HINES SPRING and ADDITIONAL MITIGATION PLANS

DRAFT

PLANS FOR 1600 ACRE FEET WATER ALLOCATION IN OWENS VALLEY

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EXECUTIVE SUMMARY

This draft report is for the Hines Spring – 1600 ac-ft Additional Mitigation project described in the MOU (Memorandum of Understanding, 1997) and the Amended Stipulation and Order, and was prepared to revise and update the draft final plan produced as part of Phase III Task 2.[1]

The draft final report produced in October, 2005, was found inadequate by MOU parties for the following reasons[2]: (1) the report does not contain final mitigation plans of sufficient detail to allow the preparation of a California Environmental Quality Act (CEQA) document that addresses the plans, (2) does not provide a clear statement that the Consultants have determined that each plan is reasonable and feasible and does not present an analysis of how such a determination was made, (3) does not narrow the preliminary recommendations down to those reasonable and feasible measures that provide the use of the 1,600-acre-feet of water per year (AFY) and which provide the most environmental benefits that can be achieved with the available water, (4) does not include schedules for implementing the mitigation measures, (5) does not adequately address the issues and concerns of affected lessees, and (6) does not present mitigation plans for Calvert Slough and Fish Springs East.

Otis Bay Ecological Consultants (OBEC) performed all Phase I and Phase II site selection work and developed mitigation plans for Calvert Slough, Warren Lake, Collins Road Artesian, Fish Springs East, Northeast of Big Pine, Mazourka Artesian, Hidden Lake and Hines Spring in Phase III. As part of Ecosystem Sciences' evaluation responsibility, White Horse Associates (WHA), another subcontractor, was asked to examine Hines Spring, Warren Lake, and Hidden Lake and provide a more detailed analysis and alternative plans for restoring these sites.

This revised draft plan addresses and resolves problems with the first plan cited above. Detailed implementation plans and schedules were developed to complete CEQA documentation; a preliminary CEQA checklist was also performed. A detailed analysis of each project's reasonability and feasibility was performed using criteria described throughout the MOU and/or Amended Stipulation and Order. Impacts to lessees are addressed. Based on an evaluation of sites and mitigation plans, recommendations are made which provide the most environmental benefits. Lessees were consulted on all sites and a detailed analysis of impacts on lessees was performed and used in the final selection. Calvert Slough and Fish Springs East were re-evaluated and subjected to the same site selection analysis and evaluation and reasonable-feasible analysis as all projects.

The MOU and Amended Stipulation and Order require Ecosystem Sciences to independently evaluate the recommendations and report(s) of subcontractors and, based on this evaluation, to select final reasonable and feasible mitigation measures for Hines Spring and other sites[3]. In compliance with the MOU and Stipulation Order, Ecosystem Sciences has determined that of the 1600 AFY water allocation, 1300 AFY will be allocated to Hines Spring and 300 AFY will be allocated to Warren Lake. These water allocations represent the best cost to benefit ratio, provide optimum environmental benefits that can be achieved with the available water, and cause minimal impact on grazing lessees. Allocating the 1,600 acre feet to these sites will create 230 acres of

[1] Amended Stipulation and Order, Hines Spring Work Plan
[2] Inyo County Water Department letter of January 19, 2006.
[3] MOU Section III 3; Amended Stipulation and Order Item 9 Part 3

habitat at Hines Spring[4] at a cost of $4,419 per acre to LADWP and $658 per acre to the lessee; Warren Lake will have 200 acres of seasonally flooded habitat (intermittent water and wetland)[5] at a cost of $55 per acre to LADWP and $0 per acre to the lessee. The net gain is 430 acres of high quality habitat at a total mitigation investment of $1,027,396.

All other mitigation plans ***combined*** (Calvert Slough, Collins Road Artesian, Fish Springs East, Northeast of Big Pine, Mazourka Artesian, Hidden Lake) would result in only 317 acres of mixed quality habitat at a total mitigation cost of $8,471,443.

[4] See Section 7.1.1 of this document.
[5] See Section 7.2.1 of this document

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TABLES

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ACRONYMS

AC	Acre
AFY	Acre feet per year
AVG	Average
AUM	Amount of forage grazed by one cow and one calf per month
Bp	Before present
BMP	Best management practices
BWMA	Blackrock Waterfowl Management Area and vicinity
CIR	Color infrared
CDFG	California Department of Fish and Game.
CEQA	California Environmental Quality Act
CFS	cubic feet per second
DEM	Digital Elevation Models
DHA	Delta Habitat Area
EA	Each
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ES	Ecosystem Sciences
ET	Evapotranspiration
FAC	Facultative
FACW	Facultative wetland
FACU	Facultative upland
HEP	Habitat Evaluation Procedure
HGM	Hydrogeomorphic
IC	Inyo County Board of Supervisors
ICWD	Inyo County Water Department
LADWP	Los Angeles Department of Water and Power
LORP	Lower Owens River Project
LRWQB	Lahontan Regional Water Quality Board
MI	Miles
MORP	Middle Owens River Project

MOU	Memorandum of Understanding
N	number of elements; count
NI	Not an indicator species
OBEC	Otis Bay Ecological Consulting
OBL	Obligate
NRCS	Natural Resource Conservation Service
PDF	Adobe file
T&E Species	Threatened and Endangered Species
WHA	White Horse Associates

1.0 INTRODUCTION

1.1 MOU AND STIPULATION AND ORDER DIRECTION

MOU Direction

The 1997 Memorandum of Understanding (MOU) between the County of Inyo (IC), the Los Angeles Department of Water and Power (LADWP), and other MOU Parties requires LADWP to provide 1,600 AFY of water for mitigation at Hines Spring and for additional mitigation at potential sites in the Owens Valley. In Section 3 of the MOU under Additional Commitments, item A (Studies and Evaluations and Commitments) the MOU states that --- "*Under the direction of LADWP and the County, Consultants and their associates will conduct the following studies and evaluations*":

> 3. *ADDITIONAL MITIGATION. A total of 1,600 afy of water will be supplied by LADWP for*
>   *(1) the implementation of the on-site mitigation measure at Hines Spring identified in the EIR, and*
>   *(2) the implementation of on-site and/or off-site mitigation that is in addition to the mitigation measures identified in the EIR for impacts at Fish Springs, Big and Little Blackrock Springs, and Big and Little Seely Springs.*

Consultants, as defined in the MOU, means Ecosystem Sciences. LADWP and IC will direct and assist Consultants in the preparation and implementation of the LORP Ecosystem Management Plan and the Hines Spring Mitigation (Additional Mitigation). Parties to the MOU have agreed to vest Consultants with the responsibility to develop many of the plans identified in the MOU.

Consultants will determine the water requirements of the mitigation measures at Hines Spring. Once the water supply requirements have been determined, opportunities to use any remaining water in the implementation of on-site mitigation at/for Fish Springs, Big and Little Blackrock Springs, and Big and Little Seely Springs will be identified and evaluated by Consultants. The establishment of a shorebird and waterfowl habitat east of Diaz Lake, the enhancement of a wetland at Calvert Slough, and the establishment of a permanent water supply for Warren Lake north of Big Pine to enhance shorebird and wildlife habitat will be included in the evaluation of off-site measures. The feasibility and the relative environmental benefits of the identified opportunities also will be assessed.

The EIR (1991) states that, "No on-site mitigation will be implemented at Fish Springs and Big Blackrock Springs: however, the CDFG fish hatcheries at these locations serve as mitigation of a compensatory nature by producing fish that are stocked throughout Inyo County. In the area of Big and Little Seely Springs, LADWP well number 349, discharges water into a pond approximately one acre in size. The pond provides a temporary resting place for waterfowl and shorebirds when the pumps are operating or Big Seely Spring is flowing. This water passes through this pond to the Owens River. Riparian vegetation has become established around this pond."

The EIR also states that, "The Hines Spring vent and its surroundings will receive on-site mitigation. Water will be supplied to the area from an existing, but unused well at the site. As a result, approximately one to two acres will either have ponded water or riparian vegetation. Hines Spring will serve as a research project on how to re-establish a damaged aquatic habitat and surrounding marshland. Riparian trees and a selection of riparian herbaceous species will be planted on the banks. The area will be fenced."

Based upon the evaluations, Consultants will recommend reasonable and feasible mitigation measures in addition to the measure at Hines Spring and will recommend how the water should be released and used to implement and maintain these mitigation measures. Feasible is defined in the MOU as capable of being accomplished in a successful manner within a reasonable period of time, taking into account, environmental, economic, legal, social, and technological factors.

Reasonable and feasible measures will be recommended which will provide the most environmental benefits that can be achieved with the available water. Generally, on-site mitigation measures will be preferred unless off-site measures are found to be more environmentally beneficial than identified on-site measures. In considering whether to recommend a measure, Consultants will confer with LADWP, the lessee for each affected area and the MOU Parties. Mitigation measures recommended by the Consultants, within the limits of 1,600 AFY, will be implemented by LADWP and will be maintained by LADWP and/or IC. The habitats developed with the1,600 AFY of water will be as self-sustaining as possible.

Stipulation and Order Direction

Section 3. A. 3. of the MOU is amended by the "Stipulation and Order" to read as follows "Consultants, in accordance with a work plan developed by Consultants and approved by LADWP and the County, and with the assistance of subcontractor(s) recommended by the County and acceptable to Consultants, will determine the water requirements of the mitigation measures at Hines Spring. Consultants will independently evaluate the recommendations and report(s) of the subcontractors(s)."

Based on this evaluation, Consultants will recommend reasonable and feasible mitigation measures in addition to the measures at Hines Spring and will recommend how the water should be released and used to implement and maintain these mitigation measures. Other appropriate sites identified by IC will be included in the evaluation of off-site measures. The recommendations shall include schedules for implementing the mitigation measures.

County and City Direction

The work plan, incorporated into the Stipulation and Order states in Task 2 that, "Ecosystem Sciences and Otis Bay will prepare draft mitigation plans for the additional mitigation sites and concurrently submit to MOU Parties and the lessees." This report has been submitted by OBEC, but MOU Parties and lessees found this plan was not adequately completed, could not be implemented, or gain CEQA required compliance.

The draft final report[6] was found inadequate by MOU parties for the following reasons: (1) the report does not contain final mitigation plans of sufficient detail to allow the preparation of a CEQA document that addresses the plans, (2) does not provide a clear statement that the Consultants have determined that each plan is reasonable and feasible and does not present an analysis of how such a determination was made, (3) does not narrow the preliminary recommendations down to those reasonable and feasible measures that provide the use of the 1,600 AFY and which provide the most environmental benefits that can be achieved with the available water, (4) does not include schedules for implementing the mitigation measures, (5) does not adequately address the issues and concerns of affected lessees, and (6) does not present mitigation plans for Calvert Slough and Fish Springs East. These comments are taken directly from the MOU parties upon their independent review of the Otis Bay report.

As a result of the Phase III Task 2 report being inadequate both IC (Letter of December 14, 2005) and LADWP (Letter of January 5, 2006) directed Ecosystem Sciences to do two things:

> **First Directive:**
> *"Work with the affected lessees and the parties to the MOU to attempt to agree to a revision of the process specified in the MOU that will remedy the deficiencies described above".*

Ecosystem Sciences, in an email on January 6, 2006 to MOU parties and lessees, solicited input and suggestions on the plan to revise the draft final plan and the process to complete the workplan. Ecosystem Sciences received no responses from this email request, and in the interest of time pursued the second directive.

> **Second Directive:**
> *"If agreement to revise the process is not possible, it is requested that Ecosystem Sciences consult with the affected lessees and the parties to the MOU in attempt to reach consensus on the measures prior to submission of final recommendations by Ecosystem Sciences as to which measures should be implemented".*

This draft report fulfills the second directive; however, this draft report is not the draft final Phase III Task 2 document as required in the Amended Stipulation and Order. The two week comment period will allow an opportunity to reach consensus prior to final recommendations.

As this draft was being completed and printed, IC and LADWP were in disagreement as to these directives described above. Before the next step can be taken (completion of Phase III Task 2) after this draft is reviewed, the city and county must agree upon clear, concise instructions to complete the final draft plan (Phase III Task 2).

1.2 GOALS AND OBJECTIVES

The goal is to mitigate for impacts to seeps and springs as a result of groundwater pumping. The general objectives are to supply 1,600 AFY of water (1) to implement on-site mitigation measure at Hines Spring identified in the EIR (1991) and (2) implement on-site or off-site mitigation that

[6] Otis Bay Ecological Consultants. 2005b. Hines Spring Mitigation Draft Phase II and III Report. October, 2005.

is in addition to the mitigation measures identified in the EIR (1991). On-site mitigation measures will be preferred to off-site mitigation measures. The MOU also calls for the continuation of sustainable uses including recreation, livestock grazing, agriculture and other activities. Sustainable use is defined in the MOU as the utilization of natural resources through time without causing environmental damage.

1.3 BACKGROUND REPORTS USED

Previous Work Products Submitted

Five work products have been submitted to MOU Parties recommending certain avenues for implementing the Hines Spring Mitigation. These are:

- Ecosystem Sciences. 2000. Technical Memorandum #22.
- Ecosystem Sciences. 2001. Requests for Comments Memorandum.
- Otis Bay and Stevens Ecological Consulting. 2005a. Hines Spring Mitigation Draft Phase 1. (OBEC, 2005a)
- Otis Bay Ecological Consultants. 2005b. Hines Spring Mitigation Draft Phase II and III Report. (OBEC, 2005b)
- White Horse Associates. 2005a. Hines Spring inventory, 2000 conditions. Report to LADWP and Inyo County. (WHA, 2005a)
- White Horse Associates. 2005b. Preliminary restoration plans, Hines Spring, Hidden Lake, and Warren Lake. Report to Ecosystems Sciences. (WHA, 2005b)

None of these reports were in final enough form or provided enough information and detail to allow successful implementation, meet MOU requirements, or allow a successful CEQA analysis. Also, none of the work products have satisfied the MOU parties, lessees, or the consultants.

This draft report uses the information and recommendations from all of the above work products to build a selection and implementation plan that uses the 1,600 AFY of water in the most reasonable and feasible way that gains the most habitat benefits possible considering social, legal, economic, and ecological needs.

2.0 APPROACH AND METHODOLOGY

In preparing this document, Ecosystem Sciences sought a method of site selection and evaluation that meets the requirements of the legal documents and work plan that are detailed in Chapter 1, considers the evaluations and merits of prior reports, and satisfies the concerns and desires of the MOU parties, the affected lessees and valley residents. In addition, the sites chosen and water allocated must represent the best use of the 1600 AFY. To accomplish this goal, a two step process was used; step 1 is an iterative process, and step 2 a reasonable and feasible analysis. The first step, an iterative process (Chapter 3), reduces the number of sites based on the MOU, 1991 EIR, Stipulation and Order and comments and concerns from the MOU parties. The second step (Chapter 5) uses the reduced number of sites' mitigation plans and possible environmental benefits described in Chapter 4, to thoroughly evaluate the reasonability and feasibility of each sites mitigation potential.

2.1 ITERATIVE PROCESS

The iterative process (Chapter 3) was designed to limit the number of sites evaluated for mitigation potential to those that fit the constraints of the legal documents or have not been eliminated from consideration through consultation with MOU parties. If a site does not fit the criteria set out in the legal documents or none of the MOU parties want the site considered, there is no merit in wasting project resources evaluating the site for mitigation potential.

The iterative process began with the original list of six sites named in the MOU to be evaluated. Over time the list of sites changed. Sites were either added or removed from the list by stipulations in written documents. Each site was examined to determine if it met all legal stipulations and the wishes of the MOU parties. The product of the iterative process was a list of sites that met the requirements of the legal documents and that the MOU parties want evaluated.

2.2 MITIGATION PLANS AND RESTORATION POTENTIAL

Following the iterative process, a mitigation plan for each site is provided (Chapter 4). Each mitigation plan outlines the restoration potential for the sites. The mitigation plans address the "relative environmental benefits" terminology from the MOU.[7] For this level of evaluation, a narrative description for each site is provided (Chapter 4). These mitigation plans were compiled from previous reports, primarily OBEC (2005b) Phase II and Phase III report and WHA Preliminary Restoration Plans for Hines Spring, Warren Lake, and Hidden Lake Area (2005b). The restoration potential outlined in the mitigation plans provide the basis by which the reasonable and feasible analysis (Chapter 5) was performed.

[7] MOU Section 3. Additional Mitigation, paragraph 2.

2.3 REASONABLE AND FEASIBLE ANAYLSIS

Based on the mitigation plans and restoration potential presented in Chapter 4, a reasonable and feasible analysis was undertaken (Chapter 5). The reasonable and Feasible Analysis was based on the criteria of cost-benefit analysis and lessee impacts. The final site recommendations were selected following this analysis.

- **Cost-Benefit Analysis**: The MOU requires that reasonable and feasible recommendations provide the most environmental benefits for the water used.[8] Each site was analyzed based on the amount of water allocated per acre of habitat gained, quality and quantity of habitat gained, and costs.

- **Lessee Impacts**: A key requirement of the MOU is to maintain sustainable agriculture in the selection and implementation of all restoration plans.[9] Livestock grazing is the principle agricultural activity. The MOU requires mitigation projects to take into account impacts to grazing and, to the extent possible, avoid or ameliorate economic impacts on lessees.

[8] MOU Section III 3
[9] MOU Section II B

3.0 SITE SELECTIONS

The MOU, the 1991 EIR and the Stipulation and Order (August 2004) provide a framework (see Chapter 1) for the Hines Spring and Additional Mitigation project. This framework is the focus of the first step of the final site selections. Each document identifies sites with potential for an allocation of the 1,600 AFY of water. Each document also gives rational for not allocating water to certain sites. Thus, in order to shorten the list of potential sites, an iterative process is used to first eliminate sites based on the rational given in the MOU, the 1991 EIR, and the Stipulation and Order.

In addition to the three legal documents, reports have been completed regarding the Hines Spring and Additional Mitigation project. These reports include Ecosystem Sciences' Technical Memorandum #22 (2000); Ecosystem Sciences' Requests for Comments Memorandum (2001); Otis Bay's Hines Spring Mitigation Draft Phase II and III Report (2005b); and Whitehorse Associates Preliminary Restoration Plans (2005b). These reports were prepared to evaluate the best way to allocate the 1,600 AFY of water to various sites. None of the reports submitted to date have met the approval and concerns of neither all MOU parties nor lessees.

Most recently, OBEC completed the Hines Spring Mitigation Draft Final Phase II and III Report (OBEC 2005b). This document was sent to the MOU parties, IC, LADWP and lessees, all of whom commented on the report. Iteration #7 (below) of the site selection process is based on OBEC's report and the comments received, which resulted in the elimination of some additional sites.

3.1 ITERATIVE SITE SELECTION

Iteration 1: On-site
The MOU specifically states that on-site mitigation measures are preferred to off-site mitigation[10].

On-site mitigation areas identified in the MOU:
1. Hines Spring
2. Fish Springs West
3. Big Blackrock Springs
4. Little Blackrock Springs
5. Big Seely Springs
6. Little Seely Springs

Iteration 2: Addition of off-site areas
Once the water supply requirements have been determined, opportunities for on-site and/or off-site mitigation will be identified and evaluated by consultants. The MOU identifies three

[10] MOU Section III 3

additional areas for possible off-site mitigation[1], which brings the total number of sites evaluated to nine.

Off-site Mitigation areas identified in the MOU:
7. East of Diaz Lake
8. Calvert Slough
9. Warren Lake

Iteration 3: Removal of Fish Springs and Big Blackrock Springs
The 1991 EIR (Mitigation Measure 10 – 14 Groundwater Pumping – Springs and Seeps – 1970 to 1990) states that: "*No on-site mitigation will be implemented at Fish Springs and Big Blackrock Springs; however, the CDFG fish hatcheries at these locations serve as mitigation of a compensatory nature by producing fish that are stocked throughout Inyo County.*"

Fish Springs West and Big Blackrock Springs are removed from the additional mitigation areas list.

1. Hines Spring
~~2. Fish Springs West~~
~~3. Big Blackrock Springs~~
4. Little Blackrock Springs
5. Big Seely Springs
6. Little Seely Springs
7. East of Diaz Lake
8. Calvert Slough
9. Warren Lake

Iteration 4: Removal of Big and Little Seely Springs
The 1991 EIR (Mitigation Measure 10 – 14 Groundwater Pumping – Springs and Seeps – 1970 to 1990) states that: "*In the area of Big and Little Seely Springs, LADWP well number 349, discharges water into a pond approximately one acre in size. The pond provides a temporary resting place for waterfowl and shorebirds when the pumps are operating or Big Seely is flowing. This water passes through this pond to the Owens River*[11]*. Riparian vegetation has become established around this pond.*"

Since Little Seely is being mitigated for and the maximum riparian vegetation and open water has been created at this site, it is removed from the additional mitigation areas list. Big Seely scored very low in OBEC's evaluation (see Table 3, p.27 of OBEC's Phase II and III draft final report. OBEC 2005b), and was dropped from further evaluation.

1. Hines Spring
~~2. Fish Springs West~~
~~3. Big Blackrock Springs~~
4. Little Blackrock Springs
~~5. Big Seely Springs~~
~~6. Little Seely Springs~~
7. East of Diaz Lake

[11] Little Seely discharges to the river via the pond, while Big Seely, when flowing, discharges directly to the river via a short channel.

8. Calvert Slough
9. Warren Lake

Iteration 5: Removal of Little Blackrock Springs
The 1991 EIR (Mitigation Measure 10 – 14 Groundwater Pumping – Springs and Seeps – 1970 to 1990) states that: "*LADWP will continue to supply water from Division Creek to the site of the former pond at Little Blackrock Springs. The marsh vegetation at this site will thus be maintained.*"

Since LADWP is presently supplying water to Little Blackrock Springs for mitigation of this site, it is removed from the additional mitigation areas list.

1. Hines Spring
2. ~~Fish Springs West~~
3. ~~Big Blackrock Springs~~
4. ~~Little Blackrock Springs~~
5. ~~Big Seely Springs~~
6. ~~Little Seely Springs~~
7. East of Diaz Lake
8. Calvert Slough
9. Warren Lake

Following the first five iterations, Hines Spring and three off-site additional mitigation areas are candidates for the 1,600 acre feet of water allocation; East of Diaz Lake, Calvert Slough, and Warren Lake.

Iteration 6: Addition of six areas identified by consultants and Inyo County
The Stipulation and Order (August 2004) directed consultants to include other appropriate sites identified by Inyo County in the evaluation of off-site mitigation measures. Inyo County and consultants identified six areas as candidates for the 1,600 acre feet of water allocation: Owens River at Warm Springs Road, artesian well site V047 south of Collins Road, artesian well site V008 north of Mazourka Canyon Road, artesian well site near Hidden lake, area northeast of Big Pine, Fish Springs east of Highway 395.

Addition of six areas brings the total evaluation list to 10.
1. Hines Spring
2. East of Diaz Lake
3. Calvert Slough
4. Warren Lake
5. Owens River at Warm Springs Road
6. South of Collins Road – artesian well site V047
7. North of Mazourka Canyon Road – artesian well site V008
8. Hidden Lake – artesian well site
9. Northeast of Big Pine
10. Fish Springs east of Highway 395

Iteration 7: Removal of East of Diaz Lake and Owens River at Warm Springs
Based on the findings in and comments received on Otis Bay's Draft Final Phase II and III report these two sites were eliminated from the additional mitigation areas list. The east of Diaz Lake

site scored very low in OBEC's evaluation (see Table 3, p.27 of OBEC's Phase II and III draft final report. OBEC 2005b) and was dropped from further evaluation. MOU parties commented that the Owens River at Warm Springs site would cause considerable conflict with existing recreation activities in the area and was, therefore, dropped from further evaluation.

Remove East of Diaz Lake[12] and Owens River at Warm Springs[13] from the additional mitigation areas list.

1. Hines Spring
~~2. East of Diaz Lake~~
3. Calvert Slough
4. Warren Lake
~~5. Owens River at Warm Springs Road~~
6. South of Collins Road – artesian well site V047
7. North of Mazourka Canyon Road – artesian well site V008
8. Hidden Lake – artesian well site
9. Northeast of Big Pine
10. Fish Springs east of Highway 395

3.2 RESULTS

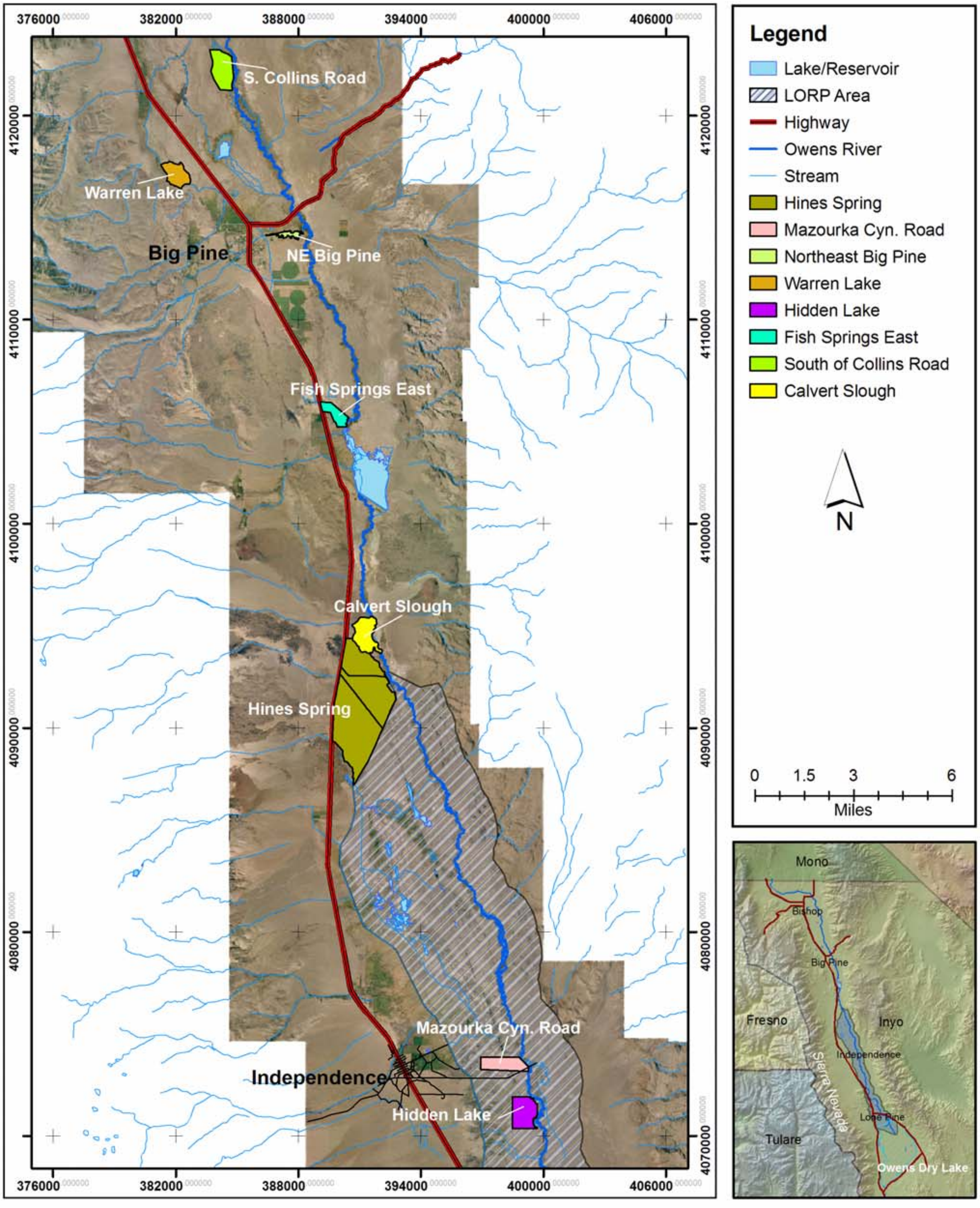
The site selection process resulted in eight sites that warrant further consideration: Hines Spring, Calvert Slough, Warren Lake, South of Collins Road, North of Mazourka Canyon Road, Hidden Lake, Northeast of Big Pine and Fish Springs East of Highway 395 (Figure 3.1).

The purpose of the iterative site selection was to document how sites where added and eliminated over time and in the course of performing previous project phases and tasks. Table 3.1 lists all of these sites and summarizes the reasons for including them in consideration and reasons for removing them from consideration.

[12] OBEC, 2005b Additional Mitigation Site Assessment East of Diaz Lake has an extremely low score and agreed upon by MOU parties that this site is unfit for mitigation.
[13] OBEC, 2005b, p. 67 – High recreational use

Table 3.1 Potential Mitigation Sites		
Site Name	**Reason Added**	**Reason Removed**
Hines Spring	MOU	**None**
Fish Springs West	MOU	1991 EIR
Big Blackrock Springs	MOU	1991 EIR
Little Blackrock Springs	MOU	1991 EIR
Big Seely Springs	MOU	1991 EIR
Little Seely Springs	MOU	1991 EIR
East of Diaz Lake	MOU	Comments on Otis Bay's Phase II and Phase III Report
Calvert Slough	MOU	**None**
Warren Lake	MOU	**None**
Owens River at Warm Springs Road	Stipulation and Order (August 2004)	Comments on Otis Bay's Phase II and Phase III Report
South of Collins Road-artesian well site V047	Stipulation and Order (August 2004)	**None**
North of Mazourka Canyon Road-artesian well site V047	Stipulation and Order (August 2004)	**None**
Hidden Lake – artesian well site	Stipulation and Order (August 2004)	**None**
Northeast of Big Pine	Stipulation and Order (August 2004)	**None**
Fish Springs east of HWY 395	Stipulation and Order (August 2004)	**None**

Figure 3.1 Potential Mitigation Sites



4.0 ALTERNATIVE MITIGATION PLANS

4.1 INTRODUCTION

The Amended Stipulation and Order states, "…*Consultants will independently evaluate the recommendations and report(s) of the subcontractor(s). Based upon this evaluation, Consultants will recommend reasonable and feasible mitigation measures in addition to the measure at Hines Spring…"*[14]. OBEC was the primary subcontractor who performed all of the site selection work and developed restoration plans for Calvert Slough, Warren Lake, Collins Road Artesian, Fish Springs East, Northeast of Big Pine, Mazourka Artesian, Hidden Lake and Hines Spring. OBEC developed a mitigation plan for Hines Spring which allocated 540 AFY of water to create 12 AC of riparian and wetland habitat. Ecosystem Sciences evaluated OBEC's plans and basis for analysis and concluded that additional, more accurate data and alternative plans were needed to meet the goals of the MOU at Hines Spring.

The MOU is quite clear that the first priority for allocating the 1,600-ac. ft. of water is at Hines Spring "*Consultants will determine the water requirements of the mitigation measure at Hines Spring. Once the water supply requirements have been determined, opportunities to use any remaining water in the implementation of on-site and/or off-site mitigation…*[15]*.*" Consequently, Ecosystem Sciences determined that OBEC's analysis was incomplete and underestimated the amount of water that could be beneficially used at Hines Spring. While it is not necessary to maximize the environmental benefits at Hines Spring[16], it is important to determine and display all potential environmental benefits in order to perform an adequate evaluation.

White Horse Associates (WHA), another subcontractor, was asked to examine Hines Spring, Warren Lake, and Hidden Lake and provide a more detailed analysis and alternative plans for mitigation at those sites. WHA was assigned to Warren Lake and Hidden Lake because these sites appeared to be very promising in view of the potential for significant open water habitat and low cost to develop, and more detailed planning was needed for Ecosystem Sciences' evaluation. WHA is a long-term subcontractor with Ecosystem Sciences on numerous mitigation and restoration projects throughout the Owens Valley[17], and had significant prior experience at Hines Spring.

All of the mitigation plans are presented in this section. Neither OBEC's mitigation plans nor those provided by WHA have been modified by Ecosystem Sciences. OBEC's plans for Calvert Slough, Warren Lake, Collins Road Artesian, Fish Springs East, Northeast of Big Pine, Mazourka Artesian, Hidden Lake and Hines Spring plus the WHA mitigation plans for Hines Spring, Hidden Lake and Warren Lake are presented here.

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[14] Amended Stipulation and Order Section 9

[15] MOU Section III A 3

[16] The 1991 EIR describes the minimum environmental benefit to be obtained at Hines Spring as one to two acres of pond or riparian habitat.

[17] WHA performed the initial vegetation mapping and mitigation analysis at Hines Spring in 1999-2000. WHA also performed wetland delineation, HGM modeling, and baseline mapping of the Owens River that included all three sites. In addition, WHA was a key participant in the LORP, Owens Gorge and Upper Owens restoration projects.

Comments from MOU parties and lessees regarding the selected additional mitigation sites and allocation of the 1,600 AFY that are presented in this report will be included in the final plan (to be issued March 3, 2006). Although the OBEC mitigation plans are conceptual in nature, sufficient detail is provided for the analysis of reasonability and feasibility, environmental benefits, impacts to lessees and recommendations as required in the Work Plan and presented in Chapter 5 of this report.

OBEC's mitigation plans presented here are excerpted from the report:

- Otis Bay Ecological Consultants. 2005b. Hines Spring Mitigation Draft Phase II and III Report. October 31, 2005.

WHA's preliminary mitigation plans presented here are excerpted from:

- Whitehorse Associates. 2005b. Preliminary Restoration Plans for Hines Spring, Hidden Lake and Warren Lake. September 2005.

4.2 HINES SPRING

4.2.1 OBEC's Hines Spring Mitigation Plan

Prepared by OBEC

The Hines Spring site is located east of Hwy 395 off Goodale Road, just south of Taboose Creek in the Blackrock area. Access to the site is via a dirt road that extends northeast from Goodale Road. The northern edge of the site is located at the southern edge of a large lava field, and the southern extent of the site is where the remnant channel intersects Goodale Road. The spring basin (<0.2 acres) and adjacent sloughs cover at least 41 acres north of the Intake Road. Several basins that appear to be related to Hines Spring continue south of the road and cover another 22 acres. During 1998-2000, surface water and/or mud was observed in several parts of the spring complex. The Hines Spring outlet is located in basalt. The aquifer and characteristics of basalt springs can be difficult to predict. The vegetation on site is dominated by exotic annuals and saltbush scrub. The current vegetation mosaic appears to have little or no correlation with the geomorphic surfaces created when water still flowed from the spring. There are remnant Gooding's willows along the channel and on adjacent terraces, and a few small ryegrass meadows in and around the channel. The vegetation distribution and condition observed on Fall 2003 field visits varied strongly from the apparent 2000 condition obtained from aerial imagery. The most dramatic evidence of the slough's recent history is the numerous large snags and logs scattered throughout the slough.[18]

Description of Proposed Mitigation Enhancement and Restoration

Two water sources are available for the Hines area enhancement: 1) water diverted through the Aberdeen Ditch and delivered by gravity to the Hines site, or 2) water pumped from Well 355 which is located adjacent to the site. Each water source has advantages and disadvantages. Flow from the Aberdeen Ditch could be delivered to the site without pumping; however, the ditch probably contains non-native fish which could preclude development of a native fish refugium unless measures were taken to exclude these fish. In addition, water from well 355 will more closely match the geochemistry and temperature of the historic Hines Spring. Therefore,

[18] From Appendix A of the OBEC Phase II & III report. OBEC 2005b

stakeholders have decided that well 355 will be used as the water source for mitigation at Hines Spring. The proposed mitigation at Hines Spring is shown in Figure 4.1.

Objectives

A. Restore the historic spring outflow channel to its natural geomorphic form.
B. Restore and enhance former riparian forest (approximately 12 acres) adjacent to Hines Spring.
C. Increase riparian forest acreage and expand the width of the riparian corridor.

Measures

A. Construct spring channel habitat distal to the Owens River.
B. Revegetate area, with riparian, wetland, and transitional upland plant species.

Feasibility

A. Well 355 will be pumped to deliver 0.75 CFS are available for the mitigation action.

Water Supply and increased ET Demand

A. Use flow from pumping at Well 355 to support riparian forest and wetlands.
B. Water will remain in natural course within former Hines Slough.
C. The expected increase in evapotranspiration demand is approximately 13 AFY.

Potential for Weed Invasion and Prevention Needed

A. Potential exists for colonization or increase of non native plants such as bassia (*Bassia hyssopifolia)*, cheatgrass (*Bromus tectorum)*, Russian thistle (*Salsola tragus*) and annual mustards.
B. Careful application of chemicals would be needed given the proximity and connection of the site to the Owens River. Application should be performed by county and state certified individuals. Both chemical and mechanical treatment could be utilized.

Goals

Mitigation at the Hines Spring site will restore spring channel outflow habitat types. Implementation of the recommended mitigation action could result in a range between a minimum of 12 acres (OBEC) to 120 acres (WHA, 2005b) of riparian and wetland vegetation. Mitigation would occur in an area heavily impacted by ground water extraction. It would be difficult to preclude invasive fish species from this site, which would preclude the potential recovery of native fishes.

Mitigation Recommendations

The evidence of a former riparian area is apparent in aerial photography.
Reconstruct the outflow channel to the appropriate scale to accommodate the selected magnitude of flow.
Promote habitat restoration while providing the possibility for a pupfish and snail refugium.

Water Allocation and Mitigation Costs

The recommended water allocation for this site is 540 AFY .
The total project cost for implementation is estimated to be $726,000.

Table 4.1 Evapotranspiration demand at Hines Spring mitigation site (ac-ft/yr). OBEC 2005b					
	Existing acreage	**Restored acreage**	**Existing ET**	**Restored ET**	**ET difference**
Open Water	0.00	0.04	0.00	0.20	0.20
Emergent Marsh	0.00	0.25	0.00	1.05	1.05
Wet Meadow	0.00	1.21	0.00	1.69	1.69
Riparian Forest	0.00	5.50	0.00	15.40	15.40
Upland	7.00	0.00	4.90	0.00	-4.90
Playa	0.00	0.00	0.00	0.00	0.00
Roads	0.00	0.00	0.00	0.00	0.00
Total	**7.00**	**7.00**	**4.90**	**18.34**	**13.44**

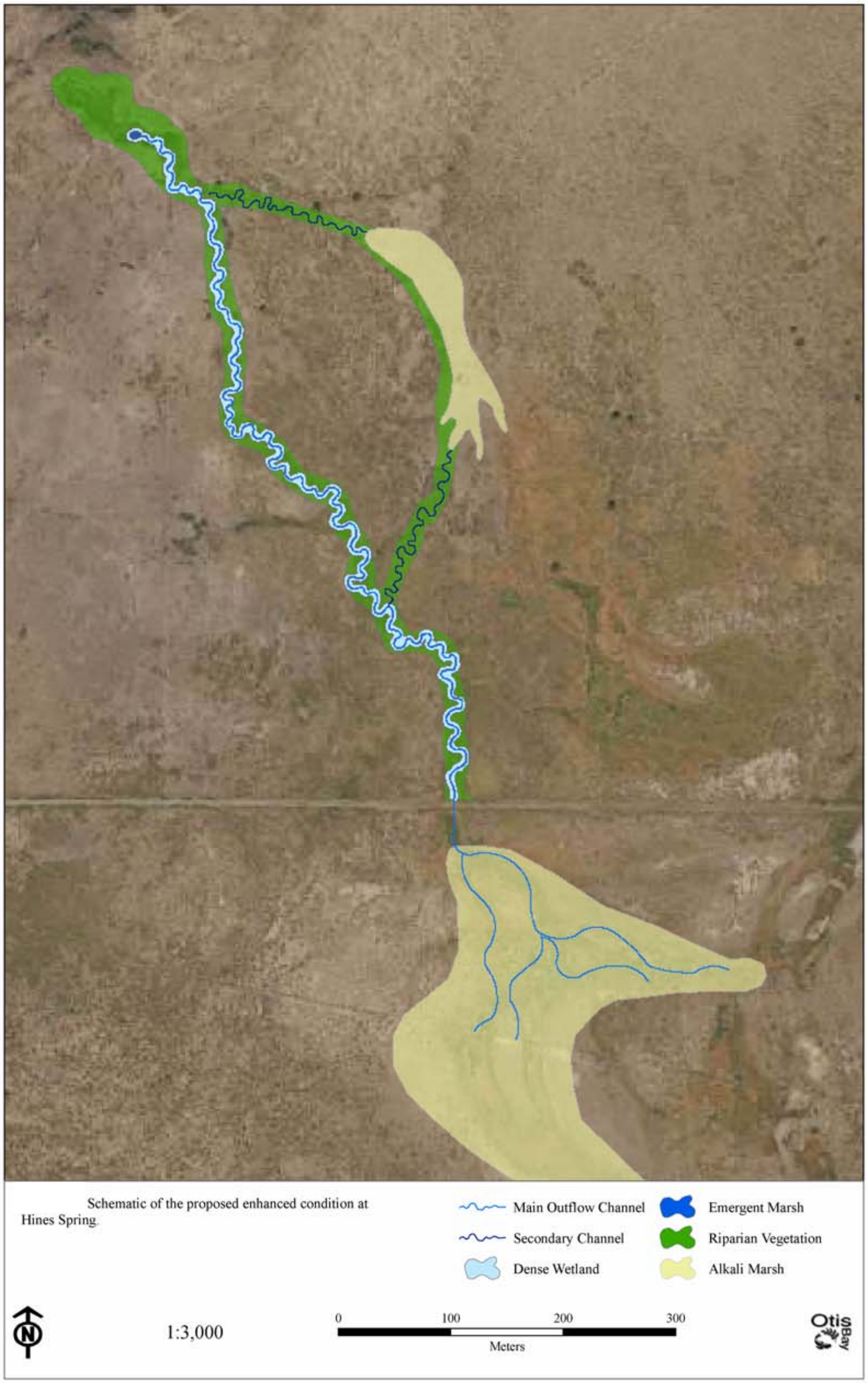

Figure 4.1 Hines Spring proposed enhancement conditions. Map by OBEC.

4.2.2 WHA's Hines Spring Preliminary Mitigation Plan

Prepared by WHA

The Hines Spring area was divided into three *zones* (Figure 4.2). One or more *areas* consisting of landtypes best suited for creation of wetlands was identified in each zone. At the direction of Ecosystem Sciences (ES), well 355 was the only water source considered for creating water/wetland habitats. We anticipate a seasonal water budget with higher demands in summer (up to about 4 CFS) and lower demands in winter (possibly less than 1 CFS) to meet the ET of created water/wetland habitats.

Zone 1 (641 acres): North of Goodale Road. This zone includes three potential wetland creation areas (Figure 4.3) where a total of about 32 acres of water/wetland could be created and another 10 acres of alkali meadow and alkali scrub/meadow (non-wetland) would could be created or maintained. A total of about 42 acres could be enhanced.

o **Area 1 (3.7 acres):** The spring drainage arising from the contemporary vent of Hines Spring. The spring drainage crosses both residual and alluvial lands (Figure 4.4). The narrow spring drainage is incised and confined along most of its course. Existing vegetation is mostly alkali forb (2.2 acres), alkali meadow (1.2 acres), and alkali scrub/meadow (0.3 acres).

Water will be delivered to the head of area 1 via a 360 foot long, 4 inch diameter buried pipeline from well 355. Three small dikes in the spring drainage will be removed and a small dike will be created to block a drainage that links area 1 and area 2. The existing culvert at Goodale Road will be modified to include an adjustable head-gate and streamflow gage.

Predicted vegetation types that could be created (Figure 4.4) includes a small pond (0.1 acres), marsh (3.2 acres), alkali scrub/meadow (0.3 acres), and a small area of wet meadow (<0.1 acre). Two existing tree willow (<0.1 acres) could also be enhanced. The total area of wetland that could be created is about 3.4 acres. Less than 0.1 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 15 acre-feet/year and the long-term bedloss is predicted to be 11 acre-feet/year.[19]

o **Area 2 (17.7 acres):** What appears to be an old spring vent[20] is at the head of this broadly concave, unconfined spring drainage. The vent has not been active since prior to 1944. There is no apparent channel through the broad spring drainage. Prominent existing vegetation includes alkali forb (5.3 acres), alkali scrub/meadow (3.7 acres), sparsely vegetated alkali flat (3.4 acres), alkali meadow (2.7 acres), and alkali scrub (2.4 acres)). An old drain about 100 meters southeast of Hines Spring link area 1 with the head of area 2. The head of area 2 is about 250 meters southeast of well 355.

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[19] LADWP estimated initial bedloss will be excessive, at least where the drainage crosses residual land near the head of the spring drainage. Average long-term bedloss estimated for spring drainage, paleochannel, fault basin, and lacustrine lands in the BWMA may underestimate bedloss for residual lands. If bedloss continues to be excessive in this area, adaptive management to reduce the water allocated to this area to that needed to sustain bulrush/cattail in the immediate vicinity of the contemporary spring vent should be considered

[20] Alternatively, the alkali conditions indicative of former wetlands in this area might have evolved in response to diversion of water from the contemporary spring drainage via a drain, the remnants of which remain visible immediately north of the area

Water will be delivered to the head of area 2 via an 890 foot long buried pipeline from well 355. Minor excavation will be needed to allow this area to overflow to the paleochannel in Zone 1/Area 3.

Predicted vegetation types that could be created (Figure 4.5) include marsh (2.7 acres), wet meadow (5.3 acres), alkali meadow (6.1 acres), alkali scrub/meadow (3.5 acres). Three tree willow (<0.1 acres) would be enhanced. The total area of wetland that could be created is about 14.2 acres. About 11 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 31 acre-feet/year and the long-term bedloss is predicted to be 53 acre-feet/year. The water budget for this area is 84 acre-feet.

o **Area 3 (20.3 acres):** Includes a fault basin (5.5 acres), paleochannel (12.2 acres), and spring drainage (2.7 acres) inset to the paleochannel. Surfaces are broadly concave and drainage would be unconfined. Existing vegetation is mostly desert sink scrub (12.2 acres), rabbitbrush-NV saltbush scrub (5.5 acres), and alkali forb (2.7 acres). The fault basin at the head of this area is about 1,000 meters east of well 355.

Water will be delivered to the fault basin at the head this area via a 3,620 foot long buried pipeline from well 355. A 2.5 acre pond will be excavated 2-3 feet. A channel (300-400 feet) will be excavated to facilitate drainage of the pond to the paleochannel. A gated and gauged culvert will be installed where the paleochannel crosses Goodale Road.

Predicted vegetation types that could be created (Figure 3-5) includes a pond (2.5 acres) in the fault basin, marsh (7.4 acres), wet meadow (10.2 acres), and alkali meadow (0.2 acres). Two tree willow (<0.1 acres) would be enhanced. The total area of water/wetland that could be created is about 20.1 acres. About 10 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 58 acre-feet/year and the long-term bedloss is predicted to be 61 acre-feet/year. The water budget for this area is 118 acre-feet.

Zone 2 (889 acres): This zone (Goodale Road to Aberdeen Ditch) includes three potential wetland creation areas (Figure 4.7) where a total of about 101 acres of water/wetland could be created and another 54 acres of alkali meadow and alkali scrub/meadow could be created or maintained. A total of about 155 acres could be enhanced.

o **Area 1 (59.7 acres):** Drainage from Zone 1 merges about 100 meters south of Goodale Road in this area. The area includes both spring drainage (14.0 acres) and paleochannel (39.8) landtypes. Prominent existing vegetation types are alkali scrub (38.8 acres), sparsely vegetated alkali flat (8.5 acres), alkali forb (7.3 acres), and alkali meadow (5.1 acres).
Areas 1 and 3 in Zone 1 will overflow to this area. Inflow will be monitored at two gated culverts under Goodale Road that will be fitted with flow recording gages. Several small dikes, three of which are associated with an existing drain, will be removed. A gauged, gated, inverted siphon will be installed under the Aberdeen Ditch to facilitate overflow to Zone 3.

Predicted vegetation types that could be created (Figure 4.8) include marsh (21.2 acres), wet meadow (19.8 acres), alkali meadow (12.3 acres), and alkali scrub/meadow (6.3

acres). The total area of wetland that could be created is about 41 acres. About 32 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 140 acre-feet/year and the long-term bedloss is predicted to be 179 acre-feet/year. The water budget for this area is 320 acre-feet.

o **Area 2 (76.5 acres):** In 1944 a drain captured part of the Hines Spring effluent in Zone 2 and carried it towards the Los Angeles Aqueduct.[21] The drain leaked into area 2, creating a large area of wetland. Alkali flat (10.6 acres), rabbitbrush-NV saltbush (46.5 acres), and desert sink scrub (19.2 acres) are the prominent existing vegetation types.

A 4,760 foot pipeline will be constructed from well V355 to the head of this area. A small dike associated with the existing drain will be removed. A gauged, gated, inverted siphon could be installed under the Aberdeen Ditch to facilitate overflow to Zone 3. Alternately, the area could be managed to not overflow to Zone 3.

Predicted vegetation types that could be created (Figure 4.9) include marsh (27.4 acres), wet meadow (15.6 acres), alkali meadow (4.0 acres), and alkali scrub/meadow (29.5 acres). A dozen tree willows (0.1 acres) would be enhanced. The total area of wetland that could be created is about 43 acres. About 20 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 172 acre-feet/year and the long-term bedloss is predicted to be 230 acre-feet/year. The water budget for this area is 402 acre-feet.

o **Area 3 (18.3 acres**): This area consists of a string of 6 fault basins. As demonstrated in the BWMA, fault basins are well suited for creating both open water and wetland. Alkali scrub/meadow (1.6 acres), rabbitbrush-NV saltbush scrub (15.9 acres) and slicks (0.8 acres) are the prominent existing vegetation types.

A 6,200 foot long pipeline and five buried pipelines or open ditches (2,600 feet) to link the six fault basins was considered, but determined to be infeasible because surfaces between basins are 8 to 10 feet above that in the fault basins.

Predicted vegetation types that could be created (Figure 3-9) include 3 small ponds (1.9 acres), marsh (7.8 acres), wet meadow (7.0 acres), and alkali scrub/meadow (1.5 acres). Seven tree willows (0.1 acres) could be enhanced. The total area of water/wetland that could be created is about 17 acres. About 7 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 52 acre-feet/year and the long-term bedloss is predicted to be 61 acre-feet/year. The water budget for this area is 107 acre-feet.

Zone 3 (1699 acres): This area is south of Aberdeen Ditch and north of the Division Creek Ditch (Figure 4.11). Nearly half of the area (803 acres) is paleochannel and lacustrine land well suited for creating wetland. A single smaller area, consisting mostly of paleochannel, best suited for creation of wetlands was considered. Both the predicted water/wetland and the water budget are conservative.

[21] see Figure 4-6 of the *Hines Spring Inventory Report*, WHA 2005a.

- **Area 1** (119.7 acres): Inflow to this area would be provided via one or two inverted siphons draining Zone 2. If flow reaches the southern part of the area, it would be contained by existing dikes along the Division Creek Ditch and the Los Angeles Aqueduct. Alkali flat (79.8 acres), rabbitbrush-NV saltbush (10.9 acres), desert sink scrub (26.3 acres), and Great Basin mixed scrub (2.2 acres) are the prominent existing vegetation types.

  No structures are anticipated at this time, although dikes might be considered later to facilitate spreading the water. A few scattered tamarisks will be removed.

  Predicted vegetation types that could be created include marsh (91.2 acres), wet meadow (21.1 acres), and alkali scrub/meadow (5.1 acres). Three tree willows (0.1 acres) would be enhanced. Conservatively, the total area of wetland that could be created is about 112 acres. About 21 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 418 acre-feet/year and the long-term bedloss is predicted to be 359 acre-feet/year. The water budget for this area is 777 acre-feet.

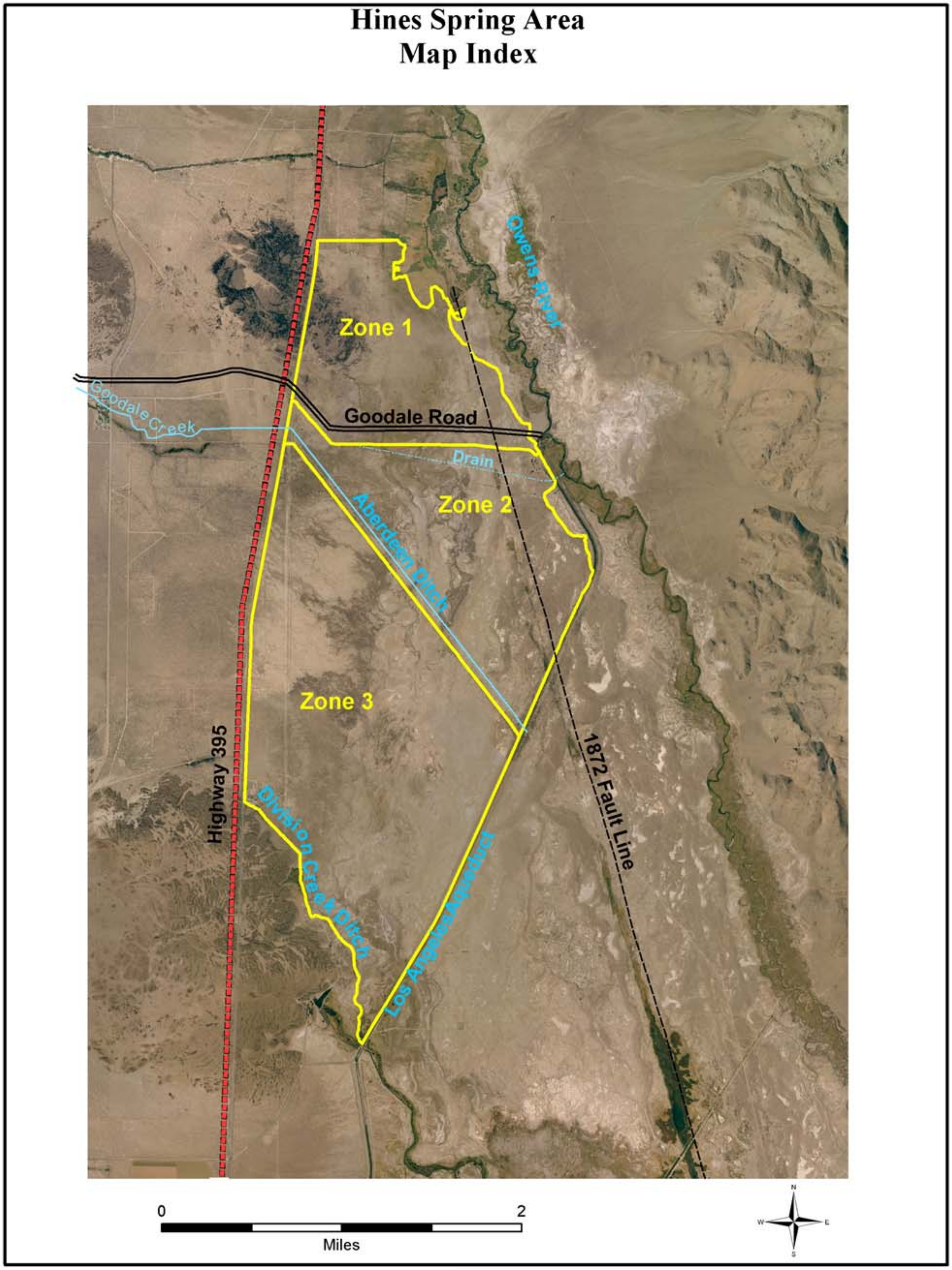


Figure 4.2 Hines Spring Area. Map by WHA.

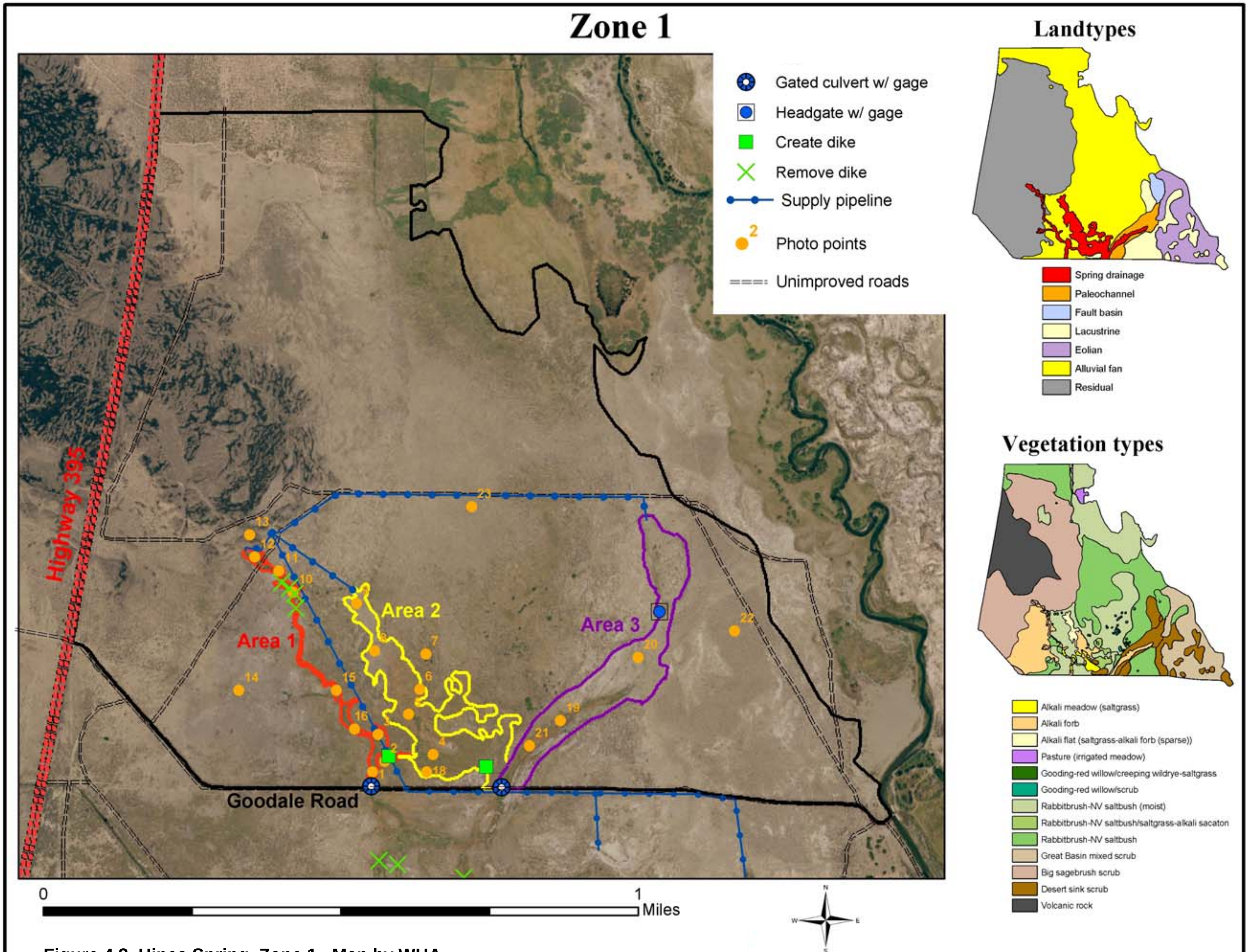
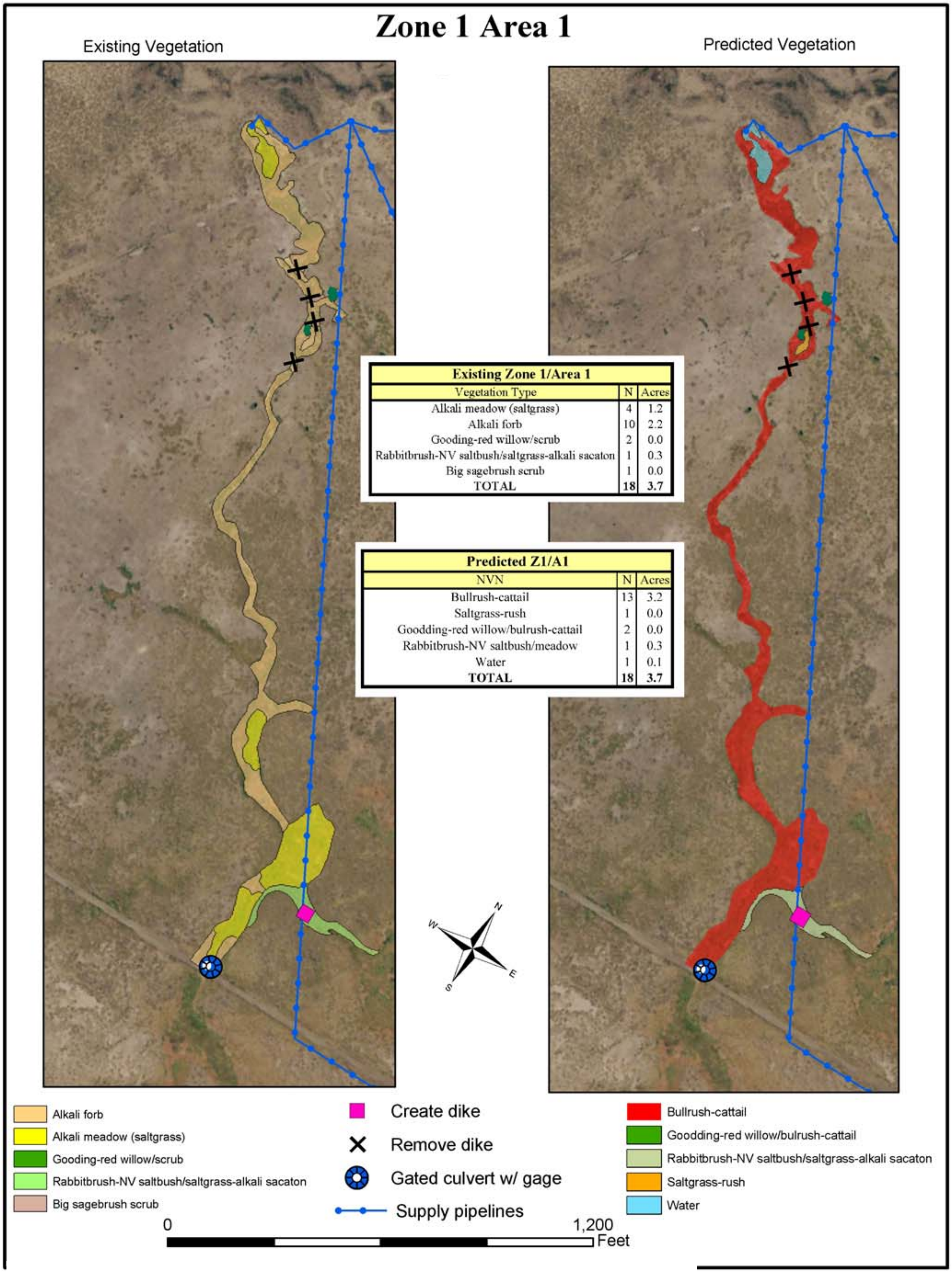


Figure 4.3 Hines Spring, Zone 1. Map by WHA.



Existing Zone 1/Area 1

Vegetation Type	N	Acres
Alkali meadow (saltgrass)	4	1.2
Alkali forb	10	2.2
Gooding-red willow/scrub	2	0.0
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	1	0.3
Big sagebrush scrub	1	0.0
TOTAL	18	3.7

Predicted Z1/A1

NVN	N	Acres
Bullrush-cattail	13	3.2
Saltgrass-rush	1	0.0
Goodding-red willow/bulrush-cattail	2	0.0
Rabbitbrush-NV saltbush/meadow	1	0.3
Water	1	0.1
TOTAL	**18**	**3.7**

Figure 4.4 Hines Spring, Zone 1, Area 1. Map by WHA.

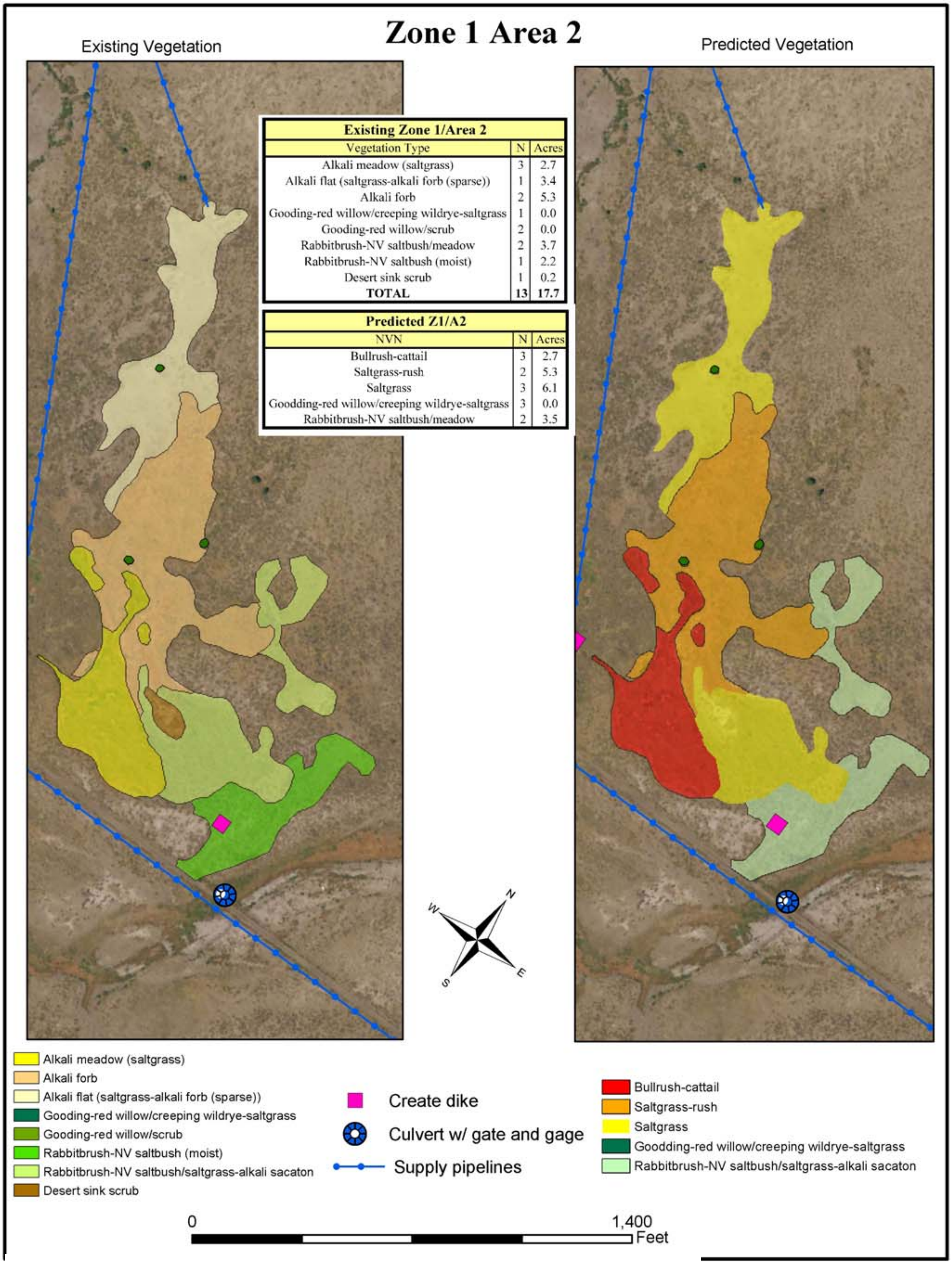


Figure 4.5 Hines Spring, Zone 1, area 2. Map by WHA.

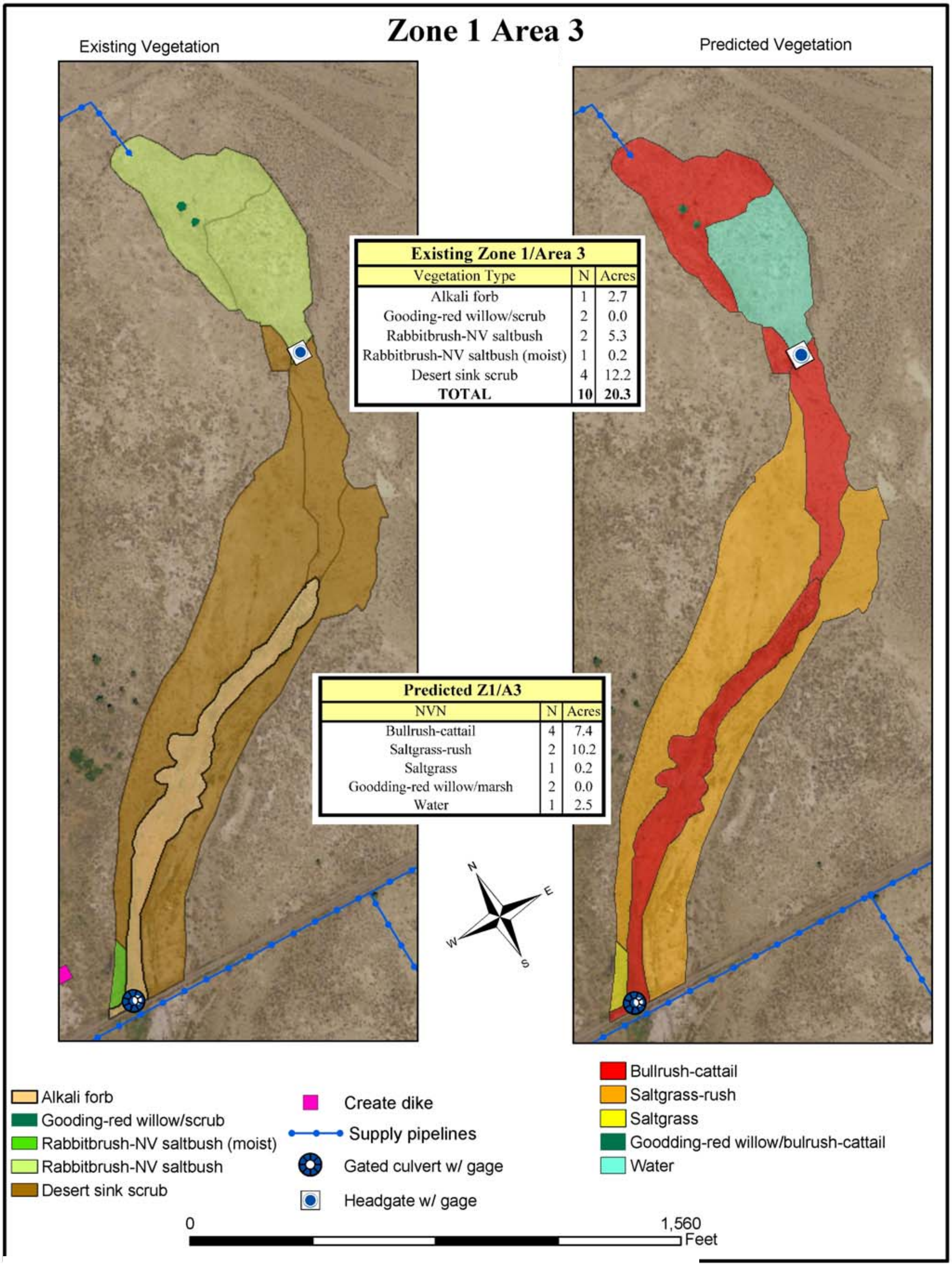


Figure 4.6 Hines Spring, Zone 1, Area 3. Map by WHA.

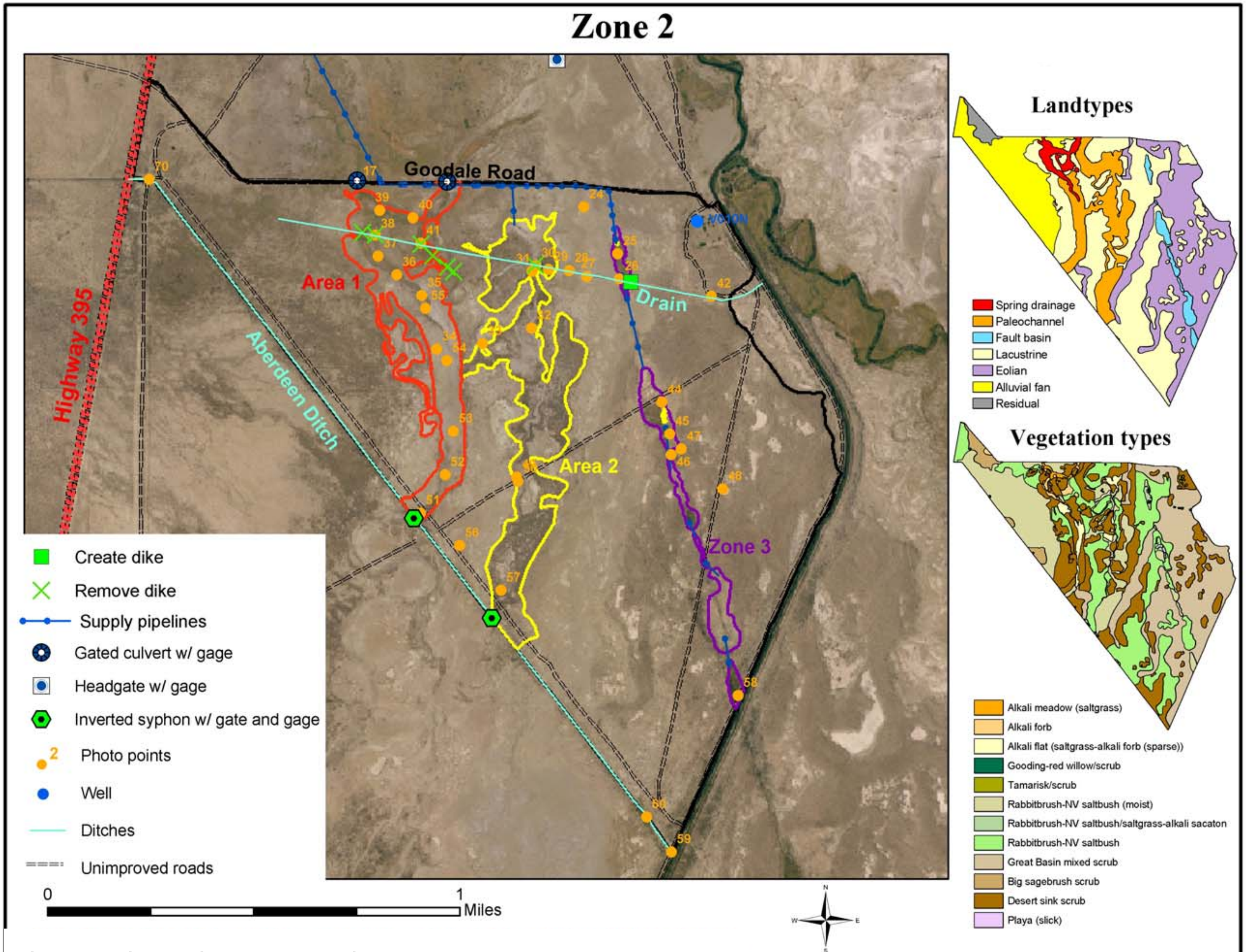
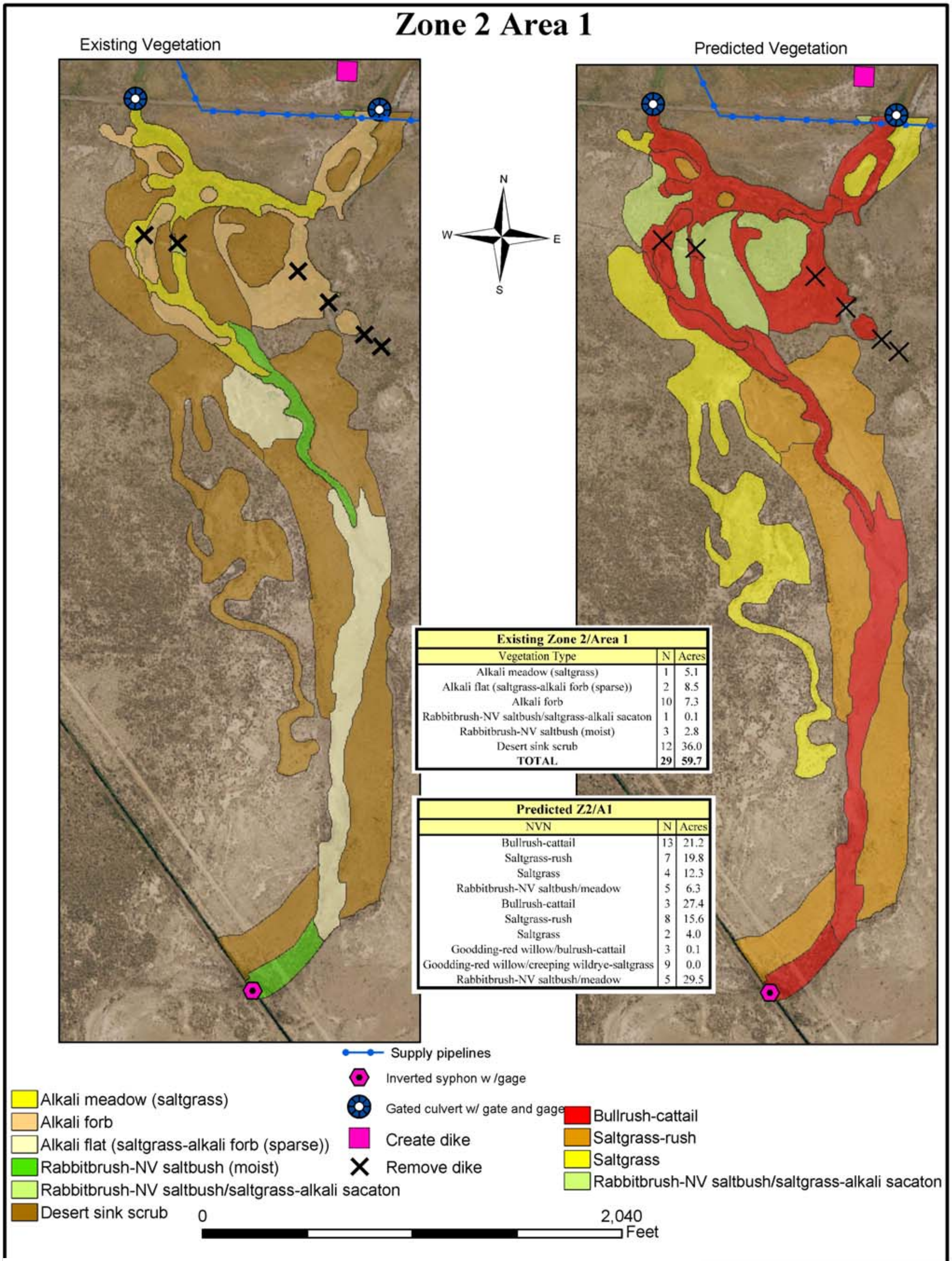


Figure 4.7 Hines Spring, Zone 2. Map by WHA.



Existing Zone 2/Area 1		
Vegetation Type	N	Acres
Alkali meadow (saltgrass)	1	5.1
Alkali flat (saltgrass-alkali forb (sparse))	2	8.5
Alkali forb	10	7.3
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	1	0.1
Rabbitbrush-NV saltbush (moist)	3	2.8
Desert sink scrub	12	36.0
TOTAL	**29**	**59.7**

Predicted Z2/A1		
NVN	N	Acres
Bullrush-cattail	13	21.2
Saltgrass-rush	7	19.8
Saltgrass	4	12.3
Rabbitbrush-NV saltbush/meadow	5	6.3
Bullrush-cattail	3	27.4
Saltgrass-rush	8	15.6
Saltgrass	2	4.0
Goodding-red willow/bulrush-cattail	3	0.1
Goodding-red willow/creeping wildrye-saltgrass	9	0.0
Rabbitbrush-NV saltbush/meadow	5	29.5

Figure 4.8 Hines Spring, Zone 2, Area 1. Map by WHA.

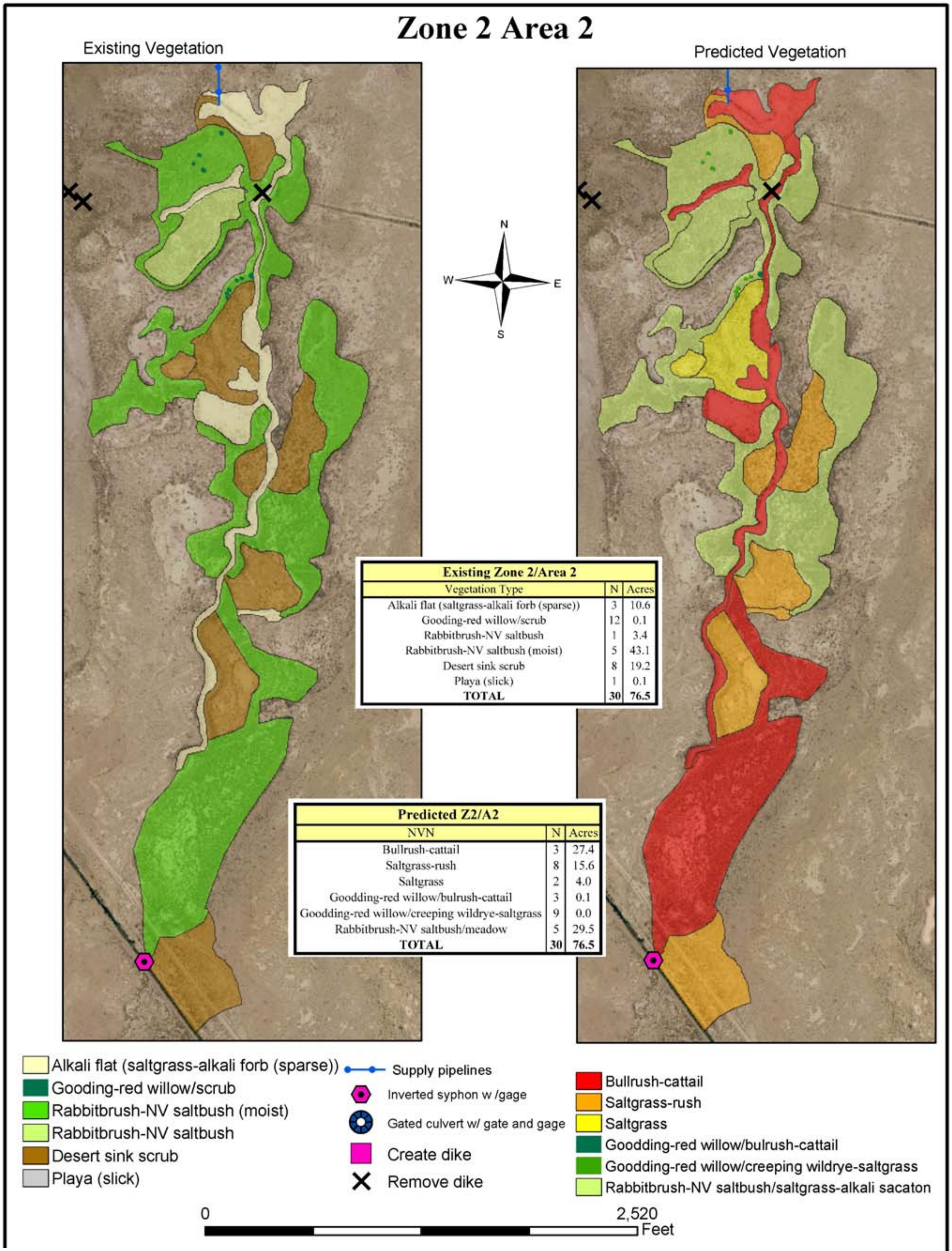


Figure 4.9 Hines Spring, Zone 2, Area 2. Map by WHA.

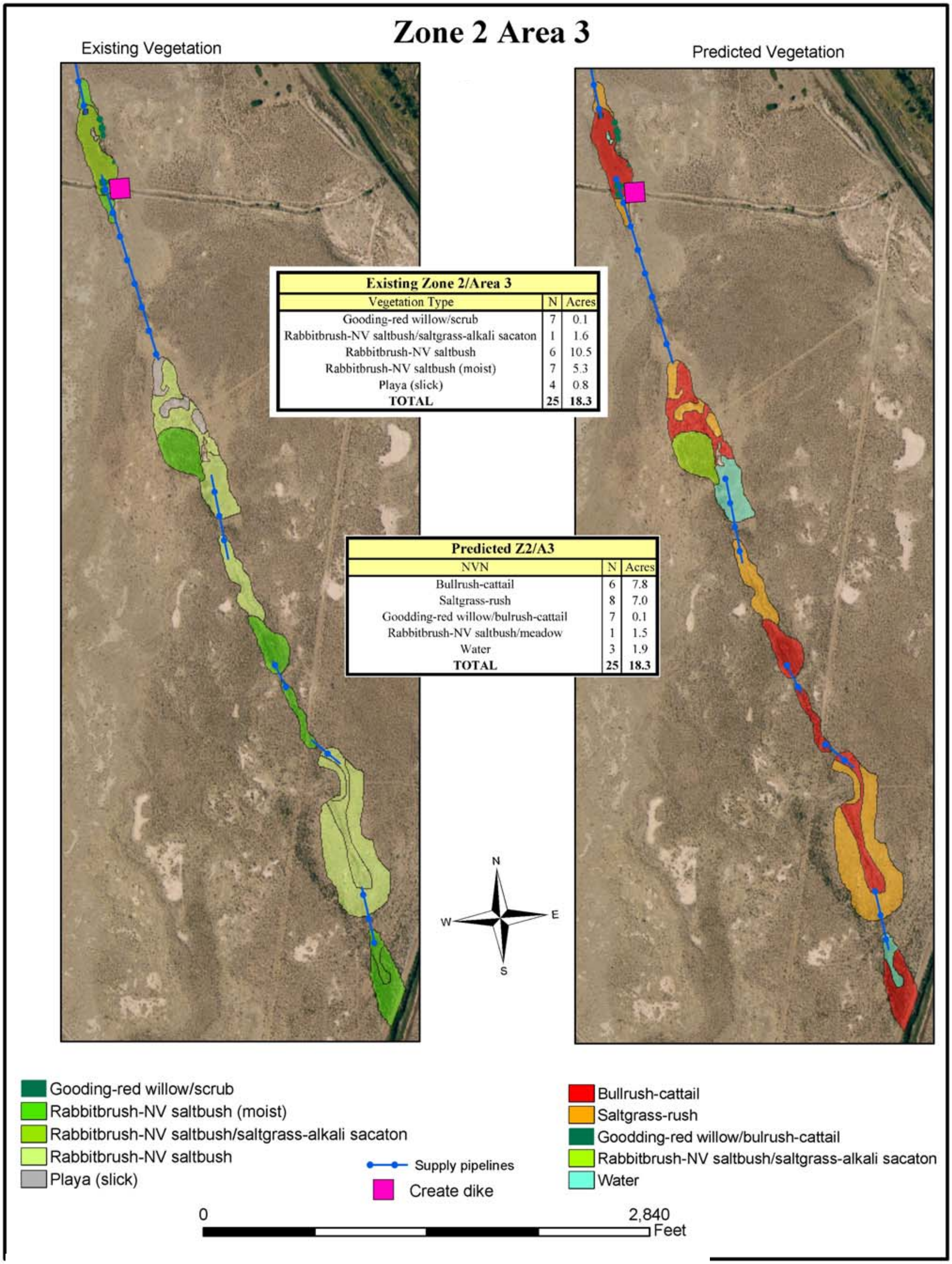


Figure 4.10 Hines Spring, Zone 2, Area 3. Map by WHA.

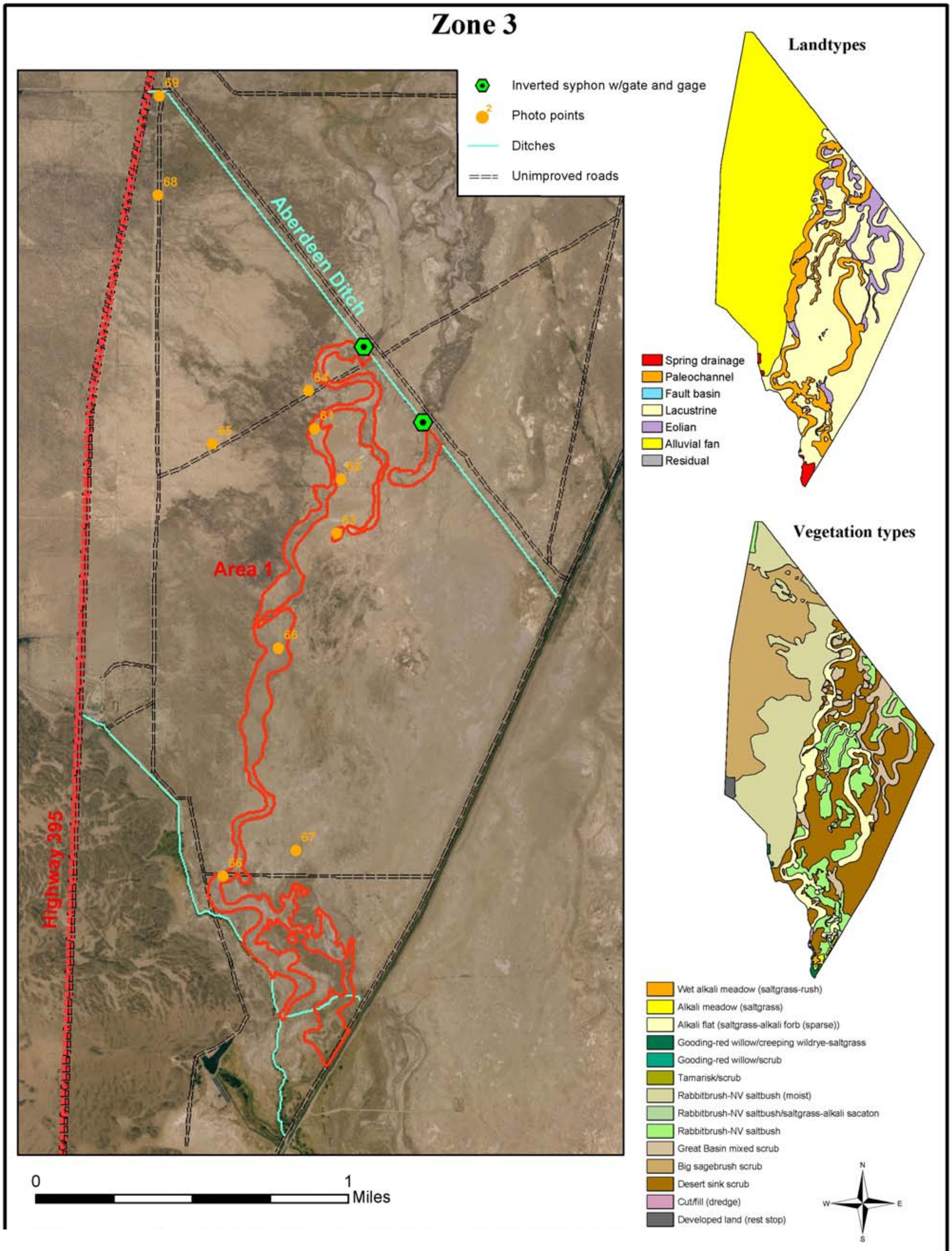


Figure 4.11 Hines Spring, Zone 3. Map by WHA.

4.3 WARREN LAKE

4.3.1 OBEC's Warren Lake Mitigation Plan

Prepared by OBEC

Warren Lake is northwest of Big Pine, on the west side of Hwy 395, just north and east of Big Pine Canal. The average size of Warren Lake is approximately 60 acres. The site is characterized by a large hard pan surrounded by saltgrass and Baltic rush associated community types. Other salt-tolerant vegetation, like *Nitrophila occidentalis*, indicate the alkali nature of the soils. There are scattered wet meadow communities, mainly in the northwest area of the site along a fence line that runs approximately north-south. Big Pine Canal borders the west and south of the Warren Lake site. A very few willows and cottonwoods are scattered along Big Pine Canal and the irrigation ditch in the northwest section of the site.[22]

Description of Proposed Mitigation Enhancement and Restoration
Warren Lake is an existing playa lake that is disconnected on the west side from the natural drainages due to the presence of the Big Pine canal. Water seeping from the canal benefits the playa\wetland environment and supports dense wet meadow vegetation along the west side of Warren Lake. The recommended mitigation action would be to use an existing diversion to divert water from the canal to Warren Lake (Figure 4.12). The most appropriate ecological function for the lake is to provide shorebird feeding and nesting habitat during spring and summer. The lake could be allowed to dry, functioning as a playa, during the fall and winter.

Objectives

A. Increase shorebird and wildlife habitat at Warren Lake.
B. Restore, enhance, and enlarge playa.
C. Increase wet meadow and seasonal wetland habitat types adjacent to Warren Lake.

Measures

A. Construct new or modify existing diversion from Big Pine canal to convey water to Warren Lake.
B. Implement planting of emergent wetland and playa species if desired or allow vegetation succession to occur without implementation.
C. Consider managing Warren Lake as a seasonal wetland.

Feasibility

A. Surface water source readily available.
B. Presence of existing diversion and low topography facilitates habitat enhancement that requires little to no construction or earthwork.

Water Supply and increased ET Demand

A. Divert water from Big Pine canal to Warren Lake via existing diversion and delivery ditch.
B. The expected increase in evapotranspiration demand is approximately 140 AFY (Table 4.2).

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[22] From Appendix A of the OBEC Phase II & III report. OBEC 2005b.

Potential for Weed Invasion and Prevention Needed

A. Low potential exists for colonization or increase of non-native plants except in xeric areas of the site.
B. Chemical treatments should not be used at this site to avoid possible chemical introductions into ground water and shorebird habitat. Mechanical treatments could be used but would be limited.

Goals

Mitigation of seasonal wetland and shorebird habitat types that were drained or desiccated due to ground water extraction could improve conditions for shore birds and other migratory bird species. These habitat types were greatly reduced following the desiccation of Owens Lake.

Aerial extent of upland vegetation would be reduced and replaced with enhanced emergent wetland and wet meadow vegetation (Figure 4.12).

Mitigation Recommendations

A. Ease of implementation makes this site a promising location for mitigation; however, the site is out of kind and would not support the biological richness found at other sites.

Water Allocation and Mitigation Costs

A. The recommended water allocation for this site is 5 AFY .
B. The total project cost for implementation is estimated to be $10,000.

Table 4.2 Evapotranspiration demand at Warren Lake mitigation site (ac-ft/yr). OBEC 2005b

	Existing acreage	Restored acreage	Existing ET	Restored ET	ET difference
Open Water	0.00	0.00	0.00	0.00	0.00
Emergent Marsh	12.74	22.03	53.51	92.53	39.02
Wet Meadow	97.95	111.68	137.13	156.35	19.22
Riparian Forest	0.00	0.00	0.00	0.00	0.00
Upland	44.21	0.00	30.95	0.00	-30.95
Playa/Open Water	35.09	56.28	7.02	119.31	112.29
Roads	0.00	0.00	0.00	0.00	0.00
Total	**189.99**	**189.99**	**228.60**	**368.19**	**139.59**

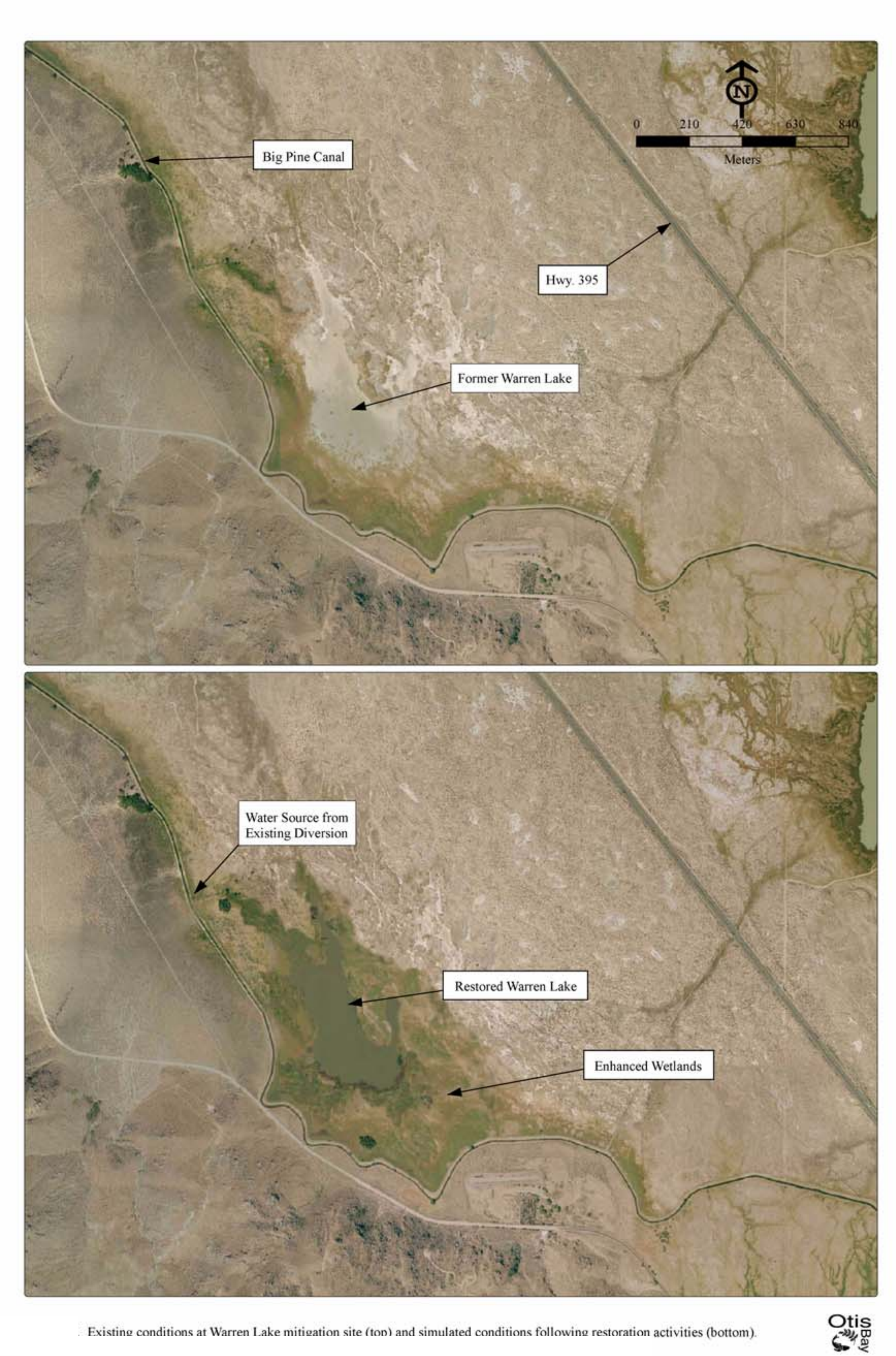


Figure 4.12 Warren Lake Mitigation Plan. Map by OBEC.

4.3.2 WHA's Warren Lake Preliminary Mitigation Plan

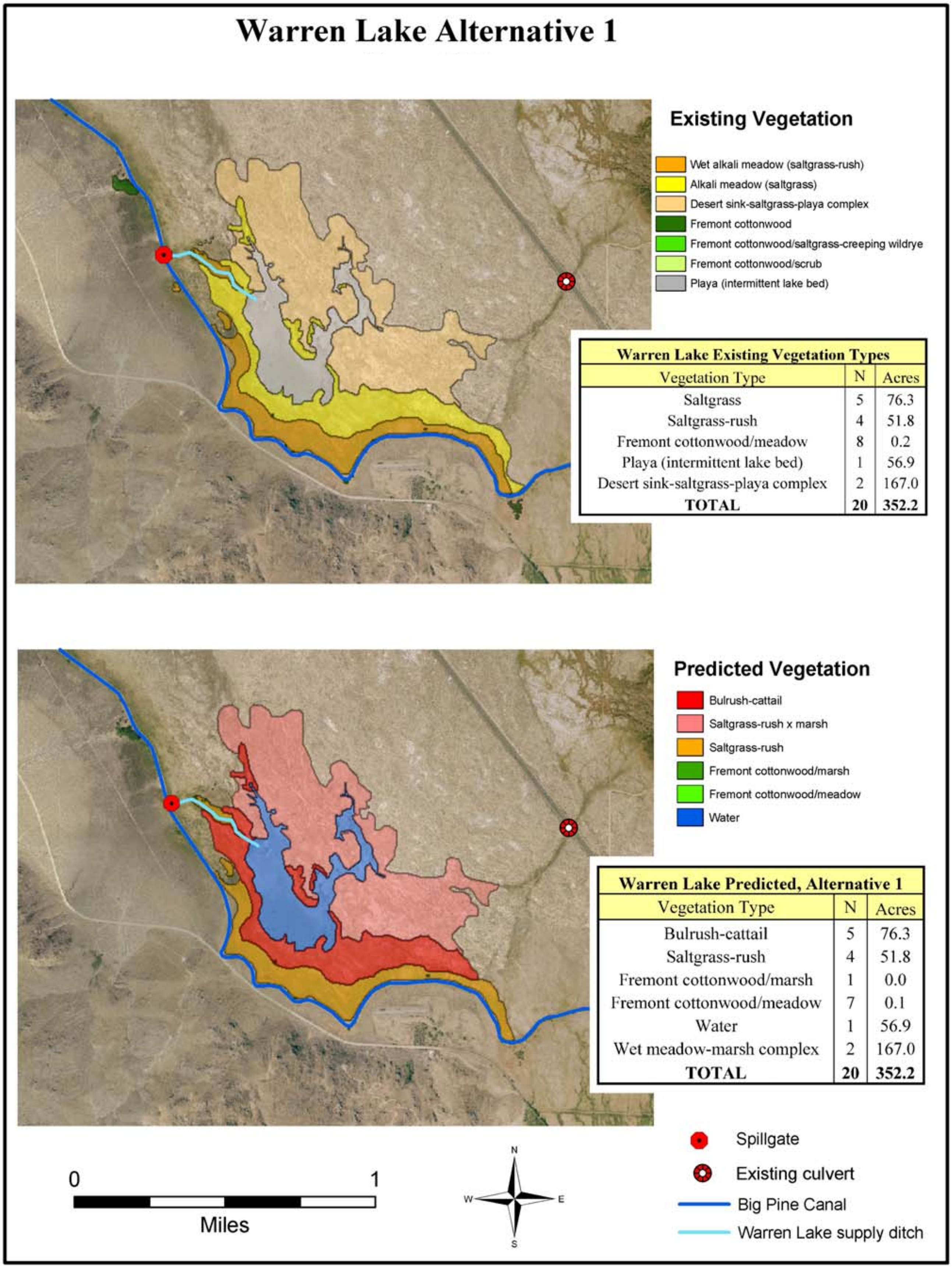
Prepared by WHA

Warren Lake is about 3 miles northwest of the town of Big Pine. Greenbook mapping shows permanent lakes/reservoirs, rush-sedge meadow, alkali meadow, and desert sink scrub vegetation types. Soil mapping shows the lake bed to be intermittent water. An existing spill-gate on the Big Pine Canal was last used to release water to Warren Lake during high-water years in the 1980s. The basin briefly overflowed to Klondike Lake during this period (Wayne Hopper, personal communication). Except after major storms, the lake bed has been dry since the 1980s.

Water will be delivered to the Warren Lake bed via an existing spill-gate and supply ditch from the Big Pine Canal. A flow gage will be installed at the spill-gate. Two alternatives were considered.

• **Alternative 1** – Supply water throughout the growing season: Water will be supplied to maintain flooding of the lake bed from May through September. Predicted habitats and vegetation types that could be created or maintained (Figure 4.13) include open water (57 acres), marsh (76 acres), wet meadow (52 acres), and 167 acres of wet meadow-marsh complex. Eight existing cottonwood/willow trees would be maintained. The net area of water/wetland that could be created is about 300 acres. About 52 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 1,122 acre-feet/year and the long-term bedloss is predicted to be 300 acre-feet/year. The water budget for this area is 1,422 acre-feet.

• **Alternative 2** – Supply seasonal water during the Spring: About 450 acre-feet of water will be supplied once in the spring of each year, corresponding to about a 1.5 foot depth over the 300 acre lake bed. Predicted habitats and vegetation types that could be created or maintained (Figure 4.14) include intermittent water (57 acres), wet alkali meadow 128 acres), and 167 acres of alkali meadow-wet alkali meadow complex. Eight existing cottonwood/willow trees would be maintained. The net area of water/wetland that could be created is about 200 acres. About 295 acres of predicted habitat would be hydrologically suitable for establishing riparian trees and shrubs, but high alkalinity may inhibit establishment. Monthly ET for predicted vegetation types were estimated from annual values by assuming a consistent rate over 6 months. The total predicted monthly ET is 120 acre-feet/month and the long-term bedloss is predicted to be 25 acre-feet/month. Initial bedloss when the lake bed is first filled is expected to be appreciably higher than the long-term bedloss. Conservatively, water may be present for 1 to 2 months of the growing season.



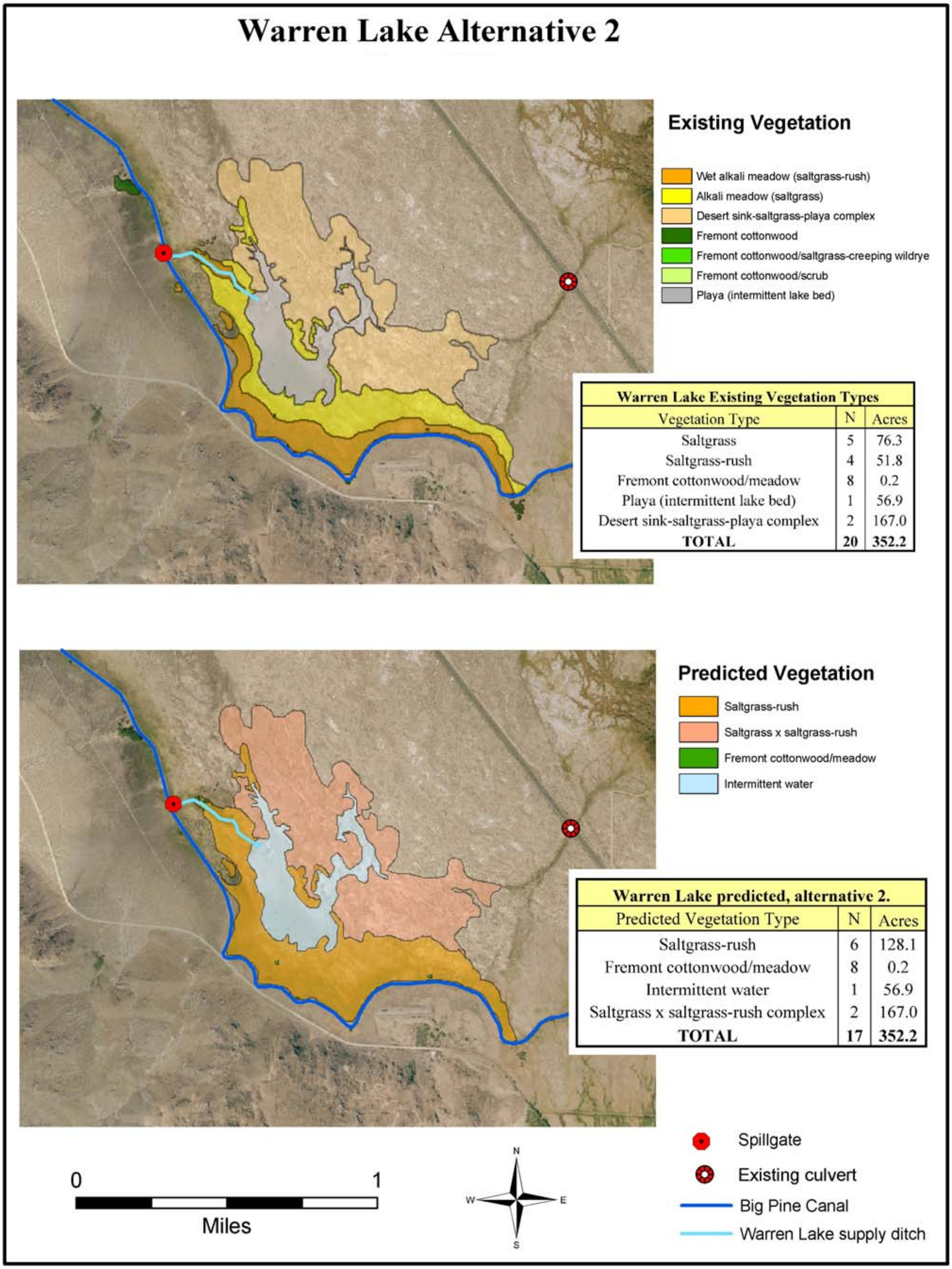
Warren Lake Existing Vegetation Types

Vegetation Type	N	Acres
Saltgrass	5	76.3
Saltgrass-rush	4	51.8
Fremont cottonwood/meadow	8	0.2
Playa (intermittent lake bed)	1	56.9
Desert sink-saltgrass-playa complex	2	167.0
TOTAL	**20**	**352.2**

Warren Lake Predicted, Alternative 1

Vegetation Type	N	Acres
Bulrush-cattail	5	76.3
Saltgrass-rush	4	51.8
Fremont cottonwood/marsh	1	0.0
Fremont cottonwood/meadow	7	0.1
Water	1	56.9
Wet meadow-marsh complex	2	167.0
TOTAL	**20**	**352.2**

Figure 4.13 Warren Lake alternative 1. Map by WHA.



Warren Lake Existing Vegetation Types		
Vegetation Type	N	Acres
Saltgrass	5	76.3
Saltgrass-rush	4	51.8
Fremont cottonwood/meadow	8	0.2
Playa (intermittent lake bed)	1	56.9
Desert sink-saltgrass-playa complex	2	167.0
TOTAL	**20**	**352.2**

Warren Lake predicted, alternative 2.		
Predicted Vegetation Type	N	Acres
Saltgrass-rush	6	128.1
Fremont cottonwood/meadow	8	0.2
Intermittent water	1	56.9
Saltgrass x saltgrass-rush complex	2	167.0
TOTAL	**17**	**352.2**

Figure 4.14 Warren Lake Alternative 2. Map by WHA.

4.4 CALVERT SLOUGH

Prepared by OBEC

Calvert Slough is located adjacent to the Owens River and east of Hwy 395, to the south of Big and Little Seeley Springs, and to the north of Hines Spring. Access to the site from the north is from Aberdeen Station Road, and from the south on Goodale Road. Adjacent sites include Hines, Taboose Creek, Aberdeen Creek, the Lower Owens River, and fault line seeps and springs. Calvert Slough is a large and complex site characterized by irrigated meadow on the west side, marsh and emergent riparian vegetation in the slough and lake areas, large and mature riparian tree willow throughout the center, and the Owens River riparian willow galleries along the east side of the site. Irrigation ditches running out from Taboose and Aberdeen Creeks provide most of the water to the Calvert site, and the Owens River is adjacent.[23]

Description of Proposed Mitigation Enhancement and Restoration
The Calvert Slough area could harbor a rich complex of wetland and riparian type habitats and abundant wildlife species. Water from Taboose Creek could be redirected to flow into the topographically complex mitigation area (Figure 4.15). The water supply would be trained to enhance existing wetland features and new features such as a meandering channel and oxbow wetlands could be constructed. Following the review of the *Draft Hines Spring Mitigation Phase II and III Report*, it has been determined that this site is not suitable for mitigation. This decision was made following reception of stakeholder comments that this site is already being managed as a mitigation site and additional mitigation actions would not qualify as mitigation under the Hines Spring MOU.

Objectives

A. Restore and enhance former riparian forest and wet meadow.
B. Increase riparian forest acreage and expand width of floodplain forest corridor.
C. Create channel habitat and emergent wetlands adjacent to the Owens River.
D. Improve forest structure by creating\enhancing wetlands, planting trees, establishing understory, and improving upland transition.

Measures

A. Construct diversion structure or move the Taboose Creek channel to convey water from Taboose Creek south to meadow area.
B. Construct channel habitat adjacent to the Owens River.
C. Revegetate area with riparian, wetland, and transitional upland plant species.

Feasibility

A. Surface water source available.
B. Shallow depth to groundwater throughout area increases potential for sustainability of wetland habitat.
C. Nearby source for plant materials such as cottonwood and willow pole cuttings.

[23] From Appendix A of the OBEC Phase II & III report. OBEC 2005b.

Water Supply and increased ET Demand

A. Divert flow from Taboose Creek or redirect the Taboose creek channel into the project site.
B. Return water to the Owens River by way of a constructed meandering channel.

Potential for Weed Invasion and Prevention Needed

A. Potential exists for colonization or increase of invasive plants such as bassia (*Bassia hyssopifolia)*, cheatgrass (*Bromus tectorum)* and Russian thistle (*Salsola tragus*).
B. Careful application of chemicals would be needed given proximity to the Owens River and should be applied by county and state certified persons. Mechanical and chemical treatments could be used.

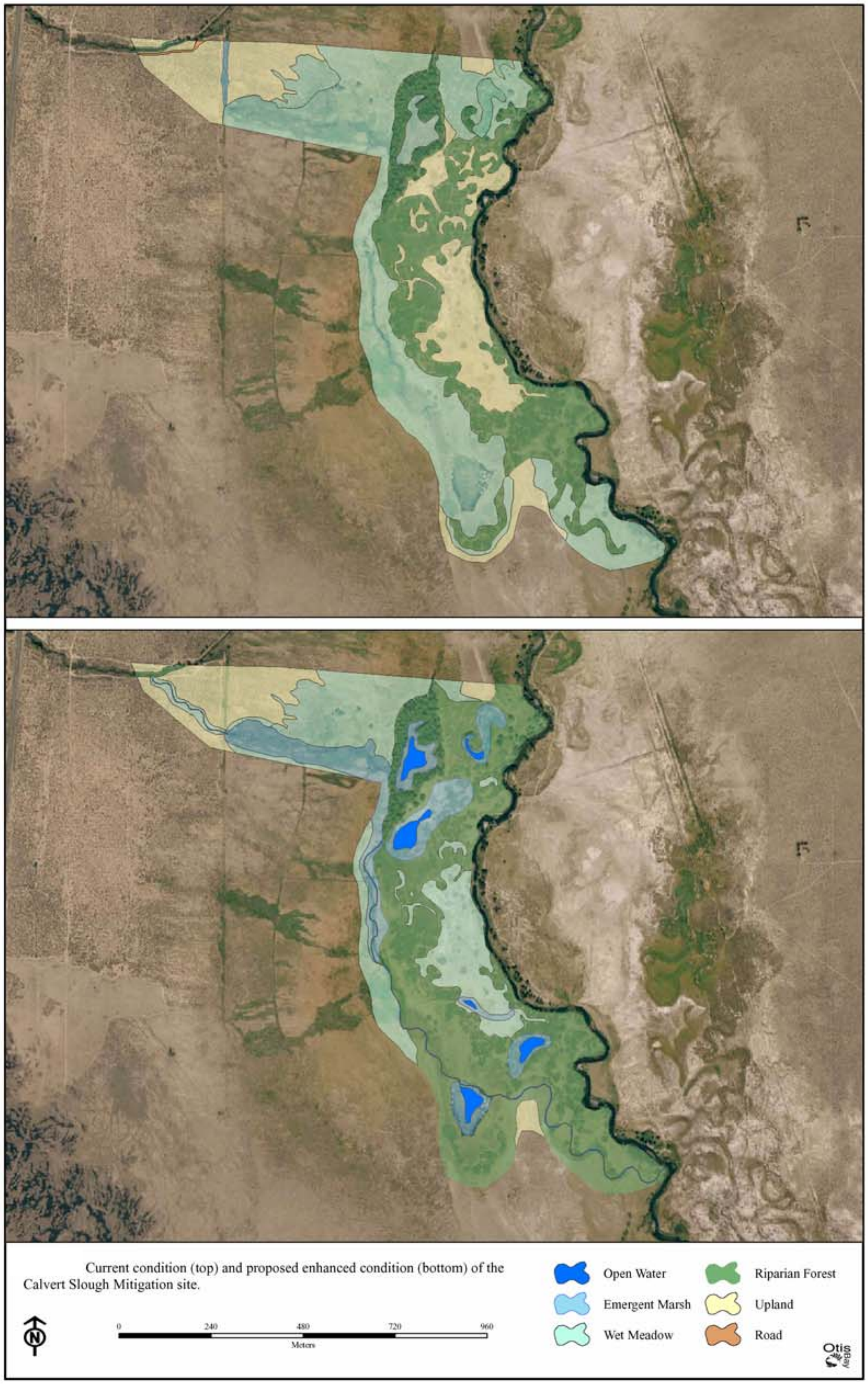
Goals

The Calvert Slough site could be enhanced to support a mosaic of interspersed habitat types: Owens River, Taboose stream channel, emergent wetland, wet meadow, riparian forest, transitional upland, and upland. The site could support several species of concern such as the osprey and least Bell's vireo, and may support some of the endemic fish if a fish barrier was constructed.

Mitigation at the Calvert Slough site would result in a considerable enhancement of riparian forest. In addition, both the aerial extent and structural complexity of the riparian vegetation would be increased. Xeric uplands would be reduced and replaced with enhanced emergent wetlands and riparian forest.

Mitigation Recommendations

A. This site is not recommended for mitigation due to the fact that the site is currently being managed under a previous mitigation project.
B. Due to the proximity of the two mitigation areas (North and South Calvert Slough), it is possible to increase the mitigation potential and value by combining both areas.



Current condition (top) and proposed enhanced condition (bottom) of the Calvert Slough Mitigation site.

Figure 4.15 Calvert Slough Mitigation Plan. Map by OBEC.

4.5 HIDDEN LAKE

4.5.1 OBEC's Hidden Lake Mitigation Plan

Prepared by OBEC

The artesian well site is approximately 0.5 miles south of Mazourka Canyon Road. The installation of two new artesian wells would create two separate source areas and outflow channels that would terminate in separate depressions resulting in wet meadow or riparian forest.[24]

Description of Proposed Mitigation Enhancement and Restoration
The mitigation action at the well site near Hidden Lake includes the installation of two new artesian wells. The proposed mitigation action in the vicinity of Hidden Lake is shown in Figure 4.16. The mitigation well could be isolated from areas that contain nonnative animal species. Endemic fish and one spring snail could be introduced. Wetland and riparian habitats that would develop at the well and outflow area would provide benefits for many animal and plant species.

Hidden Lake artesian wells are proposed to be developed as part of Phase II. The extent of Phase II development will depend upon the evaluation of Phase I activities. Should restoration activities occur at Hidden Lake, one artesian well should be drilled followed by restoration then an evaluation of the project. Based upon the evaluation results, a determination will be made concerning a second artesian well at the site.

Objectives

A. Create spring habitat types using an artesian well.
B. Support a population of endemic fish species and a snail species.
C. Create spring outflow channel habitat type.
D. Create or enhance wetland and riparian habitat types including, riparian woodlands, wet meadows, shrublands, emergent wetlands, and alkali meadow.

Measures

A. Drill one or two new well artesian wells.
B. Construct a meandering outflow channel leading from the well.
C. Revegetate with riparian, wetland, transitional upland and upland species.
D. Protect site from inappropriate human use or livestock overuse.

Feasibility

A. Presence of many artesian wells or the potential to successfully drill a new well makes this project feasible.

Preliminary Recommendations

B. Drill or locate a suitable existing flowing well.
C. Construct simulated spring orifice and spring outflow channel.
D. Train flow to existing landscape features that will create wetland habitat complexity.

[24] From Appendix A of the OBEC Phase II & III report. OBEC 2005b.

Water Supply and increased ET Demand

A. Redirect flow from existing well or introduce flow from new well.
B. Return water to the Hidden Lake basins.
C. The expected increase in evapotranspiration demand is estimated to be approximately 13 AFY (Table 4.3).

Potential for Weed Invasion and Control Measures Needed

A. Large populations of Tamarisk (*Tamarix ramosissima*) are currently present on the site. Potential exists for colonization or increase of invasive plants such as tamarisk, bassia (*Bassia hyssopifolia)* and cheatgrass (*Bromus tectorum)*.
B. The tamarisk will need to be treated and controlled prior to restoration being implemented. Control methods include a combination of mechanical and chemical treatments. Chemical treatments should follow state and county specifications.

Goals

An artesian well would best simulate the habitat types lost by spring elimination due to groundwater extraction. Mitigation at artesian well sites could enhance and create riparian forest and a mosaic of biologically rich wetland habitat types. Approximately 7,000 feet of outflow channel could be constructed that would mimic a natural spring condition. In addition, approximately 22 acres of riparian forest and 7 acres of wetland vegetation could be created. The constructed outflow channel would likely be suitable for at least three of the endemic fish species and possibly one snail species, as well as the potential to support endemic plant species. In areas where vegetation is currently dominated by upland and xeric vegetation, wetlands and riparian vegetation could be restored. The re-establishment of phreatophytic vegetation could occur and a complex riparian forest structure could be promoted.

Mitigation Recommendations

A. Develop two new wells to create spring habitat types.
B. Construct simulated spring orifice and spring outflow channel.
C. Train flow to existing landscape features that will create wetland habitat complexity.
D. Revegetate using a variety of upland, riparian, and emergent plants.
E. Prepare site for introduction of native fish species.

Water Allocation and Mitigation Costs

A. The recommended water allocation for this site ranges from 200 to 500 AFY .
B. The total project cost for implementation is estimated to be $766,000.

Table 4.3 Evapotranspiration demand at Hidden Lake mitigation site (ac-ft/yr).
Artesian Wells Near Hidden Lake
OBEC 2005b

	Existing acreage	Restored acreage	Existing ET	Restored ET	ET difference
Open Water	0.00	0.65	0.00	3.25	3.25
Emergent Marsh	0.00	2.96	0.00	12.43	12.43
Wet Meadow	0.00	4.02	0.00	5.63	5.63
Riparian Forest	0.00	22.01	0.00	61.63	61.63
Upland	19.26	0.00	13.48	0.00	-13.48
Tamarisk	10.22	0.00	56.21	0.00	-56.21
Roads	0.00	0.00	0.00	0.00	0.00
Total	**29.50**	**29.50**	**69.69**	**82.94**	**13.25**

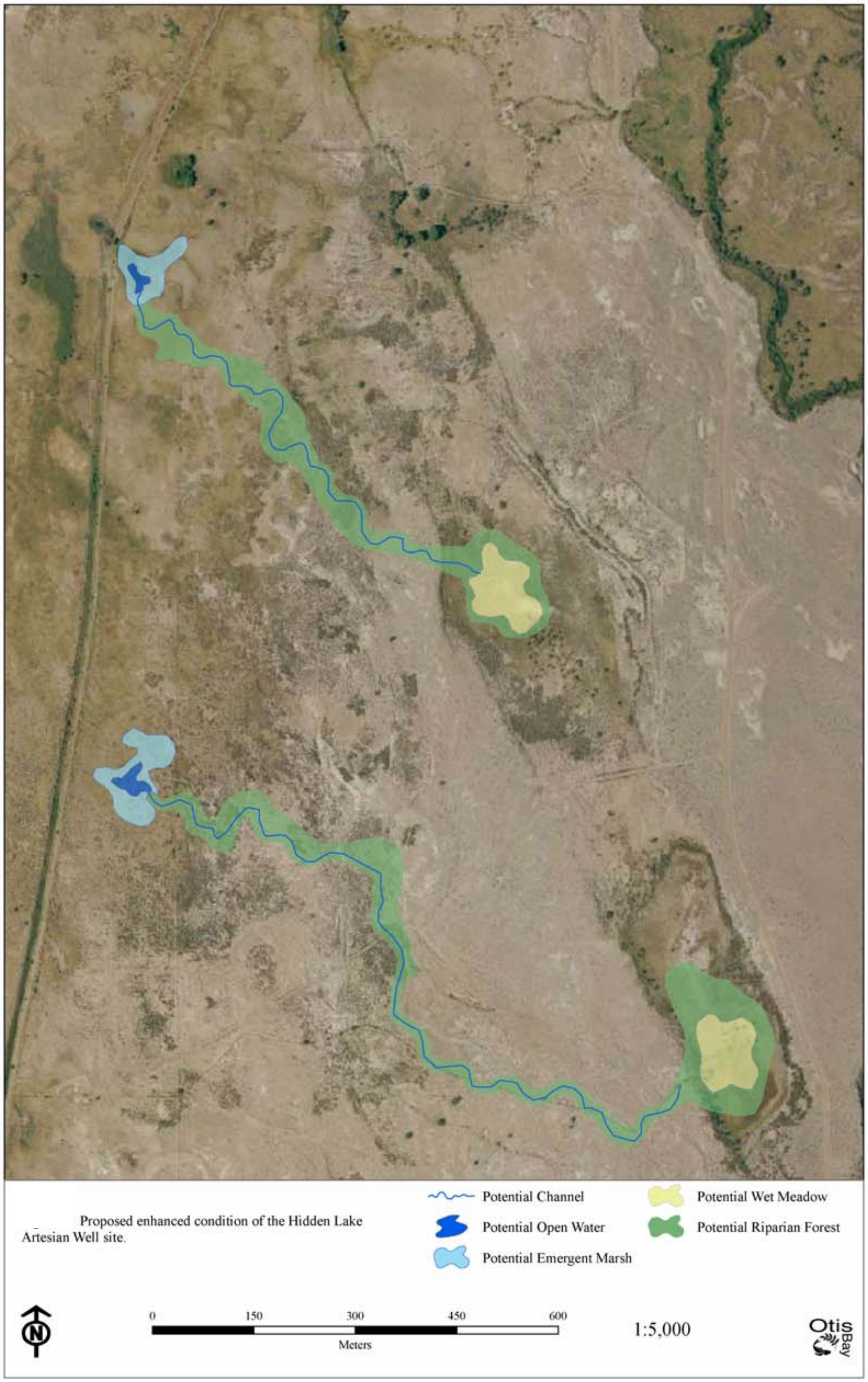


Figure 4.16 Hidden Lake Mitigation Plan. Map by OBEC.

4.5.2 WHA's Hidden Lake Mitigation Plan

Prepared by WHA

The Hidden Lake area (Figure 4.17) is south of Mazourka Canyon Road and includes two fault basins that are well suited for creating water/wetland. A flowing well is sustaining water/wetland in a similar fault basin (spring site IND182) near Mazourka Canyon Road. The northern part of Stevens Ditch appears to receive seepage from IND182 and runoff from fields irrigated by the Dean Spill-gate. Stevens Ditch is used for stock water in winter.[25] Dikes along the east side of the north basin and south of Hidden Lake suggest that the area has been used to spread water. A ditch that is normally dry links the Stevens Ditch to Hidden Lake.

Hidden Lake was mapped as part of an inventory of springs (IND168) and as part of the BWMA (WHA 2004d). Mapping of 2000 conditions (ibid.) was refined at larger-scale based on field reconnaissance of the two fault basins in August 2005 (Figure 4.18). The two fault basins (North and Hidden Lake) comprise about 40 acres. Predominate vegetation types in the two fault basins includes tamarisk (13 acres), alkali scrub/meadow (16 acres), and alkali scrub (7 acres). Several dozen scattered Russian olive and Goodding-red willow, mostly along the west flank of Hidden Lake, cover less than an acre. Two nearly barren slicks comprise about an acre. The Hidden Lake fault basin (20 acres) is about 3 meters deep.[26] The north basin (19 acres) is broader and shallower.

Two overlapping areas (Figure 4.19) were considered for creating water/wetland: 1) Hidden Lake fault basin; and 2) North and Hidden Lake fault basins.

Area 1 – Hidden Lake fault basin (20 acres): Tamarisk communities with alkali flat understory (5.4 acres), saltgrass understory (1.5 acres), and scrub understory (4.6 acres) comprise 59 percent of the basin. Alkali meadow (saltgrass) comprises 8 percent and alkali scrub/meadow comprises 30 percent of the basin. Russian olive and Goodding-red willow are scattered throughout the basin, especially along the high east flank. There is no existing wetland in the basin.

Water could be delivered to the high middle-ground of the basin via a 7,550 meter buried pipeline from a new diversion to be installed on the Los Angeles aqueduct. Alternatively, water could be delivered to the north end of the basin via an 8,200 meter pipeline from the existing Dean spill-gate. A flow gage will be installed at the inlet or the outlet of the pipeline. Piping water from Stevens Ditch to Hidden Lake was considered, but the availability of sufficient year-round flow in the ditch could not be confirmed. Tamarisk and Russian olive along the periphery of the basin will be eradicated. It may be more practical to burn the tamarisk in the bottom of the basin where flooding is expected to preclude recolonization. The basin will be filled with water to a maximum depth of 1.5-2.0 meters, or to the depth that the basin starts to overflow. Existing dikes south of Hidden Lake will divert inadvertent overflow west, away from the Owens River.

Predicted vegetation types that could be created (Figure 4.20) includes two ponds (3.4 acres), marsh (6.1 acres), wet alkali meadow (2.9 acres), alkali meadow (7.1 acres), and alkali

[25] Dale Schmidt, LADWP, personal communication. 2005
[26] USGS 1982

scrub/meadow (0.6 acres). About 17 existing tree willows (0.3 acres) will be maintained.[27] The total area of water/wetland that could be created is about 12.7 acres. About 10 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 58 acre-feet/year and the long-term bedloss is predicted to be 62 acre-feet/year. The water budget for this area is 120 acre-feet/year.

Area 2 – North and Hidden Lake fault basins (40 acres): Tamarisk communities with alkali flat understory (5.7 acres), saltgrass understory (3.9 acres), and scrub understory (5.8 acres) comprise 33 percent of the two basins. Alkali meadow (saltgrass) comprises 6 percent, alkali scrub/meadow comprises 39 percent, and alkali scrub comprises 18 percent of the basins. Scattered Russian olive and Goodding-red willow cover less than 2 percent of the basins. Barren and sparsely vegetated slicks comprise the remaining 3 percent of the basins. There is no existing wetland in the basins.

Water will be delivered to the north end of the north basin via a 6,900 foot buried pipeline from the Dean spill-gate. A flow gage will be installed at the inlet or outlet of the pipeline. Piping water from Stevens Ditch to the north basin was considered, but the availability of sufficient year-round flow in the ditch could not be confirmed. An 820 foot long ditch (or buried pipe) will be constructed to link the north basin with Hidden Lake. A culvert will be installed under the existing road between the two basins. Tamarisk and Russian olive along the periphery of the basin will be eradicated. It may be more practical to burn the tamarisk in the bottom of the basin where flooding is expected to preclude recolonization. The north basin will be filled with water to a depth of 1.0-1.5 meters, or to the elevation necessary to overflow to the south. Hidden lake will be filled to a maximum depth of about 1.5-2.0 meters, or to the depth that the basin starts to overflow. Existing dikes south of Hidden Lake will divert inadvertent overflow west away from the Owens River.

Predicted vegetation types that could be created (Figure 4.21) includes four ponds (5.9 acres), marsh (14.3 acres), wet alkali meadow (7.6 acres), alkali meadow (7.8 acres), and alkali scrub/meadow (3.5 acres). About 20 existing tree willow (0.4 acres) will be maintained (Footnote= Tree willow predicted to develop marsh understory will succumb to wetness over the long-term) of the basin could also be enhanced. The total area of water/wetland that could be created is about 28.2 acres. About 15 acres of predicted habitat would be suitable for establishing riparian trees and shrubs. The total predicted ET is 116 AFY and the long-term bedloss is predicted to be 119 acre-feet/year. The water budget for this area is 235 acre-feet.

[27] Tree willow predicted to develop marsh understory will succumb to wetness over the long-term.

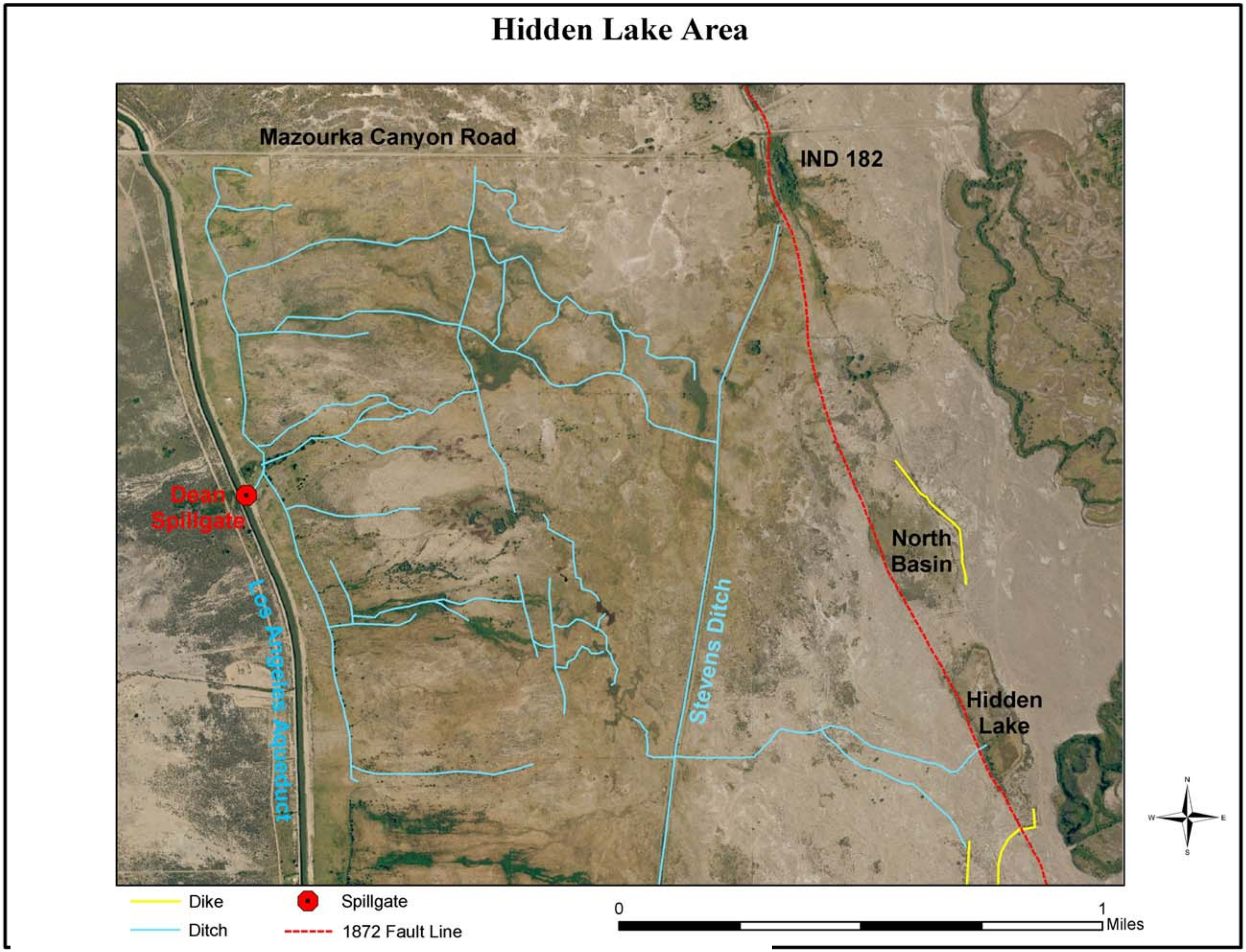


Figure 4.17 Hidden Lake. Map by WHA.

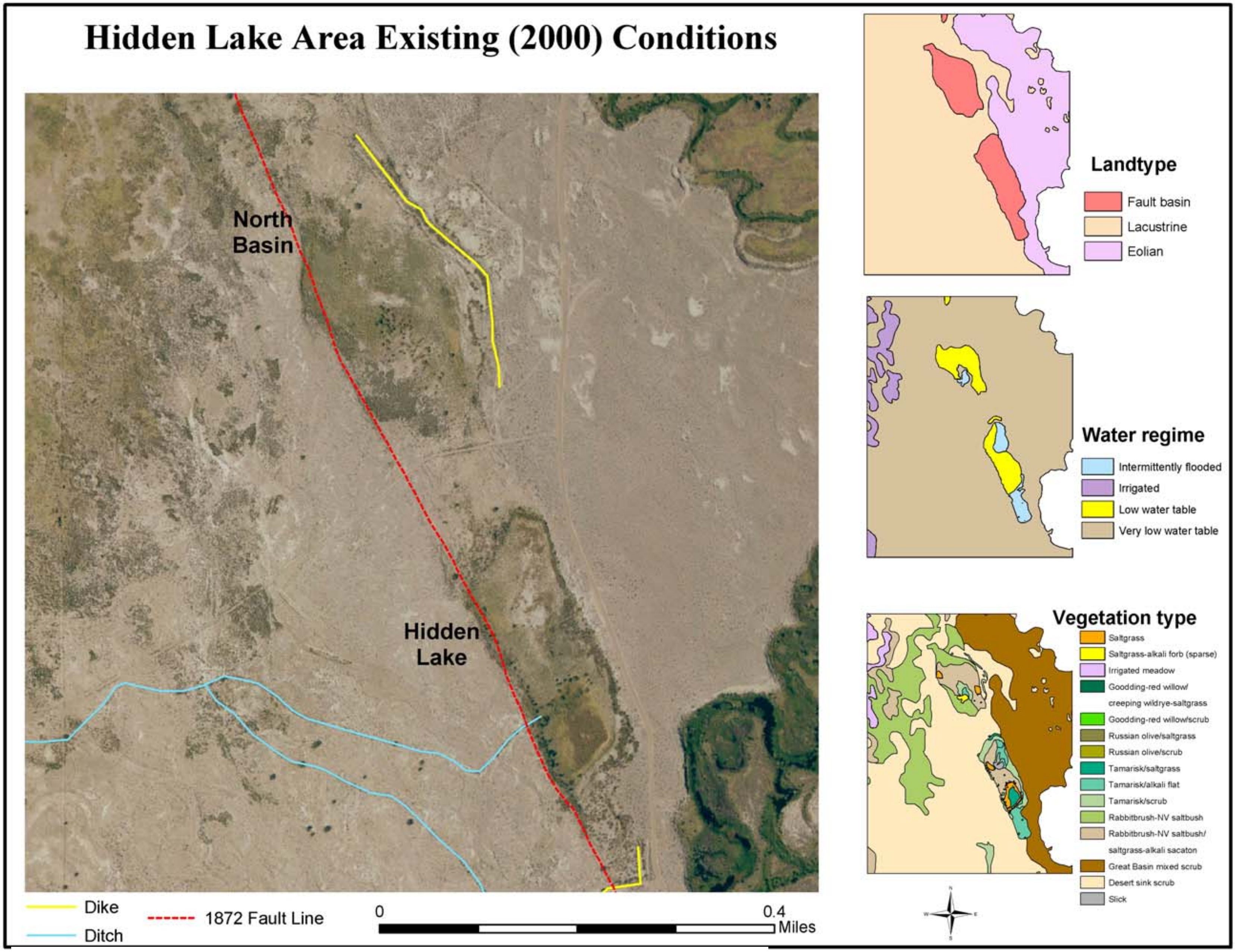


Figure 4.18 Hidden Lake Existing Conditions. Map by WHA.

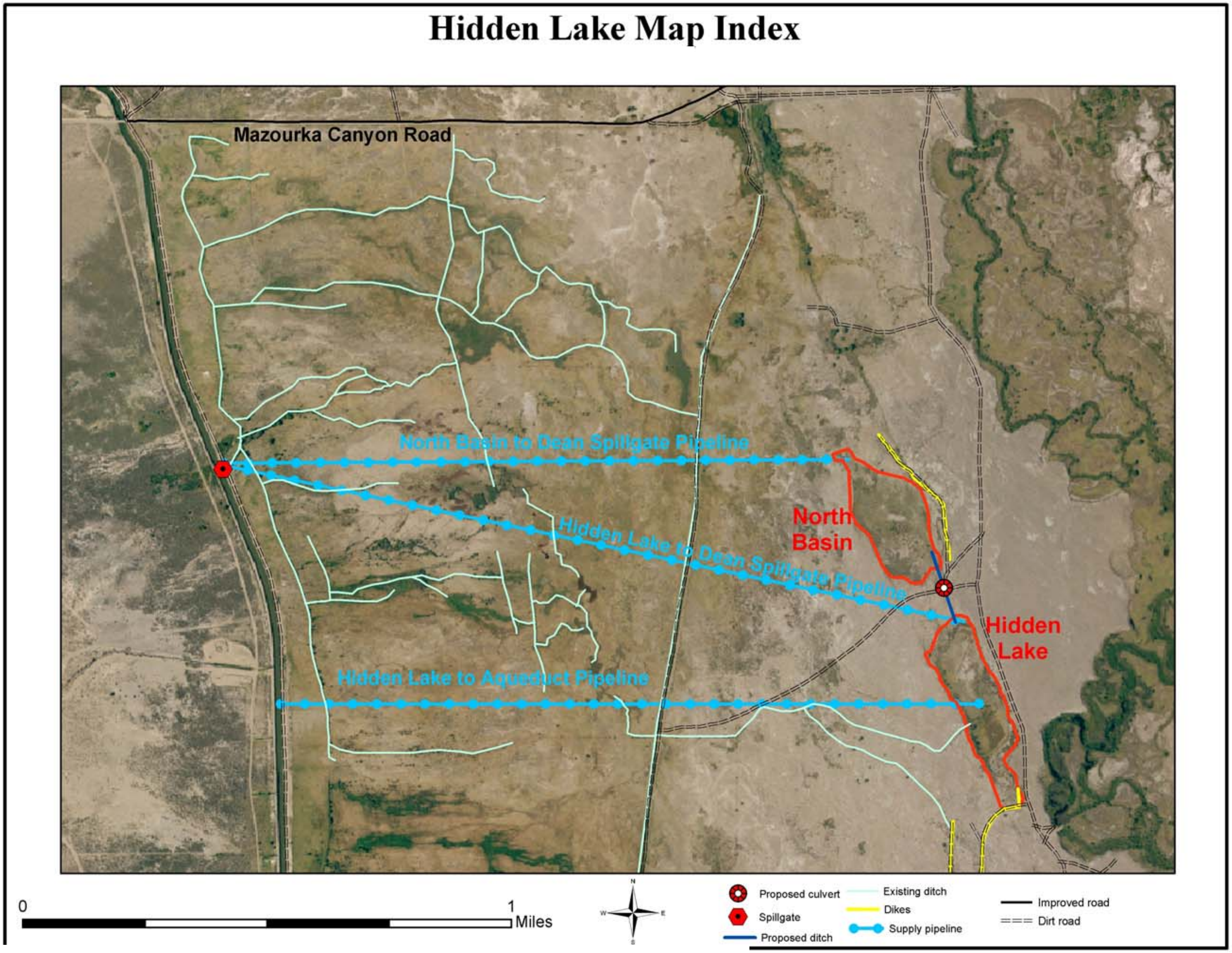
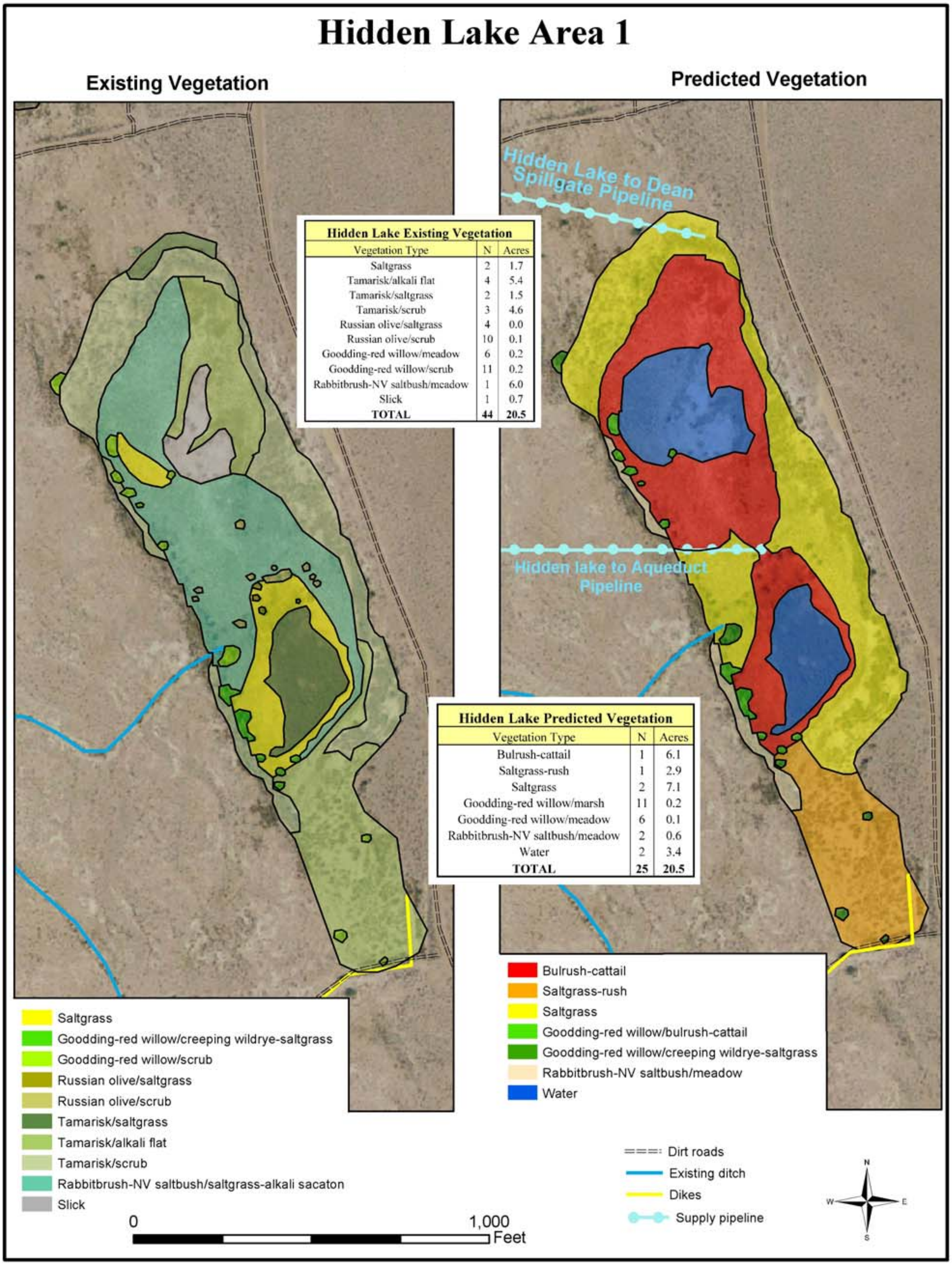


Figure 4.19 Hidden Lake Index Map. Map by WHA.



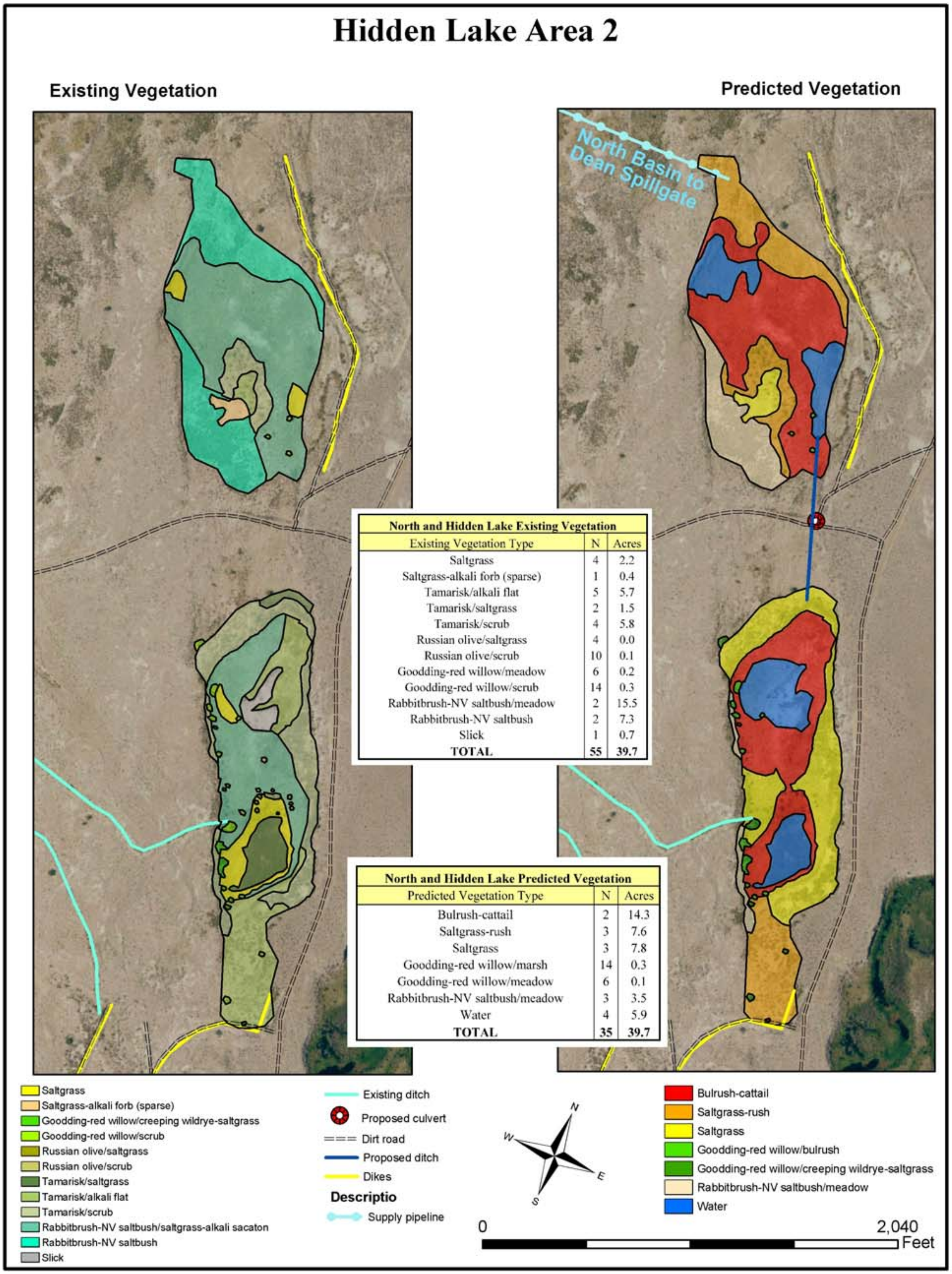
Hidden Lake Existing Vegetation

Vegetation Type	N	Acres
Saltgrass	2	1.7
Tamarisk/alkali flat	4	5.4
Tamarisk/saltgrass	2	1.5
Tamarisk/scrub	3	4.6
Russian olive/saltgrass	4	0.0
Russian olive/scrub	10	0.1
Goodding-red willow/meadow	6	0.2
Goodding-red willow/scrub	11	0.2
Rabbitbrush-NV saltbush/meadow	1	6.0
Slick	1	0.7
TOTAL	**44**	**20.5**

Hidden Lake Predicted Vegetation

Vegetation Type	N	Acres
Bulrush-cattail	1	6.1
Saltgrass-rush	1	2.9
Saltgrass	2	7.1
Goodding-red willow/marsh	11	0.2
Goodding-red willow/meadow	6	0.1
Rabbitbrush-NV saltbush/meadow	2	0.6
Water	2	3.4
TOTAL	**25**	**20.5**

Figure 4.20 Hidden Lake Area 1. Map by WHA.



North and Hidden Lake Existing Vegetation

Existing Vegetation Type	N	Acres
Saltgrass	4	2.2
Saltgrass-alkali forb (sparse)	1	0.4
Tamarisk/alkali flat	5	5.7
Tamarisk/saltgrass	2	1.5
Tamarisk/scrub	4	5.8
Russian olive/saltgrass	4	0.0
Russian olive/scrub	10	0.1
Goodding-red willow/meadow	6	0.2
Goodding-red willow/scrub	14	0.3
Rabbitbrush-NV saltbush/meadow	2	15.5
Rabbitbrush-NV saltbush	2	7.3
Slick	1	0.7
TOTAL	55	39.7

North and Hidden Lake Predicted Vegetation

Predicted Vegetation Type	N	Acres
Bulrush-cattail	2	14.3
Saltgrass-rush	3	7.6
Saltgrass	3	7.8
Goodding-red willow/marsh	14	0.3
Goodding-red willow/meadow	6	0.1
Rabbitbrush-NV saltbush/meadow	3	3.5
Water	4	5.9
TOTAL	35	39.7

Figure 4.21 Hidden Lake Area 2. Map by WHA.

4.6 SOUTH of COLLINS ROAD

Prepared by OBEC

The artesian well site is located approximately 2.5 miles south of Collins Road and approximately 0.5 miles west of the Owens River. One artesian well is present at the site. The installation of two artesian wells could result in the creation of a spring complex that extends approximately one mile in length from north to south and would result in a spring complex with three interconnected spring outflow channels.[28]

Description of Proposed Mitigation Enhancement and Restoration
An artesian well, in a suitable location, can simulate the physical conditions and habitat created in a spring environment. The proposed mitigation action in the vicinity of Well V047 is shown in Figure 4.22. The proposed enhancement or restoration would be to use one existing artesian well (V047) and potentially install one or two new artesian wells north of V047 at locations that would produce the desired benefits. Artesian flow contains water properties (temperature and geochemistry) similar to spring outflow. The mitigation well could be isolated from areas that contain non-native animal species. Endemic fish and possibly one spring snail (dependent upon water temperature) could be introduced. Wetland and riparian habitats that would develop at the well and outflow area would provide benefits for many animal and plant species.

The existing artesian well site would be developed during Phase I. Based upon the outcome of the Phase I evaluation, a second and third artesian well may be installed and developed for restoration.

Objectives
A. Create spring habitat types using an artesian well.
B. Support a population of endemic fish species and a snail species (dependent upon water temperature).
C. Create spring outflow channel habitat type.
D. Create or enhance wetland and riparian habitat types including, riparian woodlands, wet meadows, shrublands, emergent wetlands, and alkali meadow.

Measures
A. Drill one or two new artesian wells and utilize one existing artesian well.
B. Construct a meandering outflow channel leading from the wells which connects to relict channels.
C. Revegetate with riparian, wetland, transitional upland and upland species.
D. Protect site from inappropriate human use or livestock overuse.

Feasibility
A. Presence of an existing artesian well and the potential to successfully drill new wells makes this project feasible.

Water Supply and increased ET Demand
A. Flow from existing well or introduce flow from new well.

[28] From Appendix A of the OBEC Phase II & III report. OBEC 2005b.

B. Redirect return water to a relict channel.
C. The expected increase in evapotranspiration demand is estimated at approximately 82 AFY (Table 4.4).

Potential for Weed Invasion and Control Measures Needed
A. Potential exists for colonization or increase of invasive plants such as bassia (*Bassia hyssopifolia)*, cheatgrass (*Bromus tectorum)* and Russian thistle (*Salsola tragus*).
B. Control methods include a combination of mechanical and chemical treatments.
Chemical treatments should follow state and county specifications.

Goals
An artesian well would best simulate the habitat types lost by spring elimination due to groundwater extraction. Mitigation at artesian well sites could enhance and create riparian forest and a mosaic of biologically rich wetland habitat types. Approximately 17,000 feet of outflow channel could be constructed that would mimic a natural spring condition. In addition, approximately 27 acres of riparian forest and 17 acres of wetland vegetation could be created. The constructed outflow channel would likely be suitable for at least three of the endemic fish species and possibly one snail species, as well as the potential to support endemic plant species. In areas where vegetation is currently dominated by upland and xeric vegetation, wetlands and riparian vegetation could be restored. The re-establishment of phreatophytic vegetation could occur and a complex riparian forest structure could be promoted.

Mitigation Recommendations
A. Develop existing well and install two new artesian wells to create spring habitat types.
B. Construct simulated spring orifice and spring outflow channel.
C. Train flow to existing landscape features that will create wetland habitat complexity.
D. Revegetate using a variety of upland, riparian, and emergent plants.
E. Prepare site for introduction of native fish species.

Water Allocation and Mitigation Costs
A. The recommended water allocation for this site is between 200 to 400 AFY.
B. The total project cost for implementation is estimated to be $1,215,000.

Table 4.4 Evapotranspiration demand at South of Collins Road mitigation site (ac-ft/yr).
Artesian Wells South of Collins Rd.
OBEC 2005b

	Existing acreage	Restored acreage	Existing ET	Restored ET	ET difference
Open Water	0.00	0.79	0.00	3.95	3.95
Emergent Marsh	0.00	5.78	0.00	24.28	24.28
Wet Meadow	1.26	11.61	1.76	16.25	14.49
Riparian Forest	2.99	26.90	8.37	75.32	66.95
Upland	40.00	0.00	28.00	0.00	-28.00
Playa	0.00	0.00	0.00	0.00	0.00
Roads	0.00	0.00	0.00	0.00	0.00
Total	**45.00**	**45.00**	**38.14**	**119.80**	**81.66**

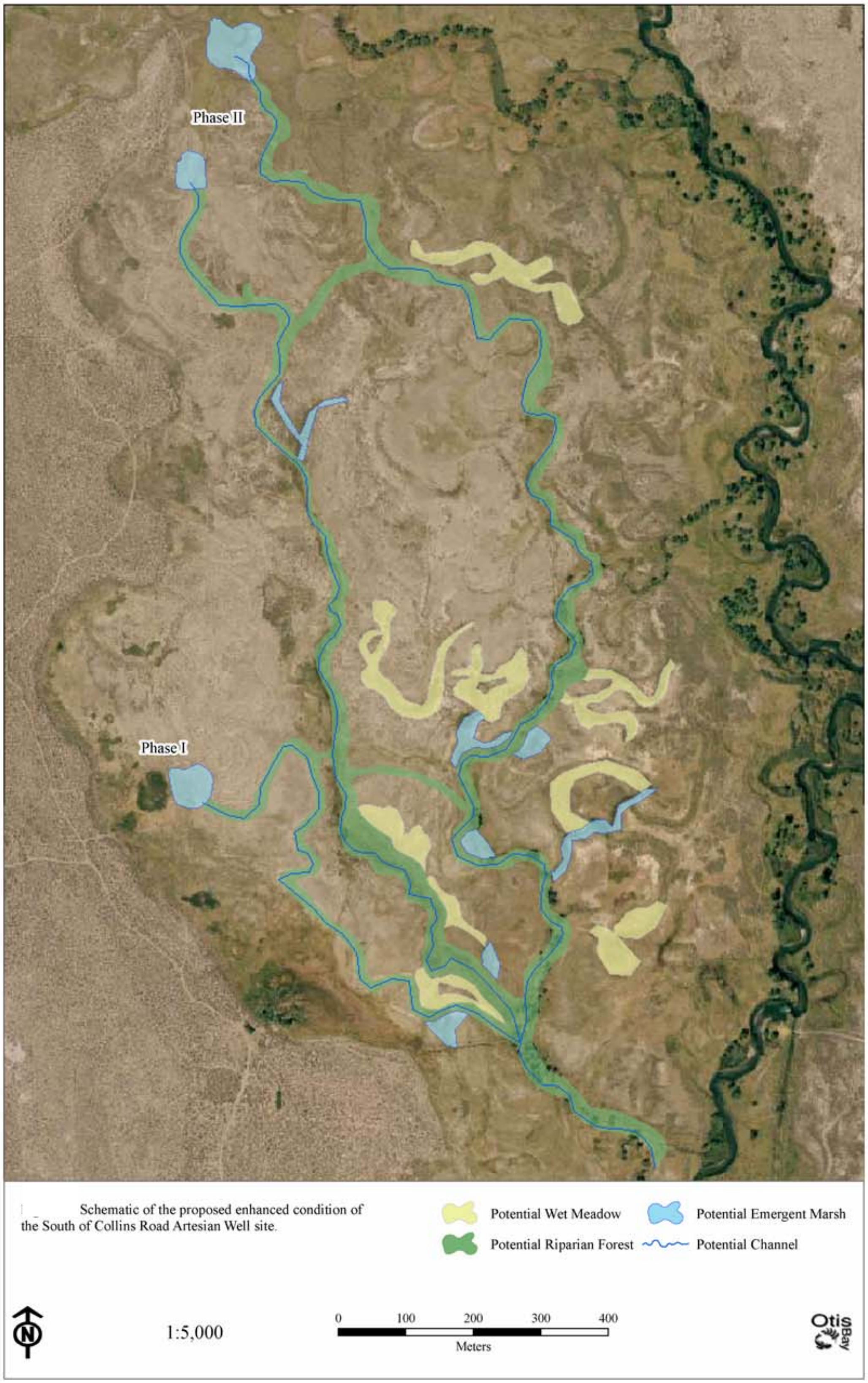


Figure 4.22 South of Collins Road Mitigation Plan. Map by OBEC.

4.7 BIG PINE NORTHEAST

Prepared by OBEC

This site is composed of xeric uplands surrounding a channelized section of Big Pine Creek. Located east of the sewage plants and adjacent to Big Pine Creek, mitigation at this site would include restoration of a channelized section of Big Pine Creek and would result in the creation and enhancement of riparian forest, riparian shrubland, and other wetland habitat types.[29]

Description of Proposed Mitigation Enhancement and Restoration
The section of Big Pine Creek east of the town of Big Pine has been channelized (straightened and entrenched). The proposed mitigation action at Big Pine Creek would be to reconnect the stream to its floodplain (elevate the stream bed) and reconstruct a meandering channel (Figure 4.23). Following mitigation, the section of channel would return to a condition similar to that observed in the undisturbed section downstream.

Objectives
A. Restore the stream channel to its natural geomorphic form.
B. Restore and enhance former riparian forest adjacent to Big Pine Creek.
C. Increase riparian forest acreage and expand the width of the riparian corridor.

Measures
A. Construct stream channel habitat distal to the Owens River.
B. Revegetate area, with riparian, wetland, and transitional upland plant species.

Feasibility
A. Existing stream water source available for increased sustainability of mitigation action.

Water Supply and increased ET Demand
A. Use existing flow in Big Pine creek to support riparian forest and wetlands.
B. Water will remain in a natural course to Owens River.
C. The expected increase in evapotranspiration demand is approximately 51 AFY (Table 4.5).

Potential for Weed Invasion and Prevention Needed
A. Potential exists for colonization or increase of non native plants such as bassia (*Bassia hyssopifolia),* cheatgrass (*Bromus tectorum),* Russian thistle (*Salsola tragus*) and annual mustards.
B. Careful application of chemicals would be needed given the proximity and connection of the site to the Owens River. Application should be performed by county and state certified individuals. Both chemical and mechanical treatment could be utilized.

Goals
Mitigation at the Big Pine Creek site will produce rich and complex riparian and stream habitat types. Approximately 20 acres of riparian vegetation and wetlands could be created following implementation of the recommended mitigation action. Mitigation would occur in an area heavily impacted by ground water extraction. It would be difficult to preclude invasive fish species from

[29] From Appendix A of the OBEC Phase II & III report. OBEC 2005B

this site, which would preclude the potential recovery of native fishes. However, the mitigation action would be beneficial for target bird species.

The aerial extent of upland vegetation would be reduced and replaced by a structurally complex riparian forest. In addition, emergent wetland vegetation would be created at this site (Figure 4.23).

Mitigation Recommendations
A. The evidence of a former riparian area is apparent in aerial photography.
B. Reconstruct the channel to pre-channelization conditions to restore and enhance riparian habitat.
C. Promote habitat restoration while providing sport fishing opportunities.
D. Site is out of kind but may be used if evaluation of Phase I sites indicate limited success.

Water Allocation and Mitigation Costs
A. The recommended water allocation for this site is 100 AFY.
B. The total project cost for implementation is estimated to be $1,110,000.

Table 4.5 Evapotranspiration demand at Northeast of Big Pine mitigation site (ac-ft/yr). OBEC 2005b

	Existing acreage	Restored acreage	Existing ET	Restored ET	ET difference
Open Water	0.36	1.02	1.80	5.10	3.30
Emergent Marsh	0.00	2.21	0.00	9.28	9.28
Wet Meadow	4.49	3.80	6.29	5.32	-0.97
Riparian Forest	10.40	29.71	29.12	83.19	54.07
Upland	47.02	25.54	32.91	17.88	-15.04
Playa	0.00	0.00	0.00	0.00	0.00
Roads	0.00	0.00	0.00	0.00	0.00
Total	**62.27**	**62.28**	**70.12**	**120.77**	**50.65**

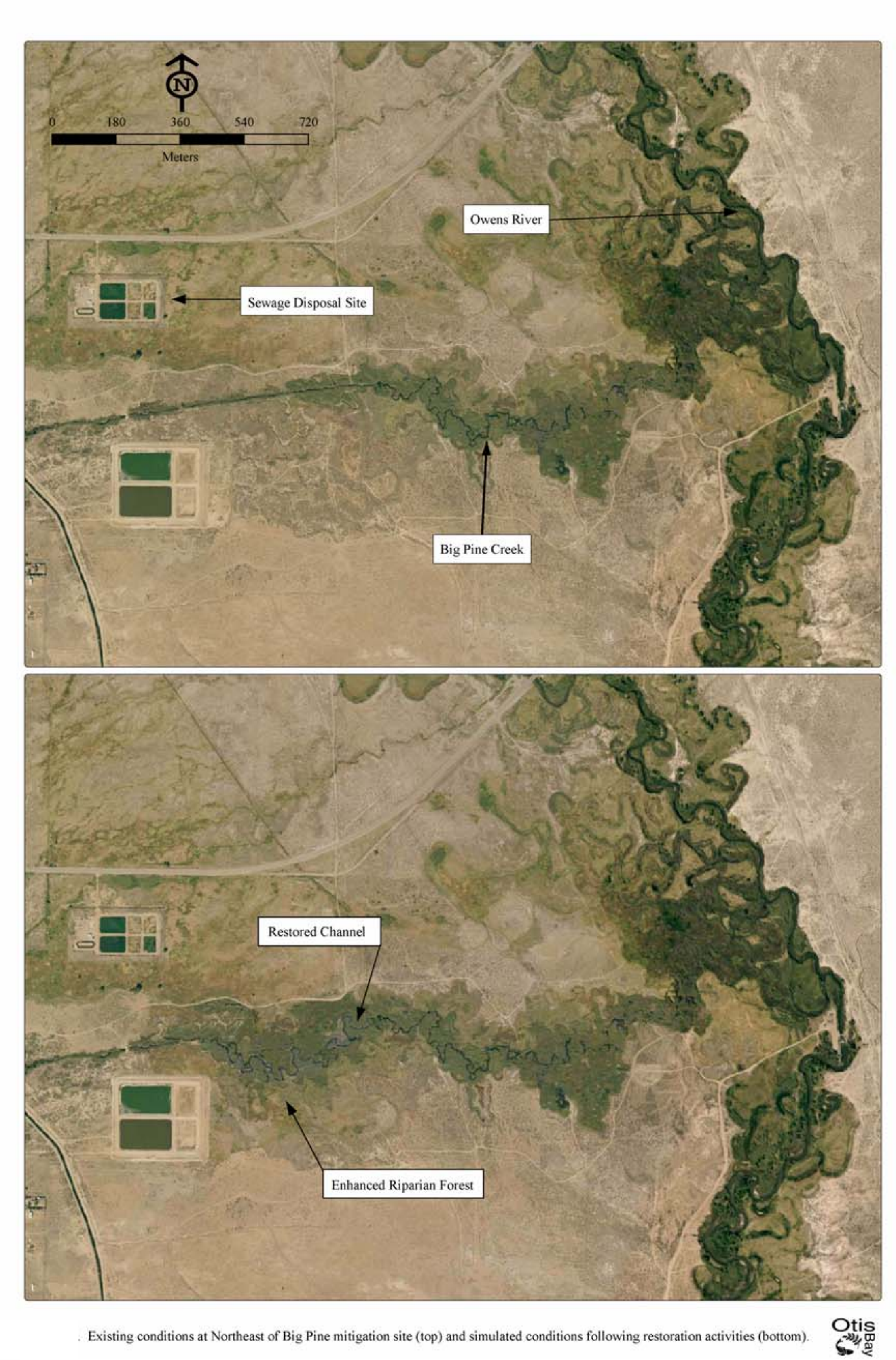


Figure 4.23 Northeast of Big Pine Mitigation Plan. Map by OBEC.

4.8 FISH SPRINGS EAST of HIGHWAY 395

Prepared by OBEC

Fish Springs east of Hwy 395 is located directly north of Tinemaha Reservoir and across the highway from the Fish Springs Hatchery. The site extends along the canal that flows from the hatchery to the Owens River at Tinemaha. The site generally slopes from west to east between Fish Spring Canal and an old ditch on the south boundary of the site from the highway to the river. The site topography is made up of complicated and undulating terrain. Scrub vegetation (rabbit brush/salt bush) dominates with some remnant willow and cottonwood. There are large areas of barren, friable soils and signs of past irrigation, dredging, earth moving, and landform manipulation. The Owens River main channel has mature willow galleries on both banks. The canal drains from the hatchery to the river, and on the north boundary of the site is a deep incised channel. The canal has been channelized or down-cut by machine excavation over time. The canal water surface elevation is -2 m from the top of the bank. Instream, the canal has a silty/muck bottom. Brown trout were observed in the channel. The channel is a steep cut bank throughout with emergent cattail along the water edge and in the main water channel. Approximately 75% open water, some stands of *Salix exigua* occur on the banks.[30]

Description of Proposed Mitigation Enhancement and Restoration
The Fish Springs East of Highway 395 site is the remnant of the Fish Spring outflow channel. Ground water extraction in the vicinity of Fish Springs has resulted in the cessation of spring flow. In addition, the outflow channel has been modified by channelization. Presently, ground water pumped from wells supplies the fish hatchery and flows into the entrenched channel. Following comments received on the *Draft Hines Spring Mitigation Phase II and III Report*, it has been determined that the Fish Springs East of Highway 395 is not desirable as a mitigation site. This decision was made by stakeholders due to the uncertainty of water supply in the event that the fish hatchery were to close, ground water extraction ceased, and the water supply to the site was subsequently eliminated.

Mitigation actions would result in an elevated channel that would be connected to the land surface adjacent to the channel. A meandering channel with riffles and pools would be constructed. Riparian areas would be re-contoured to create a complexity of topographic features. Water flowing from the Fish Springs Hatchery would supply water to the new channel (Figure 4.24).

Objectives

A. Restore and enhance former riparian forest adjacent to Fish Springs outflow channel.
B. Increase riparian forest acreage and expand width of riparian corridor.

Measures

A. Channel previously straightened and entrenched. Reconstruct sinuosity, restore riparian corridor similar to natural condition.
B. Construct in-channel habitat such as gravel bars and pools.
C. Revegetate area, with riparian, wetland, and transitional upland plant species.

[30] From Appendix A of the OBEC Phase II & III report. OBEC 2005b.

Feasibility

A. Water source is currently available for mitigation action.

Water Supply and increased ET Demand

A. Use well water outflow from Fish Springs hatchery to support riparian wetlands and forest.
B. Water will remain in natural course to Owens River.

Potential for Weed Invasion and Prevention Needed

A. Potential exists for colonization or increase of invasive plants such as bassia (*Bassia hyssopifolia)*, cheatgrass (*Bromus tectorum)*, Russian thistle (*Salsola tragus*) and annual mustards.
B. Careful application of chemicals would be needed given the proximity and connection of the site to the Owens River and should be applied by county and state certified persons. Both mechanical and chemical treatments could be used.

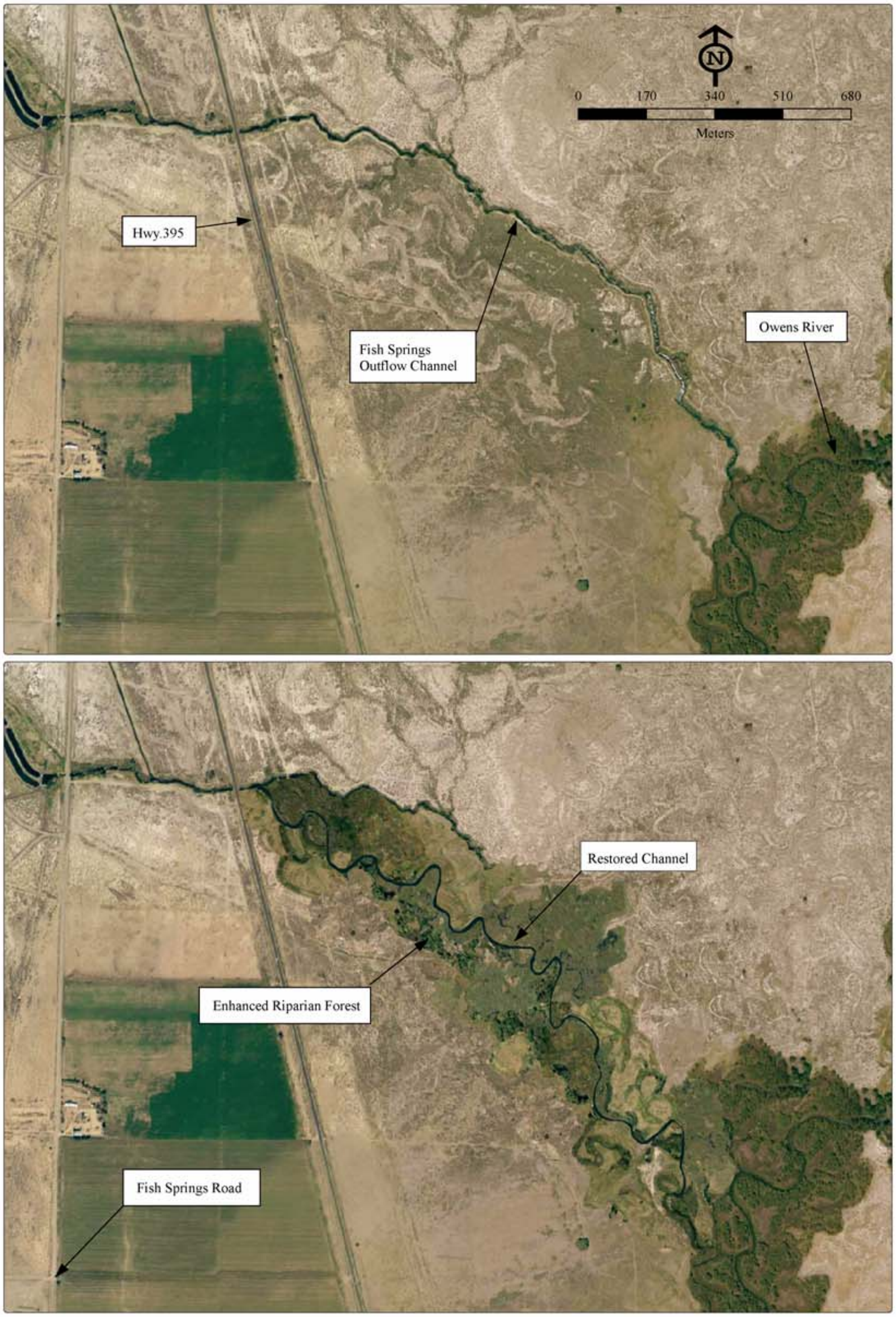
Goals

The Fish Springs East of Highway 395 mitigation will produce rich and complex riparian and stream habitat types. Mitigation would occur in an area heavily impacted by ground water extraction. It would be difficult to prevent invasive fish species from the mitigation area, which would preclude the recovery of native fishes. However, the restoration would be beneficial for target bird species.

The aerial extent of uplands would be reduced and emergent marsh would be increased. Riparian forest coverage and the structural complexity of the forests would also increase (Figure 4.24).

Mitigation Recommendations

A. This site is not recommended for mitigation due the uncertainty of continued water supply to the site from the fish hatchery.
B. The evidence of a former riparian area is apparent in aerial photography.
C. Reconstruct the channel to pre-channelization conditions to restore and enhance riparian habitat.
D. Promote habitat restoration while providing sport fishing opportunities.



. Existing conditions at Fish Springs East of Hwy. 395 mitigation site (top) and simulated conditions following restoration activities (bottom).

Figure 4.24 Fish Springs East Mitigation Plan. Map by OBEC.

4.9 NORTH of MAZOURKA CANYON ROAD

Prepared by OBEC

The artesian well sites are located approximately 0.5 miles north of Mazourka Canyon Road and approximately one mile west of the Owens River. One existing artesian well is present at the site. The installation of one new artesian well would create a spring complex with outflow channels that could flow east over the Owens Valley fault toward the Owens River. The Owens Valley fault would provide for a fish barrier installation location.[31]

Description of Proposed Mitigation Enhancement and Restoration
The mitigation action at well site V008 would include the utilization of an existing well (V008) and the installation of one new artesian well south of V008. The proposed mitigation action in the vicinity of Well V008 is shown in Figure 8. Development of artesian wells and utilization of the wells for mitigation purposes will allow for the creation of physical conditions and habitat types typical of springs. The mitigation well could be isolated from areas that contain non-native animal species. Endemic fish and one spring snail could be introduced. Wetland and riparian habitats that would develop at the well and outflow area would provide benefits for numerous animal and plant species.

The existing artesian well site would be developed during Phase I. Based upon the outcome of the Phase I evaluation, a second artesian well may be installed and developed for restoration.

Objectives
A. Create spring habitat types using an artesian well.
B. Support a population of endemic fish species and a snail species.
C. Create spring outflow channel habitat type.
D. Create or enhance wetland and riparian habitat types including, riparian woodlands, wet meadows, shrublands, emergent wetlands, and alkali meadow.

Measures
A. Drill one new well and utilize one existing artesian well.
B. Construct a meandering outflow channel leading from the wells.
C. Revegetate with riparian, wetland, transitional upland and upland species.
D. Protect site from inappropriate human use or livestock overuse.

Feasibility
A. Presence of an existing artesian well or the potential to successfully drill a new well makes this project feasible.

Water Supply and increased ET Demand
A. Redirect flow from existing well or introduce flow from new well.
B. Return water to an Owens River terrace wetland.
C. The expected increase in evapotranspiration demand is estimated at approximately 48 AFY (Table 4.6).

[31] From Appendix A of the OBEC Phase II & III report. OBEC 2005b.

Potential for Weed Invasion and Control Measures Needed
A. Bassia (*Bassia hyssopifolia*) is present on site in moderate abundance. Potential exists for colonization or increase of invasive plants such as bassia, cheatgrass (*Bromus tectorum)* and Russian thistle (*Salsola tragus*).
B. Control methods include a combination of mechanical and chemical treatments. Chemical treatments should follow state and county specifications.

Goals
An artesian well would best simulate the habitat types lost by spring elimination due to groundwater extraction. Mitigation at artesian well sites could enhance and create riparian forest and a mosaic of biologically rich wetland habitat types. Approximately 11,000 feet of outflow channel could be constructed that would mimic a natural spring condition. In addition, approximately 18 acres of riparian forest and 7 acres of wetland vegetation could be created. The constructed outflow channel would likely be suitable for at least two or three of the endemic fish species and possibly one snail species, as well as the potential to support some of the endemic plant species. In areas where vegetation is currently dominated by upland and xeric vegetation, wetlands and riparian vegetation could be restored. The re-establishment of phreatophytic vegetation would occur and a complex riparian forest structure could be promoted.

Mitigation Recommendations
A. Develop existing well and install one new artesian well to create spring habitat conditions.
B. Construct simulated spring orifice and spring out-flow channel.
C. Train flow to existing landscape features that will create wetland habitat complexity.
D. Revegetate using a variety of upland, riparian, and emergent plants.
E. Prepare site for introduction of native fish species.

Water Allocation and Mitigation Costs
A. The recommended water allocation for this site ranges from 200 to 500 AFY.
B. The total project cost for implementation is estimated to be $692,000.

Table 4.6 Evapotranspiration demand at North of Mazourka Canyon Road mitigation site (ac-ft/yr).

Artesian Wells North of Mazourka Canyon Rd
OBEC 2005b

	Existing acreage	Restored acreage	Existing ET	Restored ET	ET difference
Open Water	0.00	0.54	0.00	2.70	2.70
Emergent Marsh	0.00	3.38	0.00	14.20	14.20
Wet Meadow	3.82	3.54	5.35	4.96	-0.39
Riparian Forest	2.03	18.07	5.68	50.60	44.91
Upland	19.42	0.00	13.59	0.00	-13.59
Playa	0.00	0.00	0.00	0.00	0.00
Roads	0.00	0.00	0.00	0.00	0.00
Total	**25.50**	**25.50**	**24.63**	**72.45**	**47.82**

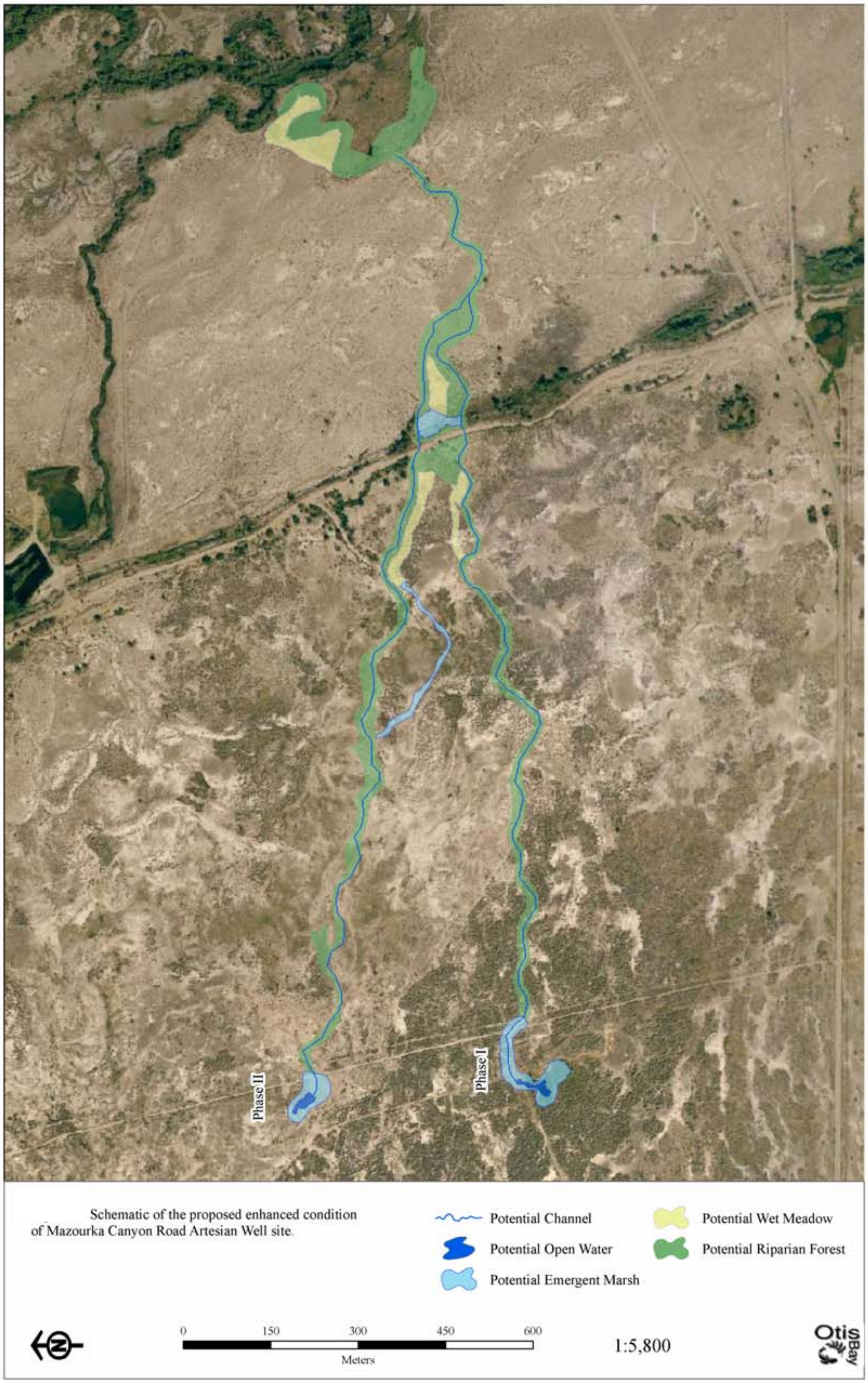


Figure 4.25 Mazourka Canyon Road Mitigation Plan. Map by OBEC.

5.0 REASONABLE AND FEASIBLE ANALYSIS

The MOU requires mitigation measures to be reasonable and feasible[32] and provide the most environmental benefits that can be achieved with the available water. The MOU does not define reasonable, but the MOU defines feasible[33] as *"capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social and technological factors"*. Reasonable can be defined as good judgment, being within the bounds of common sense, and not excessive or extreme.

Potential project sites were assessed further on the basis of feasibility and reasonability using the following criteria:

- **Cost-Benefit Analysis**: The MOU requires that reasonable and feasible recommendations provide the most environmental benefits for the water used.[34] Each site is analyzed based on the amount of water allocated per acre of habitat gained, quality and quantity of habitat gained, and annual operation and maintenance costs.

- **Lessee Impacts**: A key requirement of the MOU is to maintain sustainable agriculture in the selection and implementation of all restoration plans[35]. Livestock grazing is the principle agriculture activity. The MOU expects restoration projects to take into account impacts to grazing and, to the extent possible, avoid or ameliorate economic impacts on lessees.

5.1 COST BENEFIT[36]

In order to perform a cost benefit analysis of each potential project site, the following criteria are presented for analysis and consideration:

- volume of water allocated (AFY)
- net area of wetland habitat created (AC)
- value of wetland habitat created (rating)
- total cost of project ($)
- cost of project per acre of wetland habitat gained ($/AC).

Estimates for each criterion were determined by drawing values and figures from the OBEC 2005b and WHA 2005b reports. Where values and figures were unclear or discrepancies existed,

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[32] MOU Section III 3; Sierra Club/Owens Valley Committee letter of comment dated 12/7/05 also stated that mitigation measures must be reasonable and feasible, and that the final plan must comply with the requirements of the MOU. LADWP comment letter dated 12/7/05 cited the necessity of a "thorough evaluation of whether the various projects are reasonable and feasible…". The Inyo County Board of Supervisors comment letter dated 12/14/05 also reiterated the MOU requirement that projects be reasonable and feasible.

[33] MOU Section I D

[34] MOU Section III 3

[35] MOU Section II B

[36] A cost-benefit type analysis in which environmental benefits are compared to water allocation was cited as MOU requirements by the Sierra Club and the Owens Valley Committee (comment letter dated 12/7/05) and the Inyo County Water Department (comment letter dated 12/6/05).

estimates were made based upon best available information, and those decisions are detailed here. Values for some criteria were not presented by previous reports for Fish Springs East and Calvert Slough. Table 5.1.3 summarizes the cost benefit analysis and ranks each site according to cost benefit efficiency.

Site: Warren Lake (OBEC, 2005b)

Water Allocated (AFY): OBEC (2005b, p.73) recommends 5 AFY, and also 75 AFY (p. 51). 75 AFY was chosen because it is associated with a specific number of restored acres (5 AC).

Habitat Created: OBEC (2005b) presents several, differing estimates of habitat created: 44.24 acres of wetland (p. 31), 5 acres of created habitat (p.73), and 47 acres in their Additional Site Assessment (92 restored - 45 existing = 47 created). 5 acres (p.73) was chosen because it is associated with a specific water allocation (75 AFY).

Habitat Value (rating): (OBEC 2005b, Table 6, p. 73) rates the value LOW.

Cost/acre ($/AC): (OBEC 2005b, Table 6, p. 73) estimates $2000/acre.

Total Cost: OBEC (2005b, pp. 51 and 73) estimates costs at Warren Lake to $10,000, but estimates $13,520 in Appendix C: Mitigation Costs. $10,000 was chosen because it is associated with the AFY and acres created presented in Table 6 (p. 73).

Site: Warren Lake (WHA, 2005b) Alternative 2

Alternative 2 was chosen as a more desirable option than alternative one and was therefore selected to be included in the cost-benefit analysis.

Water Allocated (AFY): WHA (2005b, p. 45) estimates 450 AFY.

Habitat Created: WHA (2005b, p. 45) estimates 200 acres of water/wetland will be created.

Habitat Value (rating): Because of the open water created (a rare habitat type in the Owens Valley) the habitat created at Warren Lake will provide critical shorebird and waterfowl habitat. This site is therefore rated HIGH.

*Cost/acre ($/AC):*WHA (2005b, Table 5-1, p. 53) estimates $30/acre.

Total Cost ($): WHA (2005b, Table 5-1, p. 53) estimates the cost to be $6000.

Site: Collins Artesian (OBEC, 2005b)

Water Allocated (AFY): OBEC (2005b, p.36) recommends 200-400 AFY but recommends 900 AFY on page 73. 900 AFY was selected because it has specific acreage associated with it (Table 6, p. 73).

Habitat Created: OBEC (2005b, p. 30) estimates 40 acres to be created, 44 (p. 36) and 45 acres (p.73). 45 acres was chosen because it had a specific water allotment associated with it (Table 6, p. 73).

Habitat Value (rating): OBEC (2005b, Table 6, p. 73) rates the value HIGH.

*Cost/acre ($/AC): $*1,215,000 (total cost) / 45 (habitat created) = $27,000/acre

Total Cost ($): Total Implementation costs are estimated to be $1,215,000 (OBEC, 2005b, pp. 36 and 73), as well as Appendix C (OBEC, 2005b).

Site: Fish Springs East (OBEC, 2005b)

OBEC (2005b) did not present any estimates for the criteria considered in this analysis for Fish Springs East. Several comments[37] requested that this site be included in the analysis. To this end, all estimates for the criteria listed below were generated by Ecosystem Sciences based on the information provided in OBEC (2005b). These estimates should be viewed as rough approximations rather than precise predictions based on exhaustive analysis. This process is the only option given the available information, budget, and timeline.

Water Allocated (AFY): To determine the amount of water needed, the number of acres of habitat gained for each wetland habitat type was multiplied by 6 AFY[38]. The results of this analysis are found in Table 5.1.1. The estimated water allocation for this site is approximately 793 AFY.

Habitat Created: OBEC (2005b) did not provide acreages of existing or created habitat at Fish Springs East. OBEC did provide an aerial image depicting pre and post restoration, which highlighted restored features (Figure 4.24). Therefore, the Greenbook (ICWD and City of Los Angeles 1990) was used to estimate existing habitat, and a modified Greenbook (ICWD and City of Los Angeles 1990) based on OBEC's (2005b) restored conditions was used to estimate created habitat. The Greenbook was modified by altering existing, or digitizing new, polygons for Modoc-Great Basin Cottonwood-Willow Riparian Forest and Great Basin Wet Meadow based on OBEC's (2005b) restored conditions in ArcMap 9.1. The results of this analysis are summarized in Table 5.1.1.

[37] Mark Bagley (Sierra Club MOU rep.) and Carla Scheidlinger (OVC president) requested both Fish Springs East and Calvert Slough not be dismissed and excluded from analysis in their comments in an email memorandum dated December 7, 2005. In a December 6, 2005 letter, Tom Brooks (ICWD director) expressed that Fish Springs East should not be not be excluded from analysis.

[38] Estimated amount of water needed to create/enhance an acre of wetland with the land-types found at Fish Springs East (Whitehorse Associates, personal communication 2006).

Table 5.1.1 Pre and post-restoration habitat conditions at Fish Springs East following Ecosystem Sciences analysis of OBEC mitigation plan.					
Pre-restoration vegetation type	**Acres**	**Post-restoration vegetation type**	**Acres**	**Habitat Gain/Loss**	**AFY**
Alkali Meadow	156.8	Alkali Meadow	41.08	-115.75	0.00
Desert Greasewood Scrub	26.15	Desert Greasewood Scrub	12.42	-3.73	0.00
Desert Sink Scrub	9.50	Desert Sink Scrub	6.77	-2.73	0.00
Great Basin Wet Meadow	0.00	Great Basin Wet Meadow	84.59	84.59	507.54
Modoc-Great Basin Cottonwood-Willow Riparian Forest	24.10	Modoc-Great Basin Cottonwood-Willow Riparian Forest	71.68	47.58	285.47
Total	217	Total	217	+132.17 wetland	793.01

The results indicate that approximately 132 acres of wetland will be created by this mitigation plan.

Habitat Value (rating): The habitat created at this site is a combination of riparian forest and wet meadow. Both of these have value to wildlife, and riparian forest has a high value. Therefore the habitat rating for this site is MEDIUM.

Cost/acre ($/AC): $2,510,149 (total cost) / 132 (habitat created) = $19,016/acre.

Total Cost ($): To compute the total cost, Ecosystem Sciences estimated the cost of each of the 3 actions described by OBEC (2005b, p. 56) under the heading *Measures*. Two of the measures are very similar to those presented for the site Northeast of Big Pine (A and C, below). Thus, the cost for the measures for the Northeast of Big Pine site was scaled to reflect the size of the Fish Springs East site. The third measure (B, below) was not beyond these measures, so cost was added to accomplish this item.

Measures OBEC (2005b, p. 56)*:*
A. Channel previously straightened and entrenched. Reconstruct sinuosity, restore riparian corridor similar to natural condition.
B. Construct in-channel habitat such as gravel bars and pools.
C. Revegetate area, with riparian, wetland, and transitional upland.

OBEC (2005b) estimated $1,110,295 for implementation costs to perform measures A and C at Northeast of Big Pine. The proposed action at Northeast of Big Pine performs these actions on 1144 meters of stream corridor. We then computed the cost/meter for these measures:

$1,110,295 / 1144 = $971/meter
(total cost) / (meters of restored stream channel) = (cost/meter of channel)

The proposed action at Fish Springs East covers 2607 meters of stream channel. We therefore multiplied this number by the cost/meter at the Northeast of Big Pine site.

*$917 * 2607 = $2,390,619*
*(cost/meter) * (meters to be restored) = (cost for measures A and B)*

The Northeast of Big Pine site does not include measure B. Constructing these pools and gravel bars might entail more materials. To compensate for this measure we added 5% to the cost computed for measures A and C.

$2,390,619 + $119,530 = $2,510,149
(cost for measures A and C) + (cost for measure B [5% of A and C]) = (total cost)

Site: Northeast of Big Pine (OBEC 2005b)

Water Allocated (AFY): OBEC (2005b, p. 48) recommends 100 AFY.

Habitat Created: OBEC (2005b) presents three different estimates: 21.5 acres of new habitat will be created (p.31), 20 acres (p. 47), and 22 acres are estimated in Appendix A: *Additional Site Assessment* by subtracting the existing wetland/forest (2 acres) from the restored wetland/forest acres (25 AC). 21.5 acres was chosen because it best represents the spread of estimates presented in the OBEC report.

Habitat Value (rating): The habitat created at this site is a combination of riparian forest and wet meadow. Both of these have value to wildlife, and riparian forest has a high value. Therefore the habitat rating for this site is HIGH.

Cost/acre ($/AC):$1,110,295.33 (total cost) / 21.5 (habitat created) = $51,641/acre.

Total Cost ($): An estimated cost of $1,110,000 is presented by OBEC (2005b, p. 48) and $1,110,295.33 is estimated in Appendix C: Mitigation Costs (OBEC 2005b).

Site: Mazourka Artesian (OBEC 2005b)

Water Allocated (AFY): OBEC (2005b, p. 39) recommends 200-500 AFY and 500 AFY in Table 6 (p.73). 500 AFY was chosen because it is associated with specific acres of habitat created and costs.

Habitat Created: OBEC (2005b, p. 30) presents 19.42 acres of wetland/riparian forest will be restored/created. 25 restored acres is also estimated for the site by OBEC (2005b, pp. 39 and 73). 25 acres was chosen as the estimate due to preponderance of evidence and correlation with AFY presented in Table 6 (p.73).

Habitat Value (rating): OBEC (2005b, Table 6, p. 73) rates the value MEDIUM.

Cost/acre ($/AC): $692,412.50 (total cost) / 25 (habitat created) = $27,696/acre.

Total Cost ($): An estimated cost of $692,000 is presented by OBEC (2005b, pp. 39 and 73), and $692,412.50 is estimated in Appendix C: Mitigation Costs (OBEC 2005b). $692,412.50 was selected.

Site: Hidden Lake (OBEC 2005b)

Water Allocated (AFY): OBEC (2005b, p. 42) recommends 200-500 AFY and 500 AFY in Table 6 (p.73). 500 AFY was chosen because it is associated with specific acres of habitat created and costs.

Habitat Created: OBEC (2005b, p. 30) presents 29.5 acres of wetland/riparian forest will be restored/created. On page 42, 22 acres of riparian forest and 7 acres of wetland for a total of 29 restored acres is estimated for the site. On page 73, 25 acres is estimated and was chosen as the estimate due to its correlation with AFY presented in Table 6.

Habitat Value (rating): OBEC (2005b, Table 6, p. 73) rates the value MEDIUM.

Cost/acre ($/AC): $765,882 (total cost) / 25 (habitat created) = $30,635/acre.

Total Cost ($): An estimated cost of $766,000 is presented by OBEC (2005b, pp. 42 and 73), and $765,882 is estimated in Appendix C: Mitigation Costs (OBEC 2005b). $765,882 was chosen.

Site: Hidden Lake (WHA 2005b)

Of the different alternatives presented in the Whitehorse Associates Preliminary Restoration Plans for Hines Spring, Hidden Lake, and Warren Lake (WHA 2005b), area 2 was selected for this analysis due to its size and acreage created.

Water Allocated (AFY): WHA (2005b, p. 37) allocates 235 AFY.

Habitat Created: WHA (2005b, p. 37 and Table 5-1, p. 53) estimates 28 acres of wetland/open water created.

Habitat Value (rating): The habitat value for this site is MEDIUM.

Cost/acre ($/AC):$423,000 (total cost) / 28 (habitat created) = $15,107/acre.

*Total Cost ($):*WHA (2005b, Table 5-1, p. 53) estimates $423,000.

Site: Calvert Slough (OBEC 2005b)

OBEC (2005b) did not present estimates for the criteria considered in this analysis for Calvert Slough. Several comments[39] requested that this site be included in the analysis.

[39] Mark Bagley (Sierra Club MOU rep.) and Carla Scheidlinger (OVC president) requested both Fish Springs East and Calvert Slough not be dismissed and excluded from analysis in their comments in an email memorandum dated December 7, 2005. In a Dec. 6th letter, Tom Brooks (ICWD director) expressed that Slough should not be not be excluded from analysis. In a December 7th, 2005 letter, Gene Coufal of LADWP asserts that removing Calvert Slough from consideration is not at the discretion of consultants and should be included in the analysis.

To this end, all estimates for the criteria listed below were generated by Ecosystem Sciences based on the information provided in OBEC (2005b). These estimates should be viewed as rough approximations rather than precise predictions based on exhaustive analysis. This process was the only option given the available information, budget, and timeline.

An additional consideration at Calvert Slough is that a 40 AC irrigated parcel would conflict with current restoration efforts in the area, and the Taboose Creek flow, in below-normal runoff years, is so low that there is not sufficient water for the existing irrigated pasture (Type E vegetation) or to maintain the existing riparian vegetation and fishery in the creek below the diversion. Currently, Calvert Slough only receives water when it is available.[40]

Water Allocated (AFY): To determine the amount of water needed, the number of acres of habitat gained for each wetland habitat type was multiplied by 9 AFY[41]. The results of this analysis are found in Table 5.1.2. The estimated water allocation for this site is approximately 517 AFY.

Habitat Created: OBEC (2005b) did not provide acreages for existing or created habitat, but did provide a map of pre and post restoration conditions (Figure 4.15). The pre and post-restoration conditions map (Figure 4.15) was used to estimate acreages for exiting habitat and created habitat. Acreages were obtained by aligning OBEC's (2005b) pre and post restoration maps and digitizing habitat types in ArcMap 9.1 The results of this analysis is summarized in Table 5.1.2.

Table 5.1.2 Pre and post-restoration habitat conditions at Calvert Slough
following Ecosystem Sciences analysis of OBEC mitigation plan.

Pre-restoration vegetation type	Acres	Post-restoration vegetation type	Acres	Habitat Gain/Loss	AFY
Emergent Marsh	0.52	Emergent Marsh	21.42	20.89	188.03
Open Water	0.00	Open Water	3.24	3.24	29.18
Riparian Forest	46.86	Riparian Forest	80.14	33.28	299.54
Road	0.25	Road	0.00	-0.25	0.00
Upland	38.92	Upland	15.55	-23.37	0.00
Wet Meadow	71.26	Wet Meadow	37.31	-33.95	0.00
Total	157.82	Total	157.66	+23.5 wetland	516.75

Although approximately 57.5 acres of emergent marsh, open water and riparian forest will be gained through the proposed action, 33.95 of those acres are converted from wet meadow. Since wet meadow is a wetland type, this conversion does not represent a net gain in wetland, but rather an improvement of existing wetlands. The net wetland gain is therefore 57.5 acres less 33.95 acres for a net gain in wetland acres of 23.5.

Habitat Value (rating): The habitat created at this site is a combination of riparian forest, emergent marsh, and open water. Both riparian forest and open water are rare and

40 Gene Coufal, LADWP letter to ICWD October 28, 2004. Subject: *Water Supply to Calvert Slough*

41 Estimated amount of water needed to create/enhance an acre of wetland with the lad-types found at Calvert Slough (Whitehorse Associates, personal communication 2006).

valuable habitat types. The size of the existing riparian complex at Calvert Slough and its location in the landscape (connected to the river corridor) add to the habitat value. Therefore the habitat rating for this site is HIGH.

Cost/acre ($/AC): $1,904,421 (total cost) / 23.5 (habitat created) = $81,040/acre.

Total Cost ($): To compute the total cost, Ecosystem Sciences estimated the cost of each of the 3 *Measures* described by OBEC (2005b, p. 53). Two of the measures are very similar to those presented for the site Northeast of Big Pine (channel excavation/habitat creation and revegetation). To estimate the cost of these measures, the cost/meter from the computations for Fish Springs East total cost (derived from Northeast of Big Pine estimates) was multiplied by the number of meters of channel restoration at Calvert Slough. In addition to these measures, at least one diversion structure must be installed to accomplish the mitigation plan presented by OBEC. Examination of OBEC maps of the restoration site (OBEC 2005b, p. 55) appears to show the ditch flowing south from Taboose Creek being cut off by the new channel. If the current ditch is to continue to operate, another diversion structure would be needed.

The measures presented by OBEC (2005b, p. 53) are:

D. Construct diversion structure or move the Taboose Creek channel to convey water from Taboose Creek south to meadow area.
E. Construct channel habitat adjacent to the Owens River.
F. Revegetate area with riparian, wetland, and transitional upland plant species.

The proposed action at Calvert Slough covers 1951 meters of stream channel. We therefore multiplied this number by the cost/meter at the Northeast of Big Pine site.

*$971 * 1951 = $1,894,421*
*(cost/meter) * (meters to be restored) = (cost for part of measure A, measure B and C)*

The cost of constructing the diversion structure must then be added to this subtotal.

$1,894,421 + $10,000 = $1,904,421
(subtotal from above) + (diversion structure cost) = (total cost estimate)

Site: Hines Spring (OBEC)

Water Allocated (AFY): The OBEC (2005b, p. 45 and Table 6, p. 73) recommends 540 AFY be allocated to this site.

Habitat Created: OBEC (2005b, p. 31) presents an estimated 5.5 acres of riparian forest and a total of 7 restored acres. OBEC (2005b, p. 44) also estimated that 12 acres of riparian forest will be created. On pages 45 and 73 of OBEC (2005b), 12 acres of total restored acres are presented. 12 acres was chosen as the estimate due to its correlation with AFY presented in Table 6 on page 73.

Habitat Value (rating): OBEC (2005b, Table 6, p. 73) rates the value MEDIUM.

Cost/acre ($/AC):$726,017 (total cost) / 12 (habitat created) = $60,251/acre.

Total Cost ($): An estimated cost of $726,000 are presented by OBEC (2005b, pp. 45 and 73), and $726,017.50 is estimated in Appendix C: Mitigation Costs. $726,017 was chosen as the estimate.

Site: Hines Spring (WHA 2005b)

WHA (2005b) presents a myriad of alternatives for Hines Spring. Table 5-9: Assessment summary for projects/zones/areas/alternatives, on page 70 presents and assesses the different alternatives. The best-ranked alternative, based on habitat, cost and HGM assessment, as well as the alternative that creates the most habitat at Hines is the first row of the table and labeled Hines/Zone3 and Zone 2/Area and Zone1/Areas 1, 2, and 3. This alternative was chosen for the cost-benefit analysis.

Water Allocated (AFY): 1325 AFY is estimated by WHA (2005b, Table 5-9, p. 70).

Habitat Created: 155 acres is estimated by WHA (2005b, Table 5-9, p. 70).

Habitat Value (rating): Because of the large, complex array of habitat created, and its place in the landscape, the habitat rating is HIGH.

Cost/acre ($/AC):$583,200 (total cost) / 155 (habitat created) = $3,763/acre.

Total Cost ($):$583,200 is estimated by WHA (2005b, Table 5-9, p. 70).

Table 5.1.3 Cost- Benefit Analysis Table						
Site	**Water Allocated (ac/yr)**	**Habitat Created (acres)**	**Habitat Value (rating)**	**Cost/ Acre ($)**	**Total Cost ($)**	**Cost/ Benefit (rank)**
Warren Lake (OBEC)	75	5	Low	2,000	10,000	2
Warren Lake (WHA)	450	200	High	30	6,000	1
Collins Artesian (OBEC)	900	45	High	27,000	1,215,000	9
Fish Springs East (OBEC)	793	132	Medium	19,016	2,510,149	10
NE of Big Pine (OBEC)	100	21.5	High	51,641	1,110,295	8
Mazourka Artesian (OBEC)	500	25	Medium	27,696	692,412	5
Hidden Lake (OBEC)	500	25	Medium	30,635	765,882	7
Hidden Lake (WHA)	235	28	Medium	15,107	423,000	4
Calvert Slough (OBEC)	517	23.5	High	81,040	1,904,421	11
Hines Spring (OBEC)	540	12	Medium	60,251	726,017	6
Hines Spring (WHA)	1325	155	High	3,763	583,200	3

5.2 LESSEE IMPACTS[42]

The allocation of 1,600 AFY of water to mitigate "on-site" and "off-site" areas has potential to cause economic and social loss along with other hardships to those lessees whose leases are selected for the mitigation projects. Grazing activity at proposed mitigation project sites, once implemented, should be restricted from grazing as trampling and grazing would jeopardize project success (Otis Bay 2005b). Success of transplanted establishment and survival (of vegetation) will likely be dependent upon grazing restrictions (OBEC, 2005b). Livestock grazing has been identified as one of the uses that may not be compatible with mitigation efforts.

The proposed artificial construction of stream channels, spring heads, vents and ponds, and the artificial planting of riparian forest and possibly sedges are not only expensive, the construction and planting, once implemented, are very fragile and easily damaged. OBEC (2005b) recommends pole plantings of *Salix* and *Populus* species, sod installation of saltgrass and other graminoids, container plantings of various shrubs, and forbs. Because LADWP will have very large investments in the planning, implementation, and maintenance of most of the projects proposed, it would be in the best interest of LADWP to fully protect these sites from any damage caused by grazing.

The MOU calls for the continuation of sustainable uses such as livestock grazing and agriculture. Also, the MOU requires consultants to recommend reasonable and feasible mitigation measures. Therefore, each proposed mitigation site must be evaluated as to whether the project is reasonable and feasible and the implementation of the project would continue to sustain livestock grazing and agriculture.

Most proposed mitigation projects, if implemented, would reduce the AUMs of forage available for livestock, cause a reduction in livestock numbers, result in possible changes in duration and timing of grazing, and increase the cost to the lessee of managing the grazing lease. To evaluate the loss or hardship to the lessees from implementing a proposed mitigation project within his or her lease, a $10.00 rate was used for the value of one AUM of forage. This rate is very conservative, as the United States Department of Agriculture (USDA 2004) lists the value of an AUM of forage in California at $16.50. Also, because almost all the available forage in the Owens Valley is already allocated, it could be impossible for a lessee to purchase replacement AUM's of forage in other locations.

The lessee is presently responsible for maintaining almost all fences within their lease and possibly responsible for any required new fence construction. At this time the cost is applied to the lessee. New fence construction was valued at $3.21 per running foot of fence (Appendix 3) based on present fence construction costs by LADWP. All needed cattle guards, gates, signing, road re-routing, additional road construction, fence safety modifications, stream crossings, "walk throughs", "walk overs", and elk modified fence reaches are included in the cost per running foot.

[42] Instructions from the Inyo County Board of Supervisors (letter dated 12/14/05) and LADWP (letter dated 12/7/05) require an assessment of impacts on lessees by all projects. Letters from lessees Mark Lacey (12/5/05), Dennis Winchester (11/30/05), Ron Yribarren (11/29/05), Mark Johns (12/7/05), and Gary Giacomini (12/6/05) all cite the MOU requirement to consult with any affected lessee and to minimize or avoid impacts to lessees.

Annual fence maintenance cost was valued at $0.10 per running foot of fence. This maintenance cost includes all maintenance and replacement of cattle guards, gates, road beds, "walk throughs", "walk overs", stream crossings, safety modifications, and elk access modifications. The elimination of an existing fence was set at $0.38 per running foot. The economic loss over-time to the lessee was projected over two generations (50 years). An alternate evaluation approach to AUMs, and probably more reliable, was to value the loss of not being able to graze a cow at $300 per animal head year. $300 per year of monetary gain per cow grazed for a lessee is probably reasonable. But, a $300 per year monetary gain to a lessee per packer horse/mule may be too low. The loss of not being able to graze a packer horse/mule was set at $475 per head year.[43]

The following evaluation assesses the cost to the lessee if a proposed mitigation project is implemented on their lease. These are ballpark estimates, but, suitable to use for site comparison purposes. Only the lessee can fully and accurately evaluate the financial, social, future generation effects, and hardships caused by forced changes in management to his or her lease.

Using economic values (Appendix 3) derived for each lease containing a proposed mitigation site, each project can be rated as whether it is reasonable and/or feasible as it relates to lessee impacts. Also to be considered is the MOU direction to sustain livestock grazing in the Owens Valley.

Lease maps for each lease evaluated in this report can be found in Appendix 2.

Lessees Potentially Impacted

Hines Spring Mitigation Site In The Aberdeen Grazing Lease

Denis Winchester

Collins Artesian Mitigation Site In The Big Pine Grazing Lease

Ronnie and Cathy Yribarren

Calvert Slough Mitigation Site In The ST Grazing Lease

Jack and Todd Tatum

Warren Lake Mitigation Site In The 4-J Grazing Lease

Mark and Lana Johns

Mazurka Artesian Mitigation Site In The Blackrock Grazing Lease

Mark and Brenda Lacey

[43] Personal communication with Mr. Dennis Winchester, the lessee, on 1-27-06.

Hidden Lake Mitigation Site In The Blackrock Grazing Lease

Mark and Brenda Lacey

Northeast Big Pine Mitigation Site In The Round Valley Grazing Lease

George Mendiburu

Fish Spring East Mitigation Site In The 4-J Grazing Lease

Mark and Lana Johns

Lessee Impacts By Site

1. Hines Spring Mitigation Site (based on WHA Mitigation Plan)

The proposed Hines Spring mitigation site occurs in the Aberdeen Grazing Lease in the Hines Spring Parcel (2,878 acres) in the Pipeline, Division, and Hatchery Pastures. The grazing lease is used to graze horses and mules used in a commercial packer operation. The Hines Spring Exclosure will include the original Hines Spring source and downstream channels to the Goodale Road. Livestock grazing would be excluded from the exclosure.

Up to 60 head of mules and horses are allowed to presently graze the Hines Spring Parcel from October 1 through May 15 of the following year for a potential 450 AUM's of livestock forage harvested annually. Although the Hines Spring Exclosure will be excluded from livestock grazing, elk will continue to use the area. Four artificial spring heads, 4 ponds, stream channels, dikes, and planting of riparian shrubs, trees (350), and possibly sedges would take place within the exclosure. The exclosure and grazing management changes will protect 192 acres of enhanced habitat total. This exclosure includes 155 acres of new wetland and 37 acres of enhanced upland habitat.

To protect the proposed Hines Spring mitigation area an exclosure (205 acres) will be constructed to cover the original Hines Spring source, other spring heads and vents, and downstream artificial channels to protect all habitat produced within the exclosure. To protect habitat enhanced outside the exclosure, all grazing will cease in the Hines Spring Parcel for 3 years after project implementation. During this 3 year period, LADWP will find off-site forage for up to 60 mules/horses.

Construction of the Hines Spring Exclosure (205 acres) will eliminate, from grazing, 7% of the livestock forage in the Hines Spring Parcel (2,878 acres). Livestock numbers and/or possibly duration of grazing will be reduced to compensate for the forage loss. An additional 6,102 running feet of new fence (exclosure purposes) will be constructed and maintained over-time. Approximately 2,930 running feet of fence will be removed.

<u>Impacts On Lessee</u>

32 AUMs of forage will be lost to livestock grazing with an annual value of $320 for an over-time loss of $16,000. Or, the reduction of 4.2 packer horse/mule head years from the lease will result in an annual loss of $1,995 for an over-time loss of $95,750. Constructing 6,102 running feet of new fence will cost $19,587. Maintaining 6,102 running feet of new fence will cost $610 annually with an over-time cost of $30,500.

Table 5.2.1 Potential Total Cost To Lessee - at Hines Spring; RLI-479**.**

Annual Cost	Over-Time Cost	Start-Up Cost
$930 to $2,605	$46,500 to $126,250	$20,700

Table 5.2.2 Hines Spring Lease

Table of projected structural changes to the grazing lease at Hines Spring; RLI-479.

Hines Spring RLI-479	
Total Exclosure Size (Acres)	203
Total Fence for Exclosure (Mile)	2.2
New Fence Required for Exclosure (Mile)	1.2
Fence to be Removed (Mile)	0
New Cattle Guards Required	1
# of New Gates Required	2
# Gates to be Removed	0
# of Walk Through Required	0
# of water Control Structures Required	0

1A. Hines Spring Mitigation Site (based on OBEC Mitigation Plan)

The OBEC proposal would call for an exclosure 25% the size needed for the WHA exclosure. There would be no need to rest from livestock grazing the non-exclosed area. Cost over-time would equal $31,563; start-up cost would be $5,175 with an annual cost of $651.

2. Collins Artesian Mitigation Site (based on OBEC Mitigation Plan)

Mitigation measures are proposed for the area around well site V047 south of the Collins Road in the Big Pine Canal Grazing Lease in the Canal Parcel in the South 40 Field (2,927 acres). The proposed project calls for using water from an existing artesian well

(V047) and potentially constructing one or two new artesian wells north of well V047. The primary objective is to create spring habitat types (Otis Bay 2005b). Approximately 17,000 feet of artificial outflow channel and two or three artificial spring heads would be constructed. The area would receive artificial riparian tree, shrub, and possibly sedge plantings.

A 478 acre exclosure would be required to protect LADWP investments and favor vegetation development. The 478 acre exclosure would require 13,200 feet of new fence construction. Because much of the site occurs on the first terrace above the Owens River, the area produces more forage per acre than the higher elevation lands in the field. The exclosure will eliminate 65% of the available forage in the South 40 Field from livestock grazing.[44] Elk will continue to use the exclosure if they so desire.

The herd (1000 cows/calves) grazes the South 40 Field from December 1 through February 1. The South 40 Field provides 2,000 AUMs of forage with the proposed exclosure area providing 1,300 of these AUMs of forage.

Impacts On Lessee

Approximately 1,300 AUMs of forage will be lost with an annual value of $13,000 and an over-time loss of $650,000. Or, the reduction of 108 cow years from the lease will result in an annual loss of $32,400 for an over-time loss of $1,620,000. Approximately 13,200 running feet of new fence (exclosure purposes) will be constructed for a start-up cost of $42,372. Annual new fence maintenance will cost $1,320 with over-time fence maintenance costing $66,000.

The total cost to the lessee will be $14,320 to $33,720 annually, a over-time loss of $716,000 to $1,686,000, and a potential start-up cost of $42,372.

Table 5.2.3 Potential Total Cost To Lessee - at Collins Road; RLI-438**.**

Annual Cost	Over-Time Cost	Start-Up Cost
$14,320 to $33,720	$716,000 to $1,686,000	$42,372

[44] Personal communication with Mr. Ron Yribarren, the lessee, 1-26-06.

Table 5.2.4 Collins Road Lease Table of projected structural changes to the grazing lease at Collins Road; RLI-438.	
Collins Road RLI-438	
Total Exclosure Size (Acres)	478
Total Fence for Exclosure (Mile)	2.5
New Fence Required for Exclosure (Mile)	2.5
Fence to be Removed (Mile)	0
New Cattle Guards Required	3
# of New Gates Required	3
# Gates to be Removed	0
# of Walk Through Required	2
# of Water Control Structures Required	0

3. Mazourka Artesian Mitigation Site (based on OBEC Mitigation Plan)

The proposed Mazourka Artesian mitigation site is located in the Blackrock Grazing Lease in the Reservation-River Pasture (7,478 acres). The new proposed Artesian Exclosure would be closed to livestock grazing. Elk will continue to use the exclosure if they so desire. 11,000 feet of artificial stream channel is proposed along with the construction of two artificial spring heads. Riparian trees, shrubs, and possibly sedges will be planted within the exclosure.

The exclosure will eliminate 174 acres from grazing. Because these acres are close to the river they have higher forage production than other areas. The exclosure will reduce the amount of available forage for livestock grazing. Animal numbers and/or possible grazing duration will be reduced to account for this reduction. The construction of the new exclosure will require 14,784 running feet of new fence. 1,320 running feet of existing fence will be eliminated.

A 450 cow/calf herd can graze the Reservation-River Pasture (7,478 acres) from November 1 through June 1. The herd harvests a potential 3,150 AUMs of forage from the Reservation-River Pasture. The proposed exclosure area provides 2.3% of this forage equaling 73 AUMs of livestock forage. The actual forage loss is probably higher than this.

<u>Impacts On Lessees</u>

73 AUMs of livestock forage will be lost with an annual value of $730 and an over-time loss of $36,500. Or, the potential loss of 6.1 cow-head years would equal $1,830 annually with an over-time loss of $91,500. The potential start-up cost of constructing the new exclosure fence would be $47,457. Annual maintenance of the new exclosure

fence would cost $1,478 with an over-time cost of $73,900. Eliminating 1,320 running feet of fence would cost $502.

Table 5.2.5 Potential Total Cost To Lessee - at Mazourka Artesian; RLI-428.

Annual Cost	Over-Time Cost	Start-Up Cost
$2,208 to $3,308	$110,400 to $165,400	$47,959

Table 5.2.6 Mazourka Artesian Lease Table of projected structural changes to the grazing lease at Mazourka Artesian; RLI-428.	
Mazourka Artesian RLI-428	
Total Exclosure Size (Acres)	174
Total Fence for Exclosure (Mile)	2.8
New Fence Required for Exclosure (Mile)	2.8
Fence to be Removed (Mile)	0.25
New Cattle Guards Required	6
# of New Gates Required	2
# Gates to be Removed	0
# of Walk Through Required	0
# of water Control Structures Required	5

4. Warren Lake Mitigation Site (based on WHA and OBEC Mitigation Plan)

Implementation of the Warren Lake Mitigation Site would require no new fences, no additional fence maintenance, and no loss of AUMs of forage or cow years. Therefore, the loss to the lessee from implementing and maintaining the Warren Lake Mitigation Site is negligible.

Table 5.2.7 Warren Lake Lease Table of projected structural changes to the grazing lease at Warren Lake; RLI-491.	
Warren Lake RLI-491	
Total Exclosure Size (Acres)	0
Total Fence for Exclosure (Mile)	0
New Fence Required for Exclosure (Mile)	0
Fence to be Removed (Mile)	0
New Cattle Guards Required	0
# of New Gates Required	0
# Gates to be Removed	0
# of Walk Through Required	0
# of Water Control Structures Required	0

5. Hidden Lake Mitigation Site (based on WHA and OBEC Mitigation Plan)

The proposed Hidden Lake Mitigation Site is in the Blackrock Grazing Lease in the Reservation-River Pasture. The proposed Hidden Lake Exclosure would be closed to livestock grazing. Elk will continue to graze the exclosure if they so desire. Artificial stream channels and spring heads will be constructed, and riparian trees, shrubs, and possibly sedges will be planted.

<u>Impacts On Lessees</u>

The proposed exclosure will eliminate 272 acres from grazing. This will reduce the amount of available forage for the lessee. Animal numbers and/or possible grazing duration will be reduced to account for this reduction. The construction of the new exclosure will require 13,200 running feet of new fence. 3,960 running feet of existing fence will be removed.

A 450 cow/calf herd can graze the Reservation-River Pasture (7,478 acres) from November 1 through June 1. The herd harvests a potential 3,150 AUMs of livestock forage from the Reservation-River Pasture. The proposed exclosure provides 4% of this forage harvest equaling 126 AUMs of forage.

126 AUMs of livestock forage will be lost with an annual value of $ 1,260 and an over-time loss of $63,000. Or, the potential loss of 10 cow years would equal $3,000 annually with an over-time loss of $150,000. The potential start-up cost of constructing the new exclosure fence would cost $42,372. Annual maintenance of the new exclosure fence would cost $1,320 with an over-time cost of $66,000. Eliminating existing fence would cost $1,504.

Table 5.2.8 Potential Total Cost To Lessee - at Hidden Lake; RLI-428**.**

Annual Cost	Over-Time Cost	Start-Up Cost
$2,580 to $4,320	$129,000 to $216,000	$43,876

Table 5.2.9 Hidden Lake Lease

Table of projected structural changes to the grazing lease at Hidden Lake; RLI-428.

Hidden Lake RLI-428	
Total Exclosure Size (Acres)	272
Total Fence for Exclosure (Mile)	2.5
New Fence Required for Exclosure (Mile)	2.5
Fence to be Removed (Mile)	0.75
New Cattle Guards Required	2
# of New Gates Required	3
# Gates to be Removed	1
# of Walk Through Required	4
# of water Control Structures Required	0

6. Northeast of Big Pine (based on OBEC Mitigation Plan)

The proposed Northeast of Big Pine Mitigation Site is in the Round Valley Grazing Lease in the Little Field. The proposed Pine Creek Exclosure would be closed to livestock grazing. Elk will continue to graze the exclosure if they so desire. Artificial stream channels would be constructed along with riparian tree, shrub, and possibly sedge plantings

The exclosure will eliminate 83 acres from grazing. This area contains high forage production per unit area. This will reduce the amount of available forage for the lessee. Animal numbers and/or possible grazing duration will be reduced to account for this reduction. The construction of the new exclosure will require 5,280 running feet of new fence.

A 100 cow/calf herd can graze the Little Field from November 1 through May 1. The herd harvests a potential of 600 AUMs of forage from the Little Field. The proposed exclosure provides 100% of this forage equaling 600 AUMs of livestock forage. This exclosure would enclose most of the available forage in the field and the remainders of the forage would not be worth grazing.[45]

[45] Personal communication with George Medeburu, the lessee, 1-26-06

Impact On Lessee

600 AUMs of livestock forage will be lost with an annual value of $6,000 and an over-time loss of $300,000 Or, the potential loss of 50 cow years would equal $15,000 annually with an over-time loss of $750,000. The potential start-up cost of constructing the new exclosure fence would cost $16,949. Annual maintenance of the new exclosure fence would cost $528 with an over-time cost of $26,400.

Table 5.2.10 Potential Total Cost To Lessee - at Northeast of Big Pine; RLI-483.

Annual Cost	Over-Time Cost	Start-Up Cost
$6,528 to $15,528	$326,400 to $776,400	$16,949

Table 5.2.11 Northeast of Big Pine Lease

Table of projected structural changes to the grazing lease at Northeast of Big Pine; RLI-483.

NE of Big Pine RLI-483	
Total Exclosure Size (Acres)	83
Total Fence for Exclosure (Mile)	1.5
New Fence Required for Exclosure (Mile)	1.0
Fence to be Removed (Mile)	0
New Cattle Guards Required	0
# of New Gates Required	4
# Gates to be Removed	0
# of Walk Through Required	2
# of water Control Structures Required	0

7. Fish Springs East of Highway 395 (based on OBEC Mitigation Plan)

The proposed Fish Spring Mitigation Site is in the 4-J Grazing Lease in the South River Field (3,219 acres). A 217 acre exclosure would be constructed to protect the mitigation site. The exclosure will be excluded from livestock grazing. A 350 cow/calf herd grazes the South River Field. Elk will continue to graze the exclosure if they desire. The cow/calf herd grazes the South River Field from November 1 through June 1 for a potential of 2,450 AUMs of livestock forage harvested annually. Artificial stream channels and riparian shrubs and trees and possibly sedges will be planted within the exclosure.

The 217 acre exclosure will eliminate from grazing 10% of the livestock forage in the South River Field. Livestock numbers and/or duration of grazing will be reduced to compensate for the livestock forage loss. An additional 12,672 running feet of new fence (exclosure purposes) will be constructed and maintained over-time.

Impact On Lessee

245 AUMs of livestock forage will be lost to livestock grazing with an annual value of $2,450 for an over-time loss of $122,500, or 20.3 cow years equals $6,090 loss annually with an over-time cost of $304,500. Constructing 12,672 running feet of fence will cost $40,677. Maintaining 12,672 feet of new fence will cost $1,267 annually with an over-time cost of $63,350.

Table 5.2.12 Potential Total Cost To Lessee - at Fish Springs East; RLI-491**.**

Annual Cost	Over-Time Cost	Start-Up Cost
$3,717 to $7,357	$185,850 to $367,850	$40,677

Table 5.2.13 Fish Springs East of Hwy. 395

Table of projected structural changes to the grazing lease at Fish Springs East; RLI-491.

Fish Spring East RLI-491	
Total Exclosure Size (Acres)	217
Total Fence for Exclosure (Mile)	2.6
New Fence Required for Exclosure (Mile)	2.4
Fence to be Removed (Mile)	0
New Cattle Guards Required	0
# of New Gates Required	4
# Gates to be Removed	0
# of Walk Through Required	2
# of water Control Structures Required	0

8. Calvert Slough (based on OBEC Mitigation Plan)

The proposed Calvert Slough Mitigation Site is in the ST Grazing Lease in the Calvert Pasture (657 acres). A 214-acre exclosure will be constructed to protect the mitigation site. The exclosure will be removed from livestock grazing. A 400 cow/calf herd grazes the Calvert Pasture. Elk will continue to graze the exclosure if they desire. The cow/calf herd grazes the Calvert Pasture from November 1 through June 1 for a potential 2,800 AUMs of livestock forage harvested annually. Artificial stream channels and riparian shrubs and trees and possibly sedges will be planted within the exclosure.

The 214 acre exclosure will eliminate from grazing 33% of the livestock forage in the Calvert Pasture. Livestock numbers and/or possibly duration of grazing will be reduced to compensate for the livestock forage loss. An additional 12,672 running feet of new fence (exclosure purposes) will be constructed and maintained over-time.

Impact To Lessee

924 AUMs of livestock forage will be lost to livestock grazing with an annual value of $9,240 for an over-time loss of $462,000. Or, the removal of 77 cow years equals an annual loss of $23,100 for an over-time loss of $1,115,000. Constructing 12,672 running feet of fence will cost $40,677. Maintaining 12,672 running feet of new fence will cost $1,267 annually with an over-time cost of $63,350.

Table 5.2.14 Potential Total Cost To Lessee - at Calvert Slough; RLI-461**.**

Annual Cost	Over-Time Cost	Start-Up Cost
$10,507 to $24,367	$525,350 to $1,178,350	$40,677

Table 5.2.15 Calvert Slough

Table of projected structural changes to the grazing lease at Calvert Slough; RLI-461.

Calvert Slough RLI-461	
Total Exclosure Size (Acres)	213.5
Total Fence for Exclosure (Mile)	3.0
New Fence Required for Exclosure (Mile)	2.4
Fence to be Removed (Mile)	0
New Cattle Guards Required	0
# of New Gates Required	4
# Gates to be Removed	0
# of Walk Through Required	3
# of water Control Structures Required	0

Summation of Lessee Impacts

Table 5.2.16 Summation of Lease Change per Site.
Table of projected structural changes to the grazing lease at each site evaluated.

Site	Lease	Total Exclosure Size (Ac)	Total Fence Exclosure (Mile)	New Fence Required Exclosure (Mile)	Fence to be Removed (Mile)	New Cattle Guards Required	# of New Gates Required	# Gates to Remove	# of Walk Through Required	# of water Control Structures Required
Warren Lake	RLI-491	0	0	0	0	0	0	0	0	0
Collins Road	RLI-438	478	2.5	2.5	0	3	3	0	2	0
NE of Big Pine	RLI-483	83	1.5	1.0	0	0	4	0	2	0
Mazourka Artesian	RLI-428	174	2.8	2.8	0.25	6	2	0	0	5
Hidden Lake	RLI-428	272	2.5	2.5	0.75	2	3	1	4	0
Hines Spring	RLI-479	203	2.2	1.2	0	1	2	0	0	0
Calvert Slough	RLI-461	213.5	0.6	2.4	0	0	4	0	3	0
Fish Springs East	RLI-491	217	2.6	2.4	0	0	4	0	2	0

How a project will affect agriculture (grazing) is principally evaluated through an economic analysis[46] as shown in Table 5.2.17 and as a cost to the lessee for habitat acres gained in Table 5.2.18. Grazing changes required at a site are summarized then evaluated on the basis of lost cow-head years (Hines Spring site in horse/mule head years), the annual cost of these lost years, the total over-time cost of the lost years, new fencing costs (start-up costs), and the annual fence maintenance cost overtime.

[46] An AUM is the amount of forage a cow and calf or one horse will consume in one month. An Owens Valley AUM is worth $10.00. The over-time cost is the loss over two generations (50 years). Fencing costs are calculated as $3.21 per foot of new fence construction and $0.38 per foot of fence maintenance.

Table 5.2.17 Agricultural Impacts Evaluation Table			
Site	**Start-Up Costs**	**Annual Cost**	**Cost Over-Time**
Warren Lake (WHA & OBEC)	$0	$0	$0
Collins Road (OBEC)	$42,372	$33,720	$1,686,000
Fish Springs E. (OBEC)	$40,677	$7,357	$367,850
NE of Big Pine (OBEC)	$16,949	$15,528	$776,400
Mazourka Artesian (OBEC)	$47,959	$3,308	$165,400
Hidden Lake (WHA & OBEC)	$43,876	$4,320	$216,000
Hines Spring (WHA)	$20,700	$2,605	$126,250
Hines Spring (OBEC)	$5,175	$651	$31,563
Calvert Slough (OBEC)	$40,677	$24,367	$1,178,350

Table 5.2.18 Cost to Lessee for Habitat Acres Enhanced.

Cost to lessee for habitat acres enhanced from implementing and maintaining a proposed mitigation project within the lessee(s) lease.

Site	Costs Over-Time	Habitat Acres Enhanced	Cost Per Acre
Warren Lake (WHA)	0	200	0
Warren Lake (OBEC)	0	5	0
Collins Road (OBEC)	$1,686,000	45	$37,467
Fish Springs E. (OBEC)	$367,850	132	$2,787
NE of Big Pine (OBEC)	$776,400	21.5	$36,111
Mazourka Artesian (OBEC)	$165,400	25	$6,616
Hidden Lake (OBEC)	$216,000	25	$8,640
Hidden Lake (WHA)	$216,000	28	$7,714
Hines Spring (OBEC)	$31,563	12	$2,630
Hines Spring (WHA)	$126,250	155	$814
Calvert Slough (OBEC)	$1,178,350	23.5	$50,142

5.3 CONCLUSIONS

The MOU and Amended Stipulation and Order require Ecosystem Sciences to independently evaluate the recommendations and report(s) of subcontractors and, based on this evaluation, to select final reasonable and feasible mitigation measures for Hines Spring and other sites[47]. In compliance with the MOU and Stipulation Order, Ecosystem Sciences has determined that water will be allocated to Hines Spring and to Warren Lake.

Cost to benefit analysis clearly established Hines Spring and Warren Lake as the optimum mitigation sites where environmental benefits (acres and quality of habitat) will be the greatest for the amount of water and money invested (Table 5.1.3). Hines Spring and Warren Lake are also the two mitigation sites that have the fewest impacts on lessees in terms of start-up costs, annual costs, and cost over-time (Table 5.2.17), therefore, promoting sustainable agriculture.

The reminder of this document describes the detailed conditions at Hines Spring and Warren Lake and presents detailed implementation plans, costs and schedules for the two mitigation sites.

[47] MOU Section III 3; Amended Stipulation and Order Item 9 Part 3

6.0 DESCRIPTIONS of FINAL SITE SELECTIONS

The project area description that follows is summarized from Hines Spring Inventory, 2000 Conditions (WHA, 2005a). The description of the Warren Lake area was developed from a less rigorous inventory included in Preliminary Restoration Plans for Hines Spring, Hidden Lake, and Warren Lake (WHA, 2005b).

6.1 HINES SPRING PROJECT AREA

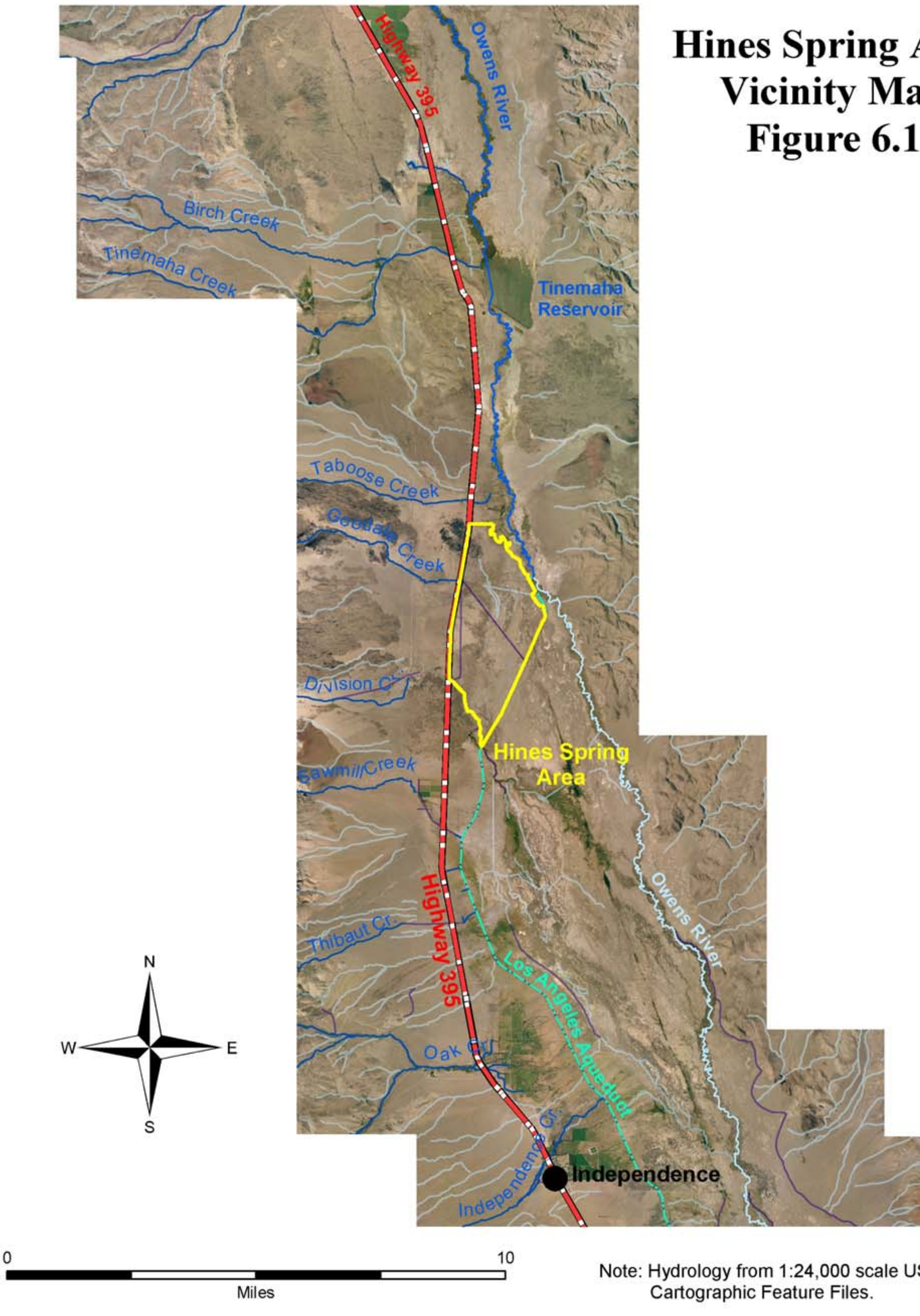
The Hines Spring area (3,329 acres) is south of Big Pine and north of Independence in Owens Valley (Figure 6.1). It is bounded on the west by Highway 395, on the east by the Owens River corridor and the Los Angeles Aqueduct, and on the south by Division Creek Ditch (Figure 6.2). Elevation ranges from about 3,850 feet near Hines Spring to 3,816 feet where Division Creek Ditch intersects the Los Angeles Aqueduct. Average slope is 0.2 percent with south-southeast aspect.

Alluvium and Quaternary volcanic rock are prominent in the Hines Spring area (Figure 6.3). The 1872 fault cuts through the east flank of the area. Surfaces on the east side of this fault shifted as much as 7 meters north and dropped about 1 meter relative to the west side of the fault during the 1872 magnitude 7.6 earthquake. Remnants of the earthquake include six fault basins in the Hines Spring area and another pair of fault basins just north in Calvert Slough.

A paleochannel (Figure 6.4) diverges from the contemporary course of the Owens River at Calvert Slough, about where the 1872 fault intersects the river north of the Hines Spring area. The paleochannel flowed south through the north part of the Hines Spring area and is well expressed where it crosses Goodale Road. South of the road, the paleochannel diverges into several channels that re-converge near Blackrock Spring. Wind-blown sand has filled parts of the eastern paleochannel south of Goodale Road. The paleochannel, augmented by Hines, Blackrock, and Little Blackrock Springs, continued south through the BWMA. The 1872 earthquake confined the Owens River to the east side of the fault. OBEC and Stevens Ecological Consulting (2005a) reported micro-fossil evidence of fish presence in Hines Spring between 320 and 1,120 years before present (bp), suggesting connectivity with the Owens River.

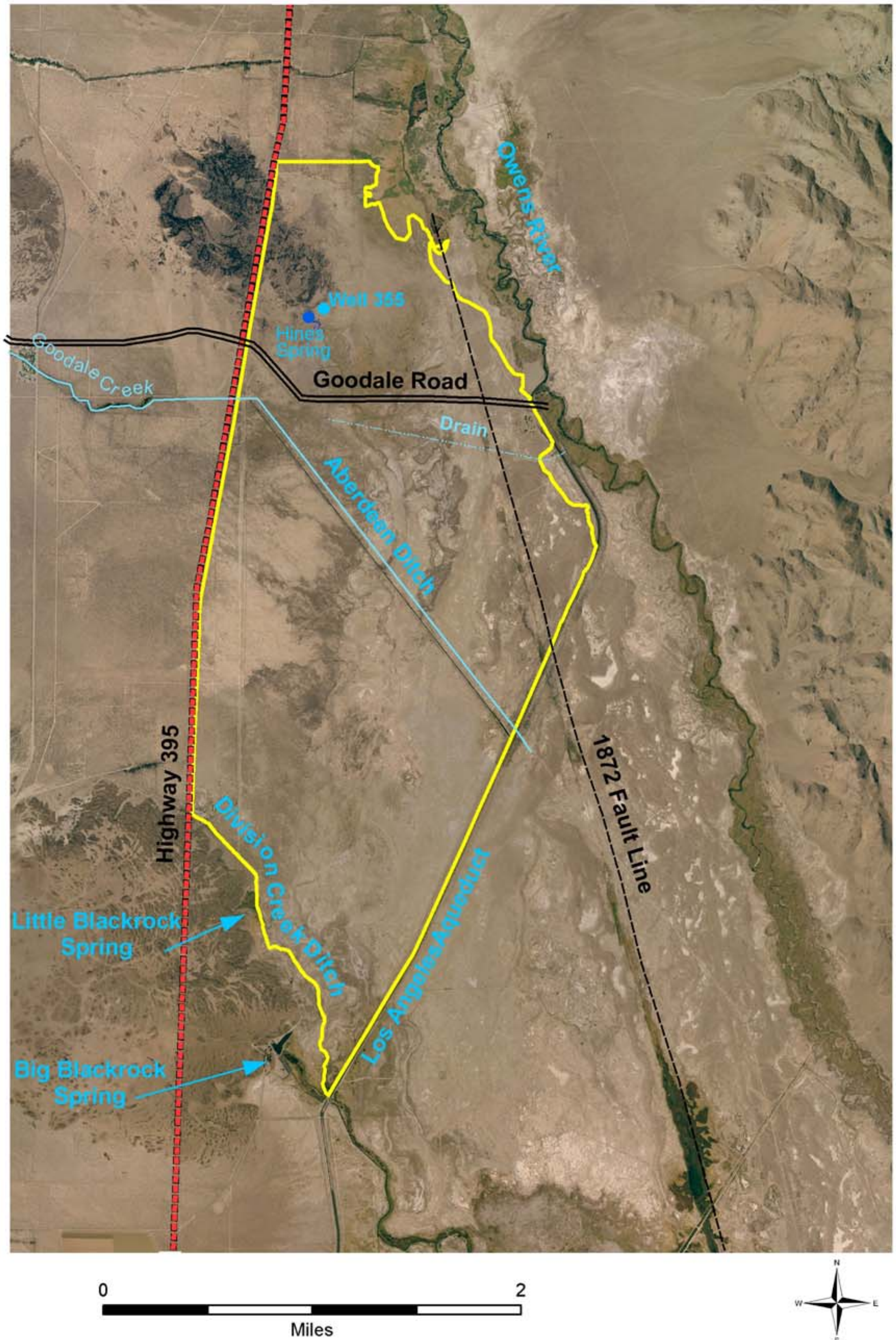
Ground water elevation has been monitored for 20 wells in the Hines Spring area (Figure 6.5), some since 1973. Average annual groundwater elevation varied from about 3,828 feet on the north to 3,804 feet on the south. The grade of the water surface resembles surface topography, sloping at about 0.2 percent with south-southeast aspect. Average annual depth to groundwater (Table 6.1) is about 16 feet, with slightly shallower depths in spring and slightly greater depth in winter. Average annual ground water elevation (Figure 6.6) has varied by more than 15 feet since 1974. Historically, Hines Spring flowed about 4 cfs year-round, of which about 1 cfs reached the Owens River in winter (Lee 1912).

Hines Spring Area Vicinity Map
Figure 6.1

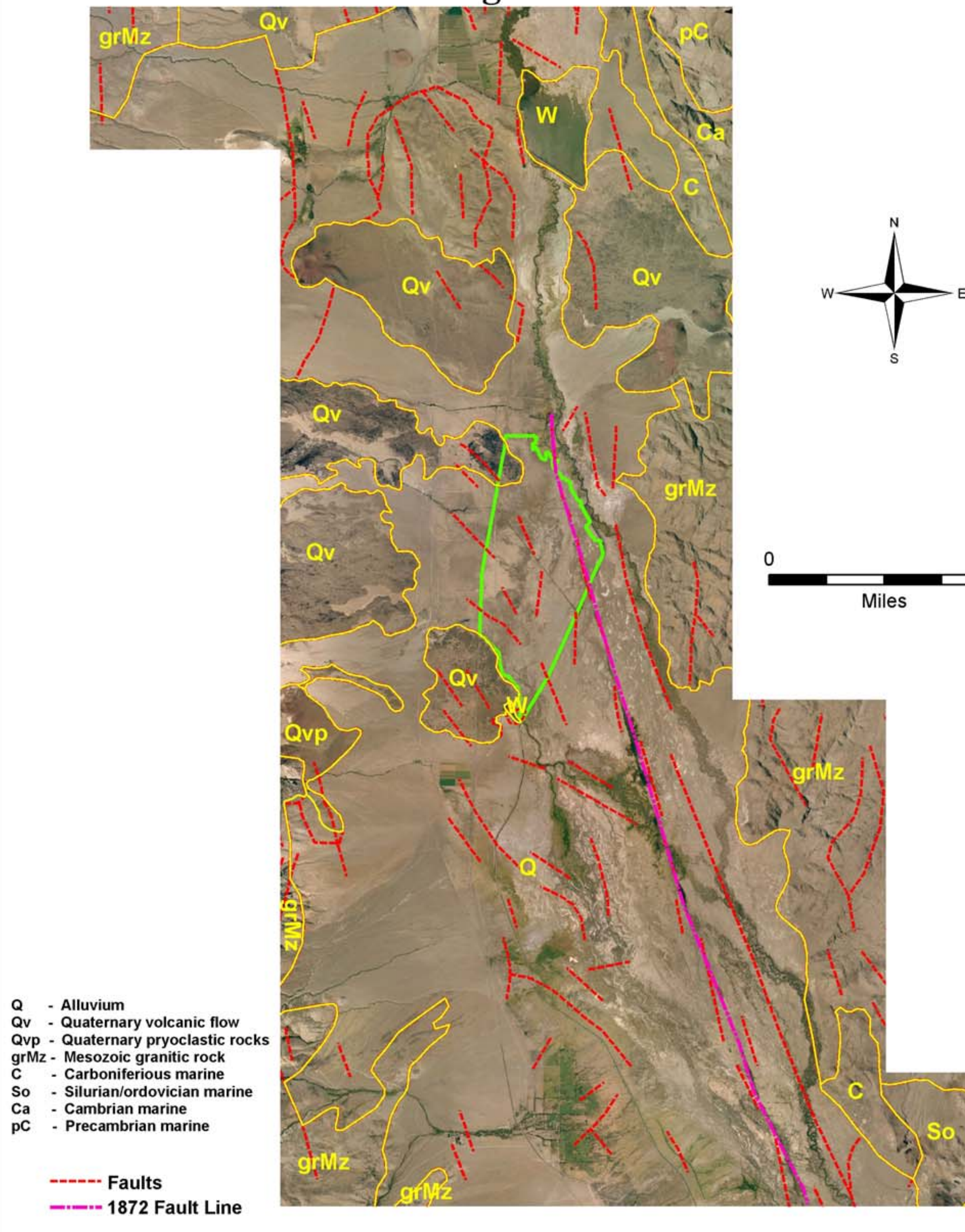


Note: Hydrology from 1:24,000 scale USFS Cartographic Feature Files.

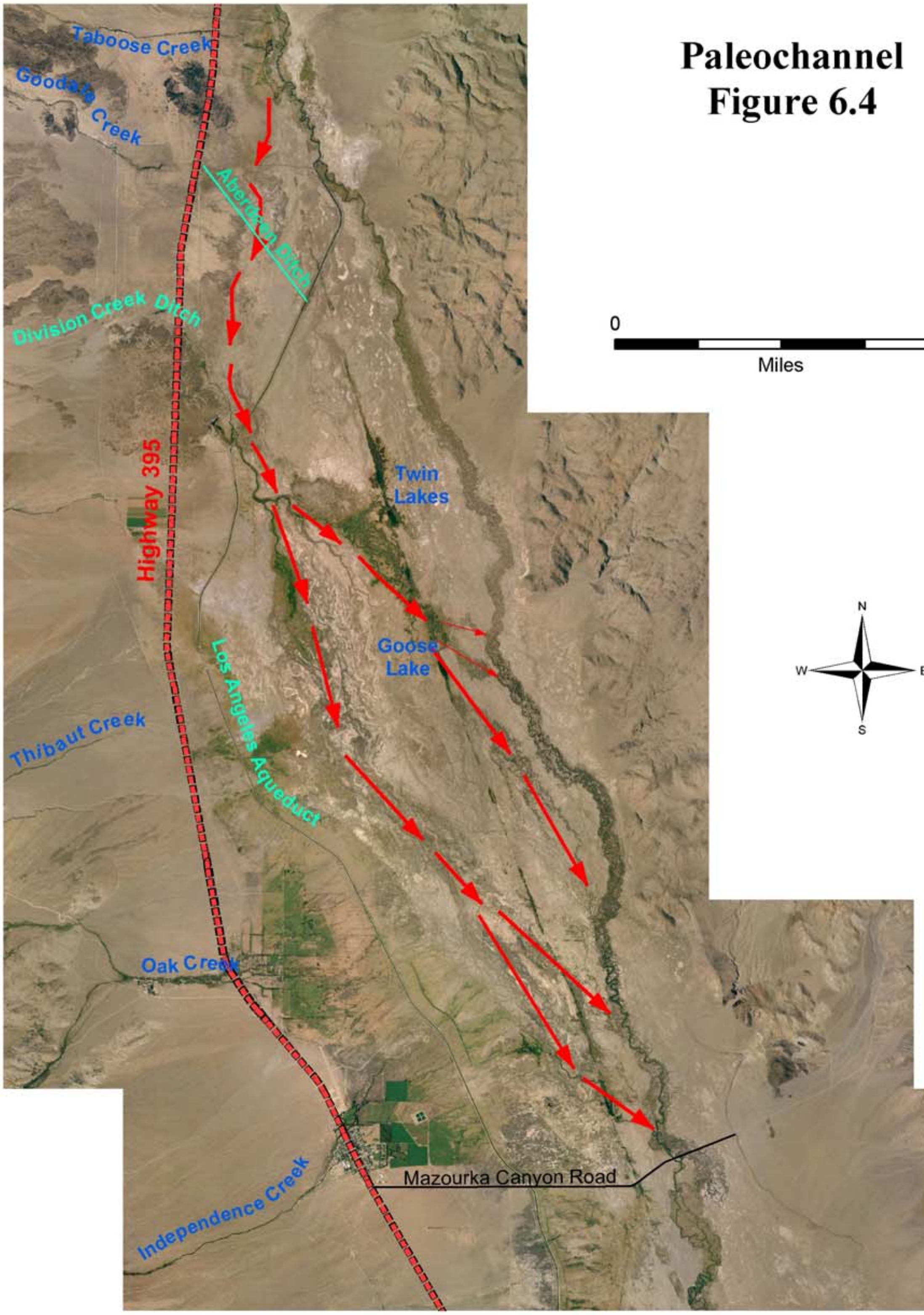
Hines Spring Area
Figure 6.2



Hines Spring Area
Geology
Figure 6.3



Paleochannel
Figure 6.4



Hines Springs Area
Average Annual Groundwater Elevation
1992-2004
Figure 6.5

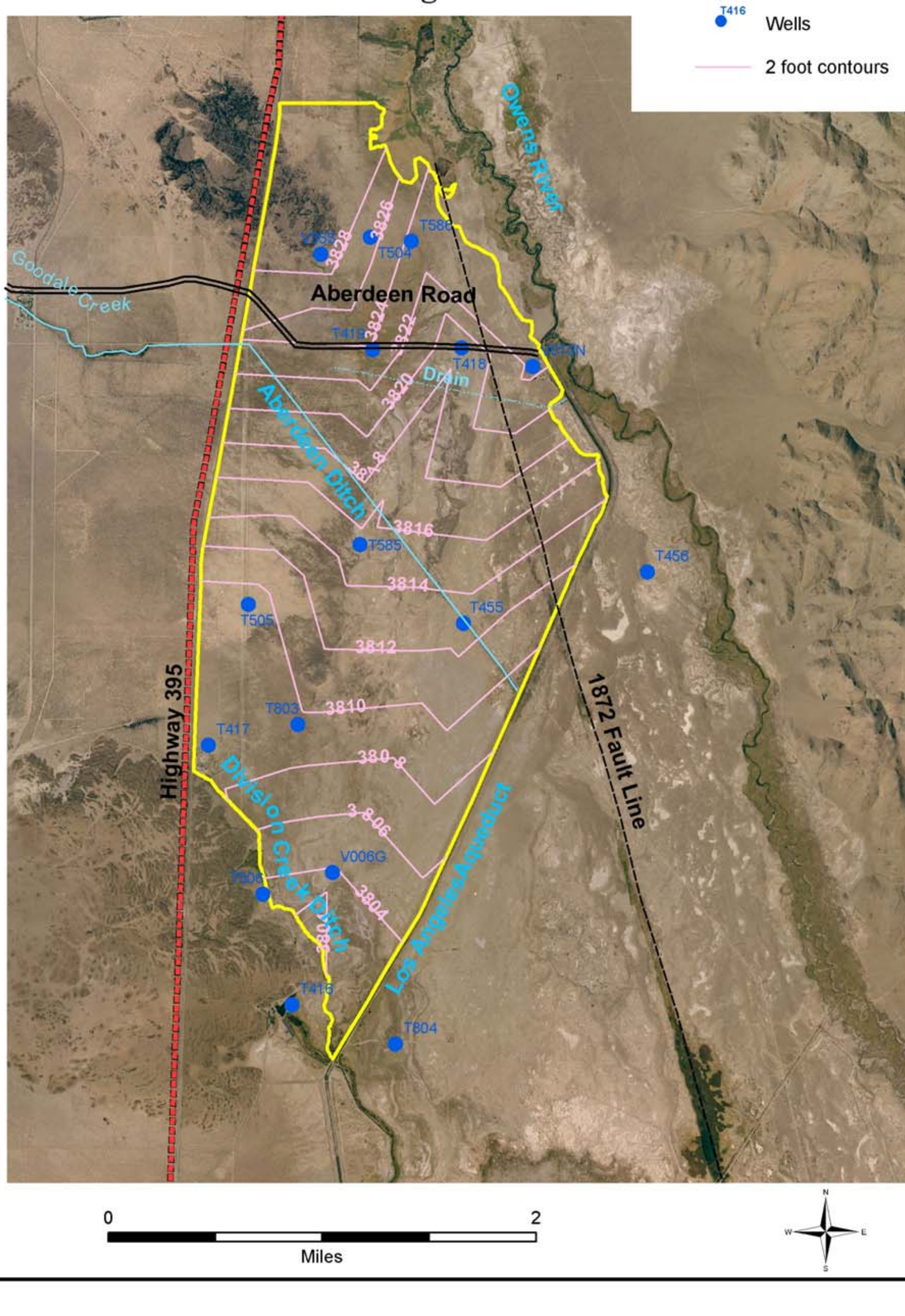


Table 6.1. Average annual ground water depth (feet).										
Year	Winter		Spring		Summer		Fall		Annual	
	N[48]	Avg	N	Avg	N	Avg	N	Avg	N	Avg
1974	6	14.6	7	13.6	7	13.3	8	16.1	6	14.1
1975	8	16.7	6	12.5	7	14.5	7	15.5	6	12.4
1976	6	18.0	7	22.1	5	18.9	7	22.1	5	18.5
1977	5	19.0	9	25.7	9	26.6	8	28.9	6	24.6
1978	7	26.4	8	24.6	10	29.8	11	26.2	7	25.5
1979	11	23.2	11	21.6	11	21.0	11	20.4	11	21.6
1980	11	19.5	11	18.3	11	18.9	11	17.9	11	18.7
1981	11	15.8	11	14.3	11	13.8	12	15.1	11	14.6
1982	12	15.7	12	15.2	12	14.4	12	13.4	12	14.7
1983	12	11.7	12	10.6	12	10.2	12	10.2	12	10.7
1984	12	9.2	12	8.6	12	9.5	12	8.2	12	8.9
1985	12	8.6	12	8.7	14	10.0	14	11.3	12	9.6
1986	15	12.2	15	11.7	14	10.4	15	9.6	15	11.0
1987	13	10.4	15	12.1	14	15.2	15	16.2	14	12.6
1988	14	17.7	15	18.9	14	22.6	15	23.8	15	20.2
1989	13	27.2	14	27.3	13	28.9	14	27.9	13	27.6
1990	13	28.0	14	25.9	13	27.0	14	25.9	14	26.2
1991	14	25.9	15	23.9	14	24.4	16	23.9	15	24.0
1992	16	23.5	16	22.7	15	22.6	16	22.1	15	23.1
1993	14	22.5	16	20.8	14	20.7	15	20.2	14	21.7
1994	14	20.3	16	18.7	14	20.2	16	19.7	15	19.6
1995	13	19.0	16	18.5	13	17.6	16	16.4	14	17.4
1996	13	14.9	14	14.9	15	14.8	14	13.6	13	14.2
1997	14	13.5	16	12.6	14	12.9	16	12.2	15	12.8
1998	14	12.3	15	11.8	14	11.8	13	11.2	13	12.0
1999	14	10.7	16	10.2	14	10.7	16	10.8	15	10.6
2000	14	10.8	16	10.9	14	11.6	16	11.4	15	11.1
2001	7	11.1	19	11.1	17	12.1	19	12.1	13	11.5
2002	17	12.1	19	12.0	13	11.3	15	12.2	17	11.9
2003	13	11.4	12	11.7	15	12.8	18	13.7	14	12.9
2004	13	13.2	17	14.0	13	14.0	17	14.8	16	14.4
2005	13	14.2	18	14.5	--	--	--	--	--	--
Average	**--**	**16.5**	**--**	**16.3**	**--**	**16.9**	**--**	**16.9**	**--**	**16.4**

[48] N = number of wells monitored for the period.

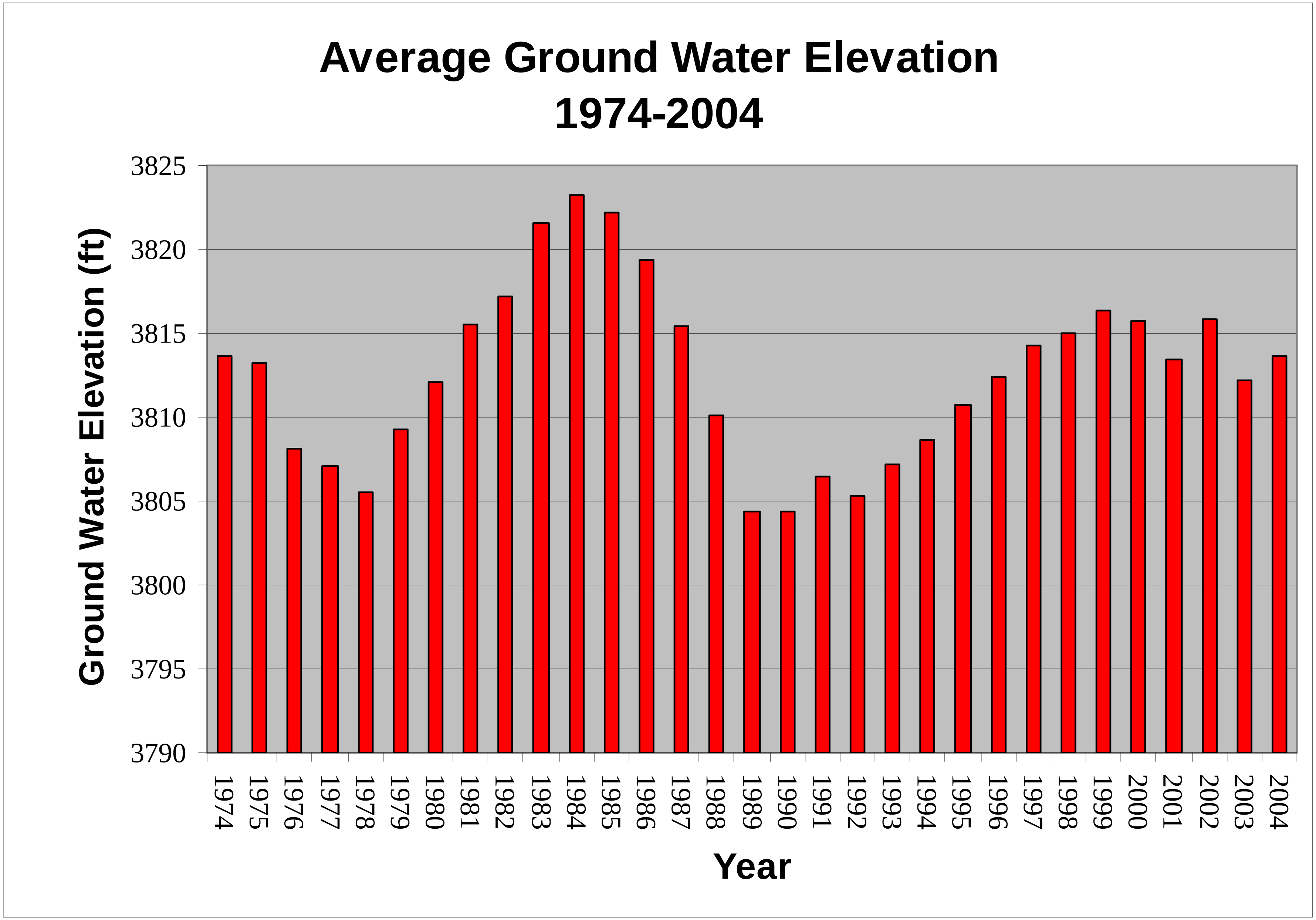
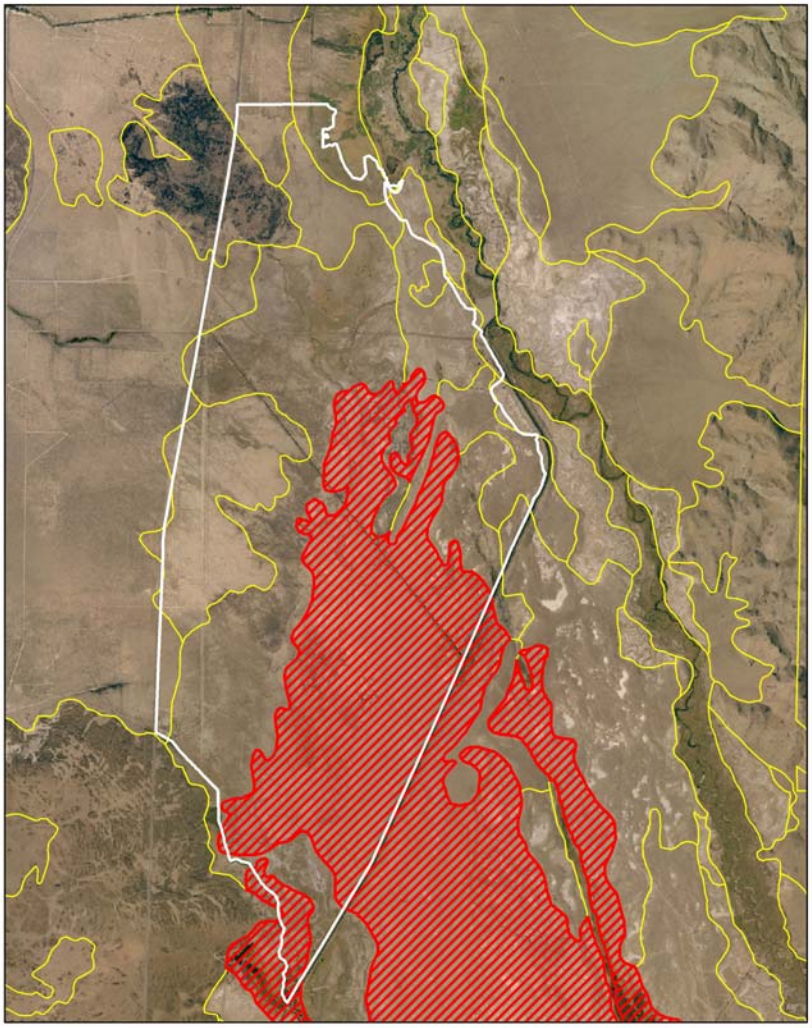


Figure 6.6. Average annual ground water elevation.

Inyo County soils were mapped at an Order 3 resolution by the Natural Resource Conservation Service. Four major soil map units (Table 6.2) comprise over 85 percent of the Hines Spring area.

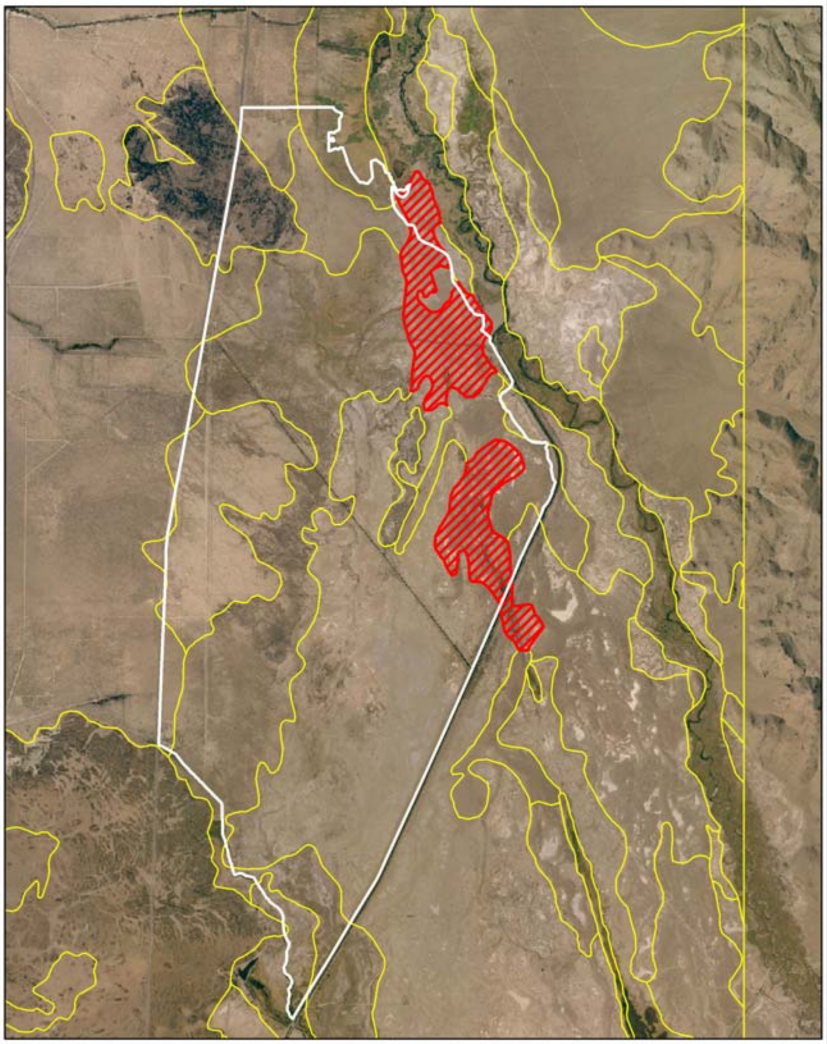
Division-Numu complex, 0-2 percent slope (191): Two parcels comprise 1,086 acres (34 percent) of the Hines Spring area. The Division fine sandy loam comprises 50 percent of the map unit. Sandy loam surface horizons overlie a duripan at about 11 inches that is 4 to 10 inches thick. The Division soil occurs on lacustrine surfaces; permeability is moderately rapid above the hardpan; drainage is poor; ground-water level is 2 to 3 feet in the spring. The Numu fine sandy loam comprises 30 percent of the map unit. Fine sandy loam surface horizons overlie stratified clay loam, clay, and loamy fine sand to a depth of 60 inches. While there is no hardpan, durinodes are present at 2 to 3 feet. The Numu soil occurs on lacustrine surfaces; permeability is moderately slow; drainage is somewhat poor; groundwater level is 3 to 5 feet in the spring. The range site for this map unit is saline bottom.

Division-Numu complex



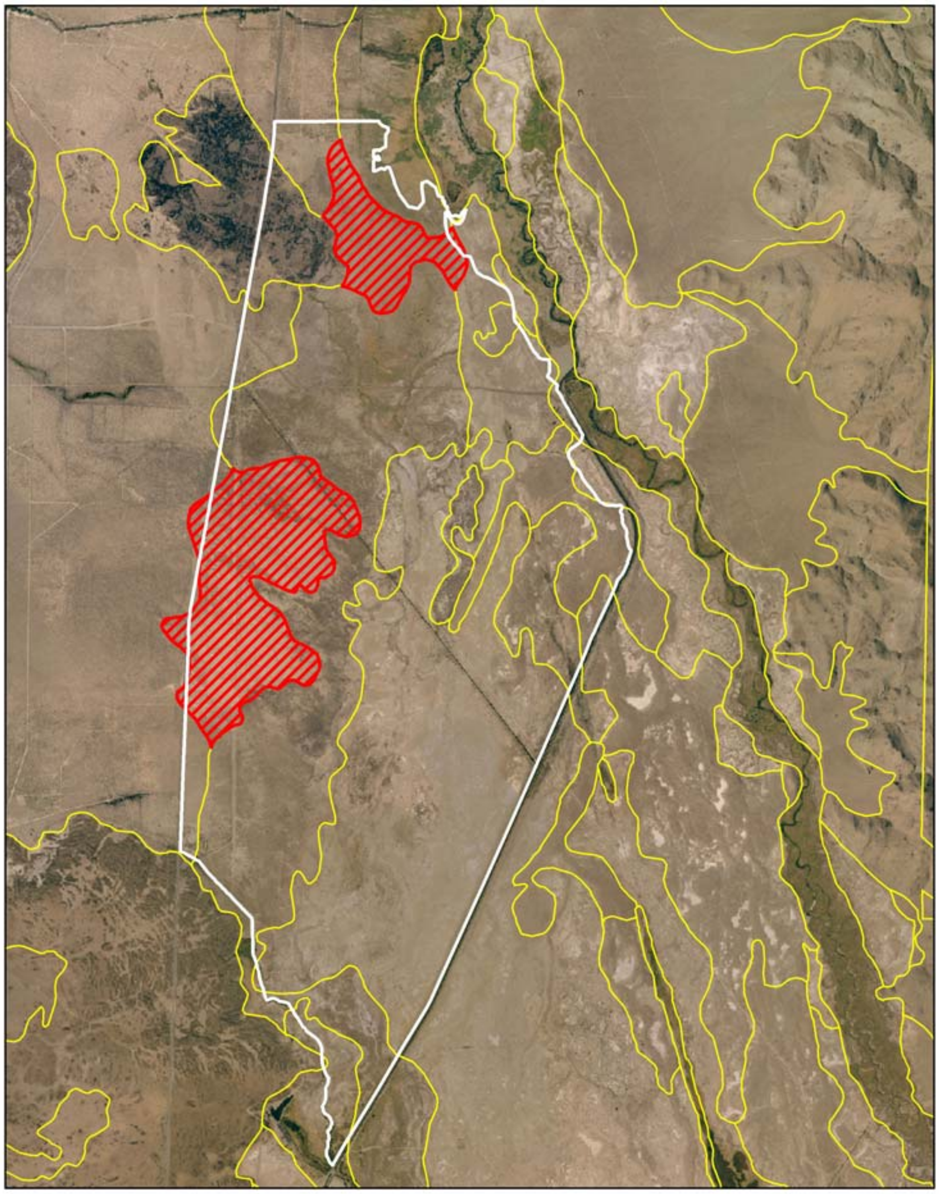
Mazourka hard substratum-Mazourka-Eclipse complex, 0-2 percent slope (261): Three parcels comprise 245 acres (8 percent) of the Hines Spring area. The Mazourka sand comprises 30 percent of the map unit. Wind deposited sand is very deep and moderately well drained; permeability is rapid. The Mazourka hard substratum component is similar to Mazourka sand, but has a weak hardpan between 40 and 60 inches. It comprises 35 percent of the map unit. The Eclipse sand comprises 20 percent of the map unit. Wind deposited sand is very deep and somewhat excessively drained; permeability is moderately rapid to rapid and runoff is slow. Illuvial horizons differentiate the Eclipse soil from the Mazourka soils. The range site is sandy terrace.

Mazourka hard substratum-mazourka-Eclipse complex



Pokonahbe loamy fine sand, 0 to 2 percent slopes (288): Two parcels comprise 451 acres (14 percent) of the Hines Spring area. The Pokonahbe series is very deep, somewhat poorly drained, and formed in alluvium from mixed rock sources. Runoff is slow and permeability is moderately slow to slow. A water table is typically present at a depth of 40 to 50 inches in spring.

Pokonahbe loamy fine sand



Winnedumah silt loam, 0-2 percent slope (363): Three parcels comprise 979 acres (30 percent) of the Hines Spring area. The Winnedumah soil is very deep, somewhat poorly drained, and comprises 85 percent of the map unit. It occurs on alluvial and lacustrine surfaces in the Hines Spring area. Soil texture is fine-loamy; permeability is moderately slow and runoff is slow; groundwater level is 48 to 60 inches in the spring. The range site is sodic fan.

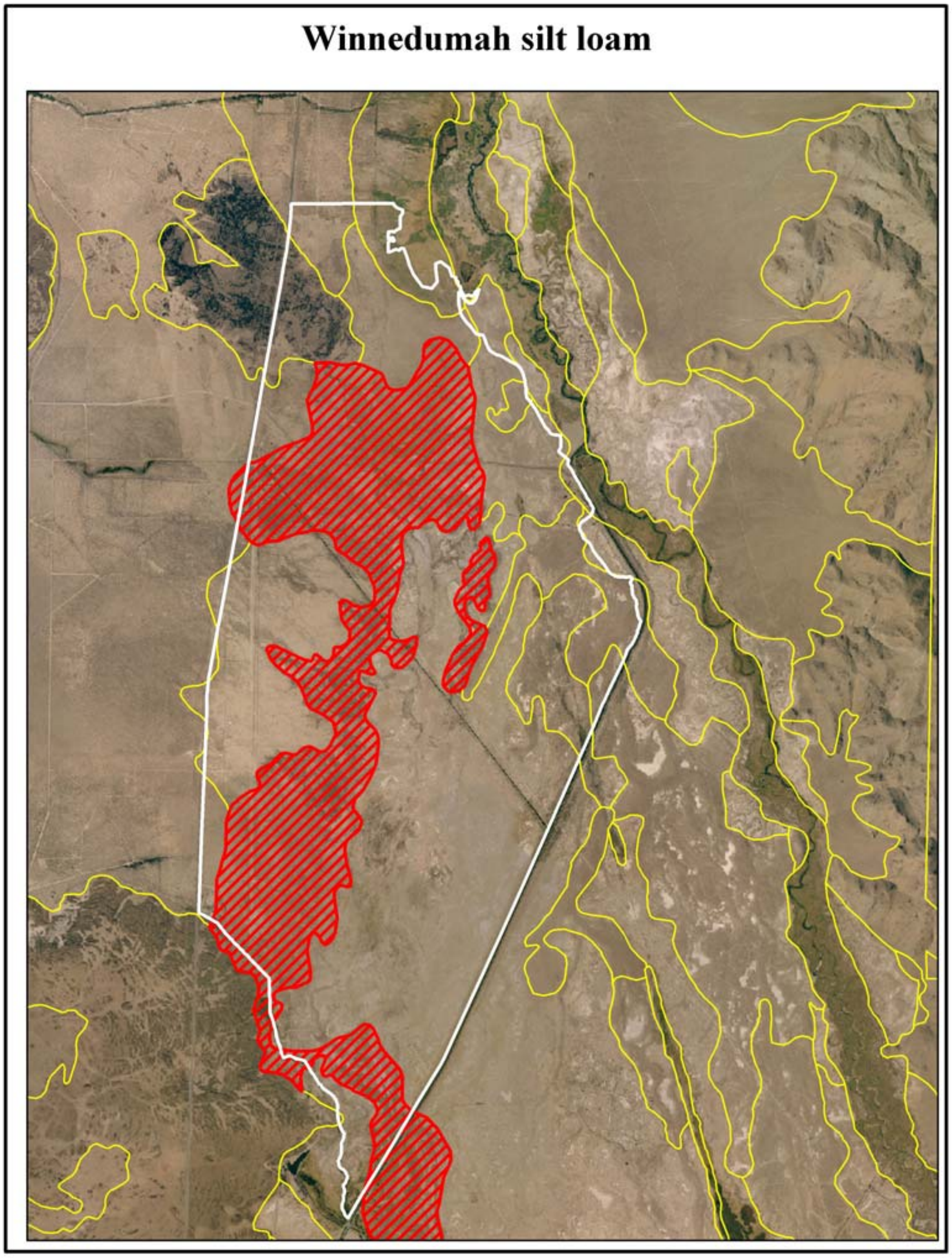


Table 6.2. Hines Spring area, soil map units[1].				
Soil Map Unit		N	Area	
Code	Name		(acres)	(%)
154	Cartago gravelly loamy sand, 0 to 2 percent slopes	5	96	3.0
191	**Division-Numu complex, 0 to 2 percent slopes**	**2**	**1086**	**33.6**
209	Hesperia loamy sand, 0 to 2 percent slopes	1	50	1.6
257	Mazourka-Eclipse complex, 0 to 2 percent slopes	1	15	0.5
261	**Mazourka hard substratum-Mazourka-Eclipse complex, 0 to 2 percent slopes**	**3**	**245**	**7.6**
288	**Pokonahbe loamy fine sand, 0 to 2 percent slopes**	**2**	**451**	**14.0**
293	Poleta-Mazourka-Eclipse complex, 0 to 2 percent slopes	1	133	4.1
294	Poleta-Mazourka-Slickspots complex, 0 to 2 percent slopes	1	15	0.5
316	Shondow loam, 0 to 2 percent slopes	1	54	1.7
321	Taboose-Lava Flows complex, 5 to 30 percent slopes	2	92	2.8
327	Torrifluvents, 0 to 2 percent slopes	3	5	0.2
328	Torrifluvents-Fluvaquentic Endoaquolls complex, 0 to 2 percent slopes	2	8	0.3
362	Winerton-Hessica complex, 0 to 2 percent slopes	1	<1	0.0
363	**Winnedumah silt loam, 0 to 2 percent slopes**	**3**	**979**	**30.3**
--	**TOTAL**	**28**	**3229**	**100.0**

[1]**Bold** font indicates major soil map units.

Ten (10) other soil map units comprise less than 15 percent (468 acres) along the periphery of the Hines Spring area.

Greenbook vegetation mapping (Figure 6.7) was conducted 1983 through 1987. A dominant vegetation type (modeled after Holland) was assigned to each parcel. Plant species cover was measured for multiple transects in each parcel. The distribution of Holland vegetation types in the Hines Spring area are listed in Table 6.3. Six major vegetation types comprised 3,101 acres (96 percent) of the Hines Spring area.

Table 6.3. Greenbook vegetation types[1].

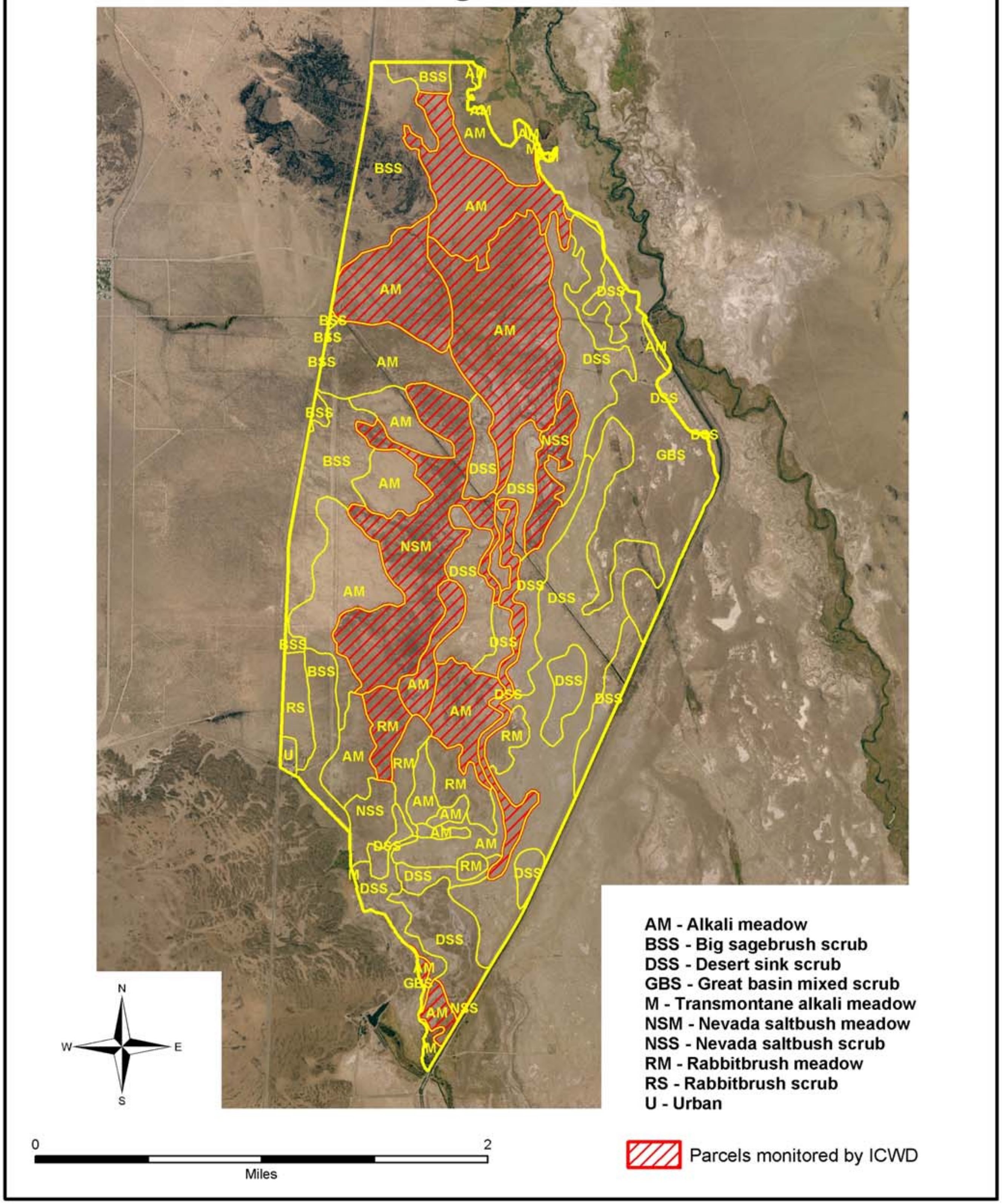
Holland Type		N	Area	
Code	Name		(acres)	(%)
12000	Urban	1	7	0.2
35100	**Great Basin Mixed Scrub**	**2**	**288**	**8.9**
35210	**Big Sagebrush Scrub**	**9**	**336**	**10.4**
35400	Rabbitbrush Scrub	1	34	1.0
36120	**Desert Sink Scrub**	**21**	**961**	**29.8**
36150	Nevada Saltbush Scrub	3	81	2.5
45310	**Alkali Meadow**	**22**	**1127**	**34.9**
45340	Rabbitbrush Meadow	5	129	4.0
45350	**Nevada Saltbush Meadow**	**1**	**260**	**8.0**
52320	Transmontane Alkali Marsh	5	7	0.2
--	**TOTAL**	**70**	**3229**	**100.0**

[1] **Bold** font indicates major vegetation types.

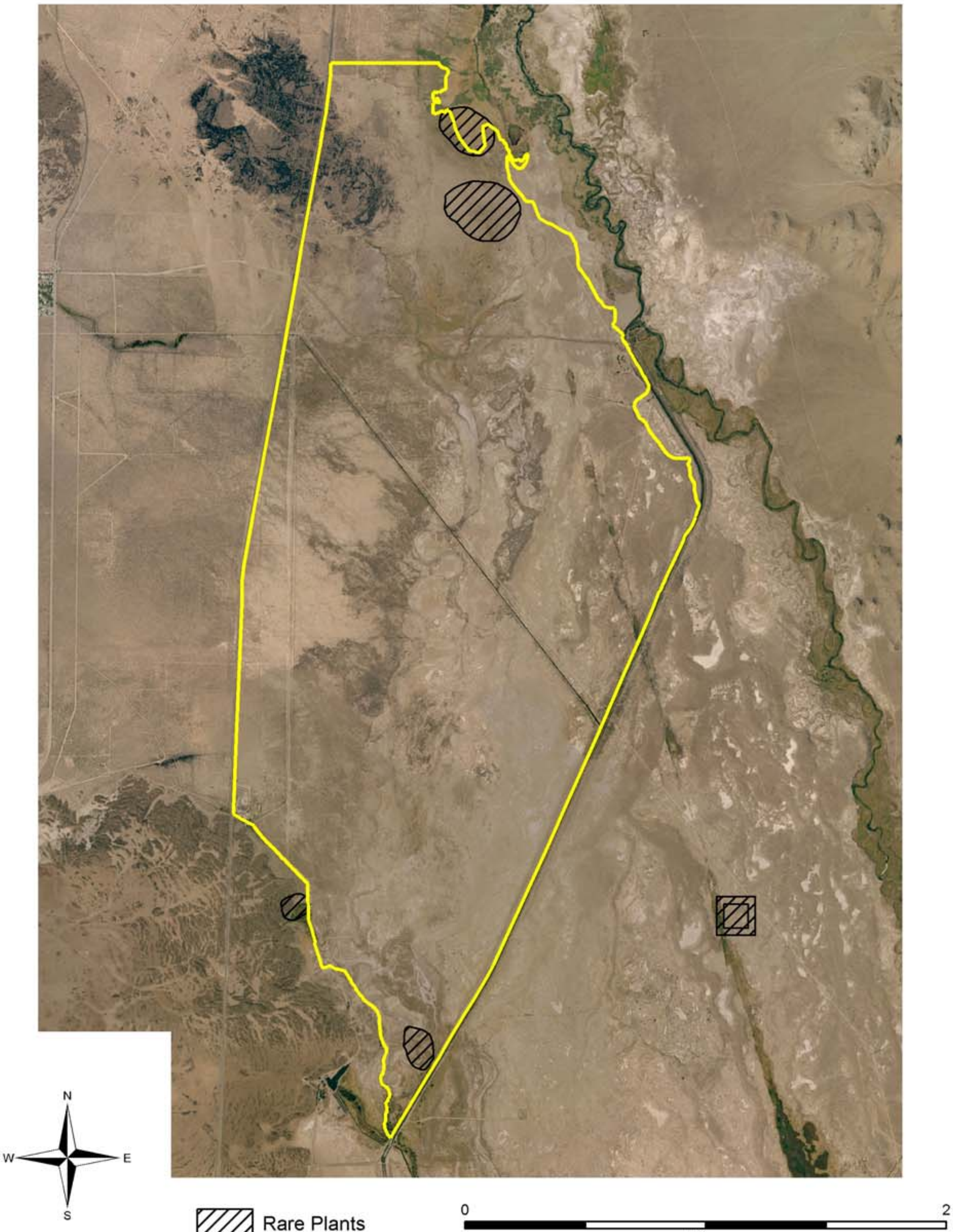
The Inyo County star-tulip (*Calochortus excavatus*), a California species of concern, occurs in at least 4 areas in, or adjacent to, the Hines Spring area (Figure 6.8). The plant occurs in wet alkali meadow, alkali meadow, alkali scrub/meadow, and alkali scrub habitats with moist to dry conditions. Existing populations are susceptible to physical disturbance, permanent flooding, and prolonged saturation.

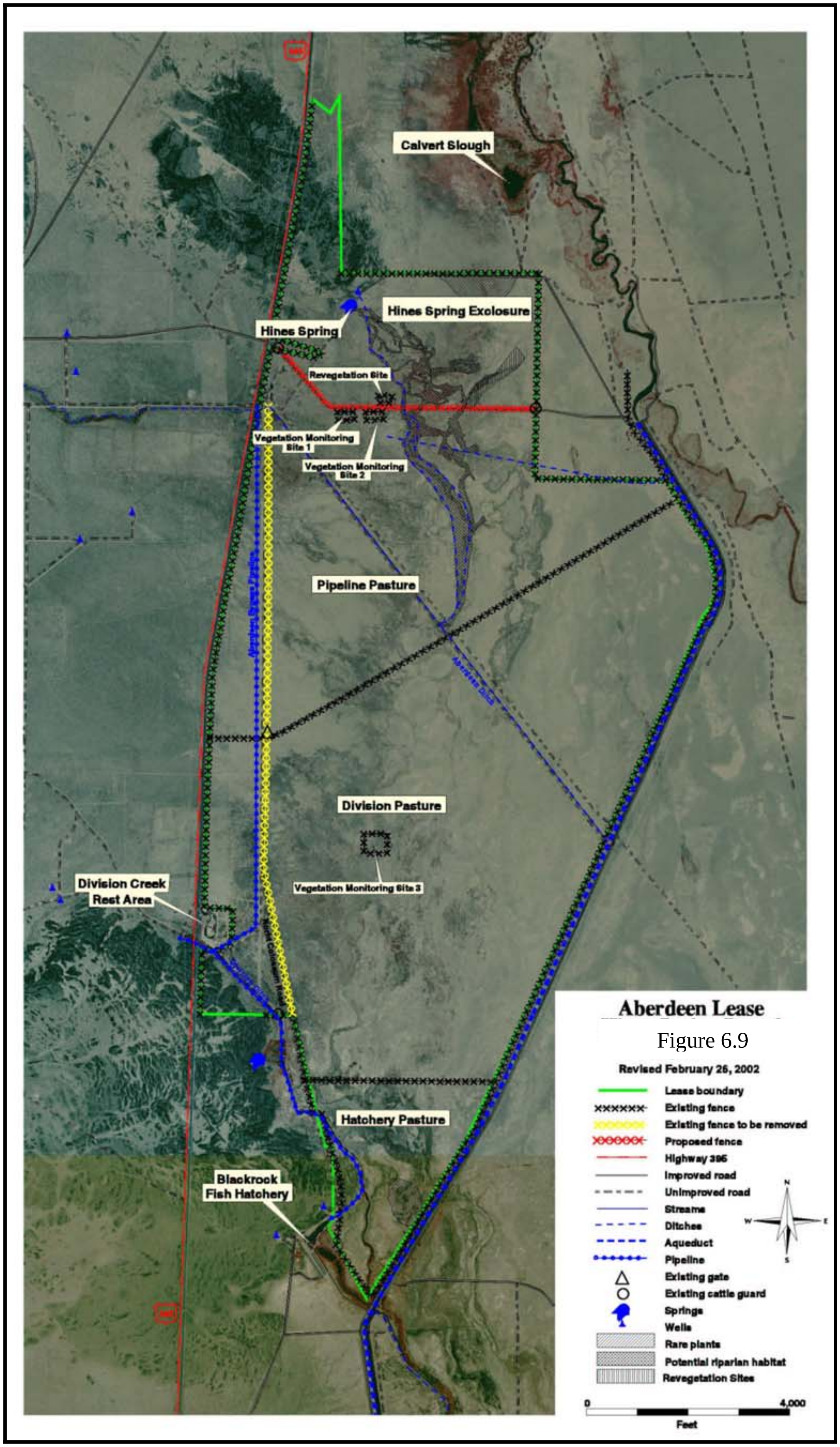
The Hines Spring area (Figure 6.9) is a part of the Aberdeen Lease. An up to date lease map of the Hines Spring Area can be found in Appendix 2.

Hines Springs Area
Greenbook Parcels
Figure 6.7



Hines Springs Area
Rare Plants
Figure 6.8





Calvert Slough
Hines Spring Exclosure
Hines Spring
Revegetation Site
Vegetation Monitoring Site 1
Vegetation Monitoring Site 2
Pipeline Pasture
Division Pasture
Vegetation Monitoring Site 3
Division Creek Rest Area
Hatchery Pasture
Blackrock Fish Hatchery
Aberdeen Lease
Revised February 26, 2002
Lease boundary
Existing fence
Existing fence to be removed
Proposed fence
Highway 395
Improved road
Unimproved road
Streams
Ditches
Aqueduct
Pipeline
Existing gate
Existing cattle guard
Springs
Wells
Rare plants
Potential riparian habitat
Revegetation Sites
N
W
E
S
0
4,000
Feet

Figure 6.9

6.1.1 Inventory of 2000 Conditions

An inventory of the Hines Spring area was based on the 2000 orthophoto and field observations (WHA 2005a). Map parcels consist of a dominant landtype, water regime and vegetation type.

Landtypes

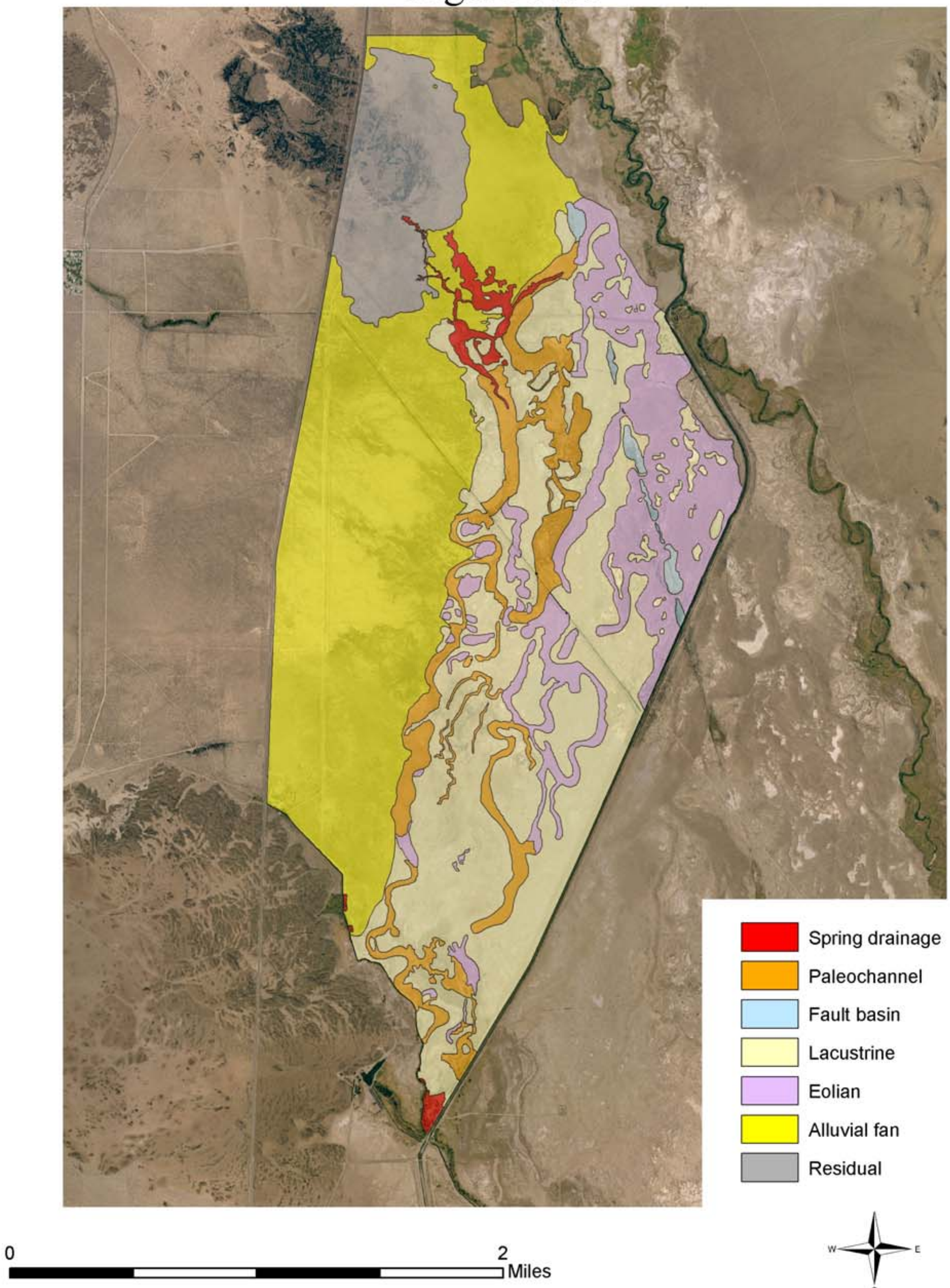
Landtypes denote geomorphic surfaces that generally correspond with distinctive soil, hydrologic character and potential vegetation. Landtypes in the Hines Spring area are *paleochannel, spring drainage, alluvial fan, fault basin, lacustrine land, eolian land*, and *residual land* (Table 6.4; Figure 6.10). Descriptions of landtypes follow.

Table 6.4. Landtypes, Hines Spring area.

Landtype	N	Area (acres)	Area (%)
Paleochannel	58	268	8.3
Spring drainage	57	48	1.5
Alluvial fan	67	1161	36.0
Fault basin	27	24	0.7
Lacustrine	158	1019	31.6
Eolian	40	434	13.4
Residual	11	276	8.5
TOTAL	**418**	**3229**	**100.0**

Paleochannel: The paleochannel diverged from the contemporary course of the Owens River at Calvert Slough, where the 1872 fault line intercepts the river on the north. North of Goodale Road the paleochannel becomes evident south of small fault basin and sand deposits (eolian land) that obliterated the channel. The paleochannel is evident where it crosses Goodale Road. South of Goodale Road, the paleochannel diverges. The eastern paleochannels are mostly filled with wind deposited sand. These areas are well suited for creation of wetlands. Much of the man-induced wetland created in the BWMA follows the course of paleochannels.

Hines Spring Area
Landtypes
Figure 6.10



Spring drainage: Concave, elongate positions that originate in the vicinity of spring vents. The most recently active vent of Hines Spring originates in residual land and follows an incised course south towards Goodale Road, where it intercepts the paleochannel. At least one addition vent converged with the incised course from the west. A more subtle spring drainage originates about 300 meters east-southeast of the contemporary vent and follows a broad, graded course that intercepts the paleochannel just north of Goodale Road. The incised spring drainage arising from the contemporary Hines Spring vent is not particularly well suited for creation of wetland; excessive percolation through the residual substrate and the narrow, confined channel may limit the extent of wetlands created with a given volume of water. But the more easterly, broad, graded channel appears well suited for creation of wetland.

Alluvial fan: Broadly convex surfaces sloped towards the valley axis. Because of rapid permeability, alluvial fans are poorly suited for creating wetland.

Fault basin: Narrow depressions that formed along the 1872 fault line. Twin Lakes, Goose Lake, and Billy Lake were all created in fault basins in the BWMA. Fault basins are well suited for creating both open water and wetland habitat.

Lacustrine land: These areas are characterized by fine-textured alkali soils, most of which were intermittently flooded by Owens Lake during the late Quaternary period. Surfaces are flat to slightly concave. The potential for creating wetland is moderate; the lack of confinement may lead to more dispersed flow and higher evaporation rates).

Eolian land: These areas have a veneer of loose, wind-blown sand ranging from a foot to several meters deep, typically underlain by fine-textured lacustrine sediments. Surfaces are convex. The extent of eolian lands generally decreases from east to west. Because of rapid permeability, eolian lands are poorly suited for creating wetland.

Residual land: Surfaces are bare rock or alluvium covering volcanic rock at a depth of less than about 2 meters. Historic spring vents were in residual land or near the transition between residual and alluvial land. Permeability is expected to be inconsistent; bedloss could be substantial. The suitability of residual land for creating wetland is uncertain.

Water Regime

Water regimes (Table 6.5; Figure 6.11) were modeled after Cowardin et al (1979), but modified to include the range of conditions inherent to the Hines Spring area. Water regimes are based on the frequency/duration of flooding and depth of alluvial groundwater, interpreted from on-site observations and photo interpretation. The 2002 color-infrared (CIR) satellite image was useful for delineating water regimes. Qualitative descriptions of water regimes identified in the Hines Spring area follow.

Table 6.5. Water regimes, Hines Spring area.

Water Regime	N	Area (acres)	Area (%)
High water table	9	6	0.2
Low water table	3	3	0.1
Irrigated	1	3	0.1
Very deep water table	405	3218	99.7
TOTAL	**418**	**3229**	**100.0**

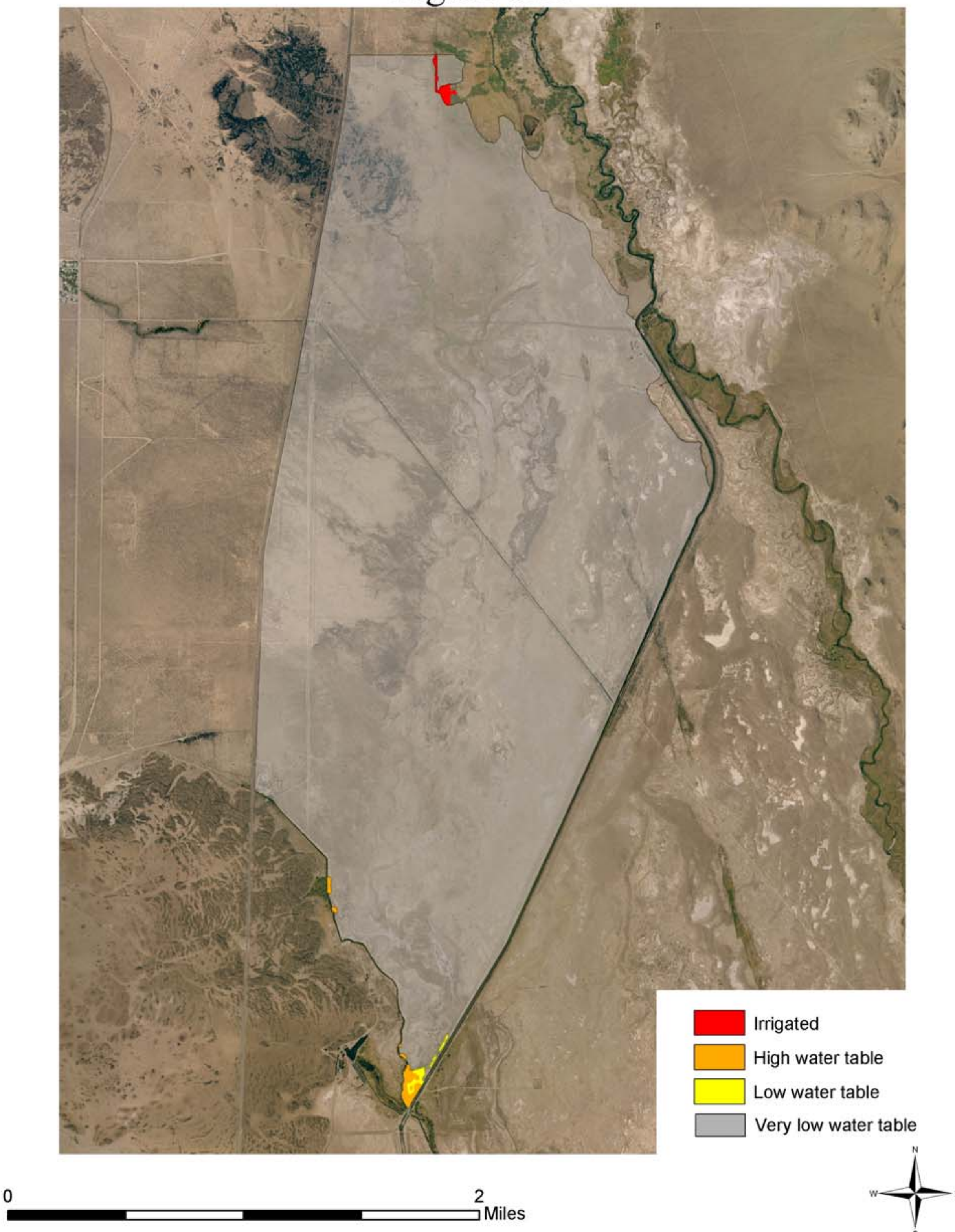
(40) ***High water table:*** These areas were typically saturated within the rooting depth of herbaceous vegetation (1 to 2 feet) for at least part of the growing season. This water regime occurs only in the vicinity of Blackrock Spring and Little Blackrock Spring. This regime denotes wetland hydrology.

(50) ***Low water table:*** These areas were typically saturated within the rooting depth of shrub vegetation (3-5 feet). This water regime occurs in the vicinity of Blackrock Spring. This regime does not denote wetland hydrology.

(60) ***Very low water table:*** Alluvial groundwater is typically below the dominant rooting depth of shrubs (>5 feet). This regime does not denote wetland hydrology.

(70) ***Irrigated:*** Areas that were watered by upslope irrigation runoff. It comprised 3 acres (< 1 percent) near Calvert Slough. This regime typically does not denote wetland hydrology.

Hines Spring Area
Water Regime
Figure 6.11



Vegetation Types

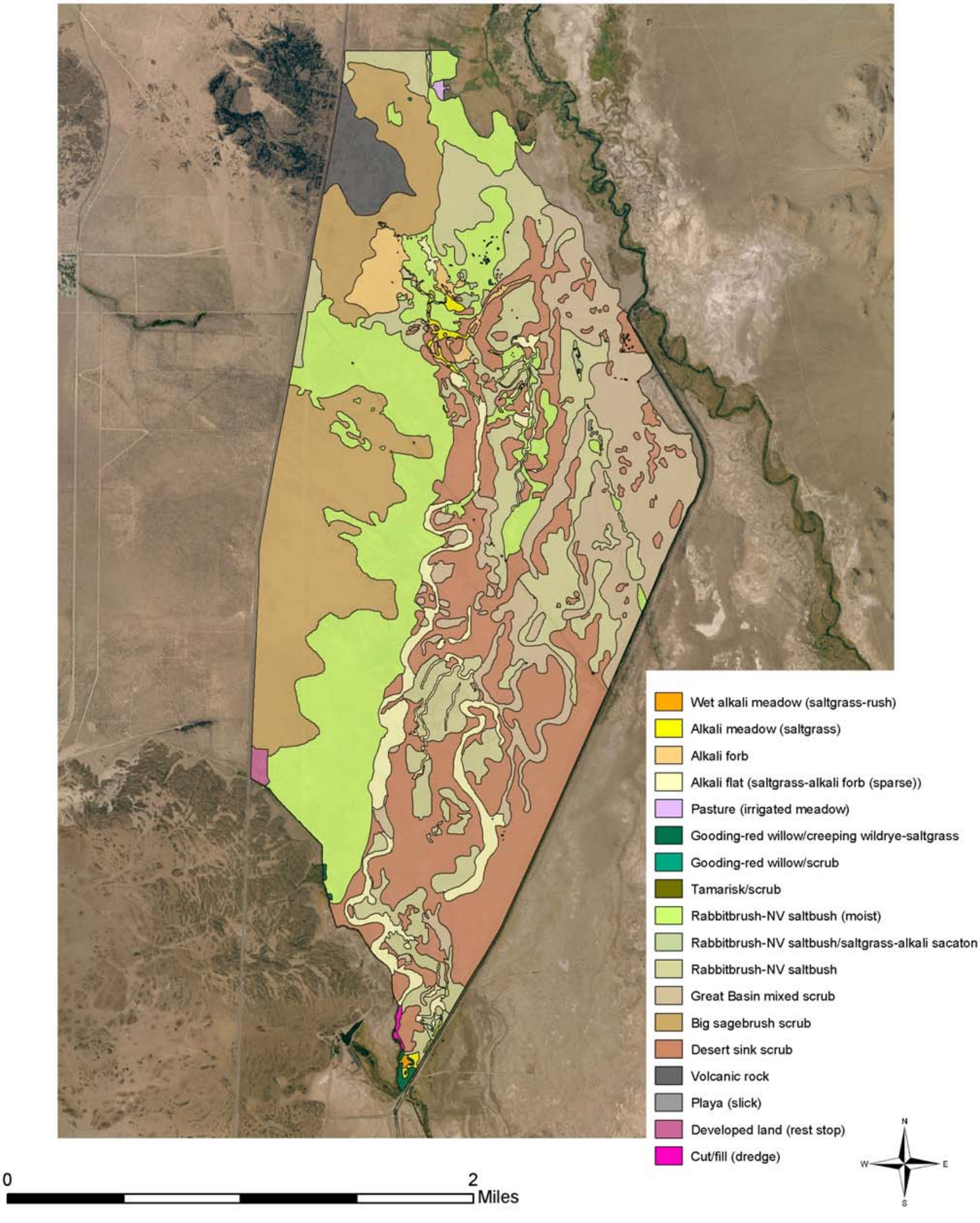
Seventeen (17) vegetation and miscellaneous types were identified (Table 6.6; Figure 6.12). Descriptions of vegetation types were summarized from field reconnaissance/descriptions, selected ICWD transect data (WHA 2005a), and descriptions of similar communities in the BWMA (WHA 2004d). Preliminary determinations of wetland status were based descriptions and studies of similar vegetation types in Owens Valley (WHA 2004g). About 0.2 acres of wetland (wet alkali meadow and Goodding-red willow/creeping wildrye-saltgrass) occurs in the vicinity of Blackrock Springs in the southern part of the Hines Spring area.

Table 6.6. Vegetation types, Hines Spring area*.

Vegetation Type	N	Area (acres)	Area (%)
Wet alkali meadow (saltgrass-rush)	*1*	*1*	*<0.1*
Alkali meadow (saltgrass)	11	11	0.4
Alkali flat (saltgrass-alkali forb [sparse])	**16**	**143**	**4.4**
Alkali forb	**21**	**56**	**1.7**
Pasture (irrigated meadow)	1	3	0.1
Tamarisk/scrub	16	<1	0.0
Goodding-red willow/creeping wildrye-saltgrass	*9*	*5*	*0.1*
Goodding-red willow/scrub	87	2	0.0
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	6	6	0.2
Rabbitbrush-NV saltbush	**55**	**514**	**15.9**
Rabbitbrush-NV saltbush (moist)	**38**	**691**	**21.4**
Desert sink scrub	**110**	**733**	**22.7**
Great Basin mixed scrub	**33**	**434**	**13.4**
Big sagebrush scrub	**6**	**551**	**17.1**
Playa (slick)	5	1	<0.1
Volcanic rock	**1**	**70**	**2.2**
Developed land (rest stop)	1	7	0.2
Cut/fill (dredge)	1	2	0.1
TOTAL	**418**	**3229**	**100.0**

* Prominent vegetation types ($\geq$ 1 percent) are **bold**. Wetland vegetation types are *italic.*

Hines Spring Area
Vegetation Types
Figure 6.12



Wet alkali meadow series (saltgrass-rush association): A single parcel of this minor herbaceous vegetation type occurs in the vicinity of Blackrock Spring. Saltgrass, creeping wildrye, and Baltic rush are common. Hydrophytic vegetation, hydric soil, and wetland hydrology are typical present. This vegetation type is wetland.

Alkali meadow (saltgrass): This minor vegetation type occurred in spring drainages with very low water table. Average total grass cover for similar communities in the BWMA was about 70 percent; saltgrass, creeping wildrye, foxtail barley, and alkali muhly were prominent. Average total forb cover was less than 14 percent; five-horn smother weed, annual sunflower, and alkali mallow were prominent. Shrubs and trees were usually absent. Average total cover was about 80 percent. The average wetland status score (2.6) indicates facultative wetland (FACW) species were prominent. Hydric soil and wetland hydrology were not evident. This vegetation type is <u>not</u> wetland.

Alkali flat series (saltgrass-alkali forb [sparse] association): This prominent vegetation type occurred in spring drainage and paleochannel landtypes with very low water table. As the name implies, these are sparsely vegetated alkali sinks. Sixty (60) ICWD transects were measured. Average total grass cover was 5; alkali sacaton and saltgrass were prominent. Average total forb cover was 4 percent; Russian thistle was prominent. Alkali shrubs were typically present with low cover (4 percent). Average total vegetation cover was 13 percent. The average wetland status score (1.3) indicates facultative upland (FACU) species were prominent. Hydric soil and wetland hydrology were not evident. This vegetation type is <u>not</u> wetland.

Alkali forb: This prominent vegetation type occurred in the bottoms of spring drainages that may be intermittently flooded by local runoff and on disturbed residual land south of the Hines Spring vent. Five (5) ICWD transects were measured. Average total herbaceous cover was 32 percent. Prominent species were alkali sacaton, annual saltbush, and fivehorn smotherweed. Alkali shrubs are typically present with about 6 percent cover. The average wetland score (1.5) indicates facultative upland (FACU) to facultative (FAC) vegetation is prominent. Hydric soil and wetland hydrology were not evident. This vegetation type is <u>not</u> wetland.

Pasture series (irrigated meadow association): A single parcel of this minor, upland type occurs on irrigated alluvial land adjacent to Calvert Slough. This vegetation type is <u>not</u> wetland.

Tamarisk series (tamarisk/scrub association): This minor, upland, tall shrub vegetation type occurred on lacustrine land. This vegetation type is <u>not</u> wetland.

Goodding-red willow series (Goodding-red willow/creeping wildrye-saltgrass association): This minor, forested vegetation type occurred in spring drainages with high water table near Blackrock Spring. Hydric soil and wetland hydrology are typically present. This vegetation type is wetland.

Gooding-red willow series (Gooding-red willow/scrub association): Eighty seven (87) parcels, most denoting a single tree, occurred in the Hines Spring area. Numerous dead tree willows were also observed in the upper part of the west spring drainage and on residual land south of Hines Spring. The prominent overstory species were Goodding willow and red willow. The understory was similar to rabbitbrush-NV saltbush or rabbitbrush-NV saltbush/saltgrass-alkali sacaton vegetation types. Hydric soil and wetland hydrology were not evident. This vegetation type is not wetland.

Rabbitbrush-NV saltbush/saltgrass-alkali sacaton: This prominent low shrub vegetation type occurred in spring drainage and fault basin landtypes with very low water table. Average grass cover was about 40 percent; saltgrass and alkali sacaton were prominent. Average forb cover was less than 10 percent; American licorice was prominent. Average shrub cover was about 20 percent; Nevada saltbush, rubber rabbitbrush, and greasewood were prominent. Trees were typically absent. Average total vegetation cover was about 75 percent. The average wetland status score (2.0) indicates facultative (FAC) species were prominent. Hydric soil and wetland hydrology were not evident. This vegetation type is not wetland.

Rabbitbrush-NV saltbush scrub: This prominent low shrub vegetation type occurred on alluvial fan, lacustrine, and fault basin landtypes with very low water table. Average grass cover was 13 percent; alkali sacaton was prominent. Average forb cover was 3 percent; no species were prominent. Average total shrub cover was 10 percent; Nevada saltbush and rabbitbrush were prominent. The average wetland status score (1.3) indicates facultative upland (FACU) species were prominent. Evidence of hydric soil and wetland hydrology were not evident. This vegetation type is not wetland.

Rabbitbrush-NV saltbush (moist): This prominent variant of rabbitbrush-NV saltbush scrub with very low water table occurred mostly along the toe of alluvial fans and parts of paleochannel, spring drainage, and fault basin landtypes that historically were wetter. Average grass cover was 7 percent; alkali sacaton was prominent. Average forb cover was 3 percent; no species were prominent. Average total shrub cover was 19 percent; Nevada saltbush and rabbitbrush were prominent. The average wetland status score (1.5) indicates facultative upland (FACU) to facultative (FAC) species were prominent. This vegetation type is not wetland.

Desert sink scrub: This prominent low shrub vegetation type occurred on lacustrine and paleochannel landtypes with very low water table. Average grass cover was 8 percent; alkali sacaton was prominent. Average forb cover was 4 percent. Average shrub cover was 7 percent; rabbitbrush, Nevada saltbush, and greasewood were typically present, but not prominent. Average total vegetation cover was 19 percent. The average wetland status score (1.4) indicates facultative upland (FACU) species were prominent. Evidence of hydric soil and wetland hydrology were not evident. This vegetation type is not wetland.

Great Basin mixed scrub series: This prominent, diverse low shrub vegetation type with very low water table occurred on eolian lands along the east flank of the Hines Spring area. Average grass cover was less than 10 percent; saltgrass and alkali sacaton were prominent. Although no forbs were recorded, annual forbs were common (and splendid) when precipitation is adequate. Average total shrub cover was about 15 percent; greasewood, Nevada saltbush, rabbitbrush, iodine bush, shadscale, indigo bush, Nevada dalea, Nevada ephedra, and big sagebrush were common, but with low cover. The average wetland status score (1.6) indicates facultative (FAC) species were prominent. Hydric soil and wetland hydrology were not evident. This vegetation type is not wetland.

Big sagebrush scrub: This prominent low shrub vegetation type with very low water table on alluvial fans and residual land along the west flank of the Hines Spring area. Average grass cover was 12 percent; alkali sacaton was prominent. Average forb cover was 1 percent. Average shrub cover was 8 percent; basin big sagebrush and rabbitbrush were prominent. Average total vegetation cover was 22 percent. The average wetland status score (1.2) indicates facultative upland (FACU) species were prominent. Hydric soils and wetland hydrology were not evident. This vegetation type is not wetland.

Playa series (slick association): This minor, mostly barren type occurred in fault basins. Slicks were commonly included with desert sink scrub on paleochannels and lacustrine land. This vegetation type is not wetland.

Developed land (rest stop): This minor miscellaneous type is a rest stop along Highway 395.

Cut/fill (dredge): This minor, miscellaneous area consists of material dredged from the Division Creek ditch.

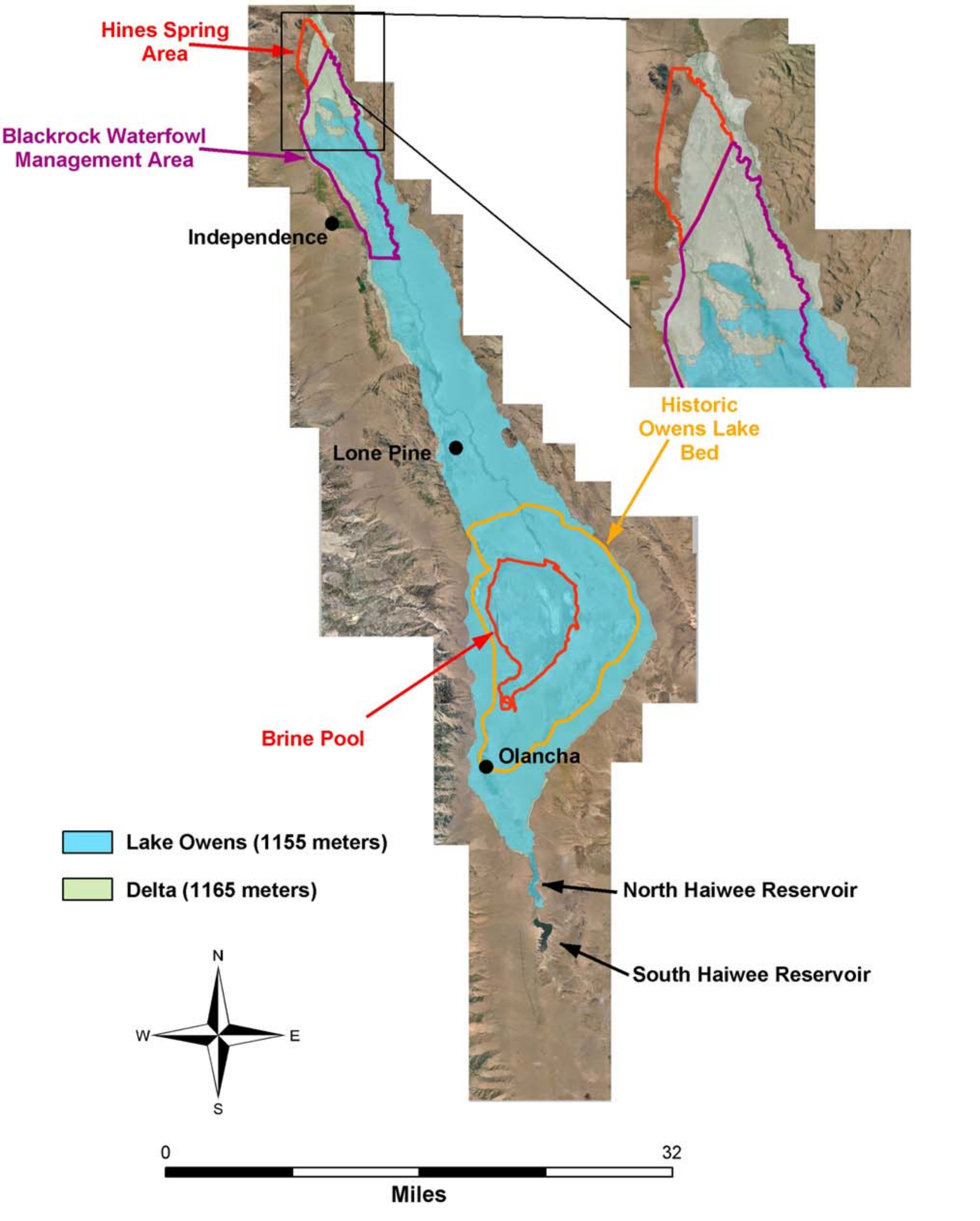
6.1.2 Historical Perspective

During the late Quaternary period Lake Owens overflowed Haiwee Pass into China Lake basin, which overflowed to Searles Lake basin, which overflowed to Panamint Lake basin (Benson et al. 1990). Lee (1912) estimated Lake Owens reached 1,155 meters elevation (Figure 6.13) before the sill at Haiwee Pass was eroded to 1,146 meters. When it last overflowed, Lake Owens covered about 240 square miles (Gale 1913; Benson et al. 1990). The mineral content of Owens Lake indicated desiccation began about 4,000 years ago, or possibly much less (Gale 1913). Smith and Street-Perrott (1983) estimated that Owens Lake last overflowed about 2,000 years ago. The delta for Lake Owens (about 1,165 meters elevation) was estimated based on lacustrine topography and soils in the BWMA and Hines Spring area. The delta extended upstream to include Calvert Slough and the east half of the Hines Spring area. There is also some evidence that a second lake flooded much of the bottomlands from Tinemaha Reservoir north to Bishop (Danskin 1988). When Lake Owens receded to its historic lake bed, the Owens River wandered across the broad deltaic sediments, as evidenced by several paleochannels (Figure 6.4) in the Hines Spring and BWMA. The 1872 earthquake confined the Owens River to the east side of the fault line. The contemporary course of the Owens River east of the Hines Spring area is incised in the delta sediments remnant of Quaternary Lake Owens.

The area of “spring induced vegetation” (intended to include water, marsh, wet meadow, alkali meadow, and alkali scrub/meadow) in the Hines Spring area was estimated for five periods from aerial photos:

- Black-and-white, 1:24,000 scale photos dated October 15, 1944
- Black-and-white, 1:12,000 scale photos dated July 10, 1968
- Natural color, 1:12,000 scale photos dated July 22, 1981
- Natural color, 1:12,000 scale photos dated July 18, 1993
- Natural color, high-resolution, digital orthophoto dated September 2000

Quaternary Lake Owens
Figure 6.13

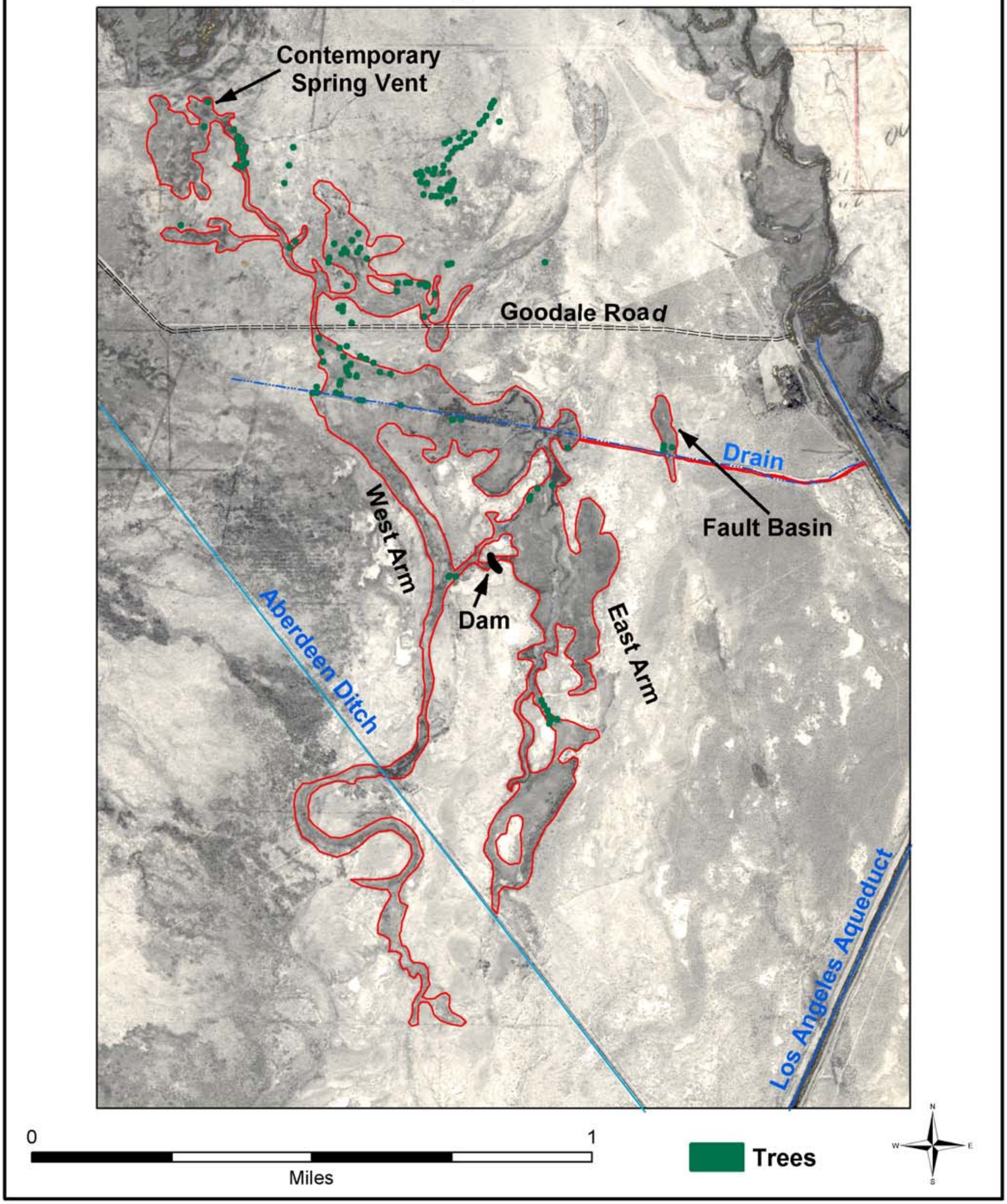


In 1944 (Figure 6.14), spring induced vegetation appears to have arisen from a diffuse seep area around the contemporary vent, flowed south, and overflowed into an adjacent basin just north of Goodale Road. South of Goodale Road, the majority of the spring drainage was captured by a drain towards the Los Angeles Aqueduct. But the drain overflowed to a paleochannel, creating an "east arm" of spring induced vegetation that extended south to Aberdeen ditch. The east arm overflowed back to the west arm through a narrow channel that was damned on the 1944 image. The drain also appears to have overflowed to a fault basin between the east arm and the aqueduct. The west arm continued south beyond the Aberdeen Ditch. About 140 trees (Gooding and red willow) were scattered both in and out of the spring induced area. Trees outside the spring induced area appear to have been sustained by groundwater, rather than spring drainage. The area of spring induced vegetation in 1944 was about 139 acres.[49] Assuming a 10 meter crown diameter, 78 trees covered about 1 percent of the spring induced area.

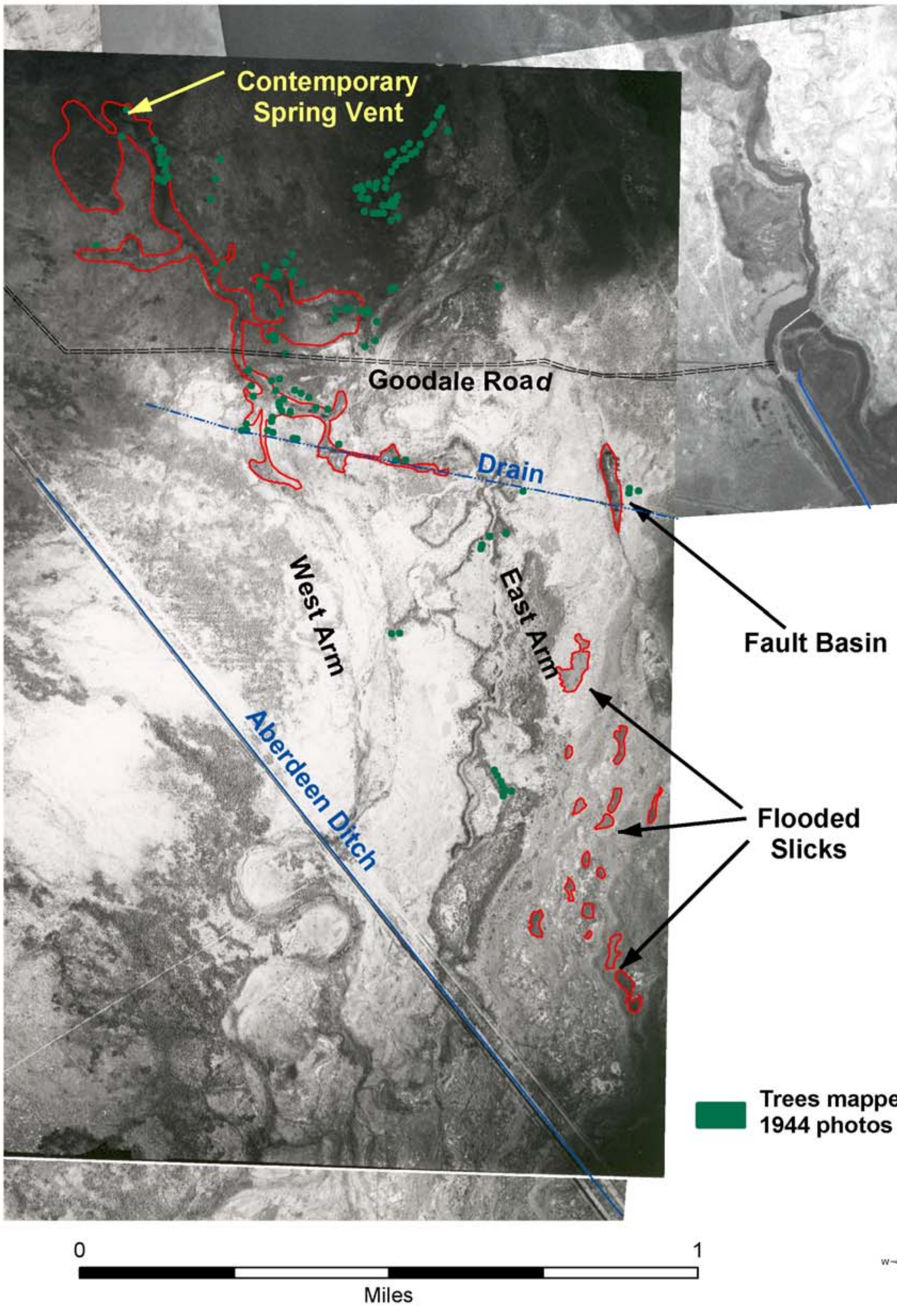
In 1968 (Figure 6.15) the area of spring induced vegetation north of Goodale Road was similar to 1944 conditions. South of Goodale Road, both the east and west arms appeared dry south of the drain. Spring induced vegetation remained present in the fault basin (1.6 acres). Curiously, slicks east of the east arm were wet or flooded in 1968. The area of spring induced vegetation (excluding flooded slicks) in 1968 (37 acres) was about 27 percent of 1944 conditions. Most of the trees present in 1944 were still present in 1968.

[49] Spring induced vegetation was difficult to map from the black-and-white images and should be viewed somewhat skeptically.

Spring Induced Vegetation
1944 Conditions
Figure 6.14



Spring Induced Vegetation
1968 Conditions
Figure 6.15



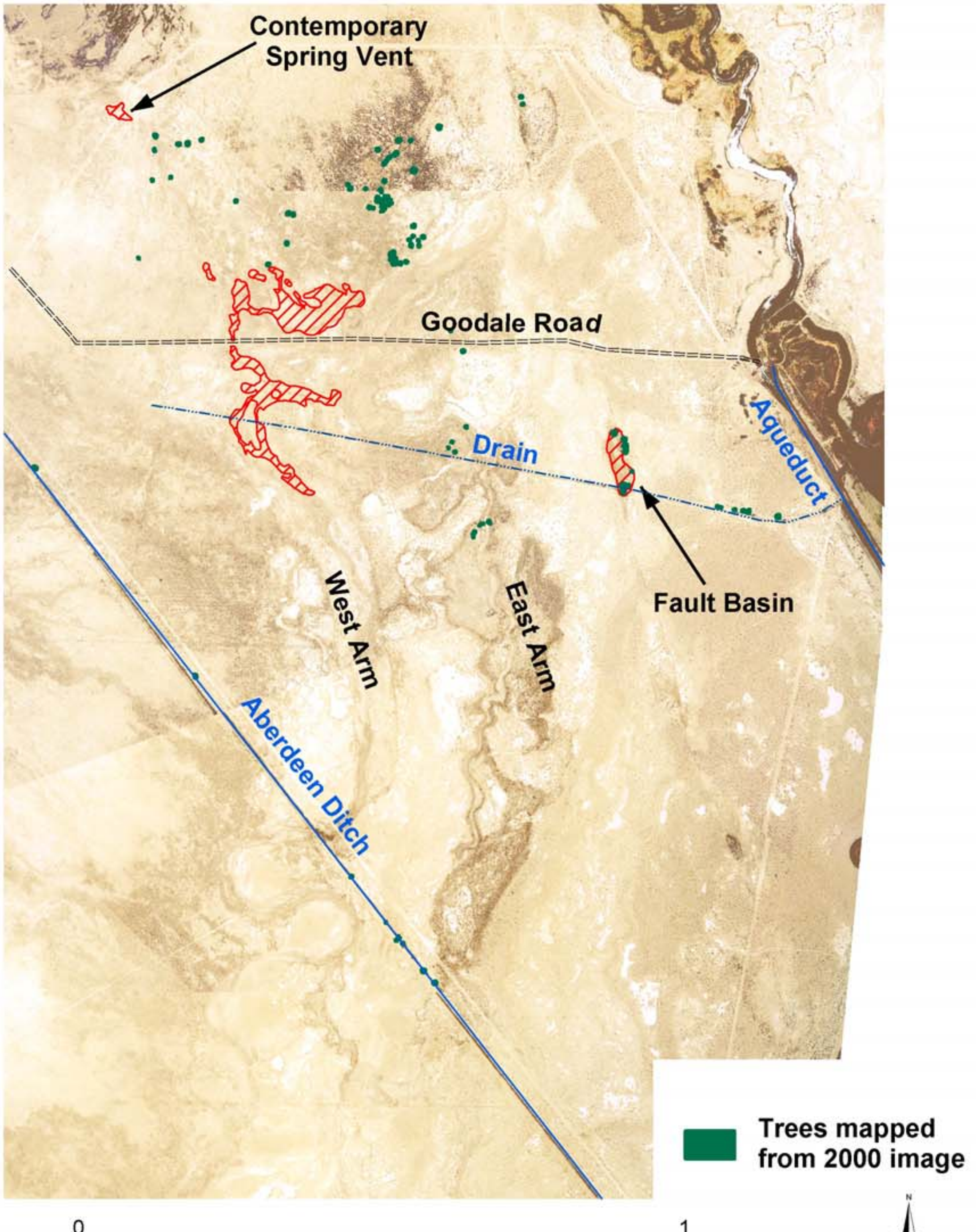
In 1981 (Figure 6.16), 1993 (Figure 6.17) and 2000 (Figure 6.18) the area of spring induced vegetation remained relatively constant, although communities probably shifted towards drier types (e.g. wet alkali meadow → alkali meadow → alkali scrub/meadow). In 1981, spring induced vegetation was reduced to a small area around the contemporary spring vent (0.4 acres), a larger area near Goodale Road that spanned two adjacent spring drainages (11.7 acres), and the fault basin (1.6 Acres). The total area of spring induced vegetation in 1981 (14 acres) was about 10 percent of 1944 conditions. In 1993 and 2000, spring induced vegetation around the vent (0.1 acres) was smaller. The total area of spring induced vegetation in 1993 and 2000 (13 acres) was about 9 percent of 1944 conditions. Of the 140 trees present in 1944, about 80 were present in 2000. In 2000, trees were decadent, with smaller live canopies than 1944.

The areas of spring induced vegetation for the five periods are summarized in Table 6.7.

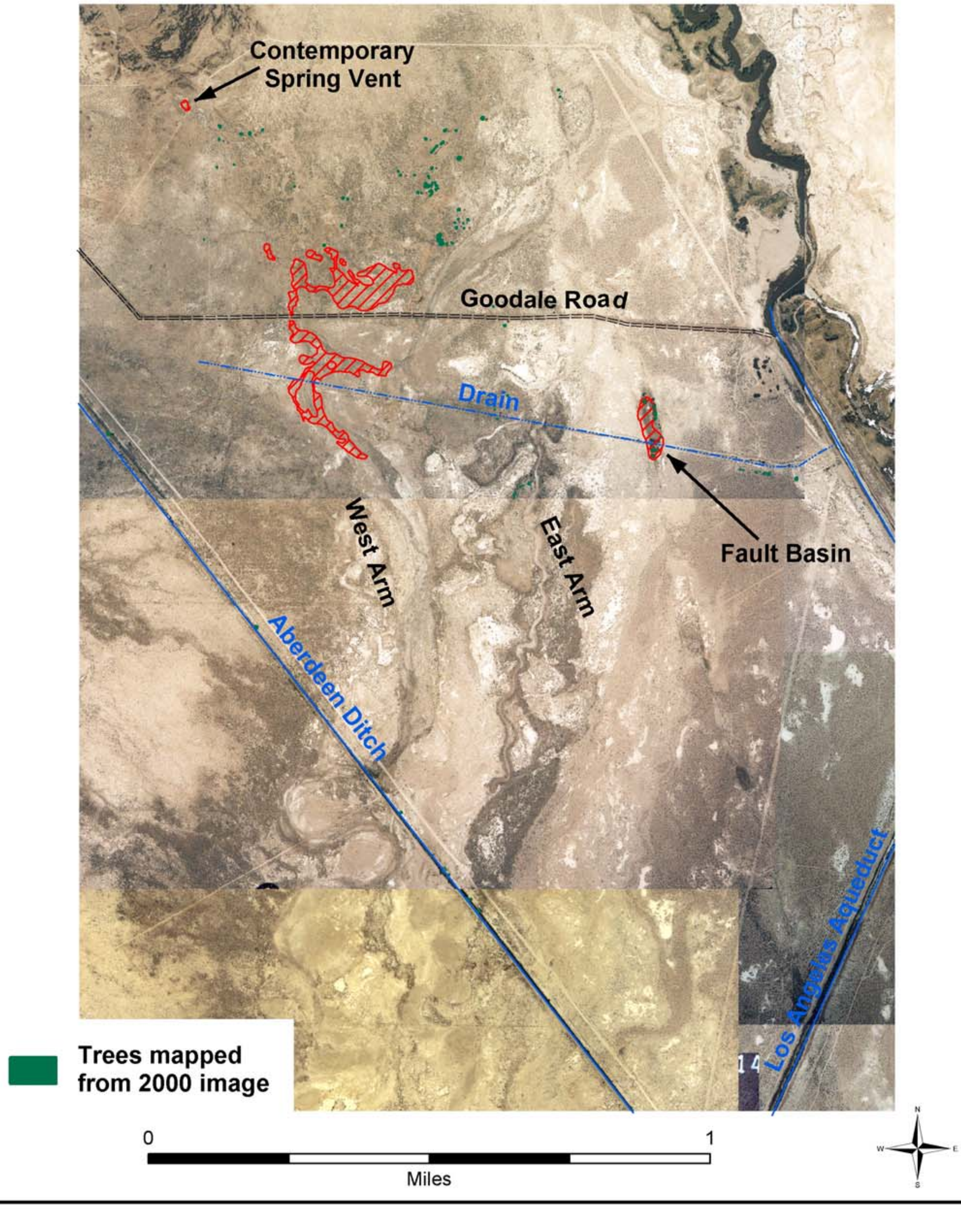
Table 6.7. 1944-2000 spring induced vegetation.

Year	Spring Induced Vegetation (acres)	Trees	
		N	(acres)
1944	139.3	140	2.6
1968	36.7	140	2.6
1981	13.7	80	1.4
1993	13.4	80	1.4
2000	13.4	80	1.4

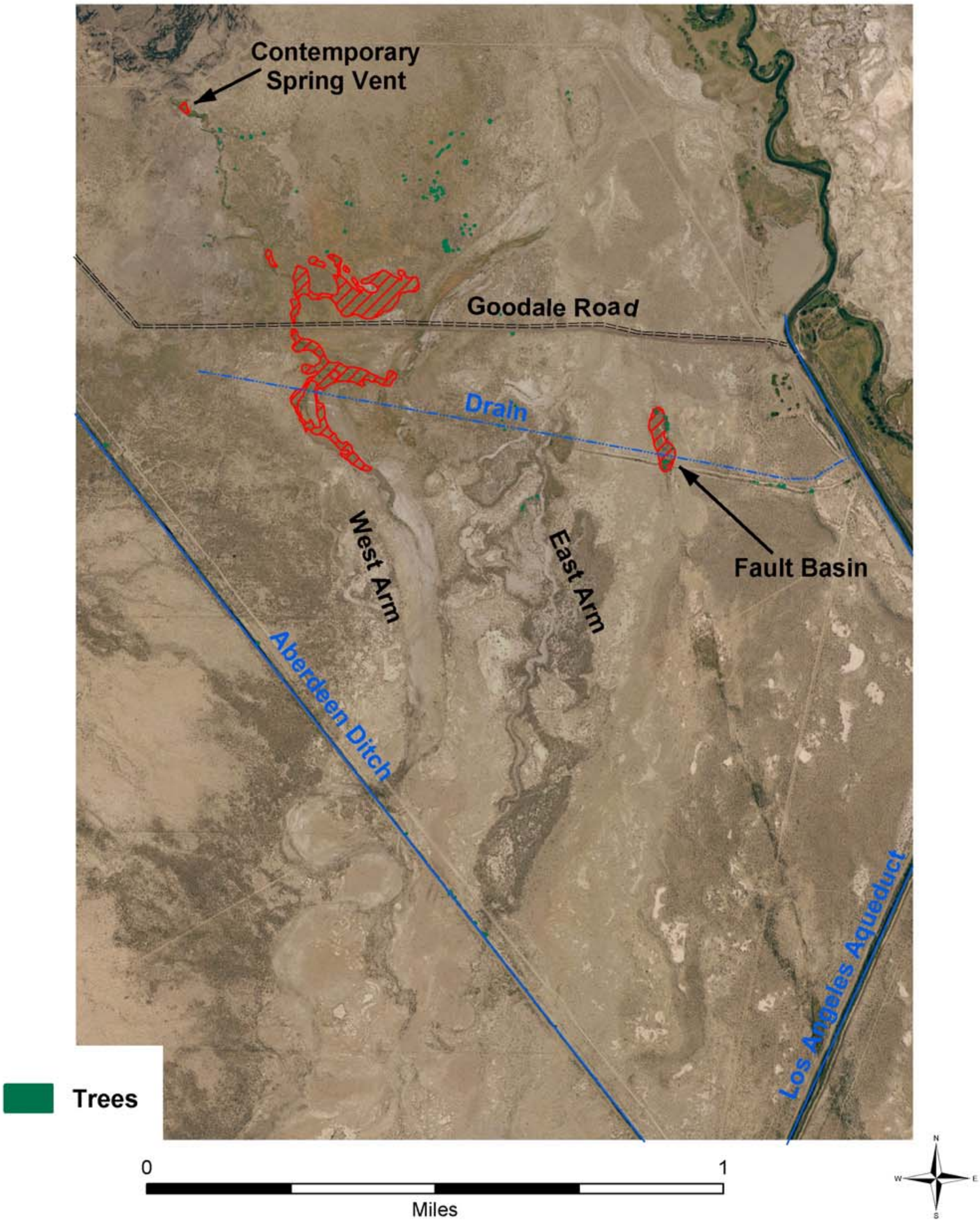
Spring Induced Vegetation
1981 Conditions
Figure 6.16



Spring Induced Vegetation
1993 Conditions
Figure 6.17



Spring Induced Vegetation
2000 Conditions
Figure 6.18



6.2 WARREN LAKE PROJECT AREA

Warren Lake (Figure 6.19) is about 3 miles northwest of the town of Big Pine. Greenbook mapping (Figure 6.20) shows permanent lakes/reservoirs, rush-sedge meadow, alkali meadow, and desert sink scrub vegetation types. Soil mapping (Figure 6.20) shows the lake bed to be intermittent water. An existing spill-gate on the Big Pine Canal was last used to release water to Warren Lake during high-water years in the 1980s. The basin briefly overflowed to Klondike Lake during this period (Wayne Hopper, personal communication). Except after major storms, the lake bed has been dry since the 1980s.

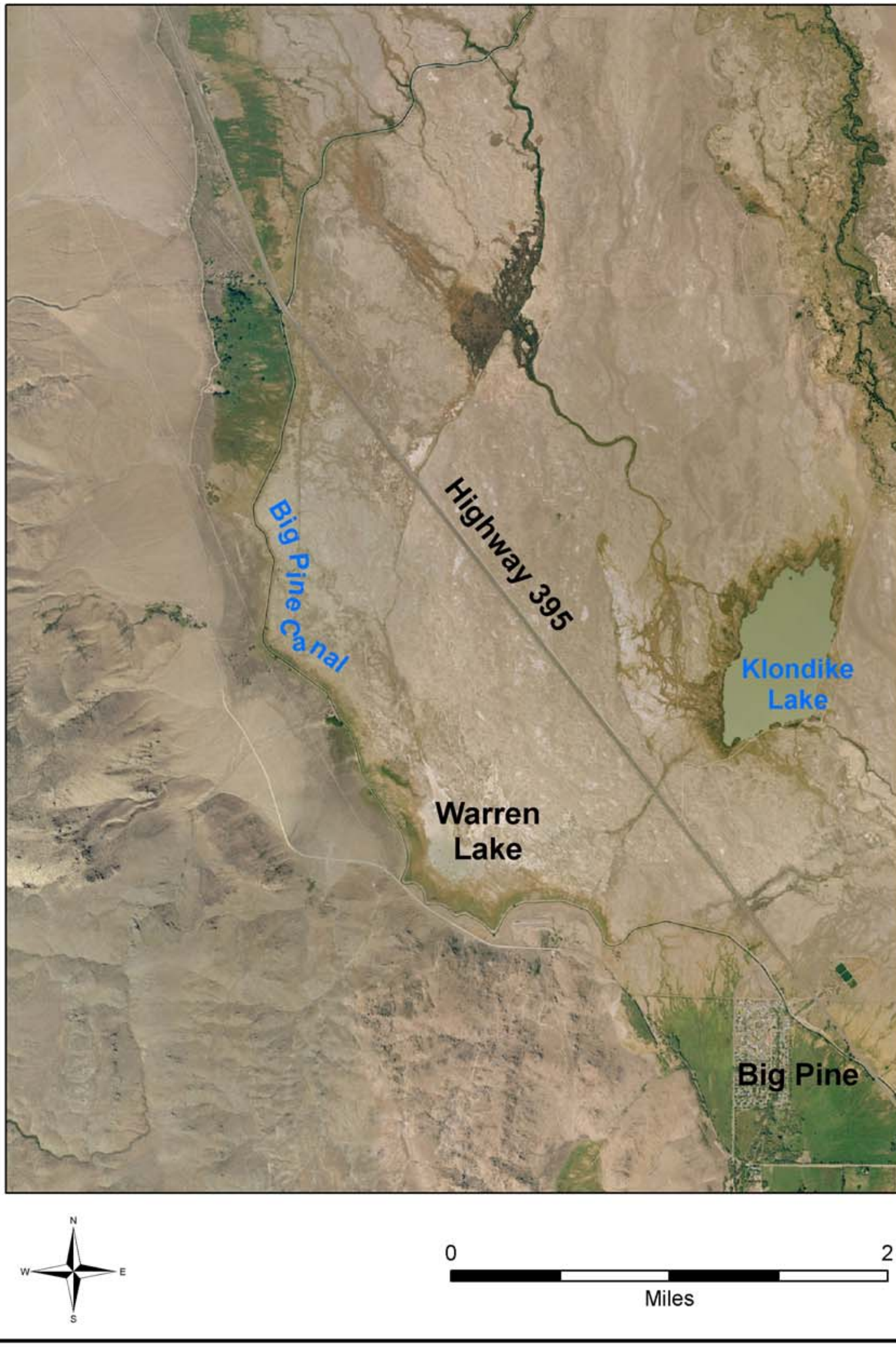
Existing vegetation types of Warren Lake were mapped from the 2000 orthophoto and a brief field reconnaissance in August 2005 (Figure 6.21). Prominent types in the lake basin (Table 6.8) include intermittently flooded playa (57 acres), saltgrass (76 acres), and a complex of desert sink scrub, saltgrass, and playa (167 acres). About 52 acres of wet alkali meadow (saltgrass-rush) are sustained by sub-irrigation from the Big Pine Canal. About eight cottonwoods and tree willow are scattered along the west flank of the lake bed. There is about 52 acres of existing wetland.

Table 6.8. Existing vegetation, Warren Lake*.

Vegetation Type	N	Area (acres)	Area (%)
Alkali meadow (saltgrass)	5	76.3	21.7
Wet alkali meadow (saltgrass-rush)	*4*	*51.8*	*14.7*
Fremont cottonwood/saltgrass-creeping wildrye	*8*	*0.2*	*0.0*
Playa (intermittent lake bed)	1	56.9	16.1
Desert sink-saltgrass-playa complex	2	167.0	47.4
TOTAL	**20**	**352.2**	**100.0**

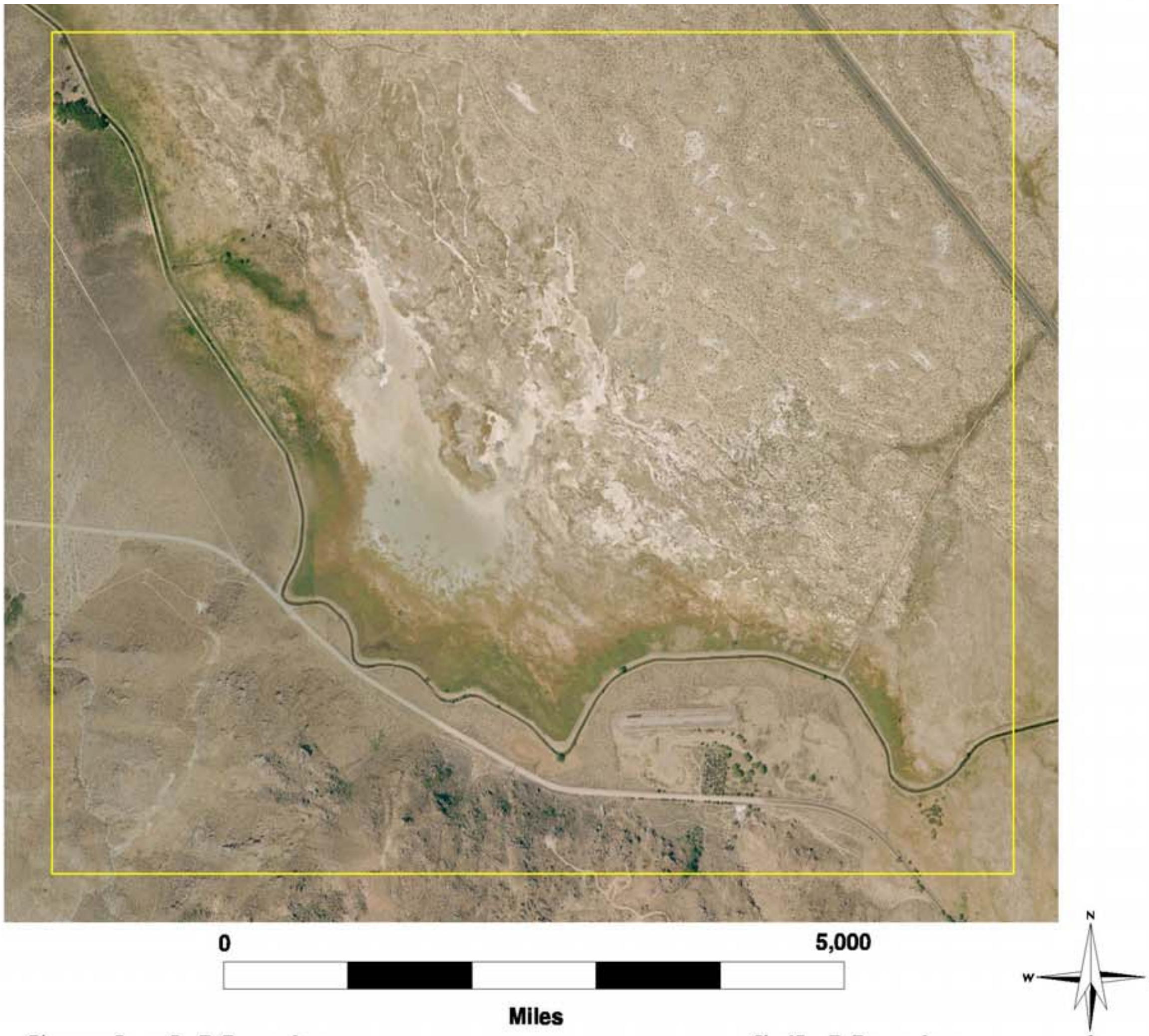
* Wetland vegetation types are *italic.*

Warren Lake Vicinity
Figure 6.19

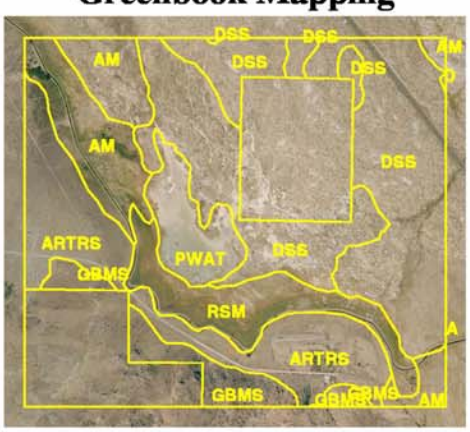


Warren Lake, Greenbook and Soils

Figure 6.20

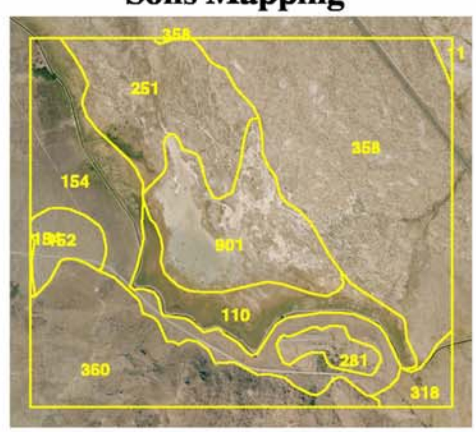


Greenbook Mapping



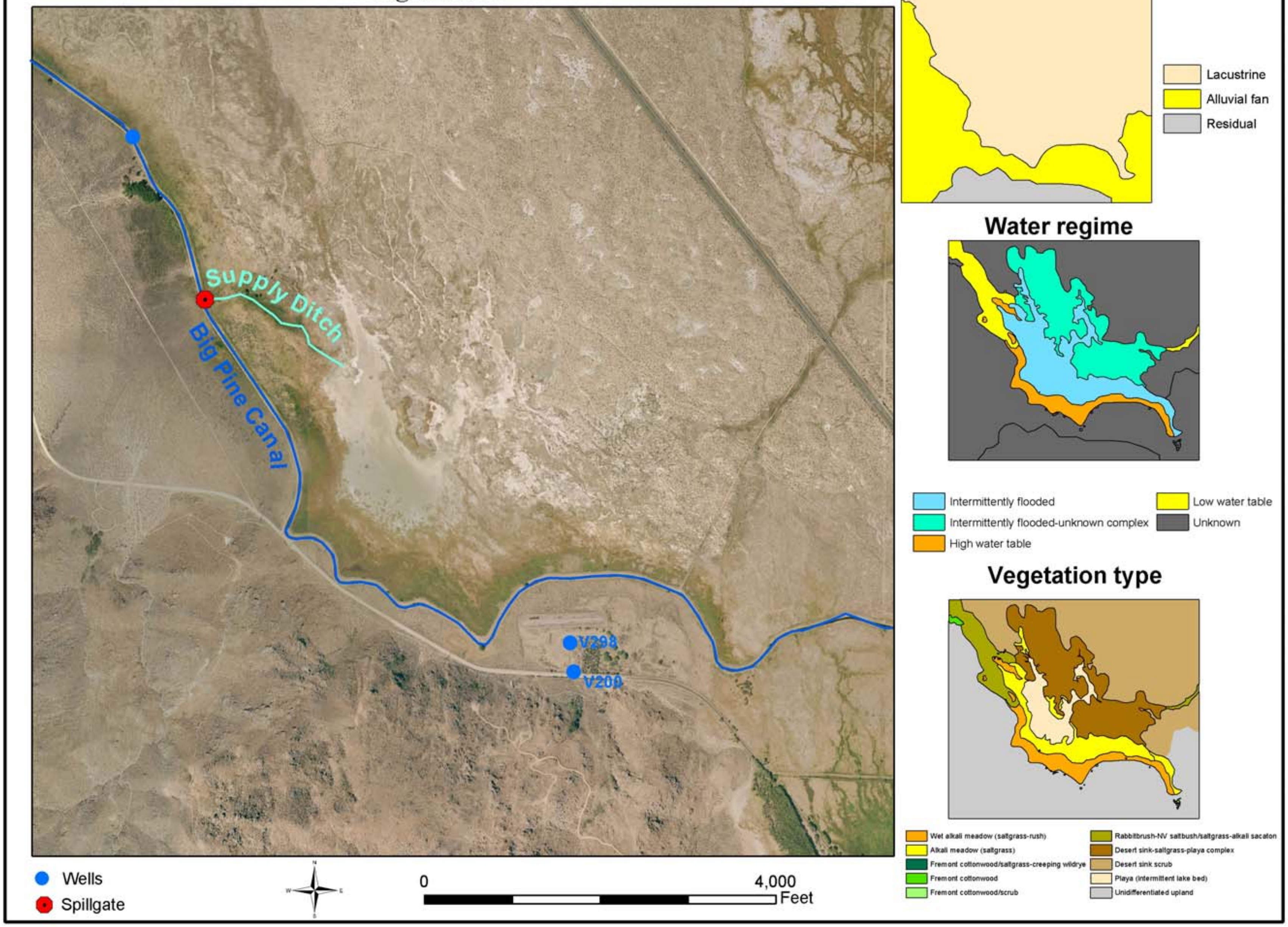
AM - Alkali Meadow
ARTRS - Big Sagebrush Scrub
DSS - Desert Sink Scrub
GBMS - Great Basin Mixed Scrub
PWAT - Permanent Lakes & Reservoirs
RSM - Rush/Sedge Meadow

Soils Mapping



110 - Aquents-Aquic Torripsamments association
152 - Cartago gravelly loamy coarse sand
154 - Cartago gravelly loamy sand
251 - Manzanar-Westguard association
281 - Pits-Dumps complex
318 - Shondow-Hessica association
358 - Westguard-Rienhakel association
360 - Whitewolf-Toquerville families association
901 - Intermittent Water

Warren Lake Area
Figure 6.21



7.0 PROJECT IMPLEMENTATION AND MAINTENANCE

Preliminary mitigation plans were developed for Hines Spring, Hidden Lake, and Warren Lake (WHA 2005b). Fiscal, habitat, and Hydrogeomorphic (HGM) assessments were completed for fourteen alternative plans in the three project areas. The draft mitigation plans for Hines Spring and Warren Lake that are presented here were refined from selected alternative plans. These draft mitigation plans should be further refined using better topographic information (e.g. high-resolution DEMs), more recent satellite imagery (i.e. 2005 Ikonos images), additional field observations (e.g. soil profile descriptions in areas that will be ponded), and a rare plant inventory focused on areas that will be physically disturbed, flooded, or saturated.

The draft mitigation plans for Hines Spring is based on an extensive inventory of 2000 conditions (WHA 2005a). The draft plan for Warren Lake is based on a less intensive inventory included in Preliminary Restoration Plans (WHA 2005b). Given existing landtypes and intended water regimes, future vegetation types were predicted based on analogous settings in Owens Valley (WHA 2004a,b,c,d,e,and f)[50].

Landtypes that evolved in the presence of hydric historic conditions (e.g. *spring drainage*, and *paleochanne*l) are best suited for creating wetland. The soils, topography, micro-relief, and existing vegetation reserves of suitable landtypes evolved over many thousands of years and cannot be easily reconstructed. Mitigation plans are intended to establish more hydric water regimes in suitable landtypes. To the extent feasible, restoration will be passive. Disturbance of soil and existing vegetation reserves will be minimized.

There are numerous examples of passive colonization by hydric herbaceous vegetation in response to hydrologic management in Owens Valley. More than 800 acres of diverse herbaceous wetlands have colonized barren lake-bed in the Delta Habitat Area since the mid-1960s (WHA 2004a). More than 1,800 acres of wetlands have recolonized the lower Owens River in response to flow management (WHA 2004b) instigated in the 1980s. More than 1,100 acres of man-induced wetlands have evolved in response to water management in the BWMA (WHA 2004c). Hydric vegetation has colonized rivulets from flowing wells along the middle Owens River (WHA 2004d). Hydric vegetation has developed in response to long-term irrigation on alluvial terraces (WHA 2004e). We anticipate passive colonization of herbaceous vegetation in response to more hydric conditions in suitable landtypes.

A more active, experimental approach will be applied for establishing riparian trees at Hines Spring. The common riparian trees in Owens Valley are red willow (*Salix laevigata*), Gooding willow (*S. gooddingii*) and Fremont cottonwood (*Populus fremontii*). Riparian trees will be established in areas where alkali meadow (saltgrass) and wet alkali meadow (saltgrass-rush) are created. The approaches to establishing riparian trees/shrubs will include adjusting hydrologic conditions to encourage survival of propagules from existing populations, establishment from cuttings obtained locally, and transplanting of nursery stock developed from local sources. The

[50] Predicted vegetation types based on existing landtype and projected water regime should be viewed somewhat skeptically. Minor differences in surface elevation, microptopography, and drainage pattern will likely result in more complex distributions of vegetation types than predicted. Predictions may be refined based on high-resolution (DEMs).

best areas for establishing riparian trees will be identified after water regimes and herbaceous vegetation have been established. Similarly, the introduction of rare plant/animal species will not be considered until restored conditions are established and it's suitability for the species evaluated.

An estimate of bedloss, the rate at which water infiltrates below the root zone, contributes to the water table, and becomes unavailable for sustaining wetland, was needed to derive water budgets. In November 2003, LADWP conducted six double ring infiltrometer tests in the vicinity of Hines Spring where alluvium covers volcanic bedrock. The average measured infiltration rate was 1,935 feet of water per year. This estimate should be viewed as the expected bedloss when water is first released to the area. This initial rate in residual land is probably much higher than for some other landtypes (e.g. lacustrine, paleochannel, and fault basin) where soils are finer and less permeable. Changes induced by wetland conditions (e.g. saturation of soils, sorting of surface materials, colonization by vegetation, swelling of soil structure, and deflocculating of soil peds) are expected to reduce bedloss over time.

LADWP infiltrometer test, site 3.

The long-term bedloss for established wetlands was estimated from man-induced wetlands in the BWMA (WHA 2004d). The Blackrock Ditch provides most of the water to the Drew, Twin Lakes, Winerton, Waggoner, and Goose Lake management units. Landtypes in these units include fault basins, paleochannel, spring drainage, and lacustrine land similar to those in the Hines Spring area. The major sources of water to these management units are the Blackrock Ditch (4,485 ac-ft/year for the 1990-2002 period) and the Blackrock Siphon (244 ac-ft/year for 1990-2002). The 4,729 acre-feet/year input sustains about 1,471 acres of hydric vegetation (Table 7.1) with an estimated evapotranspiration (ET) of about 2,992 acre-feet/year. Assuming no surface outflow from the area and 6 inches annual precipitation, the average long-term bedloss for established wetland in fault basin, paleochannel, spring drainage, and lacustrine land in the BWMA is about 2 feet per year. A more liberal bedloss of 3 feet per year was used for water budgets of Hines Spring.

Table 7.1. Estimated ET in BWMA management units supplied by the Blackrock Ditch.				
Vegetation Type		ET Rate	Area	ET
Code	Name	(ft/year)	(acres)	(ac-ft)
121	Bulrush-cattail	4.2	383	1610
131	Saltgrass-rush	1.4	212	297
135	Reedgrass	1.4	2	3
151	Saltgrass	1.4	135	189
252	Tamarisk/saltgrass	1.4	2	3
312	Goodding-red willow/Creeping wildrye-saltgrass	2.8	5	19
412	Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	1.0	697	697
500	Water	5.0	35	175
--	**TOTAL**	--	**1471**	**2992**

7.1 HINES SPRING

Hines Spring will be allocated up to 1,300 acre-feet of water projected to enhance and sustain about 230 acres of habitat. An overall design plan for establishing hydrologic conditions conducive to creating a diverse assemblage of herbaceous (understory) wetland types is first discussed. The overall design plan is followed by discussions of riparian tree/shrub establishment, construction features, water management, livestock management, monitoring/adaptive management, research opportunities, and costs.

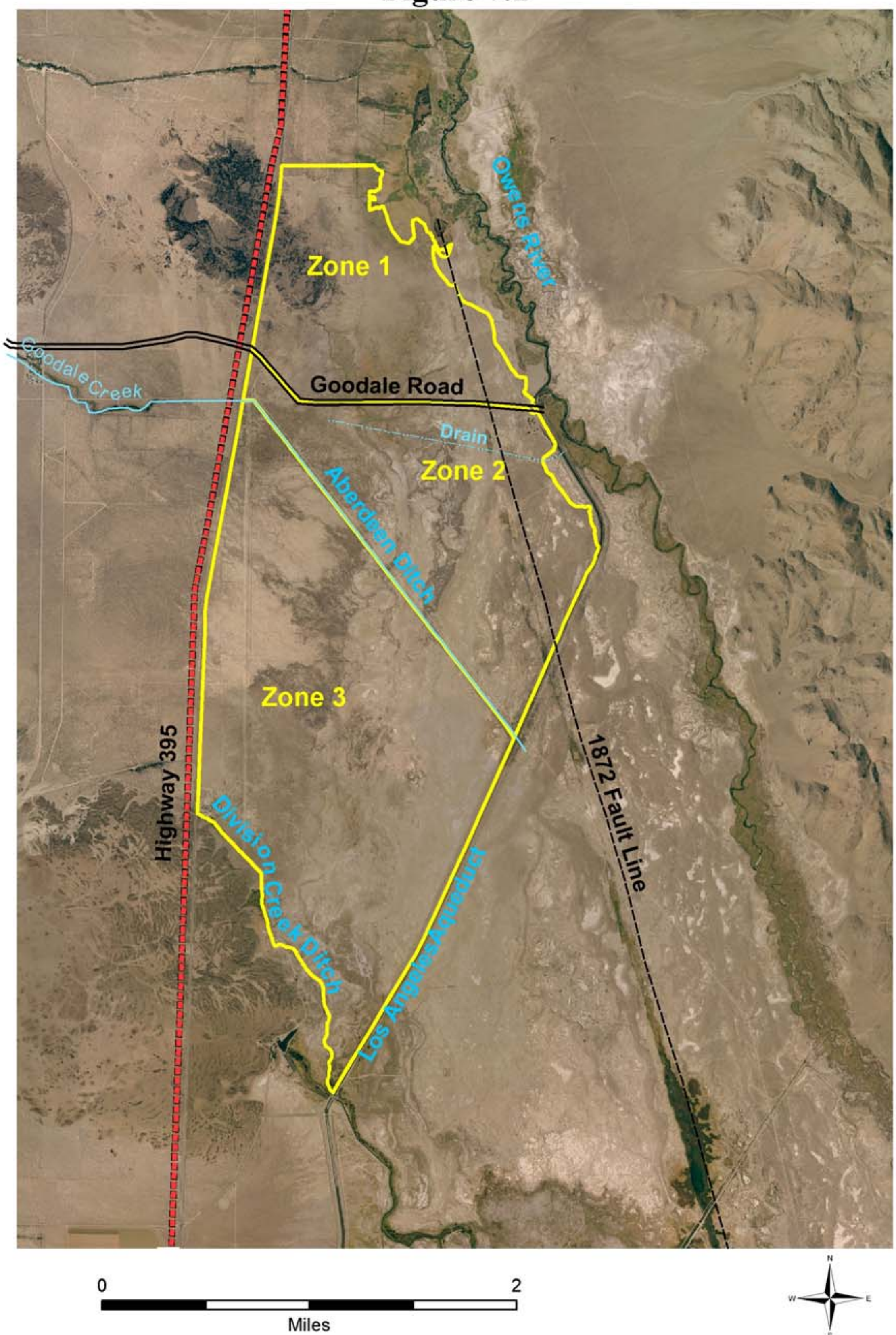
7.1.1 Overall Design Plan

The Hines Spring area was divided into three *zones* (Figure 7.1). One or more *areas* consisting of landtypes[51] best suited for creation of wetlands was identified in each zone. At the direction of Ecosystem Sciences (ES), well 355 was the only water source considered for creating wetland habitats. We anticipate a total long-term annual water budget of about 1,300 acre-feet (1.8 cfs), adjusted to meet higher ET demands in summer and lower demands in winter.

The draft overall design plans should be further refined using better topographic information (e.g. high-resolution Digital Elevation Models [DEMs] with ≤ 1 foot vertical accuracy), more recent satellite imagery (i.e. 2005 Ikonos images), additional field observations (e.g. soil profile descriptions in areas that will be ponded), and a rare plant inventory focused on the restoration areas.

[51] Landtypes are discussed in chapter 4.1 of Hines Spring Inventory, 2000 Conditions (WHA 2005a).

Hines Spring Area
Map Index
Figure 7.1



- **Zone 1 (641 acres):** North of Goodale Road. This zone includes four wetland creation areas (Figure 7.2) where a total of about 43 acres of wetland will be created and another 18 acres of alkali meadow and alkali scrub/meadow (non-wetland) will be created or maintained. A total of about 61 acres will be enhanced.

    - **Area 1 (3.7 acres):** This area is a spring drainage arising from the contemporary vent of Hines Spring. The spring drainage crosses both residual and alluvial lands (Figure 7.3) and is confined along most of its length. Existing vegetation is mostly alkali forb (2.2 acres), alkali meadow (1.2 acres), and alkali scrub/meadow (0.3 acres).

      Water will be delivered to the head of Area 1 via a 360 foot long, 8 inch diameter (1 cfs capacity) buried pipeline from well 355. A valve and flow monitoring devise will be installed near the well head. Dead weeds that fill parts of the incised channel will be burned. Three small dikes in the spring drainage will be removed (or modified). The existing culvert at Goodale Road will be modified or replaced and fitted with an adjustable head-gate and streamflow gage.

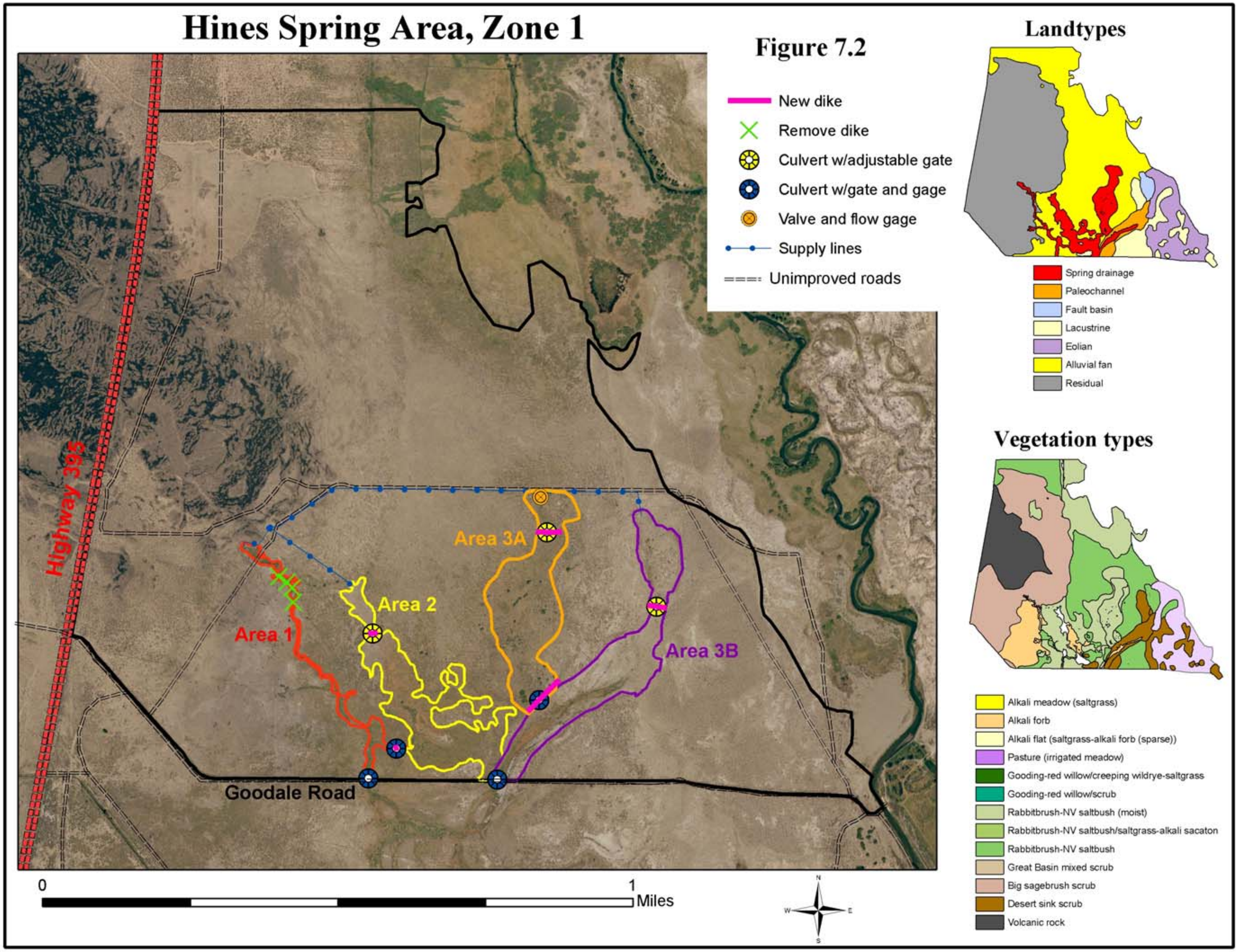
      Predicted understory types (Figure 7.3; Table 7.2) include a small pond (0.1 acres), marsh (3.2 acres), alkali scrub/meadow (0.3 acres), and a small area of wet meadow (<0.1 acre). Two existing tree willow (<0.1 acres) will be enhanced. Initially, about 3.4 acres of wetland/water will be created. Less than 0.1 acres of this habitat will be suitable for establishing riparian trees and shrubs. Wetland vegetation is expected to promote aggradation of the channel bottom, resulting in a broader wetted zone, more diversified wetland habitats, and more area suitable for establishing riparian trees and shrubs. The total predicted ET is 15 acre-feet/year and the long-term bedloss is predicted to be 11 acre-feet/year[52]. The water budget for this area is 26 acre-feet.

      Following establishment of hydrology, the water budget for this zone will be reevaluated. If bedloss if found to be excessive (≥ 6 feet per year), the area may be reduced to the vicinity of the cotemporary spring vent and allocated water may be shifted to other areas in Zone 1 and 2.

[52] LADWP estimated initial bedloss will be excessive, at least where the drainage crosses residual land near the head of the spring drainage. Average long-term bedloss estimated for spring drainage, paleochannel, fault basin, and lacustrine lands in the BWMA may underestimate bedloss for residual lands. If bedloss continues to be excessive in this area, adaptive management to reduce the water allocated to this area to that needed to sustain bulrush/cattail in the immediate vicinity of the contemporary spring vent should be considered.

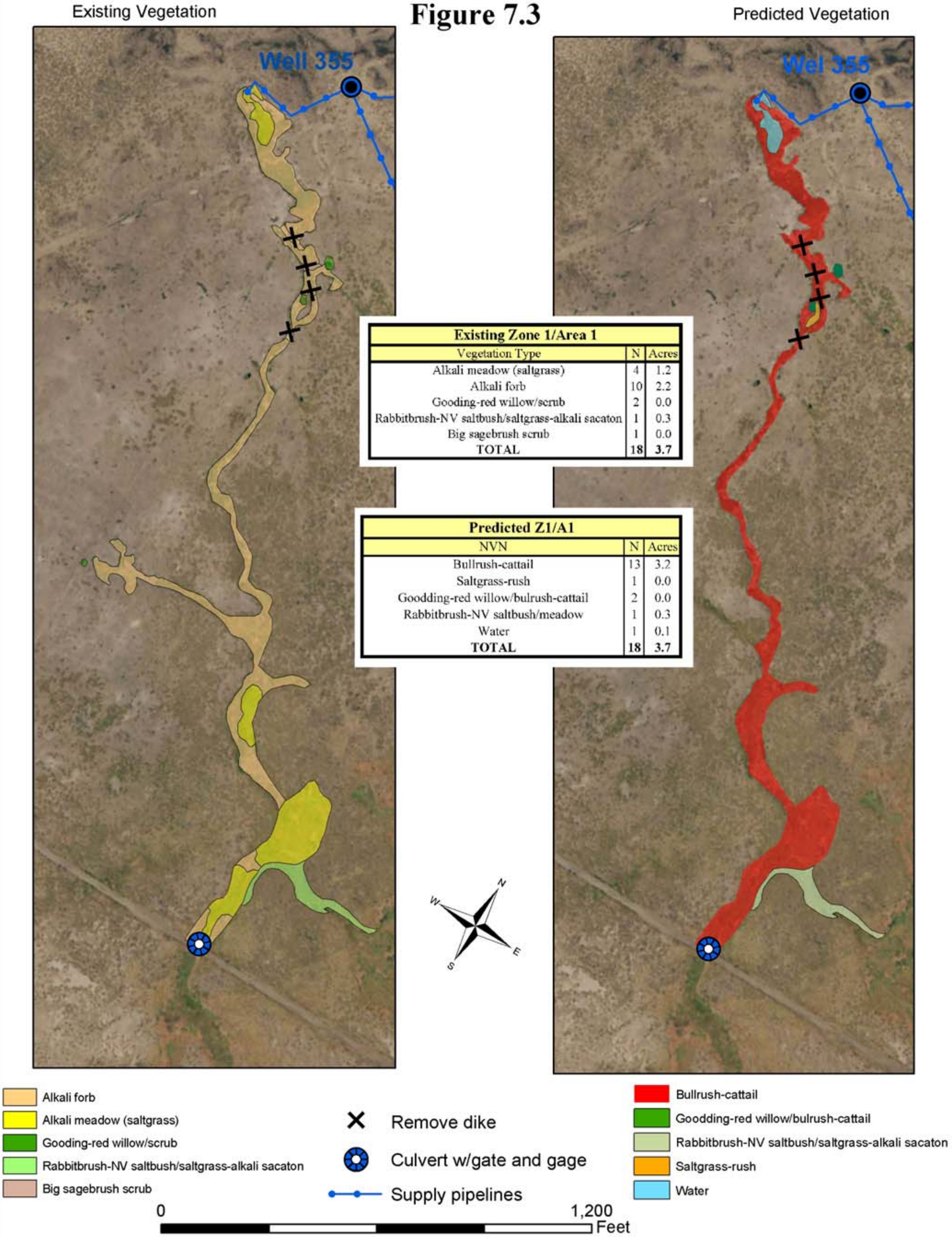
Table 7.2. Predicted Vegetation, Zone 1/Area 1				
Predicted Vegetation	N	Acres	ET (ft/year)	ET (ac-ft)
Bulrush-cattail	*13*	*3.2*	*4.2*	*13.6*
Saltgrass-rush	*1*	*0.0*	*1.4*	*0.0*
Goodding-red willow/bulrush-cattail	*2*	*0.0*	*4.2*	*0.1*
Rabbitbrush-NV saltbush/meadow	1	0.3	1	0.3
Water	1	0.1	4	0.6
TOTAL	**18**	**3.7**	**--**	**14.6**

[*] *Italics* indicate wetland vegetation types.


Hines Spring Area, Zone 1
Figure 7.2
New dike
Remove dike
Culvert w/adjustable gate
Culvert w/gate and gage
Valve and flow gage
Supply lines
Unimproved roads
Landtypes
Spring drainage
Paleochannel
Fault basin
Lacustrine
Eolian
Alluvial fan
Residual
Vegetation types
Alkali meadow (saltgrass)
Alkali forb
Alkali flat (saltgrass-alkali forb (sparse))
Pasture (irrigated meadow)
Gooding-red willow/creeping wildrye-saltgrass
Gooding-red willow/scrub
Rabbitbrush-NV saltbush (moist)
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton
Rabbitbrush-NV saltbush
Great Basin mixed scrub
Big sagebrush scrub
Desert sink scrub
Volcanic rock
Highway 395
Area 1
Area 2
Area 3A
Area 3B
Goodale Road
0
1
Miles

Existing and Predicted Vegetation, Zone 1 Area1

Figure 7.3



Existing Zone 1/Area 1

Vegetation Type	N	Acres
Alkali meadow (saltgrass)	4	1.2
Alkali forb	10	2.2
Gooding-red willow/scrub	2	0.0
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	1	0.3
Big sagebrush scrub	1	0.0
TOTAL	**18**	**3.7**

Predicted Z1/A1

NVN	N	Acres
Bullrush-cattail	13	3.2
Saltgrass-rush	1	0.0
Goodding-red willow/bulrush-cattail	2	0.0
Rabbitbrush-NV saltbush/meadow	1	0.3
Water	1	0.1
TOTAL	**18**	**3.7**

- **Area 2 (17.7 acres):** This is a broadly concave, unconfined spring drainage with no apparent channel. Prominent existing vegetation includes alkali forb (5.3 acres), alkali scrub/meadow (3.7 acres), sparsely vegetated alkali flat (3.4 acres), alkali meadow (2.7 acres), and alkali scrub (2.4 acres)). An old drain about 100 meters southeast of Hines Spring links Area 1 with the head of Area 2. The head of Area 2 is about 825 feet southeast of well 355.

  Water will be delivered to the head of Area 2 via an 890 foot long, 12 inch diameter (2 cfs capacity) buried pipeline from well 355. A water valve and flow meter will be installed at the well head. A low dike about 30 meters long will be constructed across a constriction in the spring drainage to impound water in the head of the area. A 3 foot diameter culvert fitted with an adjustable head-gate will be constructed in the dike to allow regulation of water level behind the dike. Another dike about 15 meters long will be placed across a narrow drainage to Zone 1/Area 1. The lower dike will be fitted with an adjustable head-gate and a flow gage.

  Predicted vegetation types (Figure 7.4; Table 7.3) include water (0.4 acres), bulrush-cattail (5.1 acres), saltgrass-rush (5.2 acres), saltgrass (3.6 acres), and alkali scrub/meadow (3.4 acres). Three tree willow (<0.1 acres) would be enhanced. About 11 acres of wetland will be created. About 9 acres will be suitable for establishing riparian trees and shrubs. The total predicted ET is 37 acre-feet/year and the long-term bedloss is predicted to be 53 acre-feet/year. The water budget for this area is 90 acre-feet.

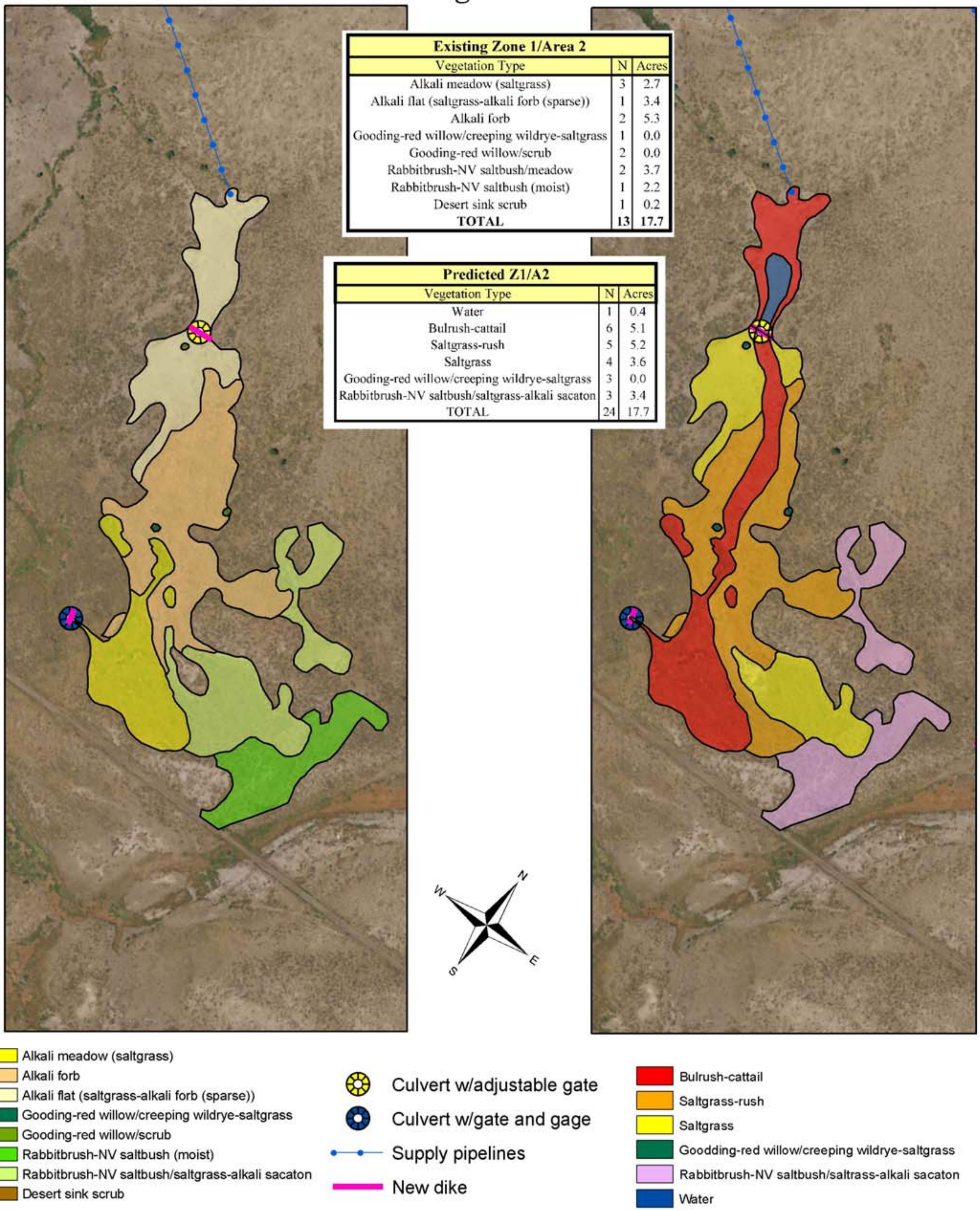
Table 7.3. Predicted vegetation types, Zone 1/Area 2

Predicted Vegetation Type	N	Acres	ET (ft/year)	ET (ac-ft)
Water	*1*	*0.4*	*4*	*1.4*
Bulrush-cattail	*8*	*5.1*	*4.2*	*21.4*
Saltgrass-rush	*5*	*5.2*	*1.4*	*7.3*
Saltgrass	4	3.6	1.4	5.0
Gooding-red willow/creeping wildrye-saltgrass	*3*	*<0.1*	*2.8*	*0.1*
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	3	3.4	1	3.4
TOTAL	**24**	**17.7**	**--**	**38.6**

[*] *Italics* indicate wetland vegetation types.

Existing and Predicted Vegetation, Zone 1 Area 2

Figure 7.4



Existing Zone 1/Area 2

Vegetation Type	N	Acres
Alkali meadow (saltgrass)	3	2.7
Alkali flat (saltgrass-alkali forb (sparse))	1	3.4
Alkali forb	2	5.3
Gooding-red willow/creeping wildrye-saltgrass	1	0.0
Gooding-red willow/scrub	2	0.0
Rabbitbrush-NV saltbush/meadow	2	3.7
Rabbitbrush-NV saltbush (moist)	1	2.2
Desert sink scrub	1	0.2
TOTAL	**13**	**17.7**

Predicted Z1/A2

Vegetation Type	N	Acres
Water	1	0.4
Bulrush-cattail	6	5.1
Saltgrass-rush	5	5.2
Saltgrass	4	3.6
Gooding-red willow/creeping wildrye-saltgrass	3	0.0
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	3	3.4
TOTAL	24	17.7

Area 3a (19.1 acres): This is a broadly concave, very subtle spring drainage[53]. Prominent existing vegetation is a moist variant of rabbitbrush-NV saltbush (18.5 acres). About 40 decadent[54] tree willows (1 acre) are evident on the 2000 image. The head of this area is about 2,500 feet east of Well 355. Rare plants are known to occur in a vegetation monitoring exclosure near the north boundary, just west of this area (Figure 6.8).

Water will be delivered to the area through a short (40 meter) pipe off the same 12 inch diameter (2 cfs capacity) pipeline used to provide Zone 1/Area 3b. A valve and flow measuring devise will be fitted to the pipe outlet to Area 3a. A 0.6 acre pond will be excavated to a maximum depth of about 3 feet. A 60 meter long dike fitted with a 3 foot diameter gated culvert will be constructed along the down-slope edge of the inlet pond. A 120 meter long dike with a 3 foot culvert, adjustable gate, and flow gage will be constructed at the lower end of Area 3a.

Predicted vegetation types (Figure 7.5; Table 7.4) include a pond (0.6 acres) and marsh (0.6 acres) in the upper basin. A complex of water, marsh, and wet meadow (7.3 acres), alkali meadow (1.0 acre) and alkali scrub/meadow (9.1 acres) is predicted in the lower part of the basin. About 40 decadent tree willows (0.6 acres) will be enhanced. About 9 acres of wetland will be created, of which about 8 acres will be suitable for establishing riparian trees and shrubs. The total predicted ET is 27 acre-feet/year and the long-term bedloss is predicted to be 57 acre-feet/year. The water budget for this area is 85 acre-feet.

Table 7.4. Predicted vegetation types, Zone 1/Area 3a

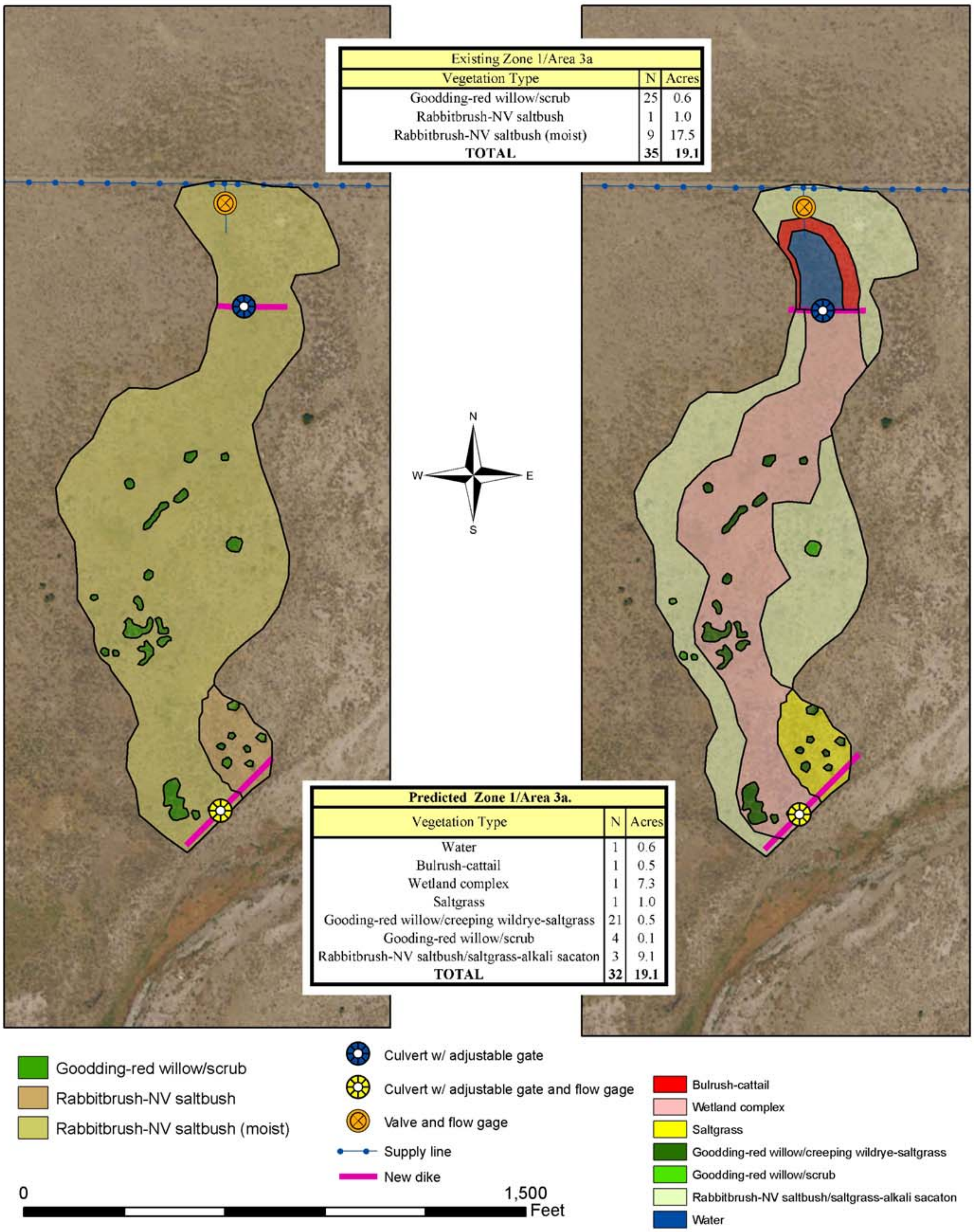
Vegetation Type	N	Acres	ET (ft/year)	ET (ac-ft)
Water	*1*	*0.6*	*4*	*2.6*
Bulrush-cattail	*2*	*0.5*	*4.2*	*2.7*
Wetland complex	*3*	*7.3*	*1.4*	*10.0*
Saltgrass	1	1.0	1.4	1.4
Gooding-red willow/creeping wildrye-saltgrass	*21*	*0.5*	*2.8*	*1.4*
Gooding-red willow/scrub	4	0.1	2.8	0.2
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	3	9.1	1	9.1
TOTAL	**35**	**19.1**	**--**	**27.4**

* ***Italics*** **indicate wetland vegetation types.**

53 This area previously included with the surrounding alluvial fan landtype (WHA 2005a).
54 Some of these tree willows might have died since 2000.

Existing and Predicted Vegetation, Zone 1 Area 3A

Figure 7.5



Existing Zone 1/Area 3a		
Vegetation Type	N	Acres
Goodding-red willow/scrub	25	0.6
Rabbitbrush-NV saltbush	1	1.0
Rabbitbrush-NV saltbush (moist)	9	17.5
TOTAL	**35**	**19.1**

Predicted Zone 1/Area 3a.		
Vegetation Type	N	Acres
Water	1	0.6
Bulrush-cattail	1	0.5
Wetland complex	1	7.3
Saltgrass	1	1.0
Gooding-red willow/creeping wildrye-saltgrass	21	0.5
Gooding-red willow/scrub	4	0.1
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	3	9.1
TOTAL	**32**	**19.1**

- **Area 3b (20.3 acres):** Includes a fault basin (5.5 acres), paleochannel (12.2 acres), and spring drainage (2.7 acres) inset to the paleochannel. Surfaces are broadly concave and drainage will be unconfined. Existing vegetation is mostly desert sink scrub (12.2 acres), rabbitbrush-NV saltbush scrub (5.5 acres), and alkali forb (2.7 acres).

  Water will be delivered to the fault basin at the head this area via a 3,620 foot long, 12 inch diameter (2 cfs capacity) buried pipeline from well 355[55]. A 2 acre pond will be excavated to a maximum depth of about 3 feet[56] . A channel (300-400 feet long) will be excavated to facilitate drainage of the pond to the paleochannel. Goodale road will need to be raised 2-3 feet in the vicinity of the paleochannel crossing. A gated and gauged culvert will be installed where the paleochannel crosses Goodale Road.

  Predicted vegetation types (Figure 7.6; Table 7.5) include a pond (1.9 acres) in the fault basin, marsh (6.4 acres), wet meadow (11.8 acres), and alkali meadow (0.2 acres). Two tree willow (<0.1 acres) will be enhanced. About 20 acres of wetland will be created. About 12 acres will be suitable for establishing riparian trees and shrubs. The total predicted ET is 51 acre-feet/year and the long-term bedloss is predicted to be 61 acre-feet/year. The water budget for this area is 112 acre-feet.

Table 7.5. Predicted Vegetation, Zone 1/Area 3b

Predicted Vegetation	N	Acres	ET (ft/year)	ET (ac-ft)
Water	*1*	*1.9*	*4*	*7.6*
Bulrush-cattail	*4*	*6.4*	*4.2*	*26.9*
Saltgrass-rush	*2*	*11.8*	*1.4*	*16.6*
Saltgrass	1	0.2	1.4	0.3
Goodding-red willow/marsh	*2*	*0.0*	*4.2*	*0.1*
TOTAL	**10**	**20.3**	**--**	**51.3**

* *Italics* indicate wetland vegetation types.

55 This same pipeline will supply Area 3a in Zone 1.

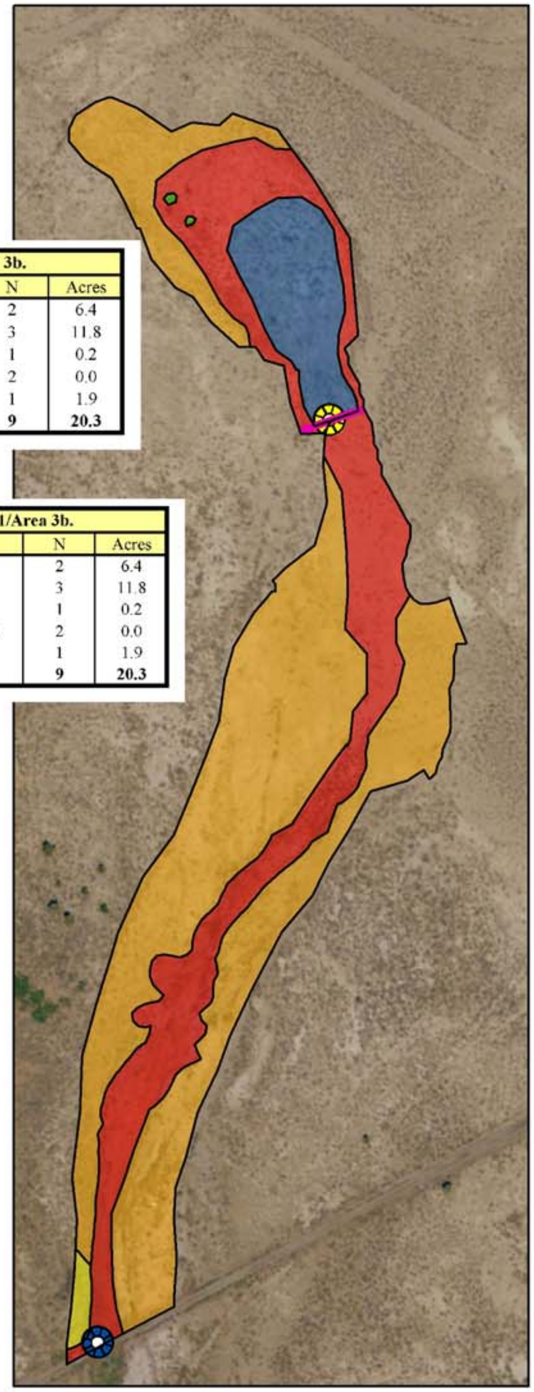
56 A soil pit needs to be described in this area to determine if the pond will hold water. If soils are too permeable, the overall design plan for this area will need to be revised.

Existing and Predicted Vegetation. Zone 1 Area 3B

Figure 7.6

Existing Vegetation

Predicted Vegetation



Predicted Zone 1/Area 3b.		
Vegetation Type	N	Acres
Bulrush-cattail	2	6.4
Saltgrass-rush	3	11.8
Saltgrass	1	0.2
Goodding-red willow/marsh	2	0.0
Water	1	1.9
TOTAL	**9**	**20.3**

Predicted Zone 1/Area 3b.		
Vegetation Type	N	Acres
Bulrush-cattail	2	6.4
Saltgrass-rush	3	11.8
Saltgrass	1	0.2
Goodding-red willow/marsh	2	0.0
Water	1	1.9
TOTAL	**9**	**20.3**

Alkali forb
Gooding-red willow/scrub
Rabbitbrush-NV saltbush (moist)
Rabbitbrush-NV saltbush
Desert sink scrub

New dike
Culvert w/gate and gage
Culvert w/gate

Bulrush-cattail
Saltgrass-rush
Saltgrass
Gooding-red willow/bulrush-cattail
Water

0 1,600 Feet

- **Zone 2 (889 acres):** This zone spans from Goodale Road to the Aberdeen Ditch. One of three areas (Figure 7.7) considered in preliminary assessments (WHA 2005b) was selected as feasible and most reasonable.

    - Area 1 (59.7 acres): Drainage from Zone 1 merges about 300 feet south of Goodale Road in this area. The area includes both spring drainage (14.0 acres) and paleochannel (39.8) landtypes. Prominent existing vegetation types are alkali scrub (38.8 acres), sparsely vegetated alkali flat (8.5 acres), alkali forb (7.3 acres), and alkali meadow (5.1 acres).

      Areas 1 and 3 in Zone 1 will overflow to this area. Inflow will be monitored at two gated culverts under Goodale Road that will be fitted with flow recording gages. Several small dikes, three of which are associated with an existing drain, will be removed. A gauged, gated, special culvert (siphon) will be used to convey drainage from Zone 2 across the Aberdeen Ditch to Zone 3. No dikes are anticipated at this time, although they may be considered later to spread water to expand wetland/water areas.

      Predicted vegetation types (Figure 7.8; Table 7.6) include marsh (21.2 acres), wet meadow (19.8 acres), alkali meadow (12.3 acres), and alkali scrub/meadow (6.3 acres). About 41 acres of wetland will be created. About 32 acres will be suitable for establishing riparian trees and shrubs. The total predicted ET is 140 acre-feet/year and the long-term bedloss is predicted to be 179 acre-feet/year. The water budget for this area is 320 acre-feet.

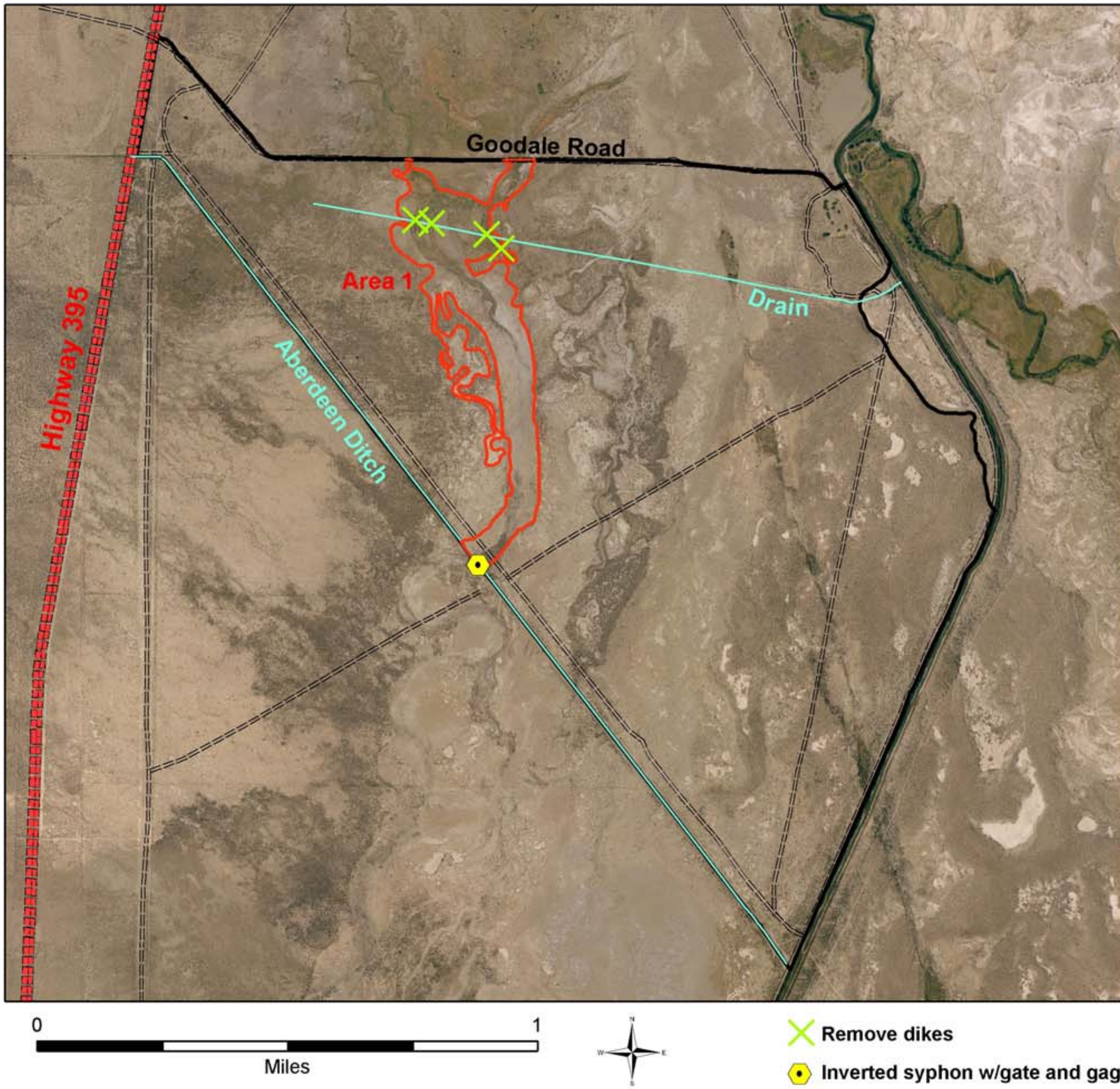
Table 7.6. Predicted Vegetation, Zone 2/Area 1

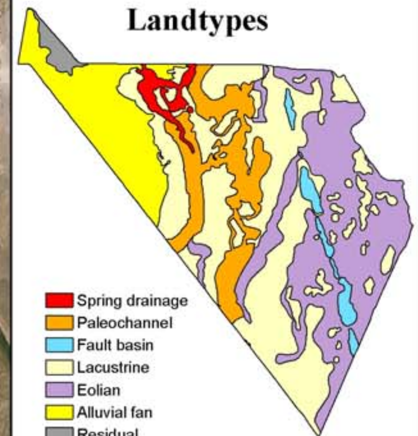
Predicted Vegetation	N	Acres	ET	
			(ft/year)	(ac-ft)
Bulrush-cattail	*13*	*21.2*	*4.2*	*89.2*
Saltgrass-rush	*7*	*19.8*	*1.4*	*27.7*
Saltgrass	4	12.3	1.4	17.2
Rabbitbrush-NV saltbush/meadow	5	6.3	1	6.3
TOTAL	**29**	**59.7**	**--**	**140.4**

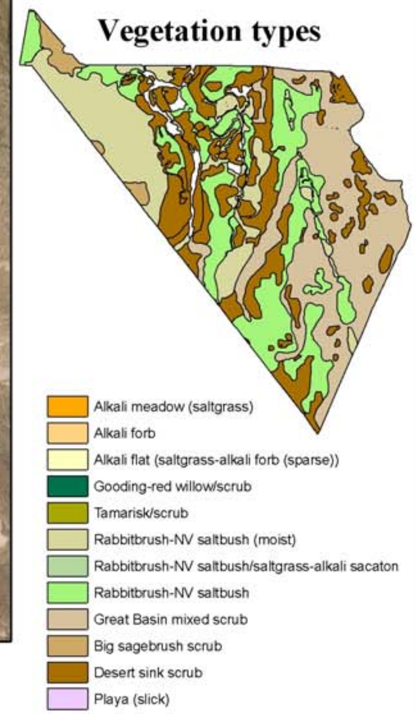
* *Italics* indicate wetland vegetation types.

Hines Spring Area, Zone 2

Figure 7.7

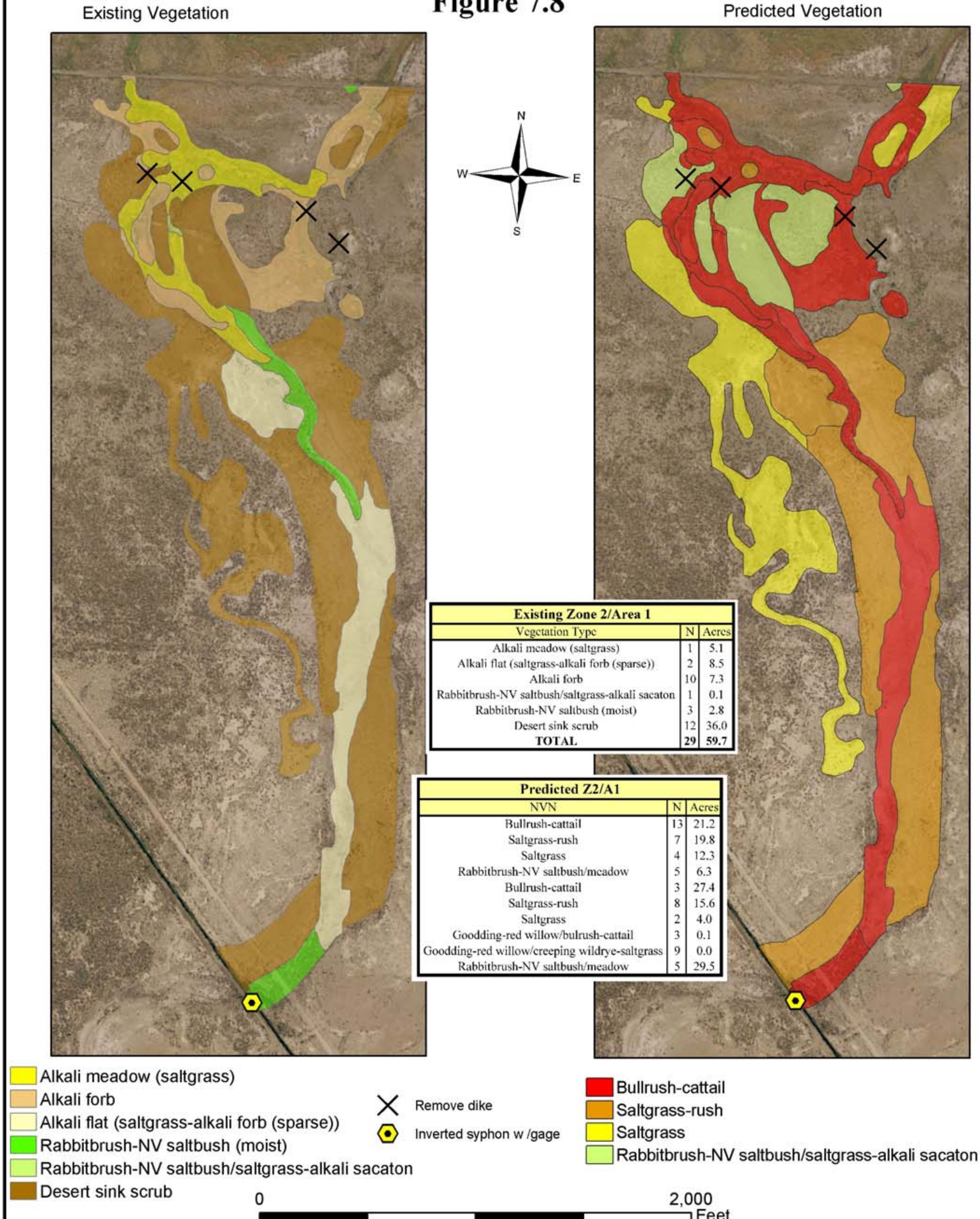






Existing and Predicted Vegetation, Zone 2 Area 1

Figure 7.8



Existing Zone 2/Area 1		
Vegetation Type	N	Acres
Alkali meadow (saltgrass)	1	5.1
Alkali flat (saltgrass-alkali forb (sparse))	2	8.5
Alkali forb	10	7.3
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	1	0.1
Rabbitbrush-NV saltbush (moist)	3	2.8
Desert sink scrub	12	36.0
TOTAL	**29**	**59.7**

Predicted Z2/A1		
NVN	N	Acres
Bullrush-cattail	13	21.2
Saltgrass-rush	7	19.8
Saltgrass	4	12.3
Rabbitbrush-NV saltbush/meadow	5	6.3
Bullrush-cattail	3	27.4
Saltgrass-rush	8	15.6
Saltgrass	2	4.0
Goodding-red willow/bulrush-cattail	3	0.1
Goodding-red willow/creeping wildrye-saltgrass	9	0.0
Rabbitbrush-NV saltbush/meadow	5	29.5

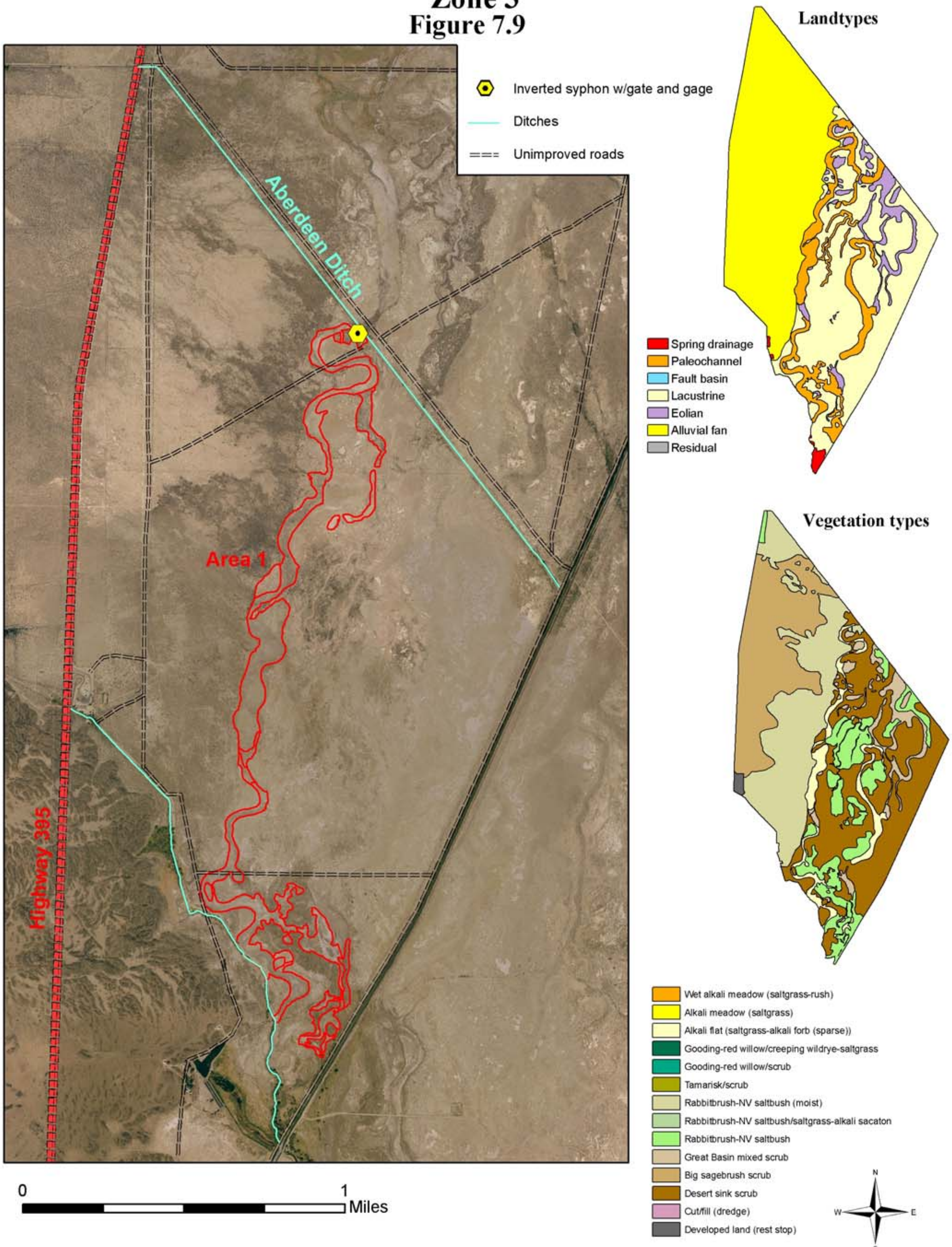
- **Zone 3 (1699 acres):** This area is south of Aberdeen Ditch, east of the Los Angeles Aqueduct, and north of the Division Creek Ditch (Figure 7.9). Nearly half of the area (803 acres) is paleochannel and lacustrine land that is well suited for creating wetland. Both the predicted area of wetland and the water budget are conservative.

  Area 1 (119.7 acres): Inflow to this area will be provided via a special culvert across the Aberdeen ditch from Zone 2/Area 1. If flow reaches the southern part of Zone 3, it will be contained by existing dikes along the Division Creek Ditch and the Los Angeles Aqueduct. Alkali flat (79.8 acres), rabbitbrush-NV saltbush (10.9 acres), desert sink scrub (26.3 acres), and Great Basin mixed scrub (2.2 acres) are the prominent existing vegetation types. Rare plants are known to occur in the southern part of this area (Figure 6-8).

  No structures are anticipated at this time, although dikes might be considered later to facilitate expansion of wetlands. A few scattered tamarisks will be removed.

  During the first five water-years, overflow to Zone 3 will be incrementally increased from about 70 acre-feet the first year up to about 270 acre-feet the fifth year (within the 1,300 acre-feet allocation). These flow increases are expected to favor an incremental expansion of wetlands and to minimize weed infestations common to intermittently flooded habitats. The long-term (water-years 6 and beyond) annual water budget for Zone 3 will be the total allocated to Hines Spring (1,300 acre-feet) less water consumed in Zone 1 and Zone 2. If long-term water consumption in Zones 1 and 2 is as predicted, about 667 acre-feet will overflow to Zone 3; if water consumed in Zones 1 and 2 is more or less than predicted, more or less water will overflow to Zone 3. Assuming an average ET of 3 acre-feet per year and average bedloss of 3 feet per year, the predicted long-term water budget for Zone 3 will sustain a complex of water, marsh, wet meadow, and alkali meadow that is about 110 acres.

Zone 3
Figure 7.9



Zone 3 Area 1

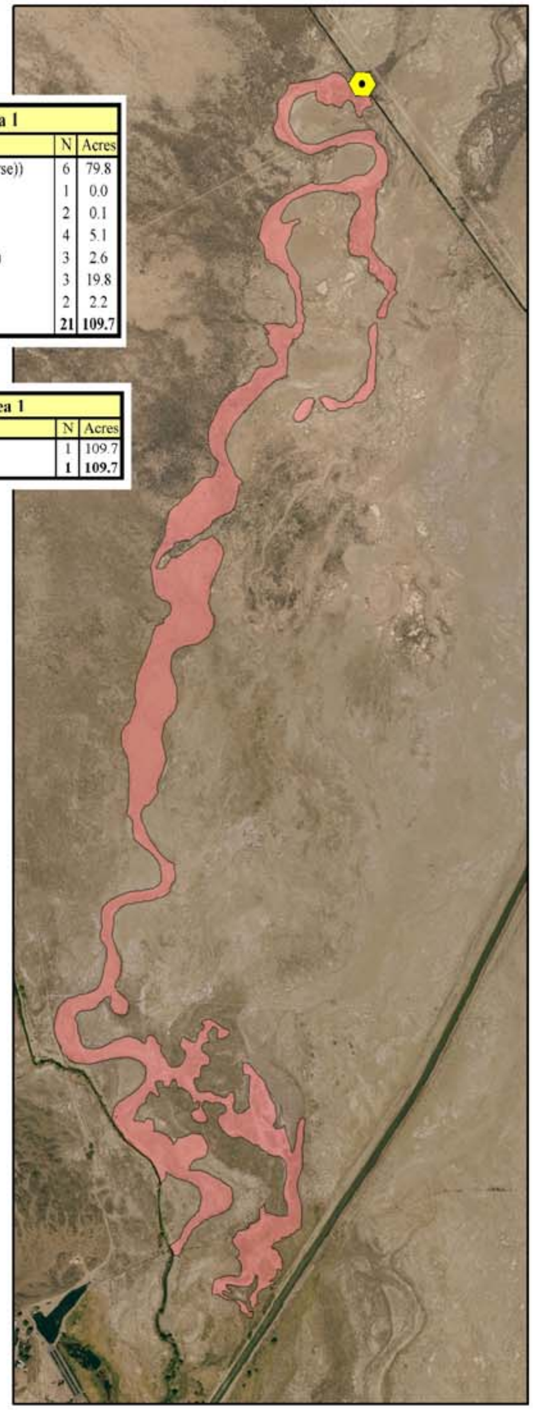
Figure 7.10

Existing Vegetation

Existing Zone 3/Area 1		
Vegetation Type	N	Acres
Alkali flat (saltgrass-alkali forb (sparse))	6	79.8
Tamarisk/scrub	1	0.0
Gooding-red willow/scrub	2	0.1
Rabbitbrush-NV saltbush	4	5.1
Rabbitbrush-NV saltbush (moist)	3	2.6
Desert sink scrub	3	19.8
Great Basin mixed scrub	2	2.2
TOTAL	**21**	**109.7**

Predicted Zone 3/Area 1		
Vegetation Type	N	Acres
Wetland complex	1	109.7
TOTAL	**1**	**109.7**

Predicted Vegetation



Saltgrass-alkali forb (sparse)
Goodding-red willow/scrub
Tamarisk/scrub
Rabbitbrush-NV Saltbush (moist)
Rabbitbrush-NV saltbush
Great basin mixed scrub
Desert sink scrub

Inverted syphon w/gate and gage

Wetland complex

0 — 6,000 Feet

The areas of predicted water regimes and vegetation types that will be established in the Hines Spring area are summarized in Table 7.7. About 194 acres of wetland and 36 acres of productive upland (alkali meadow and alkali scrub/meadow) will be created. About 28 tree willows (0.5 acres) may be sustained. A total of about 230 acres will be enhanced, including about 116 acres suitable for establishing riparian trees. The total predicted ET is 604 acre-feet/year and the long-term bedloss is predicted to be 691 acre-feet/year. The water budget is about 1,300 acre-feet.

Table 7.7. Predicted vegetation, all zones

Vegetation Type	N	Acres	ET (ft/year)	ET (ac-ft)
Water	*4*	*3.0*	*5.0*	*15*
Bulrush-cattail	*9*	*36.5*	*4.2*	*153*
Saltgrass-rush	*14*	*44.0*	*1.4*	*62*
Saltgrass	9	17.0	1.4	24
Wetland complex[57]	*3*	*109.7*	*3.0*	*329*
Goodding-red willow/bulrush-cattail	*4*	*0.0*	*4.2*	*0*
Goodding-red willow/creeping wildrye-saltgrass	*24*	*0.5*	*2.8*	*2*
Goodding-red willow/scrub	4	0.1	1.0	0
Rabbitbrush-NV saltbush/saltgrass-alkali sacaton	11	19.2	1.0	19
TOTAL	**82**	**230.2**	**--**	**604**

[*] *Italics* indicate wetland vegetation types.

[57] The wetland complex predicted for Zone 3 is expected to include a distribution of vegetation types similar to that predicted in other areas, of which about 50 percent is suitable for establishing riparian trees.

7.1.2 Water Management

Well 355 will be used to supply up to 1,300 acre-feet of water per year to the Hines Spring area. During the initial 5 year period of wetland establishment, water used at Hines Spring area may be less than 1,300 acre-feet. If the volume of water released to the Hines Spring area is less than 1,300 acre-feet for any water-year, the difference will be added to the allocation for Warren Lake the following water-year. A seasonal water budget will sustain higher demands in summer and lower demands in winter. Water will be released to Zone 1, which will overflow to Zone 2, which overflows to Zone 3. Inflow/outflow will be measured hourly and collected biweekly for the four areas in Zone 1 and for Zone 2. Hydrologic monitoring will serve as a basis for refining water management.

- **Initiation flows (Water Year 1):** These flows will maximize the extent of hydric conditions in Zone 1 and 2, while minimizing hydric conditions in Zone 3. They will also be used to estimate bedloss and calibrate flows in discrete areas. Maximum initiation flows will be 1 cfs (300 acre-feet) in fall/winter (October through February) and 2.4 cfs (1,000 acre-feet) in spring/summer (March through September). On October 1 preceding the first growing season, 1 cfs will be released to the four areas in Zone 1 (0.25 cfs per area)[58]. The adjustable gates at the head of Areas 1, 2, 3a, and 3b and the gates at the bottom of the four areas will be set to maximize hydric conditions in Zone 1. Water will be released to Zone 2 when Zone 1/Area 1 and Zone 1/Area 3b have filled to capacity. When Zone 2 is filled to capacity, inflows to Zone 1 will be adjusted to maintain about 0.1 cfs overflow to Zone 3.

  Overflow to Zone 3 will be recorded hourly and collected biweekly at a stream gage. If the total average overflow exceeds 0.1 cfs[59] for any monitoring period, inflow to Zone 1 will be reduced by the same amount for the following monitoring period. If the total average overflow is less than 0.1 cfs, inflow to Zone 1 will be increased by the same amount, <u>up to the maximum initial season flow (1 or 2.4 cfs)</u>. The product of initiation flows will be large wetted areas in Zone 1 and 2, and a smaller wetted area in Zone 3. Initiation flows will not exceed 1,300 acre-feet. If initiation flows are less than 1,300 acre-feet, the difference will be added to water allocated to Warren Lake the following year.

  Average monthly water consumption (inflow minus outflow) in Zones 1 and 2 will be evaluated from flow records for the first water-year. If water consumption for any area (e.g. Zone 1/Area 1) is found to be excessive ($\geq$ 10 acre-feet per acre) and the trend in consumption is not decreasing, actions to reduce bedloss (e.g. reduce Zone 1/Area 1 to the vicinity of the contemporary vent; lower head-gates to reduce ponded area; shift allocated water to a different Hines Spring area where bedloss is not excessive;) and/or reduce expectations for the Hines Spring area will be considered.

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[58] Establishing wetted conditions before the growing season is expected to limit weed infestations to the periphery of the wetted zone, where they can be treated. Flooding and saturated conditions are expected to limit colonization of many weeds within the wetted zone, enhancing conditions for colonization by native hydrophytic vegetation.

[59] If extensive areas of Zone 3 are flooded the first year and the extent of flooding is reduced in subsequent years as transpiring vegetation becomes established in Zones 1 and 2, weeds will proliferate.

- **Wetland creation flows (Water-years 2 through 5):** The purpose of these flows is to maintain hydric conditions established in Zones 1 and 2, and to encourage expansion of hydric conditions in Zone 3. Overflow to Zone 3 will be recorded hourly and collected biweekly at a stream gage.

    - Summer inflows will be managed to increase overflow to Zone 3 by about 0.1 cfs per year (0.2 to 0.5 cfs for water-years 2 to 5). If the total average overflow to Zone 3 exceeds the specified summer overflow for any monitoring period, inflow will be reduced by the same amount to the area in Zone 1 with the greatest outflow for the following monitoring period; if average overflow to Zone 3 is less than the specified overflow, inflow to Zone 1 will be increased by the same amount, up to 2.4 cfs maximum.

    - Winter inflows will be managed to maintain an average overflow to Zone 3 of about 0.2 cfs. If the total average overflow to Zone 3 exceeds 0.2 cfs for any winter monitoring period, inflow will be reduced to Zone 1 the following period; inflow will be increased up to a maximum of 1 cfs if overflow to Zone 3 is less than 0.1 cfs.

  Annual wetland creation flows will not exceed 1,300 acre-feet. If flows are less than 1,300 acre-feet, the difference will be added to water allocated to Warren Lake the following year.

- **Long-term maintenance flows (Water-year 6 and beyond):** The 1,300 acre-feet water allocated to Hines Spring will be used in full. Hydrologic monitoring over the five year period of record will be used distribute the total allocation as summer (May through September), fall (October through November), winter (December through February), and spring (March through April) flows to optimize sustenance and further expansion of wetland resources.

7.1.3 Riparian Trees

In 1944, the Hines Spring area supported about 140 trees (WHA 2005a). Assuming a 10 meter crown diameter, trees covered about 2.7 acres. In 2000, about 96 decadent trees with reduced crown diameter were present. Assuming a 5 meter crown diameter, decadent trees cover about 0.5 acres in 2000. Some of the decadent trees may have died since 2000. Restoration is expected to enhance about 50 existing decadent trees (some of which may be dead).

At least 300 additional trees will be established. Assuming a mature crown diameter of 10 meters for the 300 additional trees and the 50 existing trees that will be enhanced, about 6.8 acres of riparian trees will be established.

An experimental approach will be used to evaluate 3 establishment techniques:

- **Seeding:** Collect seeds of cottonwood, red, and Goodding willow from local sources. Seeds of cottonwood or tree willow will be broadcast over a shallow flooded area. The best areas for seeding will be sparsely vegetated areas (e.g. alkali flat and desert sink scrub) in spring drainage, paleochannel, and lacustrine landtypes that can be flooded in the spring, maintain moist subsoil through the growing season, and with ground water within the rooting depth of mature trees. After broadcasting the seeds, water level will be dropped to expose seedbeds and promote germination. The seedbeds will be intermittently flooded for the first few growing seasons to promote seedling survival. Seedling establishment, survival, and production will be monitored.

- **Cutting:** Cuttings of cottonwood, red, and/or Gooddings willow will be acquired from local sources. The best areas for cuttings will be those where wet alkali meadow (saltgrass-rush) is created and with groundwater present within the rooting depth of mature trees. Cutting survival and production will be monitored.

- **Nursery stock:** Cottonwood, red, and Gooddings willow will be propagated from local stock and transplanted to the area. Planting survival and production will be monitored.

Seeding, cutting, and nursery stock will be monitored for 3 years. At the end of three years, the most efficient technique (quantified in terms of survival and production per unit of effort) will be determined. The most efficient technique will be applied to augment plantings such that at least 350 live trees are present in the restoration areas.

7.1.4 Construction Features

Construction/features include upgrading well 355, earthmoving, supply pipelines, culverts, and flow gages. All construction features will be completed before October 1.

- **Well 355:** Overhead power will be supplied to the well head. The existing well will be redeveloped and equipped to supply up to about 5 cfs. The well will be upgraded to LADWP design and specifications.

- **Earthmoving**
  - **Excavation of ponds:** Ponds are anticipated in the heads of Zone 1/Area 3a (0.6 acres) and Zone 1/Area 3b (1.9 acres). Soil in the vicinity of anticipated ponds will be described and reported in a subsequent version of this mitigation plan. The ability of subsoils to retain surface water will be evaluated. If subsoils are found to be too permeable to retain surface water, alternative techniques, locations, and approaches to restoration of these areas will be considered. If subsoils are found suitable for retaining water, the qualities of materials will be further evaluated for use in other Hines Springs construction features (e.g. dikes). Spoils not used for other construction features will be stockpiled in designated locations outside the restoration areas. Assuming an average cut depth of 2 feet, about 5 acre-feet (8,000 cubic yards) of material will be excavated for the two ponds.

  - **Create dikes:** Five dikes will be constructed in Zone 1. Materials excavated from ponds will be evaluated for use in constructing dikes. The top of dikes will be at or below the elevation of surrounding uplands to minimize visual impacts. Dikes will be designed and constructed by LADWP. Assuming a trapezoidal cross-section with 5 feet top-width, 10 feet base-width, and 4 feet high, the five new dikes (900 feet total length) will require about 1,250 cubic yards of material to construct.

  - **Raise Goodale Road:** The existing dirt road will be raised 3-4 feet in the vicinity of the paleochannel crossing between Zone 1/Area 3b and Zone 2. About 1000 linear feet of road (25 feet wide) will require 2,800 to 3,700 cubic yards of road base. A buried liner will be installed along the upslope side of the road fill to prevent drainage from Zone 1/Area 3b through the fill.

  - **Remove/modify dikes:** Four (4) existing small dikes in Zone 1/Area 1 and 4 small dikes in Zone 2 will be further evaluated. If dikes are determined to inhibit restoration, they will be leveled (materials will be wasted on-site). Alternately, existing dikes may be modified to enhance restoration.

- **Supply pipelines:** Three buried pipelines will be used to supply water to Area 1, Area 2, and Areas 3a/3b in Zone 1. Dimensions of supply pipelines to be constructed by LADWP to standard specifications are:
    - **Area 1:** 360 feet long, 8 inch diameter pipe (1 cfs capacity).
    - **Area 2:** 890 feet long, 12 inch diameter pipe (2 cfs capacity)
    - **Area 3a/3b:** 3,660 feet long, 12 inch diameter pipe (2 cfs capacity)

- **Culverts:** Five 12 feet long, 3 foot diameter culverts will be installed in dikes in Zone 1 and two 25 foot long, 2 foot diameter culverts will be installed under Goodale Road. An adjustable head-gate that can be used to raise or lower the upstream water elevation will be fitted in each of the seven culverts. The elevation of culverts will be set to optimize the range of water surface elevations behind the dike. Culverts will be installed by LADWP to standard specifications.

- **Special culvert:** A 12 feet long special culvert (siphon?) will be constructed to convey of up to 2 cfs from Zone 2 across the Aberdeen Ditch to Zone 3. The special culvert will be fitted with an adjustable head gate and a streamflow gage. The elevation of special culvert will be set to optimize the range of water surface elevation in the lowest part of Zone 2. The special culvert will be designed and constructed by LADWP.

- **Flow measurement devices:** The intent is to monitor inflow and outflow for four areas in Zone 1 and for Zone 2. Only inflow will be monitored in Zone 3, where no outflow is anticipated. All devices will record hourly flow measurements.

    - **Pipe flow devices (area-velocity meters):** Automated devices near the well head will be used to measure inflow to areas 1, 2, and 3a/3b. Inflow to Zone 1/Area 3a will be measured at the pipe outlet. Measurements will be accurate to within about 5 percent.

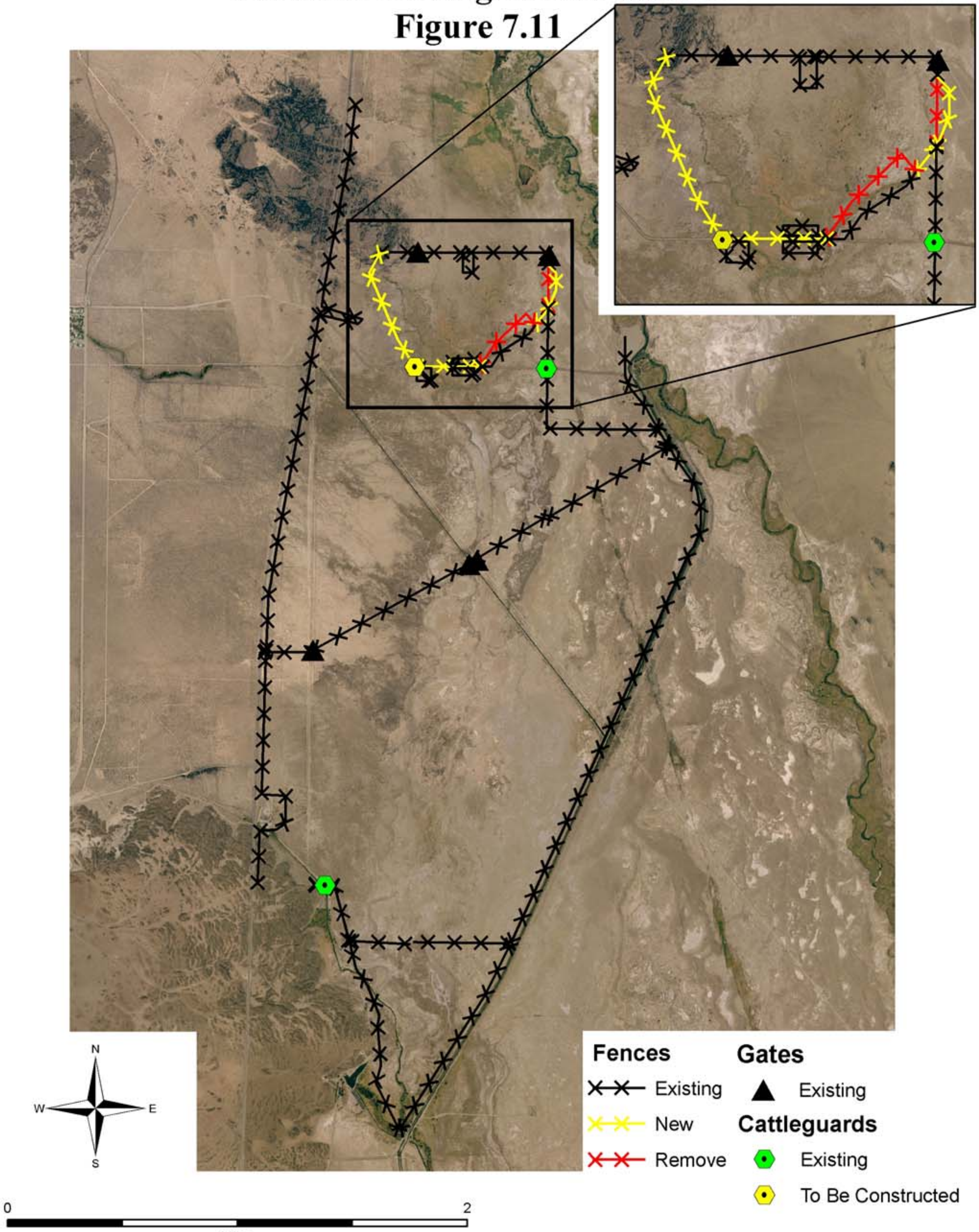
    - **Surface flow devices (small weirs):** Automated devices will measure outflow of surface water at the bottom of the four areas in Zone 1 and at the bottom of Zone 2. Measurements will be accurate to within about 5 percent.

- **Fences:** About 10.2 miles of existing fences with 5 gates will be maintained, 3.6 miles of new fence and one gate will be constructed, and 3.8 miles of existing fence will be removed. There will be one new cattle-guard on Goodale Road.

7.1.5 Livestock Management

The Hines Spring area is part of the Aberdeen Lease managed by Mr. Dennis Winchester. The lease is used to graze horses and mules used in a commercial packer operation. Fences (Figure 7.11) will be used to permanently exclude livestock from 205 acres in Zone 1, including the four restoration areas. After 3 to 5 years rest, livestock grazing will continue in Zone 2 and Zone 3 under riparian and upland prescriptions.

Hines Springs Area
Livestock Management Features
Figure 7.11



7.1.6 Monitoring

Monitoring will serve as a basis for evaluating the project, provide information for research applications, and to refine the restoration approach. It will include hydrologic and vegetation monitoring.

- **Hydrologic monitoring:** Automated area-flow meters will be installed in delivery pipelines near the well head will be used to monitor inflow to areas 1, 2, and 3a/3b in Zone 1. An area-flow meter will also be used to measured flow at the pipe outlet to Zone 1/Area 3a. Small weirs will be used to monitor outflow from the four areas in Zone 1, and outflow from Zone 2. Flow devices will be accurate to within about 5 percent for the 0-2 cfs range. Flow will be measured hourly and collected biweekly. Detailed hydrologic monitoring will be conducted through year 10. Total inflow to the Hines Spring area will be monitored for the life of the project.

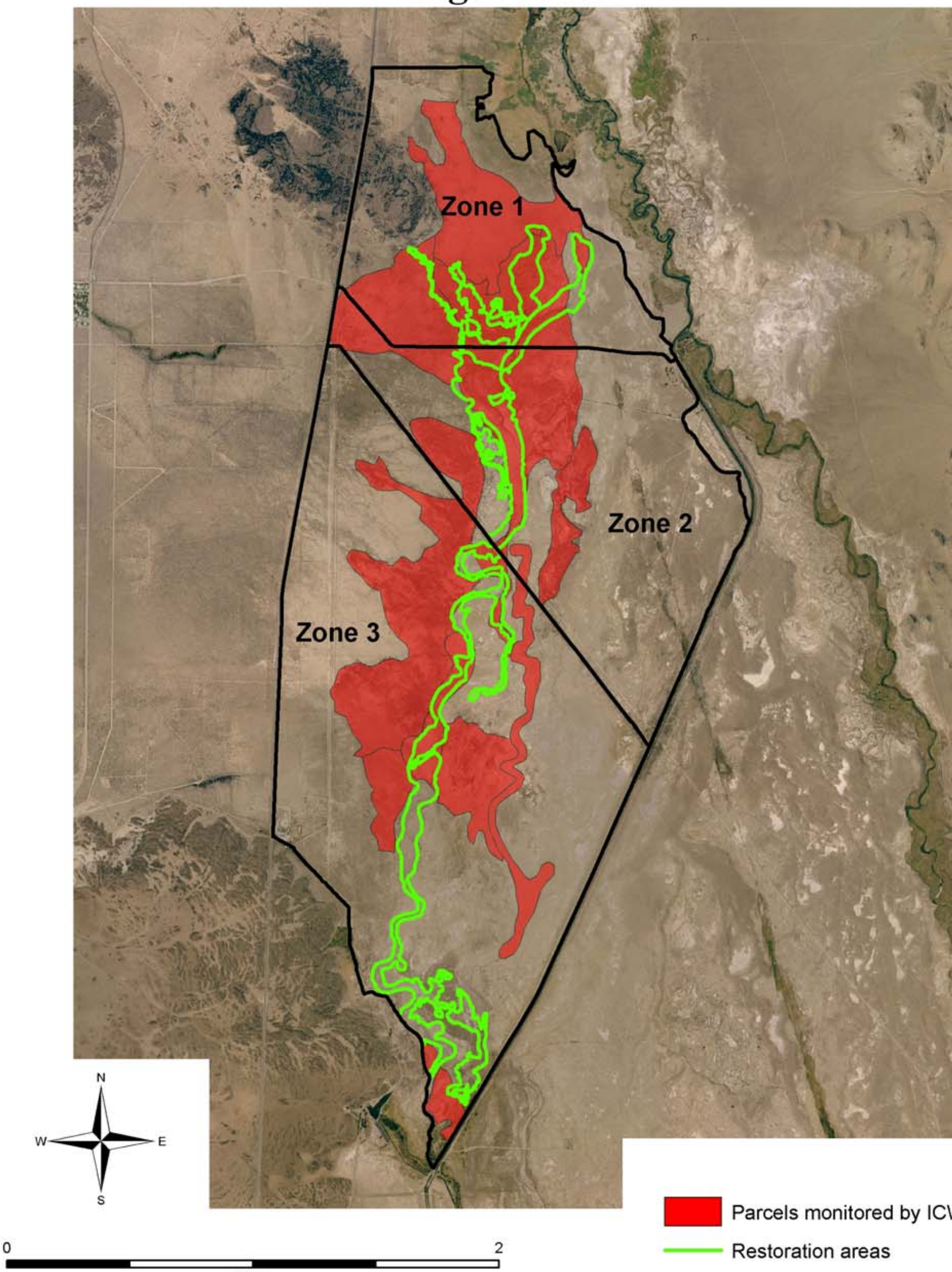
- **Vegetation monitoring:** Vegetation monitoring will include:

    - **Vegetation type distribution:** The extent of vegetation types (e.g. bulrush-cattail, saltgrass-rush, saltgrass, etc.) will be measured along variable length, fixed transects oriented perpendicular to flow direction and spanning beyond the wetted bottom. About 40 transects will be established in Zone 1, 20 transects in Zone 2, and 10 transects in Zone 3. The beginning and end-points of transects will be marked with a metal fencepost that is labeled with a transect number. The location of the beginning point and bearing of transects will be measured using GPS. A tape will be stretched between the transect markers[60]. Starting from the beginning, the distance of vegetation types will be measured. The sum of distances will equal the transect length. Vegetation type transects will be measured years 1, 2, 3, 5, and 10.

    - **Plant species composition:** ICWD has monitored up to 10 Greenbook parcels (BLK9, 11, 16, 21, 24, 33, 39, 40, 44, and 75) in the Hines Spring area since 1991 (Figure 7.12). The total area of these parcels (1,029 acres) includes 55 acres (90 percent) of the four restoration areas in Zone 1, 49 acres (82 percent) of the area in Zone 2, and 33 acres (30 percent) of area in Zone 3. Random beginning points and bearings for 50 meter, point-intercept transects were selected annually. The number of transects monitored in each parcel was determined each year based on an estimate of variance. Up to 29 transects were measured each year in selected parcels. Restoration is expected to result in abrupt vegetation change along wetland/upland boundaries, establishing the need to stratify the Greenbook parcels to reduce the variance of measured species composition to acceptable levels. Subsequent ICWD monitoring of stratified Greenbook parcels will enable a detailed evaluation of plant species composition in restoration areas.

[60] An optical or sonar measuring device will be used for transects that cross open water.

Hines Springs Area
Greenbook Monitoring Parcels
Figure 7.12



- **Mapping:** Vegetation types in the Hines Spring area were mapped for 2000 conditions (WHA 2005a). Baseline conditions will be refined using spectral classification of the high-resolution (0.8 meter pixels) 2005 Ikonos satellite image. The CIR band of the Ikonos image may be especially useful for delineating areas of hydrophytic vegetation (Figure 7.13). Vegetation types will be mapped from satellite (or aerial photo) images at 5 year intervals.

- **Photo-points:** Digital photos will be obtained from the beginning and end markers of the permanent vegetation type transects, looking along the transect line. Additional photo-points will be established at vantage points in each restoration area, marked with a steel fencepost, and labeled with a photo-point number. Photos will be taken year 1, 2, 3, 5, and 10.

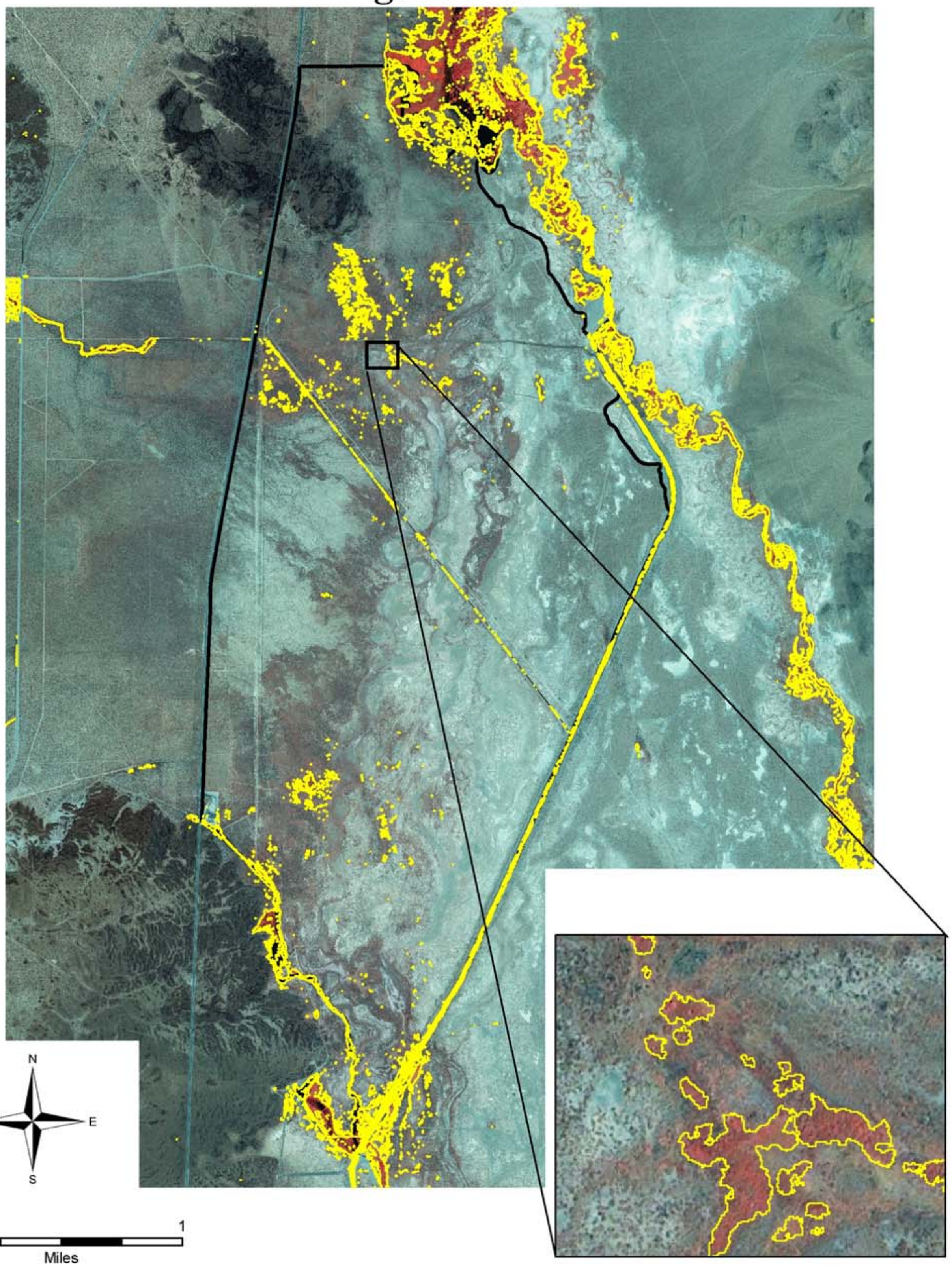
- **Riparian trees:** Existing decadent trees will be assigned a number. The height and condition of existing trees will be measured years 1, 2, 3, 5, and 10. A photo will also be obtained for each existing tree from a staked location.

  The height and count of riparian tree seedlings will be estimated years 1, 2, 3, 5, and 10. The height and condition of riparian tree cuttings and rooted plantings will be recorded on the same years.

- **Noxious weed survey:** A GPS will be used to identify the location of noxious weed patches in or adjacent to the restoration areas. The survey will be conducted early in the season so that weeds can be controlled before they seed. Noxious weed surveys will be conducted annually for the life of the project.

Results of hydrologic and vegetation monitoring will be reported for years 1, 2, 3, 5, and 10. Monitoring reports will include recommendations to enhance the extent and qualities of developing wetland resources.

Hines Springs Area
Preliminary Spectral Classification 2005 Ikonos Image
Figure 7.13



7.1.7 Maintenance

Structures (well 355, pipelines, valves, flow gages, dikes, culverts, and head-gates) will be inspected annually and repaired if needed. Areas identified in annual weed surveys will treated in a timely manner using control techniques appropriate for wetland/water habitat. Livestock exclosure fences will be inspected annually and repaired if needed.

7.1.8 Costs

Initial construction costs, including power and refurbishing well 355, are expected to be about $1,016,390 (Table 7.8). The initial cost for establishing 350 riparian trees is estimated to be about $20,000.

Water management (collecting flow data and adjusting valves at 14 day intervals) is expected to require about 12 man-days per year for the first 5 years and about 3 man-days per year for subsequent years over the life of the project. Monitoring is expected to require about 40 man-days for years 1, 2, 3, 5, and 10. Inspection/maintenance will require about 5 man-days per year for the life of the project.

7.1.9 Research Opportunities

The documentation of conditions for the Hines Spring area (WHA 2005a) will be refined based on more recent imagery (2005 Ikonos satellite image) and high-resolution topographic surveys (DEMs) anticipated in early 2006. Spectral analysis of the CIR band of the 2005 Ikonos image will be used to refine the baseline inventory of hydrophytic vegetation (Figure 7.13). The topographic survey will provide 2 foot contours from which restored hydrologic conditions can be more accurately defined, predicted, and interpreted. A refined inventory of the Hines Spring area will serve as a basis for research applications and demonstrations.

In a research study, the *dependent variables* are those that might be influenced or modified by some treatment or condition. The primary dependent variables will be measures of the extent, production, and qualities of wetland vegetation such as:

- The extent of wetland vegetation types measured along fixed transects.
- Consumptive water use (bedloss and ET) for wetland complexes.
- The condition and production (height) of riparian trees.
- The plant species composition of wetland vegetation types measured along random transects.

The *independent variables* are baseline conditions, uncontrollable variables, and/or treatments that might influence the dependent variables. Important independent variables include:

- Initial conditions documented in the refined inventory (e.g. landtype, existing vegetation type, relative surface elevation, etc.)
- Applied hydrologic variables (inflow/outflow) that will be measured for each area in Zone 1, Zone 2, and Zone 3.
- More constrained hydrologic variables controlled by structures (e.g. Waterman gates) in parts of the restoration areas.
- Climatic variables measured at the nearest appropriate weather station.

Research opportunities in the Hines Spring area include:

- Evaluate short-term and long-term bedloss for landtypes in Zone 1 and 2 based on hydrologic monitoring.
- Evaluate changes in ET for different stages of wetland development from hydrologic and vegetative monitoring.
- Evaluate different techniques for establishing riparian trees under varied hydrologic conditions.
- Evaluate effects of hydrologic management on rates of wetland expansion (e.g. compare rates in Zone 1 and 2, where extensive hydric conditions will be established the first growing season, with rates in Zone 3, where hydric conditions will be established incrementally).
- Evaluate rates of wetland establishment and expansion for varied hydrologic settings.
- Evaluate the use of hydrologic variables for modifying wetland characteristics and types (e.g. control water surface elevation using Waterman gates).
- Characterize plant species dynamics in developing wetlands from vegetation monitoring data.

Further understanding of wetland dynamics, distribution, and qualities gained from Hines Spring will likely benefit wetland mitigation planning in the BWMA and other areas with similar setting.

Table 7.8. Hines Spring costs for structural features.

Zone	Area	Feature	Dimension	Cost/unit	Cost	Notes
All	All	Upgrade well 355	--	$45,000	$45,000	Includes 3-pipe-manifold and valves
All	All	Power to well 355	--	$130,000	$130,000	
All	All	New fences	6,100 ft	$3.50/ft	$21,350	Zone 1 exclosure
All	All	Fences to remove	2,930 ft	$1/ft	$2,930	Part of paleochannel exclosure
All	All	Cattle-guard	1	$4,000 ea.	$4,000	West fence crossing Goodale Road
All	All	TOTAL	--	--	$203,280	
1	1	Flow meter at well	1	$3,000	$3,000	
1	1	8 inch buried pipe	360 ft	$100	$36,000	Valve at well head
1	1	36 inch culvert	1 (20 ft)	$75/ft	$1,500	Dike below historic vent
1	1	36 inch head gate	1	410 each	$410	Raise/lower water in historic vent
1	1	24 inch culvert	1 (25 ft)	$50/ft	1,250	Goodale Road crossing
1	1	24 inch head gate	1	$3,000	$3,000	Raise/lower upslope WSE
1	1	Stream gage	1	$8,000 ea.	$8,000	
1	1	Remove dikes	4 dikes	$500	$2,000	Small; waste on-site
1	1	Modify existing dike	50 ft	$10/ft	$500	Below historic vent
1	1	TOTAL	--	--	$55,660	
1	2	Flow meter at well	1	$3,000	$3,000	
1	2	12 inch buried pipe	890 feet	$125	$111,250	Valve at well head
1	2	Dike	2 (150 ft)	$50/ft	$7,500	Below pond & at outlet to Area 1
1	2	36 inch culvert	2 (40 ft)	$75/ft	$3,000	Inlet dike and outlet dike
1	2	36 inch head gate	2	$410 ea	$820	Inlet dike and outlet dike
1	2	Stream gage	1	$8000 ea	$8,000	Outlet dike
1	**2**	**TOTAL**	**--**	**--**	**$133,570**	

Table 7.8. Continued. Hines Spring costs for structural features.

Zone	Area	Feature	Dimension	Cost/unit	Cost	Notes
1	3b	Flow meter at well	1	$3,000	$6,000	
1	3a	Flow meter at pipe outlet	1	$3,000	$6,000	
1	3a&3b	12 inch buried pipe	3660 ft	$125/ft	$457,500	
1	3a&3b	Excavate ponds	2 (2.5 ac)	$27000/ac	$67,500	Cut 3 feet
1	3a&3b	Dike	3 (500 ft)	$50/ft	$25,000	Below ponds & 3a outlet
1	3a&3b	36 inch culvert	3 (60 ft)	$75/ft	$4,500	In dikes
1	3a&3b	36 inch head gate	3	$410 ea	$1,230	Upslope of culverts
1	3b	24 inch culvert	1 (25 ft)	$50 /foot	$1,250	Goodale Road crossing
1	3b	24 inch head gate	1	250 ea	$250	Goodale Road crossing
1	3a&3b	Stream gage	2	$8000 ea	$16,000	Outflow f/ 3a & Goodale Road
1	3b	Raise Goodale Road Grade	500 ft	$50/ft	$25,000	
1	3b	Minor excavation	1 area	$3,000	$3,000	Outlet channel from pond
1	3a&3b	TOTAL	--	--	$613,230	
1	TOTAL	TOTAL	--	--	$1,005,740	
2	1	24 inch special culvert	1 (20 ft)	$100/ft	$2,000	Crosses Aberdeen Ditch
2	1	24 inch head gate	1	250 ea	$250	
2	1	Stream gage	1	8000 ea	$8,000	Outflow from Zone 2 to Zone 3
2	1	Remove small dikes	4	$100	$400	Waste on-site
2	1	TOTAL	--	--	$10,650	
3	1	TOTAL	--	--	$0	
TOTAL		**TOTAL**	**--**	**--**	**$1,016,390**	

7.1.10 Schedule

A schedule (Table 7.9) for major tasks is presented with respect to water-years (October 1 through the following October 1).

Table 7.9. Hines Spring schedule.	
Tasks	Schedule
Final plans	Prior to construction
Construction features	Prior to construction
Water Management	
Initiation flows	1rst water-year
Wetland creation flows	water-years 2-5
Long-term maintenance flows	water-year 6 and beyond
Riparian trees Planting	water-years 1-3
Monitoring	
Hydrologic	
Total inflow	All water-years
Inflow/outflow to specific areas	water-years 1-10
Vegetation	
Vegetation type distribution	water-years 1, 2, 3, 5, and 10
Plant species composition	Ongoing Greenbook monitoring
Mapping	2005, 2010, 2015
Photopoints	water-years 1, 2, 3, 5, and 10
Riparian trees	water-years 1, 2, 3, 5, and 10
Noxious weed survey	All years
Report	water-years 1, 2, 3, 5, and 10
Maintenance	All years

7.2 WARREN LAKE

The mitigation plan for Warren Lake was refined from Preliminary Restoration Plans (WHA 2005b). At least 300 acre-feet of water will be allocated to Warren Lake to enhance about 300 acres of seasonally flooded habitat.

Long-term bedloss for Warren Lake is expected to be significantly less than that estimated for dissimilar landtypes in the BWMA (2-3 feet/year). Long-term bedloss for Warren Lake is expected to be similar to that of Klondike Lake, located about 1.5 miles to the northeast. Klondike Lake is typically full in September, when inflow is shut down until the following May. During this 7 month winter period, Klondike Lake drops 1 to 2 feet (Wayne Hopper, personal communication). Most of the water loss may be attributed to evaporation. The Warren Lake bed is sodic clay with high shrink/swell and very slow infiltration. The long-term bedloss for Warren Lake was assumed to be about 1 foot/year.

An overall design plan for establishing hydrologic conditions conducive to creating a diverse wetland complex is first discussed. The overall design plan is followed by discussions of water management, construction features, livestock management, monitoring, maintenance, cost, and research opportunities.

7.2.1 Overall Design Plans

Water will be delivered to the Warren Lake bed via an existing spill-gate and supply ditch from the Big Pine Canal. A flow gage will be installed at the spill-gate. An automated staff gage will be installed in the lake bed to monitor water surface elevation. At least 300 acre-feet of water will be supplied in the spring of each year, corresponding to about a foot depth over the 300 acre lake bed. Additional water not used at Hines Spring may be applied in years 2 through 6. Predicted habitats and vegetation types that could be created or maintained (Figure 7.14; Table 7.10) include intermittent water (57 acres), wet alkali meadow 128 acres), and 167 acres of alkali meadow-wet alkali meadow complex. Eight existing cottonwood/willow trees will be maintained. The net area of intermittent water and wetland that will be created is about 200 acres[61]. Monthly ET for predicted vegetation types was estimated from annual values by assuming a consistent rate over 6 months. The total predicted monthly ET is 120 acre-feet/month (Table 7.10) and the long-term bedloss is predicted to be 25 acre-feet/month[62]. Initial bedloss when the lake bed is first filled is expected to be appreciably higher than the long-term bedloss. Conservatively, water may be present for 1 to 2 months of the growing season when 300 acre-feet is released.

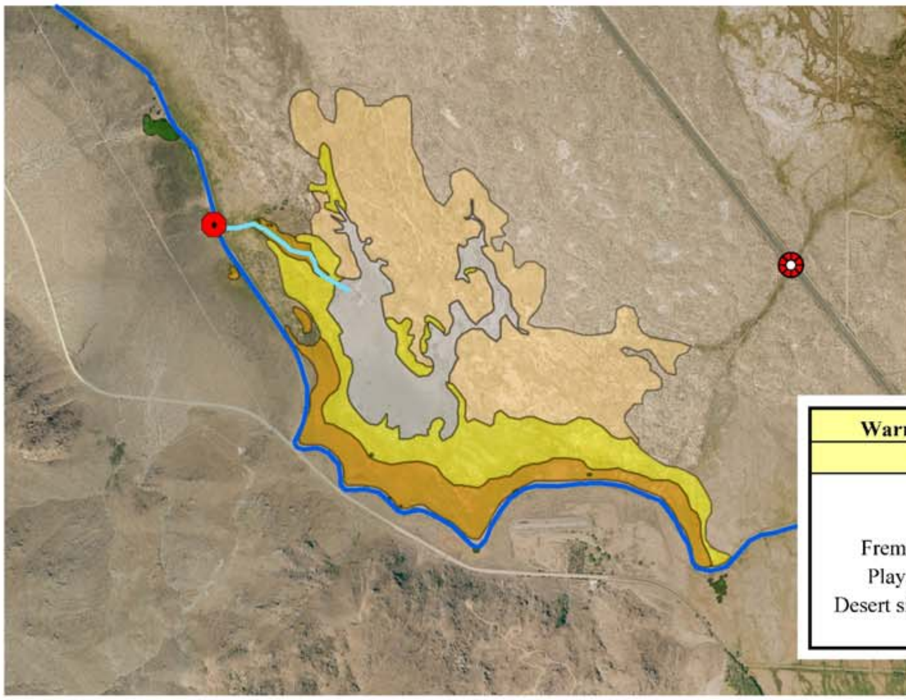
Table 7.10. Predicted vegetation, Warren Lake.

Predicted Vegetation Type	N	Area (acres)	ET (ft/month)	ET (ac-ft/month)
Saltgrass-rush	6	128.1	0.25	32.0
Fremont cottonwood/saltgrass-creeping wildrye	8	0.2	0.5	0.1
Intermittent water	1	56.9	0.8	45.5
Saltgrass x saltgrass-rush complex	2	167.0	0.25	41.8
TOTAL	**17**	**352.2**	**--**	**119.4**

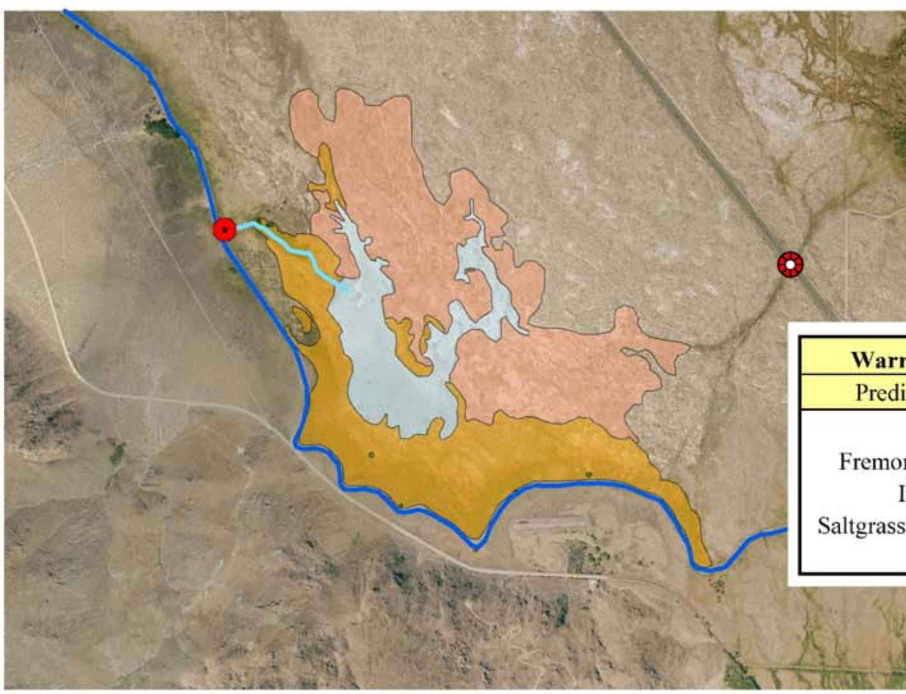
[61] This assumes that 60 percent of the predicted complex will be saltgrass (not wetland) and 40 percent will be saltgrass-rush (wetland).
[62] The 52 acres of saltgrass-rush along the Big Pine Canal was not included in the bedloss estimate.

Existing and Predicted Vegetation

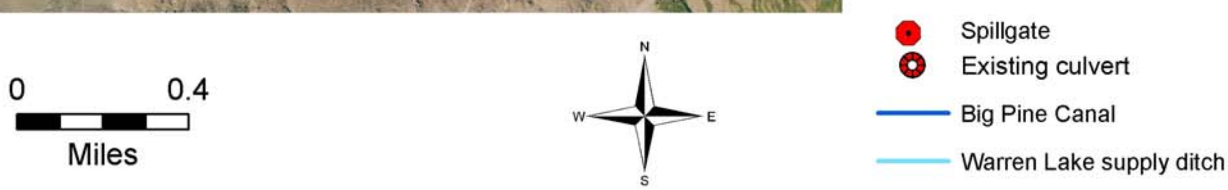
Figure 7.14



Warren Lake Existing Vegetation Types		
Vegetation Type	N	Acres
Saltgrass	5	76.3
Saltgrass-rush	4	51.8
Fremont cottonwood/meadow	8	0.2
Playa (intermittent lake bed)	1	56.9
Desert sink-saltgrass-playa complex	2	167.0
TOTAL	**20**	**352.2**



Warren Lake predicted, alternative 2.		
Predicted Vegetation Type	N	Acres
Saltgrass-rush	6	128.1
Fremont cottonwood/meadow	8	0.2
Intermittent water	1	56.9
Saltgrass x saltgrass-rush complex	2	167.0
TOTAL	**17**	**352.2**



7.2.2 Water Management

Water released to Warren Lake will consist of a *minimum* (300 AFY) and *additional water* (the difference between 1,300 acre-feet and the volume released to Hines Spring the previous water year). The minimum water will be released all years. Additional water may be released years 2 through 6. By year 6, the full 1,300 acre-feet will be utilized at Hines Spring and water to Warren Lake will be reduced to the *minimum* (300 AFY) on subsequent years.

The intent will be to consistently flood about 300 acres of the lake bed each year (in contrast to flooding 300 acres one year and 400 acres the next) to minimize invasion of weeds common to intermittently flooded habitats along the periphery of the lake bed. For water years 2-6 when additional water may be allocated to Warren Lake, inflow will be managed such that the same 300 acres is flooded, but for a longer duration.

Beginning April 1 of the first water year, 5 cfs will be released for 30 days via the existing gate and supply channel off the Big Pine Canal. Inflow will be set using a stream gage to be installed immediately below the gate. An automated staff gage will be used to monitor water surface elevation on the lake bed the first year. Water surface elevation will be recorded daily and collected bimonthly starting April 1 and ending when surface water is dissipated. The maximum wetted area will be delineated using a GPS on May 1 of the first year.

Estimates of consumptive water use the first year will be used to refine the rate (cfs) at which *additional water* in excess of 300 acre-feet is released on the subsequent five years. If the average consumptive use for the period April 15 to May 1 is less than 10 acre-feet per day, the 5 cfs inflow will be reduced to approximate the consumptive use on May 1 and the reduced inflow will continued until the total annual water allocation (*minimum* plus *additional water*) is achieved. If the average consumptive use is greater than 10 acre-feet per day, the 5 cfs inflow will be continued after May 1 until the total annual water allocation is achieved.

7.2.3 Construction Features

An existing head-gate will be used to feed an existing open channel to Warren Lake. Construction features will include:

- **Stream gage:** A gage will be installed below the exiting head-gate on the Big Pine Canal.

- **Staff gage:** An automated staff gage will be installed in the lake bed to monitor daily water surface elevation.

7.2.4 Livestock Management

Warren Lake is part of the 4J Lease. It will be grazed under existing riparian and upland management prescriptions.

7.2.5 Monitoring

Hydrologic and vegetative monitoring will serve as a basis for evaluating the project.

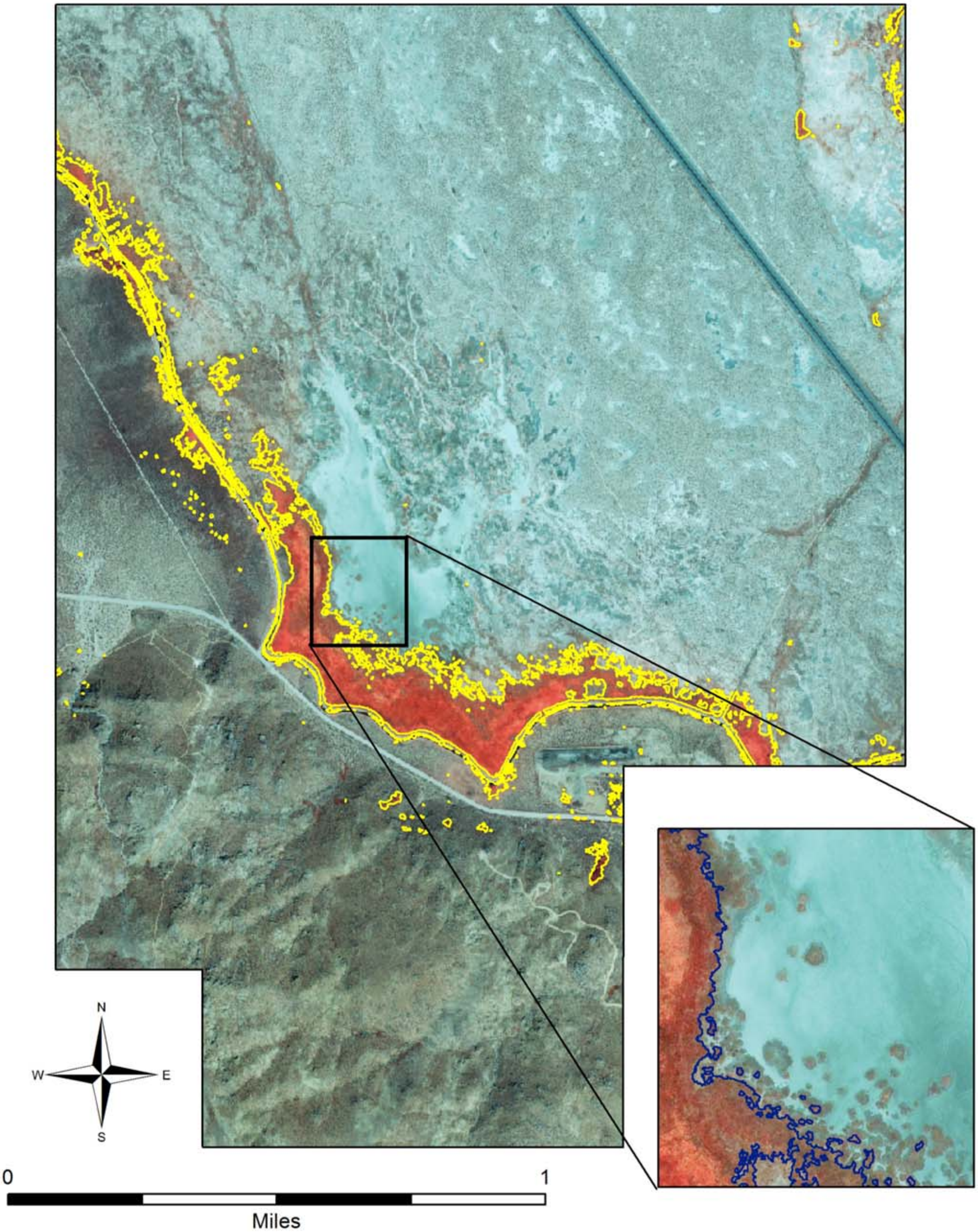
- **Hydrologic monitoring:**
  - **Inflow:** The date, time, and flow (cfs) will be recorded on the initial release each spring. The date, time, and flow will also be recorded on May 1 if flows are reduced (years 2 through 6 only). Flow measurement will be accurate to within 5 percent for the 0-5 cfs range.

  - **Water surface elevation:** An automated recording staff gage in the bottom (lowest spot) of the Warren Lake bed will be used to measure relative water surface elevation. Water surface elevation will be measured daily and records will be collected monthly.

- **Vegetation monitoring:** Vegetation monitoring will include:
  - **Vegetation type distribution:** The extent of vegetation types (e.g. bulrush-cattail, saltgrass-rush, saltgrass, etc.) will be measured along variable length, fixed transects across the lake bed. About 3 transects will be established. The beginning and end-points of transects will be marked with a metal fencepost that is labeled with a transect number. Intermediary markers will be placed at 100 meter intervals along the transects. The location of the beginning point and bearing of transects will be measured using GPS. A tape will be stretched between the transect markers. Starting from the beginning, the distance of vegetation types will be measured. The sum of distances will equal the transect length. Vegetation type transects will be measured years 1, 2, 3, 5, and 10.

  - **Mapping:** Vegetation types in the Warren Lake area were mapped for 2000 conditions (WHA 2005b). Baseline conditions will be refined using spectral classification of the high-resolution (0.8 meter pixels) 2005 Ikonos satellite image. The CIR band of the Ikonos image may be especially useful for delineating areas of hydrophytic vegetation (Figure 7.15). Vegetation types will be mapped from satellite (or aerial photo) images at 5 year intervals.

Warren Lake Area
Preliminary Spectral Classification 2005 Ikonos Image
Figure 7.15



- **Photo-points:** Digital photos will be obtained from the beginning, intermediary, and end markers of the permanent vegetation type transects, looking along the transect line. Additional photo-points will be established at selected vantage points, marked with a steel fencepost, and labeled with a photo-point number. Photos will be taken year 1, 2, 3, 5, and 10.

- **Noxious weed survey:** A GPS will be used to identify the location of noxious weed patches in or adjacent to the restoration areas. The survey will be conducted early in the season so that weeds can be controlled before they seed. Noxious weed surveys will be conducted annually for the life of the project.

Results of hydrologic and vegetation monitoring will be reported for years 1, 2, 3, 5, and 10. Monitoring reports will include recommendations to enhance the extent and qualities of developing wetland resources.

7.2.6 Maintenance

Structures (stream gage, head-gate, and supply ditch) will be inspected annually and repaired if needed. Areas identified in annual weed surveys will treated in a timely manner using control techniques appropriate for wetland habitat.

7.2.7 Costs

The initial cost will for installation of a stream gage at the diversion structure and an automated staff gage in the lake bed (Table 7.11). Water management (opening the head-gate, closing the head-gate, and collecting hydrologic data each spring) is expected to require about ½ man-day per year. Monitoring is expected to require about 5 man-days for years 1, 2, 3, 5, and 10. Inspection/maintenance will require about 1/2 man-day per year for the life of the project.

Table 7.11. Warren Lake costs for structural features.

Feature	Dimension	Cost/unit	Cost
Flow meter	1	$6,000	$6,000
Staff gage	1	$5,000	$5,000
TOTAL	**--**	**--**	**$11,000**

7.2.8 Research Opportunities

The documentation of conditions for Warren Lake will be refined based on more recent imagery (2005 Ikonos satellite image) and high-resolution topographic surveys (DEMs) anticipated in early 2006. The topographic survey will provide 2 foot contours from which restored hydrologic conditions can be more accurately defined, predicted, and interpreted. A refined inventory of the Warren Lake will serve as a basis for research applications and demonstrations.

The primary dependent variables will be measures of the extent, production, and qualities of wetland vegetation such as:

- The extent of wetland vegetation types measured along fixed transects.
- Consumptive water use (bedloss and ET) for the wetland complex.

Important independent variables include:

- Initial conditions documented in the refined inventory (e.g. landtype, existing vegetation type, relative surface elevation, etc.)
- Applied hydrologic variables that will be measured at the stream gage and staff gage.
- Climatic variables measured at the nearest appropriate weather station.

Research opportunities in the Warren Lake area include:

- Evaluate short-term and long-term consumptive use (bedloss plus ET) for the lake bed landtype based on hydrologic monitoring.
- Evaluate changes in consumptive use for different stages of wetland development from hydrologic and vegetative monitoring.
- Evaluate rates of wetland establishment and expansion.

Further understanding of wetland dynamics, distribution, and qualities gained from Warren Lake will likely benefit wetland mitigation planning in other playas and lake beds in Owens Valley.

7.2.9 Schedule

A schedule (Table 7.12) for major tasks is presented with respect to water-years (October 1 through the following October 1).

Table 7.12. Warren Lake schedule.	
Tasks	Schedule
Final plans	Prior to construction
Construction features	Prior to construction
Water Management	
Minimum inflow	1rst water-year
Additional inflow	Water-years 2-5
Minimum inflow	Water-year 6 and beyond
Monitoring	
Hydrologic	
Total inflow	All water-years
Staff gage	Water-years 1-3
Vegetation	
Vegetation type distribution	Water-years 1, 2, 3, 5, and 10
Mapping	2005, 2010, 2015
Photopoints	Water-years 1, 2, 3, 5, and 10
Noxious weed survey	All years
Report	Water-years 1, 2, 3, 5, and 10
Maintenance	All years

8.0 PRELIMINARY CEQA COMPATIBILITY ANALYSIS

Pursuant to Section 15063 of the CEQA Guidelines the following is a preliminary checklist for the mitigation projects. The implementation plans for Hines Spring and Warren Lake presented in Chapter 7.0 contains sufficient detail to allow the preparation of CEQA documentation. Explanations for potential impacts are not included in this preliminary checklist. Significant impacts or findings are not expected from either implementation project; therefore, a "Negative Declaration" finding is expected. Though there are two specific and different sites for implementation the mitigation and CEQA will be completed as one project. Only one checklist is initiated for this mitigation project.

As lead agency, LADWP, will be ultimately responsible for the final CEQA analysis and compliance for each site implementation. The Amended Stipulation and Order, Hines Spring Work Plan states in Phase III, Task 5: "*The potential adverse impacts that could be associated with mitigation actions will be described either in terms of known, likely, or the level of risk to determine the most appropriate means of complying with CEQA.*" The preliminary checklist presented here coupled with the implementation details contained in the Chapter 7.0 mitigation plans will allow for a full CEQA process to be accomplished.

8.1 CEQA ISSUES

AESTHETICS -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	☐	☐	X	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	X
d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?	☐	☐	☐	X

AGRICULTURAL RESOURCES: Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Convert Prime farmland, Unique farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	X	☐	☐
b) Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☐	X
c) Involve other changes in the existing environment, which due to their location or nature, could result in conversion of farmland, to non-agricultural use?	☐	☐	X	☐

AIR QUALITY -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	X
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	X
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	X
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	X
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	X

BIOLOGICAL RESOURCES -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	**X**
b) Have a substantial adverse effect on any riparian habitat or sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	**X**
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	**X**

BIOLOGICAL RESOURCES -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native residents or migratory wildlife corridors or impede the use of native wildlife nursery sites?	☐	☐	☐	X
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local regional or state habitat conservation plan?	☐	☐	☐	X

CULTURAL RESOURCES -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	X
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	X
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	X
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	X

GEOLOGY AND SOILS -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	X
ii) Strong seismic ground shaking?	☐	☐	☐	X
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	X
iv) Landslides?	☐	☐	☐	X
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	X	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	X	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	X

HAZARDS AND HAZARDOUS MATERIALS -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	X
c) Emit hazardous emissions or handles hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	X
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working within the project area?	☐	☐	☐	X

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	X
H) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	X	☐

HYDROLOGY AND WATER QUALITY -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	☐	☐	X	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	X	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner, which would result in substantial erosion or siltation on- or off-site?	☐	☐	X	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off-site?	☐	X	☐	☐
e) Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	X
f) Otherwise substantially degrade water quality?	☐	☐	X	☐

HYDROLOGY AND WATER QUALITY -- (continued)	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood hazard Boundary or Flood Insurance rate Map or other flood hazard delineation map?	☐	☐	☐	X
h) Place structure within a 100-year flood hazard area, which would impede or redirect flood flows?	☐	☐	X	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	X	☐
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	X

LAND USE AND PLANNING -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Physically divide an established community?	☐	☐	☐	X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	X	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	X

MINERAL RESOURCES -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	X
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	X

NOISE -- Would the project result in:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	X
b) Exposure of persons to or generation of excessive groundborne vibration noise levels?	☐	☐	☐	X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	X
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	X

POPULATION -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through the extension of roads or other infrastructure)?	☐	☐	☐	X
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	X

PUBLIC SERVICES -- Would the project	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service rations, response time or other performance objectives for any of the public services:				
a) Fire protection?	☐	☐	X	☐
b) Police Protection?	☐	☐	☐	X
c) Schools?	☐	☐	☐	X
d) Parks?	☐	☐	☐	X
e) Other public facilities?	☐	☐	☐	X

RECREATION	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	X	☐

TRANSPORTATION/TRAFFIC -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase on either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☐	X
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☐	X
c) Result in a change in traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	X
e) Result in inadequate emergency access?	☐	☐	☐	X
f) Result in inadequate parking capacity?	☐	☐	☐	X
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	X

UTILITIES AND SERVICE SYSTEMS -- Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	X
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	X
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	X
e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	X
g) Comply with federal, state, and local statutes and regulations related to solid waste.	☐	☐	☐	X

MANDATORY FINDINGS OF SIGNIFICANCE	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	X	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probably future projects)?	☐	☐	X	☐
c) Does the project have environment effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	X	☐

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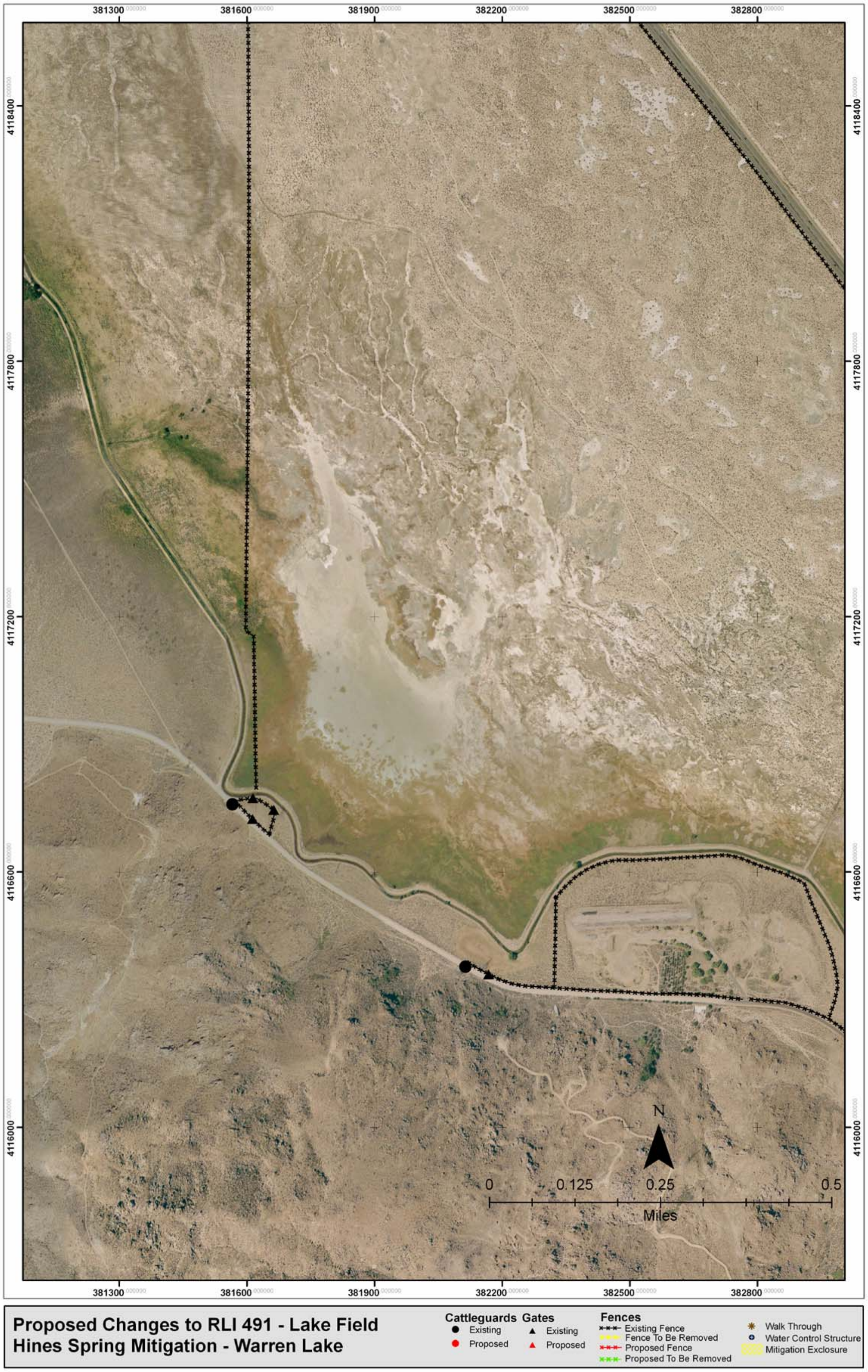
10.0 APPENDICES

10.1 APPENDIX 1 RESPONSE TO COMMENTS

This section will be completed for the final draft of this document. This section will contain comments and responses from this February 10, 2006 draft report.

10.2 APPENDIX 2 LEASE MAPS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4116000
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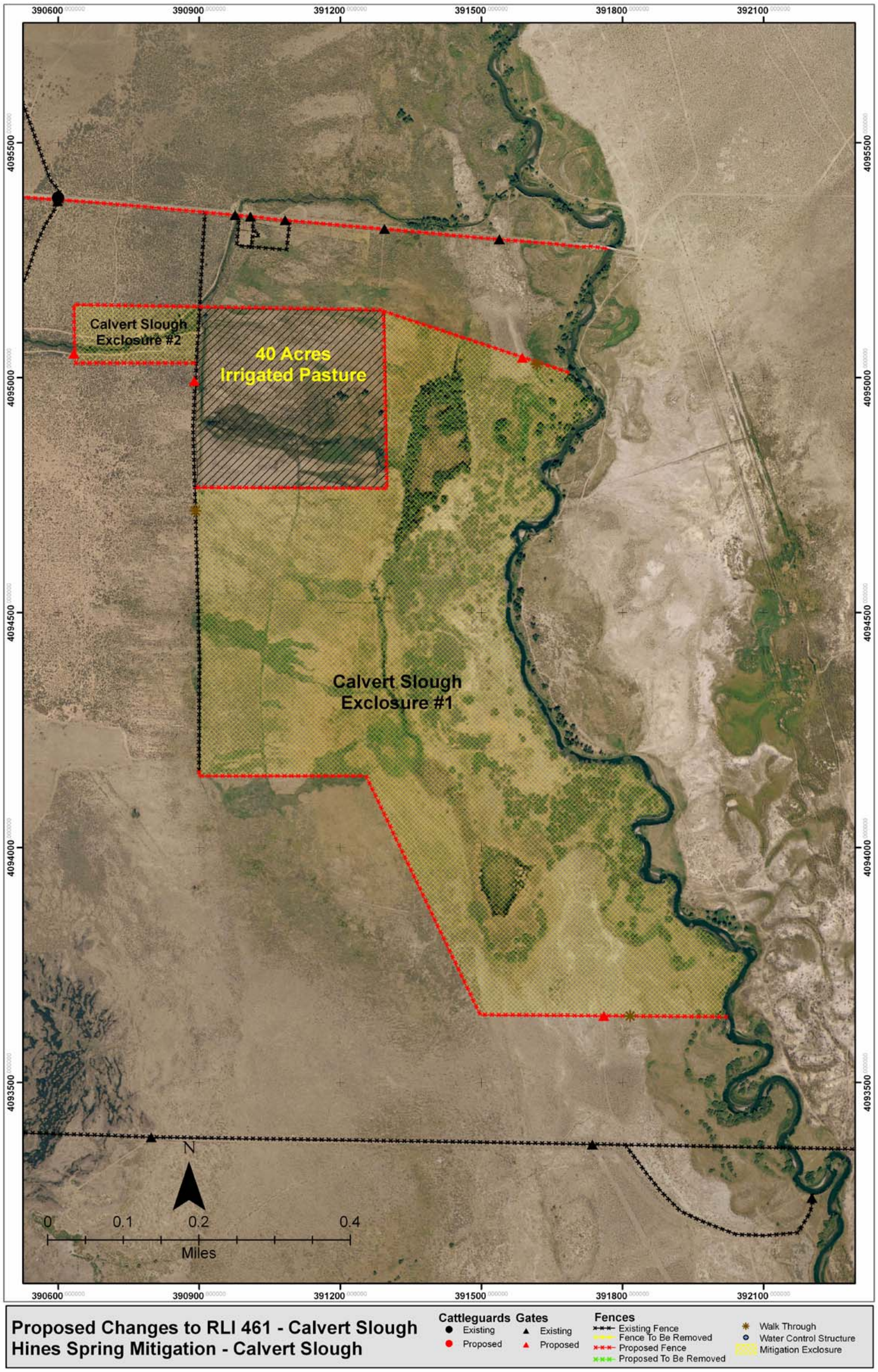
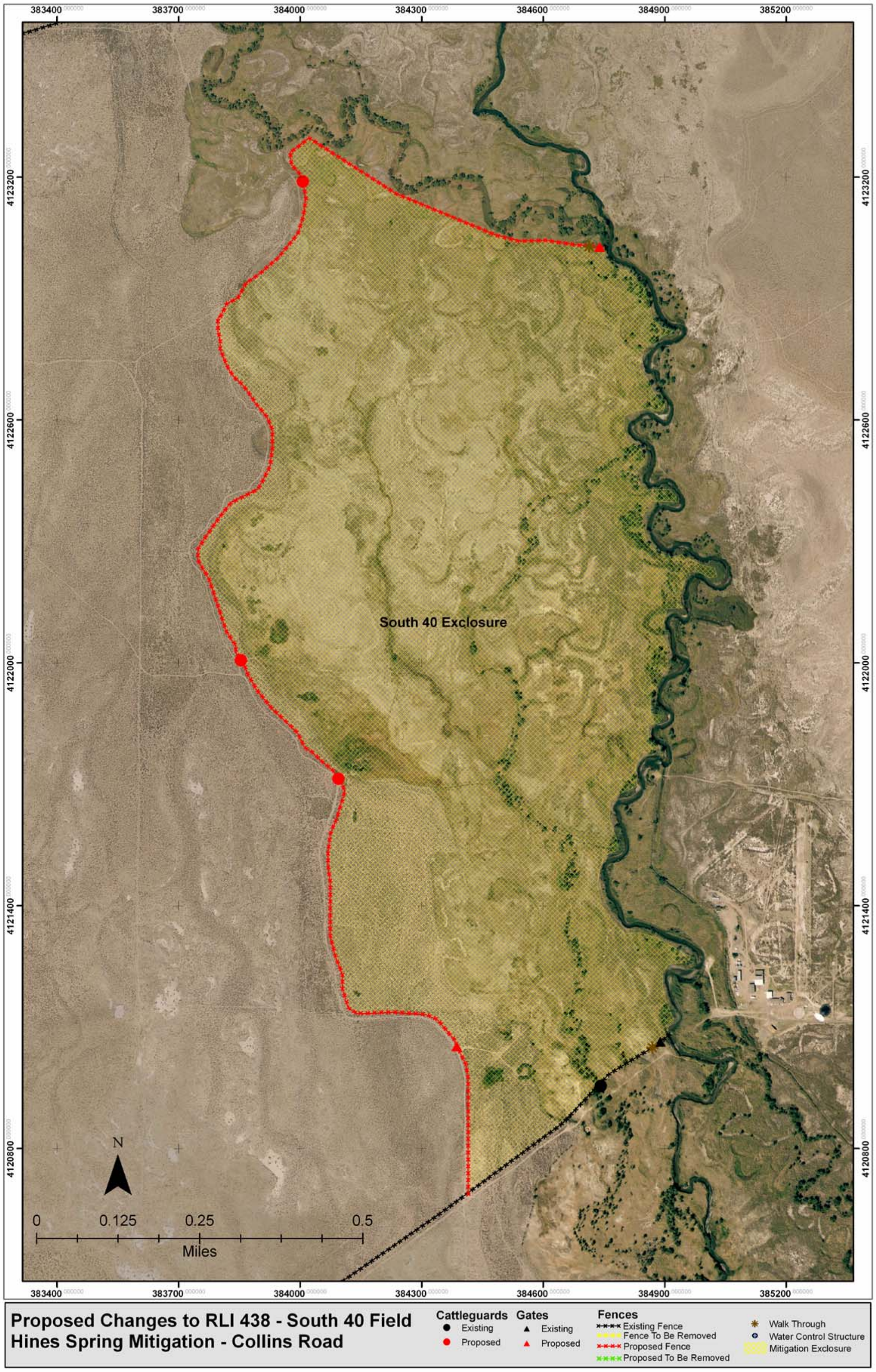
0.25
0.5
Miles
Proposed Changes to RLI 491 - Lake Field
Hines Spring Mitigation - Warren Lake
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed Fence
Proposed To Be Removed
Walk Through
Water Control Structure
Mitigation Exclosure


Calvert Slough Exclosure #2
40 Acres Irrigated Pasture
Calvert Slough Exclosure #1
N
0 0.1 0.2 0.4
Miles
Proposed Changes to RLI 461 - Calvert Slough
Hines Spring Mitigation - Calvert Slough
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed Fence
Proposed To Be Removed
Walk Through
Water Control Structure
Mitigation Exclosure


South 40 Exclosure
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384300
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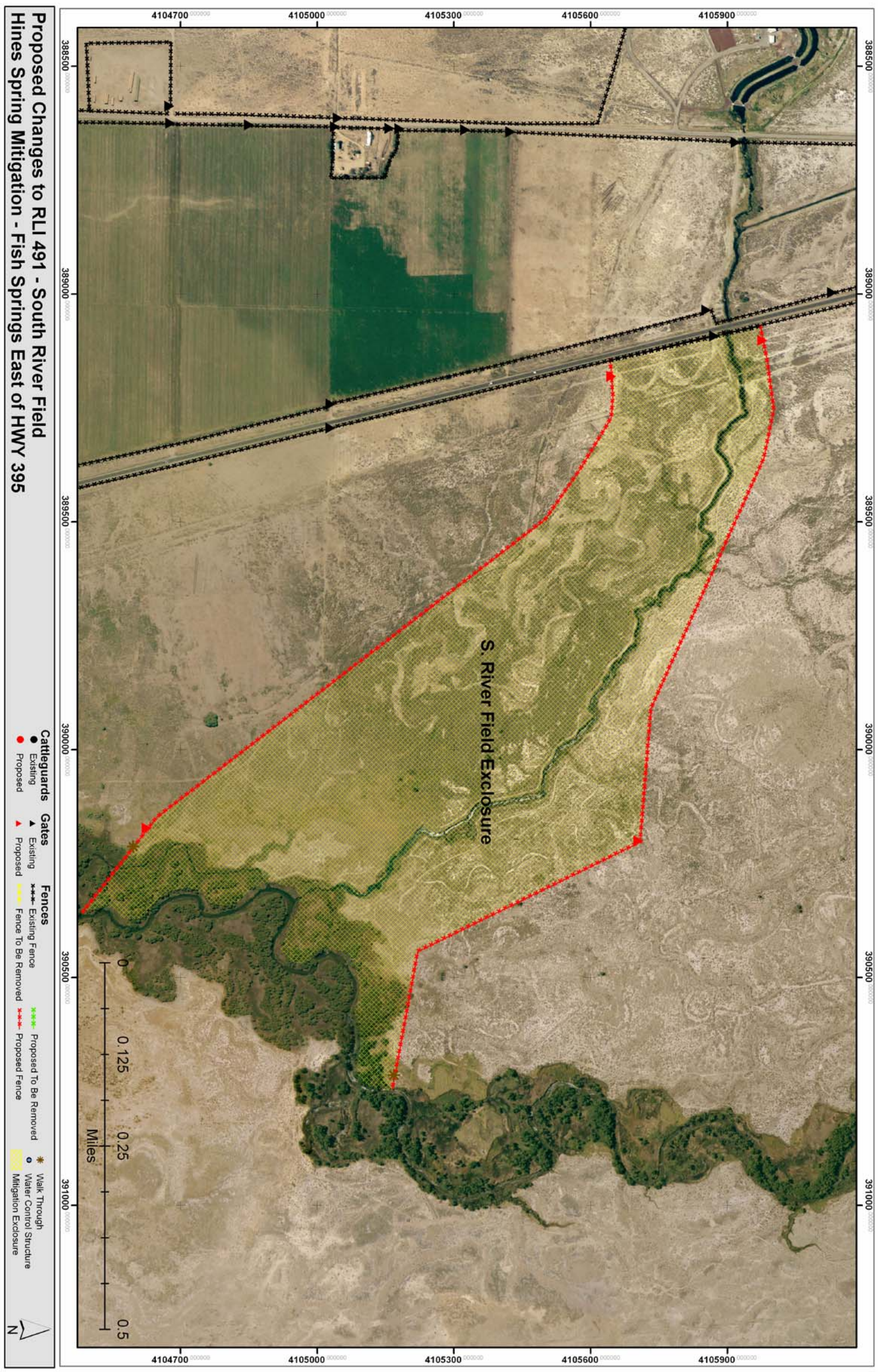
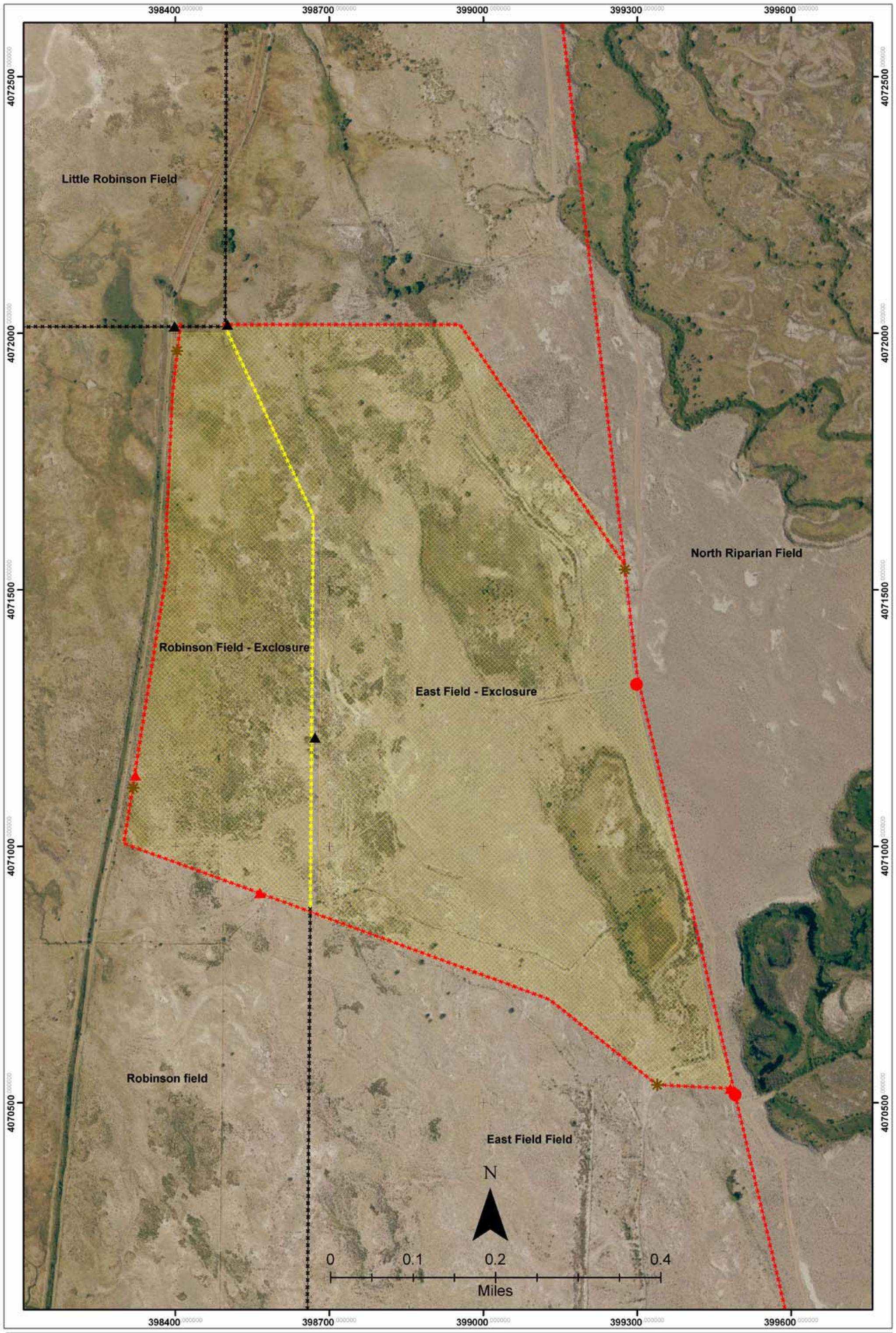
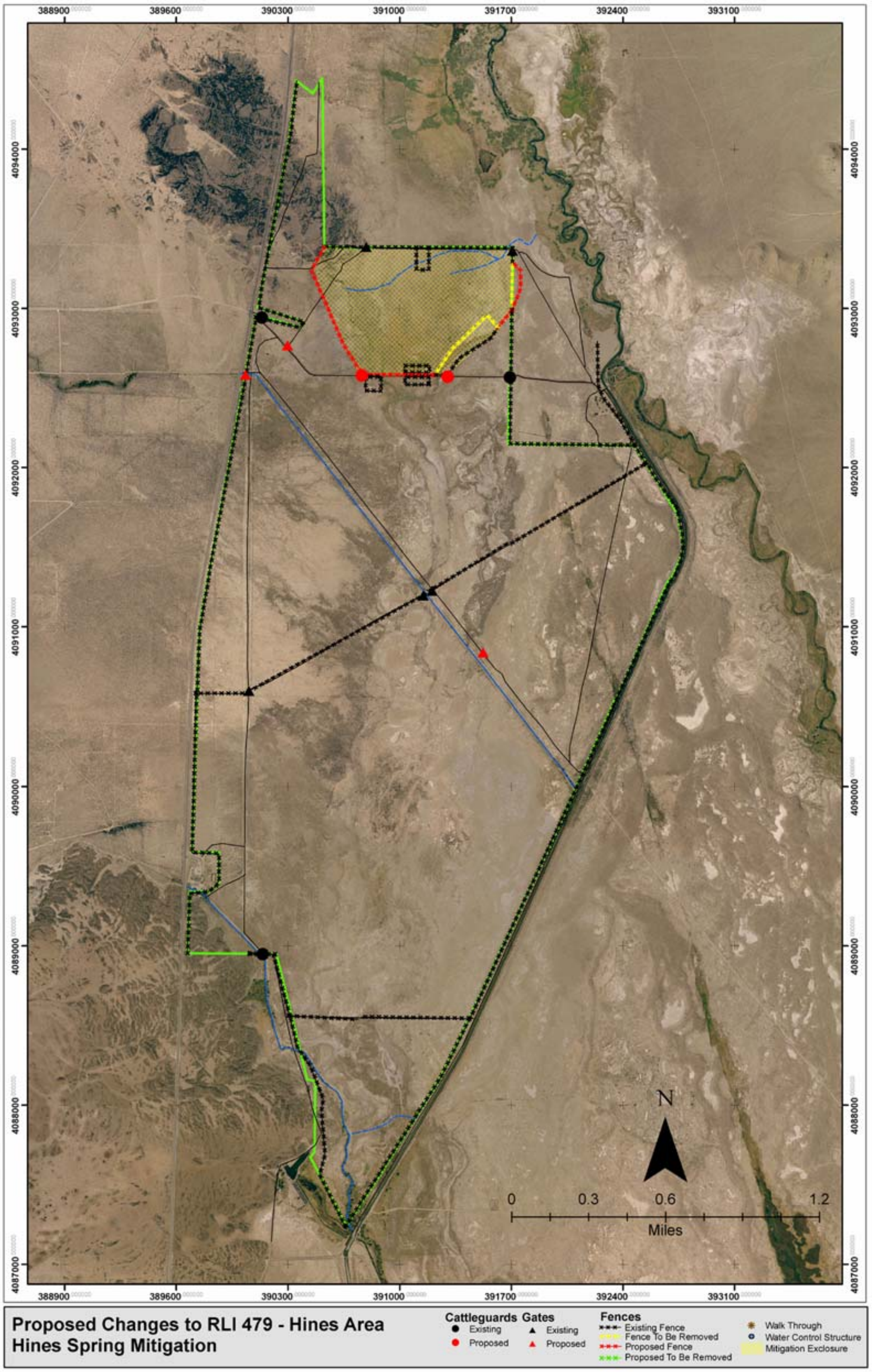
384900
385200
4123200
4122600
4122000
4121400
4120800
N
0
0.125
0.25
0.5
Miles
Proposed Changes to RLI 438 - South 40 Field
Hines Spring Mitigation - Collins Road
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed Fence
Proposed To Be Removed
Walk Through
Water Control Structure
Mitigation Exclosure

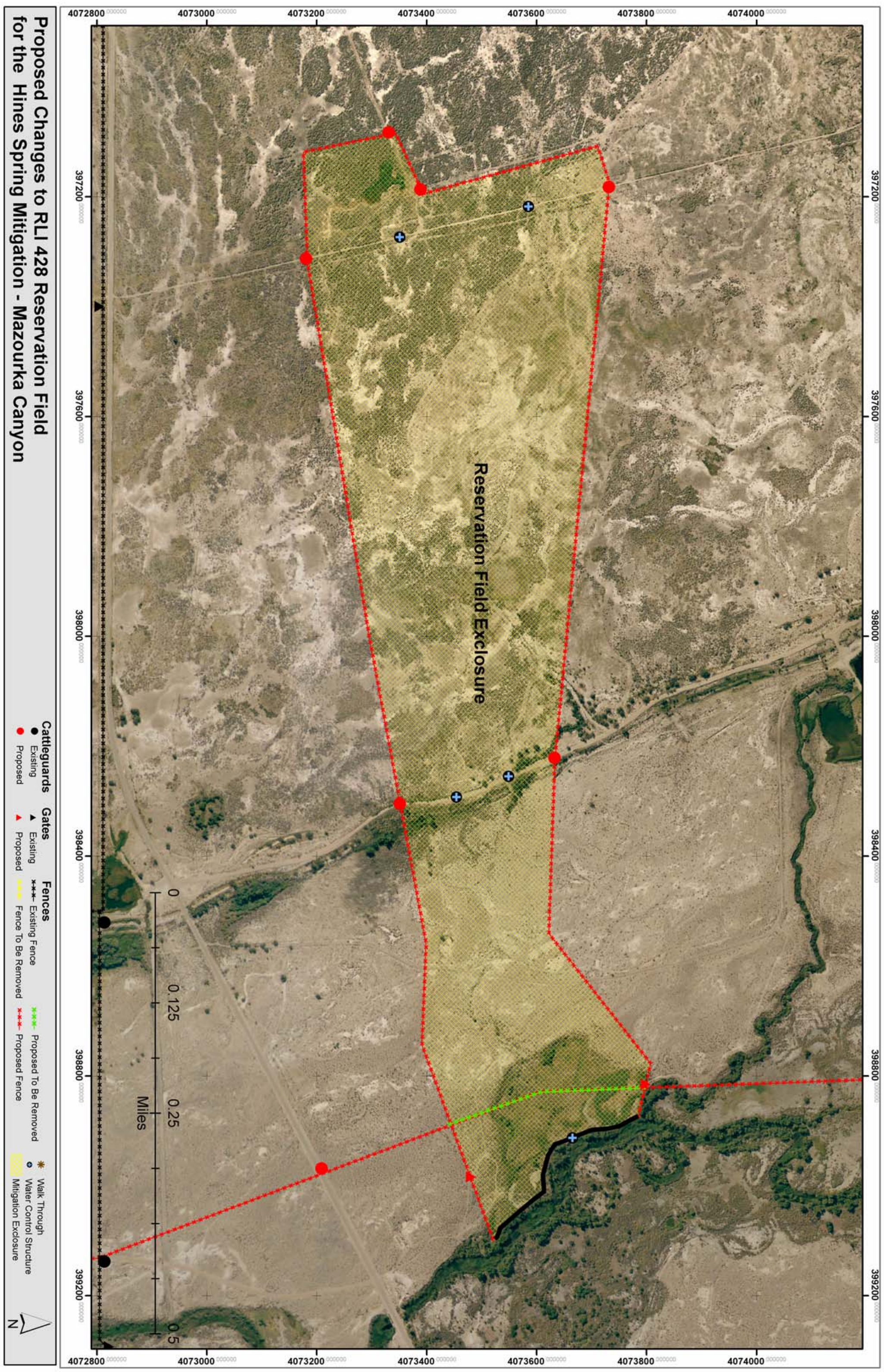

Proposed Changes to RLI 491 - South River Field
Hines Spring Mitigation - Fish Springs East of HWY 395
S. River Field Exclosure
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed To Be Removed
Proposed Fence
Walk Through
Water Control Structure
Mitigation Exclosure
0
0.125
0.25
0.5
Miles
N

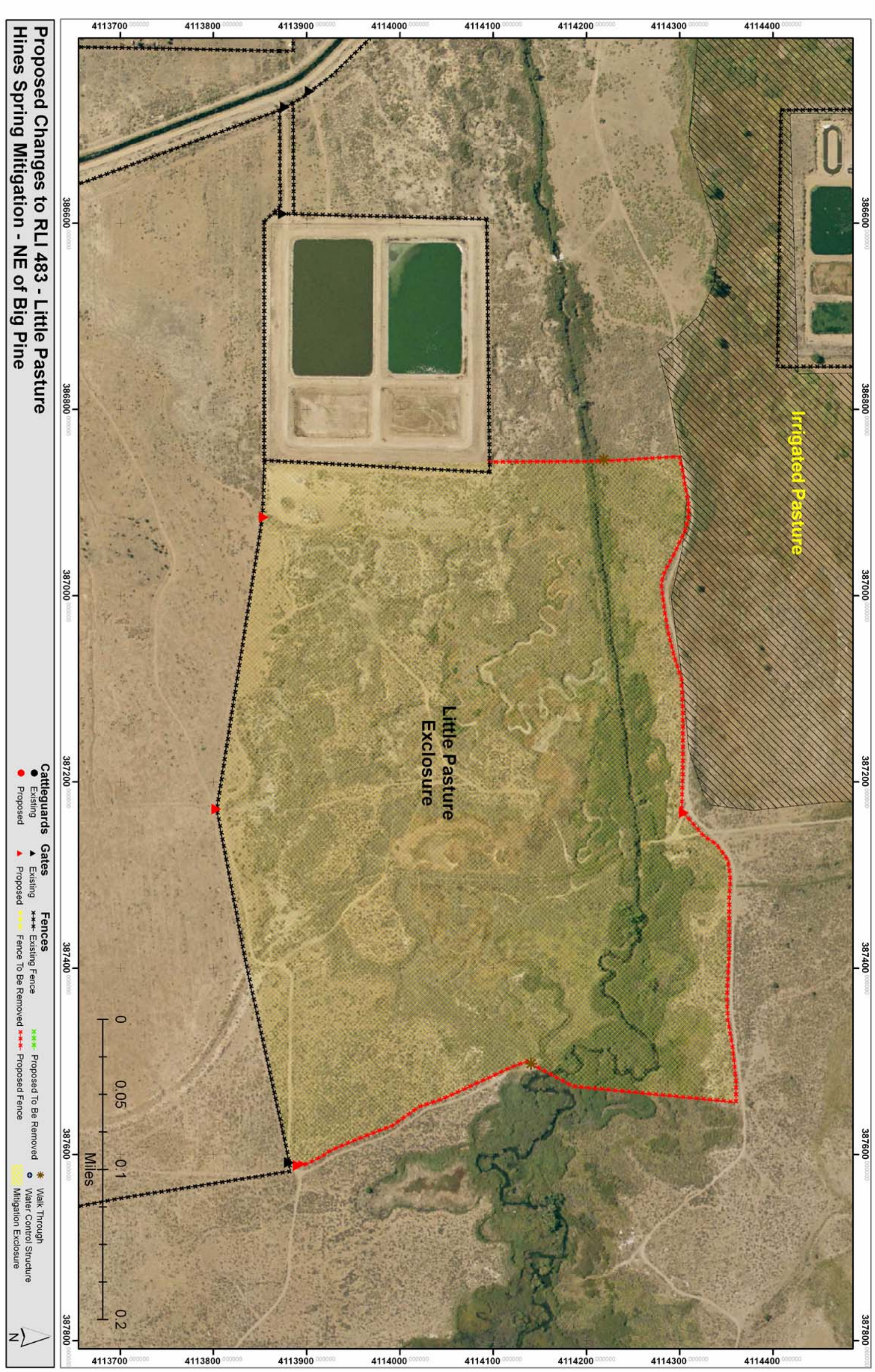


Proposed Changes to RLI 428 - Robinson and East Fields, Hines Spring Mitigation - Hidden Lake

Cattleguards: Existing; Proposed
Gates: Existing; Proposed
Fences: Existing Fence; Fence To Be Removed; Proposed Fence; Proposed To Be Removed
Walk Through
Water Control Structure
Mitigation Exclosure


388900
389600
390300
391000
391700
392400
393100
4094000
4093000
4092000
4091000
4090000
4089000
4088000
4087000
N
0
0.3
0.6
1.2
Miles
Proposed Changes to RLI 479 - Hines Area
Hines Spring Mitigation
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed Fence
Proposed To Be Removed
Walk Through
Water Control Structure
Mitigation Exclosure


Proposed Changes to RLI 428 Reservation Field
for the Hines Spring Mitigation - Mazourka Canyon
Reservation Field Exclosure
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed To Be Removed
Proposed Fence
Walk Through
Water Control Structure
Mitigation Exclosure
0
0.125
0.25
0.5
Miles
N
4072800
4073000
4073200
4073400
4073600
4073800
4074000
397200
397600
398000
398400
398800
399200


Proposed Changes to RLI 483 - Little Pasture
Hines Spring Mitigation - NE of Big Pine
Little Pasture Exclosure
Irrigated Pasture
Cattleguards
Existing
Proposed
Gates
Existing
Proposed
Fences
Existing Fence
Fence To Be Removed
Proposed To Be Removed
Proposed Fence
Walk Through
Water Control Structure
Mitigation Exclosure
0
0.05
0.1
0.2
Miles
N

10.3 APPENDIX 3 FACTORS TO DETERMINE PROJECT COSTS

Economic Reference Used to Determine Costs and Benefits

USDA. 2004. United States Department of Agriculture Statistical Highlights for 2001 through 2003. Table of Economics. Washington D. C.

Economic Values

Livestock Products from California in Year 2001	$7,346,000,000
Livestock Cash Receipts	$7,346,000,000
Animal Unit Month of Forage Annually	
Per Animal	$13.00
Unit/2	$12.80
Cow-Calf	$16.50
Per Head	$14.00

Additional Economic Values

Fence Construction	$3.21 per running foot
Annual Fence Maintenance	$0.10 per running foot
Existing Fence Elimination	$0.38 per running foot
One Cow Year	$300 per year
One Packer Horse/Mule Year	$475 per year
Owens Valley AUM (Cow-Calf)	$10 per year
Over-Time Period (Two Generations)	50 years