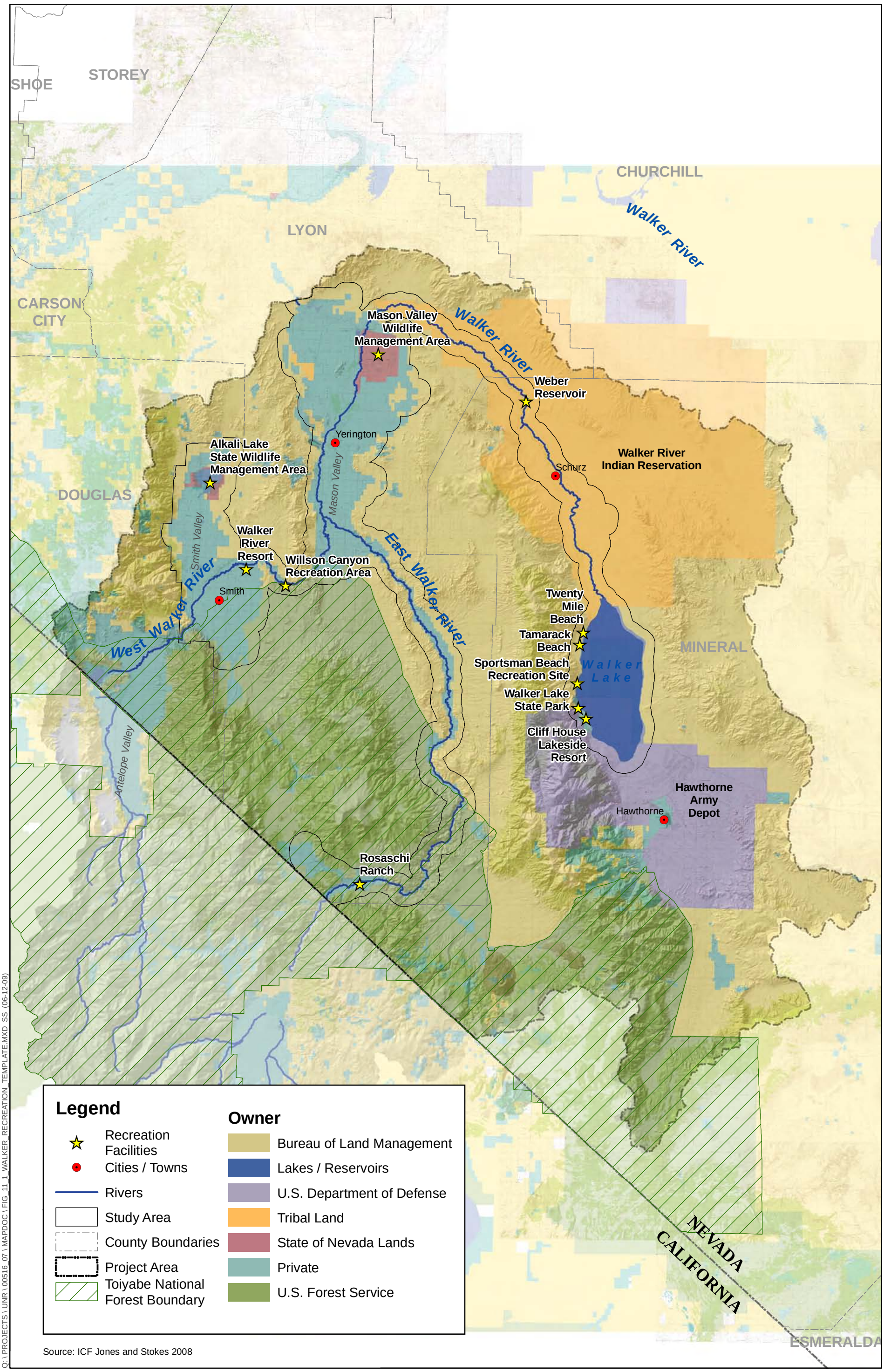


Figure 11-1
Recreation Facilities in the Study Area

unlimited OHV access to the east side of the lake (Bureau of Land Management 2001).

BLM owns and manages Wilson Canyon on the West Walker River. Wilson Canyon is a major OHV riding area, and is also popular as a place to camp, fish, hike, and picnic. BLM will fence and place signs along the bed and banks of the river in the near future to protect the river, and motorized vehicles and camping will not be allowed inside the fence (Bureau of Land Management 2008b).

National Forest System Lands

USFS manages the Humboldt-Toiyabe National Forest, located along the upper reaches of the East and West Walker Rivers. The only USFS-developed facility in the study area is Rosaschi Ranch, located on East Walker River. Rosaschi Ranch is open to the public and is a popular fly-fishing site for rainbow and brown trout. It has a “catch-and-release” fishing regulation (Flyfish Nevada 2008). Other recreational activities on national forest lands include hiking, backpacking, camping, fishing, hunting, OHV use, horseback riding, bird and wildlife viewing, photography, and summer ranger-guided programs and activities. During the winter, activities include cross-country skiing, snowshoeing, and snowmobiling. In the Humboldt-Toiyabe national forest, recreation visits were estimated to be 3,205,000 in 2006 (U.S. Forest Service 2008).

Hawthorne Army Depot

The DOD’s Hawthorne Army Depot is a 147,000-acre ammunition storage depot on the south end of Walker Lake. The portion of lake that falls under the DOD’s jurisdiction is not open to the public for recreation purposes because of unexploded ordinance hazard. This area is delineated by buoys to prevent boaters from entering (Schildt pers. comm.).

Walker River Indian Reservation

The Walker River Indian Reservation provides opportunities for dispersed recreation; camping and fishing are the main activities. Weber Reservoir is located on the reservation and is a popular weekend spot for informal camping, fishing, and picnicking by tribal members (Miller Ecological Consultants 2005).

Fishing on the reservation occurs primarily in Walker River, Weber Reservoir, and the northern tip of Walker Lake. The reservoir supports a warmwater fishery under normal operating conditions (Miller Ecological Consultants 2005). WRPT maintains fishing regulations on the reservation. Fish species include trout, largemouth bass, catfish, crappie, and carp (Walker River Paiute Tribe 2008b).

Boating in the reservation is limited to canoes, kayaks, rafts, and boats with motors less than 10 horsepower. No personal watercrafts (e.g., jet skis) are

allowed in these waters (Walker River Paiute Tribe 2008). Boating on the portion of Walker Lake located on reservation lands is limited to the fishing season only, and only by permit. Two signs located along the shoreline and an imaginary line between them designate where the reservation begins (Schildt pers. comm.).

Yerington Paiute Reservation

The Yerington Paiute Reservation is surrounded by private and BLM lands. YPT members hunt birds and small game on the reservation. The Tribe has planned the restoration of wetlands along the Wabuska Drain in the Perazzo Slough area, and has proposed recreational facilities as part of this project. This project will also support the gathering of traditional plants.

Tribal members also use multiple sites in the study area for gathering traditional plants and materials used in cultural and spiritual activities. This activity is concentrated near surface water, in wetlands, and along the Walker River. Although the Tribe does not equate cultural and spiritual activities with recreation, plant collection occurs in areas that may be managed for recreation by state and federal agencies. Plants collected include Ta'boosi, a river sedge plant; Toi, cattails; Sai'bu, tules; Suu'vii, red willows; Wuu'wii'pui, buckberries; Ma'va'bui, yellow currents; Toi'buh, rosebushes; Kwi'bah'noh, stinging nettles; Numu wai'va, river grass; rye grass; wild mushrooms; Suung'a'vii, cottonwood trees; To'no'vii, greasewood; Pah sah'wa'vii, big sagebrush; and Wii'ha, dogbane.

Nevada Department of Wildlife – Wildlife Management Areas

The State of Nevada, through NDOW, owns or has long-term leases on more than 117,000 acres of land incorporated into WMAs across the state. The management focus of most WMAs is development of wetland- and waterfowl-related activities, including the use of these areas as public shooting grounds, with all other uses being secondary (Nevada Department of Wildlife 2002). Public uses include bird watching, hiking, fishing, and hunting. Hunting on WMAs targets migratory game bird, upland game bird, furbearer, and big game hunting (Nevada Department of Wildlife 2008a).

Two WMAs occur in the study area: Alkali Lake WMA and Mason Valley WMA. These WMAs are described below. See also Chapter 7, Land Use and Agriculture.

Mason Valley Wildlife Management Area

Mason Valley WMA is located on the north end of Mason Valley and totals approximately 13,735 acres. The WMA is open year-round and attracts hunters, anglers, and other outdoor enthusiasts. It also provides nature education opportunities (Nevada Department of Wildlife 2008a).

The Walker River bisects the WMA as it traverses from south to north. Other major bodies of water include Hinkson Slough, North Pond, Mallard Pond, Honker Lake Bass Pond, Crappie Pond, and approximately 30 additional ponds, sloughs, and channels that are scattered across the WMA. Boating is allowed, but some bodies of water are closed during certain times of the year. Vessels must travel at or below 5 nautical miles per hour at all times (Nevada Department of Wildlife 2008a).

Wildlife-related recreation activities include hunting, fishing, wildlife viewing, photography, horseback riding, camping in the primitive campground, educational activities, picnicking, hiking, and touring the Mason Valley Hatchery (Nevada Department of Wildlife 2008b). Seasonal hunting in the WMA consists primarily of waterfowl hunting, but upland game and big game hunting is also allowed on certain days in the season (Nevada Department of Wildlife 2008b).

Fishing for both warmwater and coldwater species is available in the WMA. Largemouth bass is the most sought-after game species during the late spring and summer and is found in about 33% of the ponds in the WMA. Three trout species are stocked in Hinkson Slough and North Pond (Nevada Department of Wildlife 2008b).

Alkali Lake Wildlife Management Area

Alkali Lake WMA is located on the north end of Smith Valley and is approximately 3,448 acres. Recreation opportunities include hunting, hiking, wildlife viewing, and photography. Camping is not allowed (Nevada Department of Wildlife 2008a). When water is present, Alkali Lake is used by ducks, geese, shorebirds, and wading birds, and provides hunting opportunities. The lake does not support fishing (Bull pers. comm.).

Nevada Division of State Parks

Nevada Division of State Parks owns and maintains Walker Lake SRA, located 11 miles north of Hawthorne, off U.S. Highway 95. Facilities at the SRA include picnic tables, seven shade structures with tables, barbecue grills, and fire pits at each structure; and two vault-style restrooms. The concrete boat ramp is not in use because of low lake elevation. A lake surface elevation equivalent to that of 1980 (i.e., roughly 20 feet higher than the lake's July 2008 elevation) would be needed for this ramp to be usable. A primitive boat ramp north of the concrete ramp is temporarily in use. Funds previously allocated for improvements to this ramp have been reallocated because of the state of the lake. If the lake elevation continues to decline, the fishery will be lost; if the lake elevation increases, the Sportsman's Beach ramp will become usable again (Jarrett pers. comm.). In addition, boaters are currently launching and retrieving boats at Walker Lake SRA from the shore using four-wheel drive vehicles (Hull pers. comm.; Angler Guide 2008). Activities at the SRA include fishing, boating, swimming, wildlife

viewing, and hiking. Visitor use appears to have been relatively stable over the past 4 years (Table 11-1).

Table 11-1. Walker Lake State Recreation Area Visitor Use

	Total Estimated Visitors[a]				
	2004	2005	2006	2007	2008
Jan	2,637	2,568	2,408	2,325	1,779
Feb	2179	2,204	2,804	2,524	3,465
March	3,008	4,515	2,523	2,523	6,661
April	2,603	5,520	2,100	2,100	2,064
May	3,160	7,217	7,939	7,939	5,940
June	2,641	2,584	2,842	1,819	5,478
July	1,861	2,047	2,267	1,865	4,333
August	1,787	4,257	4,196	3,175	
September	1,773	1,500	1,858	1,790	
October	1,643	5,413	5,954	1,702	
November	1,704	1,600	2,000	2,000	
December	1,557	3,630	5,636	5,072	
Total	26,553	43,055	42,527	34,834	

Source: Johnson 2008.

[a] Calculated by multiplying the number of vehicles by an average number of occupants per vehicle. The average number of occupants changes with each season as determined by a visitor survey of State Park users conducted several years ago.

Lyon County

In Lyon County, the Walker River and adjacent lands provide such recreational opportunities as fishing, hiking, wildlife viewing, hunting, and photography. Public access along the West Walker River is limited because of private ownership. The East Walker River flows through private lands as well as BLM lands and USFS lands (Humboldt-Toiyabe National Forest), which allows for recreational access to the water. The mainstem Walker River flows through private lands, land owned by the City of Yerington and Lyon County, land owned by the State of Nevada (Mason Valley WMA), and the Walker River Indian Reservation. The mainstem Walker River provides the most public access opportunities because of the large amount of public lands that are immediately adjacent to the river.

Lyon County does not maintain any park facility within the study area.

Mineral County

Mineral County has one major town, Hawthorne, and a few smaller towns. Hawthorne contains a primary school, elementary/junior high and high schools, and a community college. The schools sites have ball fields and playgrounds. Hawthorne has county-maintained parks. Walker Lake is located entirely in Mineral County and provides water-related recreation opportunities, including boating, water skiing, sport fishing, swimming, and birding.

The only sport fish found in Walker Lake is LCT, which is stocked annually by NDOW and USFWS. Under ideal environmental conditions, LCT can live up to 9 years and achieve weights greater than 10 pounds. Currently, Walker Lake LCT range from 13 to 25 inches and from 1 to 3.5 pounds (Nevada Department of Wildlife 2008c).

Numerous festivals and events are held in Mineral County annually. The town of Hawthorne hosts three fishing derbies and Armed Forces Day. An annual Loon Festival has been celebrated at Walker Lake, but will not be held in 2009 because of the low number of loon sightings in 2008. The Loon Festival will be replaced by Walker Lake Education Day, which will highlight the multi-organization and agency efforts to prevent the collapse of the freshwater fishery (Lahontan Audubon Society 2009). The Pinenut Festival is held in September in Schurz on the Walker River Indian Reservation (Walker Lake Working Group 2008). The El Capitan Fishing Derby and the Thanksgiving Fishing Derby are also held at Walker Lake (Walker Lake Working Group 2008).

City of Yerington

The City of Yerington, located in Lyon County, maintains seven park facilities, providing amenities such as active sports fields, a swimming pool, playgrounds, picnic tables and shade structures, a skate park, fishing lake, and walking paths (City of Yerington 2008).

The mainstem Walker River flows through the city and delineates much of its western boundary. The river in this reach provides recreation activities, including fishing, bird watching, and photography.

Private Owners

Numerous RV parks are located within the study area, primarily in or near Hawthorne and Yerington. Most of the parks offer overnight, weekly, and monthly camping options, but do not contain recreation amenities on site or allow tent camping. The RV parks in Hawthorne are 8 miles from Walker Lake SRA and have other nearby recreation opportunities on BLM land.

Cliff House Resort is the only private facility located on the west shore of Walker Lake. It has 30 acres and a 5,000-square-foot boathouse with attached boat repair shop, motel, restaurant, bar, game room, and RV hookups (Dzvonick 2008).

Walker River Resort, near the town of Smith, is a private resort and hunting preserve located on West Walker River. The resort offers RV camping and cottages. Activities on the resort include seasonal bird hunting, clay shooting, fly fishing, swimming, golfing, and resort-planned activities. OHV riding is not allowed on the resort property, but is allowed on the surrounding 100,000 acres of BLM land (Walker River Resort 2008).

Private farmland provides opportunities for wildlife viewing and upland bird hunting.

Environmental Consequences

This section describes the impact analysis relating to recreation for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

This section assumes any lands acquired by the University as part of project implementation would not be managed for public recreation purposes.

Impact Criteria

Impacts on recreation would be considered adverse if implementation of the Proposed Project or alternatives would result in a substantial loss in recreational activity or opportunities in the study area. Outcomes that conflict with recreational policies, goals, objectives, or plans of agencies or jurisdictions in the study area would also be considered adverse.

Impacts

No Action Alternative

The No Action Alternative would result in adverse impacts on recreation at Walker Lake in several ways. With no increase in water flow, lake elevation and water volume would continue to decrease and TDS concentration would continue to increase (Chapter 3, Water Resources). The higher TDS concentration would further reduce the Walker Lake fishery, and LCT could no longer be stocked in the lake (Chapter 5, Biological Resources—Fish), effectively ending all sport fishing in Walker Lake. The collapse of the fishery would reduce the food supply for migratory birds, such as common loon (Chapter 6, Biological Resources—Wildlife). Festivals and recreation activities that center on fishing and migratory birds, including fishing derbies, would attract fewer participants or would be altogether canceled. With fewer birds in the area, recreational birding would be less attractive to visitors.

Higher TDS concentration would make recreational activities involving water contact, such as swimming, less desirable as a result of a potential increase in eye and skin irritation and algae growth. Walker Lake elevation would continue to decline, exposing more lake bottom. This would decrease the scenic quality of the lake environment, aesthetically detracting from many outdoor recreational activities at or within view of the lake, such as boating, hiking, and birding. Increased fugitive dust during wind events from the dried lakeshore would negatively affect the recreation experience at the lake. Further shrinking of Walker Lake would make access to recreation facilities on the west shore more difficult and could cause the closure of facilities. The No Action Alternative also would undermine progress toward and achievement of Mineral County's recreation-related goals. These would be adverse impacts.

Alternative 1 (Proposed Project)

Water rights acquired under Alternative 1 are expected to add an average additional inflow of 50,000 af/yr Walker Lake. It is possible, however, that less than the average 50,000 af/yr would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the average inflow to the lake would increase by only 7,300 af/yr.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that the average annual inflow to the lake would increase by the full 50,000 af/yr. Unless otherwise noted, if the full amount is not acquired, the impacts would be similar in nature but of less magnitude.

Direct Impacts

Impact REC-1: Increase Consistency with Mineral County Recreation Policies (Beneficial Impact with Full Funding; No Impact with Existing Funding)

The increased inflow under Alternative 1 would improve lake ecology and recreational conditions at Walker Lake. This improvement would support Mineral County's goal to continue recreational use of Walker Lake as well as goals to preserve and improve outstanding natural and scenic features and to restore health and functioning to the natural resources of the county. This would be a beneficial impact.

It is estimated that acquisitions limited to existing allocated funding would increase average inflows to Walker Lake by an average of 7,300 af/yr. This increase would be insufficient to significantly improve the ecology of the lake, but it would begin the process of reversing the lake's decline. Existing allocated funding would not by itself achieve Mineral County's goals as they apply to Walker Lake, but it would contribute toward those goals to a greater degree than the No Action Alternative.

Indirect Impacts

Impact REC-2: Improve Sport Fishing Opportunities in Walker Lake as a Result of Improved Water Quality (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, increased flow to Walker Lake is expected to decrease TDS concentration, resulting in an overall beneficial impact on water quality for the Walker Lake fishery (Chapter 5, Biological Resources—Fish). A decrease in TDS concentration in Walker Lake is expected to increase the survivability and size of LCT and therefore improve the sport fishing opportunities at Walker Lake. Improved fisheries would also support the multiple fishing derbies held throughout the year. This would be a beneficial impact.

With acquisitions from existing funding, sport fishing would not benefit substantially, but there could be some short-term benefit, depending on the timing of releases of acquired water from Weber Reservoir. If acquired water is released to provide spring freshets, this could result in a short-term decrease in TDS concentration that could help stocked LCT acclimate to Walker Lake (Chapter 5, Biological Resources—Fish). However, despite the average 7,300 af/yr of additional inflow, Walker Lake would continue to shrink and TDS concentration would rise over the long run to a projected concentration of over 30,000 mg/l in 2200. This is slightly better than the No Action Alternative, but not sufficient to improve the long-term prospects for LCT survival and associated sport fishing.

Impact REC-3: Improve Boating Access as a Result of Increased Flow to Walker Lake (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, increased flow to Walker Lake is expected to cause lake elevation to rise 30 to 35 feet, which would submerge the boat ramp at Walker Lake SRA and make it operable again. This would be a beneficial impact.

With acquisitions from existing funding only, lake elevation would continue to drop, although less than in the No Action Alternative. (See Chapter 3, Water Resources, Table Lake Summary, Estimated Future Water Surface Elevation and TDS Concentrations for Walker Lake for All Alternatives, for future changes in lake elevation.)

Impact REC-4: Improve Shoreline Recreational Use as a Result of Increased Flow to Walker Lake (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, increased flow to Walker Lake is expected to cause lake elevation to rise by 30 to 35 feet. The expected rise in water elevation would make access to the water for swimming, wading, fishing, and other shoreline recreation easier. This would be a beneficial impact.

With acquisitions from existing funding only, lake elevation would continue to drop, although less than in the No Action Alternative. (See Chapter 3, Water Resources, Table Lake Summary, Estimated Future Water Surface Elevation and TDS Concentrations for Walker Lake for All Alternatives, for future changes in lake elevation.)

Impact REC-5: Increase in Other Recreational Experiences and Activities as a Result of Increased Flow to Walker Lake (Beneficial Impact with Full Funding; No Impact with Existing Funding)

Under the Proposed Project, as discussed in Impact REC-2, an improved fishery would benefit migratory bird species, including common loon and American white pelican, which feed on fish in Walker Lake (Chapter 6, Biological Resources—Wildlife). These migratory birds would continue to use Walker Lake as a stopover, which would help sustain the sport of birding in the Walker Lake area. An improved fishery and subsequent benefits to migratory bird species would promote festivals that center on migratory birds, such as the Loon Festival. These would be a beneficial impacts compared to the No Action Alternative.

With existing funding under Alternative 1, any improvements in the fishery would be fleeting, as discussed in Impact REC-2, and would not be expected to benefit migratory bird populations. Consequently there would be no substantial benefit to related recreational events.

Impact REC-6: Improve Sport Fishing Opportunities in East Walker River, West Walker River, and Mainstem Walker River as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Under the Proposed Project, increased flows in East Walker River, West Walker River, and mainstem Walker River would improve water quality and increase habitat for native fish species. Fishing downstream of Weber Dam only occurs when water is released from the dam, which is limited and infrequent. Increased flow downstream from Weber Dam would enhance the potential to support native fish species (Chapter 5, Biological Resources—Fish). This could enhance fishing in Walker River, which would be a beneficial impact.

This beneficial impact would be similar in nature with either full or existing funding, and the expected magnitude of the impact would be proportional to the level of funding.

Alternative 2 (Leasing Alternative)

Because Alternative 2 requires recurring acquisitions of water leases, the actions of Alternative 2 would continue until funding is exhausted. With full funding, implementation of Alternative 2 would last an estimated 20 years, assuming Walker Lake inflow was increased by an average 50,000 af/year.

Unless otherwise noted, the impacts of Alternative 2, below, would be similar in nature to those of Alternative 1 but temporary and of less magnitude.

Direct Impacts

Direct Impacts Similar Alternative 1

Impact REC-1: Increase Consistency with Mineral County Recreation Policies (Beneficial Impact)

Increased flows over a period of approximately 20 years would substantially improve conditions at Walker Lake, which would support Mineral County's recreation and natural resource goals. This would be a beneficial impact.

Increased Walker Lake inflows of an average of 50,000 af/yr for 3 years would result in a slight improvement in conditions at the lake compared to current conditions. This would support Mineral County's goal to continue recreational use of Walker Lake and other natural resources, but would not substantially contribute to Mineral County's goals of preserving, improving, and restoring health and functioning of the county's natural resources such as Walker Lake.

Indirect Impacts

Indirect Impacts Similar to Alternative 1

Impact REC-2: Improve Sport Fishing Opportunities in Walker Lake as a Result of Improved Water Quality (Beneficial Impact)

Under Alternative 2, increased flow to Walker Lake is expected to decrease TDS concentration and increase survival rate of LCT, thus improving sport fishing opportunities. This beneficial impact would be similar in nature to that with full funding of Alternative 1, but temporary (3 to 20 years) and of less magnitude. However, in the long run, once funding was exhausted, TDS concentration would rise and there would be no long-term benefit to LCT survival and associated sport fishing.

Impact REC-4: Improve Shoreline Recreational Use as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Under Alternative 2, increased flow to Walker Lake is expected to cause lake elevation to rise 10 to 13 feet. The rise in lake elevation would improve access to the water for swimming, wading, fishing, and other shoreline recreation. This rise would be temporary, however, and of less magnitude than under Alternative 1.

With acquisitions from existing funding only, lake elevation is expected to rise 1 to 2 feet. This rise would not be sufficient to improve shoreline recreation access, although it would be less detrimental than the continued decline in lake elevation

under the No Action Alternative. (See Chapter 3, Water Resources, Table Lake Summary, Estimated Future Water Surface Elevations and TDS Concentrations for Walker Lake for All Alternatives, for future changes in lake elevations.)

Impact REC-5: Increase in Other Recreational Experiences and Activities as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Under Alternative 2, an improved fishery would benefit migratory bird species and temporarily sustain the sports of birding and fishing. After 3 to 20 years, Walker Lake would begin to decline again and festivals and recreational events centering on the Walker Lake fishery and migratory birds would decline and, most probably, eventually end (Chapter 6, Biological Resources—Wildlife).

Impact REC-6: Improve Sport Fishing Opportunities in East Walker River, West Walker River, and Mainstem Walker River as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Under Alternative 2, increased flows in East Walker River, West Walker River, and Mainstem Walker River would generally improve water quality and native fish habitat. The improvement to fish habitat would be limited to the duration of the release of flows, i.e. approximately 3 to 20 years (Chapter 5, Biological Resources—Fish). Improved conditions would allow for increased sport fishing opportunities. This beneficial impact would be similar in nature to that of Alternative 1, but temporary and of less magnitude.

Indirect Impacts Different from Alternative 1

Impact REC-3: Improve Boating Access as a Result of Increased Flow to Walker Lake (No Impact)

Under Alternative 2, increased flow to Walker Lake is expected to cause lake elevation to rise 10 to 13 feet. This would be insufficient to submerge the boat ramp at Walker Lake SRA, which is now inoperable. Boat access would remain similar to present conditions. Therefore, Alternative 2 would provide no benefit. Although lake elevation would be higher than under the No Action Alternative, boat ramp use would be similar. (See Chapter 3, Water Resources, Table Lake Summary, Estimated Future Water Surface Elevations and TDS Concentrations for Walker Lake for All Alternatives, for future change in lake elevation.)

Alternative 3 (Efficiency Alternative)

The impacts of Alternative 3 would be similar in nature to those of Alternative 1 with full funding, but of less magnitude.

Direct Impacts

Direct Impacts Similar Alternative 1

Impact REC-1: Increase Consistency with Mineral County Recreation Policies (Beneficial Impact)

Increased inflow of an average of 32,200 af/yr would improve conditions at Walker Lake, which would support Mineral County's recreation and natural resource goals. This would be a beneficial impact.

Indirect Impacts

Indirect Impacts Similar to Alternative 1

Impact REC-2: Improve Sport Fishing Opportunities in Walker Lake as a Result of Improved Water Quality (Beneficial Impact)

Under Alternative 3, increased flow to Walker Lake would increase lake surface elevation by an estimated 4 to 13 feet, resulting in a somewhat lower TDS concentration than existing conditions for 20 to 50 years (Chapter 3, Water Resources). This could increase survival of LCT and enhance sport fishing, which would be a beneficial impact. However, TDS concentration would eventually increase (Chapter 3, Water Resources). Increased inflow could improve sport fishing opportunities for a number of years but not permanently.

Impact REC-4: Improve Shoreline Recreational Use as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Under Alternative 3, increased flow to Walker would increase lake surface elevation by an estimated 4 to 13 feet. The expected rise in lake elevation would improve access to the water for swimming, wading, fishing, and other shoreline recreation. This rise in lake elevation would be of less magnitude than under Alternative 1.

Impact REC-5: Increase in Other Recreational Experiences and Activities as a Result of Increased Flow to Walker Lake (Beneficial Impact)

As discussed above in Impact REC-2, Alternative 3 could improve the fishery somewhat and support migratory bird species. This would support the sports of fishing and birding and related recreational events. This would be a beneficial impact. Because TDS concentration would eventually increase and affect fish and the birds that feed on them, these benefits would not be permanently sustained.

Impact REC-6: Improve Sport Fishing Opportunities in East Walker River, West Walker River, and Mainstem Walker River as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Under Alternative 3, increased flows in East Walker River, West Walker River, and Mainstem Walker River would generally improve water quality and native fish habitat (Chapter 5, Biological Resources—Fish). Improved conditions would allow for increased sport fishing opportunities. This beneficial impact would be of less magnitude than under Alternative 1.

Indirect Impacts Different from Alternative 1

Impact REC-3: Improve Boating Access as a Result of Increased Flow to Walker Lake (No Impact)

Under Alternative 3, increased flows to Walker Lake would increase lake surface elevation by an estimated 4 to 13 feet. The rise in lake elevation would not be substantial enough to submerge the boat ramp at Walker Lake SRA. There would be no benefit compared to present conditions. Although the lake elevation would be much higher than under the No Action Alternative, the ability to use boat ramps would be similar. (See Chapter 3, Water Resources, Table Lake Summary, Estimated Future Water Surface Elevations and TDS Concentrations for Walker Lake for All Alternatives, for future change in lake elevation.)

Chapter 12 Indian Trust Assets

Introduction

This chapter describes the affected environment for Indian Trust Assets (ITAs) and the potential impacts on ITAs that would result from the Proposed Project and other alternatives.

ITAs are legal interests in property held in trust by the United States government for federally recognized Indian tribes or individual Indians. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset. ITAs can include land, minerals, federally reserved hunting and fishing rights, federally reserved water rights, and instream flows associated with trust land. Beneficiaries of the Indian trust relationship are federally recognized Indian tribes and tribal members with trust land; the United States government is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without the approval of the United States government. The characterization and application of the United States government trust relationship have been defined by case law that interprets congressional acts, executive orders, and historic treaty provisions.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- Bureau of Reclamation Indian Trust Asset Policy and NEPA Implementing Procedures (Bureau of Reclamation1994)
- Weber Dam Repair and Modification Project EIS (Miller Ecological Consultants 2005)
- WRPT's official website (Walker River Paiute Tribe 2008a-d)

Affected Environment

This section describes the environmental setting related to ITAs in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for ITAs includes the lands owned by two federally recognized tribes in the Nevada portion of the Walker River Basin: the Yerington Paiute Tribe (YPT) and the Walker River Paiute Tribe (WRPT). The Bridgeport Indian Colony is located in Bridgeport Valley, California, and is outside the geographic scope of the Proposed Project.

Yerington Paiute Tribe

YPT has historically and prehistorically occupied the entire Walker River Basin and areas beyond, such as Mono Lake, Bodie, Sweetwater, the Desert Creek area, and Aurora. The YPT Indian Reservation was set aside in 1916. YPT was recognized under the Indian Reorganization Act of June 1934, and the bylaws and constitution were approved in 1936 recognizing the tribal government (Sharpe et al. 2008).

The YPT's lands consist of YPT Colony (Colony) and YPT Indian Reservation (also known as Campbell Ranch).

The Colony occupies 13.7 acres within the city limits of Yerington, Nevada. Land uses at the Colony are a mix of residential and commercial. The Colony has 46 homes, 12 apartments, and four tribal elders' apartments. Commercial uses include a tribal smoke shop, the Tribal Elder Center, Head Start, a three-office building that houses the EPA/General Assistance Program, the Law Enforcement Substations, and an education tutoring center. YPT also leases 1.5 acres to a Subway sandwich franchise at 198 Goldfield Avenue; this property is not held in trust for YPT. YPT also owns Arrowhead Market, a gas station and mini-market located on Campbell Lane, off the reservation (Emm pers. comm.).

Campbell Ranch encompasses 1,162 acres 10 miles north of Yerington. Land uses at Campbell Ranch are primarily agricultural and residential. Nine assignees farm on private land on the ranch and grow primarily alfalfa and onions. YPT grows alfalfa on 900 acres. Campbell Ranch also has 84 homes, including nine tribal ranch assignees' residences. The YPT leases 21.2 acres of ranch land to Rite of Passage, a school for troubled youth (Emm pers. comm.).

The final Walker River Decree (Decree C-125) provides water rights for the YPT Reservation and Colony, which are primarily used for agricultural purposes. YPT's current decreed water right in a year with a full water supply is approximately 3,958 acre-feet with priority dates from 1864 to 1905 (Wilson pers. comm.). Some water rights for the Colony have been transferred to Campbell Ranch for irrigation (Emm pers. comm.). YPT also has permits to use approximately 1,200 af/yr of groundwater (Wilson pers. comm.).

Walker River Paiute Tribe

WRPT refers to itself as Agai-Dicutta (Trout Eaters) Band of Northern Paiute Nation (Walker River Paiute Tribe 2008a). The Walker River Indian Reservation is located on 325,000 acres between the northeast end of Mason Valley and Walker Lake and has a population of approximately 1,200. The reservation was set aside by federal action on November 29, 1859, and later affirmed by Executive Order in 1874. Most of the land is held in trust by the United States for the benefit of WRPT (Miller Ecological Consultants 2005).

Approximately 10,000 acres of reservation land were divided into 20-acre allotments and distributed to individual WRPT members. These allotments are also held in trust by the United States, but are for the benefit of the individuals (Miller Ecological Consultants 2005).

Agriculture production on the reservation represents Mineral County's major farming district (Mineral County 2008). Grazing is the primary land use, as well as some ranching (Walker River Paiute Tribe 2008a), but agricultural crops are also an important part of the economic base. Alfalfa is the primary crop grown, mainly along formerly riparian areas (Walker River Paiute Tribe 2008b). Approximately 2,800 acres are in agricultural production. Of this, approximately 2,100 acres are irrigated allotments, consisting mainly of alfalfa and grass hay, and 125 acres of tribal trust land are irrigated by center pivots. Weber Dam and Reservoir provides storage and regulates the delivery of the reservation's direct flow water rights under the Walker Decree for irrigation water used on the Walker River Indian Irrigation Project. In 2007 and 2008, all the allotments on the reservation were part of a fallowing program funded by a Desert Terminal Lakes grant with the purpose of providing inflows to Walker Lake (Yardas pers. comm.).

The unincorporated town of Schurz is located on the reservation at the intersection of U.S. Highways 95 and 95-A. Land uses in Schurz include commercial uses, such as a gas station with a convenience store, a smoke shop, and a fireworks outlet (Walker River Paiute Tribe 2008a and 2008c).

Community resources include the tribal administrative offices, health clinic, and police office; a volunteer fire department; and a school for kindergarten through 8th grade (Miller Ecological Consultants 2005).

Most housing on the reservation is single-family, detached houses (Miller Ecological Consultants 2005). Some of these houses are built on allotments and others on tribal land. The WRPT's housing department administers two programs to help tribal members: a modified lease purchase program called the mutual help program and a rental program for the members with the lowest income. The department also operates programs to renovate existing homes. The department has built more than 280 housing units and operates a rental assistance program for low-income tribal members attending certain institutions of higher learning (Walker River Paiute Tribe 2008d).

ITAs include, but are not limited to, the reservation, irrigated and unirrigated trust allotment lands, water rights, Weber Dam and Reservoir, and the fish, wildlife, and riparian vegetation in and along mainstem Walker River and Weber Reservoir (Miller Ecological Consultants 2005).

The WRPT's water rights, which are provided under Decree C-125, are held in trust by BIA (Strekal pers. comm.). The Decree adjudicated to the United States a

continuous flow right of 26.25 cfs with an 1859 priority date (the most senior water right in the system) for the irrigation of 2,100 acres of land within the Walker River Indian Reservation. This water may be diverted from the Walker River on or above the reservation over a 180-day irrigation season each year (*United States* v. *Walker River Irrigation District*, 104 F2d 334, 340, 9th Cir 1939).

WRPT asserts exclusive jurisdiction over groundwater in the Walker River Indian Reservation (Yardas 2007, 63). In pending litigation (*United States* v. *WRID*, Case in Equity, C-125B), the United States and WRPT are claiming a federal reserved water right to groundwater, among other claims (Yardas pers. comm.).

Environmental Consequences

Assessment Methods

This section describes the impact analysis relating to ITAs for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assumptions

For the purposes of analysis, it is assumed that WRPT and YPT would not participate in the Acquisition Program by selling land, water appurtenant to land, or related interests; there are no provisions with appropriate mechanisms for sale of their water rights held in trust by the United States. Although WRPT and YPT are not prohibited from participating, they have not expressed interest to date in selling any specific assets.

Adverse impacts on WRPT reservation lands, reserved water rights (including the Tribes' asserted rights to groundwater), or related interests would not occur as a result of project implementation and will not be discussed further.

YPT's proximity to areas where acquisitions may occur may result in adverse impacts on some of their ITAs.

Impact Criteria

Impacts on ITAs would be considered adverse if implementation of the Proposed Project or alternatives would:

- adversely affect identified ITAs of either Tribe; or
- adversely affect the United States' trust responsibility and ability to maintain and protect legal interests in property reserved by or granted to Indian tribes or individuals by treaties, statutes, Executive Orders, and rights further interpreted by the courts.

Impacts

No Action Alternative

Direct Impacts

No direct disturbance is proposed under the No Action Alternative, and no direct impacts on ITAs attributable to acquisitions of land or water rights are anticipated.

Indirect Impacts

No Action Alternative

Under the No Action Alternative, the trends of decreasing water elevation and increasing TDS concentration in Walker Lake would continue. This would adversely affect natural resources that WRPT has historically relied upon (i.e., vegetation, fish, and wildlife). Affected resources are described in detail in Chapter 4, Biological Resources – Vegetation and Wetlands; Chapter 5, Biological Resources – Fish; and Chapter 6, Biological Resources – Wildlife. The No Action Alternative would not affect water rights as established under the C-125 Decree, or land assets such as farmland, rangeland, or recreational land.

Alternative 1 (Proposed Project)

As indicated in Chapter 2, Alternatives; and Chapter 3, Water Resources; acquisitions under Alternative 1 are expected to add an average of 50,000 additional af/yr of water to Walker Lake. It is possible, however, that less than the full 50,000 af would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the average annual inflow to the lake would increase by approximately 7,300 af.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that the average annual inflow to the lake would increase by the full 50,000 af. Unless otherwise noted, if acquisitions were limited to those obtainable with existing funding, then impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Direct Impacts

Impact ITA-1: Improve Habitats of Indian Trust Assets in the lower Walker River and Walker Lake as a Result of Increased Flow to Walker Lake (Beneficial Impact).

Overall, Alternative 1 is expected to have beneficial impacts on ITAs associated with wetland and riparian habitats in the lower Walker River and Walker Lake.

This is because the annual addition of approximately 50,000 af to Walker Lake and the associated increased flow in Walker River would improve habitats for plants, fish, and wildlife in the mainstem Walker River, in or near Weber Reservoir, and at the northern end of Walker Lake. Impacts on wetland and riparian habitats would be minor or beneficial, and implementation of the fully funded Proposed Project would have an overall beneficial impact on plants, fish, and wildlife.

With acquisitions from existing funding, average annual inflow to Walker Lake is expected to increase by approximately 7,300 af. This would enhance the potential for decreased water temperature and increased spawning and rearing habitat area for fish species. However, TDS concentration in the lake would gradually increase over the long term. This would in turn adversely affect plant, fish, and wildlife species that historically have been of importance to the Paiute people. However, the impacts of this alternative on many of the habitats would be less adverse than those under the No Action Alternative. While a smaller area along the mainstem Walker River would be available for the establishment of riparian or wetland communities than with full funding, greater enhancement of habitat of these types would be expected than under the No Action Alternative.

Impact ITA-2: Potentially Reduce Flexibility to Manage Weber Reservoir for Irrigation Purposes (No Impact)

The Proposed Project could result in changes in operation of Weber Dam and Reservoir and require an operations plan to address those changes. Such a plan would ensure that use of decreed water rights in the Walker River Indian Irrigation Project were not impaired and would protect the safety of the downstream community. Therefore, the Proposed Project would have no impact on the use of the reservation's decreed water rights.

Indirect Impacts

The following three impacts on YPT water resource ITAs could potentially occur. These impacts are fully discussed in Chapter 3, Water Resources.

Impact ITA-3: Reduce Groundwater Recharge and Elevation as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact)

Impact ITA-4: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact)

Impact ITA-5: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flows (Minor Impact)

Alternative 2 (Leasing Alternative)

Because Alternative 2 would require recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an annual average of 50,000 af, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years, as indicated in Chapter 2, Alternatives; and discussed in Chapter 3, Water Resources.

The impacts of Alternative 2, identified below, would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those for Alternative 1, but temporary.

Direct Impacts

Impact ITA-1: Improve Habitats of Indian Trust Assets as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Impact ITA-2: Potentially Reduce Flexibility to Manage Weber Reservoir for Irrigation Purposes (No Impact)

Indirect Impacts

The following three impacts on YPT water resource ITAs could potentially occur. These impacts are fully discussed in Chapter 3, Water Resources.

Impact ITA-3: Reduce Groundwater Recharge and Elevation as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact)

Impact ITA-4: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact)

Impact ITA-5: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flows (Minor Impact)

Alternative 3 (Efficiency Alternative)

As indicated in Chapter 2, Alternatives; and discussed in Chapter 3, Water Resources; full implementation of Alternative 1 would provide an additional 50,000 af/yr on average to Walker Lake. It is estimated that full implementation of Alternative 3 would yield an average annual inflow of 32,300 af.

The impacts for Alternative 3, identified below, would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, but of less magnitude because inflow to Walker Lake would be less under this alternative.

Direct Impacts

Impact ITA-1: Improve Habitats of Indian Trust Assets as a Result of Increased Flow to Walker Lake (Beneficial Impact)

Impact ITA-2: Potentially Reduce Flexibility to Manage Weber Reservoir for Irrigation Purposes (No Impact)

Indirect Impacts

The following three impacts on YPT water resource ITAs could potentially occur. These impacts are fully discussed in Chapter 3, Water Resources.

Impact ITA-3: Reduce Groundwater Recharge and Elevation as a Result of Reduced Infiltration from Fields and Canals (Adverse Impact)

Impact ITA-4: Alter the Movement of the Anaconda Mine Groundwater Plume as A Result of Change in Groundwater Recharge (Minor Impact)

Impact ITA-5: Reduce Incidental Availability of Water as a Result of Reduced Field Runoff, Seepage, or Return Flows (Minor Impact)

Chapter 13 Environmental Justice

Introduction

This chapter describes the affected environment for environmental justice in the study area and the potential impacts on environmental justice that would result from the Proposed Project and other alternatives.

Sources of Information

The key source of data and information used in the preparation of this chapter is listed below. Full references can be found in Chapter 17, References.

- 2000 U.S. Census (U.S. Census Bureau 2000a, 2000b)

While Census data are not 100% accurate or inclusive, they are the best available data and provide a sound basis for this analysis.

Affected Environment

This section describes the environmental setting related to environmental justice. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for environmental justice was defined as those census tracts or census block groups that are located within 1 mile of East Walker River, West Walker River, and mainstem Walker River; Walker Lake; irrigation canals that connect to the Walker River; and irrigated land adjacent to the canals where potential impacts from the Proposed Project and other alternatives could occur (Figure 13-1). No potential environmental justice impacts from the Proposed Project or other alternatives are known or expected outside of this study area.

Demographic data from the 2000 U.S. Census were examined for the environmental justice study area. Census tracts evaluated in Lyon County were 9402, 9602 (Block Group 2), 9607 (Block Groups 1 through 4), and 9608 (Block Groups 1 through 5). Census Tracts 9402, 9704, and 9705 in Mineral County were also evaluated. Census Tract 9706 (all Block Groups) in Mineral County falls outside the study area and is therefore excluded from this analysis. Figure 13-1 shows the distribution of census tracts within and adjacent to the study area.

Minority and Low-Income Populations

Minority and low-income populations living in the study area are defined as follows.

- Low-income populations—persons living below the poverty level. Because the CEQ guidance does not suggest a threshold to be used in

identifying low-income populations, a census tract group or block group with a proportion of persons in poverty that is meaningfully higher than in the general population is considered to be low-income for the purposes of this analysis.

- Minorities—persons of American Indian or Alaska Native origin; Asian or Pacific Islander; Black, not of Hispanic origin; Hispanic; or persons of two or more races (without double-counting persons of Hispanic or Latino origin who are accounted for in other groups). Consistent with CEQ's guidance, minority populations are identified where the minority population of the affected area exceeds 50% of the total population, or where the percentage of defined minorities in the affected area is meaningfully greater than the percentage of defined minorities in the general population or other appropriate unit of geographic analysis.

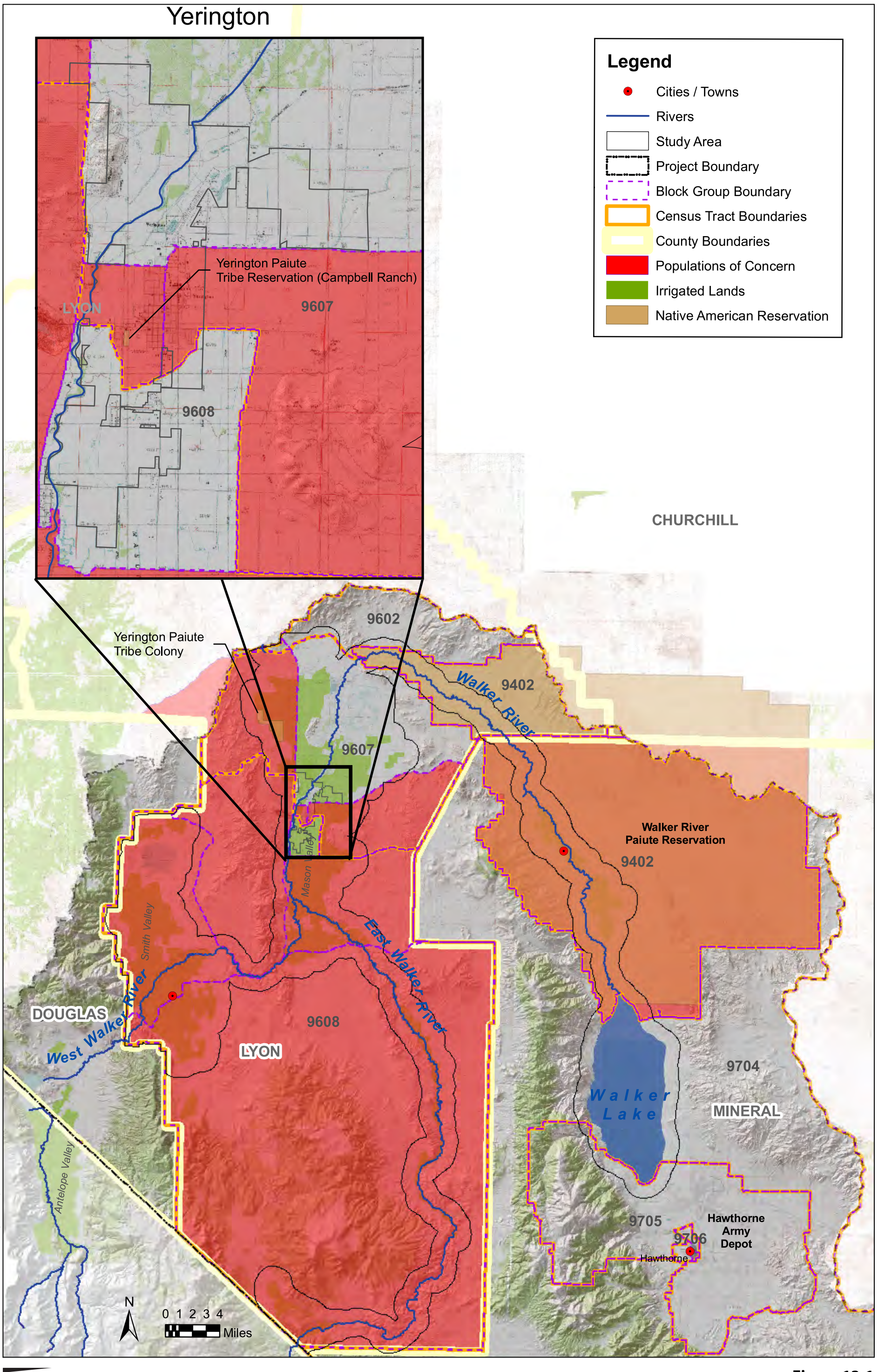
Race and Ethnicity

Racial and population characteristics occurring statewide, regionally, and in the vicinity of the study area are shown in Table 13-1. Table 13-2 summarizes the racial and ethnic characteristics of the study area population and the other comparative populations.

In general, Lyon County and Mineral County have less diverse populations than the state of Nevada. Minorities represent approximately 16.6% percent of the total population of Lyon County and 29.6% of the population of Mineral County (U.S. Census Bureau 2000a).

Seven census units in the study area were identified as having a higher percentage of minorities as compared to the state and/or county. In Lyon County, Census Tract 9607, Block Group 4, 46.36% of the total population is made up of minorities, which exceeds the minority percentage at both the county (16.55%) and state level (34.79%), Minorities comprise 20.68% of the total in Census Tract 9607, Block Group 3, which exceeds the minority percentage for the county but not for the state. Census Tract 9608 in Lyon County includes four block groups (1, 2, 4, and 5) that have a higher percentage of minorities than the county, although none exceed the state level. In Mineral County, Census Tract 9402, Block Group 1, minority populations are 87.66% of the total. This census unit's inclusion of the Walker River Indian Reservation accounts for it having a substantially higher percentage of minorities in comparison to the county and state.

All of the census units identified above contain one or more minority populations of concern, each of which accounts for a higher percentage of the total population as compared to the county and/or state. Units having high percentages of American Indian residents typically conformed to or overlapped with reservation boundaries. As stated above, in Mineral County, Census Tract 9402, Block Group 1, the primary minority population consists of Tribal residents of the Walker



00516.07 Walker River Basin Restoration Project/EIS/Chp.13/SS (06-09)

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Figure 13-1
Potentially Affected Low-Income and/or Minority Populations in the Study Area

River Indian Reservation. American Indians residing in that unit represent 72.03% of the total population and account for a substantially higher percentage of the population as compared to the county (2.11%) and state (1.07%). Likewise, in Lyon County, Census Tract 9607, Block Groups 2 and 4, American Indians residing on the Yerington Indian Reservation and the Yerington Colony accounted for 10.31% and 17.98%, respectively, of the total population. Both populations substantially exceed the American Indian population represented at the county and state level.

A second minority population of concern is Hispanic/Latinos. In Lyon County, Census Tract 9607, Block Groups 2, 3, and 4, Hispanic/Latinos range from 17.67% to 20.80% of the total population, which is higher than the percentage of Hispanic/Latinos at the county level (10.97%) but is similar to the percentage at the state level (19.72%). In Census Tract 9608, Block Groups 1, 2, 4, and 5, Hispanic/Latinos range from 16.09% to 25.87% of the total population. For some block groups, the census data indicate that these populations exceed the overall percentage of Hispanic/Latinos at the county or state levels. No other Hispanic/Latino populations in the defined area were determined to be meaningfully greater than those at the county or state level.

The comparatively high percentage of Hispanic/Latinos residing in Lyon County cannot be attributed to a single factor. The low cost and relative abundance of housing in Lyon County and its proximity to employment centers in Douglas and Washoe Counties makes it a bedroom community of sorts for the two counties (Sendall et al. n.d). As a result, a high percentage of people residing in Lyon County travel to other counties for work. Conceivably, Hispanic/Latinos in the study area could make up a portion of the County's intercounty commuting population. Additionally, anecdotal evidence suggests that a significant proportion of the agricultural labor force in Lyon County is composed of migrant Hispanic/Latino farm workers. These workers are principally brought from Mexico and other Latin American countries to work on farms in Mason Valley and Smith Valley and the East Walker area through the U.S. Department of Labor's H-2A Visa program (U.S. Department of Labor 2009).

Table 13-1. Minority Populations in the Study Area

Location (State, County, Census Tract, Block Group)	Total Population	Minority Population	Minority Population (Percent)
Nevada	1,998,257	695,256	34.79
Lyon County	34,501	5,710	16.55
Tract 9402 (1 Block)	2	0	0.00
Tract 9608	4,006	882	22.02
Block 1	1,122	298	26.56
Block 2	1,019	199	19.53
Block 3	727	92	12.65
Block 4	593	140	23.61
Block 5	545	153	28.07
Tract 9607	5,526	1,467	26.55
Block 1	1,090	183	16.79
Block 2	1,183	163	13.78
Block 3	1,992	412	20.68
Block 4	1,029	477	46.36
Tract 9602	6,689	773	11.56
Block 2	2,954	322	10.90
Mineral County	5,071	1,502	29.62
Tract 9402 (1 Block)	851	746	87.66
Tract 9704 (1 Block)	687	59	8.59
Tract 9705	20	0	0.00

Source: U.S. Census Bureau 2000a.

Table 13-2. Detailed Race and Ethnicity Characteristics in the Study Area

Location (State, County, Census Tract, Block Group)	Percent							
	White	Black/African American	American Indian/ Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More races	Hispanic or Latino (any race)
Nevada	65.21	6.58	1.07	4.43	0.39	0.14	2.46	19.72
Lyon County	83.45	0.59	2.11	0.57	0.12	0.12	2.07	10.97
Tract 9402 (1 block)	100	0	0	0	0	0	0	0
Tract 9608	77.98	0.45	0.92	0.30	0.07	0.17	1.17	18.92
Block 1	73.44	0.45	1.16	0.27	0.09	0.62	1.34	22.64
Block 2	80.47	0.49	0.98	0.39	0.10	0	1.47	16.09
Block 3	87.35	0.28	0.41	0.55	0	0	1.10	10.32
Block 4	76.39	1.01	0.34	0	0.17	0	1.18	20.91
Block 5	71.93	0	1.65	0.18	0	0	0.37	25.87
Tract 9607	73.45	1.05	6.12	0.31	0.02	0.07	2.03	16.96
Block 1	83.21	0.18	0.64	0	0	0.28	2.94	12.75
Block 2	86.22	0.17	10.31	0.68	0	0	2.62	19.61
Block 3	79.32	0.15	1.20	0.20	0	0.05	1.41	17.67
Block 4	53.64	4.96	17.98	0.49	0.10	0	2.04	20.80
Tract 9602	88.44	0.93	1.84	0.45	0.24	0.13	3.05	4.74
Block 2	89.10	0.61	1.46	0.24	0.27	0.37	3.15	4.81
Mineral County	70.38	4.30	13.90	0.30	0.02	0.16	2.48	8.46
Tract 9402 (1 Block)	12.34	2	72.03	0.12	0.12	0	3.41	9.99
Tract 9704 (1 Block)	91.41	1.16	2.33	0	0	0.15	1.75	3.20
Tract 9705	100	0	0	0	0	0	0	0

Source: U.S. Census Bureau 2000a.

Income and Poverty

Income and poverty characteristics occurring statewide, regionally, and in the vicinity of the study area are shown in Table 13-3.

Based on 2000 U.S. Census data, median household incomes in Lyon County and Mineral County were fairly widespread. Lyon County's median income ($40,699) was higher than the median income for Mineral County ($32,891). However, median incomes in both counties were comparably lower than that of the state of Nevada ($44,851).

The percentage of residents living in poverty in Lyon County and Mineral County follows a similar distribution. Based on 2000 U.S. Census data, Mineral County had a higher percentage of persons in poverty (15%) than Lyon County (10.2%). By comparison, 10.8% of the population in the state of Nevada was living in poverty.

At the census tract and block group level, median household incomes were found to range widely in the study area, consistent with the variation in values observed for the two counties. Six census units in the study area were found to have a substantially higher percentage of persons in poverty compared to county-level or statewide data. In Lyon County, Census Tract 9607, Block Group 2, which includes the Yerington Paiute Indian Reservation, persons living in poverty comprised 27.73% of the total population. This accounts for a substantially higher percentage of the population as compared to the county (10.18%) and state (10.29%). Additionally, Census Tract 9608 in Lyon County includes four block groups (1, 2, 4, and 5) that comprise a higher percentage of persons in poverty than the county or state. In Mineral County, Census Tract 9402, Block Group 1, which encompasses the majority of the Walker River Indian Reservation, impoverished persons accounted for 32.08% of the total population. The percentage of impoverished persons residing in this unit is comparatively higher than those at the county and state level.

No other low-income populations in the study area were determined to be meaningfully greater in occurrence than those at the county or state level.

Table 13-3. Income and Poverty Characteristics in the Study Area

Location (State, County, Census Tract, Block Group)	Median Household Income	Persons in Poverty (Percent)
Nevada	$44,581	10.29
Lyon County	$40,699	10.18
Tract 9608	$37,031	13.68
Block 1	$30,375	16.58
Block 2	$50,385	10.30
Block 3	$36,667	9.63
Block 4	$49,886	15.85
Block 5	$41,442	17.06
Tract 9607	$31,963	13.97
Block 1	$37,083	12.75
Block 2	$27,768	27.73
Block 3	$32,216	11.60
Block 4	$35,945	7.19
Tract 9602	$34,381	12.89
Block 2	$36,208	13.51
Mineral County	$32,891	15.01
Tract 9402 (1 Block)	$24,412	32.08
Tract 9704 (1 Block)	$29,792	19.65

Source: U.S. Census Bureau 2000a, 2000b.

Other Considerations

As detailed in Chapter 11, Recreation, there are many fishing and hunting opportunities on public and reservation lands throughout the study area. Traditional uses of fish, wildlife, and vegetation remain important to YPT and WRPT. Although data are not available to determine the use of renewable natural resources (fish, wildlife, and vegetation) for subsistence by any group in the study area, it is likely these resources are used to supplement the diet of minority and low-income persons, but do not constitute the principal portion of their diet.

Environmental Consequences

This section describes the impact analysis relating to environmental justice for the Proposed Project and other alternatives. It lists the criteria used to conclude whether an impact would be adverse or beneficial.

Assessment Methods

Environmental justice impacts were evaluated in accordance with guidance provided by the Interagency Working Group established by Executive Order 12898 and CEQ's Environmental Justice: Guidance under the National Environmental Policy Act (Council on Environmental Quality 1997). For the purposes of this analysis, environmental justice issues in the study area focused on the environmental and socioeconomic impacts of the Proposed Project and alternatives.

Environmental impacts in the study area relate primarily to impacts on natural resources upon which low-income and minority groups in the study area potentially depend for subsistence purposes. The fish, wildlife, and riparian and other native vegetation in and along mainstem Walker River, Weber Reservoir, and elsewhere in the Walker Basin have been traditionally used by YPT and WRPT. Based on CEQ guidance, subsistence on natural resources is defined as "the dependence by a minority population, low-income population, Indian tribe or subgroup of such populations on indigenous fish, vegetation and/or wildlife, as the principal portion of their diet" (Council on Environmental Quality 1997).

Socioeconomic impacts in the study area relate primarily to impacts on employment. As discussed in Chapter 7, Land Use and Agriculture, much of the acquired water rights under the Proposed Project and alternatives would come from agricultural land, which would lead to a reduction in the number of acres in agriculture and to agriculture-related job loss in the study area. Thus, there is a potential for a socioeconomic impact on minority or low-income populations through loss of jobs in the agricultural sector. Employment impacts resulting from the Proposed Project and alternatives are discussed further in Chapter 10, Socioeconomics.

Impact Criteria

The Proposed Project and alternatives would be considered to have an adverse impact on environmental justice if they would:

- disproportionately affect the access of minority or low-income populations to natural resources used for subsistence purposes; or
- disproportionately affect employment opportunities for minority or low-income populations.

Impacts

No Action Alternative

Direct Impacts

There would be no direct environmental justice impacts under the No Action Alternative.

Indirect Impacts

Impact EJ-1: Affect Employment of Minority and Low-Income Groups in Lyon County (No Impact)

Under the No Action Alternative, there would be no change in agricultural production in Smith Valley, Mason Valley, or the East Walker area. Therefore, there would be no change in agriculture-related employment in the study area.

Alternative 1 (Proposed Project)

Water rights acquired under Alternative 1 would add an average of 50,000 af/yr of water to Walker Lake. It is possible, however, that less than the full 50,000 af/yr would be provided to the lake either because of funding issues or because there would not be enough willing sellers. With current funding, it is estimated that the annual average inflow to the lake would increase by 7,300 af/yr.

This analysis of impacts under Alternative 1 assumes that the Proposed Project would be fully funded and that water rights acquired would increase the average inflow to the lake by the full 50,000 af/yr. Unless otherwise noted, if acquisitions were limited to those achievable only with the existing funding allocation, the impacts would be similar in nature (i.e., adverse, minor, beneficial, or no impact) but of less magnitude.

Direct Impacts

There would be no direct environmental justice impacts under Alternative 1.

Indirect Impacts

Impact EJ-1: Affect Employment of Minority and Low-Income Groups in Lyon County (Adverse Impact)

Under Alternative 1, irrigation water rights would be acquired, which would remove water applied to some agricultural land in Lyon County. If sufficient water is removed, the land use could convert to nonagricultural uses, which would result in the loss of agricultural employment. As noted above, a significant proportion of the agricultural labor force in Lyon County is composed of migrant Hispanic/Latino farm workers, and many agricultural areas in the County are also

served by rural low-income communities. As discussed in Chapter 10, Socioeconomics, the direct change in employment resulting from the loss in agricultural production would account for approximately 16% to 20% of total farm employment in Lyon County. Within the study area, it is estimated that more than 20 jobs would be lost within Mason Valley, Smith Valley, and the East Walker area as a result of implementing Alternative 1. On a regional basis, the loss of employment as a result of implementing Alternative 1 would not be considered substantial because these losses would represent less than 1% of total employment in the two-county study area and approximately 1% of employment in Lyon County. However, the loss in agricultural production could result in a substantial impact on employment in the Lyon County agricultural production sector, which would have a disproportionately high and adverse impact on low-income and minority groups employed by this sector. This would be an adverse impact.

With existing funding only, less water would be removed from agricultural land and fewer acres of land currently in agricultural production would be converted to nonagricultural uses. Consequently, fewer agricultural jobs held by minority and low-income groups in Lyon County would be affected.

Impact EJ-2: Affect Use of Renewable Natural Resources for Subsistence (No Impact)

Since no subsistence level of use of renewable natural resources by any population has been identified in the study area, an adverse environmental justice impact is not anticipated to occur.

Alternative 2 (Leasing Alternative)

Because Alternative 2 requires recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/yr, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years.

Unless otherwise noted, the impacts of Alternative 2, identified below, would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, only temporary.

Direct Impacts

There would be no direct environmental justice impacts under Alternative 2.

Indirect Impacts

Indirect Impacts Similar to Alternative 1

Indirect impacts that would be the same under Alternative 2 as under Alternative 1 are identified below.

Impact EJ-1: Affect Employment of Minority and Low-Income Groups in Lyon County (Adverse Impact)

Impact EJ-2: Affect Use of Renewable Natural Resources for Subsistence (No Impact)

Alternative 3 (Efficiency Alternative)

It is estimated that full implementation of Alternative 3 would yield an inflow of water to Walker Lake of only 32,300 af/yr. Unless otherwise noted, the impacts of Alternative 3, identified below, would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, but of less magnitude.

Direct Impacts

There would be no direct environmental justice impacts under Alternative 3.

Indirect Impacts

Indirect Impacts Similar to Alternative 1

Indirect impacts that would be the same under Alternative 3 as under Alternative 1 are identified below.

Impact EJ-2: Affect Use of Renewable Natural Resources for Subsistence (No Impact)

Indirect Impacts Different from Alternative 1

Indirect impacts that would be different under Alternative 3 than under Alternative 1 are identified below.

Impact EJ-1: Affect Employment of Minority and Low-Income Groups in Lyon County (Beneficial Impact)

Under Alternative 3, the proposed efficiency improvements to the water delivery systems within areas of Lyon County identified as having a high percentage of minority and/or low income individuals (Census Tracts 9607 and 9608) would not result in changes in agricultural-related employment because existing agricultural lands in these areas would remain in production. However, construction of these improvements would contribute to the local economy by increasing employment

within the construction sector. Thus, it is anticipated that the resulting increases in construction-related employment could potentially benefit minority and/or low income individuals residing in Lyon County. The magnitude of this benefit would be driven by the amount of expenditures made on improving the water delivery system, the duration of construction, and the extent to which local contractors and workers are used to construct the improvements.

Chapter 14 Cumulative Impacts

Introduction and Summary

The cumulative impacts analysis addresses the combined impacts of implementing the Proposed Project and other alternatives with those of other related past, present, and reasonably foreseeable projects that could result in impacts on the same environmental resources. This chapter introduces the approach to the cumulative impacts analysis, including the legal requirements and methods used to evaluate cumulative impacts; lists related projects and describes their relationship to the Proposed Project and other alternatives; and identifies cumulative impacts by resource area.

Approach to Cumulative Impacts Analysis

Legal Requirements

The CEQ regulations implementing NEPA (40 CFR 1508.7) define a cumulative impact for purposes of NEPA as follows:

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Associated actions (past, present, or future) which, when viewed with the proposed actions, may have cumulative significant impacts. Predictions of future cumulative impacts should not be speculative, but should be based on known long-range plans, regulations, or operating agreements. The scope of a cumulative impacts analysis can be limited through the use of tiering (40 CFR 1508.28). Tiering can be used when cumulative impacts have been adequately addressed in a previous document certified for a programmatic plan and the current project is consistent with the plan.

To determine the scope of the cumulative impacts analysis, related projects were identified. These include past, present, and reasonably foreseeable projects that may contribute to cumulative impacts, including, any projects outside of the control of the project proponent or agency. CEQ regulations state that a cumulative impacts analysis commonly only includes those plans for actions that are funded or for which other NEPA analyses are being prepared. The following criteria were used to further narrow the list of projects.

- Is the action likely to occur?

- Does the action have an identified sponsor proposing it?
- Does the action have an identified funding source?
- Has the action initiated NEPA compliance or other regulatory procedures?
- Is the action defined in enough detail to allow meaningful analysis?
- Are the actions relevant?

CEQ regulations[1] also state, "In general, actions can be excluded from analysis of cumulative impacts if the action will not affect resources that are the subject for the cumulative impacts analysis."

Methodology

For the purpose of this analysis, implementation of the Proposed Project is considered significant if, in concert with other described past, present, or reasonably foreseeable future actions, it would exacerbate the declining status of an identified resource (i.e., a resource that is already adversely affected) or create a condition in which an impact is initially minor but is part of an irreversible declining trend.

Agreements, Plans, and/or Projects with Potential Related Cumulative Impacts

Table 14-1 lists the past, present, and reasonably foreseeable actions considered in the cumulative impacts analysis. While many proposed and potential future actions were identified, only a portion of these actions relate to or directly affect water resources in the project area, or would affect the same environmental resources as the Proposed Project and other alternatives.

This section provides a brief description of the other related actions, including the context and background of each action, the status of any environmental review process for each related action (if applicable), and an assessment of the cumulative impact of each action on resources.

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[1] Considering Cumulative Impacts Under the National Environmental Policy Act, Council on Environmental Quality, Executive Office of the President, January 1997, http://ceq.hss.doe.gov/NEPA/ccenepa/ccenepa.htm

Table 14-1. Foreseeable Associated Actions Considered in the Cumulative Impacts Analysis

Project Name	Implementing Agency	Level and Status of Environmental Review
Desert Terminal Lakes Program Projects		
WRID Weed Control Program and Water Gauge Improvements	WRID	None to date
Walker Lake Fish Hatchery	Reclamation/WRPT	None to date
WRPT Purchase and Lease Program	BIA	FONSI
Tamarisk Eradication, Riparian Area Restoration, and Channel Restoration	USFWS, with NDOW and WRPT	Noxious Weed Management Program: EA
		Riparian Area Restoration: None to date
		Channel Restoration: None to date
Western Inland Trout Initiative and Fishery Improvements	USFWS, NDOW, WRPT	None to date
Mason Valley Wildlife Management Area – Water Conservation and Other Improvement	Reclamation and NDOW	EA/FONSI
Homestretch Geothermal Pilot Project	Reclamation	Anticipated completion of EA in 2009
Walker Basin Natural Resources Conservation Service Contractual Agreements		
Environmental Quality Incentives Program	NRCS	Miscellaneous levels NEPA compliance for multiple projects
Wildlife Habitat Incentives Program	NRCS	Miscellaneous NEPA compliance for multiple projects
Conservation Security Program	NRCS	n/a
Agricultural Management Assistance Program	NRCS	Miscellaneous levels NEPA compliance for multiple projects
Miscellaneous Walker Basin Projects and Actions		
Water Rights Acquisition Program for Lahontan Valley Wetlands	USFWS	EIS and ROD
East Walker River Oil Spill Draft Restoration Plan / Environmental Assessment	East Walker River Natural Resource Trustees (USFWS, CDFG, Office of Spill Prevention and Response, NDEP, NDOW)	Final Restoration Plan/EA

Project Name	Implementing Agency	Level and Status of Environmental Review
Lahontan Cutthroat Trout Recovery Plan	USFWS	Short-term action plan for LCT
Weber Dam Repair and Modification Project	BIA	EIS and ROD
Walker River Indian Reservation Storage and Water Rights Litigation	n/a	n/a
Anaconda Copper Mine Superfund Site Remediation Project	EPA	Unilateral administrative orders

Desert Terminal Lakes Program

Reclamation's Desert Terminal Lakes Program was established in 2002 pursuant to Section 2507 of PL 101-171. The Walker River Basin Acquisition Program is funded under the Desert Terminal Lakes Program. The initial and subsequent legislation provided $200 million in funding to Reclamation "to provide water to at-risk natural desert terminal lakes". . PL 108-7 Section 207 clarified that the money provided in PL 107-171 could only be used for Pyramid, Summit, and Walker Lakes in Nevada; and PL 109-103, Title II, Section 208(a) established the purposes for which $70 million in funds provided through Reclamation are to be used by the University for the Acquisition Program analyzed in this Draft EIS.

PL 110-246 also provides funding in the amount of $175,000,000 to provide water to at-risk natural desert terminal lakes. It specifies that when there are willing sellers, the funding can be used to lease water and to purchase land, water appurtenant to the land, and related interests in the Walker River Basin.

Some of the legislation authorizing the Desert Terminal Lakes Program included earmarks for specific projects. Those pertinent to the Acquisition Program are discussed below, and their contribution to cumulative impacts is identified. Desert Terminal Lakes research-funded projects are discussed in Chapter 1, Purpose of and Need for Action, but are not included here because they do not have environmental impacts.

Walker River Irrigation District Weed Control and Gauge Improvements

PL 110-161 Title II Section 208 (a) includes the following language:

- (9) shall allocate $1,000,000 to the Walker River Irrigation District--
    - (A) to plan and implement a weed control program to improve conveyance efficiency of water controlled by the Irrigation District; and

- (B) to make improvements to water gauges controlled by the Irrigation District to enhance the water monitoring activities of the Irrigation District.

WRID is currently developing the proposal for this funding and working with Reclamation on the financial assistance grant agreement.

Walker Lake Fish Hatchery

Currently, the population of LCT in Walker Lake is sustained by two state-run fish hatcheries. Approximately 70,000 6-inch LCT are stocked in March by NDOW and USFWS. Approximately 10,000 of these fish are reared at Mason Valley Hatchery (NDOW) and 60,000 are reared at the federal Lahontan National Hatchery in Gardnerville. For one week prior to release, all hatchery fish are acclimated in a mixture of fresh and saline water in the Walker River (immediately upstream of the Lake).

Creation of another LCT fish hatchery at Walker Lake is currently being evaluated under a $1 million earmark. WRPT is using earmark funding to continue a previous fish evaluation study, to determine the best methods to be employed in a full-scale facility, to complete site investigations, to develop budget cost estimates and to identify requirements for a full-scale facility on the Walker River Indian Reservation.

A planning document will be developed to provide background and site information, programmatic needs, and other information and design criteria on which to base future construction project documents. Environmental review for the future construction of a hatchery facility at Walker Lake has not been initiated.

Walker River Paiute Tribe Purchase and Lease Program

WRPT's surface water rights include the continuous flow of 26.25 cfs, diverted from the Walker River in or above the Walker River Indian Reservation during a 180-day irrigation season to irrigate 2,100 acres of land on the reservation.

BIA operates the Walker River Indian Irrigation Project. The irrigated acres served by this project are composed of 20-acre allotments and the primary crop is alfalfa.

Weber Dam and Reservoir are part of the Walker River Indian Irrigation Project and are operated by BIA and used to regulate the delivery of irrigation water to project allotments. In recent years, operations have varied to accommodate Safety of Dams Phase II construction on the dam.

PL 109-103, Energy and Water Development Appropriations Act, 2006, enacted November 19, 2005, provided not more than $10,000,000 for a water lease and

purchase program for WRPT. In 2006, Reclamation entered into a PL 93-638 contract with WRPT to develop and implement the program. WRPT proposed four phases of work for the development, administration, monitoring and evaluation of a water lease and purchase program.

In 2007, 2008, and 2009, WRPT implemented a fallowing program that required:

- WRPT's expenditure of a portion of the funds available under the water lease and purchase program,
- BIA's approval of any lease or fallowing agreements with WRPT to implement the fallowing program,
- BIA's operation of Weber Dam and Reservoir and of the Walker River Indian Irrigation Project in accordance with the fallowing program and in recognition of the modified operations of Weber Dam and Reservoir required to facilitate Reclamation's Safety of Dams construction activities during the irrigation season, and
- the SE's approval of a Temporary Change of Use Application to transfer the water saved in fallowing to Walker Lake.

The fallowing program is voluntary, and Walker River Indian Irrigation Project landowners may fallow up to a maximum of the entire 2,100 acres.

Tamarisk Eradication, Riparian Area Restoration, and Channel Restoration within the Walker River Basin

Reclamation contracted with USFWS to implement PL 109-103 Section 208(c) and earmarked $10 million for restoration activities in the Walker River Basin. The funds were obligated in May 2006, and are being administered by USFWS, in cooperation with WRPT and NDOW. The funds were not earmarked for specific locations and USFWS formed the Walker River Basin Advisory Group to oversee the use of this funding in 2006.

USFWS initiated activities by preparing a baseline watershed assessment (currently in review) to determine current channel conditions, riparian health, and other factors that affect the overall health of the Walker River watershed. The baseline assessment will be used to detail processes occurring in the basin, prioritize future restoration activities, and monitor the success of restoration projects. Actual restoration actions are uncertain at this time because of funding constraints. Future restoration projects will likely include tamarisk removal, riparian revegetation, and channel function in the lower Walker River.

A lawsuit has been filed that claims that demonstration projects were undertaken prior to the preparation of an EIS assessing which projects would provide the greatest flows to Walker Lake. It asserts that Reclamation is not complying with the legislative mandate to prioritize the expenditure of funds in a manner that will

maximize benefits to Walker Lake by giving priority to activities that are expected to result in the greatest increase in flows. Pending the outcome of the lawsuit, no future project or environmental review is currently forthcoming. However, the types of actions included for funding will likely result in beneficial impacts on wildlife habitat, water quality, and water supply.

Western Inland Trout Initiative and Fishery Improvements

PL 109-103 Section 208(c) also earmarked $5 million to USFWS, WRPT, and NDOW to develop and implement a monitoring plan focused on fishery health, and to complete a study of the Walker Lake ecosystem. Funding was also provided to assist with development of the Western Inland Trout Initiative (which includes a much larger geographic area than the Walker River basin).

In 2006, a 5-year monitoring plan for Walker Lake was developed. Year two of the 5-year monitoring plan is underway. A 5-year program to monitor fish populations and the overall lake ecosystem in response to changing TDS concentration and inflow is also underway. Future projects will include continued (long-term) monitoring of the Walker Lake ecosystem and its response to changing TDS concentration, lake elevation, and river inflow; construction of a pilot acclimation facility to increase survivorship of stocked LCT, and funding WRPT and NDOW to implement fishery improvements.

Mason Valley Wildlife Management Area – Water Conservation and Other Improvements

The Mason Valley WMA is owned by the State of Nevada with management authority assigned to NDOW. The WMA supports an abundance of fish and wildlife that contribute significantly to the biological diversity of the region. The Walker River floodplain meanders through the WMA, which has decreed Walker River water rights, and is the next-to-last diverter of water before the river empties into Weber Reservoir, which lies on the Walker River Indian Reservation.

The actual amount of water delivered to the WMA varies considerably based on precipitation, snow pack, and the total amount of water in the Walker River system. A fish hatchery on the WMA derives its water from five onsite production wells, and discharges approximately 5,700 af/yr to the WMA where the water is reused for wetland enhancement. Groundwater is also used for crop and wetlands irrigation. Other sources of water for the WMA include Nevada Energy's Fort Churchill Cooling Pond and treated effluent from the City of Yerington. The various water supplies are used to maintain wetlands and ponds, and almost no surface water flows from the WMA into the Walker River because of water quality concerns associated with the hatchery, cooling pond, and effluent waters.

In March, 2004, Reclamation and NDOW entered into an Assistance Agreement for Desert Terminal Lakes Project funds to construct water conveyance systems and implement conservation measures that would result in a net reduction in use of Walker River water. The goals of the water conservation program would be achieved by:

- providing the means for the Mason Valley WMA to more efficiently use alternative water supplies, thereby reducing the total net usage of decree water; and
- implementing water management strategies that would improve water quality to meet established standards for discharge to the Walker River.

An EA and FONSI addressing improvements at the Mason Valley WMA were released in March 2004.

Homestretch Geothermal Pilot Project

Homestretch Energy, Inc. is investigating the feasibility of discharging geothermal plant effluent into the Walker River to provide additional inflow to Walker Lake over a 5-year period. Homestretch can pump 2,700 gallons per minute, with 200 gallons going into a cooling pond and the rest discharged onto the playa or across the highway. Nearly 1,300 gallons per minute (2.9 cfs or 5.7 af/day) is discharged to the nearby land surface and wetland ecosystem.

While the discharge, before mixing, exceeds Walker River water quality standards for certain constituents, Homestretch proposes to adjust its discharge timing to allow for better dilution. Approximately 35,000 af would be transferred over 5 years (7,000 af/yr) under this pilot project via a 2 miles of pipeline proposed for construction across BLM lands.

Reclamation is preparing an EA for the pilot project estimated to be completed in 2009. Homestretch Energy has submitted a discharge permit application to NDEP and a draft permit has been developed. This pilot project represents potential beneficial impacts for water supply to Walker River and Walker Lake.

Walker Basin Natural Resources Conservation Service Contractual Agreements

Numerous landowners in the Walker River Basin have entered into contractual agreements with the U.S. Department of Agriculture NRCS to implement land, irrigation, and related system improvements under a variety of conservation-oriented programs authorized and funded by the 1996 and 2002 Farm Bills. These include the Environmental Quality Incentives Program, Wildlife Habitat Incentives Program, Conservation Security Program, and Agricultural Management Assistance Program. Information provided by the Nevada NRCS indicates that more than 100 such agreements were executed with farmers in Lyon

and Mineral Counties in Nevada, and in Mono County in California, between approximately 1998 and 2006, representing a total contract (improvement) value of nearly $4.4 million. The Mason and Smith Valley Conservation Districts have completed several bank stabilization and channel capacity improvement projects in the Walker River Basin.

Miscellaneous Walker Basin Projects and Actions

Water Rights Acquisition Program for Lahontan Valley Wetlands

The Newlands Project, an early federal Reclamation project that relies on both the Carson and Truckee Rivers for its water supply, has provided irrigation water to western Nevada since the early 20th Century. Together with changes in water use caused by modern development, diversions to the Newlands Project have resulted in adverse environmental impacts on the lower Truckee River and Pyramid Lake as well as the historic palustrine wetlands in the Lahontan Valley, resulting in disputes over a number of complex water issues in the Truckee and Carson River basins. In response, Congress passed the Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990 (Title II of PL 101-618). Section 206 of the Act established a voluntary (willing-seller) water rights acquisition program to sustain approximately 25,000 acres of wetlands in the Lahontan Valley. Under this program, which is ongoing, USFWS is authorized to purchase land or water rights and transfer the water rights to the Lahontan Valley wetlands (specifically, to wetlands in the Stillwater National Wildlife Refuge, Carson Lake and Pasture, and Fallon Paiute-Shoshone Indian Reservation Wetlands).

In November 1996, USFWS issued its ROD on the program. The program provides for USFWS to purchase up to 75,000 af of water from within the Carson Division of the Newlands Reclamation Project. The partnership of the State of Nevada, the Nevada Waterfowl Association, BIA, Reclamation, and others interested parties has acquired about 39,700 af of water from the Carson Division for Lahontan Valley wetlands to date. This includes acquisitions of 29,000 af by USFWS, 1,800 af by BIA, and 8,900 af by the state and Nevada Waterfowl Association. USFWS is seeking additional water to sustain the wetlands through other methods, such as water leasing, reservoir spills, irrigation drain water, water use reductions at Naval Air Station Fallon, groundwater pumping, or water purchased from the Carson River upstream of Lahontan Reservoir. About 20 to 25% of available water rights in the Lahontan Valley are now dedicated to wetlands rather than agriculture, and that proportion could increase to 40% by the end of the program, between 2025 and 2030.

East Walker River Oil Spill Draft Restoration Plan/Environmental Assessment

In August 2008, the East Walker River Natural Resource Trustees (USFWS, California Department of Fish and Game [CDFG], Office of Spill Prevention and Response, NDEP, and NDOW) released a revised Draft Restoration Plan/Environmental Assessment describing restoration alternatives being considered as compensation for the accidental release of fuel oil into the East Walker River by Advanced Fuel Filtration Systems Inc., in December of 2000. The spill resulted in release of approximately 3,608 gallons into the East Walker River and visibly oiled approximately 10 linear miles of stream habitat, 3 miles of which were in Lyon County, Nevada. The restoration alternatives that are outlined in the Draft Restoration Plan/Environmental Assessment include riparian habitat restoration, instream and riparian habitat restoration (fencing riparian areas, constructing instream structures, removal and control of invasive plants, planting streamside vegetation), and recreational or human-use fishing improvements, including projects that encourage public use and enjoyment of the East Walker River and surrounding area. A final plan was scheduled to be released in December 2008 with implementation of restoration projects scheduled to commence in spring 2009. The plan includes restoration projects on both public and private land. On private property, projects will only be funded when conservation easements or similar agreements with willing landowners are in place (some of which are already in progress).

Lahontan Cutthroat Trout Recovery Plan

LCT is a federally listed threatened and state-protected species whose survival in Walker Lake and Walker River has depended on hatchery stocking since 1953. In 1995, USFWS released the Lahontan Cutthroat Trout Recovery Plan, which encompasses seven basins or systems within the trout's historic range, including the Walker River Basin. The long-term goal of the plan is to remove LCT from the list of threatened and endangered wildlife and plants.

A Short-Term Action Plan for Lahontan Cutthroat Trout in the Walker River Basin was released in August 2003, and identifies short-term activities and research needed to better understand the conservation needs of LCT specific to the Walker River Basin. The plan identifies priority river reaches, establishes a scientific adaptive-management approach to implementing recovery, and defines monitoring requirements for LCT and their habitat.

Weber Dam Repair and Modification Project

The Weber Dam Repair and Modification Project repaired Weber Dam and will construct a rock ramp ladder to facilitate fish passage. Weber Dam is a small, earthen dam on the Walker River Indian Reservation that impounds the waters of the Walker River. The dam and its reservoir are BIA facilities operated to provide the reservation with irrigation water as well as provide flood protection.

The reservoir also provides recreation, fish and wildlife habitat, and other benefits to WRPT. The repair project was implemented after it was determined that the dam was seismically vulnerable. A Final EIS on the project was released in May 2005, and a ROD was issued in August 2005.

Modification and repair of embankment-related structures were completed in 2007 to reduce the likelihood of dam failure during an earthquake, provide flood protection, and restore the storage capacity of the reservoir to 10,700 af. Repairs to the dam's outlet and spillway gates were completed in April 2009. The reservoir will be emptied in fall 2009 to add the fish ladder.

Walker River Indian Reservation Storage and Water Rights Litigation

WRPT and the United States government are currently involved in litigation concerning water rights for the Walker River Indian Reservation and efforts to settle claims regarding the provision of water to Walker Lake. WRPT has filed pleadings in federal district court to resolve outstanding issues related to its water rights. Specifically, WRPT is seeking recognition of storage rights for Weber Reservoir and water rights for lands that were returned to the reservation in 1936. As described in the previous section, because the final Walker River Decree did not provide for an express right to store water in Weber Reservoir, the United States, on behalf of WRPT, is seeking to establish such a right (together with various other rights) under litigation now pending in U.S. District Court of Nevada (United States *v.* WRID, Case in Equity, C-125). Currently, development of farmland on the Walker River Indian Reservation is limited to the current 2,100 acres because no additional state or federal water right allocations are available.

Anaconda Copper Mine Superfund Site Remediation Project

The Anaconda copper mine site covers more than 3,400 acres in the north Mason Valley. Portions of the site are owned by Arimetco (in bankruptcy) and portions are public lands managed by BLM. Mining and milling operations at the site were conducted between 1918 and 1978, and the site was abandoned in 2000. At least 103 drinking water wells are found within 4 miles of the mine site, providing the sole source of water for over 5,000 people in the area.

Open-pit mining operations involved extensive groundwater pumping over a long period of time. Upon cessation of activities, a lake was formed in the open pit (called Pit Lake). Pit Lake is a 1-mile-long, 800-foot-deep lake containing about 40,000 af of water (which increases slightly each year). In 1978, groundwater contamination was found beneath the site. Studies found tailing streams contaminated with arsenic, mercury, lead, copper, zinc, and chromium, as well as a contaminant plume in the shallow groundwater. A "pumpback" system was installed to contain the plume and to prevent contamination of drinking water wells (municipal and private) and the contamination of Walker River via the Wabuska Drain. In 2001 and 2003, NDEP performed emergency removals. In 2004, the Atlantic Richfield Company installed ambient air monitoring equipment

to evaluate fugitive dust concerns. In late 2004, NDEP requested that EPA take the regulatory lead at the site, as a result of the increased complexity of contaminants at the site (including radioactive contamination).

The Atlantic Richfield Company and YPT currently monitor air, groundwater, surface water, and soil on and adjacent to the site with oversight by EPA and NDEP. However, health assessments have found existing monitoring data inadequate. Improvements to the monitoring programs are ongoing.

In 2005, EPA issued an order to Atlantic Richfield Company to improve site security, update the health and safety plan for onsite workers, implement air monitoring, conduct a radiation survey on and off the site, continue operating the groundwater pumpback system and heap leach fluids management system, prepare operations and maintenance plans, continue ongoing investigations of the process areas, sample domestic wells for uranium, supply bottled water to residents, and implement a groundwater study.

In 2007, EPA issued a second order requiring remedial investigations and feasibility studies of the Anaconda portions of the site. Currently, EPA is the regulatory lead for cleanup of the site, and is working with other federal agencies, state agencies, and potentially responsible parties.

Cumulative Impacts Analysis

This section describes the cumulative impacts that could be associated with the Proposed Project and other alternatives when combined with other related past, present, and reasonably foreseeable actions in the Walker River Basin.

Cumulative impacts would not be considered adverse for one or both of these reasons:

- cumulative impacts would be beneficial, or
- the impact of the Proposed Project or other alternatives would not be added to the impact of other projects (i.e., no cumulative impact would occur) or would be too minor or localized to be considered cumulatively.

Impacts for each resource are discussed generally in this chapter for all three action alternatives. Impacts are discussed in more detail and differentiated by alternative and by full or existing funding availability in each resource chapter in this Draft EIS.

Water Resources

Implementations of the Proposed Project and other alternatives, in combination with other related actions in the Walker River Basin, would result in impacts on water supply, groundwater, and water quality as described below.

Water Supply

Adverse impacts from the Proposed Project and alternatives would include a reduction in irrigation, reduced water supplies for remaining canal users from reduced canal flows, and reduced incidental availability of water from field runoff, seepage, or return flows. Beneficial impacts could occur to Walker Lake from increased inflows and to Walker River from increased river flow.

Several types of actions occurring in the Walker River Basin could increase surface water supply in the Walker River Basin: removal of invasive plants, water conservation and efficiency efforts, and other water acquisition projects. If these actions increase inflow to Walker Lake, lake elevation and water quality would be improved beyond what is described in Chapter 3, Water Resources, for the Proposed Project and other alternatives. These actions would result in a beneficial cumulative impact on water supply.

Conservation projects in the Walker River Basin that involve the removal of invasive plants that consume a lot of water would free this water supply for beneficial uses. Related projects with a tamarisk removal component include projects on the Walker River Indian Reservation and a long-term tamarisk removal plan that strategically prioritizes eradication activities in the Walker River Basin. The USFWS Walker River Restoration Program and projects conducted by the Mason Valley Conservation District and Smith Valley Conservation District also involve tamarisk eradication as well as noxious weed control in the East Walker River Oil Spill Draft Restoration Plan/Environmental Assessment project. WRID also has an earmark for a weed control program, along with other actions.

Related projects with a water conservation or efficiency component include improvements at the Mason Valley WMA and possibly NRCS contractual agreements. Fallowing of lands on the Walker River Indian Reservation and the Homestretch Geothermal Pilot Project would also provide additional water to the lake.

Groundwater

The Proposed Project and other alternatives could cause a potentially adverse decrease in groundwater recharge in the Walker River Basin. Other actions in the region also could potentially affect groundwater levels. For example, removal of invasive plants could improve groundwater levels, whereas efficiency efforts could reduce groundwater recharge. Fallowing on the Walker River Indian Reservation could decrease groundwater in that area. The Homestretch geothermal Pilot Project could increase groundwater adjacent to river below the river discharge point. The impacts of these actions are likely to be small compared to the impacts of the Proposed Project and other alternatives, and adverse cumulative impacts are not anticipated.

Water Quality

Land retirement and water conservation associated with the Proposed Project and other alternatives is expected to have an overall beneficial impact on water quality as a result of higher instream flow, lower water temperatures, increased dilution of poor quality inflow, decreased poor quality return flow, and reduced transport of nutrients and pesticides into receiving waters. Water quality in the lake would be improved by increased inflows. Adverse impacts on water quality could occur from altering the movement of the Anaconda Mine groundwater, or as a result of change in groundwater recharge, introduction of poor quality water (e.g., geothermal) and sedimentation from increased erosion from increased river flow and exposed soils.

Various other related projects could have water quality impacts, including a reduction in the quality of water to be purchased or the introduction of contaminants into the water supply supporting Walker Lake. These projects include the Anaconda Copper Mine Superfund Site Remediation Project, Hawthorne Army Depot Mount Grant Watershed and Well Feasibility Study, and the Homestretch Geothermal Pilot Project. However, this is not considered an adverse cumulative impact because water quality impacts from the Proposed Project and other alternatives would be expected to be small, any discharges to the river from the geothermal project would be required to undergo an NPDES permitting process to protect water quality, and water quality at the Anaconda mine site is being monitored by the EPA.

Biological Resources – Vegetation and Wetlands

The Walker River Basin has been subjected to extensive human impacts from land and water development, population growth, and recreation. These impacts have altered the physical and biological integrity of the basin causing loss of native riparian vegetation along the river system and around the lake as well as a decline of native fish populations. Functional riparian zones are important to stream systems, providing bank stability, wildlife habitat, nutrient cycling, lowered water temperatures, and a reduction in the colonization potential of nonnative species. The implementation of the acquisition alternatives would result in the potential loss of riparian habitat in some areas (canals and drainage ditches) and a gain in valuable riparian habitat along the Walker River. Various habitat restoration from other projects implemented or planned in the Walker River Basin would also increase riparian vegetation within important river system areas. Cumulative impacts on riparian vegetation along the river system could result in beneficial impacts.

Wetland areas associated with farmland and the south end of Walker Lake could decrease under the Proposed Project and other alternatives; however, the loss would be somewhat offset by wetland habitat gained along the river from increased flows. Wetland habitat below Schurz would especially benefit. Some

components of other restoration projects occurring in the Walker River Basin could also increase wetland habitat. Cumulative impacts on wetlands are not expected to be adverse.

Implementation of the Proposed Project and other alternatives could result in the permanent or temporary conversion of cropland over time and could result in the spread of weeds and invasive plant species. Other related programs such as the Tamarisk Removal Program, WRID Weed Control Plan, Conservation District Weed Control, and the Agricultural Management Assistance Program include activities to prevent the spread of noxious weeds. The Proposed Project and other alternatives, when considered in combination with other related programs, would not result adverse cumulative impacts.

Biological Resources – Fish

The Proposed Project and other alternatives, when considered along with other past, present, and reasonably foreseeable future projects, such as a fish ladder at Weber Dam, USFWS Walker River Restoration Program, Walker Lake Fish Hatchery, Walker River Paiute Tribe Purchase and Lease Program, and the USFWS Walker Lake Fishery Improvement Program and Lahontan Cutthroat Trout Recovery Plan, would have an overall beneficial impact on LCT.

Implementation of the Proposed Project and other alternatives would improve native fish habitat as a result of increased flows, reduced temperatures, and increased LCT spawning habitat in the Walker River. The Proposed Project and other alternatives would also increase the survival of LCT and tui chub as a result of improved water quality in Walker Lake.

Other projects occurring in the Walker River Basin would increase habitat for LCT and other native fish species by restoring the river corridor, providing water for Walker Lake, providing fish passage, and improving water quality through noxious weed removal. The Walker Lake Fishery Improvement Program will focus on the continued long-term monitoring of the overall Walker Lake ecosystem and its response to changing TDS concentration, lake elevation, and river inflow; and will construct a pilot acclimation facility to increase survivorship of stocked LCT. The cumulative impact of these projects on fish species would be beneficial.

Biological Resources – Wildlife

Implementation of construction-related elements of Alternative 3, along with other projects such as WRID gaging improvements and Weber Dam repair and modification, would result in some temporary construction-related impacts on wildlife. However, it is unlikely that these construction activities, which are not in the same location, would occur at the same time. Therefore, these temporary impacts would not result in adverse cumulative impacts.

Implementation of acquisitions that would temporarily or permanently remove cropland would result in a loss of foraging habitat for many wildlife species. Some habitat would also be lost that has been provided by existing farmland and riparian corridors at the southern end of Walker Lake as that wetland submerges, and at Alkali WMA if return flow diminishes. The Acquisition Program would increase and improve wildlife habitat for birds and other species in other areas, primarily along the river corridor and Walker Lake itself.

Implementation of the Proposed Project and other alternatives, in combination with other past, present, and planned programs (river, WMA, and farm restoration/conservation projects and temporary land fallowing) would have a beneficial cumulative impact on wildlife.

Land Use and Agriculture

The Proposed Project and other alternatives conflict with Lyon County and City of Yerington land use policies for agricultural preservation, and conflict with the Lyon County Master Plan policy on retaining water resources within the county. Overall agricultural productivity is expected to decrease in the study area and weeds and invasive plant species could increase on retired or fallowed farmland. The Proposed Project and other alternatives would comply with land use goals in the Mineral County Master Plan to preserve and improve outstanding natural, historic, or scenic features in the county and to restore health and functioning to the county's natural resources.

The Proposed Project and other alternatives, along with other regional and local projects, would contribute to cumulative changes in land uses in the project vicinity. Land use changes in the Walker River Basin would occur as a result of restoration projects, private development, growth in both Lyon and Mineral counties, and temporary land fallowing on the Walker River Indian Reservation. The Proposed Project and other alternatives, along with reasonably foreseeable private land actions, would result in cumulative impacts on land use.

Air Quality

Air quality impacts associated with the Proposed Project and other alternatives include less fugitive dust at Walker Lake under full funding and little or no change at the Lake under current funding. While permanently retired agriculture lands would increase the amount of vacant land, which could become a potential fugitive dust source during high wind events, current agricultural activities also result in the release of fugitive dust as a result of planting, plowing, burning, and off-road vehicle travel (e.g., tractors). Conversely, irrigated crops also tend to suppress dust erosion. Under Alternative 3, on-farm or construction activities for efficiency measures could increase temporary short-term dust emissions.

Noxious weed eradication and restoration with native plants programs occurring in the Walker River Basin would result in more stable soil systems. Fugitive dust in these restoration areas would be reduced, resulting in a minor beneficial cumulative impact on air quality.

Other related projects that also include potential impacts on air quality in the Walker River Basin are primarily those with a construction component (e.g., Walker Lake Fish Hatchery, NRCS contractual agreements, the Walker River Restoration Program, Weber Dam improvements and East Walker River Restoration Program, Anaconda Mine Remediation Project) and they could cumulatively contribute to air quality impacts in the Walker River Basin. It is unlikely that these activities would be implemented concurrently and the actions are temporary; therefore, an adverse cumulative impact on air quality would not be expected.

Cultural Resources

Implementation of Alternatives 1 and 2 would not result in ground-disturbing activity beyond current conditions or those that existed in recent history. Lake elevations would not exceed those recorded in the 1960s; therefore, cultural resources not previously inundated historically, or in the recent past, would be newly inundated or adversely affected as a result of the Proposed Project and Alternative 2. Under Alternative 3 construction activities may affect cultural resources. Conservation activity projects would be reviewed on a case-by-case basis to determine if these activities have the potential to affect historic properties should they be present and Reclamation cultural resources staff would determine what steps to take to comply with Section 106 of the NHPA, including consulting with SHPO to resolve any adverse impacts pursuant to 36 CFR Part 800.6.

The cumulative impacts of past, present, and future actions on cultural resources in the Walker River Basin relate primarily to the potential for damage to cultural resources and their context from ground-disturbing activities. Other federal projects occurring in the region would also be required to comply with Section 106 of the NHPA if applicable. Pursuant to the definition at 40 CFR Part 1508.27(b)(8), any potential adverse impacts on cultural resources from federal projects would be mitigated to less-than-significant levels using the Section 106 process. The Proposed Project and other alternatives, along with other known activities occurring in the Walker River Basin, are not expected to result in adverse cumulative impacts on cultural resources.

Socioeconomics

The Proposed Project and other alternatives could reduce agricultural and other employment, income, and tax revenues as a result of changes in agricultural production in Mason and Smith Valleys and in the east Walker area. Impacts could also result in an increase in public recreation opportunities, income from recreation, and recreation employment in the Walker Lake area. These impacts

vary from temporary to permanent, depending on which alternative would be implemented.

Other related actions occurring in the Basin may result in minor increases in available employment and subsequent income and tax revenues for certain sectors (e.g., weed control and restoration projects, Walker Lake Fish Hatchery, Anaconda Mine Superfund Site Remediation, and possibly NRCS contractual agreements).

Private sector residential, industrial, and business growth could occur over time and affect the economies of the region. These growth trends depend on a variety of dynamic social and economic factors in the Mason Valley and Smith Valley rural farm and ranch communities, in Hawthorne and other communities, and on the Walker Indian Reservation.

The socioeconomic impacts of potential private sector and federal projects are either unknown or expected to be minor. These impacts, along with those of the Proposed Project and other alternatives, are not expected to be cumulatively adverse.

Recreation

The Proposed Project and other alternatives would increase consistency with Mineral County recreation policies, improve sport fishing opportunities, boating access, and other recreational activities at Walker Lake. Increased flow would improve other recreational activities such as sport fishing opportunities in East Walker River, West Walker River, and mainstem Walker River. Recreational resources that could be affected by the Proposed Project and other alternatives include camping, boating, fishing, hunting, hiking, and wildlife viewing in the proximity of the Walker River, Walker Lake, various WMAs (including the Mason Valley WMA and Alkali Lake WMA), public lands managed by BLM and USFWS, and the Walker River Indian Reservation.

Under the Proposed Project and other alternatives, increasing the surface elevation of Walker Lake would result in a beneficial impact on recreational opportunities by increasing the abundance of fish and wildlife and improving access to the shoreline, boat ramps, and other recreational facilities that are currently well above the existing lake elevation. Other related actions in the region include undertaking activities such as fisheries improvements and habitat restoration. The implementation of the Proposed Project and other alternatives in combination with other related actions would have a beneficial cumulative impact on recreation.

Indian Trust Assets

The Proposed Project and other alternatives would improve habitats of fish, wildlife, and vegetation ITAs in the lower Walker River and Walker Lake, and

would improve the Walker Lake ecosystem. However, adverse impacts on ITAs of YPT could potentially occur as a result of reducing groundwater recharge and elevation, potential movement of the Anaconda Mine groundwater plume, and reducing incidental availability of water as a result of reduced field runoff, seepage, or return flows.

Other reasonably foreseeable projects would have beneficial impacts on ITAs (restoration, weed removal, Anaconda Copper Mine Superfund Site Remediation, Walker Lake Fish Hatchery, Western Inland Trout Initiative and Fisheries Improvements, and additional instream flows and lake inflow from Homestretch Geothermal pilot project water). No adverse cumulative impacts on ITAs from the Proposed Project and other alternatives along with other projects in the Walker River Basin are anticipated.

Environmental Justice

The Proposed Project and other alternatives could affect minority and low-income groups in Lyon County, including localized losses of agricultural employment and other services and employment for minority and low-income populations. The change in employment for the agricultural sector of Lyon County would be approximately 16% to 20% of total farm employment.

Related projects within the region include implementing potential federal and private construction work, conservation activities, fisheries and habitat improvements, and restoration activities. Implementation of the Proposed Project and other alternatives, in combination with these other actions, could result in beneficial impacts on environmental justice populations. The impacts of other projects in the Walker River Basin combined with the loss of agricultural employment would not result in a cumulative adverse impact on environmental justice populations.

Chapter 15 Climate and Climate Change

Introduction

This chapter describes the affected environment for climate and climate change in the study area and the potential impacts on climate and climate change that would result from the Proposed Project and other alternatives.

The potential impacts on resources in the study area as a result of climate change are also discussed.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed below. Full references can be found in Chapter 17, References.

- Emissions of Greenhouse Gases in the United States 2007 (U.S. Department of Energy 2008)
- Our Changing Climate: Assessing the Risks to California (California Climate Change Center 2006)
- The Science of Climate Change (Intergovernmental Panel on Climate Change 2007)
- Climate Change 2007: The Physical Science Basis—Summary for Policymakers (Intergovernmental Panel on Climate Change 2007)
- The Walker River Basin, Nevada and California: Physical Environment, Hydrology, and Biology (Sharpe et al. 2008)

Affected Environment

This section describes the environmental setting related to climate and climate change in the study area. Although the project area is the entire Nevada portion of the Walker River Basin (Chapter 1), the study area for climate is defined as the entire Walker River Basin, which includes the high Sierra Nevada of California and the Great Basin Desert of Nevada (Sharpe et al. 2008). Although the Proposed Project would not result in water acquisitions or changes to operations in California, the Californian portion of the Walker River Basin is included in the study area because regional climate affects the basin in its entirety, including the basin's air quality, water, land, and biological resources.

Past and Present Climate

Modern climate in the Walker River Basin varies from humid continental (cold winters with heavy precipitation) at high elevations to low latitude desert (arid, hot summers) at Walker Lake. The Sierra Nevada creates a rain-shadow effect to the east, resulting in decreasing precipitation as storms move from west to east across the mountain range. During the winter, storms generally deposit snow on the Sierra Nevada and Sweetwater Mountains. Occasionally, warm winter storms can cause precipitation in the form of rain at high elevations. These rain-on-snow events can cause flooding. During the summer and fall, thunderstorms can generate runoff and flash floods, although the distribution of precipitation from thunderstorms is very erratic, both in time and location (Sharpe et al. 2008).

Average annual precipitation at Bridgeport, California (elevation 6,440 feet), is 9 inches (57-year record), and average annual precipitation at Hawthorne, Nevada (elevation 4,220 feet), is approximately 5 inches (51-year record). Substantial seasonal and diurnal temperature fluctuation, common to desert environments, occurs at the lower elevations. Temperatures at Hawthorne occasionally reach 90 to 100°F but the average annual temperatures at Hawthorne range from a maximum of 71°F to a minimum of 41°F. Temperatures at Yerington consistently exceed 90° during the summer, but the average annual temperatures range from a maximum of 69° to a minimum of 34°. Average annual temperatures at Bridgeport range from a maximum of 62°F to a minimum of 24°F. Bridgeport receives an average of 43 inches of snowfall per year, and Hawthorne receives an average of 2.8 inches. Less than half of the annual precipitation occurs during the growing season (U.S. Department of the Interior 1964, Sharpe et al. 2008, Western Regional Climate Center 2008).

Climate in the Walker River Basin has not been constant. Periods over the last 20,000 years have been colder and wetter (during the last glacial period), warmer and drier, or warmer and wetter than the modern climate, which is an interglacial climate period. Because Walker Lake is a terminus lake and natural inflow to Walker Lake is linked to climate, the historic and prehistoric lake volume fluctuated in response to these differing climate regimes.

Walker Lake’s current volume is also related to agricultural water diversions from Walker River, which feeds into Walker Lake. Water has been diverted from Walker River since 1852, and agricultural developments, not drought, account for the decline in elevation from approximately 4,083 feet in 1882 to 3,934 feet msl in December 2007 (Milne 1987, Sharpe et al. 2008). This corresponds to a decrease in lake volume from 8,962,000 to 1,710,000 af, a loss of approximately 7,252,000 af of water during this time period (Sharpe et al. 2008).

Climate Change

This section provides a background on how global climate change may affect the study area. A description of global climate change, the greenhouse effect, and greenhouse gases is provided in Appendix 15A.

Temperature

A warming global climate has widespread implications for Nevada's environment. An overall average increase of 1.1 to 1.7°C has been observed over the past century (U.S. Global Change Research Program 2000a, 3). Rising temperature trends can affect the timing and quality of precipitation. Snow-covered area in the Walker River Basin is predicted to decrease by 6 to 17% for a 1°C rise in temperature and by 59 to 74% for a 5°C rise in temperature (California Department of Water Resources 2006).

Water Resources

Warming temperatures and changes in the form, timing, and amount of precipitation are very likely to cause earlier melting and significant reductions in the snowpack of the western mountains by the mid-21st Century (Bates et al. 2008 in Intergovernmental Panel on Climate Change 2008 Technical Paper IV, 102). Reductions in mountain snow-water equivalent and annual precipitation, more precipitation falling as rain, increased periods of drought, and earlier peak streamflow already have been observed in the western mountains during the past century. Projections for historically snowmelt-dominated watersheds, such as the Walker River Basin, include snowmelt runoff advances, increasing winter and spring flows, and substantially decreasing summer flows (Kiparsky and Gleick 2003).

Decreases in the Sierra Nevada snowpack have been observed over the last century and are predicted to continue in response to warming. Snowpack is predicted to decrease by as much as 70 to 90% (U.S. Global Change Research Program 2002). Specifically, for each 1°C rise in temperature, researchers predict snow levels will retreat 500 feet upward in elevation in western mountains (Nelson et al. 2007). Winter temperatures in the Sierra Nevada already have risen by almost 2°C in the second half of the 20th Century (Nelson et al. 2007). According to the California Department of Water Resources, only a few degrees rise in temperature could significantly reduce the snow-covered area in the East and West Walker River Basin (California Department of Water Resources 2006). A 3°C rise could reduce snow-covered area in the East Walker watershed by 50%. These changes will also likely increase the number of floods, increase rates of soil erosion, and present a greater risk to property and life.

Table 15-1 shows potential reductions in snow-covered area as a result of changes in temperature.

Table 15-1. Potential Changes in Snow-Covered Area in the East and West Walker River Watersheds by Increases in Temperature

Basin	Snow-Covered Area (% of basin)	Estimated Future Area Covered by Snow (% of basin)				
		1°C Rise	2°C Rise	3°C Rise	4°C Rise	5°C Rise
W. Walker	97	94	83	67	53	41
E. Walker	97	83	69	50	36	26

Source: California Department of Water Resources 2006

The effect of climate change on total precipitation in the Walker River Basin is uncertain, partly because there is much uncertainty associated with using global climate models to predict local hydrologic conditions (Bates et al. 2008). Some studies have predicted increases in rainfall and others have predicted decreases for the southwest and the Sierra Nevada (U.S. Global Change Research Program 2000b, 15; Bates et al. 2008). Walker River Basin is near a transition zone between increased precipitation and decreased precipitation as predicted by average results from 15 climate change models (Bates et al. 2008).

If average precipitation remains unchanged by climate change, total runoff would be expected to decrease. For example, a study of the Colorado River Basin showed that, with no change in precipitation, a 2°C rise can reduce mean annual runoff by 4 to 12%, and a 4°C rise can reduce mean annual runoff by 9 to 21% (Nelson et al. 2007) because of increased evaporation and evapotranspiration.

The effect of climate change on Walker Lake is uncertain. Decreased snowpack could increase the volume of uncaptured runoff and more water may flow to Walker Lake as opposed to being stored in upstream reservoirs for later irrigation purposes. Little change or a decrease in total precipitation could reduce the amount of acquired water and the flow to the lake. On the other hand, if precipitation were to increase enough to counter the effects of increases in evaporation and evapotranspiration, the amount of water available for irrigation and for lake inflow (whether acquired as part of the Acquisition Program or not) would increase.

Biological Resources

Southwestern semiarid ecosystems consist of a complex array of plant species with various phonologies (seasonal timing of activities) and physiologies. Different biochemical systems mean different responses to temperature, water availability, and CO_2 levels in the atmosphere. Semiarid ecosystems like that of the Walker River Basin, which primarily include intermountain basins big sagebrush scrubland, mixed salt desert scrub, and semidesert grassland vegetation, are vulnerable to shifts of structure and dominance that, according to the paleorecord, are not easily reversed. Thus, plants and, in turn, animals that rely

on these plants in arid regions may face significant consequences with only slight changes in water and heat stress (U.S. Climate Change Science Program 2008).

Desertification, which is the long-lasting deterioration of semiarid ecosystems, poses a significant problem in the southwestern United States, especially in light of anticipated decreases in vegetation, available water, and crop yields as a result of climate change. Degraded semiarid vegetation is less resistant to and able to recover from drought. Furthermore, the progress of desertification can be increased by the more frequent or more intense droughts that are likely to result from climate change during the 21st Century (Houghton 2004).

River and lake ecosystem health also could suffer as a result of climate change. Excess nutrients from agricultural fertilizers in conjunction with increased water temperatures could result in decreased dissolved oxygen in water and increased algae blooms on the surface of rivers and lakes (U.S. Global Change Research Program 2000c). Decreases in dissolved oxygen levels and increases in algae blooms, which also deplete the ecosystem of oxygen, could harm the other organisms in the system. Finally, water temperature increases could alter mixing and stratification of water columns in lakes, altering nutrient balances and habitat value and further affecting various species and biodiversity.

Agriculture

In some scenarios, productivity of major agricultural crops will increase (U.S. Global Change Research Program 2000b), but this is not likely to occur in Nevada. The higher net primary productivity as a result of a lengthened growing season is limited mostly to the higher latitudes of North America, where forecast temperature increases are relatively high. In addition, the benefits of elevated atmospheric CO_2 would be offset by adverse effects on crop yields attributable to droughts and other extreme events (and the winds sometimes associated with them). Climate change could also increase both crop and non-crop evapotranspiration rates, leading to increased demand for surface water and groundwater.

Continued climate change likely will shift the ranges of existing invasive plants and weeds and alter competition patterns with native plants. The ranges of these crop-damaging species are likely to expand as the species generally evolve rapidly, and significant populations are already established. Even if species range contraction were to occur, it is likely that new or different weed species would fill the emerging gaps (California Climate Change Center 2006).

Air Quality and Wildfire Hazards

Higher temperatures are expected to increase the frequency, duration, and intensity of conditions conducive to air pollution formation (California Climate Change Center 2006). There already is an air quality issue of occasional dust and

sandstorms in Nevada, resulting from the dust that is generated around the lowered elevation of Walker Lake as well as Owens and Mono Lakes in California (Chapter 8, Air Quality). With more severe, frequent, and lasting heat events such as heat waves and very high temperatures, there could be drier conditions that lead to further decreases in water elevations in these lakes as well as drier soils that could be kicked up into the air.

There have been positive human test results for the West Nile virus across the United States, including western Nevada (U.S. Geological Survey 2008). Coccidioidomycosis (valley fever) is also located in the southwestern United States, where temperatures are high and the soils are dry. With more severe, frequent, and lasting heat events associated with climate change, there could be a greater chance of infectious disease such as West Nile virus spread by insects (e.g., mosquitoes) or valley fever spread by fungi (e.g., *Coccidioides immitis*). Warmer temperatures could lead to a wider ecosystem in which such insects and fungi thrive (U.S. Global Change Research Program 2000b).

Wildfires could increase with an increase in regional fuel loads and a change in precipitation. With a predicted increase in precipitation in the form of winter rain, wildfires in grassland and chaparral areas are anticipated to increase, because more winter rain will stimulate the growth of plant fuel available to burn in the late summer and fall (California Climate Change Center 2006).

Greenhouse Gases

No studies have been conducted to determine GHG emissions resulting from human activity in the Walker River Basin. Sources of GHG emissions in the Walker River Basin encompass activities related to transportation, industry, agriculture, and energy use in building operations, military operations, and groundwater pumping.

Environmental Consequences

This section describes the impact analysis relating to climate and climate change for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assessment Methods

The assessment methods used in this analysis are qualitative because of the many uncertainties and lack of data. The magnitude of project emissions is not known because the extent of potential construction and operational activities is not yet known. Therefore, the potential impacts of the Proposed Project on GHG emissions from the use of on- and off-road vehicles are discussed in a qualitative manner. In addition, it is not known whether retirement of agricultural lands will lead to replacement of agricultural lands within the Walker River Basin, the state,

the country, or another country. Thus, the potential impacts associated with GHG emissions from agricultural effects of the Proposed Project are discussed in a qualitative manner. Finally, potential impacts associated with changes in carbon sinks and albedo (the extent to which the land surface reflects the sun's solar radiation) are described at a qualitative level. Much of the information on GHG emissions is supported by the air quality analysis in Chapter 8, Air Quality.

Impact Criteria

NEPA has not established thresholds for determining the adversity or benefit of GHG emissions, carbon sink changes, and albedo shifts from an individual project. No quantitative impact criteria will be set for GHG emissions, carbon sink change, or albedo shift to measure the impact of climate change on the region or the Proposed Project or alternatives. However, absent national guidance and established quantitative thresholds, the Proposed Project and alternatives are considered to result in an adverse impact if they would:

- make a considerable contribution to cumulative GHG emissions and global climate change.

Impacts

No Action Alternative

Direct Impacts

Under the No Action Alternative, no development or transferring of land or water rights would occur in the Walker River Basin. Current operations of water pumping and delivery to land uses in the Walker River Basin would continue and could increase with anticipated increased water demands by the land uses, primarily agricultural land. Because GHG emissions are associated with the energy used for the current pumping or diverting of river water to land uses in the region, GHG emissions could increase, and a minor impact could occur.

Indirect Impacts

Under the No Action Alternative water pumping and delivery from the Walker River system to land uses in the Walker River Basin would continue and could increase with anticipated increased water demands by the land uses, primarily agriculture. Because natural carbon sinks are primarily related to the carbon uptake potential of the ocean and vegetation, no net increase or decrease in carbon sinks would result. Regional carbon sinks, therefore, are not anticipated to change. There would be no impact.

Because albedo is connected to the reflectivity of land and its vegetated state, no net increase or decrease in albedo value would result. There would be no impact.

Alternative 1 (Proposed Project)

Direct Impacts

Impact CC-1: Change Emissions of Greenhouse Gas (Undetermined Impact)

Under the Proposed Project, irrigation and surface water rights would be acquired, which would remove water from the land. Decreasing water delivery to the land would reduce GHG emissions associated with pumping or water diversion. If land is not retired and no associated displacement of farming and livestock operations occurs (see discussion below), this would be a beneficial impact.

The Proposed Project may reduce the amount of farmed land in the Walker River Basin (see acreages in Table 7-3). Although farmland could be converted to other uses, farmers also could maintain their land in agriculture using various means, such as fallowing, growing low-water crops, and improving water use efficiency. The amount of land that might be retired as a result of the acquisition of water is therefore uncertain.

If land is retired in the Walker River Basin, this would reduce GHG emissions associated with irrigation, farming equipment, and fertilizer. Reduction in locally and regionally available feed for cattle and other livestock operations could result in a reduction of local and regional livestock operations or the transportation of feed from alternative feed sources at a greater distance than current sources. If local and regional livestock operations remain stable, feed crop farming would have to increase at alternative locations and transportation GHG emissions could increase. If local and regional livestock operations decline because of a reduction in local or regional feed, then livestock operations could be diverted to other regions or even foreign locations.

Thus, reduction of farming in the Walker River Basin (if it occurs) may not result in a net decrease of farming or livestock operations globally. Whether this would result in a net increase or decrease or no change in GHG emissions is unknown because it would depend on 1) the net change, if any, in overall farming and livestock activity globally; 2) the GHG intensity of farming and livestock at any new locations; and 3) transportation GHG emissions to either carry feed to current livestock operations from alternative sources or to carry crops and livestock to market from new farming and livestock operations.

Indirect Impacts

Impact CC-2: Change Regional Carbon Sinks Contributing to Global Climate Change (Minor Impact)

Under the Proposed Project, irrigation and surface water rights would be acquired, which would remove water from the land. If sufficient water is removed from the land, the land use could convert from agricultural to nonagricultural uses. Natural

carbon sinks exist primarily in the form of the ocean and vegetation, so a slight net decrease in carbon sinks could result, but agricultural land is a carbon sink only when vegetation is present and not after it has been harvested or when fallow. The potential decrease in carbon sinks would be an adverse impact. Irrigated land would be acquired and possibly changed to dry, nonvegetated areas (see acreages in Table 7-3). Additionally, wetland and riparian areas could increase along the rivers and Walker Lake with increased water remaining in that hydrologic system. As a result, regional carbon sinks are not anticipated to decrease significantly. There would be a minor impact.

Impact CC-3: Change Regional Albedo Contributing to Global Climate Change (Minor Impact)

Under the Proposed Project, irrigation and surface water rights would be acquired, which would remove water from the land. If sufficient water is removed from the land, the land use could convert from agricultural to nonagricultural uses. Because albedo is connected to the reflectivity of land uses, and dry, non-vegetated areas have a higher albedo value than more colorful, vegetated agricultural areas, a slight net increase in albedo value could result. The potential increase in albedo would be a beneficial impact. Irrigated land would be acquired and possibly changed to dry, nonvegetated areas (see acreages in Table 7-3); however, wetland and riparian areas could increase along the rivers and Walker Lake with increased water allowed to remain in that hydrologic system. The potential decrease in albedo associated with increased wetland and riparian areas would be an adverse impact. Overall, regional albedo value is not anticipated to increase or decrease significantly. There would be a minor impact.

Alternative 2 (Leasing Alternative)

Because Alternative 2 requires recurring water leases, the actions of Alternative 2 would last only until the funding is exhausted. Assuming that sufficient water is leased to increase inflow to Walker Lake by an average 50,000 af/yr, the existing funding is estimated to last 3 years, while full funding would last an estimated 20 years. The impacts of Alternative 2, unless noted below, would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, only temporary.

Direct Impacts

Direct Impacts Similar to Alternative 1

Impact CC-1: Change Emissions of Greenhouse Gas (Undetermined Impact)

Under Alternative 2, irrigation water rights would be leased, which would remove water from the land temporarily (3 to 20 years), but there would be no permanent change in land use. Decreasing water delivery to the land in the short term would temporarily reduce associated pumping or water diversion GHG emissions within

the Walker River Basin. If land is not retired and no associated displacement of farming and livestock operations were to occur (see discussion under Alternative 1 above), this would be a short-term beneficial impact.

Reduction of farming in the Walker River Basin (if it occurs) may not result in a net decrease of farming or livestock operations globally (see discussion under Alternative 1 above).

Indirect Impacts

Indirect Impacts Different from Alternative 1

Impact CC-2: Change Regional Carbon Sinks Contributing to Global Climate Change (No Impact)

Under Alternative 2, irrigation water rights would be leased, which would remove water from the land temporarily (3 to 20 years), but there would be no permanent change in land use. Water would be removed only temporarily from the land, and no long-term change in carbon sinks could result, because agricultural land uses would not be permanently retired. Regional carbon sinks, therefore, are not anticipated to change. There would be no impact.

Impact CC-3: Change Regional Albedo Contributing to Global Climate Change (No Impact)

Under Alternative 2, irrigation water rights would be leased, which would remove water from the land temporarily (3 to 20 years), but there would be no permanent change in land use. Water would be removed only temporarily from the land, and no long-term change in albedo could result, because agricultural land uses would not be permanently retired. Albedo, therefore, is not anticipated to change. There would be no impact.

Alternative 3 (Efficiency Alternative)

It is estimated that full implementation of Alternative 3 would yield an additional inflow of water to Walker Lake of an average of 32,300 af/yr. Unless otherwise noted, the impacts of Alternative 3, identified below, would be similar in nature (i.e., adverse, minor, beneficial, or no impact) to those of Alternative 1, but of less magnitude.

Direct Impacts

Direct Impacts Similar to Alternative 1

Impact CC-1: Change Emissions of Greenhouse Gas (Undetermined Impact)

Under Alternative 3, there would be no change in land use, and irrigation ditches and canals could be lined or piped, which would remove water to riparian vegetation along the canals. In addition, a variety of potential water conservation and efficiency measures would reduce the amount of surface water conveyed or applied to lands. Decreasing water delivery to the land would reduce associated pumping or water diversion GHG emissions within the Walker River Basin.

Indirect Impacts

Indirect Impacts Different from Alternative 1

Impact CC-2: Change Regional Carbon Sinks Contributing to Global Climate Change (No Impact)

Under Alternative 3, there would be no change in land use, and irrigation ditches and canals could be lined or piped, which would remove water to riparian vegetation along the canals. The reduction in carbon sink via decreased riparian vegetation along the canals would be balanced by the increase in carbon sink via increased riparian vegetation along the river. In addition, a variety of potential water conservation and efficiency measures would reduce the amount of surface water conveyed or applied to lands. Water would not be removed from the land, and, thus, no change in carbon sink could result, because agricultural land uses would not change. Regional carbon sinks, therefore, are not anticipated to change. There would be no impact.

Impact CC-3: Change Regional Albedo Contributing to Global Climate Change (No Impact)

Under Alternative 3, there would be no change in land use, and irrigation ditches and canals could be lined or piped, which would remove water from riparian vegetation along the canals. The increase in albedo via decreased riparian vegetation along the canals would be balanced by the decrease in albedo via increased riparian vegetation along the river. In addition, a variety of potential water conservation and efficiency measures would reduce the amount of surface water conveyed or applied to lands. Water would not be removed from the land, and, thus, no change in albedo could result, because agricultural land uses would not be changed. Albedo, therefore, is not anticipated to change. There would be no impact.

Impacts of Climate Change

This section describes the potential impacts of climate change on the study area and on the Proposed Project and alternatives. While this discussion distinguishes between the action alternatives, the conditions under the No Action Alternative are described in Affected Environment, above.

Much is unknown about how climate change will actually affect the Walker River Basin. The impacts of global climate change on the region are described at a qualitative level because local and regional projections of specific climate change impacts (such as regionally downscaled versions of global climate models) have significant uncertainty. These impacts are also described at a general level because of the wide geographical area of the Walker River Basin. Scientific findings are summarized and discussed in terms of broad implications for the Walker River Basin.

Water Resources

The key issues for analyzing the impacts of climate change on the Proposed Project and other alternatives are the amount of water lost to evaporation, and how much water will be discharged to Walker Lake, whether from delivery of acquired water and water rights, from surplus river flows, or from local surface water and groundwater sources.

The amount of water that reaches Walker Lake will be affected by changes in the timing and form of precipitation. The impact of climate change on total runoff is uncertain, but climate change is likely to reduce the portion of precipitation falling as snow, cause the runoff pattern to shift to earlier in the year, and result in higher peak flows. A shift toward earlier runoff and/or higher seasonal peak flows could reduce surface water available for diversion during the irrigation season. However, more water may fill reservoirs early in the year, before irrigation begins, resulting in increased spilling from the reservoirs. This water would not be diverted by farmers and would therefore likely continue down the system to Walker Lake, resulting in more flow reaching Walker Lake.

A shift to earlier runoff and increased evapotranspiration would likely cause reduced availability of water for irrigation. Because senior water rights are served first, this reduced availability would likely have a larger impact on junior water rights. The seniority of the water rights to be acquired under the Proposed Project is not fully known; however, based on existing option and purchase agreements, it appears that most offers will involve an array of natural flow rights with a wide range of priority dates (i.e., both junior and senior), as well as increasing allocations of supplemental storage water for the later priority dates.

The amount of water lost from evaporation could increase with increased average air temperatures. This could result in greater loss of water throughout the Walker River Basin, particularly at the upstream reservoirs and Walker Lake.

The interaction between amount of precipitation, timing of runoff, possible overflow from the upstream reservoirs to the lake, and increased evaporation and subsequent impacts on the lake are unknown.

As described above under Affected Environment, increases in air temperature would cause increases in water temperature that would affect other water quality characteristics. Increased water temperature could affect dissolved oxygen concentration, algal growth, and thermal stratification in Walker Lake. Water quality in Walker Lake would also be affected by any impact of climate change on lake levels. The potential extent of these impacts and impacts on aquatic species of concern is unknown.

Biological Resources

As described above, climate change could affect water quality and the ability of the Proposed Project or alternatives to restore water quality and ecological health in Walker Lake. Warmer water temperatures could force out some coldwater fish species, including LCT, that are currently close to the threshold of their viable habitat; this would decrease overall biodiversity (U.S. Global Change Research Program 2000c, 100). However, the Proposed Project would not contribute to warmer water temperatures. Furthermore, the Proposed Project would leave more than 50,000 af/yr of water in the Walker River and Walker Lake system and no longer divert this water to agricultural uses in the region. As a result, fishery and river and lake ecosystem health would benefit from a potentially lower saline level.

Chapter 16 Consultation and Coordination

Introduction

This chapter describes the consultation and coordination associated with the Walker River Basin Acquisition Program. Public and agency involvement, and tribal consultation are discussed.

Public Involvement

Reclamation developed a mailing list of known interested parties to provide information on this Draft EIS; this mailing list has been continually updated throughout the process as more interested parties are identified. Reclamation has provided information and updates on this Draft EIS to local newspapers throughout the EIS process.

Public Scoping

Scoping is a process to gather input from the public, agencies, and tribes. The issues and concerns that are raised in the scoping process, together with technical input and agency considerations, define the significant issues to be addressed in the environmental document. NEPA regulations (40 CFR 1500 *et seq.)* encourage scoping and associated scoping activities.

The primary objectives of the scoping process are to:

- provide the public and potentially affected agencies and tribes with adequate information and time to review and provide oral and/or written comments on a project,
- ensure that issues related to the Proposed Project are identified early and studied properly,
- ensure that the Proposed Project and alternatives that meet the identified agency Purpose and Need are balanced and thorough, and
- prepare the appropriate environmental documentation.

Reclamation placed a Notice of Intent to prepare an EIS and notice of public scoping meeting in the *Federal Register* on September 25, 2007. A brief description of the proposed acquisition program, a request for written comments, and details on the public scoping meetings were included in the notice. Reclamation also developed a one-page notice that provided a brief project description, specifics regarding the scoping meetings, and information on how to

obtain additional information on the Proposed Project. This notice was distributed via U.S. post to the project mailing list that consisted of a variety of interested parties. Scoping meetings were also advertised in various newspapers.

Scoping meetings were held on four dates at four locations.

- Monday, October 22, 2007, 6:00–8:00 p.m. in Reno, Nevada
- Tuesday, October 23, 2007, 6:00–8:00 p.m. in Yerington, Nevada
- Wednesday, October 24, 2007, 6:00–8:00 p.m. in Hawthorne, Nevada
- Thursday, October 25, 2007, 6:00–8:00 p.m. in Bridgeport, California

During these meetings, the public was given information on the acquisition program, including the purpose of and need for the Proposed Project, project objectives, authorizing legislation, the EIS process, and the project team. In addition, written comments were solicited and received from the public at these meetings and afterward.

The Walker River Basin Acquisition Program EIS Scoping Report[1] (Bureau of Reclamation, prepared by ICF Jones & Stokes 2008) provides an overview of the Proposed Project. The report describes the environmental compliance process associated with the analysis of the Proposed Project and other alternatives, including the role of public scoping. The report also discusses the public scoping meetings, lists issues raised by the public, describes the process of evaluating issues in development of the project alternatives, identifies Cooperating Agencies and their expertise, discusses tribal consultation, and contains comments received throughout the scoping process.

Public Participation in Acquisition Program EIS Meetings

In addition to the public scoping process, public participation has been encouraged and has occurred throughout the EIS process. Public input has been received, evaluated, and incorporated as appropriate in development of this Draft EIS.

In addition to the public scoping meetings, Reclamation held a series of public information meetings to describe alternatives developed for this Draft EIS and to update the public on the status of this Draft EIS. Following a presentation at the meetings, Reclamation provided an opportunity for questions and answers. Notification of these meetings were sent to the mailing list of known interested

[1] The Scoping Report is available on Reclamation's web site at http://www.usbr.gov/mp/lbao/desert_terminal/walker_river_basin.html

parties and published in local newspapers. Three meetings were held in separate locations in the project area.

- Tuesday, June 24, 2008, 6:00–8:00 p.m. in Yerington, Nevada
- Wednesday, June 25, 2008, 1:00–3:00 p.m. in Hawthorne, Nevada
- Wednesday, June 25, 2008, 6:00–8:00 p.m. in Smith Valley, Nevada

Public Review of the Draft EIS

This Draft EIS is another opportunity for the public to provide input on the analysis of the environmental impacts of the Proposed Project and the other alternatives. Public comment can be provided in several ways.

Written comments may be:

- mailed to Mrs. Caryn Huntt DeCarlo, Bureau of Reclamation, 705 N. Plaza Street, Room 320, Carson City, NV, 89701,
- emailed to chunttdecarlo@mp.usbr.gov,
- faxed to 775-884-8376, or
- submitted at the public hearings.

Oral comments may be given at the public hearings.

Public hearings on the Draft EIS are planned for Yerington, Hawthorne, Smith Valley, and Reno, Nevada. Notification of the hearings will be sent to the mailing list of known interested parties, provided to local newspapers, and published in the *Federal Register*.

The Draft EIS will be available for review and comment for 45 days following filing of the Notice of Availability of the EIS with the EPA. The Notice of Availability will be published in the *Federal Register*.

After public comment period for the Draft EIS, a Final EIS will be prepared that will include responses to public and agency comments.

Agency Consultation and Coordination

This section describes consultation and coordination that Reclamation and its consultant team have conducted with Cooperating Agencies.

Agency Consultation

U.S. Fish and Wildlife Service

Endangered Species Act Consultation

Section 7 of the ESA, as amended, prohibits federal agencies from authorizing, funding, or carrying out activities that are likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. By consulting with USFWS before initiating projects, agencies review their actions to determine if these could affect listed species or their habitat. Through consultation, USFWS works with other federal agencies to help design their programs and projects to conserve listed and proposed species. Regulations for the consultation process can be found at 50 CFR 402.

Reclamation contacted USFWS on September 5, 2007, for information on federally listed threatened and endangered species potentially occurring in the project area. On September 14, 2007, USFWS provided a list of federally listed threatened or endangered species. Reclamation met with USFWS informally on October 27, 2007, regarding potential impacts on federally listed species that may occur as a result of the Proposed Project. A biological assessment to evaluate impacts on listed species from the Proposed Project is being written to initiate formal Section 7 consultation with USFWS. Consultation with USFWS will address the determination of effects in the biological assessment.

Other Consultations

National Historic Preservation Act

Cultural resources is a term used to describe both *archaeological sites* depicting evidence of past human use of the landscape and the *built environment*, which is represented in structures such as dams, roadways, and buildings. The NHPA of 1966 is the primary federal legislation that outlines the federal government's responsibility to cultural resources. Other applicable cultural resources laws and regulations that could apply include, but are not limited to, include the Native American Graves Protection and Repatriation Act and the Archaeological Resources Protection Act. Section 106 of the NHPA requires the federal government to take into consideration the effects of an undertaking listed on or eligible for inclusion in the NRHP. Those resources that are on or eligible for inclusion in the NRHP are referred to as historic properties.

The Section 106 process is outlined in 36 CFR Part 800. These regulations describe the process that the federal agency (Reclamation) takes to identify cultural resources and the level of impact that the proposed undertaking will have on historic properties. In summary, Reclamation must first determine whether the action is the type of action that has the potential to affect historic properties. If

the action is the type of action that has the potential to affect historic properties, Reclamation must identify the APE, determine whether historic properties are present within that APE, determine the impact that the undertaking will have on historic properties, and consult with the SHPO to seek concurrence on Reclamation's findings. In addition, Reclamation is required through the Section 106 process to consult with Indian Tribes concerning the identification of sites of religious or cultural significance, and consult with individuals or groups who are entitled to be consulting parties or have requested to be consulting parties.

Involvement of Cooperating Agencies

A complete list of Cooperating Agencies that were invited and accepted participation in the preparation and review of this Draft EIS is provided in Table 16-1. Representatives of some of the Cooperating Agencies have participated in one-on-one meetings with Reclamation on various dates, attended the scoping meetings in October 2007, and/or participated in the Cooperating Agency meeting held on January 31, 2008; some also attended the public information meetings in June 2008. Some Cooperating Agency representatives have provided Reclamation with written and oral comments on the Proposed Project, potential issues of concern, the Scoping Report, and the Draft EIS Chapter 2 describing the various Alternatives and potential impacts of the Acquisition Program on resources of concern. All Cooperating Agencies were offered opportunities to participate in the review and provide comments on the majority of the Administrative Draft EIS and have the opportunity to provide comments again during the 45-day public comment period for the Draft EIS.

Table 16-1. Cooperating Agencies

Federal Agencies
Bureau of Indian Affairs
U.S. Fish and Wildlife Service
Federally Recognized Tribal Governments
Walker River Paiute Tribe
Yerington Paiute Tribe
State Agencies
Nevada Department of Wildlife
Local Agencies
Lyon County
Mineral County
Mason Valley Conservation District
Smith Valley Conservation District
Walker River Irrigation District
Other
University of Nevada

The following entities were invited to participate as Cooperating Agencies and declined: the Nevada Department of Conservation and Natural Resources, Bureau of Land Management, and U.S. Board of Water Commissioners. The Bridgeport Indian Colony did not respond to the request to be a Cooperating Agency.

Tribal Consultation

Reclamation sent consultation requests to three tribes for government-to-government consultation activities with tribal entities having entitlements to Walker River or Walker Lake and those that may be affected by or have interests in the Proposed Project. Of the three tribes contacted, WRPT and YPT have responded with interest. The YPT did not respond to tribal consultation requests but did accept Cooperating Agency status and has participated in that process for Draft EIS development. The Bridgeport Indian Colony did not respond to requests for tribal consultation or Cooperating Agency status. Reclamation has included all three tribes on all informational mailings related to Draft EIS development.

Reclamation initiated consultation with WRPT in writing on September 12, 2007, and has had additional consultation correspondence throughout the development of the Draft EIS. Additionally, Reclamation participated in consultation meetings with the Tribe on December 7, 2007, June 26, September 23, and October 9, 2008. The WRPT has participated as a Cooperating Agency.

Environmental Justice Outreach

Environmental justice, as discussed in Chapter 13, Environmental Justice, refers to the fair treatment of people of all races, income, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Executive Order 12898 (1994), Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states that each federal agency will make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

For this Draft EIS, compliance with Executive Order 12898 was accomplished by informing the widest possible cross-section of the potentially interested public about the Walker River Basin Acquisition Program Draft EIS, and providing opportunities for input from not only the general public but members of local and regional ethnic-minority and low-income populations. Efforts targeting these populations included 1) holding an open house-style public scoping meeting in each major population center in the Walker River Basin (Yerington, Hawthorne, Bridgeport, and Schurz); 2) making an offer of Cooperating Agency status to the three tribal entities in the EIS project area (WRPT, Bridgeport Indian Colony, and YPT); and 3) sending letters to representatives of YPT, Bridgeport Indian Colony, and WRPT to request initiation of tribal consultation, as required under Executive Order 13175 and the Presidential Memorandum on Government-to-Government Relations with Native American tribal governments.

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Chapter 16 Consultation and Coordination

No references

Chapter 18 List of Preparers

Lead Agency—U.S. Bureau of Reclamation

Name	Title	Contribution
Caryn Huntt DeCarlo	Walker EIS Project Lead	NEPA EIS oversight
Jonathan Connolly	Archaeologist	Cultural resources analysis

ICF Jones & Stokes

Name	Title	Contribution
Russ Grimes	Project Director	Project oversight Alternatives development
Stephen Osgood	Project Manager	Project management Technical oversight
Anne Huber	Hydrologist	Water resources analysis
Andrew Martin	Environmental Specialist	Environmental justice analysis Indian trust assets analysis
Donna Maniscalco	Fish Biologist	Fish analysis
Will Kohn	Wildlife Biologist	Wildlife analysis
Lisa Webber	Senior Botanist	Vegetation analysis
Gregg Roy	Economist	Socioeconomics analysis Cumulative analysis
Kelsey Bennett	Climate Change Specialist	Climate change analysis
Michael Slavik	Senior Air Quality Specialist	Air quality analysis
Matthew McFalls	Air Quality Specialist	Air quality analysis
Ellen Unsworth	Project Coordinator	Project coordination Land use analysis
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Karen Crawford	Senior Archaeologist	Cultural resources analysis
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Community & Global Resources Consulting

Name	Title	Contribution
David Yardas	Principal	Project Consultant

Appendix 1A NOI

date of publication of this notice. If the authorized officer determines that a public meeting will be held, a notice of the time and place will be published in the **Federal Register** at least 30 days before the scheduled date of the meeting.

(Authority: 43 CFR 2310.3–1)

Kent Hoffman,

Deputy State Director, Lands and Minerals.

[FR Doc. E7–18890 Filed 9–24–07; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF THE INTERIOR

National Park Service

Winter Use Plans, Final Environmental Impact Statement, Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway, Wyoming

AGENCY: National Park Service, Department of the Interior.

ACTION: Notice of Availability of the Final Environmental Impact Statement for the Winter Use Plans, Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway.

SUMMARY: Pursuant to National Environmental Policy Act of 1969, 42 U.S.C. 4332(2)(C), the National Park Service announces the availability of a Final Environmental Impact Statement for the Winter Use Plans, Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway, Wyoming.

Seven alternative winter use management plans are evaluated in this EIS; alternative 7 is the NPS preferred alternative. Alternative 1 would put into place the provisions of the temporary winter use plan of August 2004, with some modifications. Alternative 2 would prohibit recreational snowmobiling in the parks in favor of snowcoach access. Alternative 3A would close much of Yellowstone to oversnow travel, leaving the South Entrance to Old Faithful route open to such use. A variation of alternative 3 (3B) is the no action alternative—it closes all routes to motorized oversnow recreation. This would be the outcome of the temporary plan, should no new decision be made. Four other alternatives (4, 5, 6, and 7) would allow varying levels of snowmobile and snowcoach access to continue in the parks. Alternative 4 would allow for increased snowmobile use, relative to historic numbers. Alternative 5 would allow for some unguided snowmobile use and would feature seasonal and flexible daily entry limits in Yellowstone. Alternative 6 would provide for plowing some roads in Yellowstone to allow commercial wheeled-vehicle access from West Yellowstone and Mammoth to Old Faithful. Preferred alternative 7 would provide for a balance of snowmobile and snowcoach use and protect park soundscapes, air quality, wildlife and other resources. In Yellowstone, the daily limit on snowmobiles would be 540 snowmobiles per day in Yellowstone. 65 snowmobiles would be allowed per day in Grand Teton and the Parkway. In Yellowstone, all snowmobilers would be required to travel with a commercial guide, and in both parks, all snowcoaches and most snowmobiles would be required to use Best Available Technology (BAT). 83 snowcoaches would be allowed into Yellowstone daily. The East Entrance would remain open for cross-country ski and snowshoe access.

DATES: The National Park Service will execute a Record of Decision (ROD) no sooner than 30 days following publication by the Environmental Protection Agency of the Notice of Availability of the Final Environmental Impact Statement.

ADDRESSES: Information will be available for public inspection online at *http://parkplanning.nps.gov/yell,* in the office of Superintendent Suzanne Lewis, PO Box 168, Yellowstone National Park, WY 82190, 307–344–2019 and in the office of Superintendent Mary Gibson Scott, Grand Teton National Park, PO Drawer 170, Moose, WY 83012–0170, 307–739–3300.

FOR FURTHER INFORMATION CONTACT: Kevin Franken, P.O. Box 168, Yellowstone National Park, WY 82190, 307–344–2019, *yell_winter_use@nps.gov.*

Dated: August 30, 2007.

John T. Crowley

Acting Regional Director, Intermountain Region, National Park Service.

[FR Doc. E7–18935 Filed 9–24–07; 8:45 am]

BILLING CODE 4312–CT–P

DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Walker River Basin Acquisitions Program, Mineral, Lyon, and Douglas Counties, NV

AGENCY: Bureau of Reclamation, Interior.

ACTION: Notice of intent to prepare an environmental impact statement (EIS) and notice of public scoping meetings.

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA), the Bureau of Reclamation (Reclamation) proposes to prepare an EIS for the Walker River Basin Acquisitions Program. The primary purpose of the program is to comply with the requirements of Public Law 107–171 (Desert Terminal Lakes Program), which appropriates funds to provide water to at-risk natural desert terminal lakes, and with Public Law 109–103, which allocates funds to the University of Nevada for two specific purposes. The first purpose is to implement a program for environmental restoration to acquire from willing sellers land, water appurtenant to the land, and related interests in the Walker River Basin, Nevada. Acquired water rights would be transferred to provide water to Walker Lake. The second purpose of the University's funding is to establish and operate an agricultural and natural resources center. The actions to be analyzed in this EIS will be the purchase of water rights and related interests from willing sellers in the Walker River Basin, Nevada.

DATES: A series of public scoping meetings will be held to solicit public input on the alternatives, concerns, and issues to be addressed in the EIS. The meetings dates are:

- Monday, October 22, 2007, 6 to 8 p.m., Reno, NV.
- Tuesday, October 23, 2007, 6 to 8 p.m., Yerington, NV.
- Wednesday, October 24, 2007, 6 to 8 p.m., Hawthorne, NV.
- Thursday, October 25, 2007, 6 to 8 p.m., Bridgeport, CA.

Written comments on the scope of the EIS should be sent by November 26, 2007.

ADDRESSES: The public scoping meetings locations are:

- Reno at Rancho San Rafael Park, Main Ranch House, 1595 N. Sierra Street.
- Yerington at Yerington High School, gymnasium, 114 Pearl Street.
- Hawthorne at Mineral County Public Library, meeting room, 110 1st Street.
- Bridgeport at Bridgeport Memorial Hall, 73 N. School Street.

Send comments on the scope of the EIS to Mrs. Caryn Huntt DeCarlo, Bureau of Reclamation, 705 N. Plaza Street, Room 320, Carson City, NV 89701, via e-mail to *chunttdecarlo@mp.usbr.gov*, or faxed to 775–884–8376.

FOR FURTHER INFORMATION CONTACT: Mrs. Huntt DeCarlo, 775–884–8352.

SUPPLEMENTARY INFORMATION: The project area is in the Walker River Basin

within Nevada, and includes both the East and West Walker Rivers. The goal of the program is to acquire water rights sufficient to increase the long-term average annual inflow to Walker Lake by up to 50,000 acre-feet. To increase Walker Lake inflows by up to 50,000 acre-feet annually may require acquiring more than 50,000 acre-feet of water rights due to annual hydrologic variability.

Special Assistance for Public Scoping Meeting

If special assistance is required at the scoping meetings, please contact Caryn Huntt DeCarlo at 775–884–8352, TDD 775–882–3436, or via e-mail at *chunttdecarlo@mp.usbr.gov*. Please notify Mrs. Huntt DeCarlo as far in advance of the meetings as possible to enable Reclamation to secure the needed services. If a request cannot be honored, the requestor will be notified. A telephone device for the hearing impaired (TDD) is available at 775–882–3436.

Public Disclosure

Before including your name, address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Dated: September 18, 2007.

Robert Eckart,

Acting Regional Environmental Officer, Mid-Pacific Region.

[FR Doc. E7–18879 Filed 9–24–07; 8:45 am]

BILLING CODE 4310–MN–P

INTERNATIONAL TRADE COMMISSION

[USITC SE–07–018]

Government In the Sunshine Act Meeting Notice

AGENCY HOLDING THE MEETING: United States International Trade Commission.

TIME AND DATE: October 2, 2007 at 11 a.m.

PLACE: Room 101, 500 E Street, SW., Washington, DC 20436, Telephone: (202) 205–2000.

STATUS: Open to the public.

MATTERS TO BE CONSIDERED:

1. Agenda for future meetings: None.
2. Minutes.
3. Ratification List.
4. Inv. Nos. 731–TA–919 and 920 (Review) (Welded Large Diameter Line Pipe from Japan and Mexico)—briefing and vote. (The Commission is currently scheduled to transmit its determinations and Commissioners' opinions to the Secretary of Commerce on or before October 16, 2007.)
5. Outstanding action jackets: None.

In accordance with Commission policy, subject matter listed above, not disposed of at the scheduled meeting, may be carried over to the agenda of the following meeting.

By order of the Commission.

Issued: September 19, 2007.

William R. Bishop,

Hearings and Meetings Coordinator.

[FR Doc. E7–18811 Filed 9–24–07; 8:45 am]

BILLING CODE 7020–02–P

DEPARTMENT OF JUSTICE

[OMB Number 1122–0013]

Office on Violence Against Women; Agency Information Collection Activities: Extension of a Currently Approved Collection; Comments Requested

ACTION: 30-day notice of information collection under review: Semi-Annual Progress Report for the Rural Domestic Violence and Child Victimization Enforcement Grant Program.

The Department of Justice, Office on Violence Against Women (OVW), will be submitting the following information collection request to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act of 1995. The proposed information collection is published to obtain comments from the public and affected agencies. This proposed information collection was previously published in the **Federal Register** Volume 72, Number 137, page 39447 on July 18, 2007, allowing for a 60-day comment period.

The purpose of this notice is to allow for an additional 30 days for public comment until October 25, 2007. This process is conducted in accordance with 5 CFR 1320.10.

Written comments and/or suggestions regarding the items contained in this notice, especially the estimated public burden and associated response time, should be directed to the Office of Management and Budget, Office of Information and Regulatory Affairs, Attention Department of Justice Desk Officer, Washington, DC 20503. Additionally, comments may be submitted to OMB via facsimile to (202) 395–5806.

Written comments and suggestions from the public and affected agencies concerning the proposed collection of information are encouraged. Your comments should address one or more of the following four points:

(1) Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(2) Evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;

(3) Enhance the quality, utility, and clarity of the information to be collected; and

(4) Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Overview of This Information Collection

(1) *Type of Information Collection:* Extension of a currently approved collection.

(2) *Title of the Form/Collection:* Semi-Annual Progress Report for Grantees from the Rural Domestic Violence and Child Victimization Enforcement Grant Program.

(3) *Agency form number, if any, and the applicable component of the Department of Justice sponsoring the collection: Form Number:* 1122–0013. U.S. Department of Justice, Office on Violence Against Women (Rural Program).

(4) *Affected public who will be asked or required to respond, as well as a brief abstract:* The affected public includes the approximately 165 grantees of the Rural Program. The primary purpose of the Rural Program is to enhance the safety of victims of domestic violence, dating violence, sexual assault, stalking, and child victimization by supporting projects uniquely designed to address and prevent these crimes in rural jurisdictions. Grantees include States, Indian tribes, local governments, and nonprofit, public or private entities, including tribal nonprofit organizations, to carry out programs serving rural areas or rural communities.

(5) *An estimate of the total number of respondents and the amount of time estimated for an average respondent to*

Appendix 1B Regulatory Information

Water Resources

Federal

Walker River Decree

The Walker River Decree (C-125, filed April 15, 1936, amended April 24, 1940) establishes the rights of appropriators in Nevada (and California) to the waters of the Walker River and/or its tributaries (*U.S.* vs. *Walker River Irrigation District* 1936 and 1940). The rights adjudged to individual land owners include the amounts of water (in cubic feet per second [cfs]) to which the owner is entitled at the point of diversion from the stream course during the specified irrigation season (generally March through October); the year of relative priority (1860 through 1905) assigned to each such right; and the number of irrigated (i.e., water-righted) acres to which such water can be applied within the legally described place of use. According to Pahl (1999), a total of approximately 1,575 cfs of water rights and 110,852 acres of water-righted land were adjudicated by the Decree; of these, approximately 864 cfs and 66,376 acres were located in the Nevada portions of the Basin.

The Decree also confirms the rights of the Walker River Irrigation District (WRID) to divert water into storage at Bridgeport and Topaz Lake Reservoirs in California during the non-irrigation season (generally November through February) up to specified annual limits; the rights to divert and store additional water, up to specified limits, during the irrigation season so long as all other decreed rights are satisfied; and the right to distribute such water to lands within the WRID boundaries. Similar diversion and storage rights were adjudicated to individual claimants for a number of smaller reservoirs on upstream tributaries in California, including Black Reservoir, Green Lakes, Lobdell Lake, Poore Lake, and Lower and Upper Twin Lakes; however, such rights are beyond the scope of this Draft EIS.)

The U.S. District Court in Nevada retains jurisdiction over the Decree for the purpose of "changing the duty of water or for correcting or modifying [the] decree [and] for regulatory purposes" (*U.S.* vs. *Walker River Irrigation District* 1936, Decree Article XIV, page 73). The Decree is administered by a six-person United States Board of Water Commissioners (USBWC), which is appointed by the Court "to act as a water master or board of commissioners to apportion and distribute the waters of the Walker River, its forks and tributaries in the State of Nevada and the State of California" (U.S. Board of Water Commissioners 1996). The Chief Deputy Water Commissioner serves as federal Water Master for the system, and works across six administrative divisions to oversee daily operations in accordance with the Decree and USBWC's 1953 Rules and Regulations for the Distribution of Water. USBWC's 1996 Administrative Rules and Regulations

govern proposed changes to the point of diversion or the manner or place of use of decreed water rights, as well as compliance with California Fish and Game Code Section 5937 and with other applicable provisions of state law.

In general, proposed changes to decreed water rights in California are to be filed initially with the California State Water Resources Control Board (SWRCB), while changes to decreed water rights in Nevada are to be filed initially with the Nevada State Engineer (NSE); however, no decision or report of either state agency will take effect "unless and until the court having jurisdiction over the Walker River Action finally approves it and enters an order modifying the Walker River Decree accordingly" (U.S. Board of Water Commissioners 1996).

Walker River Indian Reservation

The final Walker River Decree adjudicated to the United States a continuous flow right of 26.25 cfs with an 1859 priority date (the most senior water right in the system) for the irrigation of 2,100 acres of land within the Walker River Indian Reservation, with said water to be diverted from the Walker River upon or above the Reservation over a 180-day irrigation season each year (9,370 acre-feet per year [af/yr]). These direct-diversion natural-flow water rights are currently administered by the federal Water Master at the U.S. Geological Survey (USGS) gage near Wabuska, just above the Reservation boundary. The BIA administers these waters within the Reservation (including any flow in excess of the above-stated water rights) on behalf of the Walker River Paiute Tribe (WRPT). Accordingly, the USBWC's 1996 Administrative Rules and Regulations (Section 2.3) "do not apply to any change in the point of diversion and/or place of use of water adjudicated to the United States…for the benefit of the Walker River Indian Reservation, which change is entirely within the boundaries of the Walker River Indian Reservation."

Weber Dam, an earthen dam on the Walker River within the Walker River Indian Reservation, was constructed in the 1930s by BIA as part of the Walker River Indian Irrigation Project. Weber Dam and Reservoir are operated and maintained by BIA to provide irrigation water to the Reservation pursuant to regulations governing the maintenance and operation of Indian irrigation projects (25 CFR Part 171). Repairs and modifications to the Dam were recently completed under BIA's Dam Safety Maintenance and Repair Program and have restored the Reservoir's maximum storage capacity to approximately 10,700 acre-feet (U.S. Geological Survey 2009). Because the final Walker River Decree did not provide for an express right to store water in Weber Reservoir (*U.S.* vs. *Walker River Irrigation District* 1940), the United States on behalf of WRPT, is seeking to establish such a right (together with various other rights) under litigation now pending in the U.S. District Court of Nevada (Yardas 2007 Appendix E).

Groundwater provides an additional source of water for the Reservation. Up to five large-capacity wells have been constructed for irrigation purposes; however,

only three of those were operational as of 2005 (Miller Ecological Consultants 2005). Numerous other small-capacity wells are used for domestic and stock water purposes. WRPT asserts exclusive jurisdiction over groundwater within the Reservation boundaries, and in the above-referenced litigation the United States on behalf of the Tribe is seeking reserved rights to groundwater under all Reservation lands (Yardas 2007 Appendix E).

Clean Water Act

The CWA was enacted as an amendment to the federal Water Pollution Control Act of 1972, which outlined the basic structure for regulating discharges of pollutants to waters of the United States. The CWA now serves as the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. In the state of Nevada, the NDEP Bureau of Water Quality Planning (BWQP) helps to administer the CWA.

The CWA empowers EPA to set national water quality standards and effluent limitations and includes programs addressing both point source and nonpoint source pollution. *Point source pollution* is pollution that originates or enters surface waters at a single, discrete location, such as an outfall structure or an excavation or construction site. *Nonpoint source pollution* originates over a broader area and includes urban contaminants in stormwater runoff and sediment loading from upstream areas. The CWA operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit.

The following paragraphs provide additional details on specific sections of the CWA.

- **Section 303 – Total Maximum Daily Loads.** Section 303(d) of the CWA established the total maximum daily load (TMDL) process to guide the application of state water quality standards. A TMDL is an assessment of the amount of a pollutant that a waterbody can receive and not violate water quality standards. TMDLs provide a way to integrate the management of both point and nonpoint sources of pollution through the establishment of waste load allocations for point source discharges and load allocations for nonpoint sources of pollution. NDEP is required to identify and prioritize those waters for which TMDLs are needed. These streams are impaired by the presence of pollutants, including sediment, and are more sensitive to disturbance.
- **Section 401 - Water Quality Certification.** Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the appropriate state regulatory agency. Under the CWA, a state must issue or waive Section 401 Water Quality

Certification for the project to be permitted under Sections 402 or 404. The applicant must submit a written request for 401 Certification to the Bureau of Water Quality Planning (BWQP) and detailed information on the project's impact on water quality prior to beginning construction.

- **Section 402 - NPDES Permits for Discharge to Surface Waters, General.** CWA Section 402 regulates discharges to surface waters through the NPDES program, administered by EPA. The NPDES program serves to control direct or point source discharges of water pollutants to surface waters of the United States. This includes construction-related stormwater discharges to surface waters. The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits.

  NPDES permits are issued either by EPA or an authorized state or tribe. In Nevada, NDEP is authorized by the EPA to oversee the NPDES program. The NPDES program issues permits to all facilities where effluent will be released or discharged to surface waters. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. Specific terms and conditions of an NPDES permit vary from facility to facility, but each state that is authorized to administer the NPDES program must at least meet minimum EPA standards.

  NPDES permits describe technology-based and water quality-based effluent limits, and establish pollutant monitoring and reporting requirements. Technology-based limitations are established according to the treatment technology capabilities of individual industrial sectors, or source categories. Water quality-based limitations are typically designed to protect designated beneficial uses of surface water (e.g., supporting aquatic life). Water quality criteria and standards vary from state to state, as well as within a given state, depending on uses of the receiving water.

- **Section 402 - NPDES Permits for Discharge to Surface Waters, Construction.** Most construction projects that disturb 1 acre of land or more are required to obtain coverage under the NPDES General Permit for Construction Activities (also known as a General Construction Permit), which requires the property owner to file a Notice of Intent to discharge stormwater and to prepare and implement a SWPPP. The SWPPP includes a site map and a description of proposed construction activities, along with demonstration of compliance with relevant local ordinances and regulations. The SWPPP must also describe the project-specific BMPs that will be implemented to prevent or reduce the discharge of construction-related pollutants, including sediments, into stormwater runoff and surface drainage. Permittees are required to conduct annual monitoring and reporting to ensure that BMPs are correctly implemented and effective in controlling the discharge of stormwater-related pollutants into stormwater runoff.

- **Section 404 - Permits for Fill Placement in Wetlands and other Waters of the United States.** Under the CWA Section 404, the U.S. Army Corps of Engineers (Corps) and EPA regulate the discharge of dredged and fill materials into waters of the United States. Waters of the United States refers to oceans, bays, rivers, streams, lakes, ponds, and wetlands, including the following:
  - areas within the OHWM of a stream, including nonperennial streams with a defined bed and bank, and any stream channel that conveys natural runoff, even if it has been realigned; and
  - seasonal and perennial wetlands, including coastal wetlands.
- Wetlands are defined for regulatory purposes as areas "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3, 40 CFR 230.3).
- Project proponents must obtain a permit from the Corps for all discharges of dredged or fill material into waters of the United States, including wetlands, before proceeding with a proposed activity. The Corps may issue either an individual permit evaluated on a case-by-case basis or a general permit evaluated at a program level for a series of related activities.
- Compliance with CWA Section 404 requires compliance with several other environmental laws and regulations. The Corps cannot issue an individual permit or verify the use of a general permit until the requirements of NEPA, the ESA, and the NHPA have been met. Additionally, the Corps cannot issue or verify any permit until a water quality certification, or waiver of certification, has been issued by BWQP pursuant to CWA Section 401. Section 404 permits may be issued only for the least environmentally damaging practicable alternative.

State

Nevada Department of Conservation and Natural Resources

The Nevada Department of Conservation and Natural Resources houses the Nevada Division of Water Resources (NDWR), which is the primary agency in charge of hydrology- and water quality-related issues in Nevada. The mission of NDWR is to conserve, protect, manage, and enhance the state's water resources through the appropriation and reallocation of public waters. NDWR is responsible for quantifying existing water rights, monitoring water use, distributing water in accordance with court decrees, reviewing water availability for new subdivisions and condominiums, reviewing the construction and operation of dams, appropriating geothermal water, licensing and regulating well

drillers and water rights surveyors, reviewing flood control projects, monitoring water resource data and records, and providing technical assistance to the public and governmental agencies.

Nevada State Engineer

The office of the NSE is within NDWR. The NSE has little involvement in the direct administration of decreed surface water rights in the Walker River Basin. As noted above, however, the NSE is charged with initial jurisdiction concerning proposed changes to decreed water rights (apart from allocated storage rights; see below); and under Nevada law, the NSE may not approve a transfer that conflicts with existing rights, with protectable interests in existing domestic wells, or which threatens to prove detrimental to the public interest; nor may the proposed change adversely affect the cost of water for other holders of rights within an irrigation district, nor lessen the efficiency of the district in the delivery or use of water (NRS Section 533.370 *et. seq*.).

Conditions for transfer approval can often be met by limiting proposed changes to the consumptive use portion of an existing water right, and/or by providing various forms of assurance with regard to the future payment of associated fees and assessments. In addition, the NSE's office has indicated a willingness to consider other possible approaches that could result in either the full transfer of an existing water right or the partial transfer of conserved water derived from such rights. While the specific circumstances of individual change proposals will always be determinative, in general, the ability to adequately monitor, track, and account for the various types of water and water rights involved will be crucial to the evaluation and approval (with or without conditions) of any such proposals (Gallagher pers. comm. December 2008).

Temporary changes to existing water rights may be approved for a period of up to 1 year in duration without prior public notice if the NSE finds that the proposed change is in the public interest and does not impair the water rights held by other persons (NRS 533.345). Alternatively, a person or entity may temporarily convert agricultural water rights for wildlife purposes or to improve the quality or flow of water for successive periods of up to three years in duration provided that the person or entity who owns the water rights applies for and receives all necessary permits and approvals from the NSE (NRS 533.0243). While either of these provisions could potentially be used in conjunction with a program of temporary water leasing in the Walker River Basin (such as Alternative 2 described in this Draft EIS), there are no comparable provisions for temporary changes under the USBWC's 1996 Administrative Rules and Regulations.

The NSE has issued at least three post-decree certificates of appropriation for the use of surface water in the Nevada portions of the Walker River Basin. Often described generally as floodwater rights (because they are junior in priority to most other existing surface water rights, and because they are only available from

May through July each year), they include two certificates granted to WRID in 1976 (8859 on the West Walker River and 8860 on the East Walker River) for the irrigation of lands located generally within the District's boundaries. (WRID describes the water derived from the exercise of these rights as "state permit water.") Of note, certificates 8859 and 8860 include the express condition that "the total duty of water shall not exceed 4.0 af/acre/season from any and/or all sources." A third certificate of appropriation (10860) was issued by the NSE to NDOW in 1983 for up to 575,870 af/yr (January 1 to December 31) for use at Walker Lake with a 1970 priority date (i.e., the most junior surface water right in the Walker River system).

Groundwater rights in Nevada are also administered by the NSE. Apart from small domestic wells, groundwater cannot be extracted for use without a state-issued permit or certificate. Groundwater permits or certificates can be issued for either primary or supplemental uses and are generally limited to a combined water duty of not more than 4.0 af per season (or per year) from all sources.

In addition, within the Walker River Basin in Nevada, Smith Valley, Mason Valley, and Whiskey Flat-Hawthorne (Walker Lake) subbasins, and the Nevada portion of the Antelope Valley subbasin, have been "designated" by the NSE and are thus closed to further appropriation for irrigation purposes. Transfers of groundwater rights are subject to NSE approval; and while transfers of supplemental groundwater rights (from one supplemental use to another) have sometimes been allowed, in general they will not be approved in designated portions of the Basin if there is a potential for increased groundwater withdrawals as a consequence. Thus, in general, a supplemental groundwater right may only be used in conjunction with a "new" water right whose date of priority is the same as or better than that of the water right originally supplemented.

Nevada Division of Environmental Protection

NDEP is the lead agency for Nevada's Comprehensive State Groundwater Protection Program). The core of this program is comprised of pollution control programs that address potential water quality impacts from mining, underground storage tanks, underground injection wells, discharges to groundwater, landfills, and hazardous waste storage. In addition, NDEP is responsible for enforcing federal and state regulations including the CWA sections 404, 402 and 401.

California

WRID's stored water rights in Bridgeport and Topaz Lake Reservoirs were initially set forth in the Walker River Decree (see above) and are presently governed by water rights licenses issued by the SWRCB of California. (See SWRCB License 9407 for Bridgeport Reservoir, as amended by SWRCB Order WR 90-18; and SWRCB License 3978 and 6000 for Topaz Lake Reservoir). In addition, under USBWC's 1996 Administrative Rules and Regulations, SWRCB

is the state agency with initial jurisdiction concerning proposed changes to decreed water rights in the California portions of the Basin. In addition, any proposed changes to the above-referenced California water rights licenses would fall under the SWRCB's exclusive jurisdiction.

Chapter 10.5 of the California Water Code (Sections 1700-1745) governs changes to the point of diversion, place of use, or purpose of use of California water rights. Section 1701 provides that a post-1914 appropriator may change the point of diversion, place of use, or purpose of use under an existing permit or license subject to the SWRCB's approval; and Section 1702 makes clear that any such approval will depend on the SWRCB's determination that the proposed change will not injure any other appropriator or other lawful water user. Under California law, no water rights permits or licenses are required for the extraction of ground water; an overlying landowner's use of ground water is limited only by the amounts reasonably necessary for beneficial use.

Local

Walker River Irrigation District

Pursuant to applicable provisions of the Walker River Decree, WRID distributed its stored water rights in Bridgeport Reservoir and Topaz Lake Reservoir to two major classes of land within its boundaries. First, all water righted lands with decreed priority dates of 1874 or later received an original apportionment[1] that sought to equalize diversion duties for the sum of natural flow plus storage at approximately 3.21 or 4.28 af/acre. (Lands with earlier decreed priority dates did not receive any allocation of supplemental storage water.) Second, storage rights were also allocated or apportioned to lands *without* any decreed water rights. For these "new lands," a primary (nonsupplemental) storage duty of up to 1.54 or 2.06 af/acre was assumed, along with a 65-day maximum diversion period.

Section 2.4 of USBWC's 1996 Administrative Rules and Regulations makes clear that "[a]ny change in the point of diversion and/or place of use of storage waters adjudicated to [WRID], which change is entirely within the boundaries of the [District], shall be made pursuant to adopted rules and regulations of the governing body of said District" (however, this exception "shall not apply to any transfer outside the present boundaries of the [District] nor shall [it] apply should there be a change in the authority given the [District] under Nevada law"). The applicable rules and regulations of WRID were last revised in 1986 (see Rules and Regulations Governing the Distribution and Use of Water, Walker River

[1] The terms *apportioned*, *distributed*, and *allocated* are used interchangeably in this section and describe the same essential function: WRID's post-decree allocation of storage water rights (both supplemental and primary) to lands within its boundaries.

Irrigation District 1986 pgs. 4-1 through 4-7). While the exact nature of WRID's post-decree storage water apportionments to individual land owners remains uncertain, it does seem clear that WRID will need to be involved in any changes to those "rights" that may be proposed by individual willing sellers as part of the Proposed Project or alternatives.

Regional Plans

Lyon County Master Plan

Smith Valley, Mason Valley, and the East Walker Valley are located in Lyon County. The Lyon County Master Plan (Lyon County 1990) contains many goals and policies pertaining to water resources. The following policies from the Conservation and Natural Resources Chapter are the most pertinent to the Proposed Project and alternatives.

- Goal 1: Retain existing water resources which exist for benefit of Lyon County use: agriculture, residential, and industrial (p 29 of pdf).
- This includes preventing the export of water or water rights from the county and performing studies to ensure that the aquifer is not being depleted.
- Goal 2: To protect and enhance water quality throughout Lyon County (p 29 of pdf).
- Goal 3: Minimize possibility of flooding and resultant damage (p 30 of pdf).
- Goal 6: Enter into long-term contracts with ranchers and other quantity users to exchange treated wastewater for fresh water where applicable (p 30 of pdf).
- Goal 7: Control soil erosion and slope stability (p 30 of pdf).

Mineral County Master Plan

The Reservation Reach and Walker Lake are located in Mineral County. The Mineral County Master Plan (Mineral County 2006) includes concern about water availability for municipal uses. Some key statements potentially relevant to the Proposed Project and alternatives are as follows.

- The water level of Walker Lake has always been and will remain a key concern to Mineral County and will continue to be of "MAJOR IMPACT in the future (p 78).
- There are two geothermal wells in the Hawthorne area and the water temperature is high enough to consider both energy development, as well as resort use (p 82).

- The County government will develop policies to protect all water rights within Mineral County from encroachment by outside entities (p 83).

Biological Resources

The following agencies have authority to review projects for conformance with biologically related issues of applicable guidelines, codes, and legislative acts:

- U.S. Fish and Wildlife Service (USFWS)—Nevada Fish and Wildlife Office
- Bureau of Reclamation (Reclamation)
- U.S. Bureau of Indian Affairs (BIA)
- U.S. Army Corps of Engineers (Corps)—Sacramento District
- Nevada Department of Wildlife (NDOW)
- Nevada Division of Environmental Protection (NDEP), Bureau of Water Quality Planning

These agencies have authority to review proposed projects within their areas of jurisdiction and, where construction is involved, inspect various aspects of the project construction, including ground-disturbing activities such as vegetation removal, ground leveling, and materials staging areas.

Federal

Endangered Species Act of 1973

The Endangered Species Act of 1973 (ESA) (16 United States Code [U.S.C.] 1531 *et seq*.) and subsequent amendments provide for the conservation of listed species or candidates for listing as endangered or threatened species and the ecosystems on which they depend. USFWS has jurisdiction over federally listed plants, wildlife, and fish species. Listed endangered species are in danger of extinction throughout all or a significant portion of their range. Listed threatened species are likely to become endangered in the foreseeable future. Once a species is listed, all protective measures authorized by the ESA apply to the species and its habitat. Proposed species are those that are proposed in the *Federal Register* (FR) to be listed under the ESA. Candidate species are those for which USFWS has sufficient information to propose them as endangered or threatened under ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Proposed and candidate species do not receive statutory protection under the ESA; however, USFWS encourages conservation measures. Relevant provisions of, or actions in response to, the ESA are described below.

- **ESA Section 7: Consultation Process for Federal Actions.** Under ESA Section 7, the lead federal agency conducting, funding, or permitting an action must consult with USFWS to ensure that the proposed action will not jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify designated critical habitat. If a proposed project "may affect" a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment (BA) evaluating the nature and severity of the expected effect. In response, USFWS issues a biological opinion (BO), with a determination that the proposed project either:
  - may jeopardize the continued existence of one or more listed species (jeopardy finding) or result in the destruction or adverse modification of critical habitat (adverse modification finding), or
  - will not jeopardize the continued existence of any listed species (no jeopardy finding) or result in adverse modification of critical habitat (no adverse modification finding).

  The BO may stipulate discretionary "reasonable and prudent" conservation measures. If it is determined the proposed project would not jeopardize the continued existence of a listed species, USFWS issues an incidental take statement to authorize the proposed activity.
- **ESA Section 9: Prohibitions.** Section 9 of ESA prohibits the *take* of any fish or wildlife species listed under ESA as endangered. *Take*, as defined by ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Harm is defined as "any act that kills or injures the species, including significant habitat modification." Take of threatened species also is prohibited under Section 9 unless otherwise authorized by federal regulations.[2] Additionally, Section 9 prohibits removing, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction.
- **ESA Section 3: Critical Habitat.** Critical habitat is defined in ESA Section 3(5)(A) as "specific areas within the geographic area occupied by the species on which are found those physical or biological features essential to the conservation of the species and which may require specific management considerations or protection." Critical habitat is also defined as "specific areas outside the geographical area occupied by the species at

[1] In some cases, exceptions may be made for threatened species under ESA Section 4(d); in such cases, USFWS or National Marine Fisheries Service (NMFS) issues a "4(d) rule" describing protections for the threatened species and specifying the circumstances under which take is allowed.

the time it is listed but a determination has been made that such areas are essential for the conservation of the species." The designation of critical habitat for a listed species helps focus conservation activities by identifying areas that contain essential habitat features regardless of whether they currently are occupied by the listed species.

- **Walker River Basin Recovery Implementation Plan.** USFWS is developing the Walker River Basin Recovery Implementation Plan to address the requirements of the 1995 Lahontan Cutthroat Trout (LCT) Recovery Plan and mandates of the ESA as amended. The concept of *recovery* is defined as "improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Endangered Species Act as amended" (50 Code of Federal Regulations [CFR] §402.02). Therefore, the long-term goal of the LCT Recovery Plan is to remove LCT from the ESA list of threatened and endangered wildlife and plants.

Clean Water Act

The Clean Water Act (CWA) was enacted as an amendment to the Water Pollution Control Act of 1972, which outlined the basic structure for regulating discharges of pollutants to waters of the United States. The CWA now serves as the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands.

The CWA empowers EPA to set national water quality standards and effluent limitations and includes programs addressing both point- and nonpoint-source pollution. Point-source pollution is pollution that originates or enters surface waters at a single, discrete location, such as an outfall structure or an excavation or construction site. Nonpoint-source pollution originates over a broader area and includes urban contaminants in stormwater runoff and sediment loading from upstream areas. The CWA operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit. Additional details on sections of the CWA. 33 U.S.C. 1251 *et seq.* are provided below.

- **CWA Section 401: Water Quality Certification.** Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the NDEP Bureau of Water Quality Planning.
- **CWA Section 404: Permits for Fill Placement.** Under the CWA Section 404, the Corps and EPA regulate the discharge of dredged and fill materials into waters of the United States. Waters of the United States refers to oceans, bays, rivers, streams, lakes, ponds, and wetlands, including:

- areas within the ordinary high water mark (OHWM) of a stream, including nonperennial streams with a defined bed and bank, and any stream channel that conveys natural runoff, even if it has been realigned; and
- seasonal and perennial wetlands.

Wetlands are defined for regulatory purposes as areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3, 40 CFR 230.3).

Project proponents must obtain a permit from the Corps for all discharges of dredged or fill material into waters of the United States, including wetlands, before proceeding with a proposed activity. As stated by the Counsel for EPA's January 19, 2001, determination in response to the *Solid Waste Agency of Northern Cook County* v. *United States Army Corps of Engineers* ruling, nonnavigable, isolated waters may not be regulated by the Corps. Generally, isolated wetlands are considered hydrologically isolated from other water bodies.

In 2006, the Supreme Court addressed the jurisdictional scope of Section 404 of the CWA, specifically the term waters of the U.S., in *Rapanos* v. *U.S.* and in *Carabell* v. *U.S.* (hereafter referred to as Rapanos). The Rapanos decision provides two new analytical standards for determining whether water bodies that are not traditional navigable waters, including wetlands adjacent to those nontraditional navigable waters, are subject to CWA jurisdiction (1) if the water body is relatively permanent or is a wetland that directly abuts a relatively permanent water body; or (2) if a water body, in combination with all wetlands adjacent to that water body, has a significant nexus with traditional navigable waters. As a result of this decision, the EPA and Corps developed guidance requiring the application of the two standards described above, as well as a greater level of documentation, to support an agency jurisdictional determination for a particular water body.

The Corps may issue either an individual permit evaluated on a case-by-case basis or a general permit evaluated at a program level for a series of related activities. General permits are preauthorized and are issued to cover multiple instances of similar activities expected to cause only minimal adverse environmental effects. A nationwide permit is a type of general permit issued to cover particular fill activities. Waters of the United States in the project area are under the jurisdiction of the Corps' Sacramento District.

Compliance with CWA Section 404 requires compliance with other laws and regulations. The Corps cannot issue an individual permit or verify the

use of a general permit until the requirements of NEPA, ESA, and the National Historic Preservation Act (NHPA) have been met. Additionally, the Corps cannot issue or verify any permit until a water quality certification, or waiver of certification, has been issued pursuant to CWA Section 401. A Section 404 permit may be issued only for the least environmentally damaging practicable alternative.

- **CWA Section 402: Permits for Stormwater Discharge.** CWA Section 402 regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program, administered by EPA. In Nevada, NDEP reviews projects through the Section 402 application process.

  NPDES permits are required for projects that disturb more than 1 acre of land. The NPDES permitting process requires the applicant to file a public notice of intent to discharge stormwater and to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP includes a site map and a description of proposed construction activities. In addition, it describes the best management practices (BMPs) that will be implemented to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) that could contaminate nearby water resources. Permittees are required to conduct annual monitoring and reporting to ensure that BMPs are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 *et seq*.) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and the Soviet Union and authorizes the Secretary of the Interior to protect and regulate the taking of migratory birds. It establishes hunting seasons and capture limits for game species and protects migratory birds, their occupied nests, and their eggs (16 USC 703, 50 CFR 21, 50 CFR 10).

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat 350) makes it illegal to import, export, take (which includes molest or disturb), sell, purchase, or barter any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*), or parts thereof. USFWS oversees enforcement of this act. The 1978 amendment authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations.

Wild and Scenic Rivers Act of 1968

The Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271–1287) establishes a National Wild and Scenic Rivers System for the protection of rivers with important scenic, recreational, fish and wildlife, and other values. Although there is no designated wild or scenic river in the study area, the National Park Service (NPS) maintains a Nationwide Rivers Inventory (NRI), a register of river segments that potentially qualify as national wild, scenic, or recreational river areas (National Park Service 2004). Under a 1979 Presidential directive, and related Council on Environmental Quality (CEQ) procedures, all federal agencies must seek to avoid or mitigate actions that would adversely affect NRI segments. NPS has identified three river segments in the study area that are listed on the NRI:

- West Walker River from Walker River confluence to source (83 miles);
- East Walker River from the Nevada/California border to bridge crossing near Flying M Ranch headquarters (26 miles); and
- East Walker River from the bridge crossing near Sweetwater Creek confluence to bridge crossing near headquarters of Flying M Ranch (24 miles).

Executive Order 13186

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (January 10, 2001; 66 FR 3853), directs each federal agency taking actions that have or may have a negative impact on migratory bird populations to work with USFWS to develop a Memorandum of Understanding that will promote the conservation of migratory bird populations. Protocols developed under the Memorandum of Understanding must incorporate the agency responsibilities listed below.

- Avoid and minimize, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.
- Restore and enhance migratory bird habitats, as practicable.
- Prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

The executive order is designed to assist federal agencies in complying with the MBTA and does not constitute any legal authorization to take migratory birds.

Executive Order 11990

Executive Order 11990, Protection of Wetlands (May 24, 1974; 42 FR 26961), provides for protection of wetlands through avoidance or minimization of adverse impacts. Any action that involved modification of or construction within

jurisdictional wetlands would require mitigation to be consistent with this executive order.

Executive Order 13112

Executive Order 13112, Invasive Species (January 14, 1999; 64 FR 2419), directs all federal agencies to prevent and control introductions of invasive nonnative species, and to minimize the economic, ecological, and human health impacts caused by invasive species infestations. It requires the NEPA process to include a determination of the likelihood of introducing or spreading invasive species and a description of measures being taken to minimize their potential harm.

State

Nevada Revised Statute 501: Wildlife Administration and Enforcement

The State of Nevada protects listed wildlife species under Nevada Revised Statute (NRS) 501. NDOW is the state agency responsible for the management, protection, and restoration of fish and wildlife resources. State regulations require a permit from NDOW to take any protected wildlife species. Nevada protected fish and wildlife species are species or subspecies of native fish, wildlife, and other fauna that are regarded as threatened with extinction. The Nevada Board of Wildlife Commission establishes policies and regulations necessary to the preservation, protection, management, and restoration of wildlife and habitat.

Nevada Administrative Code 527: Protection and Preservation of Timbered Lands, Trees and Flora

The State of Nevada maintains a list of plant species for which a population decline is documented in all or portions of their range within the state (Nevada Natural Heritage Program 2007a, 2007b), and protects those species threatened with extinction under Nevada Administrative Code (NAC) 527. This list of protected species is known as the Critically Endangered Species List. The State Forester, Fire Warden, or Nevada Board of Wildlife Commission can designate a fully protected species when, after consultation with competent authorities, it determines that a species is threatened with extinction and its survival requires assistance because of overexploitation, disease, or other factors or its habitat is threatened with destruction, drastic modification, or severe curtailment. Any species declared to be threatened with extinction must be placed on the list of fully protected species, and no member of its kind may be captured, removed, or destroyed at any time by any means except under special permit issued by State Forester, Fire Warden, or NDOW (NRS 527.270).

Nevada Revised Statute 555: Control of Insects, Pests and Noxious Weeds

The Nevada Department of Agriculture maintains a list of noxious weeds in the state (Nevada Department of Agriculture 2008), and is authorized to investigate

noxious weed occurrence and require landowners or occupants to control noxious weeds (NRS 555, sections 005-217). The overall significance of the noxious weed determines what prevention or control activities are appropriate, at what level, and when and where those activities should be conducted. According to NAC 555.090, the Walker River Weed Control District is created for the control of designated noxious weeds within the prescribed boundaries. Weeds to be controlled are limited to the following:

- Whitetop (*Cardaria* spp., *Lepidium* spp.);
- Knapweed (*Centaurea* spp.);
- Canada thistle (*Cirsium* spp.);
- Musk thistle (*Carduus* spp.);
- Scotch thistle (*Onopordum* spp.);
- Yellow star thistle (*Centaurea* spp.);
- Puncture vine (*Tribulus* spp.); and
- Licorice (*Glycyrrhiza* spp.).

Local

Mineral County Master Plan

The Mineral County Master Plan (Mineral County 2006) includes the following general goals related to the preservation and restoration of natural resources:

- Preserve and improve any outstanding natural, historic, or scenic features in Mineral County, and provide a plan that deals specifically with conservation and natural resource protection and development of public lands.
- Restore health and functioning to the natural resources of the County for present and future generations.

Lyon County Master Plan

The 1990 Lyon County Master Plan does not contain policies specifically for the protection of vegetation or wetland resources, other than as they relate to recreational uses (Lyon County 1990). An updated Lyon County Master Plan is expected in 2009. During this updating process, the County will address a variety of key issues, including natural resources and the environment (Lyon County 2007).

Land Use and Agriculture

Federal

Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) (7 U.S.C. 658) was enacted by Congress as a subtitle of the 1981 Farm Bill. The purpose of the law is to "minimize the extent to which Federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses" (Public Law [P.L.] 97-98, Section 1539-1549; 7 U.S.C. 4201 *et seq*.). The FPPA also stipulates that federal programs be compatible with state, local, and private efforts to protect farmland. For the purposes of the law, federal programs include construction projects—such as highways, airports, dams and federal buildings—sponsored or financed in whole or part by the federal government, and the management of federal lands. In addition, farmland is defined as prime farmland, unique farmland, and land of statewide or local importance. The U.S. Department of Agriculture's Natural Resources Conservation Service is charged with oversight of the FPPA.

The FPPA applies to federal projects that would convert farmland to nonagricultural uses but does not authorize the federal government to regulate the use of private or nonfederal land or affect the rights of property owners. The FPPA does not, however, require that an agency modify its project to protect farmland, only that it evaluate the impacts and consider alternatives. The land evaluation and site assessment system is a tool for complying with the FPPA. This is a numerical system that rates both the quality of the soil and other site conditions that affect farm viability, such as distance to water and parcel size (American Farmland Trust 2006). This farmland conversion impact rating is an indicator for the project sponsor to consider alternative sites.

State

Nevada Wilderness Protection Act

The Nevada Wilderness Protection Act of 1989 (P.L. 101-195, S974) designates wilderness areas in Nevada, including lands in the Toiyabe National Forest. The act defines how the lands are to be used and cared for, and reserves water rights for the wilderness areas.

Nevada Division of State Parks

The Nevada Division of State Parks manages the Walker Lake State Recreation Area (SRA). Land use at the SRA is guided by the Walker Lake State Recreation Area Master Plan (Nevada Division of State Parks1989). There are no immediate plans to update the Master Plan.

Wildlife Management Areas

Land use for the Mason Valley Wildlife Management Area (WMA) is outlined in the Mason Valley Wildlife Management Area Conceptual Management Plan (Nevada Department of Wildlife 2000). The Alkali Lake WMA, also located in the study area, currently does not have a conceptual management plan.

Local

Carson City Field Office Consolidated Resource Management Plan

Land use decisions on U.S. Bureau of Land Management (BLM) land in the Walker River Basin are guided by the Carson City Field Office Consolidated Resource Management Plan (Bureau of Land Management 2001). The plan is based on decisions from eight major field office planning documents and five amendments to these planning documents. Land use plan conformance determinations are based on the decisions and information contained in the plan. Issues covered in the plan include mining, grazing, herd management, land disposal and acquisition, and rights-of-way.

Walker River Paiute Tribe

There is no formal land use plan for the Walker River Indian Reservation, but because WRPT owns most of the land, the Tribal Council controls most land use decisions (Miller Ecological Consultants 2005).

Yerington Paiute Tribe

There is no formal land use plan for the YPT Reservation and Colony (Emm pers. comm.).

Mineral County Master Plan

Land use decisions in Mineral County are based on the 2006 Mineral County Master Plan. The goals applicable to the Proposed Project are presented below.

- Goal: Preserve and improve any outstanding natural, historic, or scenic features in Mineral County. Provide a plan that deals specifically with conservation and natural resource protection and development of public lands.
- Goal: Restore health and functioning to the natural resources of the County for present and future generations.

Lyon County Master Plan

Land use decisions in Lyon County are based on policies in the 1990 Lyon County Master Plan. The Lyon County Master Plan will be updated in 2009.

During this updating process, the County will address key issues (Lyon County 2007): land use and growth management; natural resources and the environment; parks, recreation, and open space; public facilities and services; transportation; regional coordination; community character and design; and community and culture. The conservation, natural resources, and land use goals from the current plan that are applicable to the Proposed Project are presented below.

- Goal: Retain existing water resources which exist for benefit of Lyon County use: agriculture, residential, and industrial.
- Goal: Lyon County shall review all development, special use and/or zone change proposals to ensure that existing and proposed land uses are compatible.
- Goal: Preserve agricultural lands.

Air Quality

Air quality management programs at the federal, state, and local level have evolved using two distinct management approaches:

- setting ambient air quality standards for acceptable exposure to air pollutants; and
- identifying specific chemical substances that are potentially hazardous to human health, and then regulating the amount of those substances that can be released by individual commercial or industrial facilities or by specific types of equipment.

Air quality programs based on ambient air quality standards typically address air pollutants that are produced in large quantities by widespread types of emission sources and that are of public health concern because of their toxic properties. Air quality programs based on regulation of other hazardous substances typically address chemicals used or produced by limited categories of industrial facilities.

Federal

Clean Air Act

The CAA (42 U.S.C. 85) requires each state to develop, adopt, and implement a state implementation plan (SIP) to achieve, maintain, and enforce federal air quality standards throughout the state. Deadlines for achieving the federal air quality standards vary according to air pollutant and the severity of existing air quality problems. The SIP must be submitted to and approved by EPA. SIP elements are developed on a pollutant-by-pollutant basis whenever one or more of the federal air quality standards are being violated. Additional elements of the CAA are described below.

- **Ambient Quality Standards.** Ambient air quality standards (AAQS) are regulatory levels of ambient pollutant concentrations that, when exceeded, may adversely affect the health and welfare of the public. National Ambient Air Quality Standards (NAAQS) were established as a result of the provisions of the CAA of 1970. The national standards are divided into primary standards designed to protect public health, and secondary standards intended to protect the public from any known or anticipated adverse effects of a pollutant. The NAAQS may be equaled continuously and exceeded once per year. National standards have been established for ozone (O3), nitrogen dioxide (NO2), carbon monoxide (CO), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), sulfur dioxide (SO2), and lead (Pb).
- **Section 176, General Conformity Rule.** The 1990 amendments to CCA Section 176 required EPA to promulgate rules to ensure that federal actions conform to the appropriate SIP. The U.S. EPA Conformity Rule consists of transportation and general conformity requirements. The General Conformity Rule (40 CFR 51.850-.860 and 40 CFR 93.150-.160) requires any federal agency responsible for an action in a nonattainment area to either determine that the action is exempt or positively determine that the action conforms to the applicable SIP. In addition to the roughly 30 presumptive exemptions established and available in the General Conformity Rule, an agency may establish that rates would be less than specified emission rate thresholds, known as *de minimis* limits. An action is exempt from a conformity determination if an applicability analysis shows that the total direct and indirect emissions from the project will be below the applicable *de minimis* thresholds and will not be regionally significant, which is defined as representing ten percent or more of an area's emissions inventory or budget.
- **Section 188(f), Waiver Provision.** Section 188(f) of the CAA allows the EPA to waive the attainment status for PM10 and PM2.5 in areas where nonanthropogenic sources (i.e., natural sources that are not influenced directly or indirectly by human activity) may contribute significantly to violations of the standards. Examples of nonanthropogenic PM10 emission sources include volcanic eruptions, smoke from natural forest and range fires, windblown dust from undisturbed natural areas, and salt spray in coastal areas. The U.S. House of Representatives committee report on the 1990 CAA amendments specifically cited dust from Owens Lake and Mono Lake in California as examples of anthropogenic emissions because dust storms in those areas are caused ultimately by the human activity of diverting water from the streams feeding Owens Lake and Mono Lake (Stensvaag 1991). It is likely that any fugitive dust problems linked to lakebed areas exposed by reduced water inflows to Walker Lake would be considered an anthropogenic air quality problem, and not derived from a natural event.

- **Criteria Pollutants.** Air quality in the United States is governed by the CAA, which is administered by EPA. Six criteria pollutants have been designated by EPA to focus on improving air quality throughout the country. The six criteria pollutants are nitrogen oxides (NOx), O3, Pb, SO2, CO, and PM10 and PM2.5. A number of sources, both natural and anthropocentric, contribute to air pollution. These sources include stationary (power plants, factories), mobile (motor vehicles, construction equipment), and natural (wildfires and windblown dust) sources.

State

Nevada

In Nevada, air quality programs are managed in the Department of Conservation and Natural Resources (DCNR), Nevada Division of Environmental Protection (NDEP), and the Bureau of Air Quality Planning (BAQP). The Bureau of Air Pollution Control (BAPC) is responsible for regulating air quality and implementing SIPs to meet national air quality standards. The Nevada AAQS are similar to the NAAQS, except that the state provides an additional standard for CO in areas higher than 5,000 feet above sea level. Additionally, a violation of a state standard in Nevada occurs with the first annual exceedance, whereas federal standards are not violated until the second annual exceedance. BAPC operates a network of air monitoring stations near population centers, but there are no current monitoring stations near the project area.

California

In 1988, the California state legislature adopted the California Clean Air Act (CCAA), which established a statewide air pollution control program. Responsibility for achieving California's generally more stringent air quality standards is placed on the California Air Resources Board (CARB) and local air districts. Implementation of SIPs has been vested upon the 30 air districts in the state. Air district responsibilities include, among others, preparing air quality plans and maintaining air quality monitoring stations. The CCAA requires districts to expeditiously adopt and prepare an air quality attainment plan if the district violates a state air quality standard. California is the only state with air districts.

The majority of the Walker River Basin lies outside of California, and under all of the action alternatives all proposed acquisitions would occur in Nevada. In addition, none of the action alternatives are expected to affect air quality in California. Therefore, while briefly introduced here, California standards are not addressed further.

While EPA has established NAAQS for each pollutant that must not be exceeded, individual states may establish more stringent state or county standards but may

not lessen federal standards. Table 1A-1 compares the federal and Nevada state AAQS. As discussed above, if a county meets the federal or state ambient air quality standards, it is considered to be in attainment. If a county does not meet federal or state standards, it is considered to be in nonattainment.

Local

There are no local regulations pertaining to air quality in the project area.

Cultural Resources

Federal

National Historic Preservation Act of 1966

The NHPA as amended through 1992, particularly Sections 106 and 110, established the federal government's policy on historic preservation and its program for implementation of the policy. This program includes the National Register of Historic Places (NRHP), the position of State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP).

A major provision of the Act is Section 106, which requires federal agencies to take into account the effects of their undertakings on historic properties and to allow the ACHP an opportunity to comment on undertakings that could have such an effect. Section 110 requires federal agencies to assume responsibility for historic properties under their jurisdiction and to take measures to preserve them. Federal agencies are directed to inventory, evaluate, and nominate historic properties to the National Register. The NHPA provides for the dissemination of regulations, standards, and guidelines related to its provisions.

Antiquities Act of 1906

The Antiquities Act of 1906 authorizes the President to designate National Monuments on federally owned or controlled lands, and it also provides criminal sanctions against excavation, injury, or destruction of historic and prehistoric resources, located on federal lands. This Act was the first to provide for the issuing of permits by federal agencies for archaeological investigations for scientific and educational purposes on lands under their control. Such permits are now authorized under the Archaeological Resources Protection Act of 1979.

National Environmental Policy Act of 1969

NEPA directs federal agencies to use all practicable means to "Preserve important historic, cultural, and natural aspects of our national heritage…" (Section 101(b)(4)). Regulations for implementing the procedural provisions of NEPA are found in 40 CFR 1500-1508. If the presence of a significant environmental

resource is identified during the scoping process, federal agencies must take the resource into consideration when evaluating project effects. Consideration of cultural resources may be required under NEPA when a project is proposed for development on federal land, or land under federal jurisdiction. The level of consideration depends on the federal agency involved.

Historic Sites Act of 1935

The Historic Sites Act more firmly established the federal government's duty in historic preservation, and declared a national policy to preserve for public use historic sites, buildings, and objects. Much of what was mandated in this Act was later expanded upon in the NHPA.

Archaeological and Historic Preservation Act of 1960

Originally called the Reservoir Salvage Act, the Archaeological and Historic Preservation Act (as amended) amended the 1960 Reservoir Salvage Act and provided for the preservation of significant scientific, prehistoric, historic, and archaeological materials and data that might be lost or destroyed as a result of the construction of dams and reservoirs, or other federally sponsored projects.

Archaeological Resource Protection Act of 1979

The purpose of the Archaeological Resource Protection Act of 1979 (16 U.S.C. 470, as amended 1988) is to provide for the protection of archaeological resources on federal and Indian lands. It defines archaeological resources, requires permits to conduct archaeological investigations on federal or Indian lands, and requires the location of archaeological sites to be kept confidential. It also prohibits the excavation, removal, sale, or purchase of archaeological materials without a permit, under penalty of law that includes fines, imprisonment, or civil penalties. The Act also mandates the Secretaries of the Interior, Agriculture, and Defense, and the Chairman of the Board of the Tennessee Valley Authority to develop plans for surveying lands under their control, prepare a schedule for surveying lands containing the most important resources, and develop documents for reporting violations of the Act and establish when and how such documents are to be completed.

Native American Graves Protection and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C.3001) assigns ownership or control of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony that are excavated or discovered on federal or tribal lands after 1990 to lineal descendants or culturally affiliated Native American groups.

Executive Order 11593

Executive order 11593, Protection and Enhancement of the Cultural Environment (36 FR 8921, 1971), mandates that all Executive Branch agencies, bureaus, and offices 1) compile an inventory of the cultural resources—archaeological, architectural and historical properties, sites and districts—for which they are trustee; 2) nominate all eligible government properties to the National Register; 3) preserve and protect their cultural resources; and 4) insure that agency activities contribute to the preservation and protection of non-federally owned cultural resources. The deadline for federal agency compliance with Executive Order 11593 was July 1, 1973.

Executive Order 13175

Executive order 13175, Consultation and Coordination with Indian Tribal Governments (2000), replaces Executive Order 13084 (2000) and clearly defines consultation and coordination with Indian tribal governments. Tribes are recognized as having a unique trust relationship with the United States government. These relationships are called government-to-government relationships. Federal agencies have a duty to consult with tribal governments and must recognize tribal self government and sovereignty.

Directives and Policies

- **Bureau of Reclamation Manual Directives and Standards LND 02-01** is the primary internal planning document used in the U.S. Bureau of Reclamation offices. This document incorporates all cultural resources laws and regulations and dictates policy toward cultural resources.
- **Bureau of Reclamation Manual Policy LND P01** is a statement that, in association with the Directives and Standards LND 02-01, ensures the U.S. Bureau of Reclamation maintains a cultural resources program that reflects the spirit and intent of the legislative mandates.

State

There are no regulations pertaining to cultural resources in Nevada.

Local

There are no local regulations pertaining cultural resources in the project area.

Socioeconomics

Federal

There are no specific federal regulations pertaining to the assessment of socioeconomic impacts. The requirements of Executive Order 12898 are addressed under Environmental Justice (below) and the requirements of the Farmland Protection Policy Act are addressed under Land Use (above).

State

There are no state regulations regarding socioeconomic resources in Nevada.

Local

There are no local regulations regarding socioeconomic resources in the project area.

Recreation

Federal

BLM Carson City Field Office Consolidated Resource Management Plan

Management of recreation facilities and development of recreation plans and policies on BLM land in the Walker Basin are guided by national BLM policy and the *Carson City Field Office Consolidated Resource Management Plan.* The national BLM policy states that public lands and related waters will be available for a diversity of resource-dependent outdoor recreation opportunities while also being maintained as a national resource in harmony with the principle of balanced multiple use. To meet the overall objectives of the national BLM policy, specific recreation program policies have been developed locally to provide additional guidance. Specific policies in the plan address land use allocations for recreation activities, special designations for various areas, and maintenance of recreation management plans. Walker Lake has been given a special designation under this plan and has an associated recreation management plan (Bureau of Land Management 2001).

BLM Walker Lake Recreation Management Plan

Recreation planning for most public land on the east and west sides of Walker Lake is guided by the 1979 Walker Lake Recreation Management Plan (WLRMP). While the plan is dated, the implementation and management actions still apply. The plan summarizes the planned actions for three beach sites, undeveloped sites at the lake, and area-wide actions. At the time the WLRMP was published, the managed public land totaled approximately 63,800 acres. The

area has since increased in size as the lake continues to recede. The WLRMP contains two objectives relevant to the project evaluated in this Draft EIS:

- **Objective A.** Outdoor recreation will be the primary resource management program in the plan area. Other management activities within the BLM's authority will be allowed only if they do not compromise recreation values.
- **Objective B.** BLM will develop and enhance high-quality opportunities for water-oriented public recreation activities such as boating, fishing, swimming, wading, camping, picnicking, and sightseeing, by providing and maintaining facilities to accommodate these uses. Opportunities will be managed to provide as wide a range of settings as possible, from concentrated use in developed sites to dispersed use in undeveloped sites and areas.

Walker River Paiute Tribe

WRPT is governed by a seven-member Tribal Council and is advised by many committees, advisory boards, and commissions on program areas. The Tribe maintains administrative policies to govern the tribal people and the Reservation (Walker River Paiute Tribe 2008). The Walker River Indian Reservation does not have a formal recreation management plan, but it does impose regulations on recreation-related activities. All public access to the reservation requires permission from the tribal council. Fishing, hunting, and other recreation activities (e.g., off-highway vehicle use, equestrian trial riding, camping, and group activities at Weber Reservoir) on tribal land require permits and/or permission issued by the tribal council and have accompanying regulations. Fishing and hunting at Walker Lake on the reservation lands requires the appropriate permits from the tribal council (Williams pers. comm.).

State

Statewide Comprehensive Outdoor Recreation Plan Assessment and Policy Plan

The 2003 Statewide Comprehensive Outdoor Recreation Plan Assessment and Policy Plan (last revised in 2004) provides overall statewide recreation goals and objectives. Information and recommendations are laid out in the plan to guide the decision-making process of allocation of outdoor recreation resources. The issues, actions recommended to address these issues, and recreation needs listed are the driving factors for development of Land and Water Conservation Fund projects. The federal Land and Water Conservation Fund program provides matching grants to states for the acquisition and development of public outdoor recreation areas and facilities (Nevada Division of State Parks 2004).

Local

Lyon County

Recreation policies and goals for Lyon County are contained in the 1990 Lyon County Master Plan. The county is currently undertaking a comprehensive master planning effort to update the 1990 Master Plan. The updated plan likely will not be available until sometime in 2009. The current recreation goals are listed below.

- Goal 1: To retain areas throughout Lyon County that will support game, game birds, and fishing for outdoor enthusiasts.
- Goal 2: To create and reserve areas along waterways which can be used as parks, walkways, and river access.
- Goal 5: Promote and encourage the use of water areas for water sports, boating, etc.

Mineral County

Recreation-related goals of Mineral County are contained in the 2006 Mineral County Master Plan. This plan includes goals addressing recreation explicitly as well as goals addressing natural resources that provide recreational opportunities. The goals are presented below.

Conservation and Natural Resources Goal: To preserve and improve any outstanding natural, historic, or scenic features in Mineral County. To provide a plan that deals specifically with conservation and natural resource protection and development of public lands.

Natural Resources Goal: Restore health and functioning to the natural resources of Mineral County for present and future generations.

Recreation Goal: To continue planning and improving park and recreation facilities county wide. Encourage recreational facilities for all age groups in Mineral County and to continue recreational use of open lands, Walker Lake, rivers, etc.

Indian Trust Assets

Federal

Executive Order 13175

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (65 FR 218), establishes regular and meaningful consultation and

collaboration with tribal officials in the development of federal policies that have tribal implications.

Presidential Memorandum

The Presidential Memorandum signed by President Clinton on April 29, 1994, Government-to-Government Relations with Native American Tribal Governments (59 FR 85), directs the U.S. Department of the Interior (DOI) and its bureaus (Including the Bureau of Reclamation) to assess the effect of its programs on Indian Trust Assets (ITAs) and federally recognized tribal governments. DOI and its bureaus are tasked with actively engaging federally recognized tribal governments and consulting with such tribes on a government-to-government level when its actions affect ITAs.

Department of the Interior Departmental Manual

The DOI Departmental Manual Part 512 assigns responsibility for ensuring protection of ITAs to the heads of bureaus and offices and states that it is the policy of DOI to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of federally recognized Indian tribes and tribal members. All bureaus are responsible for identifying any impact of their plans, projects, programs, or activities on ITAs; ensuring that potential impacts are explicitly addressed in planning, decision, and operational documents; and consulting with recognized tribes who may be affected by proposed activities. Consistent with this, Reclamation's Indian trust policy states that Reclamation will carry out its activities in a manner that protects ITAs and avoids adverse impacts when possible, or provides appropriate mitigation or compensation when it is not. To carry out Part 512, Reclamation incorporated requirements into its NEPA compliance procedures to evaluate the potential effects of its proposed actions on ITAs. Reclamation is responsible for assessing whether the action alternatives would impact ITAs.

Bureau of Reclamation Policies

Indian Policy

This policy affirms that Reclamation will comply with both the letter and the spirit of federal laws and policies relating to Indians; acknowledge and affirm the special relationship between the United States and federally recognized Indian tribes; and actively seek partnerships with Indian tribes to ensure that tribes have the opportunity to participate fully in the Reclamation program as they develop and manage their water and related resources.

Protocol Guidelines

These guidelines establish the protocol for conducting consultation and maintaining government-to-government relationships with Indian Tribal Governments.

Indian Trust Asset Policy and Guidance

This memorandum outlines NEPA procedures to implement Indian trust resource policy (Bureau of Reclamation 1994).

State

There are no state regulations pertaining to ITAs in Nevada.

Local

There are no local regulations pertaining to ITAs in the project area.

Environmental Justice

Federal

Executive Order 12898

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Feb 11 1994; 59 FR 32), stipulates that each federal agency will make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Environmental justice programs promote the protection of human health and the environment, empowerment via public participation, and the dissemination of relevant information to inform and educate affected communities.

State

There are no state regulations pertaining to environmental justice in Nevada.

Local

There are no local regulations pertaining to environmental justice in the project area.

Climate

Federal

There are currently no federal regulations pertaining to climate change, although 12 states and cities, in conjunction with several environmental organizations, sued to force the Environmental Protection Agency (EPA) to regulate greenhouse gas (GHG) emissions as a pollutant pursuant to the Clean Air Act (CAA) (*Massachusetts* v. *Environmental Protection Agency et al.* [U.S. Supreme Court 05-1120. Argued November 29, 2006—Decided April 2, 2007]). The Supreme Court ruled that the plaintiffs had standing to sue, that GHGs fit within the CAA's definition of a pollutant, and that the EPA's reasons for not regulating GHGs were insufficiently grounded in the CAA.

In November 2007 and August 2008, the Ninth Circuit U.S. Court of Appeals ruled that a National Environmental Policy Act (NEPA) document must contain a detailed GHG analysis. (*Center for Biological Diversity* v. *National Highway Safety Administration* 508 F. 3d 508 (2007) was vacated and replaced by *Center for Biological Diversity* v. *National Highway Safety Administration* 2008 Daily Journal Daily Appellate Report 12954 (August 18, 2008)). Despite the Supreme Court and circuit court rulings, there are no promulgated federal regulations to date limiting GHG emissions.

State

There are no state regulations addressing the assessment of climate change impacts in Nevada.

Nevada's Renewable Portfolio Standards, established in 1997 under Assembly Bill 336, raised in 2001 under Senate Bill 372, and further raised and extended in 2005 under Assembly Bill 03, require that 20% of all electricity generated in Nevada be derived from renewable generation sources by the year 2015. The Nevada Public Utilities Commission is responsible for implementing the program.

Local

There are no local regulations pertaining to climate change in the project area.

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Appendix 2A Option and Purchase Agreements

Since early 2007, the University of Nevada System of Higher Education (University) has received more than 24 inquiries and offers from prospective willing sellers of land, water appurtenant to the land, and related interests in the Walker River Basin in Nevada. To preserve at least some of these potential acquisition opportunities, the University initiated efforts to evaluate each inquiry or offer and, where appropriate, developed and entered into water and water rights option and purchase agreements with individual willing sellers. (An option and purchase agreement sets forth the terms and conditions under which a buyer would be willing, but not required, to purchase the property interests owned and offered by a willing seller. These terms typically set a fixed period of time in which to exercise the option, and require the buyer's up-front payment of a nonrefundable option fee. The terms also establish a purchase price subject to fair market value appraisal, title and ownership verification, and other contingencies.)

As of June 2009, a total of seven individual option and purchase agreements had been completed and documented with the Lyon County Recorder's Office and discussions with other potential sellers are ongoing. The completed options include five agreements to acquire, conditionally, the water and water rights represented in whole or in part by more than 30 individual provisional Walker River Irrigation District (WRID) water cards; and two separate but closely related agreements to acquire, conditionally, geothermal groundwater effluent. Table 2A-1, below, summarizes the natural flow, storage, and groundwater rights offered under each agreement, including associated lands, total negotiated purchase prices for each category of water right under option (subject to appraisal, title verification, and other contingencies), and expected average yield at existing points of diversion for each category of water right under option. Additional information for each completed option agreement appears below.

Table 2A-1. Recorded Option and Purchase Agreements as of June 2009

	Offered				Not Offered	
	NF Decree CFS	Sup Storage AF/year	New Land AF/year	Geo GW Effl AF/year	Decree Acres	New Land Acres
Option 1 - Masini	19.751	474.3	484.1	-	1,561	263
Option 2A-B - Homestretch	-	-	-	7,000	-	-
Option 3 - Sunrise	3.312	149.2	191.5	-	276	124
Option 4 - DG-HP	1.808	37.9	7.5	-	150	5
Option 5 - Aguiar	8.844	359.3	170.8	-	738	122
Option 6 - Little	9.888	345.6	-	-	824	-
	43.603	1,366.3	854.0	7,000	3,549	514
Exp. Avg. Yield (af/yr)	9,736	955	597	7,000	-	-
Purchase Price ($m)	$39.5	$4.2	$2.4	$18.0	-	-

Expected average yield @ existing points of diversion (or near Wabuska for geothermal groundwater effluent) per DEIS analysis.

Purchase price subject to appraisal and assuming acquisition of all optioned property interests.

Option 1 – Masini

Option 1 involves the potential acquisition of up to 19.75 cubic feet per second (cfs) of decreed natural flow direct diversion rights, up to 958 acre-feet per year (af/yr) of associated supplemental and New Land storage rights, associated floodwaters (where applicable), and any associated supplemental groundwater rights still available at close of escrow. Related interests include ditch and drain rights and easements.

Most of the appurtenant lands under Option 1 are located in northern Mason Valley and are served by surface water diversions into the West Hyland Ditch. The Valley Vista Ranch parcels are located in southern Mason Valley and are the sole users served by surface water diversions into the West Side Canal . For additional information, see Lyon County Document No. 414044, recorded September 19, 2007. Land use information is summarized by owner in Table 2A-2.

Table 2A-2. Option 1 Land Use Information - by Owner

Assessor Parcel Number	Acres	Land Use Code	Land Use Name
L & M Family Ltd Partnership			
014-091-013	18.8	600	Ag-Deferred VACANT
014-091-017	20.0	600	Ag-Deferred VACANT
014-091-016	20.0	602	Ag-Deferred w/Res
014-091-015	20.0	600	Ag-Deferred VACANT
014-201-035	78.6	600	Ag-Deferred VACANT
014-191-002	814.9	602	Ag-Deferred w/Res
014-201-003	75.7	600	Ag-Deferred VACANT
014-201-014	128.0	602	Ag-Deferred w/Res
014-201-001	156.3	600	Ag-Deferred VACANT
Masini Investments			
014-201-018	492.5	600	Ag-Deferred VACANT
Valley Vista Ranch LLC			
012-331-012	554.6	602	Ag-Deferred w/Res
012-331-013	39.5	600	Ag-Deferred VACANT
Total	2418.9		

Source: Lyon County 2009a, 2009b

Options 2A and 2B – Homestretch

Option 2A involves the potential purchase and delivery of up to 35,000 af of geothermal groundwater effluent from the Homestretch geothermal energy generating facility near Wabuska. The purchase would occur over a 5- to 7-year period as part of a pilot project that would provide the purchased water, net of losses, to Walker Lake. The agreement includes the potential acquisition of easements and other related interests, and defines the following sellers' obligations:

- pump and deliver water to an appropriate location for discharge to the Walker River,
- obtain Nevada Division of Environmental Protection (NDEP) discharge permits and all other approvals and agreements needed to effectuate such deliveries, and
- construct and install such facilities as may be needed to transport such water to the point of delivery and discharge.

The pilot project and the associated option agreement are not part of the Proposed Project evaluated by this Draft EIS. The Bureau of Reclamation (Reclamation) is examining the environmental consequences of the pilot project in a separate Environmental Assessment. The effects of related projects such as the Homestretch pilot project are, however, briefly discussed in the Chapter 14, Cumulative Impacts, of this Draft EIS. For additional information, see Lyon County Document No. 423957, recorded April 4, 2008.

Option 2B involves the potential acquisition of primary groundwater rights and related interests from the same geothermal energy generating facility. Contingent in part on sellers' performance under Option 2A above, Option 2B anticipates the purchase of up to 7,000 af/yr of primary groundwater rights. The terms specify that sellers may continue to pump and use the associated groundwater for nonconsumptive, noncontact geothermal uses so long as deliveries in the amount purchased are maintained on an average annual basis. Related interests under Option 2B include easements for wells and well facilities, conveyance and cooling works, rights of access, construction of necessary water delivery infrastructure, discharge permits, and operational commitments. For additional information, see Lyon County Document No. 423956, recorded April 4, 2008. Land use information for Option 2 is presented in Table 2A-3.

Table 2A-3. Option 2 Land Use Information - Homestretch Geothermal LLC and Homestretch Energy LLC

APN	Acres	Land Use
014-081-003	79.6	General Industrial
014-081-016	160.8	Vacant Industrial
014-071-002	161.1	Vacant Industrial
014-071-001	40.2	Vacant Industrial
014-071-002	120.5	Vacant Industrial
Total	562.1	
Source: Lyon County 2009a, 2009b		

Option 3 – Sunrise Ranch

Option 3 involves the potential acquisition of up to 3.3 cfs of decreed natural flow direct diversion rights in the lower Mason Valley, up to 341 af/yr of associated storage rights, associated floodwater (where applicable), and any associated supplemental groundwater rights still available at close of escrow. Related interests include ditch and drain rights and easements.

The land in this option is zoned as agricultural and is served by surface water diversions into the Joggles Ditch. The land use information for each parcel is provided in Table 2A-4. For additional information, see Lyon County Document No. 429982, recorded August 6, 2008.

Table 2A-4. Option 3 Land Use Information – Sunrise Ranch LLC

Assessor Parcel Number	Acres	Land Use Code	Land Use Name
014-321-021	196.030	602	Ag-Deferred w/Res
014-321-001	196.030	600	Ag-Deferred VACANT
Source: Lyon County 2009a, 2009b			

Option 4 – DG-HP

Option 4 involves the potential acquisition of up to 1.8 cfs of decreed natural flow direct diversion rights appurtenant to development parcels and golf course parcels in Mason Valley, up to 45 af/yr of associated storage rights, and associated floodwater (where applicable). Related interests include ditch and drain rights and easements.

The properties are served by surface water diversions into the Greenwood Ditch, Spragg-Woodcock Ditch, and Fox Ditch. A previous agreement may require DG-HP to withdraw the water rights associated with the golf course parcels prior to close of escrow. The land use information for each parcel is provided in Table 2A-5. For additional information, see Lyon County Document No. 436766, recorded January 14, 2009.

Table 2A-5. Option 4 Land Use Information – DG-HP, Inc.

Assessor Parcel Number	Acres	Land Use Code	Land Use Name
001-471-12	3.600	170	Other unbuildable
001-471-13	18.710	120	Vacant Single-Fam
001-471-14	8.380	440	Resort Commercial
001-471-15	19.680	440	Resort Commercial
001-471-16	14.430	120	Vacant Single-Fam
001-471-17	9.500	440	Resort Commercial
001-592-01	0.211	120	Vacant Single-Fam
001-592-02	0.261	120	Vacant Single-Fam
001-592-04	0.340	120	Vacant Single-Fam
001-592-05	0.247	120	Vacant Single-Fam
001-592-06	0.213	120	Vacant Single-Fam
001-592-07	0.213	120	Vacant Single-Fam
001-592-08	0.247	120	Vacant Single-Fam
001-592-09	0.337	120	Vacant Single-Fam
001-592-11	0.254	120	Vacant Single-Fam
001-592-12	0.214	120	Vacant Single-Fam
001-601-01	0.280	120	Vacant Single-Fam
001-601-02	0.266	120	Vacant Single-Fam
001-601-03	0.239	120	Vacant Single-Fam
001-601-10	0.320	120	Vacant Single-Fam
001-601-15	0.220	120	Vacant Single-Fam
001-601-17	0.290	120	Vacant Single-Fam
001-601-18	0.297	120	Vacant Single-Fam
001-602-01	0.257	120	Vacant Single-Fam
001-602-02	0.260	120	Vacant Single-Fam
001-602-03	0.277	120	Vacant Single-Fam

Source: Lyon County 2009a, 2009b

Option 5 – Aguiar

Option 5 involves the potential acquisition of water rights appurtenant to 320 acres of land just south of the Mason Valley Wildlife Management Area (WMA). The option agreement includes up to 8.844 cfs of decreed natural flow direct diversion rights, up to 359.32 af/yr of supplemental storage rights, and up to 170.83 af/yr of New Land storage rights.

The properties are served by surface water diversions into the Joggles Ditch. The land use information for each parcel is provided in Table 2A-6. For additional information, see Lyon County Document No. 437886, recorded February 11, 2009.

Table 2A-6. Option 5 Land Use Information – Aguiar Family Trust

Assessor Parcel Number	Acres	Land Use Code	Land Use Name
014-321-03	320	600	Ag-Deferred VACANT
014-321-13	535	602	Ag-Deferred w/Res
Source: Lyon County 2009a, 2009b			

Option 6 – Little

Option 6 involves the potential acquisition of water rights appurtenant to 824 acres of land within the parcels identified below, just south of the Mason Valley WMA. The option agreement includes up to 9.888 cfs of decreed natural flow direct diversion rights and up to 345.61 af/yr of supplemental storage rights.

The properties are served by surface water diversions into the Joggles and Nichol Merritt Ditches and include additional acres to which water rights owned by sellers are appurtenant (but those water rights are not included in the option agreement). The land use information for each parcel is provided in Table 2A-7. For additional information, see Lyon County Document No. 440852, recorded April 10, 2009.

Table 2A-7. Option 6 Land Use Information – David M. and Sherry L. Little

Assessor Parcel Number	Acres	Land Use Code	Land Use Name
014-321-04	560	600	Ag-Deferred VACANT
014-321-05	640	605	Ag-Def w/Impr No Res
Source: Lyon County 2009a, 2009b			

References Cited

Lyon County. 2009a. County Recorder, Lyon County Document Inquiry. Available: < <http://www1.lyon-county.org:403/cgi-bin/diw200>. Accessed: January through June 2009.

Lyon County. 2009b. County Assessor, Real Property Inquiry. Available: < http://www1.lyon-county.org:403/cgi-bin/asw101>. Accessed: January through June 2009.

Appendix 2B Estimated Yield and Associated Funding

The upstream analysis (Chapter 3, Water Resources) is based on volumes of available water, which are generally less than the face value of water rights and the amounts specified on WRID water cards.

This Draft EIS discloses impacts that would result from achieving the objective of increasing average annual inflow to Walker Lake by 50,000 af/yr (full funding) and those that would result from use of the funds already allocated for making acquisitions (existing funding). To accomplish this, it was necessary to estimate:

- the expected cost of water rights acquired by purchase or lease,
- the expected yield of acquired water rights,
- how much of the acquisition would be approved for transfer and/or discharge to Walker Lake, and
- the incremental physical losses associated with the conveyance of acquired water (and/or the water derived from acquired water rights) from existing points of diversion to Walker Lake.

The estimation of flow losses and change approval considerations is discussed in Chapter 3, Water Resources under Upstream Analysis.

- For Alternative 1 (Proposed Project) the flow loss estimate is based on:
  - the expected cost and average yield of acquired water rights,
  - the increase in discharge to Walker Lake with existing funding, and
  - the full funding amounts needed to increase Walker Lake inflows by 50,000 af/yr on average.
- For Alternative 2 (Leasing Alternative) the flow loss estimate is based on:
  - how long existing funding would last if sufficient water was leased from willing sellers to increase average Walker Lake inflow by 50,000 af/yr, and
  - how long full funding would support Alternative 2 implementation.

For Alternative 3 (Efficiency Alternative) the flow loss estimate is based on:

  - the estimated cost of conserved water based on conveyance system improvements (e.g., lining or piping of earthen canals), and

- the funding required to achieve the conservation savings analyzed in Chapter 3, Water Resources, noting that such measures would only achieve increased average inflow at Walker Lake by approximately 32,000 af/yr.

Average Yield of Acquired Water Rights at Existing Points of Diversion

Surface water rights in the Walker River Basin do not typically yield the maximum amount specified by the face value of those rights because of the varying availability of water for diversion, limitations on the ability to put water to beneficial use, and the exercise of other water rights with more senior dates of priority.

Surface water rights offered by individual willing sellers in much of the Walker River Basin are described on provisional WRID water cards. A typical water card will specify the card owner's decreed natural flow diversion rights and associated storage rights. Storage rights are of two kinds: storage rights that supplement decreed natural flow diversion rights (with priority dates of 1874 or later), and storage rights for primary use on New Lands that lack appurtenant decreed diversion rights. The amount of supplemental storage water assigned to a decreed natural flow right increases with a more recent date of priority (more junior). New Lands do not include any decreed natural flow rights and are thus assigned the largest amounts of storage water on a per-acre basis.

While the information set forth on provisional water cards is not a substitute for adequate title analysis (to confirm ownership) nor other appropriate due diligence, the cards have been used by most willing sellers to represent the water rights they believe own, and to indicate which of those rights (if not all) they are willing to sell.

The maximum face value of each individual water right (and thus of each water card composite) can be calculated or inferred as follows:

- for decreed natural flow rights for irrigation purposes, multiply decree cfs by 1.9835 to give the maximum possible af per day, then multiply the result by 245 days to yield the maximum possible af per season (or what WRID describes as the "diversion rate expanded");
- for supplemental storage, use *total acre feet required* as reported on the WRID water cards (however, care should be taken not to add this amount to the maximum face value calculated for decreed natural flow rights because if the latter were fully available there would be no need, and no basis, for the use of supplemental storage);

- for New Land storage, use *total acre feet required* as reported on the WRID water cards.

The yield from particular water rights will vary depending on the types of rights acquired and their associated priority dates. The average annual expected yield of an individual surface water right (and thus of each water card composite) can be estimated using an approach similar to that described in Appendix C of the Great Basin Land and Water (GBLW) Study (Yardas 2007). The calculations described therein were based on the methods described in a 1969 Federal Land Bank Study, but more recent data were included in the GBLW Study analysis based on 1) USBWC daily data on decreed right priorities served for the period 1970 through 2005; and 2) WRID reservoir storage water apportionment (and in some years re-apportionment) data for the period 1976 through 2005.

The GBLW Study used the following steps and assumptions to estimate the expected average yield of a water right:

- calculated average days available for decree rights by priority date over a 158-day irrigation season (April 1 to September 5) for the years 1939 through 2005;
- calculated a weighted-average storage apportionment of 90.7% for the periods 1939 through 1969 (100% assumed) and 1970 through 2005 (82.8% based on WRID apportionment and re-apportionment data);
- made separate calculations for “low duty” and “high duty” rights along the East Walker, West Walker, and mainstem Walker reaches to yield expected af/acre by priority date in each instance; and
- determined the average availability of flood (permit, excess, or surplus) water separately, then associated that water with New Land parcels (because flood water does not become available for diversion unless all demands for water under natural flow decree rights have been satisfied).

Average expected annual water deliveries associated with each of the existing options for decree and storage water rights were estimated for each water card offered (and for all water cards offered by each willing seller) using the yield analysis tool described above subject to the following additional adjustments.

- Average days available by decreed date of priority were adjusted to consider a full 245-day irrigation season along the mainstem Walker River (i.e., where most of the water cards under option as of June 2009 are served) based on USBWC summary data for decreed right priorities served for the most recent 25 years for which data were available (i.e., 1978 through 1979 and 1983 through 2005). One cannot, of course, simply assume that there is sufficient water to serve all priorities equal or senior to the priority being served on any given day; yet over time, on

average, the frequency with which a given priority has been served provides a reasonable means for estimating how often that same priority is likely to be served in the future.

- The average availability of storage water (both supplemental and New Land) was estimated at 70% of face value at the point of diversion based on the 35-year period 1970 through 2005 analyzed by the GBLW Study (i.e., 82.8% of face value), less 15% for assumed losses between the upstream storage reservoirs and the existing point of diversion. (The assumed 15% loss factor was inferred from the reported apportionment data; it may or may not represent actual physical losses.)
- While associated flood water was included in individual option agreements where applicable, it was not considered in the current analysis because 1) flood waters do not appear anywhere on the individual water cards, and 2) the allocation of that water is controlled by WRID under separate state-issued certificates of appropriation.

Based on the above methodology, as of June 2009, the maximum face value of all optioned natural flow decree rights is approximately 21,200 af per season, with an expected average yield of approximately 9,740 af per season (i.e., 46% of maximum face value). When supplemental storage is included, the expected average yield increases to 10,700 af per season, or approximately 50% of maximum face value. Finally, with New Land storage water included, maximum face value increases to approximately 22,050 af per season, while total expected average yield increases to about 11,300 af per season, or roughly 51% of the maximum face value across all cards and water types combined. Thus, based on the 31 water cards under option as of June 2009, the average expected yield relative to maximum face value for all composite water rights would be slightly more than 50% on average, with an expected range for individual water cards of 33 to 64%. (Discussions with potential willing sellers are ongoing, and it is possible that additional water card options will be entered into prior to the public release of the Draft EIS, in which case this analysis will be updated as necessary prior to completion of the Final EIS.)

Relationship between Project Funding and Increased Inflow

Alternative 1 (Proposed Project)

The following information and assumptions were used to estimate how much additional water might reach Walker Lake on average if Acquisition Program funding under Alternative 1 were limited to existing funding of $56 million.

- Approximately 10% of acquisition funds would not be available for payments directly to willing sellers but instead would be reserved for transactional support activities and other related costs such as title research, appraisals, insurance, and other due diligence activities.
- Acquired surface water rights would yield, on average, approximately 51% of their maximum face value across all types and priorities at existing points of diversion based on analysis of more than 30 provisional water cards currently under option (Appendix 3A) and excluding up to 7,000 af/yr of geothermal groundwater under option.
- Average unit acquisition costs are based on the negotiated offer prices (all subject to appraisal) described in public summaries of recorded provisional water card option agreements.
- The NSE and the U.S. District Court would allow the transfer of *up to* the full amount of the available water associated with acquired water rights (i.e., the average amount of water diverted per irrigated, water righted acre) as described in the full transfer scenario in Chapter3, Water Resources.
- Various estimated physical losses would occur between the existing points of diversion and Walker Lake (see Chapter 3, Water Resources).

As of June 2009, the University had secured options to acquire land, water appurtenant to the land, and related interests that involve up to 43.6 cfs of natural flow decree rights and up to 2,220 af of storage water rights at an aggregate negotiated cost of approximately $46.2 million (see Appendix 2A, Acquired Options). This total excludes, for the moment, the potential acquisition of rights and interests in geothermal effluent, and results in a blended average direct acquisition cost of approximately $2,100/af of maximum face value. (In order to avoid understating the potential impacts of the Acquisition Program, the impact assessment for irrigated lands in this Draft EIS assumes that the Homestretch Geothermal option will not be implemented.) If exercised in full, the current water card options are expected to yield, on average, approximately 11,300 af/yr of water at existing points of diversion, which equates to an average expected "wet water" cost of about $4,100/af.

From the above estimates it can be inferred that $50.4 million in direct acquisition funding (i.e., $56 million less 10% per the assumptions outlined above) would yield, on average, approximately 12,300 af/year at existing points of diversion. Based on the upstream analysis described in Chapter 3, Water Resources, this estimate would, in turn, result in approximately 7,500 af/yr of additional inflow at Walker Lake, on average, under the full transfer scenario. Of note, these values are approximately 3% greater than the comparable Administrative Draft EIS estimates of 11,900 af/year and 7,300 af/year because of the subsequent completion of several additional water card options and the inclusion of

information from those options. To ensure that this Draft EIS does not overstate potential beneficial impacts nor understate potential adverse impacts, the original existing funding estimates of 11,900 af/year in expected average yield and 7,300 af/year of increased average inflows will be used.

An alternative basis for estimating increased Walker Lake inflows under existing funding would be to limit changes to acquired natural flow rights to a consumptive use component, with changes to storage rights based on the full amount of the water right acquired, less an amount needed to keep ditch systems whole. Using the average acquisition cost assumptions noted above, it is estimated that existing funds would allow for the acquisition of natural flow water rights from approximately 3,876 decree acres, along with primary storage rights from approximately 561 New Land acres. If the average annual consumptive use rate for irrigated lands is 2.77 af/acre across all three subareas (see Chapter 3, Water Resources), and if a 20% loss rate or ditch system charge (Tyler et al. 2009, in UNR-DRI studies) is applied to New Land storage water rights with a weighted-average face-value allocation of 1.66 af/acre (the current average for New Lands based on existing water card options), Alternative 1 would be expected to secure for transfer approximately 11,500 af/year at existing points of diversion. This estimate is only slightly less than the yield-based estimate of 11,900 af/yr noted above, although the difference would be greater if flood waters were included in the latter. Finally, it should be noted that the UNR-DRI study cited above uses an assumed consumptive use rate of 3.6 af/acre for alfalfa and other leafy crops in the Mason Valley, and 3.3 af/acre in the Smith Valley. Using these values, and holding all other assumptions constant, Alternative 1 would be able to secure between 13,500 to 14,700 af/yr for transfer at existing points of diversion.

If geothermal effluent is included, average annual effluent water deliveries are assumed to equal the full amount offered (7,000 af/yr) at a point of delivery at or near the Wabuska gage, and the total direct cost for all options acquired through June 2008 would be approximately $64.1 million, or about $13.7 million more than the $50.4 million assumed to be available under existing funding for direct payments to willing sellers. In this case, the existing water card options would not be exercised in full, or additional acquisition funds would have to be secured; however, the permanent purchase of geothermal rights (offered at just under $12 million if those rights are exercised in full) would not take place until the pending pilot project has concluded some 5 to 7 years hence. Within the bounds of existing funding, if geothermal effluent is included, average acquisition costs would equate to approximately $3,500 per af at existing points of diversion or delivery based on an average composite yield of approximately 14,900 af/yr.

The upstream analysis in Chapter 3, Water Resources, indicates that approximately 82,000 af/yr would need to be acquired to deliver additional average inflows of 50,000 af/yr at Walker Lake under the full transfer scenario.

Applying the relationship between funding levels and water acquisitions described above – and again excluding geothermal effluent from consideration for this purpose – suggests that up to $385 million in 2008 dollars (inclusive of the 10% set-aside assumed above) would be needed under Alternative 1 to purchase enough water to result in an average increase in Walker Lake inflow of 50,000 af/yr. Accordingly, a full funding amount of $385 million will be assumed. If, however, the transfer of water were to be restricted as in the 33% scenario described in Chapter 3, Water Resources, somewhat less than the average increase of 50,000 af/yr would reach Walker Lake unless other sources of water – e.g., geothermal groundwater effluent, or water conserved through efficiency investments – were included.

Alternative 2 (Leasing Alternative)

Under Alternative 2 (Leasing Alternative), the duration of increased inflow at Walker Lake using existing funding would depend on the cost of leasing water. Based on the effective costs of participating in the WRPT's 2008 land fallowing program, and the negotiated offer price for water purchased and delivered under the Homestretch Geothermal pilot project, annual lease costs under Alternative 2 were estimated to average approximately $200/af at existing points of diversion. With $56 million in current funding, less 10% as assumed above, approximately 250,000 af could be purchased at a one-time lease price of $200/af. As noted previously, the upstream analysis in Chapter 3, Water Resources, indicates that an estimated 82,000 af/yr would need to be acquired to deliver 50,000 af/yr to Walker Lake under the full transfer scenario, in which case current funding would only last for about 3 years. If the full funding amount calculated for Alternative 1 (i.e., up to $385 million, less 10% for related costs) were available, annual leasing sufficient to provide increased inflow averaging 50,000 af/yr could be sustained for approximately 20 years.

Alternative 3 (Efficiency Alternative)

Under the Efficiency Alternative, it is assumed that sufficient funding would be available to attain the estimated increase in water efficiency as defined in Chapter 3, Water Resources. The actual cost of Alternative 3 would depend on the measures and methods selected to attain such increases, but would likely include significant investments in conveyance infrastructure (e.g., lining or piping of earthen ditches and laterals that are not already lined or piped). As noted in Chapter 2, Alternatives, there is also considerable potential for generating conserved water by reducing crop ET while keeping irrigated lands in production by switching to low-water-use alternative crops; however, for the reasons explained therein such measures have not been included in the Draft EIS analysis.

Under the 2004 water conservation investment program funded by Reclamation at NDOW's Mason Valley WMA, a long-term "best efforts" commitment was made

to provide 2,500 to 3,500 af/yr of conserved water for conveyance to Walker Lake in approximately 3 out of 5 years running. This equates to a long-term average of 1,500 to 2,100 af/yr at a point of delivery (or discharge) at or near the Wabuska gage. If approximately 50% of this amount of savings can be reliably provided by NDOW over time, or if roughly half of the associated Mason Valley WMA conservation measures would be relevant to upstream irrigators, the program's $2.36 million capital cost equates to roughly $2,250 to 3,150 per af of water conserved expressed in 2004 dollars, or about $2,430 to $3,410 per af in 2008 dollars using a 2% annual price escalator.

Using the above prices, $50.4 million in existing funds (i.e., $56 million less 10%) would allow for acquisition of 14,800 to 20,700 af/yr of conserved water on average at existing points of diversion. Applying the upper end of this price range to the upper-bound estimate for conserved water (without crop switching) of 102,000 af/yr at existing points of diversion (see Chapter 3, Water Resources), a total Alternative 3 investment cost of approximately $348 million can be inferred. Because Alternative 3 as analyzed would only provide approximately 32,000 af/yr of increased Walker Lake inflow if the water conserved upstream was fully transferrable, and because annual maintenance costs have not been included, the effective full costs of Alternative 3 are expected to be substantially greater than $348 million, particularly if crop switching or other measures were implemented (i.e., to reach the 50,000 af/yr increased inflow objective at Walker Lake). If the same ratio of water conserved upstream to increased inflow at Walker Lake applies to water conserved within the limits of existing funding, and if all water conserved upstream is fully transferrable, then approximately 4,600 to 6,500 af/yr of additional inflow could be provided with existing funds.

References

Tyler, Scott, C. Hatch, B. Rawat. 2009. Project F: Development of a Decision Support Tool in Support of Water Right Acquisitions in the Walker River Basin. Use of Fiber Optic Temperature Sensing for Water Resource Management in the Walker Basin. In Restoration of a Desert Lake in an Agriculturally Dominated Watershed: The Walker Lake Basin. M. Collopy and J. Thomas, Project Directors. Prepared for Desert Research Institute and Nevada System of Higher Education.

Yardas, D. 2007. Great Basin Land & Water Study: Issues and Opportunities for Acquiring Water from Willing Sellers to Increase Walker Lake Inflows. April. Great Basin Land Water, Truckee, CA. Submitted to the Natural Resource Conservation Service, U.S. Department of Agriculture, Reno, Nevada, Grant Agreement No. 68-9327-5-08.

Appendix 3A Water Resources

Introduction

This appendix describes the affected environment for water resources in the study area and the potential impacts on water resources that would result from the Proposed Project and other alternatives. The quantitative methods used to assess potential impacts are described. Results are presented only for the quantitative portions of the analysis, including estimates of instream losses of acquired water, reduction in groundwater recharge, reduction in irrigated land, increase in lake elevation, and reduction in lake total dissolved solids (TDS) concentration. See Chapter 3, Water Resources, for a complete discussion of qualitative and quantitative impacts.

Sources of Information

The key sources of data and information used in the preparation of this Appendix are listed below by topic. Full references can be found in Chapter 17, References.

- **Surface water diversions:** 1931-1991 data from a Nevada Division of Water Planning (NDWP) summary of surface water irrigation diversions (Pahl 2000), and 1992-2007 data received from Jim Shaw, Walker River Federal Watermaster (pers. comm. 2008).
- **Groundwater pumping:** Estimated annual groundwater pumping for 1994-2004 (Gallagher 2006).
- **Groundwater levels:** data collected by Nevada Division of Water Resources (NDWR), http://water.nv.gov/well%20net/download_data.cfm (Nevada Division of Water Resources 2009).
- **Evapotranspiration rates**: Communication with Kip Allander and Tom Lopes of U.S. Geological Survey (USGS) regarding net evapotranspiration (ET) in the Walker River Basin (Allander pers. comm. 2008a and Lopes pers. comm. 2008), USGS report 2005-5288 (Maurer et al. 2006) on ET in the Carson Valley, and information on ET rates for a variety of crops (Food and Agricultural Organization 1986).
- **Irrigated acres:** Appendix A (Desert Research Institute 2006) of the Great Basin Land and Water Study (Yardas 2007). This appendix also includes estimates of combined riparian and wetland acres.
- **River flows:** USGS flow data from multiple gages (U.S. Geological Survey 2008a).
- **Groundwater-surface water interaction:** hydrologic modeling of Smith and Mason Valleys (Myers 2001a and 2001b).
- **Walker Lake water balance and TDS:** USGS Walker Lake budget fact sheet (Thomas 1995), water balance spreadsheet from Randy Pahl (Pahl

pers. comm. 2008), USGS bathymetry data (Lopes and Smith 2007, Appendix A), historic Walker Lake elevation and TDS concentration data compiled by USGS (Allander pers. comm. 2008b), preliminary data from the USGS quarterly report to U.S. Bureau of Reclamation (Reclamation) (Lopes 2009), and total maximum daily load (TMDL) for Walker Lake TDS (Nevada Division of Environmental Protection 2005a).

Affected Environment

This section describes the Affected Environment related to water resources in the study area. The federal, state, and local regulations relevant to water resources in the study area are described in Appendix 1B of the Draft EIS**.**

The Walker River Basin is approximately 4,050 square miles and encompasses parts of California and Nevada; approximately 1,002 square miles of the basin are in California (Lopes and Smith 2007). The river and its watershed originate in the eastern Sierra Nevada and terminate at Walker Lake.

Most precipitation in the basin occurs as snow in the Sierra Nevada. Snowmelt from the Sierra Nevada and other ranges flows down the East Walker River and the West Walker River, which merge into the mainstem Walker River in Mason Valley, Nevada. The river continues flowing downstream into the northern end of Walker Lake. Walker Lake is bounded on the west by the Wassuk Range and on the east by the Gillis Range.

The study area for the water resources analysis incorporates five key hydrologic areas in the Walker River Basin. For the purposes of the Draft EIS water resources analysis, the boundaries of these areas are defined as follows using USGS gage locations (Figure 3A-1).

- East Walker reach
  - Upstream: East Walker River at the California-Nevada border. Flow measured at USGS gage 10293000, East Walker River downstream of Bridgeport Reservoir (Bridgeport gage).
  - Downstream: USGS gage 10293500, East Walker River upstream of Strosnider Ditch (now called Pitchfork-Day Ditch) near Mason (Strosnider gage).
- Smith Valley reach
  - Upstream: USGS gage 10297500, West Walker River at Hoye Bridge near Wellington (Hoye gage).
  - Downstream: USGS gage 10300000, West Walker River near Hudson (Hudson gage).

Walker Lake to:	River Miles
Schurz Gage	13.5
Three Gages	21.7
Weber Dam	24.3
Wabuska Gage	45.6
Confluence	67.5
Strosnider Gage	81.4
Hudson Gage	77.7
Hoye Bridge Gage	99.0
Bridgeport Gage	138.5

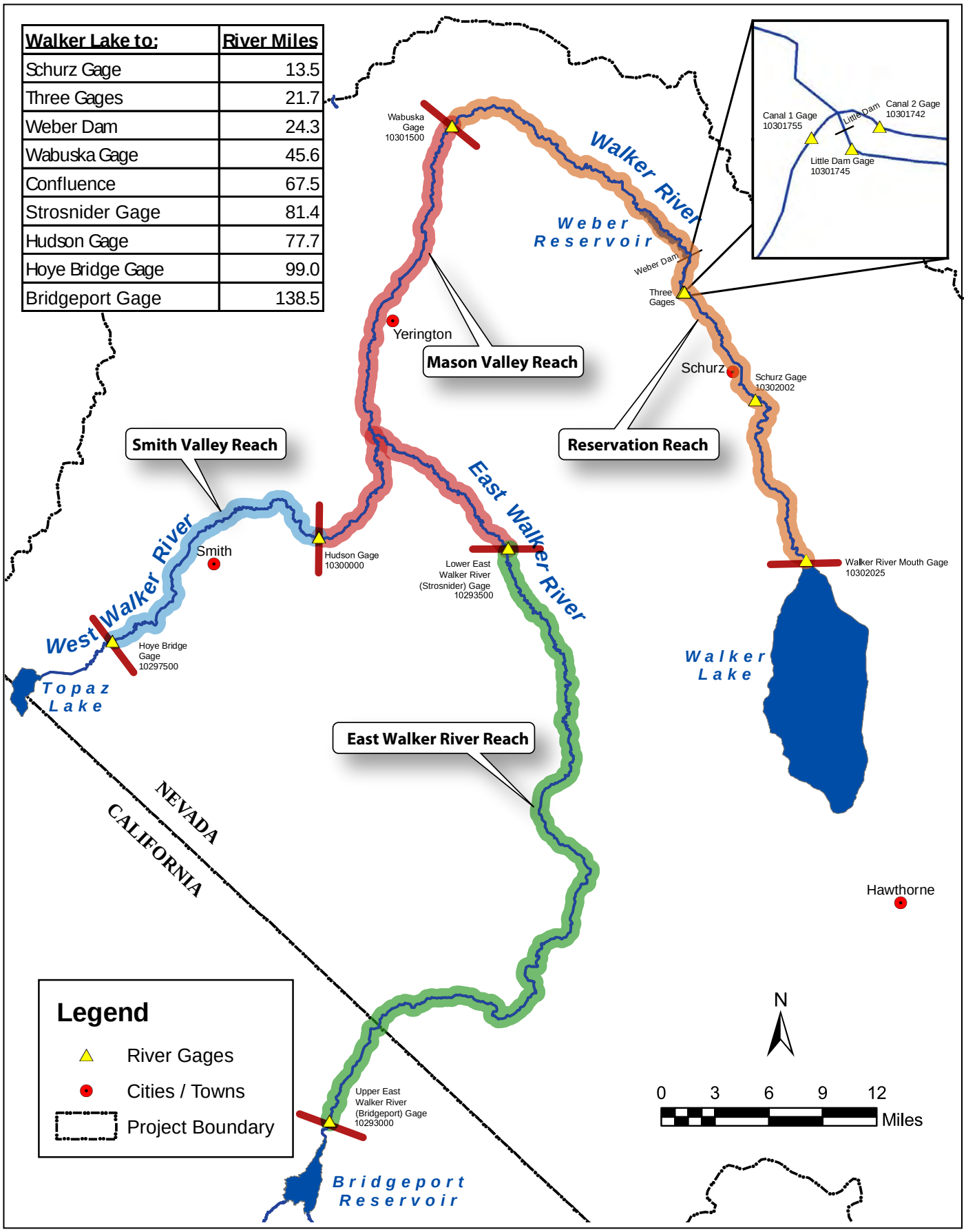

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Figure 3A-1
Walker River Basin
River Gages and Reaches

- Mason Valley reach
  - Upstream: USGS gages 10293500 (Strosnider) and 10300000 (Hudson gage).
  - Downstream: USGS gage 10301500, Walker River near Wabuska (Wabuska gage).
- Reservation reach
  - Upstream: USGS gage 10301500, Walker River near Wabuska.
  - Downstream: USGS gage 10302025, Walker River near mouth at Walker Lake.
- Walker Lake
  - USGS gage 10288500, Walker Lake near Hawthorne.

In this Appendix, the term East Walker area includes the East Walker reach and all flatlands along the East Walker River and Sweetwater Creek between the California border and Mason Valley. In addition, the three most upstream reaches (East Walker reach, Smith Valley reach, and Mason Valley reach) are referred to collectively as *upstream of Wabuska*. Water resources upstream of the study area are not expected to be affected by the Proposed Project or other alternatives.

The Affected Environment describes the water resources within the study area that would be affected by the Proposed Project and other alternatives. The discussion focuses on surface water, groundwater, the water balance for the Walker River system upstream of Wabuska, and water quality. Flows into and through the Reservation reach (including losses) are discussed in the surface water section that follows; and the water balance for Walker Lake is described under Walker Lake Analysis in the Environmental Consequences section of Chapter 3, Water Resources.

Surface Water

Key surface water topics discussed below include Walker Lake water surface elevations, Walker River flow both above and below Wabuska, and surface water diversions.

Walker Lake Water Surface Elevation

The volume of water in Walker Lake has a direct relation to water surface elevation (elevation) and surface area. This relation has been well defined by UGSG (Lopes and Smith 2007, Appendix A). Surface area affects the volume of water that leaves the lake through evaporation, and changes in lake elevation expose or cover portions of the lake bed, which can affect resources addressed in

other chapters of the Draft EIS, such as recreation and air quality. In addition, lake volume has a strong influence on water quality.

Over millennia, Walker Lake has fluctuated well above and below the present lake elevation as a result of climate fluctuation and changes in the course of the Walker River. About 4,700 years ago the lake filled quickly after having been dry or very low for at least 8,000 years (Benson 1988, Bradbury et al. 1989). During the past 3,500 years, lake elevation may have fluctuated between about 3,900 and 4,100 feet (Adams 2007**,** Sharpe et al. 2008).

Water surface elevation in Walker Lake has been on a declining trend since the late 1800s when the diversion of water to irrigate agricultural crops began in the Walker River Basin. In 1882, the lake elevation was estimated to be 4,083 feet (Russell 1885, Allander pers. comm. 2008b), but it has since dropped substantially and, as of July 2008 was at approximately 3,933 feet (preliminary value Lopes 2008a). This represents an overall decrease of 150 feet over 126 years, an average decline of about 1.2 feet per year (Figure 3A-2). With the drop in lake elevation, the concentration of TDS has increased (see Walker Lake Water Quality, Total Dissolved Solids, below).

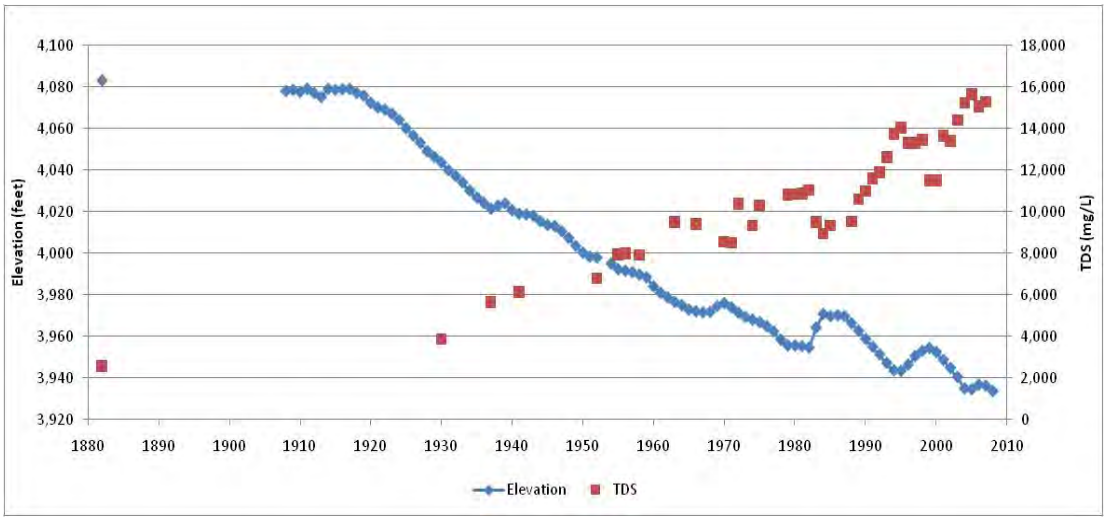


Figure 3A-2. Walker Lake Water Surface Elevation and Concentration of Total Dissolved Solids (TDS) since 1880

Volume of Walker Lake is dependent on inflow from Walker River, groundwater inflow, local surface water inflow, precipitation, and evaporation. The volume of water associated with evaporation and direct precipitation is largely dependent on the surface area. Groundwater inflow may also change in response to change in lake elevation; for example, as lake elevation drops, there is a steeper gradient from the groundwater aquifer to the lake. However, groundwater inflow is understood to be relatively small (less than 15%) compared to Walker River inflow and much of the groundwater inflow may be derived from the river

(Thomas 1995). The net change in groundwater inflow to the lake in response to river flow is uncertain because increased river flow would augment the aquifer, but higher lake elevation could reduce the gradient from the aquifer to the lake.

River Flow

The USGS has measured flows at multiple locations in the Walker River Basin (Table 3A-1). River flow is a major factor in Walker Lake water budget and influences habitat conditions. Change in river flow from upstream to downstream ends of a reach indicates the potential magnitude of accretions and depletions.

Three types of flow are presented in this section: inflow to the study area, daily flow, and average flow. First, inflow to the study area is presented to show the total amount of surface water entering the system. The daily flows for wet and dry years are presented for several locations in the study area to show the seasonal differences between these types of years. Finally, average monthly and annual flows are presented to provide a basis for understanding the system over the long term. In addition, average annual values are used in the water balance upstream of Wabuska, and for the flow losses downstream of Wabuska (presented later in this section).

Table 3A-1. USGS Flow and Storage Gage Locations in the Walker Basin at or downstream of Bridgeport and Topaz Reservoirs (Gage Locations Important for the Acquisition Program Assessment are Highlighted)

Gage Number	Full USGS Site Name (Short Site Name for EIS in Parenthesis)	Period of Record
West Walker		
10297000	Topaz Lake near Topaz, CA	1921-present
10297500	W Walker River at Hoye Bridge near Wellington, NV (Hoye Bridge Gage)	1910-present[a]
10298000	Saroni Canal near Wellington, NV	1920-1923
10298500	W Walker River near Wellington, NV	1918-1924
10299100	Desert Creek near Wellington, NV	1964-present
10300000	W Walker River near Hudson, NV (Hudson Gage)	1914-2008
East Walker		
10292500	Bridgeport Reservoir, CA	1971-present
10293000	E Walker River downstream of Bridgeport Reservoir, CA (Bridgeport Gage)	1921-present
10293048	Sweetwater Creek at Highway338 above Mouth near Bridgeport, CA	2005-present
10293050	E Walker River below Sweetwater Creek near Bridgeport, CA	1974-1982
10293500	E Walker River above Strosnider Ditch near Mason, NV (Strosnider Gage)	1947-present

Gage Number	Full USGS Site Name (Short Site Name for EIS in Parenthesis)	Period of Record
10294000	E Walker River above Mason Valley near Mason, NV	1916-1924
10294500	E Walker River near Yerington, NV	1902-1908
10295000	E Walker River near Mason, NV	1910-1916
Mainstem Walker		
10300600	Walker River near Mason, NV	1974-1984
10301000	Walker River at Mason, NV	1910-1922
10301500	Walker River near Wabuska, NV (Wabuska Gage)	1902-present
10301600	Walker River above Weber Reservoir near Schurz, NV	1977-present[b]
10301700	Weber Reservoir near Schurz, NV	1995-present
10301742	Canal No. 2 above Little Dam near Schurz, NV (Canal 2 Gage)	1995-present
10301745	Walker River above[c] Little Dam near Schurz, NV	1995-present
10301755	Canal No. 1 below[c] Little Dam near Schurz, NV (Canal 1 Gage)	1995-present
10301900	Canal 2 at End of Lined Ditch below Schurz, NV	1998-2001
10302000	Walker River at Schurz, NV	1913-1933
10302002	Walker River at Lateral 2-A Siphon near Schurz, NV (Schurz Gage)	1994-present
10302010	Reese River Canyon near Schurz, NV	1966-1977
10302025	Walker River near Mouth at Walker Lake, NV	2004-2006
10288500	Walker Lake near Hawthorne, NV	2004 – present

[a] Some periods of records contain large gaps. “Present” indicates that data extend at least into 2008.

[b] Flow measurements at this gage can be inaccurate because flow sometimes bypasses the gage (Allander pers. comm. July 18, 2008)

[c] Site names are based on the location of the gage houses, not the location of the flow being measured. Canal 1 diverts water above Little Dam and gage 10301745 measures flow in the river downstream of Little Dam (Allander pers. comm. July 30, 2008).

Inflow to Study Area

Inflow at the upstream end of the East Walker reach is measured at the USGS gage downstream from Bridgeport Reservoir and inflow at the upstream end of the Smith Valley reach is measured at the USGS gage at Hoye Bridge. Because the Proposed Project and alternatives assume no major changes in reservoir operations upstream of these sites, the sum of the flows at these two gages provides a good estimate of the historic variability in flow entering the potentially affected valleys (Figure 3A-3). Between water years 1960 and 2007, inflow to the two valleys ranged between about 100,000 and 800,000 af/yr.

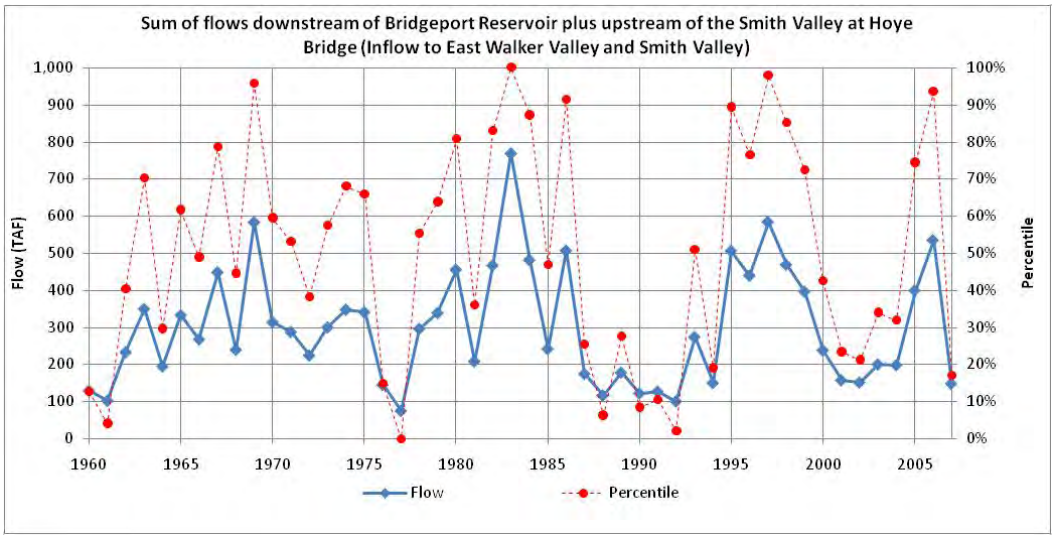


Figure 3A-3. Flow Entering the Study Area for Water Years 1960–2007, with Percentiles Shown to Characterize the Extremity of Each Inflow Value

Daily Flows

To illustrate the flow patterns for a wet year and a dry year, daily flows for water year 1997 (98th percentile) and water year 2007 (17th percentile) are shown in Figures 3A-4 through 3A-7. These figures show flows at the upstream and downstream ends of the East Walker, Smith Valley, and Mason Valley reaches.

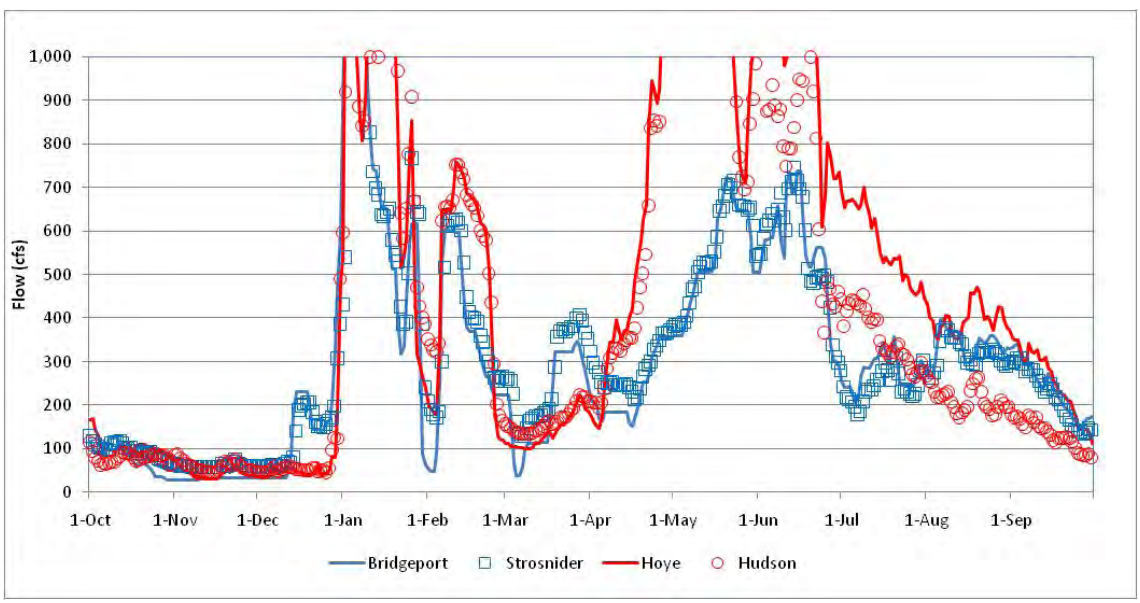


Figure 3A-4. Daily Flow in the Smith Valley Reach and along the East Walker Reach during a Wet Water Year, 1997

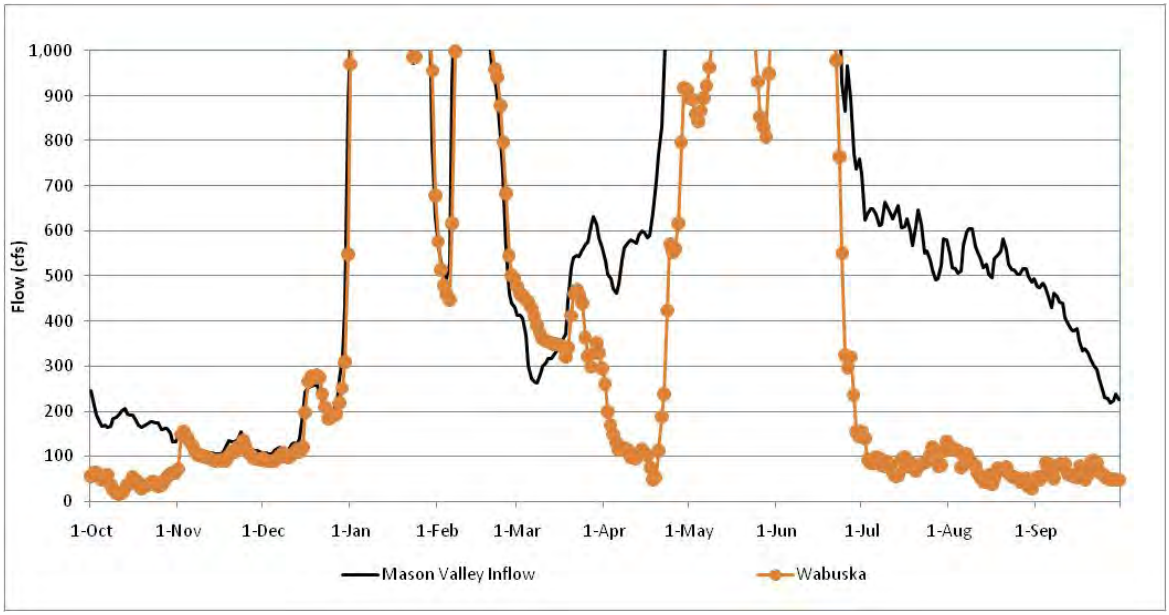


Figure 3A-5. Daily Flow at the Upstream and Downstream Ends of the Mason Valley Reach during a Wet Water Year, 1997

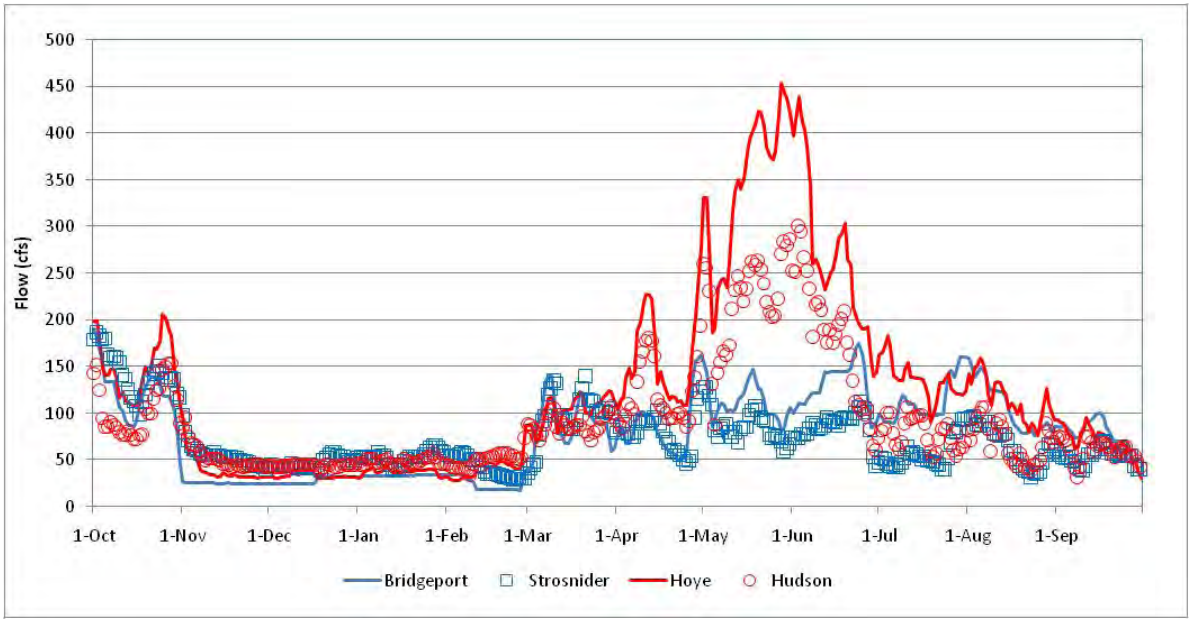


Figure 3A-6. Daily Flow in the Smith Valley Reach and along the East Walker Reach during a Dry Water Year, 2007

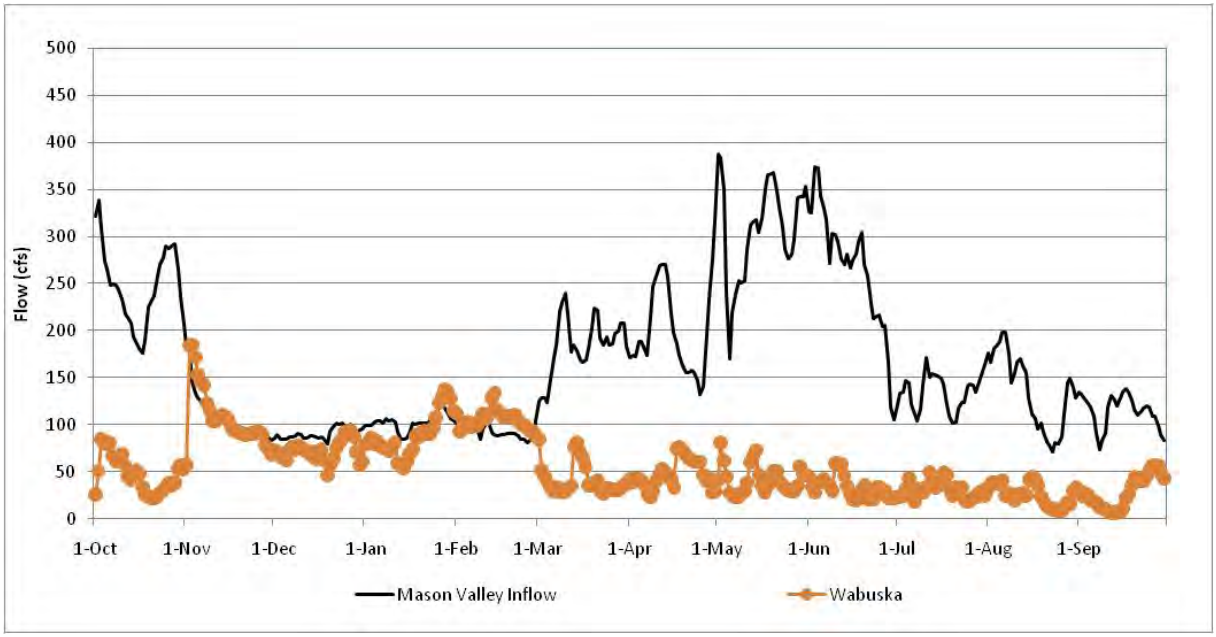


Figure 3A-7. Daily Flow at the Upstream and Downstream Ends of the Mason Valley Reach during a Dry Water Year, 2007

During the wet year of 1997, winter flows at the downstream ends of the East Walker and Smith Valley reaches, measured at Strosnider and Hudson gages, respectively, were similar to but slightly greater than the flows entering these reaches at the Bridgeport and Hoye gages, respectively. The increases may be attributable to surface runoff, tributary inflow, or gains from groundwater accretions (Figure 3A-4). Winter flows at the downstream end of Mason Valley were generally very similar to the flows at the upstream end of Mason Valley during 1997 (Figure 3A-5). However, during January, peak flows entering Mason Valley were almost 6,000 cfs, but this peak was dissipated (either by leaving the river channel or by becoming more spread out along the length of the river) and peak flows leaving the valley only reached 2,500 cfs. Once the irrigation season began, flows at the downstream ends of Smith and Mason Valleys, at the Hudson and Wabuska gages, respectively, were noticeably lower than the flows at the upstream ends, but the decrease in flow along the East Walker River was not as noticeable.

During the dry year of 2007, there were no rainy-season peak runoff events (Figures 3A-6 and 3A-7) and peak flows (450 cfs entering Smith Valley) did not occur until the irrigation season. Despite the relatively dry hydrology, winter flows at the downstream ends of the East Walker reach and the Smith Valley reach were slightly greater than the upstream flows. Because this increase in flows was still present during this relatively dry year, there is an increased likelihood that the source of the local inflow is groundwater. Winter flows at the downstream end of Mason Valley were generally very similar or less than the

flows at the upstream end of Mason Valley during 1997 (Figure 3A-5). Once the irrigation season began, flows at the downstream ends of all valleys were noticeably lower than the flows at the upstream ends of the valleys.

Average Flows Upstream of Wabuska

To evaluate flows through the valleys, monthly average flows measured at the upstream and downstream ends of the East Walker, Smith Valley, and Mason Valley reaches were compared. The evaluation focused on 1981 through 2007 when supplemental groundwater pumping was more likely to be greater than past periods (Myers 2001b pg 2). At two locations (downstream ends of the East Walker and Smith Valley reaches), flow was not measured from October through March during water years 1979 through 1994. As a result, the average values for these months are based on a smaller number of years.

Peak flows generally occur during June in response to spring snow melt (Figure 3A-8). Average June flow downstream of Bridgeport Reservoir was about 350 cfs, half of the approximately 700 cfs at the upstream end of the Smith Valley reach (Hoye gage). Flow at Wabuska, averaged 500 cfs for June, or half of the flow (1,050 cfs) entering the East Walker and Smith Valley reaches.

The pattern of flow losses and gains during the rainy season (approximately November through April) and irrigation season is similar to those described above for the 1997 and 2007 daily flows. There were slight increases in flow during the wet season along the East Walker and Smith Valley reaches and slight decreases in flow during the wet season in the Mason Valley reach. During the irrigation season, flow decreased noticeably in the Smith and Mason Valleys, but not substantially along the East Walker reach.

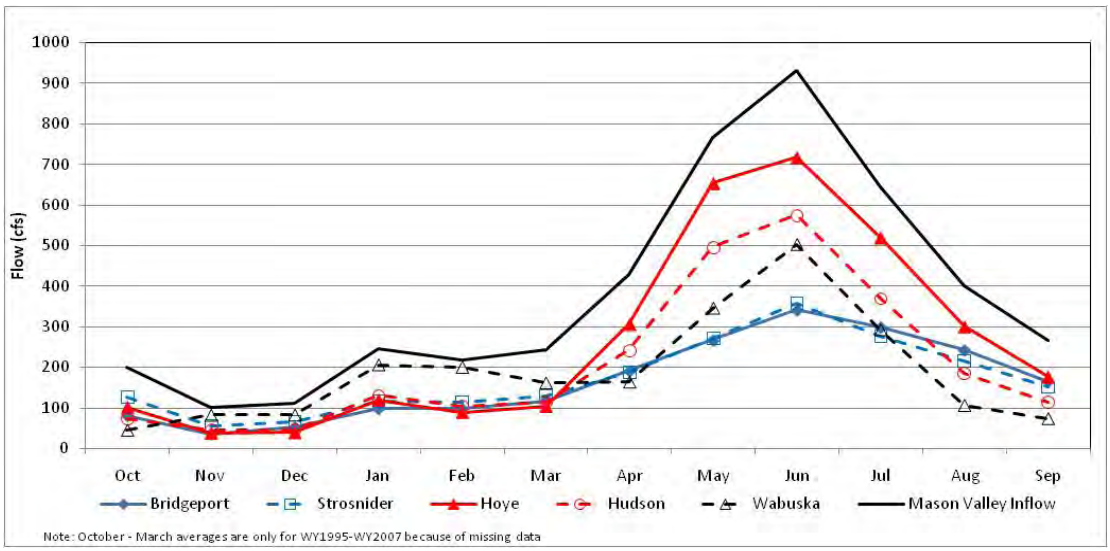


Figure 3A-8. Average Monthly Flows in the Walker River Basin, 1981-2007

Average annual flow volumes at each of these locations are as follows:

- East Walker River downstream from Bridgeport Reservoir: 118,000 af
- East Walker River upstream of Strosnider Ditch: 125,000 af
- West Walker River at Hoye Bridge (upstream Smith Valley): 191,000 af
- West Walker River near Hudson (downstream Smith Valley): 151,000 af
- Walker River near Wabuska (downstream Mason Valley): 139,000 af

The averages are based on data from water years 1981 through 2007 (except for the Strosnider and Hudson gages). The sum of these average annual inflows to the East and West Walker Rivers is 309,000 af. At Wabuska, Walker River annual average flows are 170,000 af less, or about 45% of the total inflow.

Average Flows in Reservation Reach

Downstream from Wabuska (USGS gage 10301500), the Walker River flows through Weber Reservoir, then downstream to Canals 1 and 2, located just upstream of Little Dam on the Walker River Indian Reservation, approximately 22 miles upstream of Walker Lake. Upstream of Weber Reservoir and downstream from Schurz, the river is braided. Flow measurements just upstream of Weber Reservoir are unreliable because the channel is unstable, beaver structures can affect the channel depth, and some of the flow can bypass the gaged channel, sometimes as subsurface flow (Allander, pers. comm. 2008b).

The USGS has measured flow at the Wabuska gage since 1902. In 1995 flow began to be measured at Canal 1, Canal 2, and in the Walker River at the lateral 2-A siphon near Schurz (Schurz gage). The Schurz gage, located approximately 13.5 miles upstream of the present-day lake, has the best relatively long-term measurement of river flow entering Walker Lake. Flow has been measured closer to the lake, but for shorter periods.

Figure 3A-9 shows the monthly flows measured at the Schurz gage. Between 1995 and 2008, the average annual flow was 109,000 af. Flows at this location have been highly variable, ranging from 0 cfs to more than 1,000 cfs, with the highest occurring in June. Figure 3A-10 shows the flow volumes measured annually and for the irrigation season from 1995 through 2007. This figure further illustrates the wide range of lake inflow values. Total flow at Schurz was more than 300,000 af in 1997, but less than 10,000 af/yr from 2001 through 2004. During 2007, flow at the Schurz gage was also low, 20,000 af, but not as low as it would have been without the Walker River Paiute Tribe (WRPT) fallowing program. The pattern of flows volumes for the irrigation season is similar to the annual pattern.

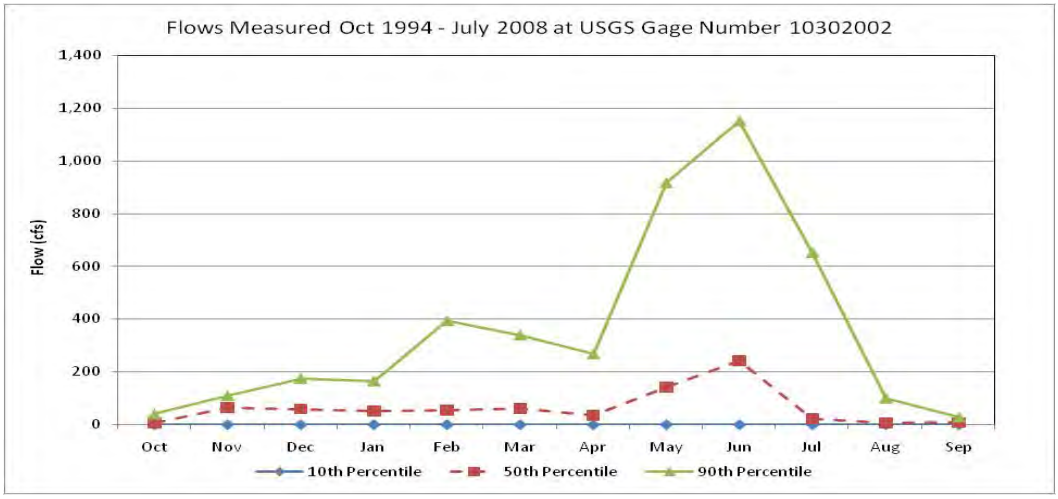


Figure 3A-9. Distribution of Monthly Average Flow in the Walker River near Schurz

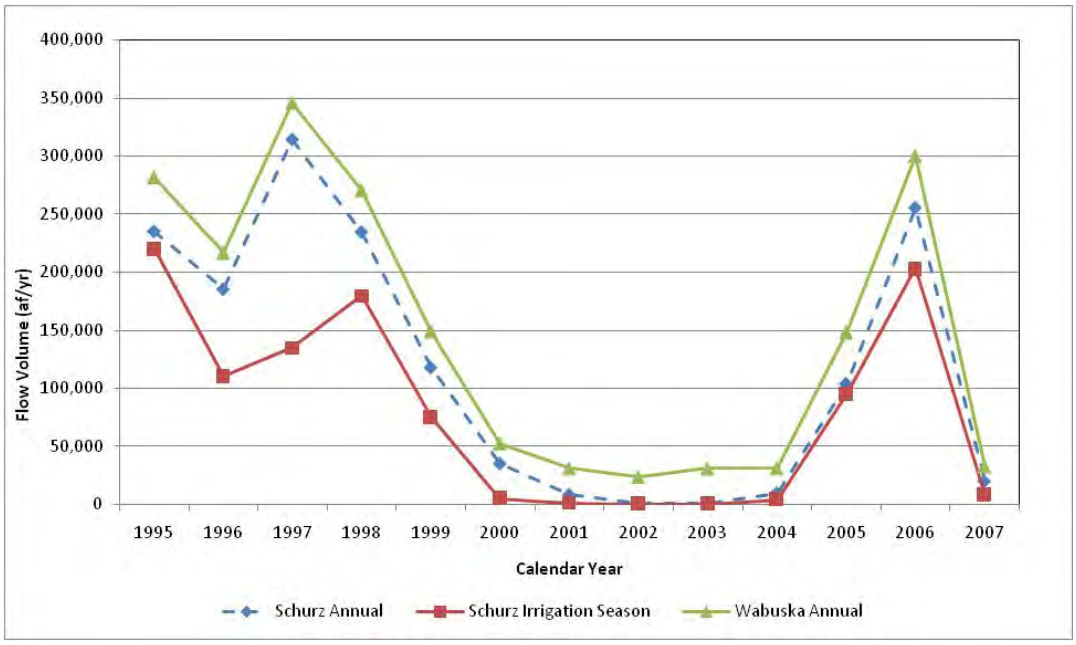


Figure 3A-10. Annual and Irrigation-Season Flow in the Walker River near Schurz Compared to Annual Flow at Wabuska.

Flow Loss in Reservation Reach

The riverine losses on the Reservation reach are of interest for the purposes of assessing the loss of any acquired flows. As described in Chapter 2, Alternatives, it is assumed that WRPT, BIA, and the University (or other implementing entities) would develop an agreement for the management of acquired water through the Reservation for delivery to Walker Lake. Therefore, the only reduction in volume of the acquired flow would be caused by loss to groundwater

or evapotranspiration. These losses are influenced by travel time, the width of the channel, and local groundwater pumping. Increases in flow caused by the acquisition of water would increase width, but decrease travel time. The presence of acquired water is not expected to change groundwater pumping on lands within the Walker River Indian Reservation.

Walker River flows losses between Wabuska and Walker Lake were evaluated for two subreaches of the Reservation reach: Wabuska to Schurz, and Schurz to Walker Lake.

Flow Loss between Wabuska and Schurz

To evaluate river losses between Wabuska and Schurz, inflows at the upstream end of this reach were compared to the flows at the downstream end. Flows at the upstream end include the flow at Wabuska plus the drawdown in Weber Reservoir storage (an increase in storage would reduce the inflow) as measured by USGS. Flows at the downstream end include flows measured in Canals 1 and 2 plus flow at Schurz as measured by USGS. The analysis was performed using data for water years to avoid unrealistic fluctuations caused by time lags between upstream and downstream flows and to avoid comparisons between the summer and winter. When a small number of years are evaluated, Weber Reservoir drawdown can have an effect on the results, although the effect of Weber Reservoir drawdown is relatively small compared to the annual inflow at Wabuska. Complete datasets were only available for water years 1998 through 2007.

The amount of water lost does not respond greatly to the amount of flow. Rather, river water losses are dependent on ET of riverine vegetation and infiltration to groundwater. These losses do not increase in direct proportion to river flows because there is a fixed amount of vegetation for ET and because the river width does not increase in direct proportion to river flows. As a result, the river loss volume is not highly variable from year to year (Figure 3A-11), indicating that an increase in flow may not incur a large increase in loss. However, the percent of flow lost does vary greatly, with higher percent losses occurring during the drier years (Figure 3A-12). Because these years contribute less to the filling of Walker Lake, these higher percents have less effect on lake volume than the lower percent losses that occur during the high flow years. For water years 1998 through 2007, 24% of the Wabuska flow disappeared before Schurz. The percentage of loss varied widely, from 4% in 1999 to 55% in 2002 (Figure 3A-12). The data suggest that in years of greater water availability, when annual river inflow is greater than 50,000 af, the loss is typically less than 10%.

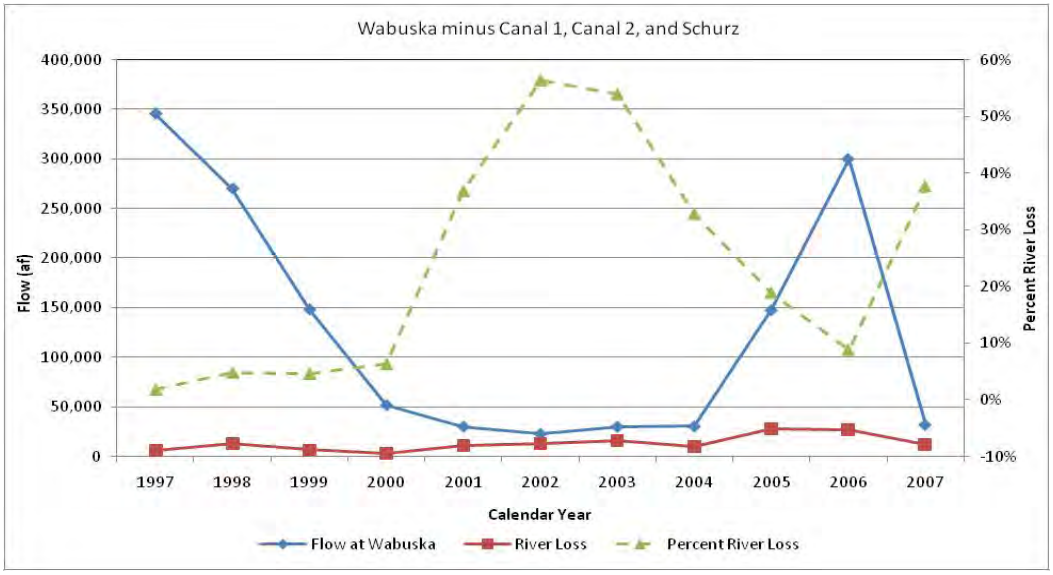


Figure 3A-11. Annual River Flow and Losses Measured between Wabuska and Schurz

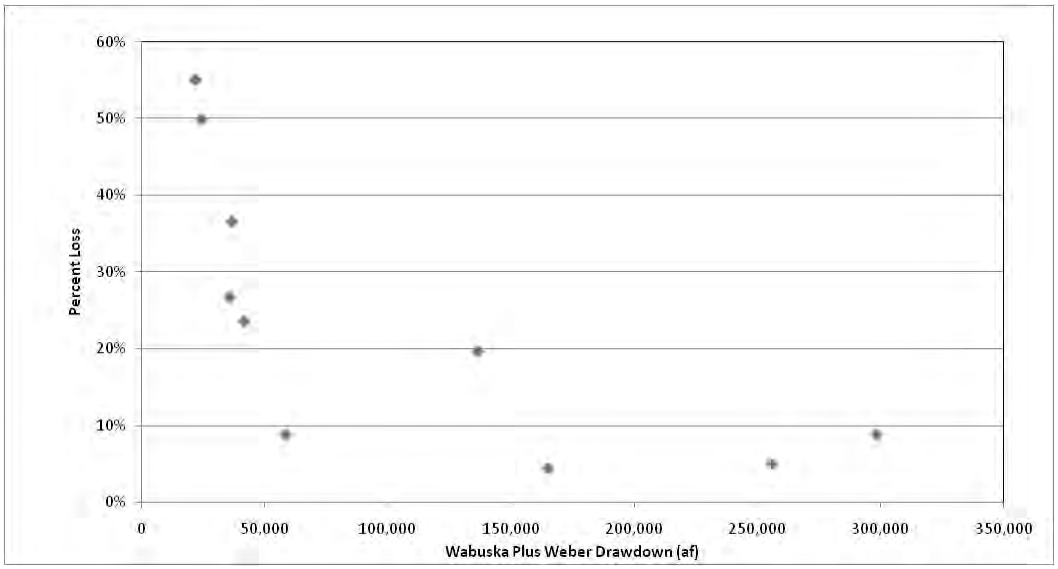


Figure 3A-12. Percent Flow Loss between Wabuska and Schurz in Relation to Reach Inflow for Water Years 1998 - 2007

The relationship between reach inflow and river loss from Wabuska to Schurz was also analyzed (Figure 3A-13). Average water year inflow to the Reservation reach (Wabuska plus Weber drawdown) was compared to the average riverine flow losses between Wabuska and Schurz for water years 1998-2007. The data indicate that as inflow increases, the volume lost may increase at a rate of approximately 4% of the reach inflow.

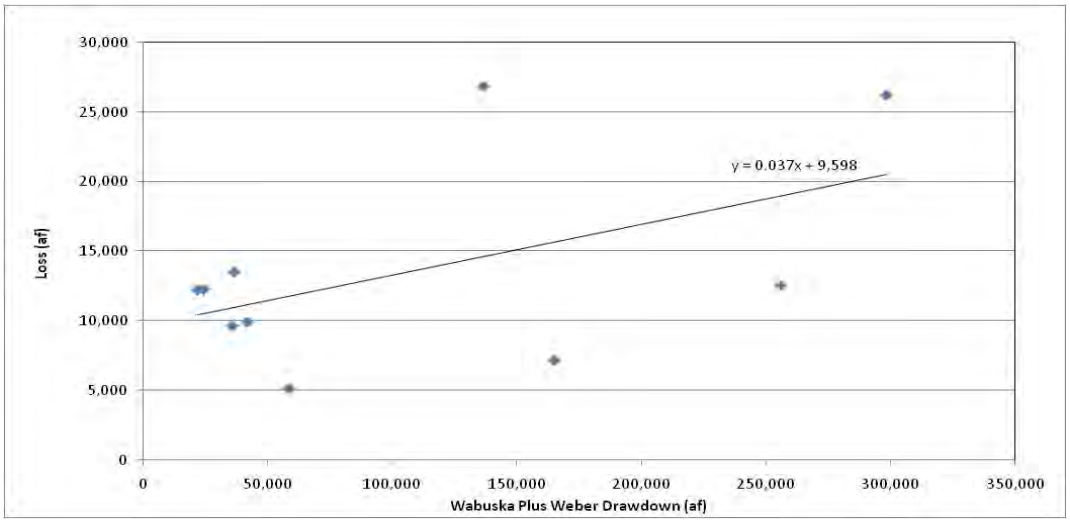


Figure 3A-13. Correlation between Annual Flow and Flow Loss between Wabuska and Schurz (Water Years 1998–2007)

Flow Loss between Schurz and Walker Lake

Flow losses in this reach are uncertain because of limited data and periods of no flow reaching Walker Lake. Losses may increase with increased flow as a result of increased ET or increased infiltration to groundwater. In this reach, some of the water infiltrating to groundwater likely flows subsurface into the lake, so some of the riverine losses may not be lost to Walker Lake.

During March 14, 2007 through September 27, 2007, Huffman and Carpenter measured flow intermittently near the Schurz gage and at Pelican Point, approximately 0.75 mile upstream of Walker Lake. The Pelican Point location was the most downstream location found for suitable flow measurements. Toward the end of the study, the Pelican Point site was dry. During March through June, when flow was present at Pelican Point, approximately 900 af (average of 4 cfs) out of 12,500 that flowed past the Schurz gage was lost. This represented approximately 7% of the inflow from Wabuska plus Weber Reservoir drawdown.

USGS measured flow intermittently between 1994 and 2007 and made a preliminary finding that little flow was lost between Schurz and the lake (Lopes 2007 p. 4). More intensive flow measurements in this reach have occurred for

relatively short periods. The USGS operated flow gage 10302025 at the mouth of the Walker River between October 2004 and May 2006. The USGS flow measurements at the mouth of the Walker River are useful because they cover more than one year. Figure 3A-14 shows the monthly flows and losses that were measured by the USGS between Schurz and the lake.

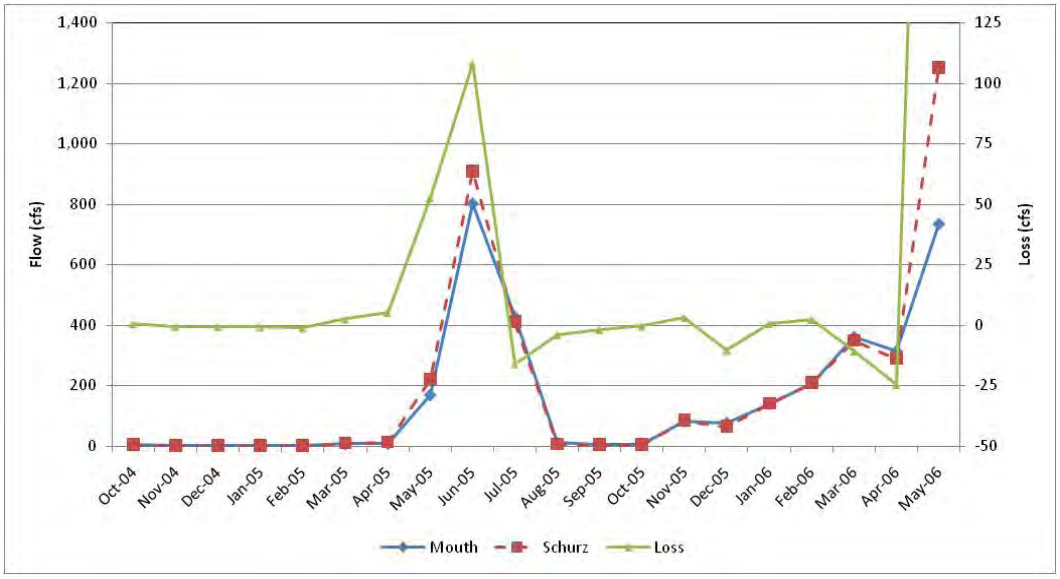


Figure 3A-14. Monthly Difference between Flows Measured at Schurz and the Mouth of the Walker River

Water year 2005 provides a useful example of potential flow losses, particularly because most of the flow occurred during the irrigation season when losses would be expected to be most similar to losses experienced by flow augmentation. During water year 2005, total flow loss between Schurz and the lake was measured as 8,600 af, 6% of the flow at Wabuska (plus Weber Reservoir drawdown). In contrast, for the first part of water year 2006, the loss was almost zero. The data indicate that the greatest losses from the river may occur as flow is increasing. When flows drop, however, the river may gain flow (e.g., July 2005, December 2005, and April 2006).

During water year 2005, most of the 8,600 af of lost water left the river through infiltration. Direct evaporation from the surface of the river is relatively small (probably less that 1,000 af) because of the relatively small surface area of the river (probably less than 150 acres for this reach). Once water infiltrates the substrate, it can then either be used by riparian and wetland vegetation or be pumped for irrigation. Water that remains in the aquifer may move through the substrate to the lake or head east out of the Walker Basin towards Double Springs (Lopes 2008a).

Surface Water Diversions for Irrigation

Surface water diversions provide an indication of how much water may be available for purchase. Surface water diversion data for the Walker River are collected by the USGS, WRID, and the federal water master. Data for 1931 through 1995 were compiled by NDWP (Pahl 2000). More recent data have been collected by the Federal Water Master and WRID. This analysis uses data from both sources.

The compiled diversions are summarized in Table 3A-2 for the period 1931 through 2007 as well as a subset reflecting more recent groundwater usage (1981 through 2007). These data exclude Walker River diversions in California, Antelope Valley, and the Walker River Indian Reservation.

The data indicate that total surface water diversions for the East Walker, Smith Valley, and Mason Valley reaches averaged about 225,000 af/yr for the period 1931-2007 with considerable annual variation. Minimum annual surface water diversion was about 57,000 af and the maximum was close to 366,000 af. Average diversions for the full period of record were a little larger than those for the more recent record. The biggest differences in diversions between the two time periods occurred in Smith Valley (10,000 af less) and Mason Valley (12,000 af less).

Table 3A-2. Summary of Walker River surface water diversions between 1931 and 2007

Year	Smith Valley Reach	East Walker Reach	Mason Valley Reach	Total [a]
1931-2007				
Minimum	14,400	6,800	35,035	57,245
Average	69,110	21,588	137,598	224,781
Maximum	119,142	37,394	219,412	365,560
1981-2007				
Minimum	14,400	7,125	35,719	57,245
Average	59,095	21,913	125,707	206,715
Maximum	117,147	37,394	202,924	344,992

This summary excludes diversions from streams tributary to the Walker River reaches.

[a] Only years with a full complement of data for each reach were included in the calculation. The calculation of minimum, average, and maximum values was based on totals for each year, not the reach components.

Surface water rights are divided into three major types:

- Decree rights are rights to divert natural river flow (i.e. flow without support from upstream storage)
- Storage rights are rights (allocated by WRID) to use water previously stored in upstream reservoirs (specifically Bridgeport and Topaz Lake Reservoirs), and
- Flood water rights are rights (allocated by WRID) to make use of natural river flow when there is excess or surplus water in the River (i.e., no unmet demand for decree rights)

Myers (2001c) differentiated diversion data obtained from NDWP into water right type (Table 3A-3). Of the total surface water diversions from 1931 to 1995 along the East Walker River, Smith Valley, and Mason Valley, approximately 60% were decree, 29% storage, and 11% flood. These percents varied by reach with the percent of decree water being as high as 81% (for the mainstem portion of Mason Valley) and as low as 43% (for Smith Valley). As a result, more of the Smith Valley diversions were storage diversions (38%) and flood water diversions (18%) compared to the other reaches.

Table 3A-3. Surface Water Diversions for 1931-1995 Categorized by Water Right Type

	Average Decree Diversion	Average Storage Diversion	Average Flood Water Diversion	Total
Acre-Feet Per Year				
East Walker	40,023	22,043	7,422	69,488
Mason Valley	55,076	9,975	3,195	68,246
Smith Valley	30,765	27,499	13,208	71,472
Tunnel Section	12,663	6,426	2,339	21,428
Total	138,527	65,943	26,164	230,634
Percent of Total for Region				
East Walker	58%	32%	11%	
Mason Valley	81%	15%	5%	
Smith Valley	43%	38%	18%	
Tunnel Section	59%	30%	11%	
Total	60%	29%	11%	

Source: Myers 2001c

BIA diverts water for agricultural purposes out of the Walker River at Canals 1 and 2 and delivers this water to 2,100 acres of Indian trust land within the Walker River Indian Irrigation Project. Canals 1 and 2 are located downstream from Weber Reservoir and immediately upstream of Little Dam. The USGS has collected flow data for these canals since 1995. The direct flow water right for the Walker River Indian Irrigation Project is 26.25 cfs diverted upon or above the Reservation for 180 days during the irrigation season, or about 9,400 af/year, which the federal Water Master administers at Wabuska. Additionally, for over 60 years, BIA has stored water in Weber Reservoir and used the stored water to regulate and deliver the direct flow water right. The federal claim for this use of the water stored and released from Weber Reservoir is pending in the Walker Decree proceeding. Capacity of Weber Reservoir is approximately 10,700 af.

During water years 1997 through 2006, annual diversions into Canals 1 and 2 averaged about 16,000 af. During 2007 and 2008, WRPT offered fallowing agreements to the landowners of the 2,100 acres in the Walker River Indian Irrigation Project, which were accepted by the landowners and approved by BIA. As such, BIA did not divert water through Canals 1 and 2 in CY 2007 and 2008; BIA established an operating plan for water releases from Weber Dam to Walker Lake in coordination with WRPT and other entities.

Land Coverage

Amounts of irrigated land and riparian and wetland vegetation in the study area are relevant to the upstream water balance presented later in this section. Total acreage in the valley floors is presented for context.

Acreage of Valley Floors

Acres of the flat portion of each valley indicate potential surface area of the aquifers and can be used to assess the relative magnitude of groundwater effects. USGS topographic maps were used with geographic information system (GIS) data to estimate the relatively flat areas of the East Walker area and Smith and Mason Valleys as:

- East Walker area including the valley of Sweetwater Creek – 26,000 acres
- Smith Valley – 81,000 acres
- Mason Valley – 114,000 acres

Acreage of Irrigated Land and Riparian/Wetland Vegetation

Vegetated land coverage can be used to estimate the consumptive use of irrigated lands and the incidental use of water by non-riverine riparian and wetland vegetation. The Desert Research Institute (DRI) has used GIS evaluation of remote sensing results to estimate the number of irrigated and riparian/wetland acres in Smith Valley, Mason Valley, the East Walker River between Mason Valley and the California border, and the region of the Walker River Indian Reservation between Wabuska and Walker Lake. (The DRI investigation also covered Antelope Valley, but because Antelope Valley is not expected to be affected by the action alternatives, it is not discussed further here.) The evaluation was based on six Landsat Thematic Mapper images taken during the late summer of 6 years between 1986 and 2002 (Desert Research Institute 2006). Fallow land and vegetation in urban areas were not included in the irrigated or riparian/wetland acres (Desert Research Institute 2006).

Irrigated acres in Mason Valley varied between about 30,000 and 39,500 acres, with an average of 35,000 acres (Table 3A-4). Irrigated acres in Smith Valley varied between about 13,500 and 19,500 acres, with an average of 17,500 acres. Irrigated acres along the East Walker River and at the Walker River Paiute Reservation were considerably less, with average values of about 4,000 acres and 2,500 acres, respectively. The combined irrigated acres ranged widely, between 62,300 and 46,200 acres, a very large difference of 16,100 acres.

In Mason and Smith Valleys, riparian/wetland acres were considerably less than irrigated acres, with average values of about 7,500 and 3,500 acres, respectively. Along the East Walker River, the average riparian/wetland acres were 3,000 acres and on the Walker River Indian Reservation, the average riparian/wetland acres were about 4,000 acres. The riparian/wetland area in Mason Valley and on the reservation are relatively large because they include portions of the Mason Valley Wildlife Management Area and the marsh areas upstream of Weber Reservoir and Walker Lake.

The UNR-DRI assessment of irrigated land for 2006-2007 (Bonnenfant et al. 2009) was not used in this analysis because the estimated irrigated acres were very similar to the values shown here and because there were no corresponding estimates of riparian/wetland area.

Table 3A-4. Estimated Acreage of Irrigated Land and Riparian/Wetland Land

	Estimated Irrigated Lands (acres)						
Region	1986	1992	1995	1998	2000	2002	Average
Mason Valley	35,853	29,963	33,412	37,503	39,459	33,641	34,972
Smith Valley	19,446	13,554	17,562	18,002	18,843	17,306	17,452
East Walker River	5,108	2,731	4,990	3,979	4,033	3,248	4,015
Reservation	2,495	2,245	2,574	2,847	2,815	2,155	2,522
	Estimated Riparian/Wetland Vegetation (acres)						
Mason Valley	10,707	5,828	7,518	7,912	6,507	6,129	7,434
Smith Valley	5,259	2,659	3,165	4,401	2,358	2,012	3,309
East Walker River	3,156	3,001	2,863	3,466	2,924	2,631	3,007
Reservation	6,075	2,890	4,613	4,476	3,918	3,045	4,170

Source: Desert Research Institute 2006, Appendix A

Acreage of Riverine Vegetation

The riparian/wetland acres were divided into riverine and non-riverine acres using GIS analysis of maps from the GAP program (U.S. Geological Survey National Gap Analysis Program 2004). Because most vegetation growing along the Walker River occurred within 1,000 feet of the river, it was assumed that vegetation within 1,000 feet of the river channel was dependent on shallow groundwater provided by the river. Riparian/wetland vegetation farther from the river was assumed to be dependent on irrigation, either directly or indirectly by being dependent on shallow groundwater maintained by irrigation. It was estimated that 88%, 33%, and 34% of the riparian/wetland vegetation within the East Walker Valley, Smith Valley, and Mason Valley, respectively is riverine (i.e. within 1,000 ft of the Walker River).

Groundwater

Key groundwater topics include hydrogeology, groundwater levels, groundwater pumping, and the river-groundwater connection.

Hydrogeology

Surface water is the primary source for groundwater in the Walker River Basin. Groundwater inflow occurs via infiltration into alluvial aquifers from both water bodies and crop irrigation water (Sharpe et al. 2008). The volume of surface water

infiltration in the valleys of the Walker River Basin is dependent on the flow volume in Walker River, amount of irrigation, and the volume of groundwater pumping in the valleys (Myers 2001a and 2001b). There is little groundwater movement between the groundwater basins (Thomas 1995). In this Draft EIS, groundwater recharge refers to groundwater recharge from all sources, whereas incidental groundwater recharge refers to groundwater recharge resulting from the conveyance and use of irrigation water.

Smith Valley

The Smith Valley aquifer occurs in alluvial deposits consisting of unconsolidated gravel, sand, silt, and clay; the older deposits are more consolidated than the younger deposits (Sharpe et al. 2008). Similar to the majority of other basins in the Walker River system, the aquifer in Smith Valley is bounded by low-permeability consolidated rocks.

Transmissivity of the alluvial aquifer in Smith Valley ranges from less than 50,000 to greater than 100,000 gallons per day per foot for the upper 500 feet of valley fill deposits (Rush and Schroer 1976), which corresponds to a hydraulic conductivity of approximately 10 to 60 feet per day. For much of the Smith Valley aquifer, the average storage coefficient, i.e., the volume of water released from storage in a confined aquifer per unit surface area per unit change in hydraulic head, is 0.15 (Sharpe et al. 2008). In other words, 0.15 cubic foot of water would be released from each square foot of aquifer material for each 1-foot drop in water level.

It is estimated that Smith Valley contains 1,500,000 af of water stored in the upper 100 feet of saturated alluvium, based on an effective area of 100,000 acres for the aquifer (Rush and Schroer 1976).

In Smith Valley north of the West Walker River, there is a groundwater and topographic divide that separates the motion of groundwater and surface water drainage (Myers 2001a). North of the divide, groundwater tends to move towards Alkali Lake, which is 200 feet lower in elevation than the West Walker River and south of the divide, groundwater tends to move towards the Walker River (Myers 2001a). Prior to the advent of surface water irrigation, groundwater probably flowed from the river toward Alkali Lake (Myers 2001a).

The main source of aquifer recharge is the West Walker River, either directly or through irrigation. Some recharge also comes from subsurface flow from the mountains, supplying an estimated 17,000 af/yr, primarily from the Pine Nut Mountains, Sweetwater Mountains, and Wellington Hills. Desert Creek, with an estimated average flow of 8,500 af/yr, also provides groundwater recharge directly or through irrigation (Rush and Schroer 1976). At altitudes less than 6,000 feet, valley floor precipitation does not contribute to aquifer recharge

(Sharpe et al. 2008). Groundwater recharge from areas north of Alkali Lake and north of the groundwater divide have not been well quantified (Myers 2001a). Groundwater outflow from the basin is assumed to be minimal (Sharpe et al. 2008).

Mason Valley

Similar to Smith Valley, Mason Valley has an alluvial aquifer. Unconsolidated gravel, sand, silt, and clay comprise the Mason Valley alluvium (Huxel and Harris 1969). Relative to the valley fill deposits, the surrounding bedrock has little hydraulic conductivity, resulting in minimal groundwater outflow from the consolidated rock (Sharpe et al. 2008).

Transmissivity of the alluvial aquifer in Mason Valley ranges from 50,000 to 200,000 gallons per day per foot in the upper 100 feet of valley-fill deposits, which corresponds to a hydraulic conductivity of 5 to 80 feet per day; the average storage coefficient for the aquifer is 0.2 (Huxel and Harris 1969). Approximately 1,100,000 af of groundwater are stored in the upper 50 feet of saturated alluvium in Mason Valley (Huxel and Harris 1969).

Like Smith Valley, the aquifer in Mason Valley is primarily recharged by percolation of irrigation water derived mainly from diversions of the Walker River (Sharpe et al. 2008). Approximately 70,000 af /yr of water from the Walker River recharge the aquifer in the valley (Myers 2001b). Aquifer recharge from precipitation in the surrounding mountains is estimated to be only 2,000 af/yr (Huxel and Harris 1969). There is no contribution to aquifer recharge from precipitation on the valley floor (Sharpe et al. 2008). Mason Valley groundwater outflow is estimated to be 1,600 af/yr, and inflow, beneath the East and West Walker rivers is approximately 500 af/yr (Huxel and Harris 1969). Some of the groundwater exits the valley to the Schurz area (Huxel and Harris 1969) and some moves through the Desert Mountains via the Wabuska Lineament into Churchill Valley (Lopes 2008b).

East Walker River Area

East Walker River is located in the East Walker River drainage basin, between Mason Valley and the outlet of Bridgeport Reservoir. Groundwater development in the East Walker River area is primarily from alluvial aquifers within the basin (Sharpe et al. 2008). Young and old alluvium comprise the aquifers in the East Walker River area; the old alluvium is unconsolidated to consolidated deposits of boulders, gravel, sand, silt, and clay, and the young alluvium is primarily unconsolidated zones of gravel, sand, silt, and clay (Sharpe et al. 2008).

There are three distinct aquifer systems in the East Walker River area: Sweetwater Flat, the Rough Creek area, and the area tributary to the East Walker River in the downstream portion of the drainage basin (Sharpe et al. 2008). Similar to the other Walker River Basin aquifers previously discussed, the alluvial aquifers in the East Walker River area are bounded by consolidated rock, which transmits little water (Sharpe et al. 2008). Information on the hydraulic properties of the area's alluvial aquifers is limited; however, because of the similarities to the aquifers of Smith and Mason Valleys, it is likely that the transmissivity values for the aquifers of East Walker River area are similar. It is estimated that 800,000 af of water is stored in the upper 100 feet of saturated sediment in the area (Glancy 1971).

The alluvial aquifers in the East Walker River are recharged by East Walker River water and from precipitation in the surrounding mountains. Of the 31,000 af/yr recharge from precipitation, it is estimated that 18,000 af/yr goes to the Rough Creek drainage area's alluvial aquifers (Glancy 1971). Groundwater inflow from Bridgeport Valley is approximately 200 af/yr, and groundwater outflow from East Walker River area to Mason Valley is approximately 150 af/yr (Glancy 1971). More than 97% of the 18,000 af of recharge water in the Rough Creek area is estimated to flow out of the East Walker River drainage area toward Mono Valley (Glancy 1971).

Schurz and Walker River Indian Reservation Area

Consolidated rock surrounds the valley fill deposits in the area, and is considered nearly impermeable (Schaefer 1980). The valley fill deposits are alluvial and are comprised primarily of sand, silt, and clay (Schaefer 1980). The alluvial aquifer in this area is fairly permeable and considered a potential source of groundwater (Sharpe et al. 2008). Approximately 1,500,000 af of groundwater is stored in the upper 100 feet of saturated alluvial deposits in the Schurz area (Resource Concepts Inc. 2000).

Recharge water in the area comes primarily from the seepage of Walker River water into the aquifer. In the Reservation reach, an average of 13,800 af/yr seeps from the river into the aquifer below (Schaefer 1980). Precipitation, subsurface inflow, and infiltration of irrigation water contribute to the recharge of the area's alluvial aquifer (Sharpe et al. 2008). An estimated 500 af/yr from precipitation contributes to aquifer recharge in the Schurz area (Everett and Rush 1967). Inflow to the basin from Mason Valley through Walker and Parker gaps is approximately 1,400 af/yr (Huxel and Harris 1969). The outflow of groundwater from the Schurz area to Walker Lake is estimated at nearly 11,000 af/yr (Shaefer 1980). In addition, some groundwater leaves the Schurz area by heading east out of the Walker Basin toward Double Springs (Lopes 2008a).

Whiskey Flat-Hawthorne Area

The Whiskey Flat-Hawthorne area extends from the southern boundary of the drainage area to the southern end of Walker Lake. Consolidated rock lies beneath the alluvial deposits and surrounds the valley fill deposits in the area and is assumed to have low permeability (Everett and Rush 1967). The alluvial deposits are poorly consolidated to unconsolidated (Everett and Rush 1967).

Approximately 900,000 af of groundwater is stored in the upper 100 feet of saturated alluvial deposits in the Whiskey Flat-Hawthorne area (Everett and Rush 1967). The aquifer is the drinking water source for the town of Hawthorne and is used for limited irrigation in both Hawthorne and Whiskey Flat (Everett and Rush 1967). The sources of groundwater recharge in the Whiskey Flat-Hawthorne area include precipitation, Walker River seepage, and irrigation water (Everett and Rush 1967). Everett and Rush (1967) estimated that the annual recharge to the Whiskey Flat-Hawthorne area is 5,400 af.

Walker Lake Area

The Walker Lake area includes the east and west sides adjacent to Walker Lake. Walker Lake is bounded by the Wassuk Range on the west side, and is solid rock nearly to the shore. Approximately 100,000 af of groundwater is stored in the upper 100 feet of saturated alluvial deposits in the area's aquifer (Everett and Rush 1967). Groundwater in the area is recharged by seepage from Walker River, percolation of irrigation water, and precipitation, primarily from the surrounding mountains (Everett and Rush 1967). Little recharge enters from the mountains immediately west of the lake due to the consolidated rock and steep slopes (Everett and Rush 1967). Annual recharge to the alluvial aquifer in the Walker Lake area is approximately 600 af (Everett and Rush 1967).

Groundwater Withdrawals

There are two types of groundwater rights, as described below.

- Primary groundwater rights: The holder of these rights can apply water only to specific pieces of land. The land to which these rights are appurtenant does not receive surface water.
- Supplemental groundwater rights: The holder of these rights can use groundwater to supplement surface water diversions or primary groundwater rights; however, the combination of the surface water diversions and supplemental groundwater is not to exceed a specified amount

Groundwater pumping can be combined with surface water diversions and other information to estimate total water withdrawals and water efficiency.

Groundwater pumping records have been compiled for Smith and Mason Valleys for 1994 through 2004 by NDWR (Gallagher 2006). As river flow increases (and the availability of surface water increases), the amount of groundwater pumping decreases (Lopes 2008a). Annual groundwater pumping in Smith Valley ranged from 10,000 to 33,000 af, with an average of 24,000 af (Table 3A-5). Annual groundwater pumping in Mason Valley ranged from 40,000 to 122,000 af, with an average of 79,000 af. Myers (2001) estimates that, on average, about 50% of all groundwater withdrawals involve supplemental pumping, with considerable year-to-year variability (e.g., 45-55% in Smith Valley and 36-62% in Mason Valley during the 3-year period 1994-96 for which estimates by type were available).

Table 3A-5. Groundwater Pumping in Smith and Mason Valleys from 1994 through 2004

	Smith Valley (acre-feet)	Mason Valley (acre-feet)
1994	33,204	122,001
1995	10,340	41,427
1996	17,249	51,302
1997	15,901	43,264
1998	13,391	39,645
1999	16,957	48,856
2000	29,579	83,888
2001	31,313	116,016
2002	32,518	114,809
2003	30,959	101,512
2004	32,805	108,495
Average	24,020	79,201

Source: Gallagher 2006

NDWR has not collected groundwater pumping records for the East Walker River upstream of Mason Valley, nor for the Walker River Indian Reservation (Beutner pers. comm. 2008).

Smith Valley, Mason Valley, and Whiskey Flat-Hawthorne (Walker Lake) groundwater subbasins have been designated by the Nevada State Engineer (NSE) and are closed to new groundwater appropriations for irrigation purposes.

Groundwater Levels

Measurements of groundwater levels over time indicate whether aquifer storage is changing. Information on existing trends in Smith and Mason Valleys is presented below.

Smith Valley

Groundwater levels in Smith Valley appear to have decreased (Figure 3A-15). Between 1972 and 1993, the groundwater gradient toward the river decreased from 0.0083 to 0.0033 (i.e., for every 10,000 feet in a horizontal direction toward the river, there is a 33 foot drop in the top of the aquifer) . Despite the decrease in gradient, the Smith Valley reach of the West Walker River continues to be a gaining reach, partly because surface water irrigation and local inflows (e.g., Desert Creek and subsurface flow from the mountains) contribute enough to groundwater that levels still slope towards the river (Myers 2001a).

A linear trend line fit to groundwater level data collected from wells in Smith Valley by NDWR between 1976 and 2007 (Nevada Division of Water Resources 2009) indicates an average increase in depth to water of approximately 16 feet over the 31 years evaluated, an overall drop of about 0.5 foot per year. Much of the variation in the water levels in the wells is caused by differences between well locations and differences in year-to-year surface water hydrology and groundwater pumping.

The estimated decrease in groundwater levels is somewhat dependent on the years selected for evaluation. For Smith Valley, 1976 was chosen as the starting point because there was much less data collected prior to 1976. The individual extent of decrease and yearly variation depends on the well evaluated, with water depth varying more in wells with greater depth to groundwater. When groundwater is nearer to the surface, it suggests the close proximity of a source of substantial recharge such as the Walker River.

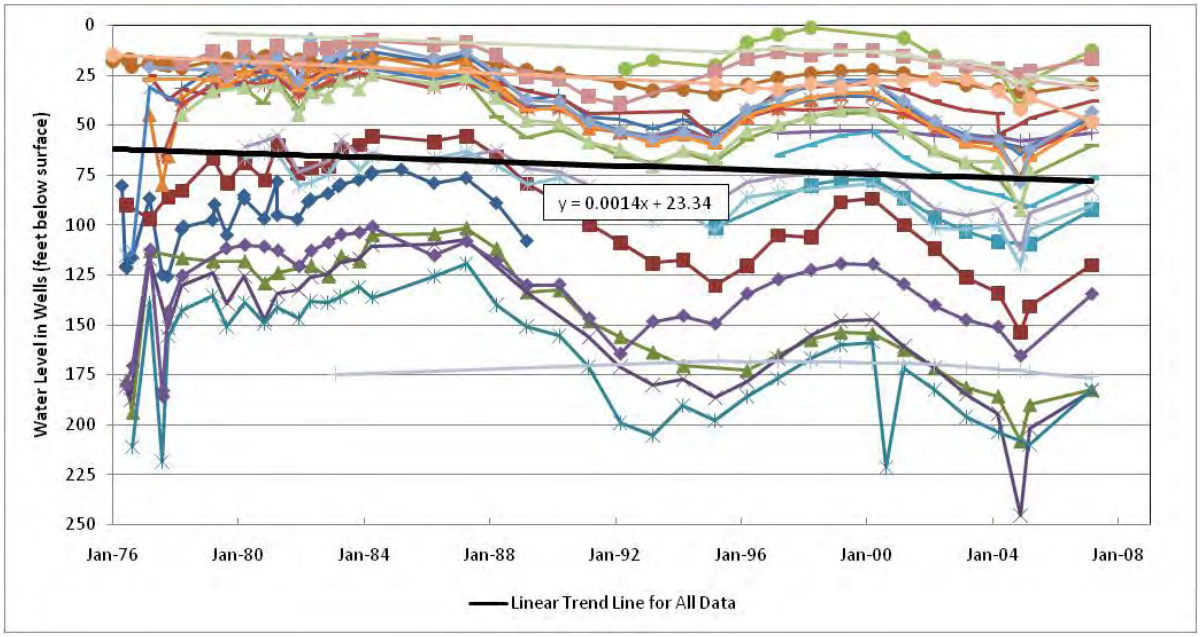


Figure 3A-15. Smith Valley Water Level Data Collected from 27 Wells during Winter 1976 through Winter 2007 (Nevada Division of Water Resources 2009)

Mason Valley

Groundwater trends in Mason Valley are similar to those in Smith Valley. Groundwater levels appear to have decreased, and gradients once directed toward the river are now directed away from the river. However, levels in Mason Valley do not appear to have dropped as much as in Smith Valley (Myers 2001b).

The groundwater level data collected by NDWR indicate that average depth to groundwater in Mason Valley may be less than in Smith Valley (Figures 3A-15 and 3A-16). A linear trend line fit to groundwater level data collected from wells in Mason Valley by NDWR from November 1981 through 2007 (Nevada Division of Water Resources 2009) indicates an average increase in depth to water of approximately 11 feet over the 26 years evaluated, an overall decrease of about 0.4 ft/yr (Figure 3A-16). Much of the variation in the water levels in the wells is caused by differences between well locations and differences in year-to-year surface water hydrology and groundwater pumping.

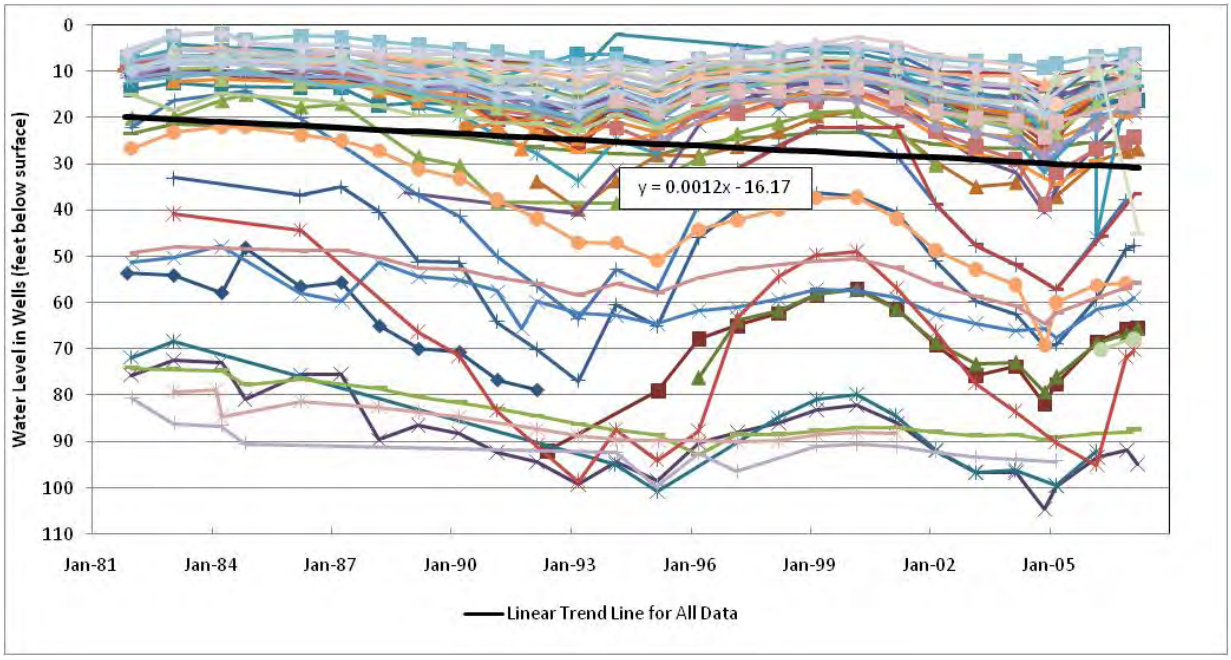


Figure 3A-16. Mason Valley Water Level Data Collected from 64 Wells during Fall 1981 through Spring 2007 (Nevada Division of Water Resources 2009)

The estimated decrease in groundwater levels is somewhat dependent on the years selected for evaluation. For Mason Valley, November 1981 was chosen as the starting point for generating the trend line because multiple wells with greater water level depth were added at that time. The individual extent of decrease and yearly variation depends on the well evaluated, with water depth varying more in wells with greater depth to groundwater. When groundwater is nearer to the surface, it suggests the close proximity of a source of substantial recharge such as the Walker River.

Schurz, Whiskey Flat-Hawthorne, and Walker Lake Areas

Groundwater levels near Walker Lake have declined as a result of the decrease in lake elevation and groundwater pumping (Allander and Lopes 2008). On the Walker River Indian Reservation, groundwater levels dropped prior to 1960, but have not changed greatly since then. Preliminary analysis shows that since the 1950s, groundwater levels on the Army Depot have dropped 15 feet and groundwater levels south of Hawthorne (Whiskey Flat) have dropped 70 feet (Lopes 2008a).

River-Groundwater Connection

There is a strong relation in the study area between groundwater recharge and extraction and Walker River flows. Information from two studies by Myers (2001a and 2001b) was used for this Draft EIS to assign a quantitative value to the link between groundwater recharge and river flow. Recent modeling work by the University indicates a degree of river-aquifer connection may be comparable to the Myers work (Boyle et al. 2009), although future use of the University model could indicate that adjustments in the assumptions would be appropriate.

Smith Valley

The Smith Valley aquifer contains clay layers that tend to slow the vertical movement of groundwater (Myers 2001a) as well as the response of the river to changes in groundwater recharge and pumping. Nevertheless, there is still a strong connection between the Walker River and the Smith Valley aquifer; it is strongest close to the river and weakest north of the groundwater divide.

Myers used groundwater-surface water modeling to estimate that if groundwater pumping were reduced within 2 miles of the river, river flows would increase by about 80 % of the amount of the pumping reduction (Myers 2001a). As another example, on a valley-wide basis, it was simulated that a reduction in recharge could lead to a reduction in river flow equal to about 52% of the recharge reduction within 25 years (Myers 2001a).

Mason Valley

The Mason Valley aquifer contains some silt/clay layers that could slow the vertical movement of groundwater as well as the response of the river to changes in groundwater recharge and pumping (Myers 2001b). Nevertheless, there is still a strong connection between the Walker River and the Mason Valley aquifer; it is strongest close to the river (Myers 2001b).

Myers used groundwater-surface water modeling to estimate that if groundwater pumping were reduced near the river, river flows would increase by 40 to 90% of the amount of the pumping reduction (Myers 2001b). As another example, on a valley-wide basis, it was simulated that a reduction in recharge could lead to a reduction in river flow equal to about 82% of the recharge reduction within 25 years (Myers 2001b).

Reservation Reach

There is also a strong connection between the river and groundwater aquifer in the Reservation reach. Preliminary results from the USGS found that as flow increases, the water level in wells adjacent to the river increase almost immediately. The well sites examined are Willows (north of Weber Reservoir),

lateral 2-A (near Schurz), and Powerline (approximately half way between Lateral 2-A and Walker Lake) (Lopes and Allander 2006, Lopes 2008a).

Water Balance for Study Area Upstream of Wabuska

This water balance assessment focuses on the East Walker Valley, Smith Valley, and Mason Valley. Current losses of water from the Walker River downstream of Wabuska are addressed above in the Surface Water subsection. A separate water balance for Walker Lake is described in the Environmental Consequences section.

To understand the flow of water through the Walker River system, flows along the river can be compared to diversions and consumptive use in order to estimate some of the flows that are not measured. There is some uncertainty in the values used in this upstream water balance, particularly associated with ET rates, the acres of land to which different ET rates should apply, and amount of groundwater pumping in the East Walker area above Mason Valley.

The water balance assessment presented here is based on average values. Although river flows, water demands, and reservoir operations change daily, an assessment based on averages is appropriate for determining the long-term effects that are pertinent for evaluating the potential for increasing inflow to Walker Lake. Ideally the average values that are used would represent the same long time span. However, because of data limitations, this was not always possible. Table 3A-6 presents some of the values used in the assessment.

Table 3A-6. Data Sources for Walker River Basin Upstream of Wabuska Water Balance

Variable	Data Source	Time Period	Average Values
Surface Water Diversions (af)	Pahl 2000 p. 12 and Shaw pers. comm. 2008	1981–2007	E. Walker: 22,000 Smith: 59,000 Mason: 126,000
Groundwater Pumping (af)	Gallagher 2006 p. 11	1994–2004	Smith: 24,000 Mason:79,000
Groundwater Pumping (af)	Estimate[a]		E. Walker: 0
Irrigated Area (ac)	DRI 2006 pp. 17–20	1986, 1992, 1995, 1998, 2000, 2002	E. Walker: 4,015 Smith: 17,452 Mason: 34,972
Riparian/Wetland Area (ac)	DRI 2006 pp. 17–20	1986, 1992, 1995, 1998, 2000, 2002	E. Walker: 3,307 Smith: 3,309 Mason: 7,434
Percent of riparian/wetland that is considered riverine[b]	GIS analysis of GAP data (U.S. Geological Survey National Gap Analysis Program 2004)		E. Walker: 88% Smith: 33% Mason: 34%
Annual Flow East Walker downstream from Bridgeport Reservoir (af)	USGS 2008a	1981–2007	118,000
Annual Flow East Walker upstream of Strosnider Ditch (af)	USGS 2008a	1981–2007	125,000
Annual Flow West Walker at Hoye Bridge (af)	USGS 2008a	1981–2007	191,000
Annual Flow West Walker near Hudson (af)	USGS 2008a	1981–2007	151,000
Annual Flow at Wabuska (af)	USGS 2008a	1981–2007	139,000

[a] East Walker groundwater pumping was estimated based on ratios for Smith and Mason Valleys of overall water use (surface water diversions plus groundwater pumping) to irrigated plus non-riverine riparian acreage.

[b] This evaluation assumed all riparian/wetland vegetation within 1,000 feet of the river channel to be riverine (directly linked to the river). Riparian/wetland vegetation that is farther from the river channel is assumed to be dependent on irrigation or incidental groundwater recharge resulting from irrigation.

Water extracted by diversions (from the River) and pumping (from the aquifer) has three possible fates:

- **Evapotranspiration (ET)** – water can be "lost" through evaporation or transpiration.

  Note: for the purposes of this Draft EIS, net ET equals total ET minus precipitation and consumptive use equals net ET from irrigated land.
- **Incidental groundwater recharge** – water can seep through the soil and contribute to recharging the local groundwater aquifer.
- **Return flow** – water can return to the Walker River either via surface drains or groundwater flow. Water that drains off fields and is used elsewhere (e.g., in other fields or WMAs) is not counted as return flow unless it eventually returns to the Walker River.

In the following evaluation, evapotranspiration is estimated and the combination of incidental groundwater recharge and return (GRR) flows are calculated as the sum of diverted and pumped water minus evapotranspiration.

Evapotranspiration

The amount of water that disappears through ET can be approximated using measured net ET rates for typical vegetation, where net ET equals total ET minus precipitation. Net ET was estimated for irrigated lands, riverine vegetation, and non-riverine riparian and wetland vegetation. Riverine vegetation was assumed to draw water indirectly from river flows. Non-riverine riparian and wetland vegetation was assumed to obtain water incidentally from surface water diversions and groundwater extractions.

Measured ET rates can be quite variable. For alfalfa, which makes up more than half of the irrigated lands (see DRI acreage summaries in Chapter 7, Land Use and Agriculture), net ET measurements in the Walker and Carson basins have ranged between 31 and 45 inches (Allander pers. comm. July 29, 2008 and Maurer et al. 2005). Net ET rates for irrigated pasture have ranged between 28 and 46 inches. Riparian and wetland areas have relatively high ET, but other crops grown in the Walker River basin, such as onions and garlic, probably have lower ET rates (Allander pers. comm. July 29, 2008).

For this analysis, the average values measured for alfalfa in the Walker and Carson River Basins were adjusted downward to estimate the ET for other crops. The downward adjustment was based on comparing alfalfa ET to ET measurements made for a range of other crop types. The various estimated crop ET rates were then weighted by the occurrence of the crops to estimate overall ET rates for Smith and Mason Valleys as 34.5 and 32.4 inches, respectively. The ET rate for the East Walker reach was assumed to be the same as the Smith Valley

rate. The ET rate for riparian/wetland areas was assumed to be 41.2 inches based on ET rates measured for Willow in the Walker River Basin by the USGS (Lopes pers. comm. August 26, 2008).

When the agricultural ET rates are applied to the estimated irrigated acres and the riparian ET rate is applied to the fraction of the riparian/wetland acres that are estimated to be non-riverine, the resulting combined ET annual volumes are 13,000 af, 58,000 af, and 111,000 af for the East Walker area, Smith Valley, and Mason Valley, respectively. Because these values include water used incidentally by riparian vegetation, these values are greater than the consumptive use of the water as that term is used in this analysis (i.e., consumptive use equals the net ET associated with agricultural crops grown on irrigated, water-righted lands). The consumptive use values are estimated to be 12,000 af/yr, 50,000 af/yr, and 94,000 af/yr for the East Walker Valley, Smith Valley, and Mason Valley, respectively.

This calculation was also made for estimating the ET associated with the riverine portion of the riparian vegetation (i.e., the portion of the riparian vegetation expected to obtain water from shallow groundwater that is adjacent to the river). Riverine ET was estimated to be 9,000 af/yr, 4,000 af/yr, and 9,000 af/yr for the East Walker reach, Smith Valley, and Mason Valley, respectively. There is much uncertainty in these numbers, but they are useful for indicating the potential magnitude of this term relative to river flow. These calculations indicate that riverine ET may be about 8%, 2%, and 3% of the annual inflow to the East Walker reach, Smith Valley, and Mason Valley, respectively. The riverine ET for the East Walker reach is a relatively high percent of flow as a result of the amount of riparian vegetation within 1,000 feet of the river channel.

There is also a certain amount of ET associated with natural phreatophytic vegetation such as rabbitbrush and greasewood. Phreatophytes have deep roots and are not dependent on the high groundwater table produced by the river or irrigation as is riparian and wetland vegetation. Preliminary results show that in some locations, annual ET associated with this vegetation is similar to annual precipitation, resulting in little effect on the water balance for the aquifer (Lopes 2006, p. 2). In other locations, phreatophytic vegetation may draw from the aquifer. This potential effect on the aquifer was not analyzed because it was assumed that ET from phreatophytic vegetation would be largely unaffected by the action alternatives.

Incidental Groundwater Recharge and Return Flows (GRR)

Of the water that is applied, the water that is not lost to ET would either go to incidental groundwater recharge or the river. GRR flows were calculated as the residual of diverted and pumped water minus evapotranspiration of agricultural crops and non-riverine riparian and wetland vegetation.

Total incidental groundwater recharge and returns was calculated as:

GRR = SW + GW – ETag – ETnrrip

Where:

GRR = incidental groundwater recharge plus returns

SW = surface water diversions

GW = groundwater pumpage

ETag = estimated ET for agricultural fields, and

ETnrrip = estimated ET for non-riverine riparian and wetland vegetation

For the ET volumes calculated above, the combined estimated annual GRR volumes are:

East Walker River: 9,000 af

Smith Valley: 25,000 af.

Mason Valley: 94,000 af

There is a groundwater divide in Smith Valley. GRR north of the divide flows toward Alkali Lake instead of the Walker River. The estimate provided here is for the entire Smith Valley, both north and south of the divide.

Water Efficiency

The amount of water diverted from surface water and groundwater and the estimated consumption by crops can be used to produce an estimate of water efficiency. Some of the water that is applied runs off the field or seeps into the ground. In addition, there are conveyance losses, which either provide water for the ET of non-riverine vegetation or add to GRR flows.

Water efficiency can be estimated as:

$$E = CU / (SW + GW)$$

Where:

E = water efficiency

CU = consumptive use (agricultural ET)

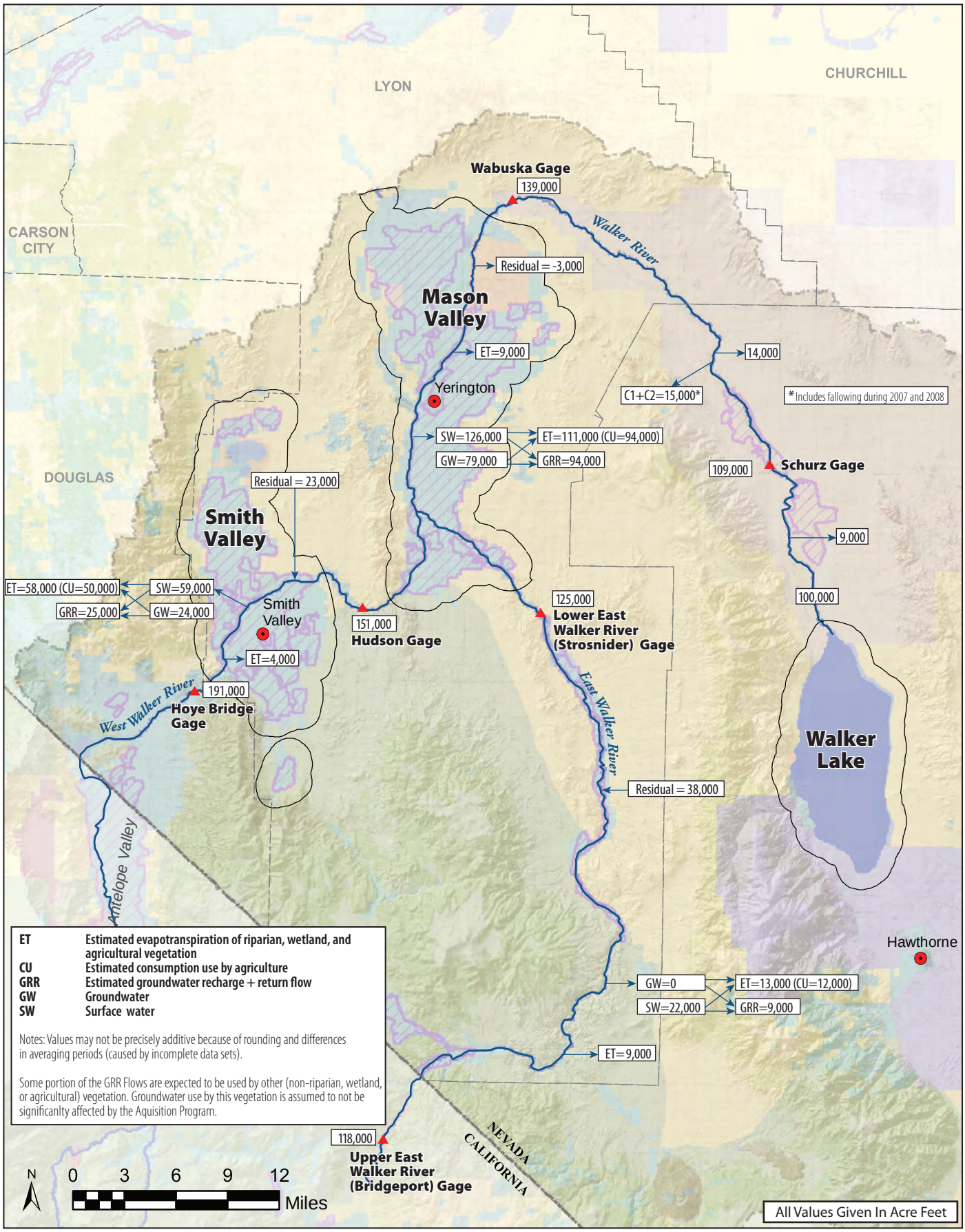
SW = average annual surface water diversions

GW = average annual groundwater pumpage

For the East Walker reach, Smith Valley, and Mason Valley, the estimated water efficiency is 53%, 60%, and 46%, respectively, with an overall value of 50%. Note that these efficiency rates include the effect of conveyance losses. The water that is not used consumptively is either used by riparian/wetland vegetation or contributes to incidental groundwater recharge and return flows.

Upstream Water Balance Results

Table 3A-7 provides a summary of the average flow volumes in the East Walker, Smith Valley, and Mason Valley reaches (Figure 3A-17). The river inflows and river outflows for each reach in Table 3A-7 are based upon gaged river flows. The river inflow to each reach minus the surface water diversions and the estimated riverine ET would not equal the river outflow because there can be numerous unmeasured small local inflows and outflows such as return flows, tributary flow, and interaction with groundwater. The return flow portion of the estimated GRR is a potential source of any unexpected increase in river flow from the upstream to the downstream end of a reach. In the East Walker reach, the estimated GRR flows are only 9,000 af/yr, not enough to account for the average increase in flow of 38,000 af/yr. In comparison, in Smith Valley, the estimated GRR (25,000 af/yr) is approximately equal to the increase in flow (23,000 af/yr), although some of the increase in flow probably comes from contributions from the mountains and Desert Creek (Myers 2001a). In Mason Valley, the estimated GRR is large (94,000 af/yr), but on average there is a small measured loss in river flow (3,000 af/yr), suggesting a slight net loss to groundwater.



ET	Estimated evapotranspiration of riparian, wetland, and agricultural vegetation
CU	Estimated consumption use by agriculture
GRR	Estimated groundwater recharge + return flow
GW	Groundwater
SW	Surface water

Notes: Values may not be precisely additive because of rounding and differences in averaging periods (caused by incomplete data sets).

Some portion of the GRR Flows are expected to be used by other (non-riparian, wetland, or agricultural) vegetation. Groundwater use by this vegetation is assumed to not be significanlty affected by the Aquisition Program.

00516.07 Walker River Basin Restoration Project/Average Flow Volumes (12-08)

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Figure 3A-17
Average Annual Flow Volumes for the Walker River Basin for all Data Available from 1981 to 2008

Table 3A-7. Estimated Average Annual Flow Volumes in Three Subareas of the Walker River Basin

	East Walker[d]	Smith Valley[d]	Mason Valley[d]
Inflow (af)	118,000	191,000	276,000
Surface Water Diversion (af)	22,000	59,000	126,000
Groundwater Pumping (af)	0	24,000	79,000
Irrigated Acres	4,015	17,452	34,972
Riparian/Wetland Acres	3,007	3,309	7,434
Fraction of Riparian/Wetland Acres Supported by Irrigation	0.12	0.67	0.66
Estimated Riparian/Wetland Acres Supported by Irrigation	353	2,217	4,906
Estimated Acreage Supported by Irrigation[a]	4,367	19,669	39,877
Acre-Feet per Acre [b]	5.0	4.2	5.1
Agricultural ET Rate (inches)	34.5	34.5	32.4
Non-Riverine ET Estimate (af) [c]	13,000	58,000	111,000
Agricultural ET Estimate (Consumptive Use) (af)	12,000	50,000	94,000
Percent of Diversions and Pumping Used Consumptively	53%	60%	46%
Riverine ET Estimate (af)	9,000	4,000	9,000
Riverine ET as % of Inflow	8%	2%	3%
Incidental Groundwater recharge and return (af)	9,000	25,000	94,000
Inflow Minus Surface Water Diversion Minus Riverine ET (af)	87,000	128,000	141,000
Outflow (af)	125,000	151,000	139,000
Flow change within reach (af)	38,000	23,000	-3,000

Note: This table does not include water budget values not expected to change, such as ET from natural phreatophytic vegetation or evaporation from the Anaconda Mine Pit lake or Alkali Lake.

[a] This value is the irrigated acres plus the riparian/wetland acres supported by irrigation (e.g., from canal seepage, tailwater runoff, or shallow groundwater).

[b] Surface Water diversions plus groundwater pumping divided by estimated acreage dependent on irrigation

[c] Combined ET from crops and non-riverine riparian vegetation

[d] Water volumes are rounded to the nearest 1,000 af.

Water Quality

Key water quality topics are water quality of Walker River and Walker Lake, groundwater quality, and the plume of contaminated groundwater from the Anaconda Mine site.

While several water quality constituents are of concern in the Walker River Basin, this Draft EIS focuses on TDS because of its effects on the ecosystem of Walker Lake. TDS is a measure of all dissolved solids in water, including salts, metals, and all organic and inorganic components of water that are dissolved or extremely small (small enough to pass through a fine-mesh filter).

Walker River Water Quality

The water quality of rivers is determined largely by interaction of water with the landscape and human activities. Water moving across and through the landscape is exposed to different minerals within the soils and rocks of different geomorphic regions. Human activities that alter the land, consume and use water, or discharge material to a water body further modify water quality. It is common to find differences in surface water quality across a large region like the Walker River Basin, which encompasses urban, rural, and undeveloped desert areas.

Under Section 303(d) of the federal Clean Water Act, Nevada is required to develop a list of water bodies requiring action to achieve water quality standards. Water bodies that do not meet established water quality standards and are listed on a state's 303(d) list are considered impaired. An impaired water body is a water body that has concentrations of pollutants or contaminants that exceed the threshold to support its beneficial uses (e.g., irrigation, or municipal and domestic water supply). The East and West Walker Rivers and the mainstem Walker River are listed as impaired waters on Nevada's 303(d) list, as shown in Table 3A-8. Nevada's 2004 303(d) Impaired Water Bodies List (Nevada Division of Environmental Protection 2005b) is the most recent EPA-approved 303(d) list for the state. Nevada's draft 2006 303(d) list, published in 2008, has not yet been approved by the EPA (Sertic pers. comm. 2008).

Table 3A-8. 303(d) Impaired Waters List for Walker Lake and Tributaries

Water Body	Location	Parameter	TMDL Priority
West Walker River	At the state line	Zinc	Low
Topaz Lake Reservoir	Topaz Lake Reservoir (Nevada Portion)	Phosphorus (Total)	Low
		Temperature	Low
West Walker River	From CA state line to Wellington	Temperature	Low
West Walker River	From Wellington to confluence with the E. Walker River	Temperature	Low
East Walker River	East Fork of Walker River at state line	pH	Low
		Temperature	Low
East Walker River	East Walker River at Bridge B-1475 to the East Walker at the state line	Phosphorus (Total)	Low
		Temperature	Low
		pH	Low
East Walker River	East Walker River above the confluence with the West Walker to Bridge B-1475	Temperature, water	Low
		Iron	Low
Mainstem Walker River	From the confluence of the East and West River to the inlet of Weber Reservoir	Iron	Low
Mainstem Walker River	From the outlet of Weber Reservoir to the inlet of Walker Lake	pH	Low
Walker Lake	Entire lake	Arsenic	Low
		Cadmium	Low
		Molybdenum	Low
		Phosphorus	Low
		Selenium	Low
		TDS	High

Source: Nevada's 2006 303 (d) Impaired Waters List—Draft (Nevada Division of Environmental Protection 2008a)

Sediment, nutrients, and metals are the most widespread pollutants contributing to the exceedance of water quality standards in the major rivers of Nevada (Nevada Department of Conservation and Natural Resources 2008). In the East and West Walker River, phosphorus is the nutrient found most consistently at elevated concentrations. Possible sources of phosphorus to these rivers include fertilizers from agricultural runoff, animal feedlots (manure), and natural sources such as soil and rock formations. Historic mining activities and natural sources, such as metal-bearing rock formations and geothermal springs, are associated with high metal concentrations in surface water.

Sediment has been a concern for all branches of the Walker River (East, West, and Mainstem). Sediment transported in a stream or present in the water column of a standing body of water is commonly measured as total suspended solids (TSS). TMDL criteria for controlling TSS have been established for the East Walker River in Nevada (U.S. Environmental Protection Agency 2008a) and the Walker River upstream of the Walker River Indian Reservation (Nevada Division of Environmental Protection 2005b).

In the Walker River upstream of Wabuska, active sediment transport occurs. Recent University research employing multiple methods of analysis found that sediment transport would be expected to occur at essentially all flow conditions. Their analyses were consistent with field observations. (Dennett et al. 2009)

Since 1998, when elevated concentrations of mercury were found in common loons from Walker Lake (Seiler et al. 2004), mercury has been a concern in the Walker River Basin. Weathering of naturally occurring minerals, mining activities in the basin (i.e., Aurora, Bodie, and Yerington), geothermal springs, and atmospheric deposition of mercury from regional and global sources are all potential sources of mercury in the basin.

A summary of water quality data recently collected by the University are provided in Table 3A-9 (Hershey et al. 2009). These data were collected between April 2007 and September 2008 during the months of February, April, August, and September. The data show that electrical connectivity (EC) and TDS concentration generally increase as water flows downstream. As expected, water temperature was also found to generally increase as the river moves downstream (Davis et al. 2009). At the downstream end of the Walker River, water temperature is approximately equal to average air temperature (Stone et al. 2009)

TDS at Walker River near Schurz had a median concentration of 337 mg/L, whereas TDS in the East and West Walker Rivers had median TDS concentrations of 156 and 121 mg/L, respectively. These concentrations are below the 500 milligrams per liter (mg/L) annual average maximum limit for water supply, irrigation, and livestock uses set by the Nevada Administrative Code (NAC 445A.160, NAC 445A.162, and NAC 445A.163). Generally, TDS

concentration tends to be lower in headwaters and increase downstream. Seasonal changes in stream flow also affect TDS; TDS concentration generally decreases as flow increases.

Table 3A-9. Summary of Select Water Quality Measurements Collected during 2007-2008 (Hershey et al. 2009)

Reach	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)
East Walker				
Minimum	8.05	192	116	4.2
Median	8.17	238	156	15.1
Maximum	9.33	317	206	73.6
West Walker				
Minimum	7.64	62	34	0.6
Median	8.11	200	121	3.8
Maximum	8.61	571	345	67.0
Mainstem				
Minimum	8.03	235	150	1.1
Median	8.20	435	253	14.2
Maximum	8.82	644	394	59.0
Schurz				
Minimum	8.05	472	283	1.1
Median	8.22	539	337	4.8
Maximum	8.82	644	394	12.2

Water quality data collected by the University researchers from April 2007 to September 2008 showed that TSS concentrations were relatively low (less than 20 mg/L) in the upper portions of the West and East Walker Rivers and in the lower portion of the mainstem Walker River near Schurz. Concentrations were highest in the lower portion of the East Walker River, about 25 river miles upstream of the main confluence, with an average of 27.7 mg/L and a median value of 35.8 mg/L, based on seven measurements. Intermediate concentrations were generally found in the lower portion of the West Walker River (also about 25 river miles

upstream of the main confluence) and in the mainstem Walker River from the confluence of the East and West Walker Rivers to Wabuska.

West Walker River

TDS in West Walker River has recently ranged from 34 to 345 mg/L (Hershey et al. 2009). These concentrations are below the 500 milligrams per liter (mg/L) annual average maximum limit for water supply, irrigation, and livestock uses set by the Nevada Administrative Code (NAC 445A.160, NAC 445A.162, and NAC 445A.163).

As indicated in Table 3A-8, portions of the West Walker River is on Nevada's 2006 draft 303(d) list for zinc and temperature (Nevada Division of Environmental Protection 2008a). West Walker River also was listed on Nevada's 2004 303(d) list for iron, phosphorus, boron, pH, and temperature (Nevada Division of Environmental Protection 2005b). In addition, according to the West Walker River Basin Watershed Assessment, excess sediment has been identified as a primary water quality concern in the West Walker River (Mono County 2007a, 89). Sediment transported in a stream or present in the water column of a standing body of water is commonly measured as TSS.

East Walker River

East Walker River is listed as an impaired water body on Nevada's draft 2006 303(d) list for pH, temperature, phosphorus, and iron (Nevada Division of Environmental Protection 2008a) (Table 3A-8). A TMDL for TSS has been established for East Walker River in Nevada and approved by the EPA (U.S. Environmental Protection Agency 2008a). Stressors of concern for East Walker River on Nevada's 2004 303(d) list were similar to the draft 2006 303(d) list; however, nitrite and TSS were also listed as stressors of concern for East Walker River at state line, and East Walker River from Bridge B-1475 to the confluence with the West Walker River, respectively (Nevada Division of Environmental Protection 2005b). TDS is not a constituent of concern on the East Walker River because concentrations tend to be low (recent measurements have ranged between 116 and 206 mg/L, Hershey et al. 2009).

A recent USGS study suggests that the primary mercury source areas are associated with the Bodie and Aurora mining districts in the Rough Creek watershed, which is part of the East Walker Basin (Seiler et al. 2004). Mercury concentrations in the East Walker River system vary widely by location and are the highest just upstream of the confluence with the West Walker River. The USGS reported that mercury concentrations in the East Walker River increased from 0.0014 microgram per liter (µg/L) upstream of Sonoma Creek to approximately 0.057 µg/L just upstream of the confluence with West Walker River (Seiler et al. 2004, p. 9), which is well below thresholds of concern based

on Nevada's water quality standards for mercury for municipal and domestic supply beneficial uses (2 µg/L) as well as aquatic life beneficial use (1.4 µg/L 1-hour average, and 0.77 µg/L 96-hour average) (NAC 445A.144). Total mercury concentrations in streambed sediment samples greater than 200 nanograms per gram (ng/g) have been recorded for several tributaries of the East Walker River where mining activities occurred during the 19th century (Seiler et al. 2004).

Mainstem Walker River

The Walker River from the confluence of the East and West Walker Rivers to the Weber Reservoir inlet and from the Weber Reservoir outlet to Walker Lake is listed as impaired for iron and pH, respectively (Table 3A-8). In Nevada's 2004 303(d) list, Walker River from the confluence of East and West Walker Rivers to the Walker River Indian Reservation boundary was listed for iron and TSS (Nevada Division of Environmental Protection 2005b). A TMDL for TSS has been established for this same reach (Nevada Division of Environmental Protection 2005b).

It was stated above that sediment is a water quality issue in all branches of the Walker River. It was also indicated that TSS concentrations measured at Schurz were found by University researchers to be relatively low (Table 3A-9). Nevertheless, the lower main stem Walker River channel near and downstream of Schurz is unstable and, as a result, substantial amounts of sediment can be eroded during high flow events. For example, in June 2005 when flows reached as high as 1400 cfs, approximately 477,000 metric tons of sediment were eroded from the banks of the lowermost 1.5 kilometers (0.9 mile) of the Walker River (Adams and Chen 2009).

The instability of the lower Walker River can be attributed greatly to the recession of Walker Lake. As the lake recedes, the topographic gradient increases, leading to substantial down-cutting of the river channel. This down-cutting propagates upstream as the gradient becomes more severe. As of early 2009, the head cut had propagated as far upstream as the defunct siphon that crosses the river near Lateral 2A about a mile below Schurz and had begun undercutting the siphon. As the lake recedes, the river also extends through terrain that formerly was river delta or lake bottom with deposits of finely grained sediment that are highly erodible (Adams and Chen 2009).

Walker River contributes an annual average TDS load of approximately 21,000 tons per year (Thomas 2004, as cited in Nevada Division of Environmental Protection 2005a). TDS concentration tends to be slightly higher at Schurz than at Wabuska. From May 1998 to March 2001, the period of data overlap for the two locations, TDS concentrations from grab samples ranged from 111 to 412 mg/L at Wabuska (average of 241 mg/L) and from 132 to 476 mg/L near Schurz (average of 274 mg/L) (Nevada Division of Environmental Protection 2008b).

Recent studies by UNR/DRI found that TDS in the Walker River near Schurz is typically 300-400 mg/L (Hershey et al. 2009).

Walker Lake Water Quality

Walker Lake is listed as an impaired water body on Nevada's draft 2006 303(d) list for TDS, selenium, and phosphorus (Nevada Division of Environmental Protection 2008a). TDS is the only water quality constituent of high priority for TMDL development and implementation within the Walker River Basin (Table 3A-8). A TMDL for TDS has been established for Walker Lake and approved by the EPA (Nevada Division of Environmental Protection 2005a). Mercury concentration in Walker Lake has also been a concern (Seiler et al. 2004).

Walker Lake Limnology

Walker Lake is monomictic; it is thermally stratified from May or June to November and undergoes a period of complete mixing in late fall (Beutel 2001; Sharpe et al. 2008). The boundaries of the epilimnion and hypolimnion, and consequently, the metalimnion, undergo broad shifts during the warmer months of the year (Sharpe et al. 2008, p. 32). Summer water temperature in the epilimnion ranges from 68° to 78° F and from 50° to 54° F in the hypolimnion (Beutel et al. 2001). Late winter water temperatures ranges from 43° to 46° F throughout the water column (Beutel et al. 2001).

The hypolimnion of Walker Lake becomes anoxic following thermal stratification. Decomposition of organic matter, primarily algae, depletes the oxygen, making it an unsuitable habitat for fish. Hypolimnetic anoxia in Walker Lake results in the accumulation of ammonia and sulfide in the hypolimnion. The ammonia enters the epilimnion during summer wind mixing events and by diffusion across the thermocline. Ammonia within the hypolimnion then promotes eutrophication (Beutel et al. 2001).

Walker Lake is limited in nitrogen and rich in phosphorus, a characteristic common to lakes in semi-arid environments (Beutel et al. 2001). This characteristic has promoted spring and summer blooms of nitrogen-fixing cyanobacteria, particularly of the genus *Nodularia* (Acharya et al. 2009). *Nodularia* dominates the phytoplankton community in summer, and consequently reduces phyto- and zooplankton diversity (Sharpe et al. 2008). Another type of cyanobacteria, *Synechococcus*, which can grow in anaerobic conditions, was found to bloom in the hypolimnion (Acharya et al. 2009).

Predominant zooplankton species include the cladoceran *Monia hutchinsoni*, the calanoid copepod *Leptodiaptomus sicilis*, and the rotifer *Hexarthra fennica*; *M. hutchinsoni* is most abundant from July through October, *L. sicilis* is perennial in the lake, and *H. fennica* abundance exhibits yearly variations (Beutel et al. 2001).

Walker Lake Total Dissolved Solids

As Walker Lake elevation has declined, TDS concentration has increased (See Affected Environments, Walker Lake Surface Elevations). TDS concentration has increased from 2,560 mg/L in 1882 (Russell 1885, compiled by USGS) to 16,081 mg/L on March 4, 2008 (Heggeness 2008, pers. comm.), a net increase of approximately 13,500 mg/L over 126 years (an average increase of about 110 mg/L per year).

The increase in TDS concentration is a function of reduced freshwater inflow and evaporation. As water evaporates, dissolved solids are left behind; with less dilution (and lake volume) from reduced inflow, TDS concentration increases.

Thomas (1995) estimated TDS flux into the lake to be 66,000 tons/year. More recently, net TDS flux into the lake has been estimated to be 56,000 tons/year, with the river, groundwater, and movement to and from the lake bed sediments all playing a role (Thomas 2004, as cited in Nevada Department of Environmental Protection 2005a). As a result, the total amount of TDS in the lake has been estimated to have increased from 31 million tons in 1882 (Nevada Department of Environmental Protection 2005a) to 38 million tons in 2007.

TDS concentration can be described with the following equation:

[TDS in mg/L] = tons of TDS in the lake * 735.56 / lake volume in af

Where:

Tons of TDS in the lake = $31*10^6$ + (# of years since 1882)*56,000

This equation matches the measured data fairly well (Figure 3A-18).

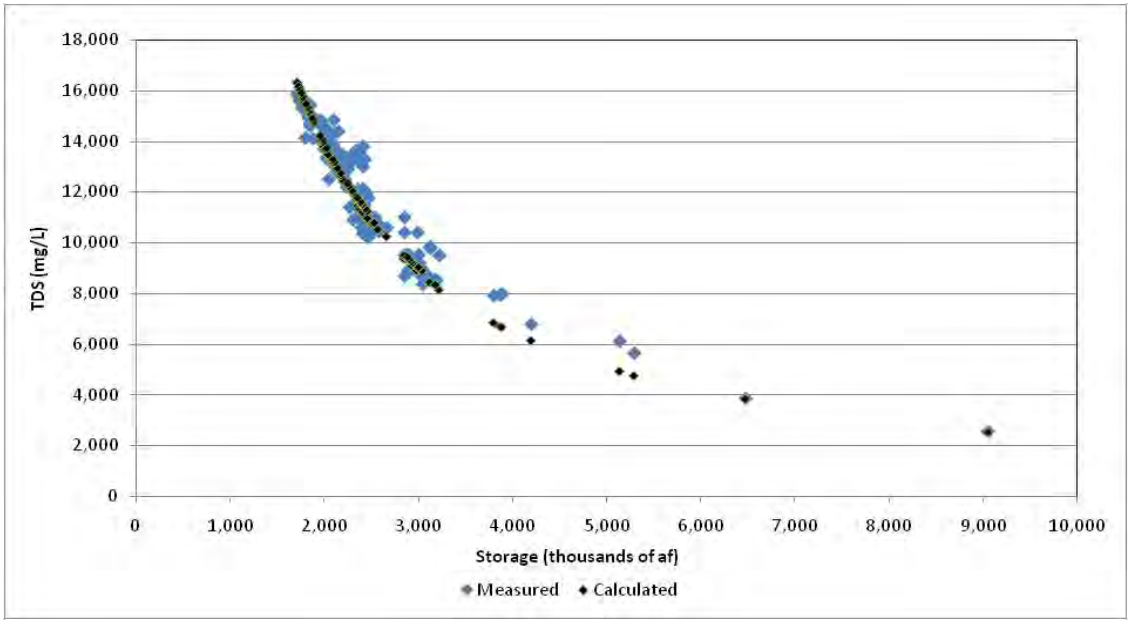

Figure 3A-18. Walker Lake Volume Compared to Concentration of Total Dissolved Solids

Groundwater Quality

Groundwater quality is important for determining whether there might be issues associated with the purchase of groundwater to augment Walker Lake inflow or with groundwater recharge.

Total Dissolved Solids

The concentration of TDS in groundwater is an indicator of the general quality of the water. In groundwater, much of the TDS originates from natural sources such as mineral springs, and carbonate and salt deposits in rock. Other sources include stormwater and agricultural runoff, and point/nonpoint wastewater discharges. High TDS concentration may indicate aquifer contamination from agricultural drainage, industrial wastes, or geothermal water (Thodal 1996).

The quality of groundwater in the Walker River Basin is variable. In general, the TDS concentration in recharge areas in the mountains is low and increases closer to discharge areas in the lower parts of the valley (Everett and Rush 1967). In the Schurz area, groundwater TDS concentration derived from specific conductance values average around 2,361 mg/L (U.S. Geological Survey 2008b). The federal recommended drinking water standard for TDS is 500 mg/L. NDEP currently uses federal Safe Drinking Water Act standards for groundwater quality. In the Whiskey Flat-Hawthorne area, the average TDS concentration in wells, derived from specific conductance values, was 860 mg/L (U.S. Geological Survey 2008b).

Anaconda Mine Site

In Mason Valley, a plume of contaminated groundwater from the site of the Anaconda Copper Mine is moving north, in the direction of local groundwater flow. This site, also known as the Yerington Mine, covers more than 3,400 acres just west of Yerington. Portions of the site are owned by Arimetco (now in bankruptcy) and portions are public lands managed by BLM (U.S. Environmental Protection Agency 2008b). When open-pit mining ceased on the property, the groundwater pumping that had been used to keep the pit dry also stopped, and Pit Lake was formed. The lake volume is around 40,000 acre-feet. The water has filled approximately 500 feet of depth out of the total pit depth of 800 feet. The lake surface elevation increases at the rate of 10 feet/year (U.S. Environmental Protection Agency 2008b). At this rate, the lake would fill in roughly 30 years, but the rate of increase would probably decline as the water elevation approaches the ground surface elevation.

Although the site is not on the National Priorities List, the EPA Region 9 Superfund Program does have the lead for the site as a special project (Seter pers. comm. 2008), EPA Project ID# NVD083917252. EPA has spent approximately $6 million at the Anaconda Mine site since 2000 investigating and addressing environmental issues. Actions include capping 100 acres of mine tailings to prevent erosion and fugitive dust, constructing and lining a new pond to prevent overflow of mine drainage, and completing other upgrades to the system.

ARCO is conducting response actions at the site, including broad investigation of the nature and extent of groundwater contamination (Trout 2008). Wells have been placed in the path of the contaminated groundwater plume to create a “pump back” system that is used for monitoring water quality and for restricting the movement of the plume by pumping contaminated groundwater into lined evaporation ponds (U.S. Environmental Protection Agency 2009).

Although groundwater monitoring data are limited, six contaminants were detected in drinking water wells north of the mine site: arsenic, boron, fluoride, uranium, radium, and gross alpha radioactivity. In some wells, arsenic and uranium concentrations and gross alpha activity have exceeded federal water standards of the Safe Drinking Water Act (U.S Dept. of Health and Human Services 2006, U.S. Environmental Protection Agency 2008c).

Geothermal Water

As indicated in Chapter 2, Alternatives, there is an existing option to purchase water from the Homestretch Geothermal Power Plant (operated by Homestretch Geothermal), which is located immediately upstream of the Wabuska gage. If secured, discharge to the River from this source would occur via pipeline at a suitable point of delivery near the Wabuska gage in accordance with the terms of

a water quality discharge permit from the Nevada Division of Environmental Protection and all other necessary approvals. NDEP has issued a draft discharge permit for public review (Nevada Division of Environmental Protection 2009). Spent geothermal water from the power plant is currently discharged to an alkali flat east of the power plant and to a basin west of the power plant.

Water quality data from the power plant from 2003 to 2005 indicate arsenic, boron, copper, fluoride, sulfate and TDS concentrations in excess of water quality criteria (Nevada Division of Environmental Protection 2006), with fluoride being of greatest concern (Pahl 2008, pers. comm.). Arsenic, boron, copper, and fluoride make up a tiny fraction of the TDS from the site (Nevada Division of Environmental Protection 2006), and sulfates constitute about 40% of the TDS. A recent report by the U.S. Bureau of Reclamation (2009) indicates that aluminum, arsenic, boron, fluoride, sulfates, TDS, and the sodium absorption ratio (SAR) all exceeded state water quality standards in a significant percentage of samples, that adequate dilution flows would limit the frequency and duration of the allowable Homestretch discharge, and that when dilution flows are adequate to meet the fluoride standard all other constituents of concern would be in compliance with their respective water quality standards.

Environmental Consequences

This section describes the impact analysis relating to water resources for the Proposed Project and other alternatives. It lists the criteria used to determine whether an impact would be adverse or beneficial.

Assessment Methods

Some potential water resources impacts were assessed qualitatively based on existing processes and issues in the Walker River Basin and how they may change in response to the Proposed Project and alternatives. These impacts are listed below.

- Improved Walker River water quality because increased river flow results in the dilution of low quality inflow.
- Introduction of warm water or poor quality water to Walker River.
- Reduction in Walker River water temperature.
- Change in the migration of contaminated groundwater from the Anaconda Mine site.
- Change in the amount of groundwater pumping.
- Reduction of water supplies for remaining canal users as a result of reduced canal flows.

- Reduction in water availability for water users dependent upon incidental field runoff, seepage, and return flow from neighboring farms.
- Improved water quality resulting from reduced return flow.
- Increased erosion resulting from greater river flow and from more exposed soil (i.e., fallowed or retired lands) that could be susceptible to erosion during rainstorms.
- Construction-related stormwater impacts (short-term impacts potentially associated with construction under Alternative 3).

Conflicts with policies and goals in the master plans of Lyon and Mineral Counties that relate to water resources are addressed in Chapter 7, Land Use and Agriculture.

Quantitative evaluations of impacts are based on two distinct analyses: one for the portion of the study area upstream of Walker Lake, and one for Walker Lake. The methods employed in these analyses are described below. Hydrologic effects evaluated quantitatively for the upstream area are:

- reduction in surface water diversions,
- reduction in irrigated lands (a potential indirect effect of reduced surface water diversions), and
- estimated effect of reduced irrigation on groundwater recharge.

Hydrologic effects evaluated quantitatively for Walker Lake are:

- change in Walker Lake elevation and storage as a result of increased inflow, and
- change in Walker Lake TDS concentration as a result of increased inflow.

Average annual values were used for the quantitative analyses. Because the effects of Alternatives 1 and 3 would take many years to reach fruition, the use of average annual values is appropriate. The duration of Alternative 2, as analyzed, is shorter, but because it is impossible to predict year-to-year variations in future hydrologic conditions, average annual values are still considered an appropriate way to estimate effects.

The University has recently developed three integrated models and data for assessing hydrologic conditions in the basin (Boyle et al. 2009). The three models simulate:

- Runoff in response to precipitation,
- Groundwater –surface water interactions, and

- Operations and water rights allocation.

The models have not yet been used to estimate hydrologic impacts associated with the Acquisition Program, but they may eventually help to improve the estimated project effects described below in this Draft EIS.

Upstream Analysis

Purpose

The purpose of the upstream analysis is to estimate the effect of the alternatives on the flow of water to Walker Lake, on remaining water supplies for agriculture, and on incidental recharge of groundwater. To these ends, and to provide input to the Walker Lake analysis, the upstream analysis was used to estimate:

- The amount of water to be acquired from the East Walker area, Smith Valley, and Mason Valley to achieve an additional 50,000 af/yr of additional inflow to Walker Lake, on average, under Alternatives 1 and 2.
- The portion of acquired water that would reach Walker Lake under Alternatives 1 and 2. This result was then used together with information from Chapter 2, Alternatives, to determine the amount of additional lake inflow that could be achieved with existing funding for Alternative 1.
- The estimated increase in Walker Lake inflow under Alternative 3.
- The reduction in irrigated acres under Alternatives 1 and 2.
- The effect of each alternative on groundwater recharge.

The upstream assessment is useful for providing an understanding of the processes that affect groundwater recharge, irrigation, and river losses and the magnitude of potential Acquisition Program effects on these hydrologic processes. It also provides a framework for integrating many pieces of information and highlights necessary assumptions.

The analysis assumes that sufficient funds are or would become available to obtain, in perpetuity, an average additional 50,000 af/yr at Walker Lake under Alternative 1 (Proposed Project). A comparable amount of total funding is then assumed to be available for Alternative 2 (Leasing Alternative); however the need for recurrent expenditures to sustain a leasing program means that funding would eventually run out, and the effects of Alternative 2 would only be temporary. If only partial funding were available, the effects described here would be expected to be proportional to the funding. For example, if only 50% of the total funding needed for Alternative 1 were available, Alternative 1 would only yield an average of half as much water to the lake (25,000 af/yr) and effects on irrigation and groundwater recharge would also be half of that expected for the fully-funded project. If the funding for Alternative 2 were diminished by 50%, the increased

inflow to Walker Lake and effects on irrigation and groundwater recharge would only last half as long. Finally, for Alternative 3 (Efficiency Alternative), the analysis assumes that sufficient funding would be available to increase water efficiency to a high level. Estimated funding requirements for full implementation of the action alternatives, existing allocated funding levels, and assumed level of efficiency for Alternative 3 are discussed further in Chapter 2, Alternatives.

General Approach to Upstream Analysis

The upstream analysis uses the baseline water balance for the portion of the study area upstream of Wabuska (see Affected Environment, above) combined with estimates of additional river losses that would occur in the Reservation reach as a result of flow augmentation.

The main approach of the upstream analysis is to estimate how the movement of water would deviate from existing conditions in response to a reduction in irrigation diversions resulting from acquisitions. This includes estimating changes in water use by vegetation, changes in incidental groundwater recharge associated with irrigation, and changes in the hydrologic interaction between the river and the groundwater aquifer in each valley. The effect of each alternative on groundwater recharge was estimated by evaluating current incidental recharge, potential changes to incidental recharge, and how much extra water the river would contribute to groundwater recharge if there were a reduction in incidental groundwater recharge as a result of reduced surface water diversions.

The upstream analysis is based upon actual water use, i.e., it evaluates potential changes to the existing water balance based on historic average diversions, groundwater withdrawals, consumptive use by crops, and other variables. A discussion of the conversion between water rights and actual water appears in Chapter 2, Alternatives; however this conversion is not needed for the upstream analysis discussed herein.

The analysis does not separately account for the different types of surface and groundwater rights that may be appurtenant to irrigated lands, but is instead based on analysis of average total surface water diversions, average total groundwater withdrawals, and average total irrigated land within each valley. While important for day-to-day operations, these distinctions by type should not matter for determining the long-term average annual relationships between water application, irrigated land, and GRR flows. Future use of the University hydrologic models (Boyle et al. 2009) may further refine the assessment of impacts associated with the Acquisition Program by incorporating smaller time steps and more fine-scale evaluation of water right types and locations.

In this analysis, incidental GRR flows are estimated as the difference between the amount of irrigation water diverted and pumped and the amount of irrigation

water consumed by agricultural crops and non-riverine riparian/wetland vegetation. The two components of GRR cannot be readily separated because it is unknown how much of the irrigation water drains to the river either directly in canals or via subsurface flows, nor is it known how much is reapplied by another user. (Return flows can be estimated using upstream to downstream changes in flow, but other uncertain factors such as riverine ET and river infiltration to groundwater also affect river flows.) Groundwater recharge and return flows both have a large effect on river flows.

To estimate the amount of acquired water that would reach Walker Lake each year, on average, over the long term, the upstream analysis includes estimates of additional losses that could occur as a result of the action alternatives. When acquired or saved water is left in the river instead of being diverted into a canal, there are several ways that the additional volume of water could be reduced before it reaches Walker Lake:

- Return Flows – Return flows include surface water returns and shallow groundwater returns to the river that are associated with the application of irrigation water from both surface and groundwater sources. If there had been return flows associated with water obtained through any of the three alternative actions, those return flows would no longer be contributing to river flow.
- Groundwater – If incidental groundwater recharge from irrigation is reduced, then the groundwater table could drop. If this happens, river flows would be reduced because either there would be less groundwater inflow to the river or there would be more seepage from the river to groundwater.
- Loss downstream of Wabuska –Increases in flow in this area might produce an increase in river losses associated with groundwater infiltration or riparian ET.

Two other possible sources of additional loss were considered, but not included in the analysis because they are likely to be insignificant: increased ET upstream of Wabuska and increased infiltration to groundwater resulting from increases in river flow.

If a river is the primary source of water for an aquifer, as it is for most of the Walker River system, and the water moves readily through the substrate, a reduction in groundwater recharge can have a fairly large effect on river flow. Figure 3A-19 shows two possible scenarios that may occur if groundwater recharge is reduced. When water moves readily from a river to the aquifer, the river is able to compensate for reductions in incidental groundwater recharge associated with a reduction in surface water diversions or increased water efficiency. This compensation, however, comes at a cost of reduced river flow. If

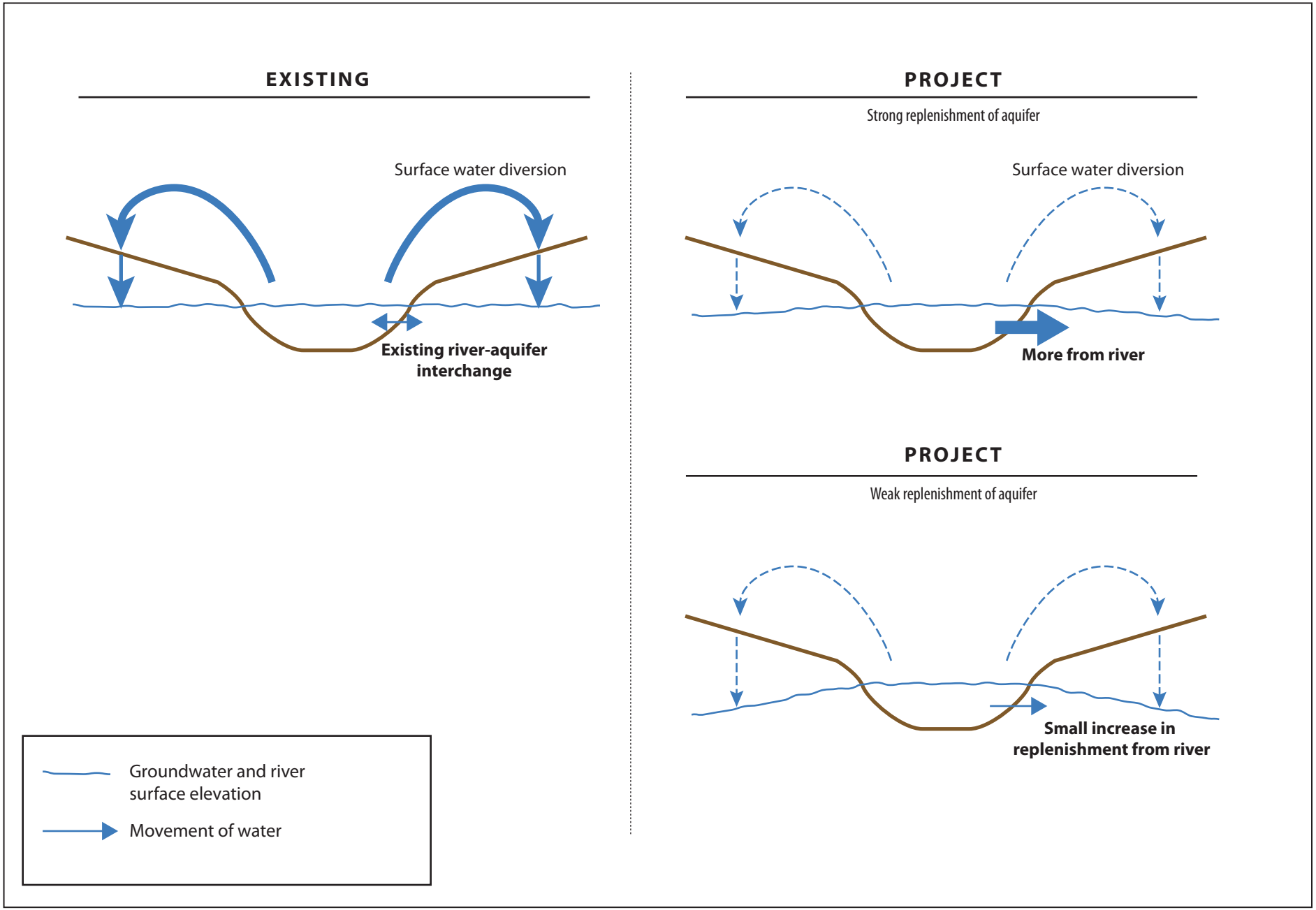

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Figure 3A-19
Conceptual Diagram Showing How Project Effects on the Aquifer and River are Dependant on the Rate of Interchange between the River and the Aquifer

there is weak replenishment from the river to the aquifer, then river flow would not be much reduced, but the groundwater table would drop.

Assumptions

Because of uncertainties in the upstream analysis, the following assumptions were made:

- Acquisitions would be evenly distributed within each valley (distribution between valleys is expected to differ and is described later).
- Non-riverine riparian and wetland vegetation is dependent on irrigation water.
- ET of native phreatophytic vegetation would not significantly change in response to project actions.
- Pumping of groundwater would not change substantially. However, the potential for acquisitions to cause a change in groundwater pumping is discussed qualitatively in the Impacts section of Chapter 3, Water Resources.
- All water acquisitions would be derived from irrigation supplies. This assumption was made for the purposes of the upstream hydrologic analysis and to estimate the amount of irrigated land that could be affected by the alternatives. Impacts to existing irrigated lands could be lessened by the purchase of non-agricultural water (e.g., geothermal).
- Acquired water would not be diverted by downstream water users, but the flow augmentation would be reduced as a result of river losses.
- The river would partially compensate for reductions in GRR by increased infiltration to groundwater, reducing the magnitude of the incremental increase in river flow caused by the action alternatives.
- No transit losses were assumed for water passing from East Walker Reach or Smith Valley Reach through Mason Valley. The basis for this assumption is described below.
- Approximately 10% of the incremental flow increase at Wabuska would be lost between Wabuska and the lake. The basis for this assumption is described below.
- ET by riparian vegetation near the river would not substantially increase upstream of Wabuska, but may increase downstream from Schurz where the channel is now often dry.
- For Alternatives 1 and 2, water efficiency (crop ET divided by diverted and pumped water) would remain unchanged.

- For Alternative 3, the same level of water efficiency would be attained in all valleys.
- For Alternative 3, total ET from irrigated lands would not change.

Transfer Scenarios for Alternatives 1 and 2

The effects of water right acquisitions on agricultural lands and groundwater are dependent on how much of the acquired water would be allowed to be transferred. Depending on the specific circumstances involved with a particular acquisition, it is possible that NSE or another agency whose approval of a water transfer is sought, could determine that some portion of the acquired water should remain in canals to avoid harm to other existing water right holders. If this were the case, additional water would need to be acquired to compensate for the portion not transferred.

Two scenarios, the Full Transfer Scenario and the 33% Scenario were established to represent likely extremes for evaluating Alternatives 1 and 2. These scenarios bound the range of potential impacts, such as the amount of irrigated land needed to implement the Acquisition Program. For Alternative 3, the amount of irrigated land involved in acquisitions was not considered to be critical because the alternative would not cause irrigated land to be retired or fallowed. Consequently, no specific transfer scenario was developed for Alternative 3.

Full Transfer Scenario

The Full Transfer Scenario assumes that all acquired water could be left in the river to flow downstream, and that no supplemental groundwater rights would be retired. Supplemental groundwater would be available to the seller, potentially to supplement other primary rights; however, it is assumed that supplemental groundwater pumping would not increase, based on expected conditions of NSE approval. The Full Transfer Scenario minimizes future reductions in irrigated land resulting from acquisition of appurtenant water rights (identified as the “best case” for irrigated land in Table 3A-10), but has the greatest impact on groundwater because existing incidental groundwater recharge associated with an acquisition would be eliminated and pumping of supplemental groundwater could continue (“worst case” for incidental groundwater recharge in Table 3A-10). This scenario also would cause the greatest reduction in surface or sub-surface return flows to the river.

The amount of water to be acquired from each valley was adjusted until the irrigated lands required for acquisitions were similar in proportion for each valley, yet the amounts of increased inflow at Walker lake associated with each acquisition subarea still fell within the subarea percentages indicated in Chapter 2, Alternatives (i.e., of the 50,000 af/yr average additional inflow to Walker Lake that is expected to accrue as a result of upstream water acquisitions, 60-85%

would come from Mason Valley, 10-30% from Smith Valley, and 5-10% from East Walker.). In reality, the percent reduction in irrigated land would likely differ among the valleys because of the willing–seller requirement.

33% Scenario

Out of concern for impacts on other existing water right holders, NSE could impose restrictions on transfers, such as limiting transfers to the consumptive use portion of the water right (i.e. only the amount of water consumed by crops, quantified as ET). NSE indicated such restrictions have been imposed in the past, but such issues could be addressed on a case by case basis (Yardas pers. comm. 2008). If NSE were to limit all transfers to the consumptive use portion of the purchased water rights and require that all supplemental groundwater rights previously associated with those rights be retired, the amount of irrigated land needed for acquisitions would be substantially larger than for the Full Transfer scenario. To limit the potential impact, the University has stated that it intends to make acquisitions that would result in no more than a 33% reduction in the irrigated acreage within Mason Valley, Smith Valley, or the East Walker area (James pers. comm. 2009). Consequently, the 33% Scenario was developed to fit the assumption that no more than 33% of the irrigated land in each valley would be retired or fallowed as a consequence of Alternatives 1 or 2 (the "worst case" for irrigated land in Table 3A-10). Under the 33% Scenario, effects on incidental groundwater recharge would be minimized by restrictions that may require some of the acquired water to remain in canals ("best case" for incidental groundwater recharge in Table 3A-10). Consequently, more irrigated land would be required than under the Full Transfer Scenario but groundwater effects and reductions in return flows would be smaller.

Whether the Full Transfer Scenario or the 33% Scenario could actually deliver 50,000 af/yr of additional inflow to Walker Lake depends most fundamentally upon the extent of viable offers from willing sellers, although other factors also influence them both, such as the extent to which restrictions are imposed on transfers of acquired water and whether supplemental groundwater rights are retired. The likelihood of the 33% Scenario providing an average additional inflow of 50,000 af/yr to Walker Lake also depends heavily upon the geographic distribution of offers from willing sellers, to a greater extent than does the Full Transfer Scenario. If nearly all acquired water does come from irrigated agriculture but minimal offers come from Smith Valley or the East Walker area, the 33% limit would prevent sufficient acquisitions from being made to provide 50,000 af/yr of additional inflow to Walker Lake.

Transfer Scenario for Alternatives 3

For Alternative 3 it is assumed that mechanisms would be developed to allow conserved water to pass downstream without being diverted by downstream and/or junior priority rights holders. For example, diversion rights might be reduced in amounts commensurate with the conservation savings to ensure that conserved water can be administered like a water right and thus protected from simply becoming part of the available water supply.

Approach for Specific Alternatives

A qualitative description of the transfer scenarios for each action alternative is provided in Table 3A-10.

The upstream analysis for Alternative 1, the Proposed Project, also applies to Alternative 2, the Leasing Alternative. Both of these alternatives were evaluated with the Full Transfer Scenario as well as the 33% Scenario, and both of these alternatives result in the same estimated reduction in irrigated lands and incidental groundwater recharge. The distinction between these two alternatives is that, under Alternative 1, some land would be permanently removed from irrigated agricultural production and the resulting flow changes would be permanent, whereas under Alternative 2, as analyzed, fallowing would likely be rotated between different land parcels over time and the resulting flow changes would be temporary (i.e., until funds are exhausted). Alternative 3 (Efficiency Alternative) differs in that irrigation of existing irrigated lands is assumed to continue.

For Alternative 3, a scenario of 100% efficiency was evaluated to assess the theoretical maximum yield of this alternative. In practice, absolute efficiency is not achievable, so a more realistic overall efficiency value of 75% was used to assess impacts from Alternative 3.

This 75% overall efficiency value roughly represents a 90 to 95% conveyance efficiency combined with an 80 to 85% on-farm or application efficiency. Literature indicates that application efficiency rates ranging from 60% to 90% are attainable with a variety of irrigation technologies (Howell 2003 pp 467 - 472; Solomon 1988). Attaining an efficiency of 90% would require a very large investment in conveyance infrastructure improvements such as canal lining and piping.

Alternative 3 has fairly large impacts on incidental groundwater recharge because a large portion of current losses contributes to groundwater recharge. Because of feasibility concerns, crop switching was not considered as part of the quantitative assessment for Alternative 3. However, if crop switching measures were to be included as part of Alternative 3, it could result in potentially significant water savings with less impact to GRR flows.

Table 3A-10. Qualitative Evaluation of Transfer Scenarios for the Action Alternatives

Alternative	Best Case for Irrigated Land	Worst Case for Irrigated Land	Best Case for Incidental Groundwater Recharge	Worst Case for Incidental Groundwater Recharge
1	Full Transfer	33% Scenario	33% Scenario	Full Transfer
2	Full Transfer	33% Scenario[a]	33% Scenario	Full Transfer
3	NA	NA	Elimination of incidental ET	75% Overall Efficiency

[a] For Alternative 2, the reduction in irrigated land is assumed to result from the temporary fallowing of land rather than permanent retirement of parcels.

Alternatives 1 and 2 were evaluated assuming that the percent reduction in irrigated land in each of the three valleys (East Walker, Mason Valley, and Smith Valley) would be relatively similar, while the percent of total acquisitions for each valley would fall within the ranges described in Chapter 2, Alternatives. For Alternative 3, it was assumed that with the same water efficiency would be attained in each valley.

Assumptions and Methods Specific to the Full Transfer Scenario

To evaluate the Full Transfer Scenario, assumptions for supplemental groundwater pumping and GRR flows were as follows:

Supplemental Groundwater Rights

If supplemental groundwater rights are acquired along with surface water rights, the supplemental groundwater rights might have to be retired and the associated groundwater pumping would be discontinued. However, it is likely that many supplemental groundwater rights would not be retired. For the Masini and Sunrise options, for example, the sellers were not willing to include their supplemental groundwater rights in their offers except on a contingent basis (i.e., if not in the process of being transferred at the time of the close of escrow). It is not clear how the NSE would handle supplemental groundwater rights in this context. However, for purposes of this Draft EIS, their continued exercise is assumed to require that they be transferred to and used in conjunction with a different surface water right of equal or greater seniority.

The retirement of supplemental groundwater rights could provide mitigation for reduced incidental groundwater recharge. However, because the Full Transfer analysis is an evaluation of the maximum groundwater effects and the minimum loss of agricultural land, this scenario assumes that no supplemental groundwater rights would be retired (i.e., those rights might still be available for farming or other purposes in the future if they are used to supplement primary rights that

have equal or greater expected reliability as compared to the previous primary rights).

Incidental Groundwater Recharge and Return (GRR) Flows and River Losses.

Under the Full Transfer Scenario, GRR flows would be affected by water rights acquisitions. Under existing conditions, the estimated agricultural GRR flows for the East Walker River, Smith Valley, and Mason Valley are 9,000 af/yr, 25,000 af/yr, and 94,000 af/yr, respectively (see Affected Environment).

To estimate the effect of water acquisitions on GRR and river flows under the Full Transfer Scenario, the following assumptions were made:

- Agricultural GRR flows decrease in proportion to the fraction of the irrigation water that is acquired, and
- River flow would be reduced in response to a reduction in GRR flows (i.e., some of the reduction in groundwater recharge would be offset by groundwater infiltration from the river).

Work by Myers (2001a and 2001b) indicates that there is a moderate to strong connection between flows in the river and the groundwater aquifer in Mason Valley and Smith Valley, with the exception of the far northern portion of the Smith Valley. If groundwater recharge were reduced in these areas, either the rate of movement from groundwater to the river would be reduced or more water would seep from the river to groundwater. Any long-term decline in groundwater levels is likely to reduce flows in the river. The exact reduction in river flows cannot be predetermined, especially because the location of all the farmland to be affected is currently unknown. If the land is close to the river, the link between the river and the groundwater is more direct than if the land is far from the river.

Myers investigated the potential long-term effect that a reduction in groundwater recharge would have on river flows using a groundwater model. Myers work is currently the only source of published information regarding how infiltration from Walker River may respond to long-term decreases in groundwater recharge (Myers 2001a and Myers 2001b). The analysis was performed for 4 locations in the Smith and Mason Valleys. The estimated valley-wide percent connection between the recharge reduction and the river flows forecasted for 25 years in the future were 52% for the Smith Valley (Myers 2001a) and 82% for the Mason Valley (Myers 2001b). This means that 52% (Smith Valley) and 82% (Mason Valley) of any reduction in GRR is estimated to be offset by reduced river flows over time. The Smith Valley value is much lower than the Mason Valley value because water that is applied north of the groundwater divide in the Smith Valley tends to flow towards Alkali Lake instead of the river. The value for the East Walker reach was assumed to be the same as the value for Mason Valley. In the

following text, these values are referred to as the “Link” values (i.e., to reflect the link between the river and groundwater).

These Link values can be used to estimate the reduction in river flow as a percent of surface water purchases. Assuming that groundwater pumping remains unchanged (the Full Transfer Scenario assumes no reduction in supplemental groundwater pumping) this percent can be calculated as:

$$PercRed = 100 * Link * GRR_e / (SW_e + GW_e)$$

Where:

PercRed = the percent reduction of transferred water resulting from a reduction in incidental groundwater recharge assuming full transfer of water.

Link = the fraction of a reduction in incidental groundwater recharge that is compensated by a reduction in river flow (0.82 for the East Walker reach and the Mason Valley reach and 0.52 for the Smith Valley reach as estimated by Myers, 2001a and 2001b).

GRR_e = Average annual GRR flow volume estimate for existing conditions.

SW_e = Average annual surface water diversion volume estimate for existing conditions.

GW_e = Average annual groundwater pumping volume estimate for existing conditions.

The calculated values for PercRed are:

East Walker reach: 34.1 percent

Smith Valley reach: 15.9 percent

Mason Valley reach: 37.3 percent

Part of the reason there is such a strong connection between groundwater recharge and the river is that some agricultural return flows to the river move through the ground. The assessment of GRR flows assumes that most of the GRR flows are either incidental groundwater recharge or return flows that move through the groundwater aquifer. If all of the GRR flows were composed of return flows, there would be a 100% connection between a loss in the GRR flows and reduction in river flow (and the PercRed values would be 41.8% for East Walker reach, 30.4% for Smith Valley reach, and 45.7% for Mason Valley reach). River flows

would decline in response to a reduction in GRR flows most quickly by a loss in direct return flows and then less directly, or secondarily, by a change in the river interaction with the aquifer. Any reduction in GRR flows that is not compensated by the river would affect net groundwater recharge.

Assumptions and Methods Specific to the 33% Scenario

It is possible that restrictions on the transfer of water and retirement of supplemental groundwater rights could result in substantially larger reductions in irrigated lands than under the Full Transfer scenario. Because of concerns regarding potential impacts on irrigated lands, a cap of 33% has been placed on the reduction in irrigated lands allowed to occur in association with the Acquisition Program under the 33% Scenario.

It is difficult to perform detailed numerical assessments on the 33% scenario because the extent and nature of transfer restrictions are unknown, the effectiveness of the restrictions on maintaining groundwater recharge is unknown, and the potential reduction in supplemental groundwater pumping is also unknown. However, because the goal of this analysis is to estimate some of the worst impacts that are likely to occur, it is not necessary to perform detailed quantitative analysis for this scenario; the 33% Scenario assigns a maximum value for impacts on irrigated land and its effects on groundwater recharge would be less than those of the Full Transfer Scenario.

Assumptions and Methods Specific to the Efficiency Alternative

For existing conditions, the amount of water lost to non-riverine riparian and wetland vegetation (incidental or non-crop ET) combined with the estimated incidental GRR flows provides an estimate of the amount of water lost to inefficiencies in the conveyance or application of water for irrigation (see Affected Environment section). For the three valleys, East Walker, Smith Valley, and Mason Valley, the inefficiencies were estimated as 47%, 40%, and 54%, respectively, of the total irrigation water. The estimated volumes of water lost to inefficiency are approximately 10,000 af/yr for East Walker Valley, 33,000 af/yr for Smith Valley, and 111,000 af/yr for Mason Valley. The corresponding efficiency values are 53%, 60%, and 46%, respectively.

For this alternative, it is assumed that:

- Flows would be augmented by increasing the percent efficiency for each valley to the same value. The most water savings would come from the Mason Valley because it appears to have the lowest percent efficiency as well as the largest use of irrigation water.
- Efficiency measures would reduce incidental ET by the same percent they would reduce incidental GRR flows.

- Groundwater pumping and consumptive use (i.e., net ET from crops) would remain unchanged.

Compared to the GRR flows, the incidental ET is relatively small. Total existing incidental ET is estimated to only be 26,000 af/yr for all three valleys, as compared to 128,000 af/yr for total GRR flows. Thus, removal of incidental ET by itself could not provide an additional 50,000 af/yr to Walker Lake. Reduction in GRR flows would also be necessary. Reduction in GRR flows is not as effective as reduction in incidental ET because the GRR flows help maintain river flows and may also help to support other existing water rights.

Similar to the Full Transfer Scenario, the variable Link was used to estimate the percent by which the water savings left in the river would be reduced as a result of increased river infiltration to groundwater resulting from a reduction in incidental GRR flows. When the above assumptions are made, the percent reduction in water savings is independent of the target efficiency rate.

$$PercRed = 100 * Link * GRR_e / (GRR_e + IET_e)$$

Where:

PercRed = the percent reduction in saved water resulting from a reduction in incidental groundwater recharge.

Link = the fraction of a reduction in incidental groundwater recharge that is compensated by a reduction in river flow (0.82 for the East Walker and the Mason Valley reach and 0.52 for the Smith Valley reach based on work by Myers [2001a and 2001b]).

GRR_e = Estimated average annual GRR flow volume for existing conditions.

IET_e = Estimated average annual incidental ET (i.e., ET for non-riverine riparian and wetland vegetation or non-crop ET) under existing conditions.

Note that, if IET_e is zero, then all water savings come from a reduction in GRR and the percent reduction equals the savings times the Link parameter.

The calculated values for PercRed are:

East Walker reach:	72.1% (because incidental ET is low)
Smith Valley reach:	40.2%
Mason Valley reach:	69.2%

Assumptions and Methods for Additional Losses

Whatever portion of acquired water is eventually approved for transfer, additional physical losses would occur between the existing points of diversion and Walker Lake. Losses related to a potential decrease in GRR flows, which are particular to the alternative being evaluated, are discussed above. This section describes how potential additional losses were assessed for all alternatives.

Riverine Evapotranspiration Upstream of Wabuska

As the river flows downstream, some flow is lost directly to ET along the river. As estimated in the Affected Environment section, this includes flow reductions associated with trees using shallow groundwater within 1,000 feet of the river channel. Estimated riverine ET represents a fairly small percent of total flow volume (8% for the East Walker reach, 2% for the Smith Valley reach, and 3% for the Mason Valley reach).

It is uncertain whether riverine ET along the Walker River would increase in response to increases in flow. Increase in river flow would likely have a relatively small effect on the elevation of the shallow groundwater that supports riparian vegetation along the river. Furthermore, this small effect might be negated by potential project-related lowering of the groundwater table. Other factors affecting riverine ET are the amount of space available for riparian vegetation and the type of vegetation present. Riverine vegetation is often limited to the extent of the floodplain, which is not expected to change as a result of the Acquisition Program. Because it is unclear whether riverine ET would increase beyond existing levels and because, if there were an increase, it would represent a small percent of the total acquired water, riverine ET was assumed to remain at existing levels in the upstream valleys. The existing riverine ET is supported by existing flows and would not reduce the volume of a flow increase.

Mason Valley Transit Losses

No transit losses were assumed for water passing from East Walker Reach or Smith Valley Reach through Mason Valley. As water flows through Mason Valley a certain amount of water is lost to ET (discussed above) and infiltration. As river flow increases, there is an increase in the wetted perimeter, which theoretically could increase the amount of infiltration to groundwater. However, most infiltration, which is largely dependent on local groundwater conditions, already occurs under base flow conditions and would not reduce the amount of acquired water moving through the valley. There is no clear significant relationship between groundwater infiltration and mere increases in flow within the Mason Valley. Any increases in infiltration associated with increases in flow (transit losses) are likely to be insignificant compared to the losses estimated to be associated with reductions in GRR flows.

Incremental Increase in Losses between Wabuska and Walker Lake

A discussion of existing losses in this reach, as well as the relationships between losses in the reach and flow at Wabuska, is included in the Affected Environment, Affected Environment section of Chapter 3, Water Resources. The analysis described below builds upon that Affected Environment information.

Wabuska to Schurz
There are sufficient flow measurements from Wabuska and Schurz to estimate how riverine losses in this reach may increase in response to increases in flow. Based on the analysis in the Affected Environment section, the incremental loss associated with a flow increase over and above existing flows is assumed to be 4% of the additional flow at Wabuska.

Schurz to Walker Lake
The flow measurements taken at Schurz and near the lake indicate the magnitude of the existing flow losses in this reach. However, it is difficult to say how much the losses in this reach may increase if river flow is increased as a result of the Acquisition Program. Clearly, if river flow goes from zero to some value, losses would increase. Under existing conditions, there is usually some flow at Schurz (e.g., median flow of 5-7 cfs for August-September, the months with the lowest flow) to provide for a base level of ET and infiltration. However, about a quarter of the summer months have no flow at Schurz under existing conditions. If the increases in flow were to bring flows to Schurz during such times, losses associated with flow augmentation could be relatively high. However, because acquired water rights are more likely to yield water when more water is available, increased flows in this reach are likely to occur when flow is already present at Schurz.

In addition, there is some potential for Weber Reservoir to be operated to optimize the flow of water into the lake. Weber Reservoir may provide an opportunity to manage lower river flows and discharge to Walker Lake during the irrigation season. To the extent that there is available capacity, it may be possible to store acquired water in the reservoir in order to focus releases during a particular period and benefit aquatic and riparian resources or minimize flow losses downstream from the reservoir, provided that reservoir operating criteria are met. Such reservoir operations would be secondary to those for irrigation and flood control and require agreement among the project manager, BIA, and Walker Tribe. Changes in the use of Weber Reservoir would require development and implementation of an operations plan for Weber Reservoir to assure that use of decreed water rights in the Walker River Indian Irrigation Project would not be impaired and to protect the safety of the downstream community. (See Chapter 2, Alternatives, for additional discussion about potential operations of Weber Reservoir.)

Factors that could cause an increase in river losses in association with increased flow between Schurz and Walker Lake would be:

- Increased evaporation from the river – Increased evaporation would be limited by the increase in water surface area.
- Increase in ET from existing vegetation – Given the use of averaged data for this analysis, it may be reasonable to assume that existing vegetation is already obtaining sufficient water to survive.
- Increase in ET resulting from increase in riparian vegetation – This would depend in part upon the success of restoration efforts (see Chapter 14, Cumulative Impacts).
- Increase in groundwater infiltration – Increased infiltration would be largest when flow increases result in a change from zero base flow to a positive flow value. However, groundwater that is not used for irrigation or by riparian vegetation in this area may eventually flow to the lake.

Wabuska to Walker Lake
As described in Chapter 2, Alternatives, it is assumed that the Walker River Paiute Tribe, BIA, and the University (or other implementing entities) would develop an agreement for the management of acquired water through the Reservation for delivery to Walker Lake.

For the purposes of estimating the incremental losses associated with increased flows between Wabuska and Walker Lake, a composite value of 10% of flow at Wabuska was used. This 10% represents a combination of the estimated 4% increase in losses between Wabuska and Schurz, along with an additional 6% loss. The additional 6% roughly accounts for incremental increased losses between Schurz and the lake that might result from occasionally providing flow when there are no baseline flows as well as for increases in ET from additional growth of riparian and wetland vegetation made possible by the increased flow from the action alternatives.

Six percent is probably more than enough to cover incremental losses between Schurz and the lake. In water year 2005, the only water year with a full set of flow measurements at the upstream and downstream end of this reach, total losses were 6% of the flow at Wabuska. If 2005 was known to be representative, this data suggests that only an additional 2% loss would be needed beyond the 4% already allocated for new losses between Wabuska and Schurz.

Consequently, any increase in losses associated with flow augmentation would be expected to be less than the composite 10% value. Ten percent is used conservatively to avoid underestimating potentially adverse upstream impacts of the action alternatives. Based on this 10% loss factor, in order to deliver an

additional 50,000 af/yr to Walker Lake on average, the estimated increase in flow needed at Wabuska would be an average of 55,555 af/yr.

Upstream Analysis Results

Percent of Flow Augmentation Reaching Walker Lake

Table 3A-11 illustrates the combined effects of incremental flow losses on the percent of the acquired or saved flow reaching Walker Lake. Numbers are presented for both the Full Transfer Scenario (Alternatives 1 and 2) and the Efficiency Alternative (Alternative 3). The amount of flow augmentation is listed as 10,000 af/yr merely for the purposes of illustrating analytically the percent of water remaining in the river.

Under the Full Transfer Scenario, it is estimated that 59%, 76%, and 56% of the acquired or leased water would reach Walker Lake from the East Walker reach, Smith Valley reach, and Mason Valley reach, respectively. In contrast, under Alternative 3, it is estimated that only 25%, 54%, and 28% of the water savings would reach Walker Lake from the East Walker reach, Smith Valley reach, and Mason Valley reach, respectively (Table 3A-11). The percent of flow augmentation estimated to reach the lake is much lower for Alternative 3 because a large proportion of the water savings for this alternative come at the expense of a reduction in GRR flows that help to sustain river flows.

These percents can be used to estimate what portion of a volume of acquired water would reach Walker Lake.

It may seem counterintuitive that more water acquired from Mason Valley would be lost on the way to Walker Lake than would be lost from water acquired from Smith Valley. Most of the estimated loss is caused by the river response to a reduction in GRR flows. This loss would result directly from acquisitions within the valley. If no water were acquired within a valley, then there would be almost no incremental increase in losses within the valley. For that reason, water acquired in Mason Valley would be reduced in response to the connection between the river and the aquifer in Mason Valley and water acquired in Smith Valley would be reduced in response to the connection between the river and the aquifer in Smith Valley. The primary reason for the seemingly odd result of losing more Mason Valley water than Smith Valley water is the presence of the groundwater divide in the Smith Valley. The presence of the groundwater divide in Smith Valley has the effect of reducing the valley-wide average connection between the river and the aquifer in Smith Valley. As a result, more of the water acquired from Smith Valley would stay in the river (and there would be a larger reduction in groundwater).

Table 3A-11. Estimated Percent of Acquired, Leased, or Saved Water that Would Reach Walker Lake

	East Walker	Smith Valley	Mason Valley
Full Transfer Scenario (Acquisition and Lease Alternatives)			
Water Acquisitions or Leases (af/yr)	10,000	10,000	10,000
Percent Loss from Reduction in GW Recharge Plus Returns	34.1%	15.9%	37.3%
Acquired Water at Downstream End of Valley (af/yr)	6,590	8,410	6,270
Percent Loss between Wabuska and Lake	10%	10%	10%
Percent Acquired Water Arriving at Lake	59%	76%	56%
Efficiency Alternative			
Water Savings (af/yr)	10,000	10,000	10,000
Percent Loss from Reduction in GW Recharge Plus Returns	72.1%	40.2%	69.2%
Saved Water at Downstream End of Valley (af/yr)	2,790	5,980	3,080
Percent Loss between Wabuska and Lake	10%	10%	10%
Percent Acquired Water Arriving at Lake	25%	54%	28%

Estimated Impacts on Irrigated Land and Groundwater Recharge

The main purpose of the upstream analysis is to estimate potential impacts on irrigated lands and groundwater recharge that may be associated with the Acquisition Program. Tables 3A-12 and 3A-13 provide summaries of estimated impacts and further detail is provided below. For the Full Transfer Scenario, the estimated reduction in irrigated land was approximately 26% and reduction in net groundwater recharge was estimated to be 5-11% of the estimated incidental GRR flows. For the 33% Scenario, the reduction in irrigated land was 33% and the reduction in net groundwater recharge would be less than for the Full Transfer Scenario. For Alternative 3, without a reduction in ET from irrigated lands, it would be unlikely that inflow to Walker Lake could be increased an average of 50,000 af/yr. (Crop substitution offers one potential method to reduce ET.) When water efficiency was increased to 75% from the approximately 50% for existing conditions, the estimated reduction in net groundwater recharge was estimated to be 12-23% of the estimated incidental GRR flows.

Table 3A-12. Estimate of Hydrological Effects Upstream of Walker Lake

	Alternative 1[a]		Alternative 2[a]		Alternative 3[b]
	Full Transfer Scenario	33% Scenario	Full Transfer Scenario	33% Scenario	75% Water-Use Efficiency
Acquisition of Real Water (average af/yr)					
East Walker	6,000	Not Analyzed[c]	Same as Alternative 1 but temporary	Same as Alternative 1 but temporary	7,000
Smith Valley	20,000	Not Analyzed[c]			16,000
Mason Valley	56,000	Not Analyzed[c]			79,000
Total	82,000	Not Analyzed[c]			102,000
Increase in Walker Lake Inflow (average af/yr)					
East Walker	3,500	<=FTS[d]			1,600
Smith Valley	15,000	<=FTS[d]			8,700
Mason Valley	31,500	<=FTS[d]			21,900
Total	50,000	<=FTS[d]			32,200
Maximum Reduction in Irrigated Land (acres)[e]					
East Walker	1,100	1,300			0
Smith Valley	4,200	5,800			0
Mason Valley	9,500	11,500			0
Total	14,800	18,600			0
Maximum Percent Reduction in Irrigated Land[e]					
East Walker	27	33			0
Smith Valley	24	33			0
Mason Valley	27	33			0
Weighted Average	26	33			0
Reduction in Groundwater Level (inches/year)					
East Walker	0.2	<FTS			0.5
Smith Valley	0.4	<FTS			0.9
Mason Valley	0.5	<FTS			1.3
Weighted Average	0.4	<FTS			1.0

Notes:

Many assumptions were used in generating these estimates. See description of assessment methods above and in Appendix 9A.

FTS = Full Transfer Scenario

a. Estimates for Alternatives 1 and 2 assume that funding would be sufficient to attain an average increase in Walker Lake inflow of 50,000 af/yr under Alternative 1.

b. Water savings were assumed to result from reductions in ET from riparian/wetland vegetation and reductions in incidental groundwater recharge, not reductions in ET from irrigated lands (as may result from crop switching).

c. It was not necessary and there was too little information to develop detailed numerical estimates for the 33% Scenario (see Appendix 9A).

d. The amount of additional water reaching Walker Lake under the 33% Scenario may or may not be as high as an average 50,000 af/yr, depending on the extent of water transfer restrictions and the geographic distribution of acquisitions.

e. The estimated reduction in irrigated land for Alternatives 1 and 2 assumes no increase in water-use efficiency.

Table 3A-13. Summary of Assessment Scenarios and Results

Alternative	Best Case for Irrigated Land	Worst Case for Irrigated Land	Best Case for Incidental Groundwater Recharge	Worst Case for Incidental Groundwater Recharge
Scenarios				
Alternative 1	Full Transfer	33% Reduction	33% Reduction	Full Transfer
Alternative 2	Full Transfer	33% Reduction[a]	33% Reduction	Full Transfer
Alternative 3	NA	NA	Elimination of incidental ET[b]	75% Overall Efficiency
Results				
	Percent Reduction in Agriculture		Reduction in Net Groundwater Recharge (% of Existing GRR)	
Alternative 1	24-27% [e]	33%	0% [c]	5%-11% [e]
Alternative 2	24-27% [e]	33%	0% [c]	5%-11% [e]
Alternative 3	NA	NA	0%[d]	12%-23% [e]

[a] For Alternative 2, the reduction in irrigated land is assumed to result from the temporary fallowing of land rather than permanent retirement of particular land parcels.

[b] For the Efficiency Alternative to avoid effects to incidental groundwater recharge, it would be necessary to remove non-riverine riparian and wetland vegetation and limit improvements only to the extent that system losses are used for incidental ET as opposed to contributing to groundwater recharge.

[c] This value would depend on the type of restrictions placed on water transfers by the NSE

[d] If Alternative 3 were limited to water saved by elimination of incidental ET, Alternative 3 would not provide enough water to the lake. The estimated total amount of incidental ET for all three valleys was only 25,000 af/yr.

[d] Value varies between valleys.

Alternatives 1 and 2

The Full Transfer Scenario assumes no restrictions would be placed on the transfer of acquired water (where acquired water is the real-water yield of acquired water rights) and that all supplemental groundwater rights associated with acquired water would continue to be exercised at historic rates of use instead of retired. However, it also assumes that any decreases in river flow associated with the Acquisition Program would reduce the quantity of acquired water available for conveyance to Walker Lake. The Full Transfer Scenario is the best-case scenario for maintaining irrigated land, but the worst-case scenario for groundwater recharge. If restrictions are placed on the transfer of water, the reductions in irrigated land could reach the maximum permitted level of 33% (see

Chapter 2, Alternatives). This 33% Scenario represents the worst-case scenario for irrigated lands and the best-case scenario for groundwater recharge.

Impacts on Irrigated Land
For the Full Transfer Scenario, the estimated percent of acquired water arriving at Walker Lake (see above) was used to estimate the amount of water needed from each valley in order to have an additional 50,000 af/yr reach the Lake. The amounts were adjusted until the agricultural impacts (lands removed from production or no longer irrigated) were similar in percentage terms for each valley (Table 3A-14). Average baseline (existing) irrigated land coverage is estimated to be 4,000 acres for East Walker Valley, 17,500 acres for Smith Valley, and 35,000 acres for Mason Valley (see Table 3A-12 and the Land Coverage subsection above). When the acquisition/lease amounts were set to 6,000 af/yr, 20,000 af/yr, and 56,000 af/yr for the East Walker, Smith Valley, and Mason Valley, respectively, the estimated average increase inflow at the lake was 50,000 af/yr and the estimated percent reduction in water use (and percent reduction in irrigated land) was 27%, 24%, and 27%, respectively, for each of the valleys (average of 26%). This corresponds to a reduction in irrigated lands of 1,100 acres for East Walker, 4,200 acres for Smith Valley, and 9,500 acres for Mason Valley.

Under the 33% Scenario, the reduction in water use and irrigated land would be 33% for each valley. This represents the largest reduction in irrigated lands for each valley allowed by the Proposed Project or its alternatives (see Chapter 2, Alternatives). This corresponds to a reduction in irrigated lands of 1,300 acres for East Walker, 5,800 acres for Smith Valley, and 11,500 acres for Mason Valley.

Incidental Groundwater Recharge and Return Flows
A reduction in irrigation under Alternatives 1 or 2 could cause a reduction in groundwater recharge. However, because of increased river flows, groundwater levels could rise slightly near the river. The area of decreased groundwater levels would likely be greater than the area of increased groundwater levels. The magnitude of the reduction in groundwater levels would depend on whether conveyance and irrigation inefficiencies are maintained by restrictions (conditions of approval) on water right transfers. The magnitude of the reduction would depend on whether water transfers were more similar to the Full Transfer Scenario or the 33% Scenario.

Table 3A-14. Estimated Water Acquisitions or Leases, Reduction in Agricultural Acres, and Groundwater Effects for the Full Transfer Scenario

	East Walker	Smith Valley	Mason Valley	Total
Water Augmentation at Lake (%)	7%	30%	63%	100%
Water Augmentation at Lake (af/yr)[a]	3,500	15,000	31,500	50,000
Percent Acquisition/Lease at Lake[b]	59%	76%	56%	
Amount of Surface Water Acquisition/Lease (af/yr)	5,900	19,800	55,800	81,500
Percent of Total Surface Water Acquisition/Lease	7%	24%	68%	100%
Average Existing SW Diversion (af/yr)[c]	21,900	59,100	125,700	206,700
Average Existing GW Pumping (af/yr)[c]	0	24,000	79,200	103,200
Total % Reduction in Water Use	27%	24%	27%	26%
Existing Irrigated Land (acres)[c]	4,015	17,452	34,972	56,439
Reduction in Irrigated Land (acres)	1,081	4,162	9,525	14,768
Incidental GRR Flows before Flow Augmentation (af/yr)[c]	9,200	25,300	93,600	128,100
Reduction in Incidental GRR (af/yr)[d]	2,500	6,000	25,500	34,000
Fractional Effect of GRR on River Flow (Link)[e]	0.82	0.52	0.82	
Increased River Percolation to GW (af/yr)[f]	2,000	3,200	20,800	26,000
Net Reduction in GW Recharge (af/yr)[g]	500	2,900	4,700	8,000
Net Reduction in GW Recharge (inches/year)[h]	0.2	0.4	0.5	0.4
Percent Reduction in Net GW Recharge	5.0%	11.4%	5.0%	6.3%

Notes:

[a] Values selected to create similar percent agricultural impacts in each valley.

[b] Calculation shown in Table 3A-11.

[c] Described in Affected Environment.

[d] Reduction in incidental groundwater recharge and return flows (GRR) calculated as (estimated existing GRR) * the fraction of the irrigation water that is acquired or leased.

Note: this assumes that farmers would not change their water application rate in response to water sales.

[e] This fraction (Link) is applied to the reduction in GRR to estimate reduction in river flow.

[f] Calculated as the ((reduction in GRR) - the reduction in supplemental GW pumping) * Link.

Note: the reduction in supplemental groundwater pumping is assumed to be zero.

[g] Calculated as the ((reduction in GRR) - the reduction in supplemental GW pumping) * (1-Link)

[h] Net reduction in GRR flows divided by estimated surface area of each of the valleys.

Under the 33 % Scenario, groundwater impacts would not occur if transfer restrictions were to maintain conveyance losses and incidental groundwater recharge. In reality, transfer restrictions are likely to only partially maintain conveyance losses and incidental groundwater recharge. Groundwater would be most affected under the Full Transfer Scenario, under which some of the acquired water that is left in the river would have contributed to incidental groundwater recharge under existing conditions.

For the Full Transfer Scenario, the reduction in incidental GRR flows could be fairly large. For example, based on the upstream analysis, the reduction in incidental GRR flows in Mason Valley could be 25,500 af/yr, if the Mason Valley flow acquisition were 55,800 af/yr (Table 3A-14). However, the strong link between the river and groundwater would help minimize the reduction in net groundwater recharge. Initially, reduced groundwater recharge would have little effect on river flows, but eventually average river infiltration would increase in response to dropping groundwater levels. In the example above, 20,800 af/yr of the reduction in GRR flows could be offset by increased infiltration from the river, resulting in only a 4,700 af/yr decrease in net groundwater recharge in Mason Valley. (The increased infiltration from the river is the main reason that the estimated average increase in the amount of water reaching Walker Lake from Mason Valley [31,500 af/yr] is so much less than the 55,800 af/yr acquisition).

Under the Full Transfer Scenario, the long-term average annual reduction in net groundwater recharge could be 500 af for East Walker Valley, 2,900 af for Smith Valley, and 4,700 af for Mason Valley based on the flow acquisition volumes in Table 3A-14. This would represent between 5% and 11% of the existing incidental GRR flows. Spread over the estimated surface areas of the three valleys, these volumes would represent 0.2 inch/year for East Walker Valley, 0.4 inch/year for Smith Valley, and 0.5 inch/year for Mason Valley. These estimated average rates of groundwater decline associated with the Proposed Project are much less than the average rates of decline estimated for existing conditions: 6 inches/year for Smith Valley and 5 inches/year for Mason Valley (see Affected Environment).

Any changes in groundwater level would vary across each valley, with the largest drops likely to occur farther from the influence of the river, although impacts may vary locally depending on groundwater motion and the location of the affected land. Eventually, the groundwater aquifer would stabilize at a volume corresponding to a point in which inflow from the river and other smaller sources could maintain the amount of water extracted by deep-rooted vegetation and wells.

The percent reduction in incidental groundwater recharge would be higher in the Smith Valley (11%) compared with Mason Valley because the groundwater divide reduces the extent to which the river would compensate for a reduction in

incidental recharge. There is also some potential for the groundwater divide to move in response to changes in groundwater recharge. A reduction in recharge associated with irrigation could move or weaken the divide closer to the river, which would be more similar to conditions prior to irrigation. However, any response of the groundwater divide would likely be dependent on project details that are as of yet unknown.

For the East Walker reach, groundwater impacts may be more localized because of the river gradient and the isolation of the relatively flat portions of the valley. For example, groundwater in the upper portion of the reach is unlikely to be affected by project actions taken farther downstream.

Under Alternative 2, groundwater elevations would be expected to drop in a manner similar to Alternative 1. However, Alternative 1 was evaluated from a long-term perspective. Under the long-term perspective, groundwater elevations would drop, but there would be substantial offset resulting from increased infiltration from the river to groundwater. Because Alternative 2 may be temporary, the groundwater aquifer would not drop as much as for Alternative 1, and the amount of infiltration from the river to groundwater would be somewhat reduced. Once Alternative 2 ends, groundwater elevations would be expected to vary from year to year in a manner similar to the No Action Alternative. Because groundwater elevations in many locations appear to be dropping, the impact of Alternative 2 on groundwater may be to slightly hasten the drop in the groundwater table.

Alternative 3

For Alternative 3 (the Efficiency Alternative), the theoretical maximum (but physically impossible) scenario of 100% efficiency was evaluated to assess the theoretical maximum yield of this alternative. A more realistic overall maximum efficiency value of 75% was used to assess impacts from Alternative 3 and to estimate a more likely average annual increase in flow to the lake resulting from widespread adoption of efficiency measures in the study area. Efficiency of 75% would represent a substantial increase from the estimated existing efficiency of 50% (overall value for all three valleys calculated as estimated consumptive use divided by volume of water used for irrigation)

Feasibility

In order to attain an additional 50,000 af/yr at Walker Lake through efficiency measures, water use efficiency may need to be close to 100% (the theoretical maximum, but physically impossible). When a more realistic maximum efficiency value of 75% is used, the estimated average increase in flow to Walker Lake is 32,300 af/yr, assuming existing ET rates remain unchanged.

Crop switching could further increase lake inflow under Alternative 3. Total crop ET for the Mason Valley, Smith Valley, and East Walker River study areas is estimated to be 156,000 af/yr. A relatively small reduction in this number would be needed to bring the average increase in lake inflow from 32,300 af/yr to 50,000 af/yr. Because reductions in crop ET resulting from crop switching would minimally affect GRR flows, reductions in crop ET could make it to Walker Lake with very little loss. Applying a 10% loss rate (for Wabuska to Walker Lake), only an approximate 19,700 af/yr reduction in average crop ET (about 13% of the total estimated crop ET) would be needed to augment lake inflow by an average additional 17,700 af/yr to bring the average increase in lake inflow to 50,000 af/yr. However, because of feasibility concerns, crop switching was not included in the upstream analysis for Alternative 3.

Impacts on Irrigated Lands

Under Alternative 3, there would be no direct reduction in irrigated acres. Water saved would flow to the lake instead of being used for irrigation. Theoretically there could be indirect effects associated with reductions in incidental groundwater recharge and return flows. However reduction in return flows would be attributable to the Acquisition Program and should not affect water rights holders who are not willing participants in the Program. In addition, reduction in groundwater recharge is expected to be largely compensated by increased infiltration from the river to the aquifer.

Impacts on Non-Riverine Riparian and Wetland Habitat

If water-use efficiency were 75%, much of the riparian and wetland habitat that is dependent on leaking canals or shallow groundwater recharge associated with irrigation would no longer be able to survive. This could represent a large area because under existing conditions, the estimated acreages of non-riverine riparian and wetland habitat are 350 acres for the East Walker Valley, 2,200 acres for the Smith Valley, and 4,900 for the Mason Valley (numbers based on Appendix A from GBLW report and GIS calculations of riparian vegetation more than 1,000 feet from the river according to the GAP data, see Affected Environment).

Incidental Groundwater Recharge and Return Flows

If water-use efficiency were 75%, incidental GRR flows would be greatly reduced (Table 3A-15). However, the strong link between the river and groundwater would help to minimize the reduction in net groundwater recharge. For example, it is estimated that there would be a 67,000 af/yr reduction in incidental GRR for the Mason Valley. However, it is estimated that 54,600 af/yr of this water would be compensated by a reduction in river flow, resulting in a net reduction of groundwater recharge of only 12,300 af/yr.

Table 3A-15. Estimated River Flow Augmentation and Groundwater Effects Associated with the Efficiency Alternative

	East Walker	Smith Valley	Mason Valley	Total
New Percent Efficiency	75%	75%	75%	
Water Saved (af/yr)	6,500	16,200	79,000	101,700
Percent of Total Savings	6%	16%	78%	100%
Percent of Savings Reaching Lakeb	25%	54%	28%	
Water Augmentation at Lake (af/yr)	1,600	8,700	21,900	32,300
Percent Augmentation at Lake	5%	27%	68%	100%
Consumptive Use, Crop ET (af/yr)	11,600	50,200	94,400	156,200
Incidental ET before Efficiency Measures (af/yr)	1,200	7,600	16,800	25,700
Incidental ET after Efficiency Measures (af/yr)	400	3,900	4,800	9,100
Incidental GRR Flows before Efficiency Measures (af/yr)[c]	9,200	25,300	93,600	128,100
Reduction in Incidental GRR (af/yr)d	5,800	12,400	67,000	85,100
Fractional Effect of GRR on River Flow (LINK)e	0.82	0.52	0.82	
Increased River Percolation to GW (af/yr)f	4,700	6,500	54,600	65,800
Net Reduction in GW Recharge (af/yr)g	1,100	5,900	12,300	19,300
Net Reduction in GW Recharge (inches/year)h	0.5	0.9	1.3	1.0
Percent Reduction in Net GW Recharge	12%	23%	13%	15%

Notes:

[a] Potential achievable overall water- efficiency including effect of conveyance losses and incidental GRR flows.

[b] Calculation shown in Table 3A-11.

[c] Described in Affected Environment.

[d] Reduction in incidental groundwater recharge and return flows (GRR) calculated as (estimated existing GRR) * (factor needed to generate a specified new level of efficiency) . In this hypothetical example, the factor equals one.

[e] This fraction (Link) is applied to the reduction in GRR to estimate reduction in river flow.

[f] Calculated as the (reduction in GRR) * Link

[g] Calculated as the (reduction in GRR) * (1-Link)

[h] Net reduction in GRR flows divided by estimated surface area of each of the valleys.

Assuming 75% efficiency, estimated average annual total GRR flows for the three valleys could drop from 128,100 af/yr for existing conditions to 42,900 af/yr under Alternative 3. However, the strong link between the river and groundwater would help to minimize the reduction in net groundwater recharge. It is estimated that 65,800 af/yr of the reduction in incidental GRR flows would be compensated by a reduction in river flow, resulting in a net reduction of groundwater recharge of only 19,300 af/yr for all three valleys (1,100 af/yr for East Walker, 5,900 af/yr for Smith Valley, and 12,300 af/yr for Mason Valley). This represents between 12 and 23% of the existing incidental GRR flows. The percent reduction in incidental groundwater recharge would be higher in Smith Valley (23%) because the groundwater divide would reduce the extent to which the river would compensate for a reduction in incidental recharge.

If these volumes are spread over the estimated surface areas of the three valleys, this would represent 0.5 inch/year for East Walker Valley, 0.9 inch/year for Smith Valley, and 1.3 inch/yr for Mason Valley. Any changes in groundwater level would, however, vary across the valley with the largest drops likely to occur farther from the influence of the river. Effects may vary locally depending on groundwater motion and the location of the affected land. These estimated average rates of groundwater decline associated with Alternative 3 are much less than the average rates of decline estimated for existing conditions, 6 inches/year for Smith Valley and 5 inches/year for Mason Valley (see Affected Environment).

For Alternative 3 to avoid effects to incidental groundwater recharge, it would be necessary to remove non-riverine riparian and wetland vegetation and limit improvements only to the extent that system losses are used for incidental ET as opposed to contributing to groundwater recharge (to keep the net incidental groundwater recharge unchanged). Because estimated incidental ET for all valleys combined is 26,000 af/yr, such actions could represent a fairly large portion of the additional 32,300 af/yr estimated to arrive at Walker Lake. However, because efficiency cannot be 100%, some of the incidental ET would likely remain. Reductions in incidental GRR flows are not as effective as reductions in incidental ET because reductions in incidental GRR flows would cause reduction in river flow over the long term. In reality, it would be difficult to limit incidental ET without affecting net incidental GRR flows. Removal of vegetation adjacent to canals (particularly tamarisk) may be the easiest way to help reduce conveyance losses without affecting groundwater recharge.

Discussion of Key Uncertainties

It was necessary to make multiple assumptions to estimate upstream hydrologic effects associated with the Walker River Basin Acquisition Program. Most of these assumptions are discussed above. Some key assumptions that have an associated moderate degree of uncertainty and which are more likely to affect results are discussed below.

Uncertainties Relevant to All Alternatives

Transfer restrictions
One substantial uncertainty is the extent of restrictions that may be imposed on water transfers by the NSE or other agencies. Restrictions are likely to depend upon the individual circumstances of water acquisitions. For example, there is some potential for other existing water rights to be negatively affected by the transfer of a water right that has been acquired from a willing seller. For example, conveyance losses along a canal are borne by all the water rights holders along the canal. If flow through the canal is reduced, the percent conveyance loss for individual farmers could increase. In addition, farmers benefit from having more water in their canals because it increases head for taking water out of the canal more quickly or efficiently. As a result of the distributed benefits of irrigation water, there is potential for some water rights transfers to be restricted to some portion of the full amount of water available.

The NSE is charged with initial jurisdiction concerning proposed changes to decreed water rights (apart from allocated storage rights, see below); and under Nevada Law, the NSE may not approve a transfer that conflicts with existing rights, with protectable interests in existing domestic wells, or which threatens to prove detrimental to the public interest; nor may the proposed change adversely affect the cost of water for other holders of rights within an irrigation district, nor lessen the efficiency of the district in the delivery or use of water (NRS Section 533.370 et. seq.). However, water transfers would not likely be restricted for the purpose of maintaining a water supply for water users who may have depended on the inefficiency of others (e.g., those dependent on incidental groundwater recharge).

NSE ruling No. 5760 provides an example of how groundwater recharge issues might be handled by the NSE. This ruling was made in August 2007 regarding a 2004 change application submitted by the cities of Reno and Sparks and Washoe County, which sought to transfer an existing Newlands Project surface water irrigation right (one acquired from a willing seller) to an instream wildlife purpose in the Truckee River downstream of Derby Dam, the existing point of diversion. In this ruling, it was stated that:

> "While the water that leaked or seeped into the ground from ditches, drains, or irrigation became a source of recharge, the State Engineer concludes that he cannot compel the continuation of that situation in order to create that recharge and removal of the recharge is not the type of injury to existing rights contemplated under the water law." (NSE 2007 p26)

The largest restriction likely to be placed on a water transfer would be to limit the transfer to the consumptive use component of the water right. Such a restriction could be limited to estimated actual consumptive use or could be limited to ideal

consumptive use (i.e., maximum consumptive use, which would result from ideal watering conditions). If all water for the Acquisition Program were to come from irrigation water and all of that water were to be subject to a consumptive use restriction, then it is possible that the 33% limit on reduction to irrigated lands could prevent the full 50,000 af/yr from reaching Walker Lake. Table 3A-16 shows two estimates of the amount of water that might be obtained under these circumstances (all water from irrigation supplies and consumptive use restriction placed on all acquisitions). The resulting amount of water is 52,000 af/yr with estimated actual consumptive use and 65,800 af/yr with ideal consumptive use, both less than the 82,000 af/yr needed for the Full Transfer Scenario. However, if all transfers were restricted to consumptive use, GRR flows would be minimally affected and losses would be much less than under the Full Transfer Scenario.

Table 3A-16. Estimated Water Transferred if Consumptive Use Restriction Applied to 33% of Irrigated Lands

Valley	Average Irrigated Acres[a]	33% of Irrigated Acres	Estimated Actual Consumptive Use (ft/yr)[b]	Water Allowed to be Transferred (af/yr)	Estimated Ideal Consumptive Use (ft/yr)[c]	Water Allowed to be Transferred (af/yr)
East Walker	4,015	1,325	2.88	3,812	3.5	4,637
Smith	17,452	5,759	2.88	16,569	3.5	20,157
Mason	34,972	11,541	2.70	31,163	3.5	40,392
Total	56,439	18,625		51,543		65,187

a. From Table 3A-4

b. From water balance analysis

c. Huntington pers. comm. 2008

Connection between River and Aquifers

The calculations for the interrelationship between river flow and groundwater recharge and return flows are very dependent on the work performed by Myers, which showed a strong connection between groundwater recharge and river flows (Myers 2001a and 2001b). Considering that a large portion of agricultural return flows to the river may come from groundwater recharge, it is not completely unexpected that a reduction in groundwater recharge could have a large effect on river flows. If river flows are, in reality, not so responsive to incidental groundwater recharge, less water would need to be acquired, leased, or saved to meet a given increased inflow objective. However, groundwater impacts would be larger.

Work by DRI and UNR researchers through the UNR-DRI Walker Basin Project has provided some support to the conclusion that river diversions left in the river

would be lost to infiltration as a result of decreased irrigation. For Mason Valley they found that "The fraction of diversion left in the river, but then lost to the aquifer, ranges from four to 97% depending on the HRU [Hydrologic Response Unit]. Average losses are 16 percent, but if several river pumps are excluded from the analysis, then average losses reach 42 percent" (Boyle et al. 2009). Myers numbers for the relationship between reduced groundwater recharge and river flow were used to estimate that 37% of the diversions left in the river under the Full Transfer Scenario would be lost (see discussion of PercRed above under Assumptions and Methods Specific to the Full Transfer Scenario). This value is comparable to the initial results from the University study. However, future use of the university models could result in adjustments to the conclusions.

Even if the valley-wide long-term estimates for the connection between incidental groundwater recharge and river flows are accurate, the actual effect of the project would depend on the locations of agricultural land that is fallowed or retired, or the locations of any efficiency-increasing actions. Furthermore, short-term effects of reduced groundwater recharge on river flow would probably be less than the long-term effects. This is particularly pertinent to Alternative 2, which would only last as long as there is funding. River infiltration could also be affected by decreasing groundwater levels under existing trends (see Affected Environment) and the No Action Alternative. In the absence of the Acquisition Program, decreasing groundwater levels have the potential to increase river infiltration, thereby reducing base flows.

Water Accounting

New river losses associated with a reduction in incidental GRR flows are assumed to reduce the volume of the flow augmentation and not affect or conflict with existing water rights. Similarly, new river losses associated with increased flow downstream of Wabuska (estimated to be 10% of the increase in flow) are assumed to reduce the volume of the flow augmentation and not affect or conflict with water rights held by the Walker River Paiute Tribe. In reality, separate accounting for river losses may be difficult and it is possible that existing and new river losses would be comingled. It is also assumed throughout this Draft EIS that that portion of acquired water supplies that ends up in Walker Lake would actually build upon (rather than supplant) existing Walker Lake inflows based on an assumed repeat of period-of-record averages.

Natural Vegetation

As part of the water balance approach used for this analysis, it was assumed that most natural vegetation (e.g., phreatophytes such as rabbitbrush and greasewood) away from the river would continue to survive and use groundwater at about current rates with or without the project. However, because riparian and wetland vegetation needs water that is closer to the surface, riparian/wetland vegetation that is more than 1,000 feet from the river was assumed to be dependent on irrigation. This analysis assumes that if irrigation is reduced, not only would there

be a reduction in crops, but there would also be a reduction in non-riverine riparian/wetland acres. In reality, some riparian vegetation may survive a loss of irrigation and be able to use groundwater, but there may also be a decrease in water use by natural vegetation.

Protection of Acquired Water
Finally, water that is acquired but not protected through the water rights change application process and/or by agreements with appropriate parties may be diverted by other water rights holders. For all alternatives, it is assumed that these or other methods would be used to ensure that all acquired water would be protected from such diversions consistent with the assumptions for each alternative (e.g., full transfer under the Full Transfer Scenario vs. partial transfer under the 33% Scenario).

Uncertainties Relevant to Alternatives 1 and 2

Under Alternatives 1 and 2, if non-agricultural water can be purchased, the extent of agricultural water acquisitions and reduction in irrigated acres would be reduced. For example, the Homestretch Geothermal option for 7,000 af/yr could have a large effect on reducing the need for water acquisitions from agriculture, especially the effects of Alternative 1 with existing funding. Other potential acquisitions that could help reduce agricultural impacts in the upstream valleys would include acquisitions from the Walker River Paiute Tribe (or land fallowing undertaken within their Reservation) for the benefit of Walker Lake, or acquisitions from willing sellers who have already taken their land out of agricultural production or converted their land to non-agricultural purposes. In addition, if farmers remaining in production can use water more efficiently, agricultural impacts would be reduced.

Uncertainties Relevant to Alternative 3

For Alternative 3, one key uncertainty is the level of overall water use efficiency that can be attained. The overall maximum efficiency of 75% was chosen for analysis based on conveyance and farm/field efficiencies that have been attained elsewhere (Howell 2003, Solomon 1988), but actual overall efficiency attained would likely be different.

In addition, Alternative 3 may have somewhat more uncertainty associated with the assumption that Acquisition Program water could be transferred to the lake without reduction in volume by downstream water rights holders. Downstream transfer may be more difficult for Alternative 3 because there is little precedent in Nevada for assigning water rights to water saved through efficiency measures.

Summary of Uncertainties

There are many factors that could cause the estimated upstream volume of water needed to attain an average additional 50,000 af/yr at Walker Lake (and the estimated agricultural effects) to be high or low. Some of the key uncertainties (some of which are described above) are listed below:

Uncertainties that would reduce impacts on agricultural lands:

- Non-agricultural acquisitions (e.g., Homestretch Geothermal or purchases from farmers who have already retired their land)
- Improved efficiency (e.g., crops that use less water, lining of ditches, or improved irrigation management and/or technology) occurring along with Alternatives 1 and 2
- Less connection between GRR flows and river flows
- Increased baseline inflows to Walker Lake (e.g., greater or more frequent flood flows)

Uncertainties that would increase impacts on agricultural lands:

- Increase in riverine ET in the upstream valleys in response to flow augmentation
- Water transfer restrictions imposed by the Nevada State Engineer or other jurisdictional entities
- Retirement of supplemental groundwater rights
- Potential reduction in base flow resulting from dropping groundwater levels
- Imbalance of water acquisitions causing the percent impact to differ between valleys
- Reduced baseline inflows to Walker Lake (e.g., persistent conditions of drought)

Walker Lake Analysis

The analysis of Walker Lake includes hydrologic and water quality (TDS) components. The TDS component is dependent on the hydrologic evaluation. A water balance of the lake was developed using two different baseline inflow scenarios (low and high). The lake water balance was then used to estimate future lake elevations and TDS concentrations for all alternatives.

Walker Lake Hydrologic Analysis Methods

To develop the Walker Lake water balance, lake storage values at the end of each water year were used to calculate the change in storage. The amounts of water entering the lake as direct precipitation and leaving as gross evaporation were calculated to determine net evaporation (i.e. outflow). The change in storage that was not attributable to evaporation or precipitation was assigned to the net inflow from Walker River, groundwater, and local surface water.

Use was made of prior Walker Lake hydrologic analyses (Table 3A-17). Water balance calculations initiated by Pahl in 1999 (Pahl pers. comm. 2008) were updated to include more recent data including a recent average precipitation value from Allander and Lopes (2008) and storage data from the USGS (Allander pers. comm. 2008). (Collectively, the information from Pahl, Allander, and Lopes, and USGS are referred to below as the updated NDWP analysis.) A range of lake evaporation rates was used to evaluate changes in Walker Lake conditions. (USGS is working on a water balance analysis publication that is expected in 2009.)

Table 3A-17. Estimated Average Annual Values for Walker Lake Water Balance Parameters by various authors

Parameter	Everett and Rush 1967 (1908-1965)	Thomas 1995 (1939-1993)	Allander and Lopes 2008 (1995-2007)	Lopes 2009 (1988-1994)	Kleinfelder 2007 (1939-1993; 1926-2004)
Evaporation (feet)	4.1	4.1	4.9[d]	4.3[e]	4.3[c]
Precipitation (inches)	4	4.9	3.8		
Walker River inflow (af)	140,000	76,000	117,000[b]	0 during 1988-1994	77,200, 1939-93; 89,000, 1926-2004
Local Surface Water (af)	3,000	3,000			
Ground Water (af)		11,000[a]			3,000 local, 8,000 from Walker River

[a] Cited as coming from Schaefer, 1980, p. 31

[b] Average flow at Schurz gage (13.5 miles upstream of Walker Lake) for water years 1995–2007.

[c] Based on Topaz Lake Reservoir pan evaporation * 0.75; estimate may be low because value did not compensate for missing December–March data (Allander and Lopes pers. comm. 2008).

[d] Based on measurements of evaporation

[e] Preliminary result based on water balance assessment for the 1988-1994 drought after determining that evaporation measurements were too high

Projection of No Action Alternative

The inflow and evaporation values can be used to project future lake elevations. High and low average inflow and evaporation scenarios were used to produce a range of future lake storages.

Estimated inflow and evaporation must correspond in order to explain observed changes in storage. For example, if a relatively high value for evaporation is assumed, there must be a relatively high inflow to meet the observed sequence of historic storage values. Consequently, projections of future lake elevation similarly must use inflow and evaporation rates that correspond with each other.

The selected net inflow and evaporation values used in the two scenarios are:

- **Low inflow/low evaporation scenario:** average annual net inflow = 90,000 af and net evaporation = 3.7 feet (Thomas 1995).
- **High inflow/high evaporation scenario:** average annual net inflow = 106,100 af and net evaporation = 4.0 feet. The inflow value is the estimated average for the period 1960 to 2007 using the updated NDWP analysis and evaporation is a preliminary USGS estimate (Lopes 2009). The period of record is relatively long and reflects recent historic conditions that involve substantial groundwater pumping in addition to surface water diversions.

Projection of Action Alternatives

If average annual inflow to Walker Lake is increased by 50,000 af, lake surface elevation would increase relative to current conditions. The extent of this expected increase was assessed by adding 50,000 af/yr to the low and high lake inflow scenarios described above. The selected net inflow values were:

- Low lake inflow: average annual net inflow = 90,000 af (base) + 50,000 af (flow augmentation) = 140,000 af (net evaporation = 3.7 feet).
- High lake inflow: average annual net inflow = 106,100 af (base) + 50,000 af (flow augmentation) = 156,100 af (net evaporation = 4.0 feet).

To assess lake elevation for Alternative 1 under currently available funding, it was assumed that an additional 7,300 af/yr reached Walker Lake (as described in Chapter 2, Alternatives) instead of 50,000 af/yr.

For Alternative 2, it was assumed that enough water could be leased to increase average annual lake inflow by 50,000 af. Such increase, however, is only expected to last 3 years (as analyzed) with current funding, or about 20 years with full funding.

Alternative 3 was evaluated by assuming that an average of 32,300 af/yr would reach Walker Lake (as described above) in addition to baseline inflows, in a manner similar to that used for Alternative 1.

Groundwater inflow to the lake was assumed to remain constant for each action alternative, although it could increase (by aquifer augmentation) or decrease (by reduced gradient) in response to increased lake inflow.

The increased inflow to the lake was assumed to start instantaneously in water year 2008. In reality, it would take some unknown amount of time to fully implement each of the alternatives. The start date would have little effect on the end results of Alternatives 1 and 3 because the effects would be long-term.

However, because the effect of Alternative 2 is more transient, the estimated lake elevation when the leasing program ends would depend on the start date as well as the hydrologic conditions. None of the action alternatives was implemented in water year 2008 as was assumed in the evaluation, and deviations from the average increased inflow of 50,000 af/yr would have a pronounced effect for actions lasting a limited number of years. As a result, the lake water surface elevations estimated for years 3 and 20 for Alternative 2 are not expected to be accurate. However, the change in lake elevation and TDS should be close to correct if Alternative 2 is initiated relatively soon and average hydrologic conditions prevail.

Walker Lake TDS Analysis Methods

To assess future concentration of TDS in Walker Lake under No Action, the equation for TDS as a function of time and lake storage, described above under Affected Environment, was applied for a given year and lake elevation. The equation was adjusted to account for increased TDS flux from the river, and then used to calculate TDS concentration that would correspond to the change in lake elevations estimated with the future inflow values described above.

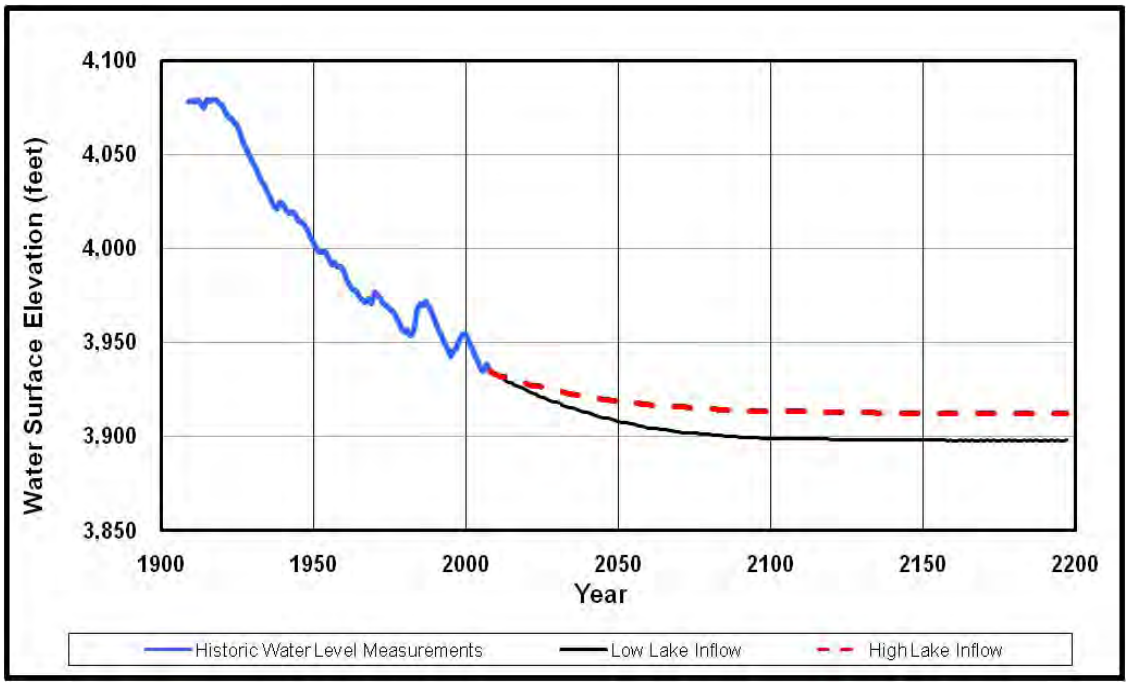
For future conditions, the low and high average annual inflows were assumed to occur each year. This assumption yields smooth curves for future conditions. In reality, flows would vary greatly from year to year and the long-term equilibrium values would not be constant but fluctuate about a mean.

Lake Analysis Results

Results of the lake assessment for water surface elevation and TDS concentration are summarized for all alternatives in Table 3A-18 and more information is provided below.

No Action Alternative: Walker Lake Storage and Surface Area

Figure 3A-20 shows past and projected lake elevations for the high and low inflow scenarios described in the methods section above. The equilibrium lake elevation range is 3,898 feet to 3,906 feet. These elevations correspond to storages of 701,900 af to 906,000 af and represent elevation decreases of approximately 37 to 29 feet, from the September 2007 elevation of 3,935 feet. Based on lake bathymetry data (USGS bathymetry report), this would represent a decrease in lake surface area of approximately 7,300 to 5,100 acres.



Note: Lines representing the future are smooth because they are based on average annual inflow values. Actual lake elevation would fluctuate around these values.

Figure 3A-20. Historic and Projected Water Surface Elevation of Walker Lake under the No Action Alternative based on a High and Low Inflow Scenarios

No Action Alternative: Walker Lake TDS

Projected TDS concentrations for the high and low inflow scenarios for No Action are shown in Figure 3A-21.

Table 3A-18. Estimated Future Water Surface Elevation and TDS Concentrations for Walker Lake for All Alternatives

	Estimated Future Lake Elevation (feet)						Estimated Future TDS (mg/L)				
	At High Point[a]	Approximate Year of High Point[b]	At Year 2200	At High Point-Change from September 2007 [c]	At Year 2200-Change from September 2007	At Year 2200-Change from No Action Alternative	at Low Point	Approximate Year of Low Point[b]	at Year 2200	At Low Point-Change from September 2007 [c]	At Year 2200-Change from No Action Alternative
No Action Alternative											
High Average Inflow	NA	NA	3,906	NA	-29		NA[d]	NA[d]	39,500		
Low Average Inflow	NA	NA	3,898	NA	-37		NA[d]	NA[d]	51,000		
Alternative 1 - Proposed Project											
Current Funding (average additional 7,300 af/yr)											
High Average Inflow	NA	NA	3,915	NA	-20	9	NA[d]	NA[d]	31,600		-7,900
Low Average Inflow	NA	NA	3,905	NA	-30	7	NA[d]	NA[d]	40,700		-10,300
Full Funding (average additional 50,000 af/yr)											
High Average Inflow	NA	NA	3,970	NA	35	64	11,300	2090	12,400	-4,319	-27,100
Low Average Inflow	NA	NA	3,965	NA	30	67	12,300	2090	13,500	-3,319	-37,500
Alternative 2 – Leasing Alternative											
Current Funding (additional 50,000 af/yr for 3 years)[a]											
High Average Inflow	3,937	2011	3,906[d]	2	-29[d]	0[d]	15,400	2011	39,500[d]	-219	0[d]
Low Average Inflow	3,936	2011	3,898[d]	1	-37[d]	0[d]	15,600	2011	51,000[d]	-19	0[d]
Full Funding (additional 50,000 af/yr for 20 years)[a]											
High Average Inflow	3,948	2028	3,906[d]	13	-29[d]	0[d]	13,200	2028	39,500[d]	-2,419	0[d]
Low Average Inflow	3,945	2028	3,898[d]	10	-37[d]	0[d]	13,900	2028	51,000[d]	-1,719	0[d]
Alternative 3 - Efficiency Alternative											
75% Efficiency (average additional 32,300 af/yr)											
High Average Inflow	NA	NA	3,948	NA	13	42	14,800	2060	16,800	-819	-22,700
Low Average Inflow	NA	NA	3,939	NA	4	41	16,000	2030	19,600	381	-31,400

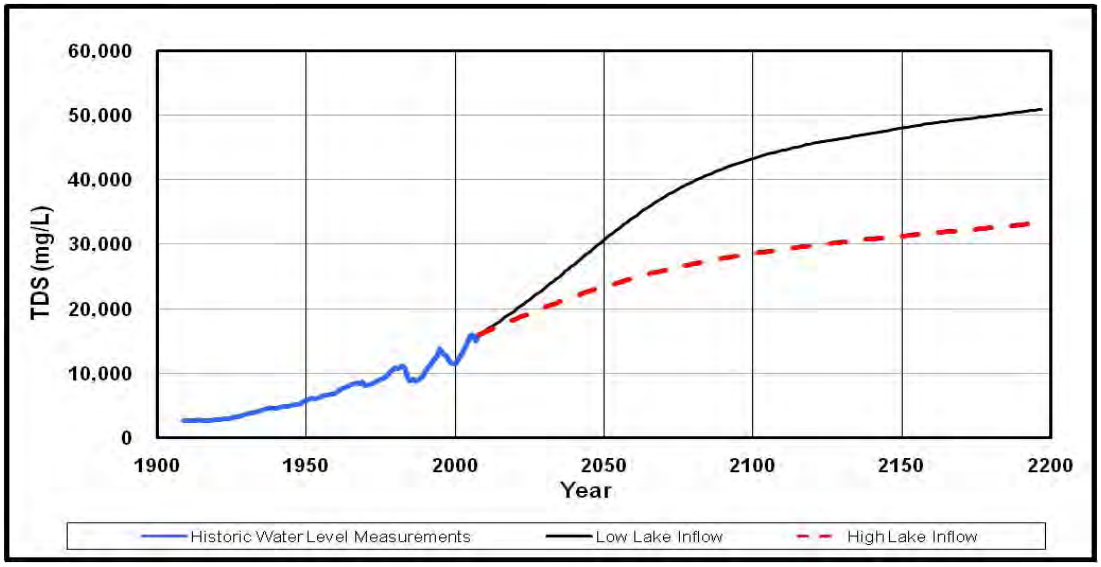
a. Lake elevations for Alternatives 1 and 3 are expected to generally tend towards their equilibrium values, which are estimated to be attained after year 2100. However, because the increased inflow for Alternative 2 would be temporary, lake level would be expected to rise to a high point and then tend towards the same equilibrium as the No Action Alternative.

b. Assumes that the Walker Lake Acquisition Program was initiated at the beginning of water year 2008 (fall 2007).

c. Fall 2007 was used as a basis of comparison (elevation of 3,935 feet and TDS concentration of 15,600 mg/L in September 2007) because calculations assumed the Acquisition Program was initiated at the start of water year 2008 (October 1, 2008 - September 30, 2008). Because the actions of Alternatives 1 and 3 could continue indefinitely, the lake elevation would change until it eventually would fluctuate about a particular equilibrium value that is independent of the starting elevation. Because Alternative 2 would be temporary, the starting elevation is more important. Because the exact start date of the Acquisition Program is unknown, the short-term results for Alternative 2 are best evaluated not in terms of elevations and TDS concentrations, but in terms of change from the starting point used in the assessment.

d. No low point for TDS because lake level continues to drop from current elevation

e. Alternative 2 was evaluated using the year 3 and year 20 values from the analysis for the fully-funded Alternative 1 (all these scenarios assume an additional average inflow of 50,000 af/yr). Whether the increased inflow was ended at year 3 or 20, the eventual lake levels would be the same as for the No Project Alternative, it would just take 3-20 years longer to reach the equilibrium, and the TDS concentration at year 2200 would be similar to that for the No Project Alternative.



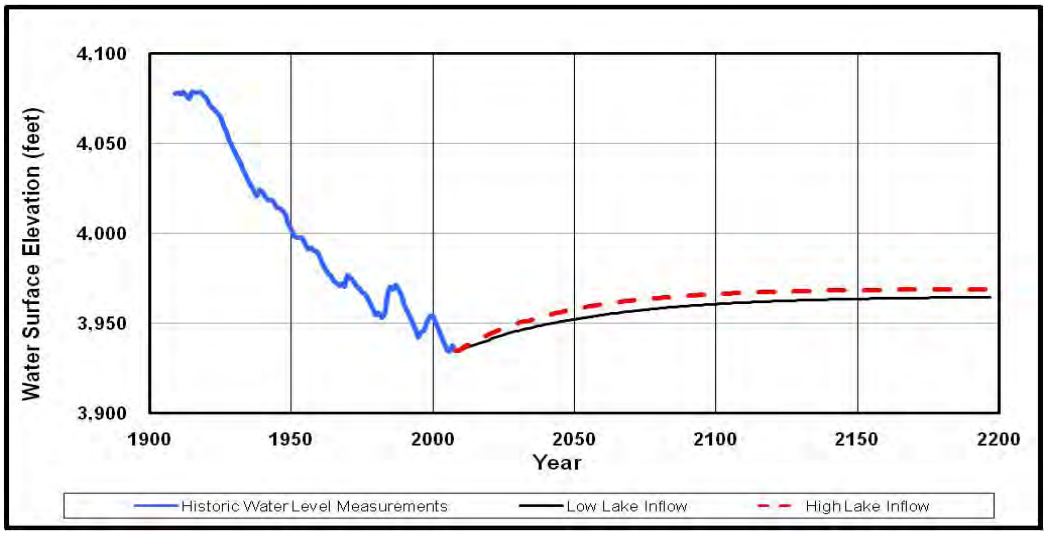
Note: Lines representing future conditions are smooth because they are based on average annual inflow. Actual TDS concentrations would fluctuate around these values.

Figure 3A-21. Historic and Projected TDS Concentration in Walker Lake under the No Action Alternative based on High and Low Inflow Scenarios

The projected TDS values under No Action range from 39,500 to 51,000 mg/L by 2200, compared to 15,600 mg/L in September 2007 and 16,100 mg/L in March 2008. Unlike the estimated lake storage, TDS concentration would continue to increase over time because of the continual influx of salts and other dissolved solids, although this might be offset to some extent by other factors (e.g., mineral precipitation, wind/wave dispersal, and decrease in evaporation rate resulting from high concentration of TDS). In addition, as lake volume changes, TDS flux to and from bed sediments could change.

Alternative 1: Walker Lake Storage and Surface Area

Figure 3A-22 shows past and projected lake elevations for the high and low inflow scenarios with an average additional 50,000 af/yr. Under Alternative 1, the equilibrium lake elevation ranges from 3,965 feet to 3,970 feet. These elevations correspond to lake storages of 2,801,700 af and 3,000,000 af. Compared to recent elevation of 3,935 feet in September 2007, these lake elevations would represent long-term elevation increases of 30 to 35 feet (i.e., 64 to 67 feet higher than for the No Action Alternative). Based on lake bathymetry data (Lopes and Smith 2007), this represents an increase in lake surface area of 6,200 to 7,100 acres.



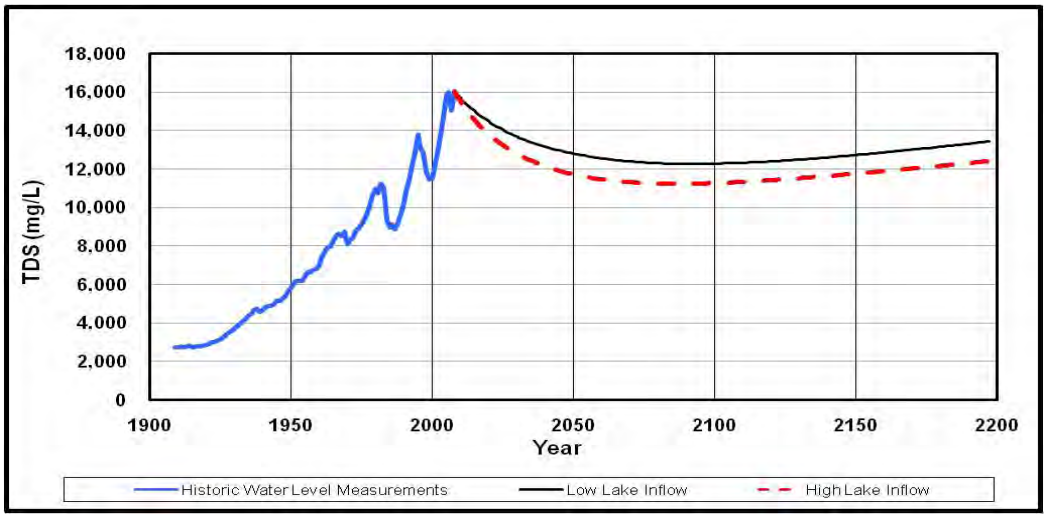
Note: Lines representing future conditions are smooth because they are based on average annual inflow values. Actual lake elevation would fluctuate around these values.

Figure 3A-22. Historic and Projected Future Water Surface Elevation of Walker Lake under Alternative 1 based on a High and Low Average Annual Lake Inflow

With current funding and average inflow increase of 7,300 af/year, lake water surface elevation would be expected to continue to decline, to 3905 to 3915 feet (7 to 9 feet higher than under No Action).

Alternative 1: Walker Lake TDS

Estimated TDS concentrations corresponding to the high and low inflow scenarios are shown in Figure 3A-23.



Note: Lines representing future conditions are smooth because they are based on average annual inflow. Actual TDS concentrations would fluctuate around these values.

Figure 3A-23. Historic and Projected TDS Concentration in Walker Lake under Alternative 1 based on a High and Low Lake Inflow Scenarios

If an additional 50,000 af/yr reached Walker Lake on an average annual basis, the estimated TDS concentration would decline until about the year 2090. At that point, TDS would range between approximately 11,300 mg/L (high inflow scenario) and 12,300 mg/L (low inflow scenario). With time, however, these values would creep upward so that by 2200, TDS would be approximately 12,400 mg/L to 13,500 mg/L (27,100 to 37,500 mg/L less than under No Action).

This upward creep would depend on the TDS flux into the lake. For example, as lake volume increases, TDS flux to and from bed sediments could change. Other factors could also influence TDS concentrations (e.g., mineral precipitation, wind/ wave dispersal). In addition, for this action alternative, the TDS flux (load) from the river was estimated to increase in proportion to the flow increase, which could be a slight overestimate because TDS concentration tends to decrease as flow increases. However, this tendency could be counteracted by any acquired water that had a higher TDS concentration (e.g., Homestretch Geothermal) than the river.

If increased inflow were limited to what could be purchased with available funding, it is estimated that the additional inflow would not reduce lake TDS concentration compared to existing conditions. TDS concentration would increase, although not as much as under the No Action Alternative. With existing funding for Alternative 1, TDS in Walker Lake is estimated to reach 31,600 to 40,700 mg/L by the year 2200 (7,900 to 10,300 mg/L less than under No Action).

If funding were limited to what is currently available, water quality would be better than under the No Action Alternative, but would not be sufficient to sustain or improve the current lake ecology. However, the improved water quality under the fully-funded Proposed Project would be a beneficial.

Alternative 2: Walker Lake Storage and Surface Area

Under Alternative 2, initially storage in Walker Lake would increase. However, storage would stop increasing in approximately 3 to 20 years under existing funding and full funding, respectively. Because the estimated rise for Alternative 2 is not based upon an ultimate equilibrium value but on a comparison of temporary elevations in specific years, the water surface elevation and lake surface area are not exact. Elevations attained at the end of the leasing period would depend greatly on when acquisitions under Alternative 2 are initiated as well as actual hydrologic conditions. Assuming average hydrologic conditions prevailed during the leasing program, Alternative 2 would result in approximately a 1- to 2-foot rise in lake water surface elevation over 3 years and a 10- to 13-foot rise over 20 years, compared to baseline conditions. This is 31 to 38 feet higher than under No Action. The particular elevations reached would depend on when acquisitions would be fully initiated as well as actual hydrological conditions.

Once Alternative 2 runs out of funding, however, the lake would tend toward the same water surface elevation expected under No Action.

Alternative 2: Walker Lake TDS

Under Alternative 2, it is expected that initially TDS concentration in Walker Lake would drop. However, this beneficial effect would cease in approximately 3 to 20 years for existing funding and full funding, respectively. Assuming average hydrologic conditions, Alternative 2 would result in an estimated drop in TDS of 200 mg/L in 3 years and 1,700 to 2,400 mg/L in 20 years. The exact concentration would depend on when acquisitions are initiated as well as actual hydrologic conditions. Once Alternative 2 runs out of funding, TDS in the lake would be expected to eventually reach the same concentration as under No Action.

Alternative 3: Walker Lake Storage and Surface Area

Based on the methods described for the upstream analysis above, average annual inflow to Walker Lake would increase by 32,300 af/yr if Alternative 3 is fully implemented at 75% combined conveyance and on-farm water efficiency. This additional inflow is projected to increase lake surface elevation to a range of 3,939 to 3,948 feet. This would be 4 to 13 feet higher than the September 2007 level of 3,935 feet and 41 to 42 feet higher than under No Action.

Alternative 3: Walker Lake TDS

With the increased inflow of 32,300 af/year estimated for Alternative 3, Walker Lake water surface elevation is projected to rise, as indicated in HC-1. However, TDS concentration would not be greatly reduced compared to existing conditions. Initially, for a period of approximately 20 to 50 years, TDS would change little from existing levels, reaching concentrations of 14,800 to 16,000 mg/L, and then gradually increasing because of evaporation. Concentrations for the year 2200 would be approximately 16,800 mg/L to 19,600 mg/L. There would be essentially no benefit compared to existing conditions. However, this result would be beneficial to the lake than No Action, which would result in projected TDS concentrations in the range of 39,500 to 51,000 mg/L. Alternative 3 would result in TDS concentrations 22,700 to 31,400 mg/L less than under No Action.

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Appendix 4A Vegetation Community and Cover Types

The following sections describe the 28 vegetation community and cover types that have been mapped in the study area (Figure 4-1). These descriptions have been adapted from the legend descriptions for the Southwest Regional GAP map (U.S. Geological Survey National GAP Analysis Program 2005). Information provided by the Southwest Regional GAP map identifies areas of individual vegetation communities as small as approximately 0.25 acre.

Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland

The Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland (riparian) community often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. The variety of plant associations connected to this community type reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include mountain alder (*Alnus incana*), water birch (*Betula occidentalis*), narrow-leaved cottonwood, black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), Fremont's cottonwood (*Populus fremontii*), red willow (*Salix laevigata*), Goodding's willow (*Salix gooddingii*), and Douglas-fir (*Pseudotsuga menziesii*). Dominant shrubs include silver sagebrush, American dogwood (*Cornus sericea*), narrow-leaved willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*), Lemmon's willow (*Salix lemmonii*), and yellow willow (*Salix lutea*). Herbaceous layers often are dominated by species of sedge (*Carex*) and rush (*Juncus*) and perennial grasses and mesic forbs such tufted hairgrass, slender wheatgrass, fowl mannagrass (*Glyceria striata*), western blue flag (*Iris missouriensis*), false lily of the valley (*Maianthemum stellatum*), or meadow rue (*Thalictrum fendleri*). Introduced forage species such as creeping bentgrass (*Agrostis stolonifera*), Kentucky bluegrass (*Poa pratensis*), Timothy (*Phleum pratense*), and the weedy annual cheatgrass (*Bromus tectorum*) are often present in disturbed stands. These are disturbance-driven communities that require flooding, scour, and deposition for germination and maintenance. Livestock grazing is a major influence in altering structure, composition, and function of the community.

Invasive Southwest Riparian Woodland and Shrubland

The Invasive Southwest Riparian Woodland and Shrubland (invasive riparian) community type includes areas that are dominated by introduced riparian woody species such as tamarisk (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolius*).

Great Basin Pinyon-Juniper Woodland

The Great Basin Pinyon-Juniper Woodland (pinyon-juniper woodland) community type occurs at lower elevations of dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. These woodlands are dominated by a mix of singleleaf pinyon pine and Utah juniper (*Juniperus osteosperma*), pure or nearly pure occurrences of singleleaf pinyon pine, or solely by Utah juniper. Desert mountain mahogany is a common associate. Understory layers are variable, including shrubs such as greenleaf manzanita (*Arctostaphylos patula*), low sagebrush (*Artemisia arbuscula*), black sagebrush (*Artemisia nova*), big sagebrush, desert mountain mahogany, littleleaf mountain mahogany (*Cercocarpus intricatus*), blackbrush, and bunch grasses such as needlegrass (*Hesperostipa comata*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Great Basin wildrye, and muttongrass (*Poa fendleriana*).

Rocky Mountain Montane Dry–Mesic Mixed Conifer Forest and Woodland

The Rocky Mountain Montane Dry–Mesic Mixed Conifer Forest and Woodland (dry–mesic mixed conifer forest) community type includes mixed-conifer forests occurring on all aspects at elevations ranging from 1,200 to 3,300 meters. Rainfall averages 40 to 60 centimeters per year with summer “monsoons” contributing substantial moisture during the growing season. The composition and structure of overstory are dependent on the temperature and moisture relationships of the site and the successional status of the occurrence. White pine (*Pinus flexilis*) is common in Nevada. Douglas-fir forests occupy drier sites, and ponderosa pine is a common codominant. As many as seven conifers can be found growing in the same occurrence, and a number of cold-deciduous shrub and grass species are common, including bearberry manzanita (*Arctostaphylos uva-ursi*), dwarf mahonia (*Mahonia repens*), Oregon boxwood (*Paxistima myrsinites*), mountain snowberry (*Symphoricarpos oreophilus*), fivepetal cliffbush (*Jamesia americana*), and Arizona fescue (*Festuca arizonica*).

Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland

The Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland (mesic mixed conifer forest) communities are mixed-conifer forests that occur predominantly in cool ravines and on north-facing slopes at elevations ranging from 1,200 to 3,300 meters. Occurrences of this community are found on cooler and more mesic sites than Rocky Mountain Montane Dry–Mesic Mixed Conifer

Forest and Woodland. Douglas-fir is a common canopy dominant, but ponderosa pine may be present. This community type includes mixed conifer/quaking aspen (*Populus tremuloides*) stands. A number of cold-deciduous shrub species can occur, including mountain alder (*Alnus incana*), water birch (*Betula occidentalis*), American dogwood (*Cornus sericea*), fivepetal cliffbush, mallow ninebark (*Physocarpus malvaceus*), New Mexico locust (*Robinia neomexicana*), thinleaf huckleberry (*Vaccinium membranaceum*), and whortleberry (*Vaccinium myrtillus*). Herbaceous species include fringed brome (*Bromus ciliatus*), Geyer's sedge (*Carex geyeri*), Ross's sedge (*Carex rossii*), dryspike sedge (*Carex siccata*), screwleaf muhly (*Muhlenbergia virescens*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sprucefir fleabane (*Erigeron eximius*), Virginia strawberry (*Fragaria virginiana*), smallflowered woodrush (*Luzula parviflora*), sweetcicely (*Osmorhiza berteroi*), heartleaf groundsel (*Packera cardamine*), western meadow-rue (*Thalictrum occidentale*), and Fendler's meadow-rue (*Thalictrum fendleri*).

Great Basin Xeric Mixed Sagebrush Shrubland

The Great Basin Xeric Mixed Sagebrush Shrubland (xeric mixed sagebrush shrubland) community type occurs in the Great Basin on dry flats and plains, alluvial fans, rolling hills, rocky hillslopes, saddles, and ridges. Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Shrublands are dominated by black sagebrush (mid and low elevations), low sagebrush (higher elevation); they may be co-dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) or yellow rabbitbrush (*Chrysothamnus viscidiflorus*). Other shrubs that may be present include spiny saltbush (*Atriplex confertifolia*), ephedra, goldenbush (*Ericameria* spp.), spiny hopsage, (*Lycium shockleyi*), bud sage (*Picrothamnus desertorum*), greasewood, and horsebrush species (*Tetradymia* spp.). The herbaceous layer is likely sparse and composed of perennial bunch grasses such as Indian rice grass, desert needlegrass (*Achnatherum speciosum*), Thurber's needlegrass (*Achnatherum thurberianum*), squirreltail (*Elymus elymoides*), or one-sided bluegrass (*Poa secunda*).

Inter-Mountain Basins Big Sagebrush Shrubland

The Inter-Mountain Basins Big Sagebrush Shrubland (big sagebrush shrubland) widespread community type typically occurs in broad basins between mountain ranges, plains and foothills. Soils are typically deep, well-drained, and non-saline. These shrublands are dominated by basin big sagebrush and/or Wyoming big sagebrush. Scattered juniper, greasewood, and saltbush species may be present in some stands. Rubber rabbitbrush (*Ericameria nauseosa*), yellow rabbitbrush, bitterbrush, or mountain snowberry (*Symphoricarpos oreophilus*) may codominate disturbed stands. Perennial herbaceous components typically

contribute less than 25% vegetative cover. Common grass species include Indian rice grass, blue grama (*Bouteloua gracilis*), thickspike wheatgrass (*Elymus lanceolatus*), Idaho fescue, needlegrass, Great Basin wildrye, James's galleta (*Pleuraphis jamesii*), western wheatgrass (*Pascopyrum smithii*), one-sided bluegrass, or bluebunch wheatgrass.

Inter-Mountain Basins Big Sagebrush Steppe

This Inter-Mountain Basins Big Sagebrush Steppe (big sagebrush steppe) community is dominated by perennial grasses and forbs with basin big sagebrush, Wyoming big sagebrush, silver sagebrush (*Artemisia cana* ssp. *cana*), and/or bitterbrush dominating or codominating the open to moderately dense (10 to 40% cover) shrub layer. Spiny saltbush, yellow rabbitbrush, rubber rabbitbrush, greasewood, horsebrush (*Tetradymia* spp.), or prairie sagewort (*Artemisia frigida*) may be common, especially in disturbed stands. Associated grasses can include Indian rice grass, plains reedgrass (*Calamagrostis montanensis*), streambank wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*), junegrass (*Koeleria macrantha*), one-sided bluegrass, western wheatgrass, needlegrass, green needlegrass (*Nassella viridula*), blue grama, and bluebunch wheatgrass. Thread-leaf sedge (*Carex filifolia*) and needleleaf sedge (*Carex duriuscula*) are also important. Common forbs are spiny phlox (*Phlox hoodii*), sandwort (*Arenaria* spp.), prickly pear (*Opuntia* spp.), scarlet globemallow (*Sphaeralcea coccinea*), purple prairie clover (*Dalea purpurea*), dotted blazing star (*Liatris punctata*), and milkvetch (*Astragalus* spp.). Areas with deeper soils more commonly support basin big sagebrush but have largely been converted for other land uses. Soils are typically deep and non-saline, often with a surface layer of lichen, moss, and other small plants (microphytic crust).

Inter-Mountain Basins Montane Sagebrush Steppe

The Inter-Mountain Basins Montane Sagebrush Steppe (montane sagebrush steppe) community type includes sagebrush communities occurring at montane and subalpine elevations. Climate is cool, semi-arid to subhumid. This community occurs primarily on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes and generally occurs on relatively flat areas with fine soils and some source of subsurface moisture. It is composed primarily of mountain sagebrush and other sagebrush species such as snowfield sagebrush (*Artemisia spiciformis*). Bitterbrush may codominate or even dominate some stands. Other common shrubs include snowberry species (*Symphoricarpos* spp.), service berry species (*Amelanchier* spp.), rubber rabbitbrush, wild crab apple (*Peraphyllum ramosissimum*), wax currant (*Ribes cereum*), and yellow rabbitbrush. Most stands have an abundant perennial herbaceous layer (more than 25% cover), but this community also includes mountain big sagebrush shrublands. Common grasses include Arizona fescue, Idaho fescue, needlegrass, muttongrass,

slender wheatgrass (*Elymus trachycaulus*), California brome grass (*Bromus carinatus*), one-sided bluegrass, spike fescue (*Leucopoa kingii*), tufted hairgrass (*Deschampsia caespitosa*), pine grass (*Calamagrostis rubescens*), and bluebunch wheatgrass. In many areas, frequent wildfires maintain an open, herbaceous-rich steppe condition, although at most sites, shrub cover can be unusually high for a steppe community (more than 40%), with the moisture providing equally high grass and forb cover.

Inter-Mountain Basins Semi-Desert Shrub-Steppe

The Inter-Mountain Basins Semi-Desert Shrub-Steppe (semi-desert shrub-steppe) community type typically occurs at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe typically is dominated by grasses (more than 25% cover) with an open shrub layer. Characteristic grasses include Indian rice grass, blue grama, saltgrass, needlegrass, James' galleta, one-sided bluegrass, and alkali sacaton. The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include shadscale, big sagebrush, Greene's rabbitbrush (*Chrysothamnus greenei*), yellow rabbitbrush, ephedra (*Ephedra* spp.), common rabbitbrush, matchweed (*Gutierrezia sarothrae*), and winterfat. Big sagebrush may be present but does not dominate. This community may be open shrubland with patchy grasses or patchy open herbaceous layer. Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some stands.

Inter-Mountain Basins Mixed Salt Desert Scrub

The Inter-Mountain Basins Mixed Salt Desert Scrub (mixed salt desert scrub) is an extensive community type that includes open-canopied shrublands of typically saline basins, alluvial slopes, and plains. Substrates are often saline, medium- to fine-textured, alkaline soils but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more saltbush species such as spiny saltbush, shadscale, cattle saltbush (*Atriplex polycarpa*), or spinescale saltbush (*Atriplex spinifera*). Other shrubs present to codominate may include Wyoming big sagebrush, yellow rabbitbrush, rubber rabbitbrush, Nevada jointfir (*Ephedra nevadensis*), spiny hopsage, winterfat (*Krascheninnikovia lanata*), desert thorn (*Lycium* spp.), bud sagebrush (*Picrothamnus desertorum*), or horsebrush species. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial grasses such as Indian rice grass, blue grama, streambank wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*), western wheatgrass, James's galleta, big galleta (*Pleuraphis rigida*), one-sided bluegrass, and alkali sacaton. Various forbs are also present.

Mojave Mid-Elevation Mixed Desert Scrub

The Mojave Mid-Elevation Mixed Desert Scrub (mixed desert scrub) community type is common on lower piedmont slopes in the transition zone into the southern Great Basin. The vegetation in this community is quite variable. Codominants and diagnostic species include blackbrush, California buckwheat (*Eriogonum fasciculatum*), Nevada jointfir, spiny hopsage, spiny menodora (*Menodora spinescens*), beargrass (*Nolina* spp.), buckhorn cholla (*Opuntia acanthocarpa*), Mexican bladdersage (*Salazaria mexicana*), Parish's goldeneye (*Viguiera parishii*), and Mojave yucca (*Yucca schidigera*). Desert grasses, including Indian rice grass, desert needlegrass, Porter's muhly (*Muhlenbergia porteri*), James's galleta, big galleta (*Pleuraphis rigida*), and one-sided bluegrass, may form an herbaceous layer. Scattered Utah juniper (*Juniperus osteosperma*) or desert scrub species also may be present.

Inter-Mountain Basins Greasewood Flat

The Inter-Mountain Basins Greasewood Flat (greasewood flat) community type typically occurs near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas. Sites typically have saline soils and a shallow water table and flood intermittently but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. This community usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by greasewood. Shadscale, spiny saltbush, or winterfat may be present to codominant. Occurrences often are surrounded by mixed salt desert scrub. The herbaceous layer, if present, is usually dominated by grasses. There may be inclusions of alkali sacaton, saltgrass (where water remains ponded the longest), or spikerush (*Eleocharis palustris*) herbaceous types.

Inter-Mountain Basins Active and Stabilized Dune

The Inter-Mountain Basins Active and Stabilized Dune (dune) community type occurs in basins and is composed of unvegetated to moderately vegetated (less than 10 to 30% plant cover) active and stabilized dunes and sandsheets. Species occupying these environments often are adapted to shifting sands and form patchy or open grasslands, shrublands, or steppe composed of Indian rice grass (*Achnatherum hymenoides*), sand sage (*Artemisia filifolia*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), shadscale (*Atriplex canescens*), ephedra (*Ephedra* spp.), blackbrush (*Coleogyne ramosissima*), common rabbitbrush (*Ericameria nauseosus*), sand wildrye (*Leymus flavescens*), chokecherry (*Prunus virginiana*), scurf pea (*Psoralidium lanceolatum*), bitterbrush (*Purshia*

tridentata), alkali sacaton (*Sporobolus airoides*), fourpart horsebrush (*Tetradymia tetrameres*), or crinklemat (*Tiquilia* spp).

North American Arid West Emergent Marsh

North American Arid West Emergent Marsh (emergent marsh) may occur in depressions in the landscape (ponds, kettle ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes also are referred to as sloughs). Marshes are frequently or continually inundated, with water depths up to 2 meters. Water levels may be stable, or may fluctuate 1 meter or more over the course of the growing season. Water chemistry may include some alkaline or semi-alkaline situations, but the alkalinity is highly variable even within the same complex of wetlands. Marshes have distinctive soils that typically are mineral but also can accumulate organic material. The vegetation is characterized by herbaceous plants that are adapted to wet soil conditions. Common emergent and floating vegetation includes species of tule (*Scirpus*) and/or bulrush (*Schoenoplectus*), cattail (*Typha*), rush, pondweed (*Potamogeton*), smartweed (*Polygonum*), pond lily (*Nuphar*), and canarygrass (*Phalaris*). This community type may include areas of relatively deep water with floating-leaved plants, such as duckweed (*Lemna*), pondweed, and water shield (*Brasenia*), and submergent and floating plants, such as water milfoil (*Myriophyllum*), coon's tail (*Ceratophyllum*), and waterweed (*Elodea*).

Inter-Mountain Basins Playa

The Inter-Mountain Basins Playa (playa) community type is composed of barren and sparsely vegetated playas (generally less than 10% plant cover) found in the intermountain western U.S. Salt crusts are common, with small saltgrass beds in depressions and sparse shrubs around the margins. These communities are intermittently flooded. The water is prevented from percolating through the soil by an impermeable subsurface soil layer and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. Characteristic species may include iodine bush (*Allenrolfea occidentalis*), greasewood (*Sarcobatus vermiculatus*), spiny hopsage (*Grayia spinosa*), Lemmon's alkaligrass (*Puccinellia lemmonii*), Great Basin wildrye (*Leymus cinereus*), saltgrass (*Distichlis spicata*), and saltbush (*Atriplex* spp.).

Inter-Mountain Basins Semi-Desert Grassland

The Inter-Mountain Basins Semi-Desert Grassland (semi-desert grassland) is a widespread community type that occurs on dry plains and mesas. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesatops, plateau parks, alluvial flats, and plains, but sites typically are xeric.

Substrates are often well-drained sandy or loamy-textured soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. These grasslands typically are dominated or codominated by Indian rice grass, three awn (*Aristida* spp.), blue grama, needlegrass, muhly (*Muhlenbergia* spp.), or James's galleta and may include scattered shrubs and dwarfshrubs of species of sagebrush, saltbush, blackbrush (*Coleogyne*), ephedra, matchweed (*Gutierrezia*), or winterfat.

Invasive Annual Grassland

The Invasive Annual Grassland (annual grassland) community type includes areas that are dominated by introduced annual grass species such as oat (*Avena* spp.), brome (*Bromus* spp.), and Mediterranean grass (*Schismus* spp.).

Invasive Perennial Grassland

The Invasive Perennial Grassland (perennial grassland) community type includes areas that are dominated by introduced perennial grass species such as crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), Lehmann lovegrass (*Eragrostis lehmanniana*), pennisetum species (*Pennisetum* spp.), bulbous blue grass (*Poa bulbosa*), Kentucky blue grass (*Poa pratensis*), and intermediate wheatgrass (*Thinopyrum intermedium*).

Invasive Annual and Biennial Forbland

The Invasive Annual and Biennial Forbland (forbland) community type includes areas that are dominated by introduced annual and/or biennial forb species such as saltlover (*Halogeton glomeratum*), common red sage (*Kochia scoparia*), and Russian thistle (*Salsola* spp.).

Inter-Mountain Basins Cliff and Canyon

The Inter-Mountain Basins Cliff and Canyon (basin cliff and canyon) community type is found from foothill to subalpine elevations and includes barren and sparsely vegetated landscapes (generally less than 10% plant cover) of steep cliff faces, narrow canyons, smaller rock outcrops, and unstable scree and talus slopes below cliff faces. Widely scattered trees and shrubs may include two needle pinyon pine (*Pinus edulis*), white pine (*Pinus flexilis*), single leaf pinyon pine, juniper (*Juniperus* spp.), big sagebrush (*Artemisia tridentata*), bitterbrush, desert mountain mahogany (*Cercocarpus ledifolius*), ephedra, cream bush (*Holodiscus discolor*), and other species often common in adjacent plant communities.

Sierra Nevada Cliff and Canyon

The Sierra Nevada Cliff and Canyon (Sierra cliff and canyon) community type includes barren and sparsely vegetated areas (less than 10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops. This type also includes unstable scree and talus slopes typically occurring below cliff faces. Scattered vegetation may include California red fir (*Abies magnifica*), Douglas-fir, lodgepole pine (*Pinus contorta* var. *murrayana*), ponderosa pine, Jeffrey pine (*Pinus jeffreyi*), quaking aspen, or single leaf pinyon pine (*Pinus monophylla*), Utah juniper (*Juniperus osteosperma*), and littleleaf mountain mahogany (*Cercocarpus ledifolius*) at lower elevations. There may be shrubs, including species of manzanita (*Arctostaphylos*) or ceanothus (*Ceanothus*).

Open Water

The open water cover type includes areas of open water, generally with less than 25% cover of vegetation or soil.

Agriculture

Agriculture is an aggregated land cover type that includes both pasture/hay areas and cultivated crops. Pasture/hay cover consists of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Cultivated crops are areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and perennial woody crops such as orchards and vineyards. Agriculture also includes all land being actively tilled. Most areas mapped as agriculture are irrigated, and patchy playa wetland vegetation may occur at the wettest edges of the fields. In this chapter, agricultural land refers to land mapped with agriculture as its cover type. See Chapter 7, Land Use and Agriculture, for additional information about agricultural land use.

Barren Lands, Non-Specific

The Barren Lands, Non-Specific (barren) cover type includes barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulation of earthen material. Generally, vegetation accounts for less than 15% of total cover.

Recently Mined or Quarried

The Recently Mined or Quarried (mined) cover type includes areas where open pit mining or quarries are visible in the imagery used for the Southwest Region GAP mapping (images acquired between 1999 and 2001), and are 2 hectares or greater in size.

Developed (Open Space, Low Intensity)

The Open Space cover type includes areas with a mixture of structures and associated landscaping but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

The low intensity cover type includes areas with a mixture of structures and associated landscaping. Impervious surfaces account for 20 to 49% of total cover. These areas most commonly include single-family housing units.

Developed (Medium–High Intensity)

The Developed (Medium Intensity) cover type includes areas with a mixture of constructed materials and vegetation. Impervious surface accounts for 50 to 79% of the total cover. These areas most commonly include single-family housing units. Developed (High Intensity) cover type includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100% of the total cover.

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Appendix 4B Noxious Weeds of Nevada

Common Name	Scientific Name
Category A Weeds:	
African rue	*Peganum harmala*
Austrian fieldcress	*Rorippa austriaca*
Austrian peaweed	*Sphaerophysa salsula/Swainsona salsula*
Camelthorn	*Alhagi camelorum*
Common crupina	*Crupina vulgaris*
Dalmation toadflax	*Linaria dalmatica*
Dyer's woad	*Isatis tinctoria*
Eurasian water-milfoil	*Myriophyllum spicatum*
Giant reed	*Arundo donax*
Giant salvinia	*Salvinia molesta*
Goats rue	*Galega officinalis*
Houndstongue	*Cynoglossum officinale*
Hydrilla	*Hydrilla verticillata*
Iberian starthistle	*Centaurea iberica*
Klamath weed	*Hypericum perforatum*
Leafy spurge	*Euphorbia esula*
Malta starthistle	*Centaurea melitensis*
Mayweed chamomile	*Anthemis cotula*
Mediterranean sage	*Salvia aethiopis*
Purple loosestrife	*Lythrum salicaria, L. virgatum* and their cultivars
Purple starthistle	*Centaurea calcitrapa*
Rush skeletonweed	*Chondrilla juncea*
Sow thistle	*Sonchus arvensis*
Spotted knapweed	*Centaurea masculosa*
Squarrose star thistle	*Centaurea virgata* var. *squarrosa*
Sulfur cinquefoil	*Potentilla recta*
Syrian bean caper	*Zygophyllum fabago*
Yellow starthistle	*Centaurea solstiltialis*
Yellow toadflax	*Linaria vulgaris*

Common Name	Scientific Name
Category B Weeds:	
Carolina horse-nettle	*Solanum carolinense*
Diffuse knapweed	*Centaurea diffusa*
Medusahead	*Taeniatherum caput-medusae*
Musk thistle	*Carduus nutans*
Russian knapweed	*Acroptilon repens*
Sahara mustard	*Brassica tournefortii*
Scotch thistle	*Onopordum acanthium*
White horse-nettle	*Solanum elaeagnifolium*
Category C Weeds:	
Black henbane	*Hyoscyamus niger*
Canada thistle	*Cirsium arvense*
Green fountain grass	*Pennisetum setaceum*
Hoary cress	*Cardaria draba*
Johnson grass	*Sorghum halepense*
Perennial pepperweed	*Lepidium latifolium*
Poison hemlock	*Conium maculatum*
Puncture vine	*Tribulus terrestris*
Saltcedar (tamarisk)	*Tamarix* spp.
Water hemlock	*Cicuta maculata*

Category A: Weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; actively eradicated from nursery stock dealer premises; control required by the state in all infestations.

Category B: Weeds established in scattered populations in some counties of the state; actively excluded where possible, actively eradicated from nursery stock dealer premises; control required by the state in areas where populations are not well established or previously unknown to occur.

Category C: Weeds currently established and generally widespread in many counties of the state; actively eradicated from nursery stock dealer premises; abatement at the discretion of the state quarantine officer.

Source: Nevada Department of Agriculture. 2008a. Noxious Weed List. Last revised: February 8, 2008. Available: <http://agri.nv.gov/nwac/PLANT_NoxWeedList.htm. Accessed: June 10, 2008>.

Figure 4B-1 shows the locations of weed management areas (WMAs) in Nevada, including the Walker River Basin WMA (Nevada Cooperative Weed Management Areas, 2006).

Figure 4B-1. Weed Management Areas in Nevada

Appendix 15A Climate Change Technical Information

Global Climate Change and the Greenhouse Effect

Global climate change is a phenomenon exacerbated by anthropogenic emissions of GHGs into the atmosphere through combustion of fossil fuels and other GHG-producing activities such as deforestation and land use change. The phenomenon known as the *greenhouse effect* keeps the earth's atmosphere near the surface warmer than it would be otherwise and allows successful habitation by humans and other forms of life.

GHGs play a critical role in maintaining the earth's radiation budget by trapping some of the longwave infrared radiation emitted from the earth's surface, which would otherwise escape to space (Figure 15A-1). GHGs affect the radiative forcing of the atmosphere (the change in net irradiance at the tropopause[1] after allowing for stratospheric temperatures to readjust to radiative equilibrium, but with surface and tropospheric temperatures and state held fixed at the unperturbed values), which is used to assess and compare the anthropogenic and natural drivers of climate change. Principal GHGs contributing to this process are water vapor, CO_2), N_2O, CH_4, O3, and certain anthropogenic HFCs and PFCs.

Fossil fuel combustion and deforestation release carbon from the geosphere and biosphere into the atmosphere. Such carbon had historically been stored underground in sediments or in surface vegetation . With the accelerated increase of fossil fuel combustion and deforestation since the industrial revolution of the 19th Century, concentrations of GHGs have increased exponentially in the atmosphere. Such emissions of GHGs in excess of natural ambient concentrations enhance the natural greenhouse effect. This enhanced greenhouse effect has contributed to *global warming*, an increased rate of warming of the earth's surface temperature. Specifically, increases in GHGs lead to increased absorption of longwave infrared radiation by the earth's atmosphere and warm the lower atmosphere further, thereby increasing evaporation rates and temperatures near the surface (Figure 15A-1).

Global warming is expected to affect weather patterns, sea level, ocean acidification, chemical reaction rates, precipitation rates, and other climate phenomena in a manner commonly referred to as *climate change*. Climate change is a global problem, and GHGs are global pollutants that do not result in pollution

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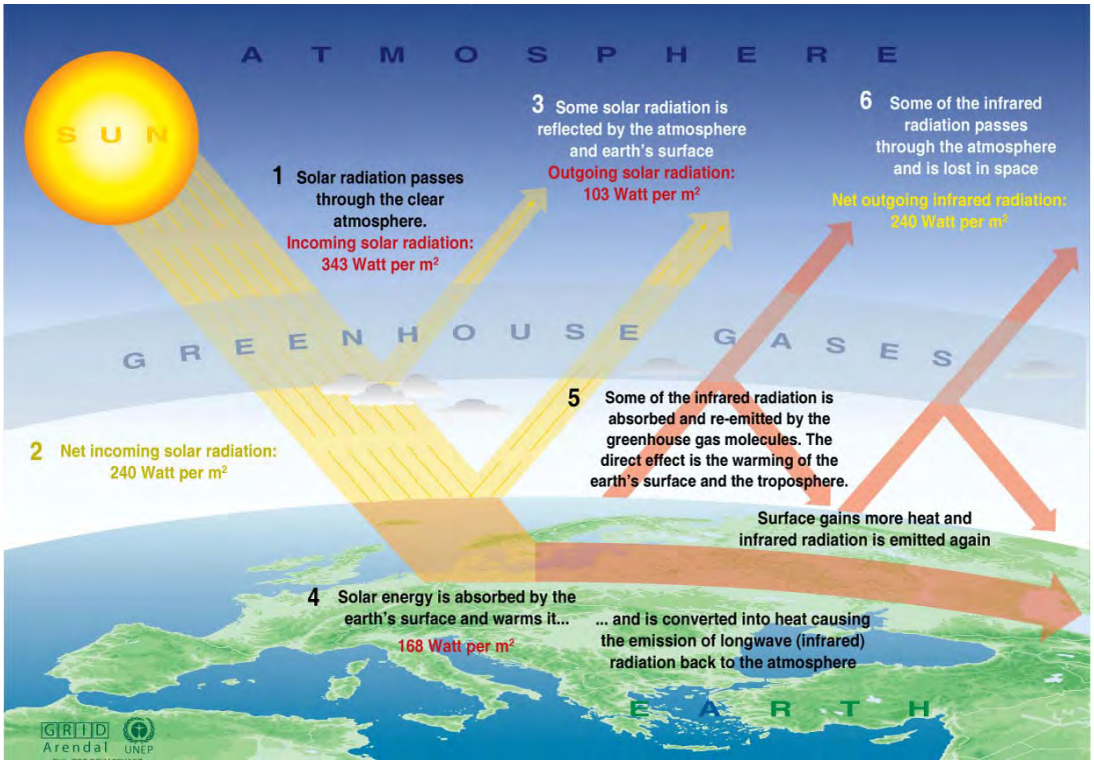
[1] The tropopause is the upper boundary of the troposphere (the layer of the atmosphere closets to earth's surface) and is usually characterized by an abrupt change in lapse rate from positive (decreasing temperature with height) to neutral or negative (temperature constant or increasing with height).

hotspots, unlike criteria air pollutants (such as ozone precursors) and toxic air contaminants that are pollutants of more regional and local concern.



Source: UNEP/GRID-Arendal, http://maps.grida.no/go/graphic/greenhouse_effect.

Figure 15A-1: The Greenhouse Effect

The Intergovernmental Panel on Climate Change Temperature Prediction

IPCC was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socio-economic information relevant to the understanding of climate change, its potential impacts, and options for adaptation and mitigation. IPCC predicts substantial increases in temperatures globally of between 1.1 and 6.4°C (Intergovernmental panel on Climate Change 2007a).

Greenhouse Gases and Global Emissions

The GHGs listed by IPCC (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) are documented in this section, in order of abundance in the atmosphere. Water vapor, although the most abundant GHG, is not included because natural concentrations and fluctuations far outweigh anthropogenic influences.

To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the global warming potential (GWP) methodology. IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2e, which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). For example, a high GWP represents high longwave infrared absorption and long atmospheric lifetime compared to CO_2. A time horizon must be selected to convert GHG emissions to equivalent CO_2 emissions to account for chemical reactivity and lifetime differences among various GHG species. The standard time horizon for climate change analysis is 100 years. Generally, GHG emissions are quantified in terms of metric tons of CO_2e emitted per year.

The atmospheric residence time of a gas is equal to the total atmospheric abundance of the gas divided by its rate of removal (Seinfeld 2006). The atmospheric residence time of a gas is, in effect, a half-life measurement of how long a gas is expected to persist in the atmosphere when taking into account removal mechanisms such as chemical transformation and deposition.

Table 15A-1 lists the GWP of each GHG, its lifetime, and abundance in the atmosphere in ppt. Units commonly used to describe the concentration of GHGs in the atmosphere are ppm, ppb, and ppt, referring to the number of molecules of the GHG in a sampling of 1 million, 1 billion, or 1 trillion molecules of air. Collectively, HFCs, PFCs, and SF_6 are referred to as high GWP gases. CO_2 is by far the largest component of worldwide CO_2e emissions, followed by CH_4, N_20, and high GWP gases in order of decreasing contribution to CO_2e. Table 15A-2 lists the anthropogenic contribution of GHGs in terms of CO_2e in 2004.

Table 15A-1. Lifetimes, Global Warming Potentials, and Abundances of Significant Greenhouse Gases

Gas	Global Warming Potential (100 years)	Lifetime (years)	1998 Atmospheric Abundance (ppt[1])
CO_2	1	50–200	365,000,000
CH_4	21	9–15	1,745
N_2O	310	120	314
HFC-23	11,700	264	14
HFC-134a	1,300	14.6	7.5
HFC-152a	140	1.5	0.5
CF_4	6,500	50,000	80
C_2F_6	9,200	10,000	3
SF_6	23,900	3,200	4.2

Sources: Intergovernmental Panel on Climate Change 1996, 2001.

Note: CF_4 and C_2F_6 are PFCs.

[1] *ppt* is a mixing ratio unit indicating the concentration of a pollutant in parts per trillion by volume.

Table 15A-2. Global Anthropogenic Greenhouse Gas Emissions in 2004 (CO_2 Equivalent)

Gas	Source	GHG Emissions (Gt CO_2e/year)	CO_2 Equivalent Percentage
CO_2	Deforestation, decay of biomass	8.5	17.3
CO_2	Fossil fuel use	27.7	56.6
CO_2	Other	1.4	2.8
CH_4	Agriculture, natural gas combustion, coal mining,	7.0	14.3
N_2O	Agriculture, industry, transportation	3.9	7.9
High GWP gases (includes HFCs, PFCs, and SF_6)	Consumer products, refrigerants, aluminum production, semiconductor manufacturing	0.5	1.1
All GHGs		49.0	100

Sources: Olivier et al., 2005, 2006 in Intergovernmental Panel on Climate Change 2007b (page 103, 110-111).
Gt = gigaton; GWP = global warming potential

Carbon Dioxide

CO_2 is the most important anthropogenic GHG and accounts for more than 75% of all anthropogenic GHG emissions. Its long atmospheric lifetime (on the order of decades to centuries) ensures that atmospheric concentrations of CO_2 will remain elevated for decades after mitigation efforts to reduce GHG concentrations are promulgated (Olivier et al. 2005, 2006 in Intergovernmental Panel on Climate Change 2007b).

Increasing concentrations of CO_2 in the atmosphere are largely attributable to emissions from fossil fuel combustion, gas flaring, cement production, and land use changes. About 75% of the current radiative forcing is likely due to anthropogenic CO_2 emissions that are the result of fossil fuel combustion (and to a very small extent, cement production), and approximately 25% of the current radiative forcing is the result of land use change (Intergovernmental Panel on Climate Change 2007a).

Anthropogenic emissions of CO_2 have increased concentrations in the atmosphere most notably since the industrial revolution. The concentration of CO_2 has increased from about 280 to 379 ppm over the last 250 years, an increase of over 35% (Intergovernmental Panel on Climate Change 2007a). IPCC estimates that the present atmospheric concentration of CO_2 has not been exceeded in the last 650,000 years and is likely the highest ambient concentration in the last 20 million years (Intergovernmental Panel on Climate Change 2007a).

Methane

CH_4, the main component of natural gas, is the second largest contributor to anthropogenic GHG emissions, and has a GWP of 21 (Association of Environmental Professionals 2007, Intergovernmental Panel on Climate Change 1996).

Anthropogenic emissions of CH_4 are the result of growing rice, raising cattle, combusting natural gas, and mining coal (National Oceanic and Atmospheric Administration 2005). Atmospheric CH_4 has increased from a preindustrial concentration of 715 to 1,775 ppb in 2005 (Intergovernmental Panel on Climate Change 2001). Although it is unclear why, atmospheric concentrations of CH_4 have not risen as quickly as anticipated (National Oceanic and Atmospheric Administration 2005).

Nitrous Oxide

N_2O is a powerful GHG, with a GWP of 310 (Intergovernmental Panel on Climate Change 1996). Anthropogenic sources of N_2O include agricultural processes, nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. N_2O also is used in rocket engines, racecars, and as an aerosol spray propellant. Agricultural processes that result in anthropogenic N_2O

emissions are fertilizer use and microbial processes in soil and water (Association of Environmental Professionals 2007).

N_2O concentrations in the atmosphere have increased from preindustrial levels of 270 to 319 ppb in 2005, an 18% increase (Intergovernmental Panel on Climate Change 2001).

Hydrofluorocarbons

HFCs are anthropogenic chemicals used in commercial, industrial, and consumer products (U.S. Environmental Protection Agency 2006). HFCs generally are used as substitutes for ozone-depleting substances in automobile air conditioners and refrigerants. As seen in Table 15A-2, HFCs, in order from most abundant to least, include HFC-134a (35 ppt), HFC-23 (17.5 ppt), and HFC-152a (3.9 ppt).

Concentrations of HFCs, which have high GWPs, have risen from zero to current levels (Table 15A-2). Because these chemicals are human-made, they do not exist naturally in ambient conditions.

Perfluorocarbons

The most abundant PFCs are CF_4 and C_{2F6}. These human-made chemicals are emitted largely from aluminum production and semiconductor manufacturing processes. PFCs are extremely stable compounds that are destroyed only by very high-energy ultraviolet rays. These chemicals thus have a very long lifetime, as shown in Table 15A-2 (U.S. Environmental Protection Agency 2006).

PFCs have large GWPs and have risen from zero to current levels (Table 15A-2).

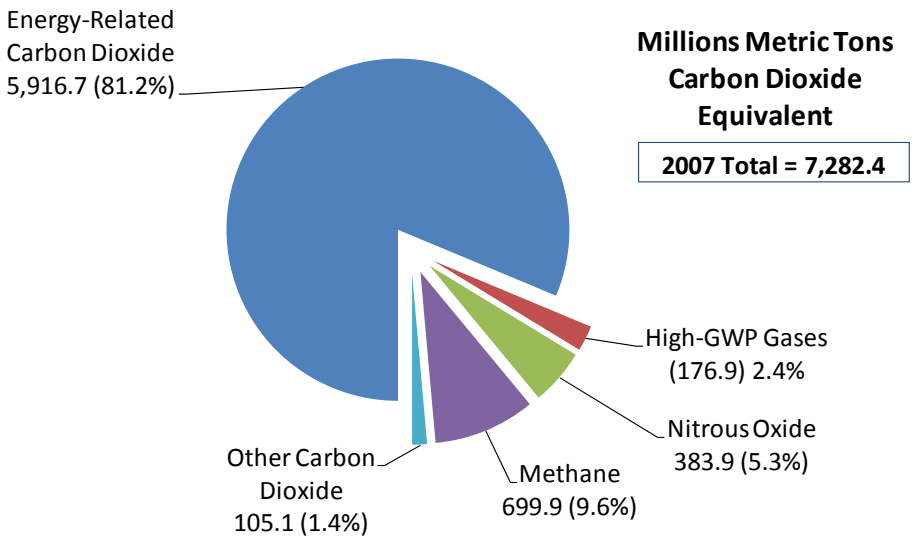
Sulfur Hexafluoride

SF_6, another human-made chemical, is used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, in semiconductor manufacturing, and also as a trace chemical for the study of oceanic and atmospheric processes (U.S. Environmental Protection Agency 2006). In 1998, atmospheric concentrations of SF_6 were 4.2 ppt and steadily increasing in the atmosphere.

SF_6 is the most powerful of all GHGs listed in IPCC studies, with a GWP of 23,900 (Intergovernmental Panel on Climate Change 1996).

United States Greenhouse Gas Emissions

Total United States greenhouse gas emissions in 2007 were 1.4% above the 2006 total. (U.S. Department of Energy, Energy Information Administration 2008) Figure 15A-2 presents the proportionate emissions of the major United States GHG emissions in 2007.



Source: U.S. Department of Energy, Energy Information Administration 2008
Note: High-GWP Gases include HFCs, PFCs, and SF_6.

Figure 15A-2: United States Greenhouse Gas Emissions by Gas, 2007

Total emissions growth—from 7,179.7 mmt CO_2e in 2006 to 7,282.4 mmt CO_2e in 2007—was largely the result of a 75.9-mmt CO_2e increase in CO_2 emissions. There were larger percentage increases in emissions of other GHGs, but their absolute contributions to total emissions growth were relatively small: 13.0 mmt CO_2e for CH4, 8.2 mmt CO_2e for N_2O, and 5.6 mmt CO_2e for high GWP gases (U.S. Department of Energy, Energy Information Administration 2008).

The increase in United States CO_2 emissions in 2007 resulted primarily from two factors: unfavorable weather conditions, which increased demand for heating and cooling in buildings; and a drop in hydropower availability that led to greater reliance on fossil energy sources (coal and natural gas) for electricity generation, increasing the carbon intensity of the power supply. (Energy Information Administration 2008) The increase in CH4 emissions resulted from energy sources, waste management, and agriculture. The increase in N_2O is attributed primarily to an increase of emissions from nitrogen fertilization of agricultural soils.

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Glossary

agricultural drainage	(1) The process of directing excess water away from the root zones of plants by natural or artificial means, such as by using a system of pipes and drains placed below ground surface level. (2) The water drained away from irrigated farmland.
agricultural land	Land in farms regularly used for agricultural production; all land devoted to crop or livestock enterprises, for example, farmstead lands, drainage and irrigation ditches, water supply, cropland, and grazing land.
agricultural runoff	The runoff into surface waters of herbicides, fungicides, insecticides, and the nitrate and phosphate components of fertilizers and animal wastes from agricultural land and operations. Considered a nonpoint source of water pollution.
air quality	A measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.
air quality classes	Classifications established under that Prevention of Significant Deterioration portion of the Clean Air Act that limit the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air quality would be significant; Class II applies to areas where the deterioration normally accompanying moderate well-controlled growth would be permitted; Class III applies to areas where industrial deterioration would generally be allowed.
ambient air	Any unconfined portion of the atmosphere: open air, surrounding air.
appropriate	To authorize the use of a quantity of water to an individual requesting it.
appropriated water	(1) A quantity of water from a well, stream, river, reservoir, or other source reserved for a specific use and place of use under state water-right laws, statutes, or regulations. (2) Surface water in an irrigation district that has been assigned or allocated to owners of water rights.

appropriation doctrine (prior)	The system for allocating water to private individuals used in the western United States under which (1) the right to water was acquired by diverting water and applying it to a beneficial use and (2) a right to water acquired earlier in time is superior to a similar right acquired later in time. The doctrine of prior appropriation was in common use throughout the arid west as early settlers and miners began to develop the land. The prior appropriation doctrine is based on the concept of first in time, first in right. The first person to take a quantity of water and put it to beneficial use has a higher priority of right than a subsequent user. Under drought conditions, higher priority users are satisfied before junior users receive water. Appropriative rights can be lost through nonuse; they can also be sold or transferred apart from the land.
appropriative water right	Nevada's water law is based on statutes originally enacted in 1903 and Nevada Revised Statutes, Chapter 533, and is founded on the principal of *prior appropriation*. Unlike some other states, Nevada has a statewide system for the administration of both groundwater and surface water. Appropriative water rights are based on the concept of applying water to beneficial use and first in time, first in right. Appropriative water rights can be lost through nonuse and they may be sold or transferred apart from the land. Due in large part to the relative scarcity of water in Nevada and numerous competing uses, Nevada has had a thriving market for water transfers for a number of years. A person in Nevada who desires to place water to beneficial use must file an application with the State Engineer to initiate the process of acquiring an appropriative water right.
appropriator	One taking water from a watercourse under the authority of the state and applying it to beneficial use.
appurtenant	(1) (Legal) A right, privilege, or property that is considered incident to the principal property for purposes such as passage of title, conveyance, or passage of title. (2) (Water-Related) A right to water that is incident to the ownership or possession of the land.
appurtenant land	The land base to which water rights legally pertain or belong.

appurtenant to place of use	The location of where the water will be put to beneficial use.
appurtenant water right	A water right that is incident to the ownership or possession of land.
aquifer	A geologic formation, a group of formations, or a part of a formation that is water-bearing.
aquifer, basin-fill	An aquifer located in a basin surrounded by mountains and composed of sediments and debris shed from those mountains. Sediments are typically sand and gravel with some clay.
aquifer, confined	An aquifer that is bounded above and below by formations of impermeable or relatively impermeable material. An aquifer in which groundwater is under pressure significantly greater than atmospheric and its upper limit is the bottom of a bed of distinctly lower hydraulic conductivity than that of the aquifer itself.
aquifer, unconfined	An aquifer made up of loose material such as sand or gravel that has not undergone lithification (settling). In an unconfined aquifer the upper boundary is the top of the zone of saturation (water table).
aquitard	A geological formation that contains, and is impermeable to, groundwater.
arid	A term applied to a climate or region where precipitation is so deficient in quantity, or occurs so infrequently, that crop production is impractical or impossible without irrigation.
attainment area	An area considered to have air quality as good as or better than the national ambient air quality standards as defined in the Clean Air Act. An area may be an attainment area for one pollutant and a nonattainment area for others.

Basin and Range province	A region of north-trending mountains ranges and valleys encompassing western Utah and essentially all of Nevada. This geologic territory includes virtually all of the Great Basin and extends south and east through Arizona, New Mexico, and Texas all the way into Mexico. The Basin and Range can be differentiated from its surrounding geologic regions by its uplifted and tilted ranges separated by broad elongated basins. The Great Basin forms a unique part of this geologic region in as much as this hydrologic area has no drainage to the ocean.
basin	The land where water drains downhill into a body of water. The U.S. Geological Survey and the Nevada Division of Water Resources, Department of Conservation and Natural Resources, have divided Nevada into discrete hydrologic units for water planning and management purposes. These have been identified as 232 hydrographic areas (256 areas and subareas, combined) within 14 major hydrographic regions or basins.
bathymetry	(1) The measurement of the depth of large bodies of water. (2) The measurement of water depth at various places in a body of water. Also the information derived from such measurements.
best management practice	A generally accepted practice for some aspect of natural resources management, such as water conservation measures, drainage management measures, or erosion control measures. Typically incorporates conservation criteria.
Biological Assessment	A document submitted to the U.S. Fish and Wildlife Service that provides data and project impacts to evaluate whether a federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat. The Biological Assessment is used by the agency to prepare their Biological Opinion.

Biological Opinion	A document that states the opinion of the U.S. Fish and Wildlife Service as to whether a federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat.
braiding (of river channels)	Successive division and rejoining of river flow with accompanying islands.
carbon monoxide	A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.
combustion	The act or instance of burning some type of fuel such as gasoline to produce energy. Combustion is typically the process that powers automobile engines and power plant generators.
confluence	(1) The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet. (2) The stream or body of water formed by the junction of two or more streams; a combined flood.
conservation district	A public organization created under state-enabling law as a special purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries. In the United States, such districts are usually a subdivision of state government with a local governing body and are frequently called a soil conservation district or a soil and water conservation district.
consumptive use	Water that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment.
conveyance loss	Water that is lost in transit from delivery systems such as pipes, canals, conduits, or ditches by leakage, seepage, spillage, evaporation, or evapotranspiration by plants growing in or near the channel. Generally, some portion of such losses will not be available for further use; however, leakage from an irrigation ditch, for example, may percolate to a groundwater source and be available for further use.

cooperating agency	Any public agency other than a lead agency that has jurisdiction over a resource or particular expertise that would be significantly affected by a proposed action or alternative. A state or local agency or an Indian Tribe, may, by agreement with the lead agency, become a cooperating agency.
criteria pollutants	Six pollutants known to be hazardous to human health for which the Environmental Protection Agency has established National Ambient Air Quality Standards: ozone, carbon monoxide, total suspended particulates, sulfur dioxide, lead, and nitrogen oxide. These standards are required under the 1970 amendments to the Clean Air Act.
de minimis	The minimum air pollutant threshold for which project conformity determination must be performed.
decree	The judgment of a court, an official order, or settlement.
decreed water rights (water)	Water rights determined by court decree. As specified by the Walker River Decree, a right to divert natural flow from the Walker River.
dedicated natural flow	River flows allocated to environmental use.
depletion	(1) The water consumed within a service area or no longer available as a source of supply; that part of a withdrawal that has been evaporated, transpired, incorporated into crops or products, consumed by man or livestock, or otherwise removed. (2) Net rate of water use from a stream or groundwater aquifer for beneficial and nonbeneficial uses.
Desert Research Institute	A unit of the University of Nevada created in 1959 by an act of the Nevada Legislature. The DRI became an autonomous, nonprofit division and has since grown to be one of the world's largest multidisciplinary environmental research organizations focusing on arid lands. The DRI's five research centers focus on the geosphere, hydrosphere, biosphere, and atmosphere.
direct effects	Effects that are caused by an action and occur at the same time and place as the action.

discharge	The volume of water that passes a given point in a given period of time.
diversion	The redirection of movement of water from a stream, lake, aquifer, or other source of water by a canal, pipe, well, or other conduit to another watercourse or to the land, as in the case of an irrigation system.
drainwater	Any residual water that flows away from an irrigation project; it may or may not satisfy some portion of downstream water rights.
drawdown	The act, process, or result of depleting, as a liquid or body of water as in the lowering of the water surface level due to release of water from a reservoir.
Environmental Impact Statement	A report required by the National Environmental Policy Act for all major projects that may have a significant impact on the quality of the human environment or are environmentally controversial. The Environmental Impact Statement is a detailed and formal evaluation of the favorable and adverse environmental and social impacts of a proposed project and its alternatives. A tool for decision making, the Environmental Impact Statement describes the positive and negative impacts of the Proposed Action and includes alternatives to the Proposed Action that meet the identified Purpose and Need for the action.
epilimnion	The warm upper layer of a body of water with thermal stratification, which extends down from the surface to the thermocline, forming the boundary between the warmer upper layers of the epilimnion and the colder waters of the lower depths, or hypolimnion. The epilimnion is less dense than the lower waters and is wind-circulated and essentially homothermous.
erosion	(1) Detachment of soil particles under the influence of water and/or wind. (2) The wearing away and removal of materials of the earth’s crust by natural means. (3) The process by which flood waters lower the ground surface in an area by removing upper layers of soil. As usually employed, the term includes weathering, solution, corrosion, and transportation.

evaporation	(1) The physical process by which a liquid (or a solid) is transformed to the gaseous state. (2) The process by which water is changed from a liquid to a vapor.
evapotranspiration	The loss of water to the atmosphere from the earth's surface by evaporation and by transpiration through plants.
evapotranspiration, net	Evapotranspiration minus rainfall.
Executive Order	Legally binding orders given by the President, acting as the head of the Executive Branch, to federal administrative agencies. Executive Orders are generally used to direct federal agencies in their execution of congressionally established laws or policies.
fallow	(1) Allowing cropland, either tilled or untilled, to lie idle during the whole or greater portion of the growing season. (2) Land plowed and tilled and left unplanted (i.e., not irrigated).
farmland, prime	As defined in the Farmland Protection Policy Act of 1981: Land that provides optimal physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (urban areas are not included).
floodplain	A normally dry land area that is susceptible to being inundated by water from any natural source. This area is usually low land adjacent to a river, stream, watercourse, ocean or lake.
flood stage	(1) An elevation for the water level at high flows. (2) The elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.
floodwater	The terms floodwater and permit water are used interchangeably to mean the water derived from the most junior surface water right controlled by the Walker River Irrigation District. This water is only available from May through July under state-issued certificates of appropriation, when demands for all other more senior surface water rights have been satisfied and there are excess or surplus natural flows remaining in the Walker River stream system.

floor	A generic term for the nearly level, lower-part of an inter-montane basin or a major desert stream valley.
flow rate	The speed or rate at which a volume of water is taken from a water course or flows past a point of measurement or diversion (e.g., cubic feet per second).
flow, natural	The rate of water movement past a specified point on a natural stream from a drainage area that has not been affected by stream diversion, storage, import, export, or change in consumptive use resulting from man's modification of land use. Natural flow rarely occurs in a developed country.
fugitive dust	Dust particles that are introduced into the air through certain activities such as soil cultivation, or vehicles operating on open fields or dirt roadways. A subset of fugitive emissions.
full funding	Sufficient financing to purchase enough water to increase Walker Lake inflows by an average of 50,000 af/yr.
full transfer of available water	The assumed transfer of up to the full amount of the water historically diverted (on an annual average acre foot per acre basis) to serve irrigated lands in the Mason Valley, Smith Valley, and East Walker sub-areas. Full transfer assumes that this water would be fully available at existing points of diversion for transfer to Walker Lake, although the water would be subject to other physical losses below those points, such as infiltration from the Walker River to groundwater.
gaining stream	A stream or reach of a stream, the flow of which is being increased by the inflow of ground water seepage or from springs in, or alongside, the channel.
Gap Analysis	A method for determining spatial relationships between areas of high biological diversity and the boundaries of national parks, national wildlife refuges, and other preserves. The primary goal of Gap Analysis is to prevent additional species from being listed as threatened or endangered. Analyses are made and displayed using a geographic information system.

geographic information system	A computer information system that can input, store, manipulate, analyze, and display geographically referenced (i.e., geo-spatial) data to support the decision-making processes of an organization.
geothermal	Heat usually associated with groundwater, e.g. a geothermal aquifer.
gradient	Degree of incline; slope of a stream bed. The vertical distance that water falls while traveling a horizontal distance downstream.
Great Basin	A hydrogeographic area covering most of Nevada and much of western Utah and portions of southern Oregon and northeastern California. The region consists primarily of arid, high elevation, desert valleys, sinks (playas), dry lake beds, and salt flats. In the Great Basin, all surface waters drain inward to terminal lakes, sinks, or playas.
gross duty of water	The gross amount of water allowed to be used or diverted for irrigation purposes at the farm headgate or at the intake of a canal system, usually expressed in terms of a maximum volume per unit of area per unit of time (e.g., acre feet per acre per year, CFS per acre per season).
groundwater table	(1) The depth below the surface of the ground where the soil is saturated (the open spaces between the individual soil particles are filled with water). (2) The upper surface of the zone of saturation for underground water. Also referred to as the water table.
groundwater, perched	Groundwater that is separated from the main body of groundwater by an impermeable (unsaturated) layer.
groundwater basin	A groundwater reservoir together with the entire overlying land surface and the underlying aquifers that contribute water to the reservoir. In some cases, the differing boundaries of successively deeper aquifers make it difficult to define the limits of the basin. A groundwater basin could be separated from adjacent basins by geologic boundaries or by hydrologic boundaries.
groundwater recharge	The infiltration of water into a subsurface aquifer. It may increase the total amount of water stored underground or only replenish the groundwater supply depleted through pumping or natural discharge.

groundwater right, primary	A state-permitted right to pump groundwater for use on land that has no rights to surface water. Generally, such rights are limited to a maximum rate of flow and to an overall volumetric limit, such as 4.0 acre feet/acre per season.
supplemental groundwater right	A state-permitted right to pump groundwater to supplement another surface or ground water right. Generally, such rights are limited to a maximum rate of flow and to an overall volumetric limit from all sources, such that combined surface and groundwater use may not exceed (for example) 4.0 af/acre per season.
habitat	The native environment or specific surroundings where a plant or animal naturally grows or lives. The surroundings include physical factors such as temperature, moisture, and light together with biological factors such as the presence of food or predator organisms.
head cut	A break in slope at the top of a gully or section of gully that forms a waterfall, which in turn causes the underlying soil to erode and the gully to expand uphill.
hydrologic	Pertaining to the science dealing with water, its properties, phenomena, and distribution over the earth's surface.
hydrologic balance	An accounting of all water inflows to, water outflows from, and changes in water storage within a hydrologic unit over a specified period of time.
hydrologic model	Mathematical formulations that simulate hydrologic phenomenon considered as processes or as systems.
hypolimnion	The lowermost, noncirculating layer of cold water in a thermally stratified lake or reservoir that lies below the thermocline, remains perpetually cold, and is usually deficient of oxygen.
impermeable	Unable to transmit water; not easily penetrated. The property of a material or soil that does not allow, or allows only with great difficulty, the movement or passage of water. Impervious.

incidental recharge	Groundwater recharge (infiltration) that occurs as a result of water conveyance losses (seepage) through unlined (earthen) canals, or from residuals in the application or use (ET) of irrigation water.
indirect effects	Effects that are caused by an action and occur later in time, or at another location, yet are reasonably foreseeable.
International Vegetation Classification System	Characterizes vegetation as it currently exists on the landscape. Landforms, soils, and other features are not directly considered as part of the classification criteria.
inundate	To cover with water, especially floodwaters.
invasive plant	A plant that moves in and takes over an ecosystem to the detriment of other species; often the result of environmental manipulation.
inversion	A layer of warm air in the atmosphere that prevents the rise of cooling air and traps pollutants beneath it.
irrigated land	Land receiving water by controlled artificial means for agricultural purposes from surface or subsurface sources.
irrigation	The application of water to soil for the purpose of growing crops when rainfall is insufficient to maintain desirable soil moisture for plant growth.
irrigation canal	An irrigation conduit constructed to convey water from the source of supply to one or more farms, including lined and unlined ditches and laterals as well as surface and sub-surface pipelines.
irrigation conveyance loss	The loss of water in transit from a reservoir, point of diversion, or groundwater pump (if not on farm) to the point of use, whether in natural channels or in artificial ones, such as canals, ditches, and laterals.

irrigation district	(1) Quasi-political districts created under special laws to provide for water services to property owners in the district. (2) A cooperative, self-governing public corporation set up as a subdivision of the state government, with definite geographic boundaries, organized and having taxing power to obtain and distribute water for the irrigation of lands within the district; created under the authority of a state legislature with the consent of a designated fraction of the landowners or citizens and having taxing power.
irrigation return flow	Applied water that is not consumptively used; that is, water that is not transpired, evaporated, or deep percolated into a groundwater basin, and which eventually returns to the river through the irrigation drainage network.
lake	A considerable body of inland water formed by natural processes, a constructed reservoir, or an expanded part of a river.
land retirement	Taking land out of agricultural production through the cessation or irrigation, thus leaving it permanently fallow.
lead federal agency	The federal agency or agencies preparing or having taken primary responsibility for preparing an Environmental Impact Statement.
losing stream	A stream or reach of a stream that is losing water by seepage into the ground. Also referred to as an influent stream.
metalimnion	The middle layer of a thermally stratified lake or reservoir. In this layer there is a rapid decrease in temperature with depth.
Mitigation	Action taken to avoid, reduce the severity of, or eliminate an adverse impact. Mitigation can include one or more of the following actions: • avoiding impacts; • minimizing impacts by limiting the degree or magnitude of an action; • rectifying impacts by restoring, rehabilitating, or repairing the affected environment; • reducing or eliminating impacts over time; and

	• compensating for the impact by replacing or providing substitute resources or environments to offset the loss.
National Ambient Air Quality Standards	National standards for outdoor air quality established by the U.S. Environmental Protection Agency. These include primary standards, which set limits to protect public health; and secondary standards, which set limits to protect public welfare.
National Environmental Policy Act	A 1970 Act of Congress that requires all federal agencies to incorporate environmental considerations into their decision-making processes. The act requires an Environmental Impact Statement for any "major federal action significantly affecting the quality of the human environment."
National Pollutant Discharge Elimination System permit	A permit required for any discharges of pollutants directly into the waters of the United States.
navigable waters	A body of water that is sufficiently high, wide, and deep enough to allow a vessel to pass through. Navigability may vary according to ship size, or environmental conditions such as water velocity or freezing.
Nevada State Engineer	The public official and office charged with the administration of the water appropriation system within the State of Nevada, Division of Water Resources, Department of Conservation and Natural Resources.
New Lands	Lands without any decreed water rights.
nitrogen oxides	Compounds of nitric oxide, nitrogen dioxide, and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. Nitrogen dioxide is a criteria air pollutant, and may result in numerous adverse health effects.
No Action Alternative	Projected baseline condition, or anticipated future condition without a given action being taken. The expected future condition if no action is taken—which is not necessarily the same as the present condition. The effects of action alternatives are measured against this "no action" condition.

nonattainment area	Area that does not meet one or more of the National Ambient Air Quality Standards for the criteria pollutants designated in the Clean Air Act.
noxious weed	A plant species that possesses one or more of the following attributes: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insect or disease and being native or new to or not common to the United States or parts thereof.
outlet	Point where water exits from a stream, river, lake, reservoir, tidewater, or artificial drain. The mouth of a river where it flows into a larger body of water.
oxygen depletion	The removal of dissolved oxygen from a body of water as a result of bacterial metabolism of degradable organic compounds added to the water, typically caused by human activities.
ozone	A strong-smelling, pale blue, reactive toxic chemical gas consisting of three oxygen atoms. Ozone is a product of the photochemical process involving the sun's energy and ozone precursors, such as hydrocarbons and oxides of nitrogen. Ozone exists in the upper atmosphere ozone layer (stratospheric ozone) and at the Earth's surface in the troposphere (ozone). Ozone in the troposphere causes numerous adverse health effects and is a criteria air pollutant. It is a major component of smog.
ozone precursors	Chemicals such as non-methane hydrocarbons and oxides of nitrogen, occurring either naturally or as a result of human activities, that contribute to the formation of ozone, a major component of smog.
particulate matter	Any material, except pure water, that exists in the solid or liquid state in the atmosphere. The size of particulate matter can vary from coarse, wind-blown dust particles to fine particle combustion products. Particulate matter is generally measured in microns.

permitted water right	The right to put surface or groundwater to beneficial use that is identified by a document issued by the Nevada State Engineer prior to the filing of satisfactory proof of "perfection of application" in accordance with Nevada Revised Statutes Chapter 533. If proof of beneficial use is accepted by the State Engineer, then the water right permit can be converted into a certificated water right. If proof of beneficial use in not made to or accepted by the State Engineer, then the right to claim title to the water may cease.
place of use	The specific location, typically documented in a water right permit, where water is applied or used. A water user cannot use water at another location without transferring the right or obtaining a new right.
priority date	The date of establishment of a water right; the officially recognized date associated with a water right. The rights established by application have the application date as the date of priority. The priority date may make a water right senior (predating other rights) or junior (subordinate to other rights).
project area	The area generally affected by the proposed action. For this proposed action in this EIS, the project area is defined as the Nevada portions of the Walker River Basin.
proposed action	The federal action proposed to address an identified purpose and need in an Environmental Impact Statement.
proposed project	The specific project proposed for development, which may have an impact on the natural and human environment, and is evaluated in the Environmental Impact Statement.
qualitative analysis	The examination of a phenomenon to determine its qualitative characteristics, i.e., characteristics for which precise numerical identification are not appropriate.
quantitative analysis	The examination of a phenomenon using actual observed data with an intention to explain historic behavior and/or predict future behavior.
recharge, natural	The replenishment of groundwater storage from naturally-occurring surface water supplies such as precipitation and natural stream flows.

recreation resource	Land and water areas and their natural attributes, with or without constructed facilities, which provide opportunities for outdoor recreation.
relicted land	Land exposed by declines in water levels or location.
reservoir	1) A body of water used or constructed for the storage, regulation, and control of water. (2) An artificially created lake in which water is collected and stored for future use.
riparian	Pertaining to the banks of a river, stream, waterway, or other flowing body of water, and to plant and animal communities along such bodies of water.
riparian habitat	Areas adjacent to rivers and streams with a high density, diversity, and productivity of plant and animal species relative to nearby uplands.
river mile	The distance of a point on a river measured in miles from the river's mouth along the low-water channel.
runoff	(1) That portion of precipitation that moves from the land to surface water bodies. (2) That portion of precipitation that is not intercepted by vegetation, absorbed by the land surface or evaporated, and thus flows overland into a depression, stream lake or ocean. (3) That part of the precipitation, snow melt, or irrigation water that appears in uncontrolled surface streams, rivers, drains, or sewers.
storage rights	A right to water stored in designated reservoirs (for this Environmental Impact Statement, Bridgeport and Topaz Lake Reservoirs). Supplemental storage rights are used to supplement decreed (or natural flow) direct diversion water rights for more junior (1874 or later) dates of priority.
study area	The area that may be affected by the proposed project. This area varies by resource.
substantial	Meaningful or important adverse change in context or intensity. A substantial change is one that would be noticeable and measurable and that would have either a short-term or long-term beneficial or adverse impact.

sulfur dioxide	A strong-smelling, colorless gas that is formed by the combustion of fossil fuels. Power plants, which may use coal or oil high in sulfur content, can be major sources of sulfur dioxide. Sulfur dioxide and other sulfur oxides contribute to the problem of acid deposition. Sulfur dioxide is a criteria air pollutant.
tailwater runoff	Refers to unused irrigation water that is collected at the downstream end of an irrigation system or field in a ditch, drain, or impoundment. This water may be reused again for irrigation purposes, left to evaporate, percolate into the ground, treated, and/or discharged to surface bodies of water.
thermocline	(1) The region in a thermally stratified body of water that separates warmer oxygen-rich surface water from cold oxygen-poor deep water and in which temperature decreases rapidly with depth. (2) A layer in a large body of water, such as a lake, that sharply separates regions differing in temperature, so that the temperature gradient across the layer is abrupt.
threatened species	Any plant or animal species likely to become an endangered species within the foreseeable future throughout all of a significant area of its range or natural habitat; identified by the Secretary of the Interior as “threatened” in accordance with the 1973 Endangered Species Act.
total dissolved solids	All the solids (usually inorganic mineral salts) that are dissolved in water. Used to evaluate water quality. Solutions high in Total Dissolved Solids have the capability of changing the chemical nature of water. High Total Dissolved Solids concentrations exert varying degrees of osmotic pressures and often become lethal to the biological inhabitants of an aquatic environment.

transpiration	(1) The movement of water from the soil or ground water reservoir via the stomata in plant cells to the atmosphere. (2) The quantity of water absorbed, transpired, and used directly in the building of plant tissue during a specified time period. It does not include soil evaporation. (3) The process by which water vapor escapes from a living plant, principally through the leaves, and enters the atmosphere.
upstream	Toward the source or upper part of a stream; against the current. In relation to water rights, the term refers to water uses or locations that affect water quality or quantity of downstream water uses or locations.
Walker River Irrigation District (WRID)	Formed in April 1919 by farmers in Smith and Mason Valleys in response to the Decree 731, WRID includes all irrigated and non-irrigated lands in Nevada on the East Walker River, the West Walker River, and the main Walker River, except for lands within the Walker River Indian Reservation. Although WRID was established as a Nevada agency serving lands entirely within Nevada, its surface storage reservoirs are located either entirely in California (Bridgeport Reservoir) or partially in California and Nevada (Topaz Reservoir).
water efficiency	Refers to the fraction of diversions and groundwater pumping for irrigation that is used consumptively by irrigated land (i.e., net evapotranspiration for irrigated lands divided by the sum of surface water diversions and groundwater pumping).
watershed	(1) An area that, because of topographic slope, contributes water to a specified surface water drainage system, such as a stream or river. An area confined by topographic divides that drains a given stream or river. (2) The natural or disturbed unit of land on which all of the water that falls (or emanates from springs or melts from snow packs), collects by gravity, and fails to evaporate, runs off via a common outlet. (3) All lands enclosed by a continuous hydrologic drainage divide and lying upslope from a specified point on a stream; a region or area bounded peripherally by a water parting and draining ultimately to a particular water course or body of water. Also referred to as water basin or drainage basin. (4) A ridge of relatively high land dividing two areas that are drained by different river systems.

water rights	The qualified right to draw and use up to a specific amount (and/or flow rate) of water from a specified water source at a particular location, for a designated purpose, and for a specified period of time
wetlands	(1) Federal: those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (2) Nevada: Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, playas, springs, seeps, and similar areas. Wetlands are land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. For the purpose of this classification wetlands must have one or more of the following attributes: hydrophytic vegetation, hydric soil, or wetland hydrology.
Wildlife Management Area	Lands and waters that have been acquired to implement a coordinated and balanced program resulting in the maximum revival of fish and wildlife and in the maximum recreational advantages to the people of the State of Nevada. Wildlife Management Areas are managed by the Nevada Department of Wildlife subject to supervision by the Nevada Board of Wildlife Commissioners.

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