Chapter 3.0

Affected Environment

3.0 Affected Environment

This chapter contains the description of the existing environmental conditions in the vicinity of the proposed project alternatives. During EIS preparation, the most up-to-date and accurate information available was used to describe the existing environment. The information serves as a baseline from which to identify and evaluate environmental changes resulting from the proposed alternatives. The baseline year for the information presented in this section is 2002, 2003, and 2004 depending on data availability.

The environmental resources discussed in this chapter include water resources, biological resources, cultural resources, recreation, hazardous materials, noise, air quality, earth resources, land use, visual resources, socioeconomics, environmental justice, transportation and traffic, and paleontological resources.

3.1 Water Resources

This section focuses on water resources in the vicinity of the proposed alternatives. Surface water and drainage, groundwater, and water quality are described in this section.

3.1.1 Surface Water & Drainage

The Las Vegas Wash is the primary conveyance corridor of surface water runoff for the Valley. The Las Vegas Wash Watershed encompasses the CLV, City of North Las Vegas, COH, and portions of unincorporated Clark County. The watershed is bounded on the north by the Sheep Mountains, on the west by the Spring Mountains, on the south by the McCullough Mountains, and on the east by the River and Frenchman mountains (Figure 3.1-1). The total area of the watershed at the upstream end of Lake Las Vegas is approximately 1,550 square miles (4014 square km) (Clark County Regional Flood Control District [CCRFCD] 2002). The Las Vegas Wash discharges to Lake Mead and the Colorado River system.

The terrain of the Las Vegas Wash Watershed is comprised of steep mountain slopes around the perimeter that transition to alluvial fans at the base of the mountains. The alluvial fans then drain to braided washes and sheet flow areas with some areas containing large incised washes that are tributaries to the Las Vegas Wash. The major tributaries to the Las Vegas Wash include Range Wash, Northern Las Vegas Wash, Flamingo/Tropicana Wash, Duck Creek/Blue Diamond Pittman Wash, and the C-1 Channel (Figure 3.1-2). These major tributaries drain through developed areas prior to their confluence with the Las Vegas Wash. In developed areas, many of the tributaries have been modified from their natural condition to include structural improvements such as concrete, riprap, and gabion linings as well as modification of the channel geometry. The tributaries are ephemeral with the exception of nuisance flow draining from adjacent developments.

There are numerous surface water channels that cross the project area and are subject to periodic flooding during major rainfall/runoff events. The majority of these surface-water channels within

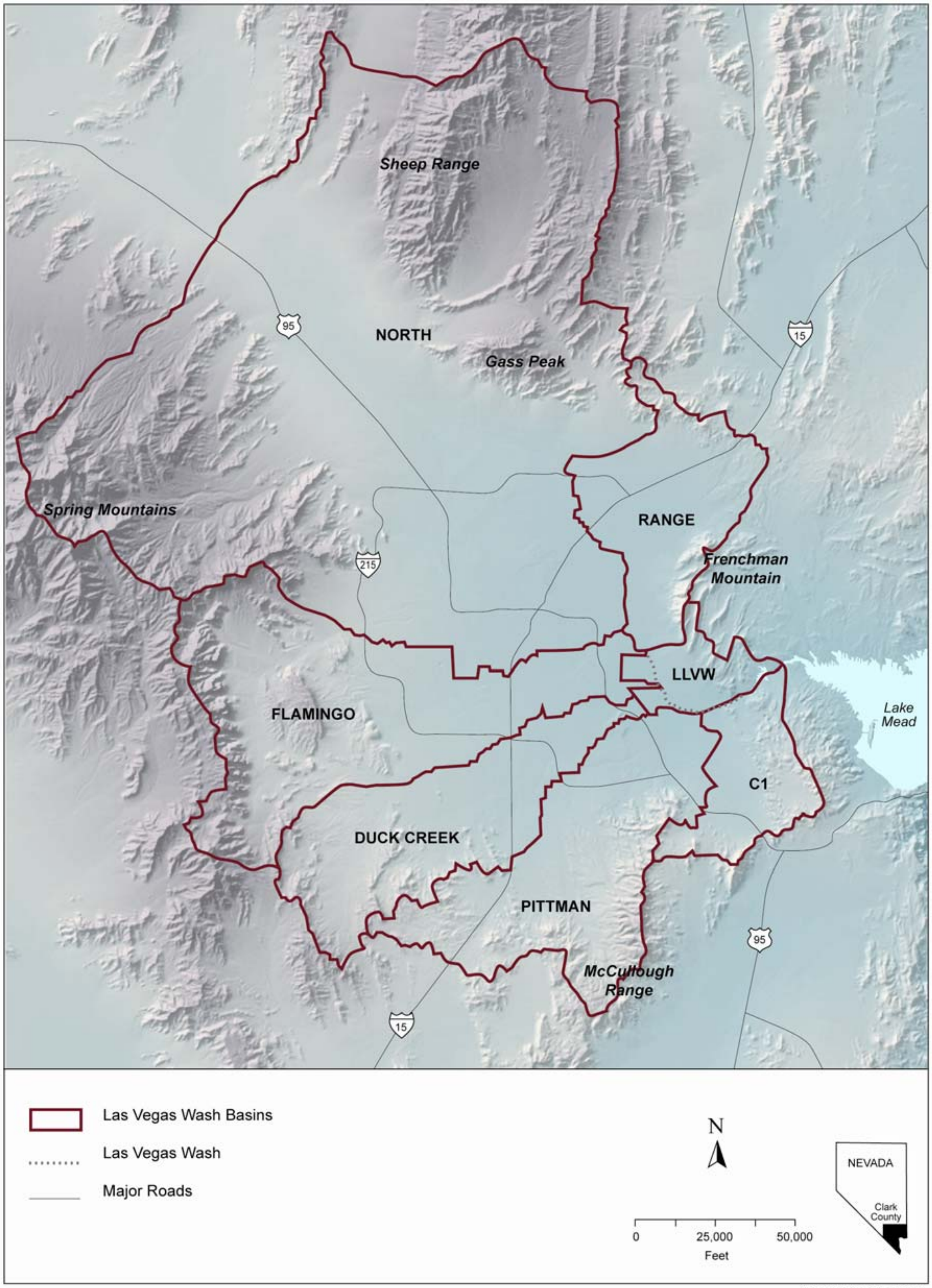

Figure 3.1-1 Hydrographic Basins.

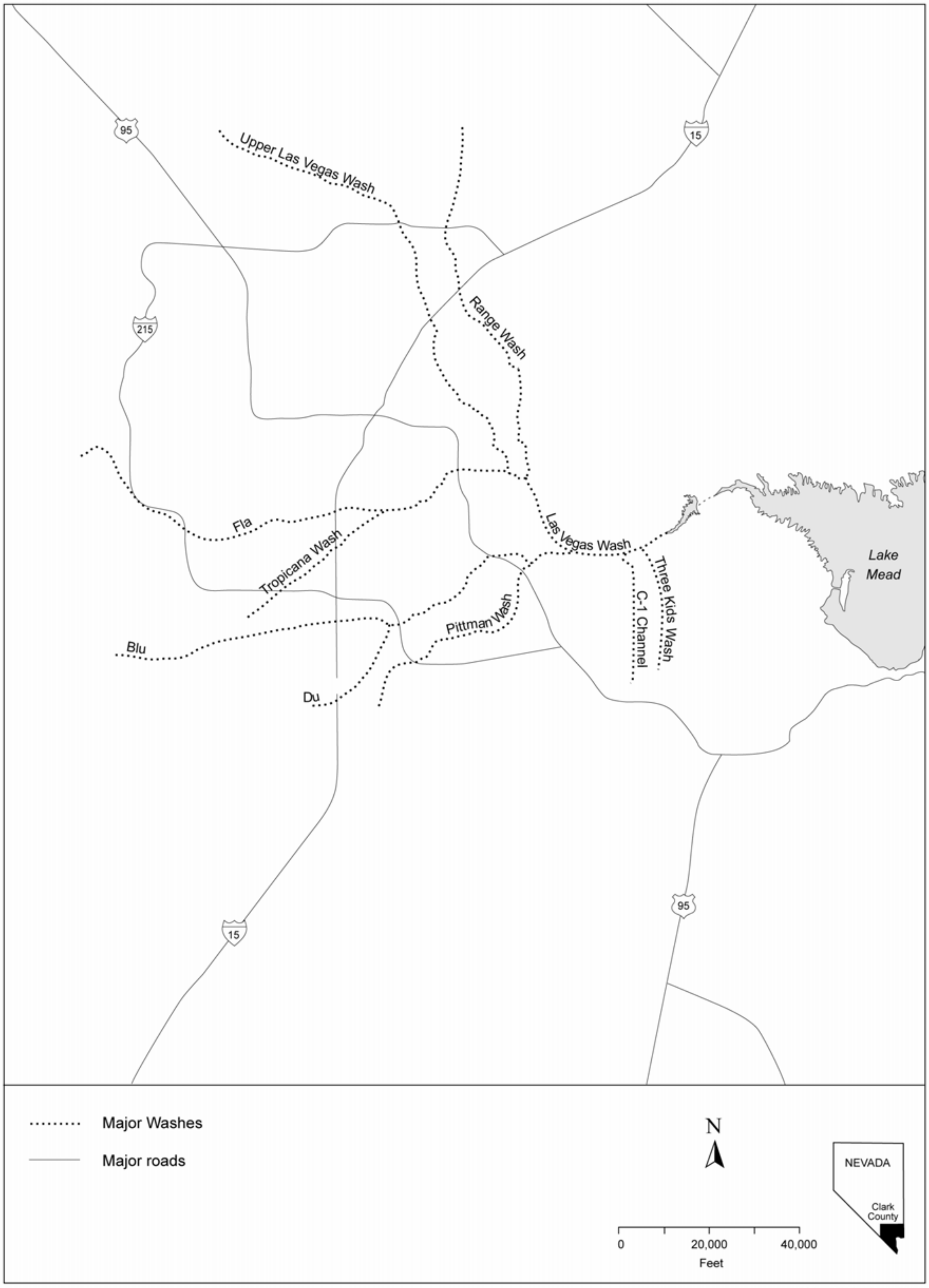

Figure 3.1-2 Major Tributaries.

the project area have not been heavily disturbed by urban development and human activity, and still exist in their natural desert condition. These natural ephemeral channels within the project area are in addition to the Las Vegas Wash, which is the main surface-water conveyance corridor through the project area.

Waters of the U.S. include lakes, rivers, streams and their tributaries, and wetlands (33 CFR 228.3). Other waters of the U.S. in the study area include intermittent drainages that are tributaries to navigable waters, such as lakes, rivers, streams, and other surface features with defined beds and banks (e.g., the Las Vegas Wash, Lake Mead, the Colorado River). Drainages that do not connect to navigable waterways are typically not defined as other waters of the U.S.

Lakes, rivers, streams, wetlands, and other waters of the U.S. within the study area were identified based on review of the 1:24,000-scale USGS topographic quadrangle maps, the USFWS National Wetland Inventory maps, previous wetland delineation reports, and a field reconnaissance survey conducted by PBS&J in May 2003. Potential waters of the U.S., including intermittent drainages that cross the proposed project alignments are identified on Figure 3.1-3 and Figure 3.1-4.

3.1.1.1 Las Vegas Wash Flow Contributors

The Las Vegas Wash conveys flow from several different sources:

- Nuisance water from developed areas,
- Wastewater treatment plant discharge,
- Groundwater seepage, and
- Rainfall runoff.

The Las Vegas Wash is a perennial stream due to the flow contribution from these sources. The majority of the perennial or base flow comes from the wastewater treatment plant discharges. However, the quantity of base flow is insignificant when compared to the flow rate during major rainfall/runoff events. The average discharge from the three wastewater treatment plants combined is approximately 252 cfs (7 cubic meters per second [cms]) (Black & Veatch 2004b). The average total base flow is approximately 283 cfs (8 cms) (Black & Veatch 2004b). The 100-year peak flow developed for the *2002 Las Vegas Valley Flood Control Master Plan Update* is 16,000 (453 cms) to 22,000 cfs (623 cms) (CCRFCD 2002). During the storm event of July 8, 1999, a peak flow of 11,000 cfs (311 cms) was recorded at the intersection of the Las Vegas Wash and Vegas Valley Drive, and a peak flow of 16,000 cfs (453 cms) was recorded at Lake Las Vegas (CCRFCD 2002).

A complex formula is used to calculate Nevada's return flow credits. The values used in the formula are based on several factors, including flow volumes in the Las Vegas Wash. The flow contributors described previously are taken into account during calculation of Nevada's return flow credits.

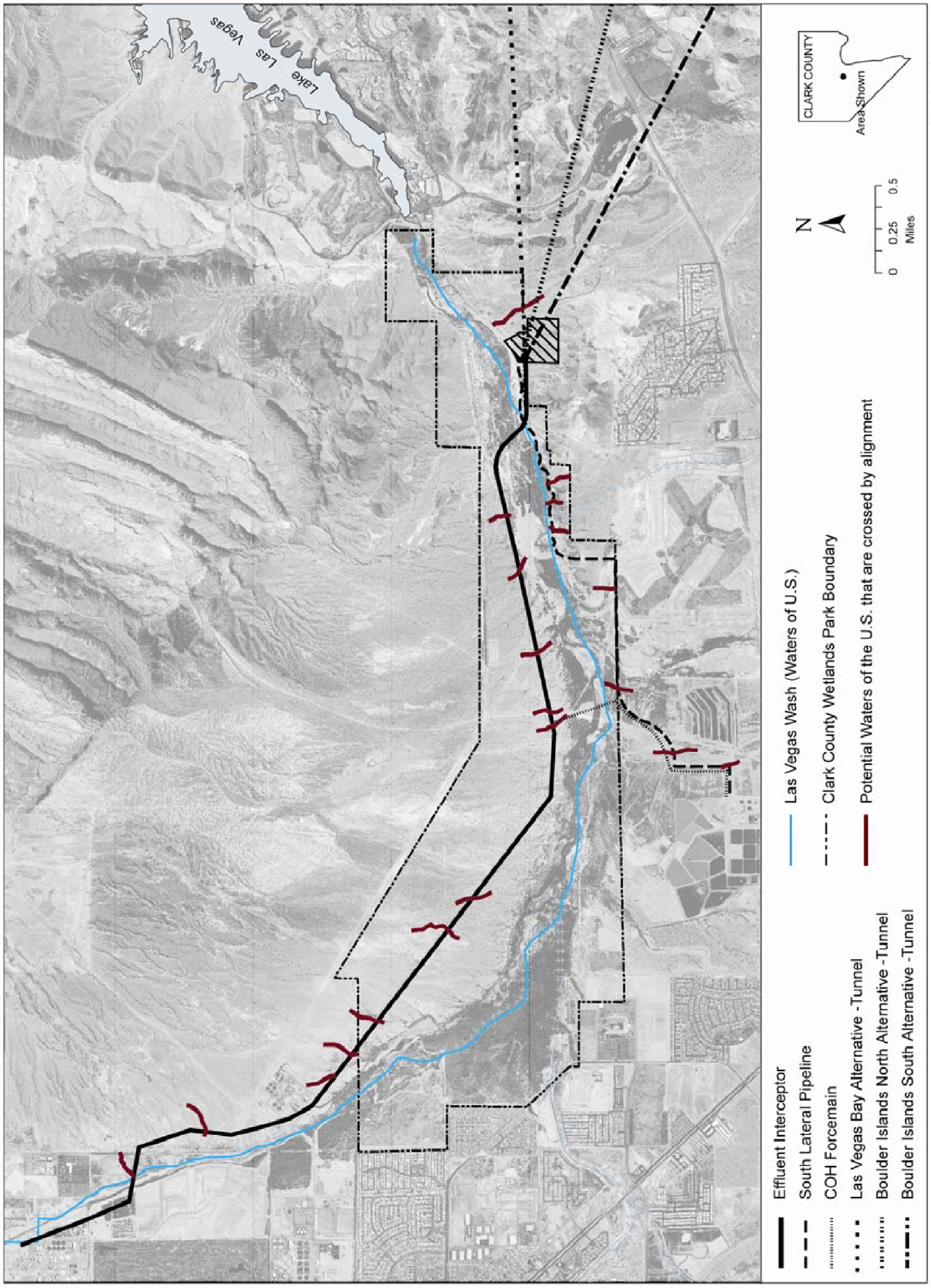

Figure 3.1-3 Potential Waters of the United States – Effluent Interceptor Segment.

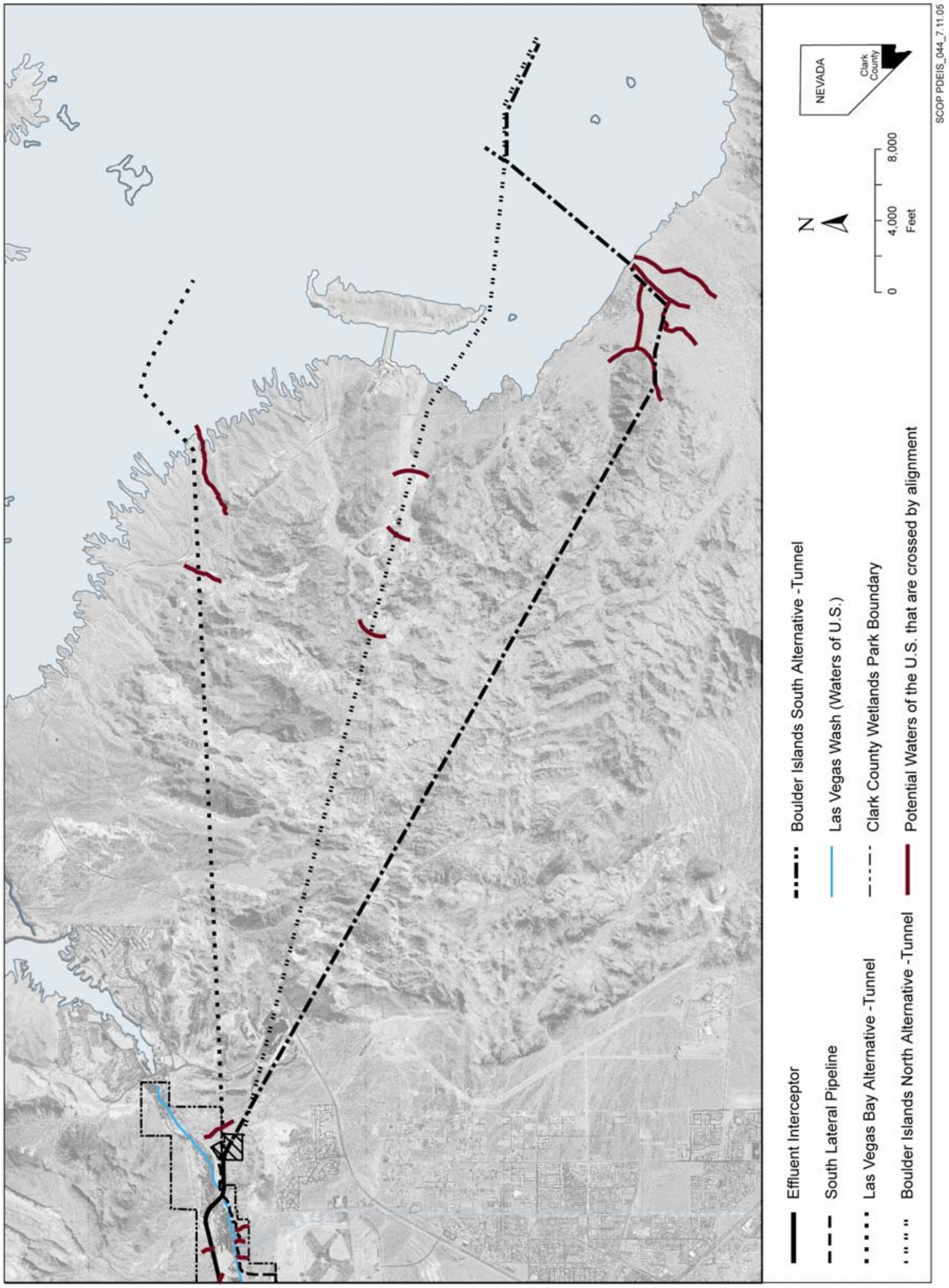

Figure 3.1-4 Potential Waters of the United States – Lake Conveyance System Segment.

3.1.1.2 Las Vegas Wash Flooding

As discussed in the previous section, the projected and historical flow rates of the Las Vegas Wash for the 100-year frequency flood event are significant. The 100-year frequency flood event is defined as having a 1-percent chance of occurrence in any given year. The Federal Emergency Management Agency (FEMA) and local entities regulate activity on the Las Vegas Wash within the 100-year frequency flood event floodplain to plan for and protect life and property from flooding. The FEMA has delineated and published maps, which are developed from computer-based hydraulic models, showing the 100-year floodplain for the Las Vegas Wash. The FEMA designated that the 100-year floodplain width varies significantly from Vegas Valley Drive to Lake Las Vegas (Figure 3.1-5). The floodplain for the Las Vegas Wash is approximately 200 ft (61 m) wide between Vegas Valley Drive and Desert Inn Road and is completely contained in an improved channel. The floodplain is approximately 500 to 2,500 ft (152 to 762 m) wide between Desert Inn Road and Pabco Road with much of the water being conveyed in the overbank areas adjacent to the main channel (FEMA 2002). Below Pabco Road, the Las Vegas Wash becomes more incised with floodplain widths of less than 800 ft (244 m) (FEMA 2002).

Flow velocities vary widely throughout the Las Vegas Wash with average velocities in the range of 1 to 15 fps (0.3 to 5 mps) (FEMA 2002). Flow velocities less than 5 fps (1 mps) generally occur in overbank areas. Flow velocities greater than 5 fps (1 mps) generally occur in the main channel. Velocities in excess of 15 fps (5 mps) may occur for short distances where the channel is very steep, usually in areas where headcutting is occurring (see Section 3.1.1.3).

3.1.1.3 Las Vegas Wash Erosion

The Las Vegas Wash was relatively stable in terms of erosion and degradation prior to the presence of modern humans in the Valley. Prior to this presence, the Las Vegas Wash watershed was virtually undisturbed. Under natural conditions, runoff from major rainfall events likely transported a large amount of sediment to the Las Vegas Wash due to sparse ground cover, steep channel slopes, and non-cohesive erodable soils, which encompass the majority of the upstream watershed. A substantial amount of this transported sediment was deposited in the less steep, wide, shallow floodplain of the Las Vegas Wash. The large influx of sediment offset channel degradation and lateral bank migration as soil material was removed from the Las Vegas Wash and was replaced with sediment transported from the upstream watershed. This balance between the sediment inflow from the upstream watershed and sediment discharge at the downstream end of the Las Vegas Wash along with the infrequent rainfall/runoff events would have a tendency to substantially limit the amount of overall channel degradation and lateral bank migration that could occur over a relatively short period of geological time (several hundred years). Though lateral migration of the stream banks and channel degradation likely occurred prior to the presence of modern humans, it was a slow process that occurred over thousands of years or over the geological time scale. The influence of human activity in the watershed has drastically changed this balance of sediment inflow and discharge to the Las Vegas Wash. The result is an acceleration of erosion, increase in lateral bank migration, channel degradation, and the formation of an incised channel. Three major causes of the accelerated erosion are:

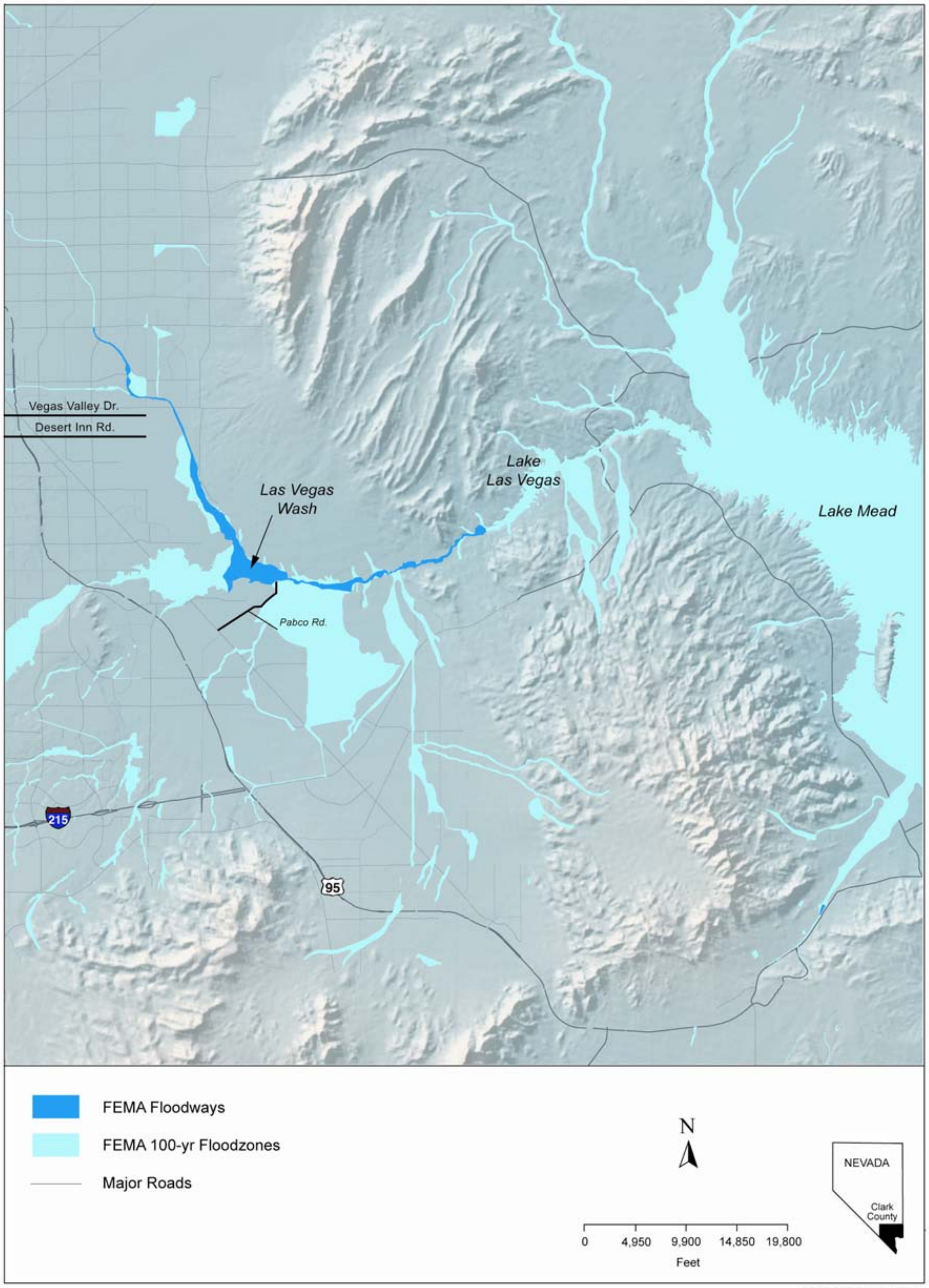

Figure 3.1-5 Floodplain Map.

- Development in the watershed reducing soil infiltration of rainfall and increasing volume of runoff;
- Construction of detention basins, structurally lined tributary channels, buildings and pavements covering or retaining erodable soil in the upstream watershed and reducing the influx of sediment in the Las Vegas Wash; and
- Introduction of a large continuous base flow in the Las Vegas Wash from wastewater treatment plant effluent that is discharged carrying virtually no sediment (clear water) and is highly erosive over a period of several decades.

The effluent flows are likely the primary cause of the accelerated erosion in the Las Vegas Wash. This continuous base flow is discharged into the Las Vegas Wash carrying minimal, if any, sediment and subsequently becomes highly erosive due to its ability to scour and transport sediment from the channel bed and banks. The channel banks become taller, steeper, and in most cases, unstable, as the channel bed is degraded by the transport of sediment in the continuous base flow. Material from the channel banks then begins to detach and fall into the channel to be carried away by the base flow. The channel degrades, deepens, and gets wider. In addition, the unstable channel banks become more susceptible to erosion when major flood events occur. Headcuts (sections of the channel that are much steeper than the segments of the channel upstream and downstream) form as the channel erodes and short segments of the channel become steeper and unstable. In many cases the headcuts become vertical drops or waterfalls in the channel. The headcuts are extremely unstable due to the high flow velocities that occur from the vertical or near vertical drops. As a result, the headcuts generally migrate upstream relatively quickly, deepening and widening the channel as they go. As the channel deepens and widens it impacts the vegetation and wildlife adjacent to the channel. Many segments of the Las Vegas Wash contain wetland areas in the overbanks adjacent to the channel. These wetlands are dependent on the shallow depth to groundwater and the perennial flow in the Las Vegas Wash. The majority of these overbank wetlands were created by the perennial flow in the Las Vegas Wash from treatment plant effluent discharges, which began in the 1950s. However, as the effluent discharges increased over the years and the Las Vegas Wash channel degraded, the wetlands began to drain. Eventually most of the wetlands were left without a constant source of water, and perished.

Since periodic monitoring of channel degradation began in 1975, the channel bed elevation in many reaches of the Las Vegas Wash has dropped 10 to 30 ft (3 to 9 m), depending on the distance upstream of Lake Las Vegas (Reclamation et al. 1998). This rate of channel degradation is projected to continue for many years until the channel slope is reduced to approximately 0.4 percent, or the current conditions in the Las Vegas Wash are modified to eliminate the causes of the degradation (Reclamation et al. 1998). In response to the channel degradation and the associated impacts, SNWA has developed a plan to reduce or stop channel degradation in the Las Vegas Wash, and to restore some of the failing wetland areas. The SNWA proposes to construct a series of 26 ECSs and 27,000 ft (8,230 m) of bank protection in or adjacent to the Las Vegas Wash between Las Vegas Bay and the Harmon Avenue alignment (CCRFCD 2002). The SNWA has already completed the construction of seven permanent ECSs and one temporary ECS upstream of Lake Las Vegas. The NPS has completed three ECSs downstream of Lake Las Vegas for a total of 10 permanent and 1 temporary ECSs currently installed (Figure 3.1-6).

Several thousand feet of bank protection has also been installed by SNWA along the Las Vegas Wash. The ECSs and bank protection have reduced channel degradation and erosion in the Las Vegas Wash.

Significant erosion downstream of Lake Las Vegas occurred prior to and after the construction of Lake Las Vegas. Headcuts in this reach of the Las Vegas Wash are as deep as 24 ft (7 m) (Reclamation 2001). Erosion continues as in other reaches of the Las Vegas Wash due to the perennial flows. Most of the sediment that has eroded over the years has been deposited at the downstream end of the Las Vegas Wash in Lake Mead. The Las Vegas Wash has deposited approximately 1,850 acre-ft of sediment in Lake Mead at the inner Las Vegas Bay (Figure 3.1-7) (USGS 2001).

3.1.2 Groundwater

The Valley is a fault-bounded structural and hydrologic basin containing up to 15,000 ft (4,572 m) of late Tertiary and Quaternary basin fill that includes sediments deposited in alluvial, playa, and paludal environments. These sediments consist of coarse-grained alluvial-fan deposits flanking the Valley margins that interfinger with fine-grained units toward the middle of the Valley.

3.1.2.1 Groundwater Aquifers

The accessible portions of the Las Vegas basin valley fill contains three aquiformations. From younger to older these are: the Las Vegas Wash Aquitard, the Las Vegas Springs Aquifer, and the Duck Creek Aquifer (Donovan 1996). The Las Vegas Wash Aquitard extends from land surface to between 150 and 500 ft (46 and 152 m) depth. The underlying Las Vegas Springs Aquifer has variable thickness averaging 500 ft. Most municipal and domestic water is obtained from this aquiformation, and its most productive areas are in the west-central and northwest portions of the Valley. Some municipal wells also tap the upper portions of the subjacent Duck Creek Aquifer, which (locally) may exceed 900 ft (274 m) in thickness.

Each of these aquiformations contain interbedded boulder to pebble conglomerate, sandstone, siltstone, and claystone of variable thickness. The proportion of finer-grained sediment increases away from the flanking mountains toward the valley center, and is also higher near some faults.

3.1.2.2 Groundwater Recharge

There are three main sources of groundwater recharge in the Valley. The first is natural recharge from snowmelt, runoff, and precipitation that falls on the flanking Spring and Sheep Mountains. A second source is deep-well artificial recharge to the drinking water aquifers. Since 1991, artificial recharge, largely by the LVVWD, has emplaced approximately 260,000 acre-ft into these aquifers, and has been an important factor in water-level stabilization and increase (LVVWD 2004).

The third source includes irrigation water, with a minor component of effluent discharge that enters the shallow groundwater system. Interaction between the shallow groundwater system,

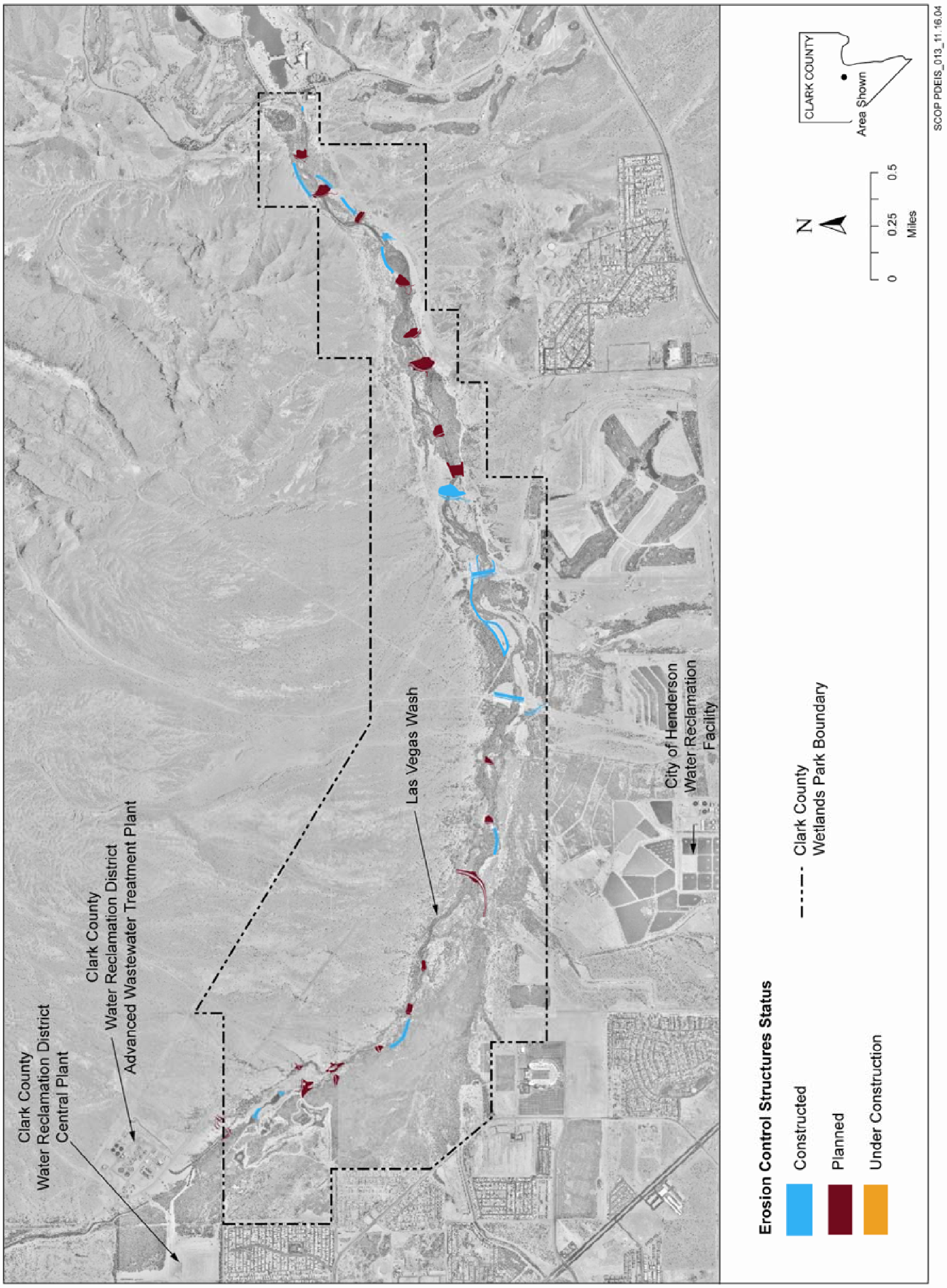

Figure 3.1-6 Erosion Control Structures.

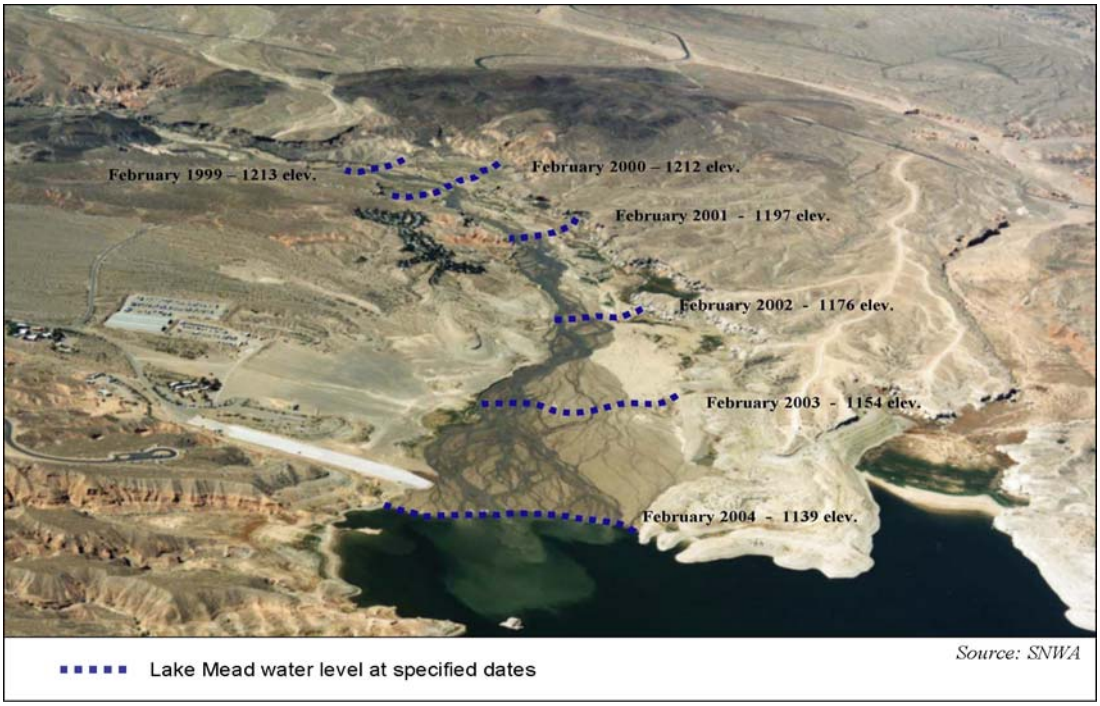

Figure 3.1-7 Las Vegas Bay Delta.

which is contained within the Las Vegas Wash Aquitard, and underlying aquifers, is slight. Prior to urbanization the shallow groundwater system was recharged by slow upward artesian flow from the Las Vegas Springs Aquifer. This flow has diminished in the area due to extraction of groundwater. However, increased irrigation has caused the shallow system to integrate and expand in some areas (Leising 2004).

3.1.2.3 Groundwater Flow

Groundwater flow in the Las Vegas basin is characterized by:

- Lateral movement of orographically recharged water,
- Impacts of water supply pumping and recharge, and
- Evapotranspiration.

The dynamic character of groundwater is shown not only in the variation of the water table levels but also by the horizontal movement of groundwater. The ease with which the water moves is related to the hydraulic conductivity of the aquifer. Hydraulic conductivity in the vicinity of the proposed EI alignments varies from 0.1 to 675 gallons per day per ft squared (gpd/ft^2) (0.38 to 2,555 liters per day per meters squared [Lpd/m^2]).

Groundwater levels along the EI alignments range in depth from 5 to 46 ft (2 to 14 m) below the ground surface (SNWA 2002). These groundwater levels were obtained from different wells located adjacent to the Las Vegas Wash. The different values for groundwater depth were averaged for each well to determine an average estimate of the groundwater depth in the vicinity of the proposed EI alignment. Figure 3.1-8 shows the location of the wells and the depth to groundwater in the vicinity of the proposed EI alignment. Additional data from different sources were used to create a potentiometric surface of the shallow groundwater system.

3.1.2.4 Groundwater Quality

Hydrochemical facies of native groundwater were categorized into three facies based on TDS and sulfate, bicarbonate, chlorine, magnesium, calcium, and sodium concentrations. The three facies are: the Spring Mountains, Red Rock alluvial fan, and McCullough Mountains.

The Spring Mountains facies underlies the northern and northwestern portions of the Valley and has low TDS (around 350 – 500 parts per million [ppm]). The Red Rock facies flanks the Spring Mountains facies on the south and extends into the southeastern portions of the Valley. This facies' TDS ranges from 600 ppm to about 1200 ppm, and contains more sulfate than the Spring Mountains facies. The McCullough Mountains facies is on the down-gradient end of the regional flow system in the extreme eastern and southeastern portions of the Valley. This facies is characterized by moderately high TDS (around 500 – 800 ppm), a predominance of sulfate over bicarbonate and moderate to high chloride and significant sodium concentrations. Data suggests that these three facies transect lithostratigrahic boundaries. Isotopic data suggest hydrostratigraphic connections between these facies where faults may act as conduits of flow from one facies to the other (Leising 2004).

In the vicinity of the proposed EI alignments, recent studies indicate that chloroform is present in groundwater but does not represent an environmental threat. Perchlorate concentrations range from 0 to 8,400 ppb. At certain periods of time, these concentrations exceeded the SNWA public notification level, which is 18 ppb. Nitrates, sulfates, and radionuclides were also detected in the shallow and near-surface aquifers (Converse Consultants 2002).

3.1.3 Surface Water Quality

This section presents water quality standards, impairments and concerns, and baseline surface water quality in the Las Vegas Wash, Las Vegas Bay, at the SNWA intakes, and at Hoover Dam. Water quality data from 2002 is used as the water quality baseline in this EIS to ensure consistency with the concurrent water modeling being conducted for the SCOP. The ELCOM/CAEDYM alternative runs were modeled using base conditions from 2002. Year 2002 was selected as the baseline year for the following reasons:

- Prior to year 2000, not much water-quality data is available for Lake Mead;
- A significant amount of data is available for years 2000, 2001, and 2002;
- Year 2001 was an atypical year concerning algal growth in Lake Mead, so it was eliminated from consideration;
- Year 2002 data is representative of typical conditions in Lake Mead including algal growth years; and
- Year 2002 lake elevation was lower, which is expected to be typical in the future.

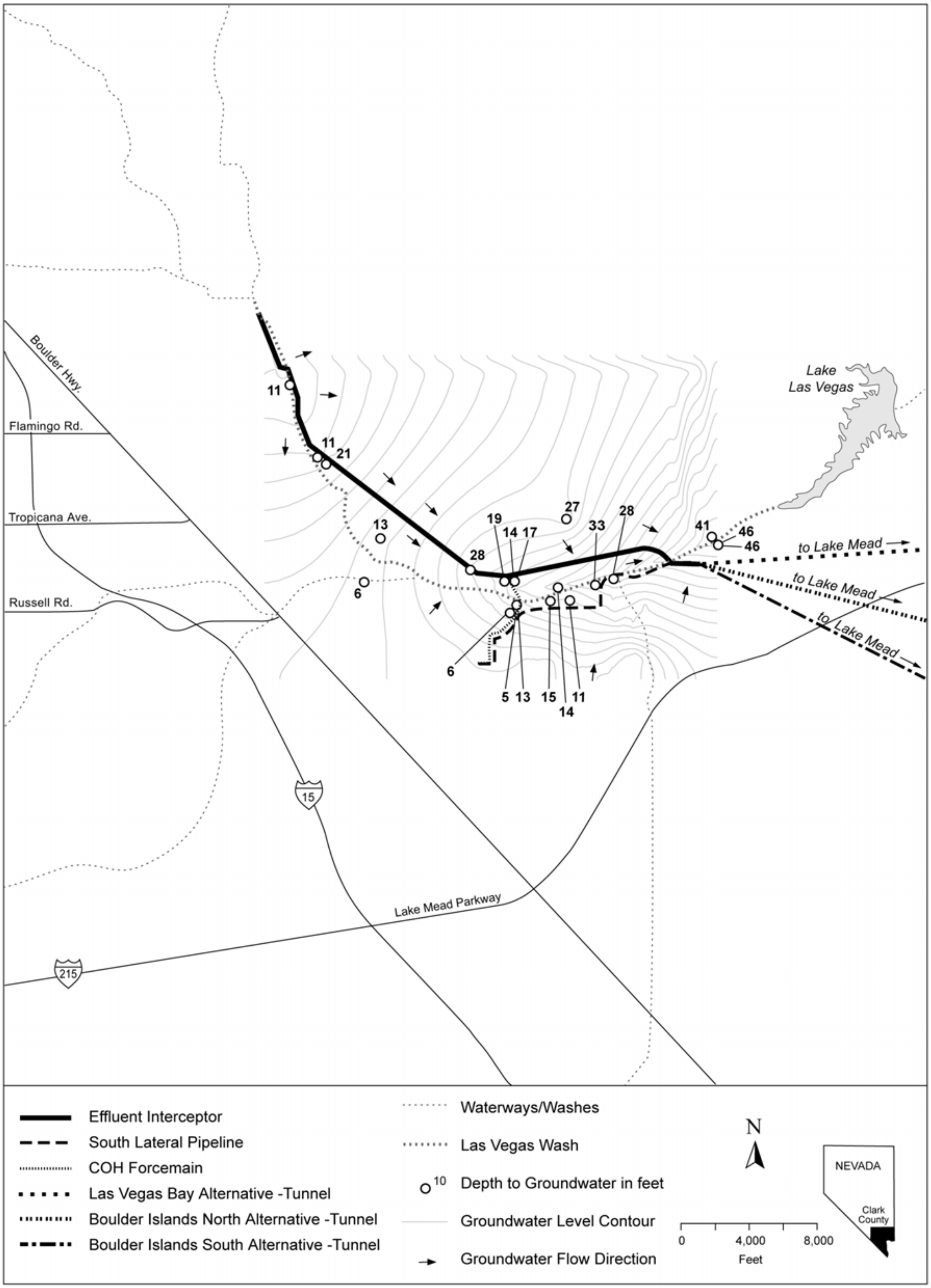

Figure 3.1-8 Location of Groundwater Wells, Depth to Groundwater, and Groundwater Flow in the Vicinity of the Effluent Interceptor.

Baseline water-quality data was obtained from several agencies, including the COH, CLV, CCWRD, SNWA, Reclamation, USFWS, and USGS. Flows and water quality data was obtained for the wastewater treatment plants' effluent, the Las Vegas Wash inflow (including tributary and groundwater inflow), the SNWA intakes, the BMI intake, the Hoover Dam discharge, and the Boulder Basin. Groundwater quality is discussed in Section 3.1.2.4.

3.1.3.1 Water Quality Standards

Standards for Water Quality for Nevada are contained in the *Nevada Administrative Code* (NAC), (Chapter 445A.118-445A. 225). The NDEP proposes standards (often based upon EPA criteria) that are then adopted by the State Environmental Commission into the NAC. Standards are also submitted to EPA for review and approval.

The NAC stipulates three key elements for water quality standards:

- Designated beneficial uses,
- Criteria to protect beneficial uses, and
- Anti-degradation provision (requirements to maintain existing higher quality [RMHQ]).

As discussed in Section 1.4, water quality standards are legally enforceable and used to define the water quality goals that correspond with an intended beneficial use of a water body. In addition to the criteria to protect beneficial uses, RMHQs are also established. These RMHQs are set to prevent degradation of the water while beneficial use standards are the minimal requirements to protect the various beneficial uses. The RMHQs are established when the existing water quality (as evidenced by monitoring data) for each parameter is better than the criteria necessary to protect the beneficial uses. The NDEP is reconsidering the role of RMHQs in the standards process.

The following four areas (Figure 3.1-9) within the project area are designated by the NAC as having beneficial uses:

- Las Vegas Wash from Telephone Line Road to the confluence of discharges from the CCWRD and the CLV wastewater treatment plants (Upper Las Vegas Wash) (NAC 445A.198),
- Las Vegas Wash from the confluence of Las Vegas Wash and Lake Mead to Telephone Line Road (Lower Las Vegas Wash) (NAC 445A.200),
- Lake Mead from the western boundary of the Las Vegas Bay Campground to the confluence of Las Vegas Wash (Inner Las Vegas Bay) (NAC 445A.196), and
- The remaining areas of Lake Mead (Lake Mead) (NAC 445A.194).

The beneficial uses of these four areas are listed in Table 3.1-1. The water quality standards for the RMHQs and beneficial uses of these four areas are listed in Table 3.1-2.

The NDEP has proposed revisions to the standards in response to lower Lake levels, because Lake locations identified in the standards are now on dry land. The proposed revisions identify monitoring locations that compensate for changes in Lake levels.

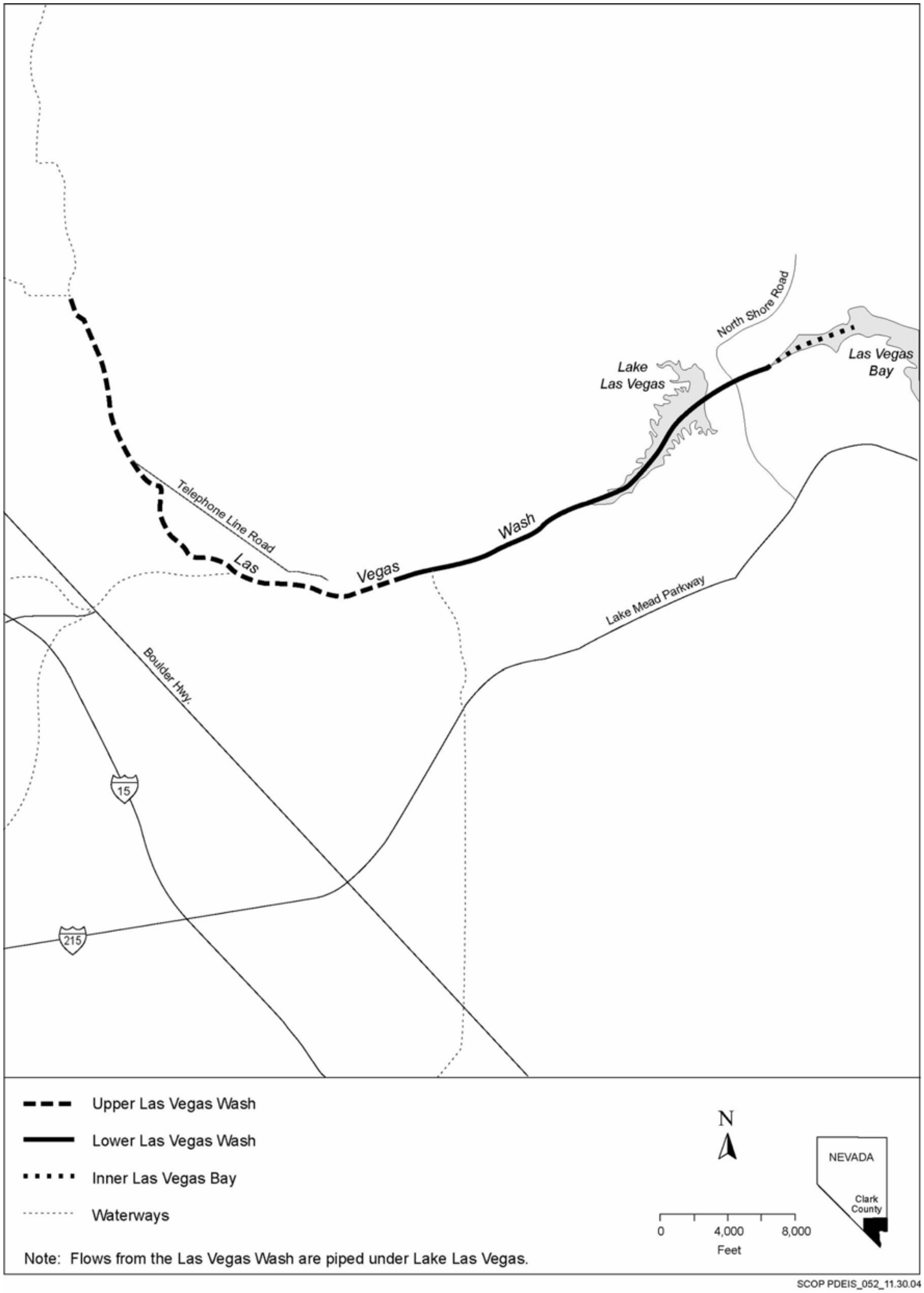

Figure 3.1-9 Areas Designated for Beneficial Use.

Table 3.1-1 Beneficial Uses.

Use	Upper Las Vegas Wash	Lower Las Vegas Wash	Inner Las Vegas Bay	Lake Mead
Irrigation	X	X	X	X
Watering of livestock	X	X	X	X
Recreation involving contact with the water				X
Recreation not involving contact with the water	X	X	X	X
Industrial supply			X	X
Municipal and/or domestic supply				X
Maintenance of a freshwater marsh	X	X		
Propagation of wildlife	X	X	X	X
Propagation of aquatic life	X[1]	X[1]	X[2]	X[2]

Notes:
[1] Excluding fish, does not preclude the establishment of a fishery.
[2] Including, without limitation, a warm water fishery.
Source: NAC, chapter 445A.194, 445A.196, 445A.198, and 445A.200.

3.1.3.2 Water Quality Impairment and Concern

As discussed in Section 1.4, the total phosphorus (TP) TMDL and WLA were established to ensure attainment of the RMHQs for chlorophyll *a*. Chlorophyll *a*, the principal photosynthetic pigment in plants, is used as an indicator of algal biomass in water. Chlorophyll *a* is a reliable measure of algal concentrations because it is directly related to the quantity of algae present (NDEP 1987). Algae have the potential to change the apparent color of water when excessive amounts are present, and they may create undesirable surface scum that can impair recreational use and can create taste and odor problems. High algae densities can settle to the lake bottom and reduce dissolved oxygen (DO) levels.

The total ammonia TMDL and WLA were established to ensure attainment of the beneficial use standards for un-ionized ammonia (Section 1.4). Un-ionized ammonia can be toxic to fish. In water, ammonia occurs in two forms, un-ionized ammonia (NH_3) and ionized ammonia (NH_4+), which together form total ammonia (NH_4 -N). Un-ionized ammonia is calculated from the total ammonia concentration, pH, and temperature. The concentration of un-ionized ammonia increases as a function of increasing pH and increasing temperature (NDEP 1987, 1989).

The decreasing levels of Lake Mead are an issue of concern because of the reduced amount of water. This issue is discussed further in Section 3.1.3.3.1.

Table 3.1-2 Water Quality Standards.

	Las Vegas Wash (Upper and Lower)		Inner Las Vegas Bay		Lake Mead	
Parameter[1]	**RMHQ**	**Beneficial Uses Criteria**	**RMHQ**	**Beneficial Uses Criteria**	**RMHQ**	**Beneficial Uses Criteria**
Temperature (°Celsius [C])	ΔT=0 [2]	—	ΔT=0 [2]	ΔT=2 [2]	ΔT=0 [2]	ΔT=2 [2]
pH (Standard Unit)	—	6.5-9.0	95% of samples ≤8.9	6.5-9.0	95% of samples ≤8.8	6.5-9.0
Dissolved oxygen (DO) (mg/L)	—	Aerobic conditions desirable	—	≥5	—	≥5 [3]
Chlorophyll *a* (μg/L)	—	—	—	[4]	[4]	—
Un-ionized ammonia as N (mg/L)	—	—	—	4-day aver. ≤0.05 Single value ≤≤0.45	—	4-day aver. ≤0.05 Single value ≤≤0.45
Total dissolved solids (mg/L)	95% samples: Upper LVW[5] ≤1,900, Lower LVW ≤2,400	≤3,000	[6]	≤3,000	[6]	≤1,000
Chloride (mg/L)	—	—	—	—	[7]	≤400 [7]
Sulfate (mg/L)	—	—	—	—	[7]	≤500 [7]
Total suspended solids (mg/L)	—	≤135 [8]	—	≤25	—	≤25
Nitrate-N (mg/L)	—	≤10	—	≤90	—	≤10
Nitrite-N (mg/L)	—	≤1	—	≤5	—	≤1
Total inorganic nitrogen (mg/L)	95% samples: Upper LVW ≤20, Lower LVW ≤17	—	95% samples ≤5.3	—	95% of samples ≤4.5	—
Turbidity (NTU) [9]	—	—	≤10 of natural conditions	≤25	≤10 of natural conditions	≤25
Fecal coliform (MPN/100mL) [10]	—	Point Source Only ≤200/400 [11]	—	Point Source Only ≤200/400 [11]	—	≤200/400 [11]
E. Coli 30-day Log Mean	—	—	—	—	— —	≤126 ≤235
Color (Platinum-Cobalt Scale Units)	—	—	—	—	≤10 of natural conditions	—

Notes: See following page.

Table 3.1-2 Notes:

[1] Unless mentioned otherwise, requirements or criteria refer to single value.

[2] ΔT means change in temperature. Maximum allowable increase in temperature above water temperature at the boundary of an approved mixing zone.

[3] In the epilimnion or average in water column during periods of non-stratification.

[4] The requirements for chlorophyll *a* are:

- Not more than one monthly mean in a calendar year at Station 3 may exceed 45 µg/L.
- The mean for chlorophyll *a* in summer (July 1-September 30) must not exceed 40 µg/L at Station 3, and the mean for 4 consecutive summer years must not exceed 30 µg/L. The sample must be collected from the center of the channel and must be representative of the top 5 m (16 ft) of the channel. "Station 3" means the center of the channel at which the depth is from 16 to 18 m (52 to 59 ft).
- The mean for chlorophyll *a* in the growing season (April 1-September 30) must not exceed 16 µg/L at LM4 and 9 µg/L at LM5. LM4 is located just outside of the Las Vegas Bay launch ramp and marina, next to buoy RW "1". LM5 is located next to buoy RW "A" with the southshore landmark of Crescent Island.
- The mean for chlorophyll *a* in the growing season (April 1-September 30) must not exceed 5 µg/L in the open water of Boulder Basin, Virgin Basin, Gregg Basin, and Pierce Basin. The single value must not exceed 10 µg/L for more than 5 percent of the samples.
- Not less than two samples per month must be collected between the months of March and October. During the months when only one sample is available, that value must be used in place of the monthly mean.

[5] LVW = Las Vegas Wash.

[6] Flow weighted annual average concentration ≤723 mg/L measured below Hoover Dam.

[7] The combination of this constituent with other constituents comprising TDS must not result in the violation of the TDS standards for Lake Mead and the Colorado River.

[8] Not applicable when flows are greater than 110 percent of average flow as measured at the nearest gauge.

[9] Nephelometric Turbidity Unit.

[10] Most Probable Number per 100mL (1 deciliter).

[11] Based on a minimum of not less than 5 samples taken over a 30-day period, the fecal coliform bacterial level must not exceed a log mean of 200 most probably number per 100 milliliters (MPN/100mL) nor must be more than 10 percent of the total samples taken during any 30-day period exceed 400 MPN/100 mL.

Source: NAC, Chapter 445A.195-201.

The 5-mile (8-km) segment of the Las Vegas Wash between Telephone Line Road and Lake Mead is on Nevada's 2002 303(d) *Impaired Waters List* (NDEP 2002a). The pollutants or stressors of concern are total iron and TSS. The 303(d) list notes that data indicates a majority of the iron is in particulate form associated with sediment. The TSS values in the Las Vegas Wash are highest during runoff events and lowest during dry weather when wastewater flows dominate. However, TSS levels have improved following the construction of ECSs. The NDEP concluded that additional monitoring is needed to confirm standards compliance.

The same segment of the Las Vegas Wash is also on the list of waterbodies warranting further investigation due to total selenium concentrations exceeding the 96-hour toxicity criterion.

The Nevada's 2002 303(d) *Impaired Waters List* does not list TIN as a concern, but according to the *2003 Water Quality Report*, exceedances of the RMHQ for TIN have occurred several times in the Inner Las Vegas Bay and Lake Mead. The exceedances of TIN were small and occurred at low Lake levels as the Las Vegas Wash enters the Inner Bay. In a very short travel distance, the

TIN was within Water Quality Standards. After review with NDEP, it was determined that the field measurement should occur throughout the entire water column, which will be representative of the original intent of the TIN water quality monitoring program. Also, the State Environmental Commission recently enacted a revised monitoring program that will take into account the rise or lowering of the Lake levels. Nitrogen is a nutrient that, along with phosphorus, can have a significant impact on the algal production of a lake. However, algal production in Las Vegas Bay and Boulder Basin are believed to be controlled by phosphorus, rather than nitrogen (Black & Veatch 2005a).

Perchlorate was detected in 1997 in Lake Mead. The source was traced to the Las Vegas Wash. The chemical has been seeping into the Las Vegas Wash from nearby manufacturing sites through the shallow groundwater system. There is currently no limit on perchlorate in the federal *Safe Drinking Water Act* (42 USC 300f et seq.; PL 93-523). However, on February 18, 2005, EPA issued a safety standard of 24.5 ppb for perchlorate. The SNWA uses the perchlorate concentration of 18 ppb as a public notification level. A remediation system was installed under the direction of NDEP in 2002 to intercept and treat the perchlorate entering the Las Vegas Wash. This system removes more than 2,500 pounds per day (lbs/day) (1,134 kilograms/day [kg/day]) of perchlorate from the groundwater. Levels at the SNWA intake went from 11 to 12 ppb in 2003 to about 6 ppb in 2004. Future monitoring results will show the effect of this remedial action on the Las Vegas Wash and Lake Mead.

3.1.3.3 Las Vegas Wash

The Las Vegas Wash is the primary conveyance of surface water runoff for the Valley. The Las Vegas Wash drains 1,600 square miles (4,144 square kilometers) of the Valley and channels urban runoff and stormwater, shallow groundwater, and reclaimed water into the Las Vegas Bay. Factors affecting the water quality in the Las Vegas Wash and the baseline water quality conditions are discussed in this section.

3.1.3.3.1 Factors Affecting Water Quality

Treated effluent is a major component of the dry weather flow in the Las Vegas Wash. The wastewater is highly treated to meet NPDES permit requirements before discharging into the Las Vegas Wash. Continuous flows include treated effluent from the three treatment facilities and cooling water discharged from BMI, an industrial site located in Henderson.

Stormwater transports various contaminants such as bacteria, oil, grease, pesticides, herbicides, and nutrients in fertilizer from the land surface into the Las Vegas Wash. The high flows during storm events are very erosive and convey large amounts of sediment downstream into Lake Mead.

Dry weather urban discharge and intercepted shallow groundwater contribute about 15 percent of the annual flows in the Las Vegas Wash. The shallow groundwater contains high levels of TDS and many other substances including selenium and perchlorate. Dry-weather urban discharge is generally due to the excess water from urban uses, such as overwatering of landscapes. As the Valley’s population grows, development results in increasing impervious cover, which in turn leads to increased urban runoff. However, improvements such as stormwater detention basins and ECSs reduce the erosive effects of stormwater runoff.

3.1.3.3.2 Baseline Water Quality Conditions

This section provides a description of the baseline water quality conditions of the Las Vegas Wash up to the confluence with Lake Mead. The COH provided the baseline water quality data for the Las Vegas Wash (Table 3.1-3) (COH 2002d). Baseline data for the Las Vegas Wash is based upon 2002 annual average data from monitoring station LW0.55, which is located downstream of Northshore Road (Figure 3.1-10). Station LW0.55 was used to determine the baseline water quality conditions in the Las Vegas Wash because it is the location where all the inflows into the Las Vegas Wash are combined and NDEP established TP and total ammonia WLAs to meet the Las Vegas Bay water quality standards as discussed in Section 1.4.

The pH values in the Las Vegas Wash are within the required range for sustaining designated beneficial uses and RMHQs. The dissolved oxygen levels are generally high as needed to meet the desired goal of an aerobic environment. Water quality is therefore appropriate for fish. However, the Las Vegas Wash is considered poor habitat for most fish because of the high flow velocities, suspended sediment, unstable bottom, and more recently, blockage by ECSs.

Algal levels are low in the Las Vegas Wash because there is not enough retention time of the water for algae to grow. Flows in the Las Vegas Wash are too rapid to promote algae growth.

High values of TSS occur during storm runoff events. Concentrations are usually low during dry weather when effluent dominates.

Effluent flows have low fecal coliform (FC) values due to disinfection at the treatment plants. The presence of FC bacteria in aquatic environments indicates that the water has been affected by the fecal material of man or animals. In the Las Vegas Wash, elevated FC levels have been attributed primarily to birds. The Las Vegas Wash is not used for swimming because of shallow water and high flow velocities.

Selenium is not added to the Las Vegas Wash through treated effluent. Selenium present in the Las Vegas Wash originates from the soil and is considered part of the natural conditions in the Las Vegas Wash. Selenium levels in the Las Vegas Wash are being monitored and addressed by a group of agencies including the LVWCC and NDEP.

Measured perchlorate concentrations along the Las Vegas Wash below Pabco Weir ranged from 4.8 to 832 µg/L. More discussion of this issue is provided in Section 3.1.3.4.

Samples from the Las Vegas Wash have been analyzed for NDMA. Analysis results for one sample indicated the presence of NDMA at the very lowest measurable concentration of 2 nanograms per liter.

Table 3.1-3 Baseline Water Quality Conditions in the Las Vegas Wash.

Parameter	LW0.55
Temperature (°C) [°F]	22.6 [72.7]
Perchlorate (µg/L)	NA[1]
Conductivity (µS/cm)	2344
Total Dissolved Solids (mg/L)[2]	1484
Dissolved Oxygen (mg/L)	8.9
Chlorophyll (µg/L)	NA
Total Phosphorus (mg/L)	0.2
Soluble Phosphorus (mg/L)	0.1
Total Inorganic Nitrogen (mg/L)	16
Nitrate (mg/L)	15.8
Total Ammonia Nitrogen (mg/L)	0.1
Un-ionized Ammonia (mg/L)	NA
Bromide (mg/L)	NA
Sulfate (mg/L)	633
Chloride (mg/L)	309
Fecal Coliform (MPN/100mL) [3]	231
pH	8.3

Notes:

1 NA = Not available.

2 Total Dissolved Solids are calculated from the correlation TDS (mg/L) = 0.633 Conductivity (µS/cm).

3 Most probable number per 100 ml (1 deciliter).

Source: COH 2002d.

3.1.3.4 Boulder Basin, Lake Mead

A discussion of the main factors affecting water quality and the baseline water quality conditions in the Boulder Basin of Lake Mead are presented in this section. It is based on a general understanding of lake limnology, observations in Boulder Basin, and modeling results that provide insights into the hydrodynamics and mixing of the system. Most of the information presented in this section is based on the *Lake Mead Modeling Report* (Black & Veatch 2005b). Additional information regarding the limnology of Lake Mead may be found in two research reports prepared by UNLV (UNLV 1980, 2002) and several published papers (LaBounty and Horn 1997). In addition, the CWC routinely monitors water quality in Lake Mead.

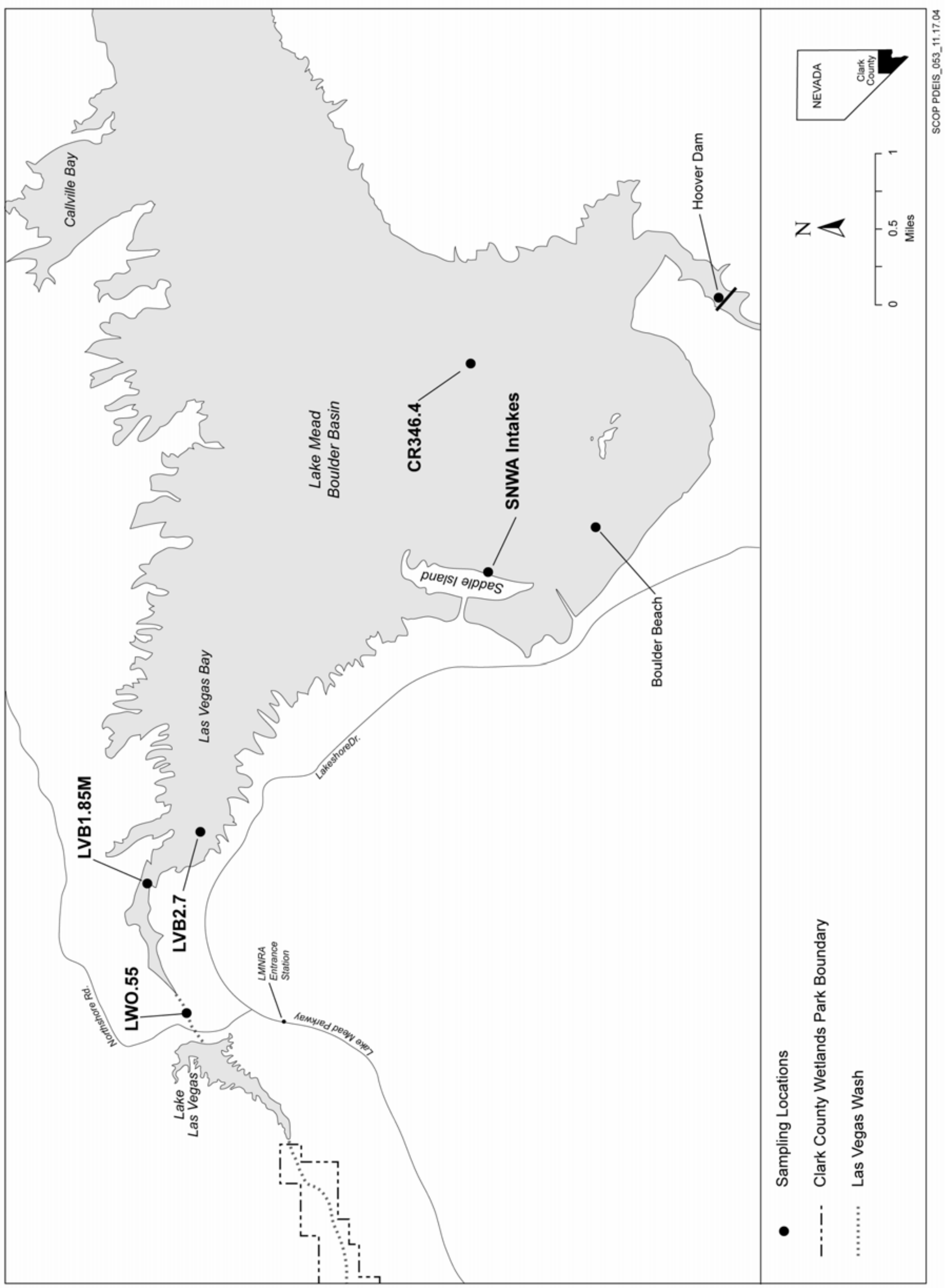

Figure 3.1-10 Water Quality Sampling Locations in Boulder Basin.

3.1.3.4.1 Factors Affecting Water Quality

The dominant factors that affect water quality in the Boulder Basin include various aspects of the limnology of Lake Mead and the primary inflows. These factors include:

- Lake stratification,
- Wind,
- Solar radiation,
- Lake surface elevation, and
- Las Vegas Wash and Colorado River inflow.

Lake Stratification

Thermal stratification is an important physical characteristic of Boulder Basin and dominates most aspects of lake mixing. The formation of thermal stratification is a direct result of increasing solar radiation and air temperature in the spring. In the winter, decreasing solar radiation and air temperature, combined with wind mixing, contributes to destratification of the lake. The upper, warmer water is called the epilimnion, the deeper, colder water is called the hypolimnion. The middle portion separating these two layers, where the rate of vertical temperature change is greatest, is called the metalimnion or thermocline.

In February, water temperatures in Boulder Basin are nearly uniform in the vertical direction at a value near 12 to 13 degrees Celsius (^{o}C) (53 to 55 degrees Fahrenheit [^{o}F]) and the Lake is usually fully mixed. By summer, the thermocline is well defined and located at an approximate depth of 30 to 50 ft (9 to 15 m) below the surface. In the fall, surface water temperatures steadily decrease (to about 16^{o}C [60^{o}F]) due to decreased solar radiation. This deepens the thermocline to a depth of 160 ft (49 m) by November and causes wind mixing to be more effective. The stratification continues to weaken until the Lake destratifies in February.

Thermal stratification has profound effects on the mixing processes within Boulder Basin. Since there is little mixing between the epilimnion and hypolimnion during the stratified period, the concentrations of chemical components in either layer are mostly independent and unaffected by inflow loadings into the other layer for much of the year. In some ways, the stratified Lake behaves like two distinct water bodies. For example, if there is a summertime inflow of a substance into the epilimnion, the substance will be generally contained within the epilimnion. At the same time, the concentration of that substance in the hypolimnion will be essentially unchanged until the Lake destratifies in the winter and the substance becomes fully mixed throughout the depth of the reservoir. Until then, the substance concentration profile will show significant vertical stratification in the same way that there is vertical temperature stratification.

Wind

Wind is an important mixing mechanism in Boulder Basin. However, unless the thermal stratification is very weak, the vertical mixing is mostly limited to the epilimnion. Horizontal mixing in the epilimnion is affected by the wind direction. If the surface currents generally flow north and west (towards the inner Las Vegas Bay), the effluent plume from the Las Vegas Wash may build up within the Las Vegas Bay for a few days until the currents change. If the surface currents generally flow south and east (towards Hoover Dam), the flows from the Las Vegas Wash quickly spread horizontally into the open water. Wind also causes the thermocline to tilt, and produces deeper currents in the Lake that increase mixing.

Solar Radiation

Solar radiation is the driving force that creates thermal stratification in Boulder Basin and provides the energy required by phytoplankton for photosynthesis. The solar radiation is at a minimum in December/January and a maximum in July/August.

Lake Surface Elevation

Water surface elevations in Boulder Basin can have a direct effect on the water quality of its outflows. If the Lake elevation drops to extremely low levels, the SNWA and Hoover Dam intakes may withdraw water from the thermocline or epilimnion (instead of the hypolimnion, from which they have historically withdrawn water). Moreover, a lower water surface elevation may mean that there is less water available for dilution of constituents in the Las Vegas Wash and the Colorado River inflow, especially in the hypolimnion.

Las Vegas Wash and Colorado River Inflow

The Las Vegas Wash and the Colorado River are the two primary inflows into Boulder Basin. The average flow rate of the Colorado River between 2000 and 2002 was about 8,000 mgd (12,320 cfs), which is almost 50 times that of the Las Vegas Wash. Due to its high inflow rate, the Colorado River serves as the primary dilution source for various water-quality constituents that enter Boulder Basin from the Las Vegas Wash.

The Las Vegas Wash flows enter Boulder Basin as a surface stream into the inner Las Vegas Bay. After entering the reservoir, the stream mixes with Lake water and settles to a depth controlled by its density relative to the density of the Lake water. The Las Vegas Wash inflow travels along the thermocline between April and October where it is vertically mixed within the epilimnion by strong winds. Between December and February, the inflow travels along the bottom of the reservoir. In November and March, the inflow intrudes into both the epilimnion and the hypolimnion.

The Colorado River flows enter Boulder Basin through the Narrows. Like the Las Vegas Wash inflow, it is believed that the Colorado River flows along the thermocline in summer, and deeper in the winter. Although the net flow goes through the Narrows downstream from the Virgin Basin into the Boulder Basin, there is evidence of a reverse flow from Boulder Basin upstream into the Virgin Basin that is related to high-velocity wind events that cause significant water movement upstream towards the Narrows.

3.1.3.4.2 Baseline Water Quality Conditions

Baseline water-quality conditions for the Boulder Basin are described in this section. Water quality is described for the Las Vegas Bay, Boulder Basin, Boulder Beach, SNWA intake area, and the Hoover Dam discharge area. Table 3.1-4 shows the baseline levels of various constituents in these areas based on 2002 water quality data. Figure 3.1-10 shows the locations of the water quality sampling sites in the Boulder Basin.

The water quality in Boulder Basin is characterized by the concentrations of its chemical and biological constituents. The parameters addressed include conductivity, perchlorate, bromide, sulfate, chloride, FC, TP, nitrogen, chlorophyll, Secchi depth, DO, and pH.

Conductivity. Conductivity indicates the level of the total amount of mineral substances that are dissolved in a sample of water. The concentration of TDS is computed from the correlations: TDS (mg/L) = 0.633 Conductivity (microsiemens per centimeter [µS/cm]) in Lake Mead; TDS (mg/L) = 0.68 Conductivity (µS/cm) in Las Vegas Wash. In Boulder Basin (particularly the Las Vegas Bay), the main source of conductivity is from the Colorado River flows. The Las Vegas Wash conductivity for 2000 to 2002 was generally around 2,500 µS/cm (1,583 mg/L TDS). In comparison, the average conductivity in the Colorado River inflow was about 850 µS/cm (538 mg/L TDS), but there was about 50 times more flow. The average conductivity in Boulder Basin from 2000 through 2002 was about 930 µS/cm (589 mg/L TDS).

Perchlorate. Perchlorate is an ionic substance made up of chlorine and oxygen that forms part of ammonium perchlorate, which is used in solid rocket fuel and explosives production. In solution, the ammonium perchlorate disassociates and the perchlorate ion is very stable and unreactive. At high doses, perchlorate is known to affect the function of the thyroid gland, which regulates hormone production.

In Boulder Basin, perchlorate loading is believed to come primarily from the groundwater (base flow) in the Las Vegas Wash. The average perchlorate concentration in the Las Vegas Wash inflow from 2000 through 2002 was about 400 µg/L. Due to dilution with the Lake water, perchlorate concentrations in the Lake average about 15 µg/L. As discussed earlier, remediation activities began in 2002 to intercept and treat the perchlorate entering the Las Vegas Wash. This system removes more than 2,500 lbs/day (1,134 kg/day) of perchlorate from the groundwater. Levels at the SNWA intake went from 11 to 12 ppb in 2003 to about 6 ppb in 2004.

Bromide. If ozone is used in treatment processes, Bromide is a precursor to the formation of harmful disinfection by-products in municipal water supplies. Therefore, source waters with high bromide concentrations may require additional treatment to inhibit the formation of bromate.

The average bromide concentration is about 0.3 mg/L in the Las Vegas Wash and 0.08 mg/L in the Colorado River inflow. The bromide concentrations in Boulder Basin are close to that of the Colorado River inflow with little seasonal variation, mainly due to the fact that most of the bromide in the basin (on a mass loading basis) comes from the Colorado River where bromide concentrations remain steady.

Sulfate. Average sulfate concentrations are about 600 mg/L in the Las Vegas Wash inflow. In Boulder Basin, average measured sulfate concentrations at station CR346.4, near the surface, are around 220 mg/L, close to that of the Colorado River inflow.

Table 3.1-4 Baseline Water Quality Conditions in Boulder Basin
(1,178 ft for year 2002 with effluent flows of 150 mgd [231 cfs] and effluent TP = 292 lbs/day). [1]

Parameter	Inner Bay (LVB1.85M) [2]	Inner Bay (LVB2.7)	Boulder Basin (CR346.4)	Boulder Beach	Hoover Dam Discharge [3]	SNWA Intake [4]
Temperature (°C) [°F]	20.3 [68.6]	20.3 [68.5]	19.6 [67.2]	19.3 [66.7]	13.2 [55.7]	13.0 [55.3]
Perchlorate (µg/L)	45.2	46.7	12.9	13.9	6.6	5.8
Conductivity (µS/cm)	1085	1094	947	952	901	896
Total Dissolved Solids [5]	687	693	599	603	570	567
Dissolved Oxygen (mg/L)	8.7	8.7	8.3	8.3	7.7	7.5
Chlorophyll (µg/L) [6]	12.4	12.4	2.0	2.1	≤ 0.01	≤ 0.01
Total Phosphorus (mg/L)	0.018	0.018	0.005	0.005	0.005	0.004
Soluble Phosphorus (mg/L)	0.009	0.009	0.003	0.003	0.004	0.004
Total Nitrogen (mg/L)	1.6	1.7	0.4	0.4	0.3	0.4
Nitrate (mg/L)	1.6	1.6	0.4	0.4	0.3	0.3
Total Ammonia Nitrogen (mg/L)	0.012	0.013	0.01	0.011	0.014	0.019
Un-ionized Ammonia (mg/L)	0.0008	0.0008	0.0002	0.0004	0.0002	0.0003
Bromide (mg/L)	0.11	0.11	0.09	0.087	0.08	0.08
Sulfate (mg/L)	295	297	257	259	243	242
Chloride (mg/L)	107	108	85	85	79	78
Fecal Coliform (MPN/100mL) [7]	1.0	1.1	0.0	0.0	0.0	0.0
pH	8.1	8.1	8.0	8.0	7.7	7.7

Notes:

1 Sampling depth is surface to 1 m (3.3 ft) for locations other than SNWA and Hoover Dam, which were sampled at intake depths, and except chlorophyll, which was sampled within the top 5 m (16 ft). All data is the mean annual average, except for chlorophyll, which includes the mean annual seasonal average (see note 5).

2 M = Mobile. LVB1.85M is mobile and located at a depth of 16 to 18 m (52 to 59 ft) near the confluence of Las Vegas Wash and Lake Mead. All other locations are stationary.

3 Hoover Dam discharge data is from upper and lower intakes combined.

4 SNWA intake data is from the lower intake only.

5 Total Dissolved Solids are calculated from the correlation TDS (mg/L) = 0.633 Conductivity (µS /cm).

6 Chlorophyll data includes the mean annual seasonal average. Samples were taken at the top 5 m (16 ft).

7 Most Probable Number per 100 ml (1 deciliter).

Source: Black & Veatch 2004d.

Chloride. High chloride concentrations can give rise to detectable tastes in water. Average chloride concentrations are 300 mg/L in the Las Vegas Wash inflow and 70 mg/L in the Colorado River inflow. The chloride concentrations in Boulder Basin are between 80 and 100 mg/L.

Fecal Coliform. Fecal coliforms are bacteria found in the large intestines of humans and other animals, and also in soil and on the surfaces of plants and structures (Miller et al. 1966, EPA 1986, Haas et al. 1999). While a few strains of coliforms produce serious toxins, they are generally not harmful. The FC test is often used as an indicator of possible contamination by fecal matter and a measure of the potential for contamination by other pathogens. Treated effluent has been disinfected and therefore is not a significant source of FC. Stormwater runoff is often one of the biggest sources of FC. However, the bacteria rapidly settle or die off when they reach the Lake. In Boulder Basin, FC concentrations are usually very low, typically less than 2 MPN/100mL.

Total Phosphorus. Phosphorus is an essential nutrient in lakes, but in high concentrations can cause excessive algal and aquatic plant growth. It is generally believed that phosphorus is the limiting nutrient in Boulder Basin. This means that all of the other components necessary for phytoplankton growth in Boulder Basin (e.g., nitrogen and carbon) are available in sufficient quantities and it is a lack of phosphorus that limits aquatic plant growth. In this situation, when a limiting nutrient is added to the Lake, algae and plant growth will increase.

Historically, TP loadings from the Las Vegas Wash vary seasonally. Total phosphorus loading ranges from 800 to 1,200 lbs/day (363 to 544 kg/day) in the winter, and averages 200 lbs/day (91 kg/day) in the summer. This seasonal variation is a direct result of the effluent discharge permit requirements for TP that only limit effluent discharge loadings in the summer (April 1st through September 30th). However, in 2001, the treatment plants agreed to operate at 0.2 mg/L TP year round, which equals approximately 292 lbs/day (132 kg/day) of effluent TP with the current average effluent flows of 150 mgd. In the past, phosphorus loading was much higher and often exceeded 1,500 lbs/day (680 kg/day) year round.

While the concentrations of TP entering from the Narrows are significantly smaller than those from the Las Vegas Wash, the TP mass loading from the Narrows is comparable in magnitude to that from the Las Vegas Wash. Total phosphorus levels in the open waters of Boulder Basin are estimated to be about 0.004 to 0.011 mg/L.

Nitrogen. Nitrogen enters Boulder Basin through the Las Vegas Wash or from sources such as rainfall, groundwater, and the Colorado River. Some types of algae and bacteria are capable of nitrogen fixation, which converts nitrogen gas to forms of nitrogen that can be used by plants. There are several species of nitrogen existing in water including nitrate (NO_3), nitrogen dioxide (NO_2), NH_3, and organic nitrogen. The dominant form of nitrogen in Boulder Basin is NO_3 and thus, it can be used as an indicator for total nitrogen in the Lake.

During dry weather, the wastewater nitrate-nitrogen (NO_3-N) concentrations average about 15 mg/L in the Las Vegas Wash inflow and about 0.5 mg/L in Boulder Basin. Average NO_3-N concentrations upstream of the Narrows are typically about 0.2 mg/L in the summer and 0.35 mg/L in the winter.

Ammonia-nitrogen (NH_3-N) measurements are also taken at different locations within the Lake. Levels are typically below the reporting limits of either 0.04 or 0.08 mg/L. As a result, the distribution of NH_3-N in the reservoir is uniformly low.

Chlorophyll. As discussed previously, chlorophyll is a pigment found in aquatic plants and algae and can be used as a measure of the algae content in a water body. There are three different types of chlorophyll – *a*, *b*, and *c*. Chlorophyll *a* was the only type sampled and analyzed for the purposes of this project. Therefore, the terms chlorophyll and chlorophyll *a* are used interchangeably in this document. High chlorophyll concentrations indicate high algal densities, which are a result of elevated nutrients in the water. Figure 3.1-11 shows the modeled chlorophyll levels in Boulder Basin for the baseline year 2002. In Boulder Basin, algae begin to grow in the early spring (March), reach maximum densities in the summer, and die in the winter. In 2001, a large algal bloom caused the average chlorophyll concentration to approach 5 µg/L and above in the basin.

Chlorophyll levels in the inner Las Vegas Bay are significantly higher than those in the open waters of Boulder Basin. The TP WLA limited the three wastewater treatment plants to a total discharge of 334 lbs/day (151 kg/day) of TP from March to October. At current flows, this translates to a TP concentration of about 0.2 mg/L. In Boulder Basin, the average chlorophyll concentration was 2 to 3 µg/L in years 2000 and 2002.

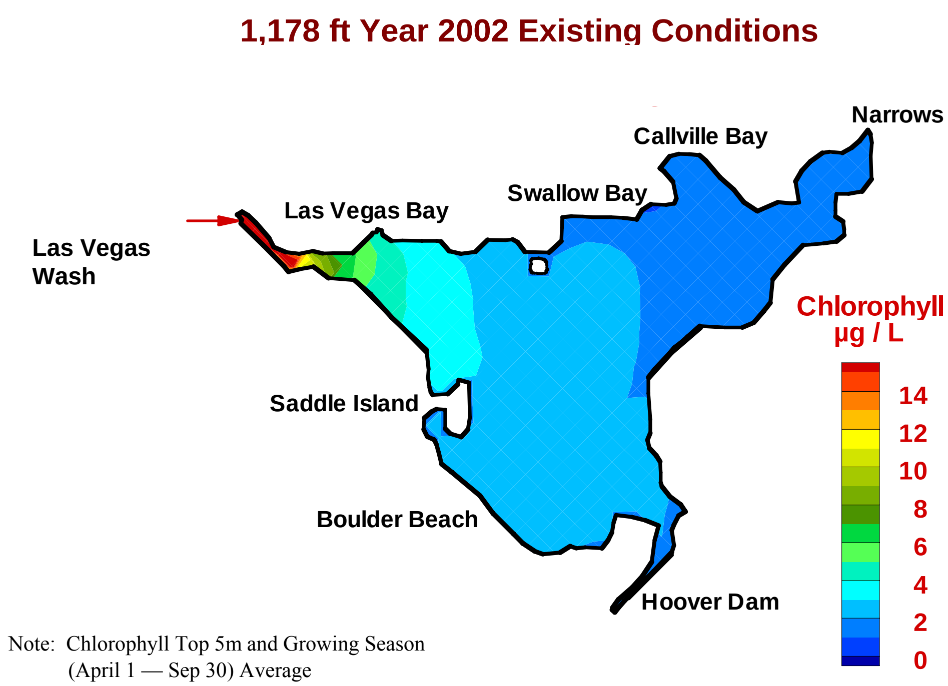

Figure 3.1-11 Baseline Chlorophyll Levels in Boulder Basin.

Secchi Depth. Secchi depth is a measure of the water transparency in a lake to a specific depth, and is influenced by inorganic or organic turbidity. Secchi depth is expected to correlate with organic turbidity from algae growth except near the Las Vegas Wash. When chlorophyll levels increase from algae growth then clarity (or Secchi depth) is reduced. Secchi depth is typically low in the inner Las Vegas Bay and higher in the open water of Lake Mead.

Dissolved Oxygen. Most aquatic life depends on DO for growth and reproduction. Dissolved oxygen is consumed in respiration by plants and animals or in the process of decay by dead plants and other organisms. It can be produced by plant photosynthesis when sufficient light and nutrients are available and replenished through surface aeration by wind and wave action. In Boulder Basin, DO levels are generally high. Dissolved oxygen is usually abundant in the epilimnion, especially in the summer when plant photosynthesis is high. Dissolved oxygen in the hypolimnion is also generally high, except in some bottom locations where there is decomposition of organic materials in the sediment.

pH. The pH value of water is a measure of acidity or alkalinity and can vary considerably from natural causes. The majority of Boulder Basin is alkaline, meaning that the pH is above 7.0. The average pH in the epilimnion and hypolimnion in 2002 was 8.0.

3.2 Biological Resources

The Mojave Desert ecoregion encompasses approximately 80,000 square miles (207,199 square km) across portions of southeastern California, northwestern Arizona, southern Nevada, and southwestern Utah (Larson 1977). This region is marked by extreme conditions. The climate is arid, accompanied by temperatures ranging from 20°F (-7°C) to more than 100°F (38°C). Overall precipitation is very low, averaging 4 to 6 inches (10 to 15 cm) per year, with erratic rainfall patterns that tend to be localized (Bradley and Deacon 1965). Most precipitation occurs during summer monsoons with autumn being the driest season.

The methodology used to develop the biological resources baseline in the study area included agency coordination, literature review, and field investigations. The methodology and a detailed discussion of the resources found in the study area are presented in Appendix E.

3.2.1 Vegetation

Four plant communities, Mojave creosote bush scrub, desert saltbush scrub, Mojave wash scrub, and desert riparian scrub were identified within the study area, along with ruderal vegetation, which comprises previously disturbed lands. A summary of the vegetation types and the corresponding acreages are presented in Appendix E.

The Mojave creosote bush scrub, the most common vegetation community found in the project area, occurs in approximately 36 percent of the project area. Creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) are the dominant shrubs in this community and a variety of annual grasses and forbs comprise the herbaceous understory.

The Mojave wash scrub occurs in approximately 8 percent of the study area. Common species associated with this community include catclaw acacia (*Acacia greggii*), cheesebush (*Hymenoclea salsola*), and mesquite (*Prosopis* sp.).

The least dominant community, the desert saltbush scrub occurs in approximately 2 percent of the project area. This community includes littleleaf saltbush (*Atriplex polycarpa*) and four-wing saltbush (*Atriplex canescens*).

Lands in the study area that have been physically altered by prior and ongoing surface disturbance are barren or support ruderal vegetation composed primarily of invasive, non-native annual grasses and forbs, such as Russian thistle (*Salsola tragus*) and red brome (*Bromus madritensis*). Approximately 43 percent of the study area contains ruderal vegetation, which are weedy and commonly introduced plants growing where the vegetational cover has been disturbed.

3.2.1.1 Wetlands and Riparian Communities

Wetland and riparian communities are considered valuable natural resources that provide habitat for a variety of common and special status plant and wildlife species. Hydrophytic vegetation occurring along the Las Vegas Wash is dominated by herbaceous species growing within the channel and on the banks several feet upslope of the waters edge. Common wetland plant species found within the banks of the Las Vegas Wash include cattail (*Typha domingensis*), bulrush (*Scirpus* spp.), pale smartweed (*Polygonum lapathifolium*), common reed (*Phragmities australis*), and yellow nut-sedge (*Cyperus esculentus*) (SWCA 2000b). Plant species occurring along the side slope of the upper portions of the Las Vegas Wash embankment include big saltbush (*Atriplex lentiformis)*, common sunflower (*Helianthus annus*), sacred datura (*Datura meteloides*), cocklebur (*Xanthium strumarium*), and exotics such as giant reed (*Arundo donax*) and tamarisk (*Tamarix ramosissima*).

Desert riparian scrub occurs in approximately 9 percent of the study area. The term riparian describes a unique physical environment and associated plant vegetation that occurs along banks of freshwater bodies, watercourses, and surface-emergent aquifers and adjacent areas. The riparian scrub vegetation community located within the floodplain of the Las Vegas Wash is a monoculture comprised predominantly of tamarisk, an aggressively invasive exotic species that commonly occurs along floodplains, riverbanks, stream courses, salt flats, marshes, and irrigation ditches in arid regions of the southwestern U.S. (Mozingo 1987). The understory vegetation is composed of big saltbush with a few concentrations of honey mesquite (*Prosopis glandulosa* var. *torreyana*), common reed, arrow weed (*Pluchea sericea*), seep willow (*Baccharis salicifolia*), sandbar willow (*Salix exigua*), Anderson desert thorn (*Lycium andersonii*), rabbit's foot grass (*Polypogon monspeliensis*), and exotics such as perennial whitetop (*Lepidium latifolium*) and giant reed. Though the dominant plant is tamarisk in the Las Vegas Wash floodplain, native plants thrive in areas where tamarisk has been removed or suppressed due to hydrology, typography, or other physical means.

3.2.1.2 Special Status Plant Species

Five special status plant species were reported to potentially occur in or near the study area based on information obtained through the literature search and agency coordination (Appendix E). All five species are federal species of concern, four are protected by the state of Nevada due to rarity, salvage restriction, or other factors, and three are covered by the *Clark County Multiple Species Habitat Conservation Plan* (MSHCP). None are federally listed or proposed for listing as endangered or threatened under the ESA. The scientific and common names, protection status, and indication of presence or absence of suitable habitat for special status plant species in the study area are included in Table 3.2-1.

Results of the botanical surveys conducted in spring 2003, 2004, and 2005 determined that two of the five plant species of concern, the Las Vegas bearpoppy and the rosy twotone beardtongue (*Penstemon bicolor* ssp. *Roseus*), have potential to occur in the study area. The threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*) and sticky buckwheat (*Eriogonum viscidulum*) have been previously recorded as occurring in Clark County but habitat for these species does not occur within the study area. The last recorded observation of the Las Vegas catseye (*Cryptantha insolita*) was in 1942, at an undefined location in the Valley, and it is now presumed extinct (Mozingo and Williams 1980, Nevada Natural Heritage Program [NNHP] 2003). However, to confirm presence or absence of the species in the study area, all plants of the same genus as the Las Vegas catseye (i.e. *Cryptantha*) found during the botanical surveys, were identified to the species level. No Las Vegas catseye were found in the study area.

Table 3.2-1 Special Status Plant Species Evaluated for Potential Occurrence in the SCOP Study Area.

Species		**Protection Status**			**Suitable Habitat Present**
Scientific Name	**Common Name**	**Federal [1]**	**State of Nevada [2]**	**MSHCP Covered [3]**	
Arctomecon californica	Las Vegas bearpoppy	SOC	Yes	Yes	Yes
Astragalus geyeri var. triquetrus	Threecorner milkvetch	SOC	Yes	Yes	No
Cryptantha insolita [4]	Las Vegas catseye	SOC	Yes	-	-
Eriogonum viscidulum	Sticky buckwheat	SOC	Yes	Yes	No
Penstemon bicolor ssp. Roseus	Rosy twotone beardtongue	SOC	-	-	Yes

Notes:

1 Federal (USFWS) status for listing under the ESA: SOC (Species of Concern).

2 State of Nevada special status species protected under Nevada Revised Statutes 527.

3 Species covered by the Clark County MSHCP.

4 Presumed extinct.

Source: Clark County 2000a, Nevada Natural Heritage Program (NNHP) 2002, and USFWS 2003.

A comprehensive list of plant species identified in the study area is included in Appendix E. Additionally, brief descriptions of the threecorner milkvetch, sticky buckwheat, and Las Vegas catseye are presented in Appendix E. However, based on the reasons previously stated, they will not be discussed in further detail in this section.

Las Vegas Bearpoppy. The Las Vegas bearpoppy is a federal species of concern and a Nevada state-protected species that occurs in Clark County, Nevada, and in Mohave County, Arizona near Lake Mead, at elevations ranging from 1,310 to 2,760 ft (399 to 841 m) above msl (Mozingo and Williams 1980). It is often found in highly gypsiferous soils on barren, gravelly desert flats, hummocks, and slopes. The Las Vegas bearpoppy is a perennial that produces several flower stalks bearing yellow flowers in April and May.

Potentially suitable bearpoppy habitat occurs in the study area along EI Reaches 1 and 2, and near the EI Terminus. However, a large portion of the habitat is highly degraded from frequent off-highway vehicle (OHV) use. One Las Vegas bearpoppy was observed in bloom outside of the study corridor about 1 mile (2 km) southeast of the CCWRD AWT as shown on Figure 3.2-1. About 200 ft (61 m) southeast of this individual plant, a cluster of dead bearpoppies was observed. Additionally, a population of bearpoppies is located outside of the project area west of the Magic Way access road. No bearpoppies were observed within the study area.

The BLM SMA, located north of the study area, includes designated areas for preservation and restoration of the Las Vegas bearpoppy and its habitat.

Rosy Twotone Beardtongue. The rosy twotone beardtongue, a federal species of concern, is typically associated with creosote bush habitats in Clark County, Nevada, and portions of Arizona. It grows in shallow gravelly washes and on roadsides at elevations ranging from 1,970 to 5,480 ft (600 to 1,670 m) above msl. Ephemeral washes and roadsides in the study area provide potentially suitable habitat for the rosy twotone beardtongue. However, the species was not observed in the study area during the spring 2003, 2004, or 2005 field investigations.

Nevada State-protected Cacti, Yuccas, and Conifer Trees. During the botanical surveys, cacti were encountered infrequently. Approximately one to three individuals per acre of cottontop cactus (*Echinocactus polycephalus* var. *polycephalus*), barrel cactus (*Ferocactus cylindraceus*), pygmy barrel cactus (*Sclerocactus johnsonii*), fishhook cactus (*Mamillaria* sp.), beavertail cactus (*Opuntia basilaris* var. *basilaris*), pencil cholla (*O. ramosissima*), buckhorn cholla (*O. acanthocarpa*), and silver cholla (*O. echinocarpa*) were observed in the study area. No state-protected yucca or conifer species were noted during the field investigations.

3.2.1.3 Noxious Weeds

Federal agencies are directed by Invasive Species EO 13112 (1999) to expand and coordinate efforts to prevent the introduction and spread of invasive plant species (noxious weeds) and to minimize the economic, ecological, and human health impacts that invasive species may cause. Weed management is an integral part of maintaining ecosystem health. A noxious weed is generally destructive and difficult to control or eradicate. A list of noxious weed species that are known to occur within the study area is included in Appendix E.

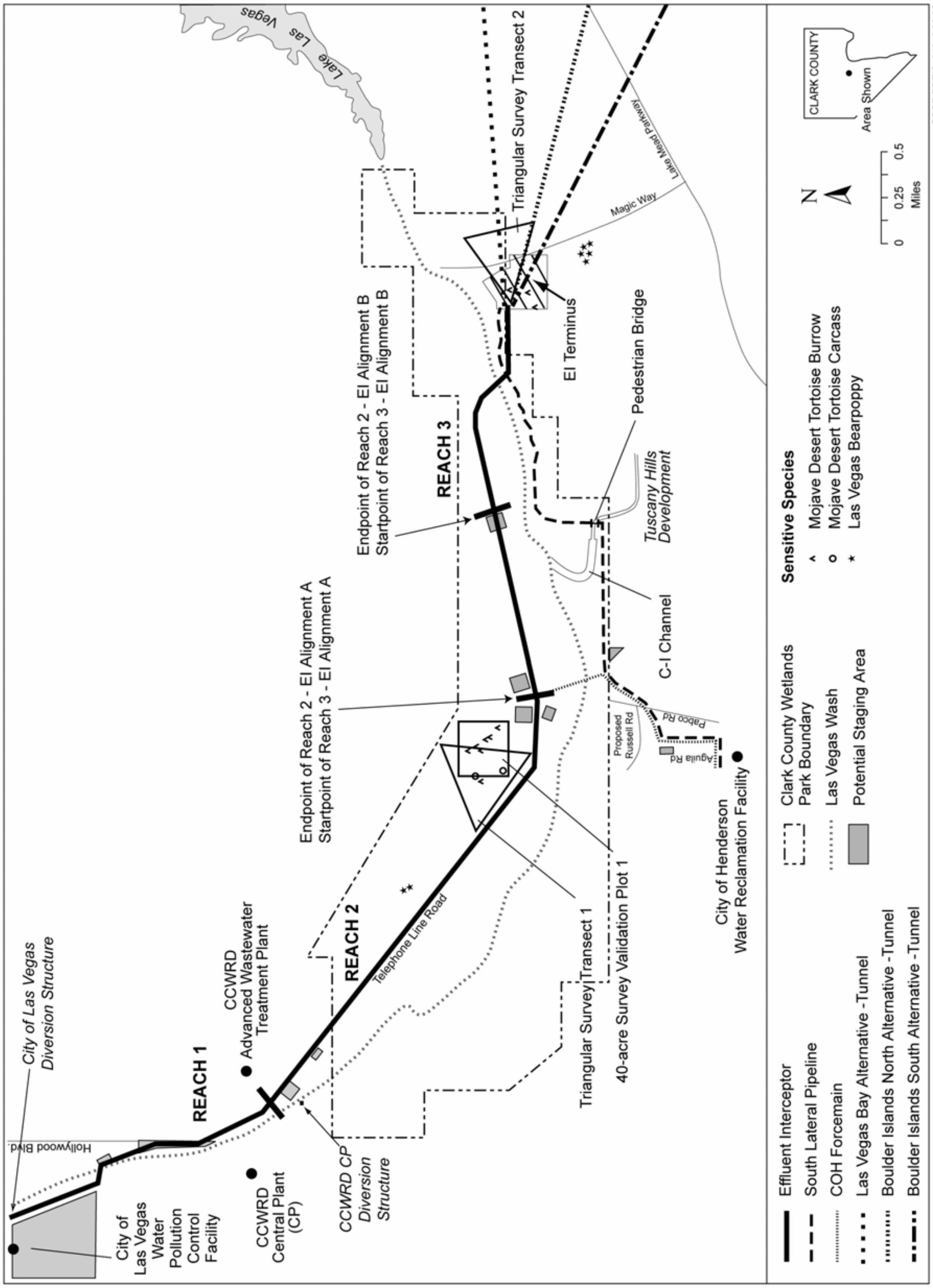

Figure 3.2-1 Sensitive Species – Effluent Interceptor Segment.

Two state-regulated noxious weeds, tamarisk and tall whitetop (*Lepidium latifolium*) are known to occur in the study area along the Las Vegas Wash. Current and ongoing efforts by Clark County and the LVWCC are underway to eradicate these invasive species from the Las Vegas Wash (LVWCC 2003b).

3.2.2 Wildlife

Wildlife species discussed in this section commonly occur in the Mojave Desert and have adapted to desert scrub habitats with little cover and xeric conditions. All wildlife species observed within the study area, or identified by indirect evidence such as tracks, burrows, carcasses, or scat, are listed in Appendix E.

Common reptiles in the Mojave Desert and the study area include the western whiptail lizard (*Cnemidophorous tigris*), zebra-tailed lizard (*Callisaurus draconoides*), desert iguana (*Dipsosaurus dorsalis*), side-blotched lizard (*Uta stansburiana*), desert spiny lizard (*Sceloporus magister*), and gopher snake (*Pituophis melanoleucus deserticola*).

Birds common to the Mojave Desert include common raven (*Corvus corax*), mourning dove (*Zenaida macroura*), black-throated sparrow (*Amphisizia bilineata*), house finch (*Carpodacus mexicanus*), cactus wren (*Campylorhynchus brunneicappillus*), Gambel's quail (*Callipepla gambelii*), and turkey vulture (*Cathartes aura*). A formal bird census was not conducted for the proposed project; however, several bird surveys have been conducted previously along the Las Vegas Wash and in portions of the study area. Approximately 150 migratory birds occur in the study area, with the highest diversity found along the Las Vegas Wash.

Common mammalian species in the study area include the pocket mouse (*Chaetodipus* spp.), whitetail antelope squirrel (*Ammospermophilus leucurus*), kangaroo rat (*Dipodomys* spp.), desert woodrat (*Neotoma lepida*), black-tailed jackrabbit (*Lepus californicus*), desert kit fox (*Vulpes macrotis arsipus*), and coyote (*Canis latrans*).

Thirty-one special status wildlife species were reported to potentially occur in the study area based on information obtained through the literature search and agency coordination. The scientific and common names, federal and state protection status, and indication of presence or absence of suitable habitat for special status wildlife species in the study area are included in Table 3.2-2. Five of these species are federally listed as threatened or endangered, one is a candidate for federal listing, and twenty-four are federal species of concern. Twenty-three of these species are also protected by the State of Nevada, due to rarity or other factors.

3.2.2.1 Federally Listed as Threatened or Endangered

Five federally listed wildlife species were evaluated for potential occurrence in the study area. The southwestern willow flycatcher, Yuma clapper rail, and least tern (*Sterna antillarum*) are federally listed as endangered. However, the least tern has federal protection status in a portion of its range that does not include Nevada. The bald eagle (*Haliaeetus leucocephalus*) and Mojave Desert tortoise are federally listed as threatened. Aquatic species are described in Section 3.2.3.

Table 3.2-2 Special Status Wildlife Species Evaluated for Potential Occurrence in the SCOP Study Area.

Species		Protection Status			Suitable Habitat Present
Scientific Name	Common Name	Federal [1]	State of Nevada [2]	MSHCP Covered [3]	
Reptiles					
Gopherus agassizii	Desert tortoise (Mojave Desert population)	LT	Yes	Yes	Yes
Heloderma suspectum cinctum	Banded Gila monster	SOC	Yes	-	Yes
Sauromalus obesus	Chuckwalla	SOC	-	Yes	Yes
Birds					
Athene cunicularia hypugea	Western burrowing owl	SOC	Yes	-	Yes
Chlidonias niger	Black tern	SOC	Yes	-	Yes
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	C	Yes	Yes	Yes
Empidonax traillii extimus	Southwestern willow flycatcher	LE	Yes	Yes	Yes
Falco peregrinus anatum	American peregrine falcon	SOC	Yes	Yes	Yes
Guiraca caerulea	Blue grosbeak	SOC	Yes	Yes	Yes
Haliaeetus leucocephalus	Bald eagle	LT	Yes	-	Yes
Ixobrychus elixis hesperis	Western least bittern	SOC	Yes	-	Yes
Phainopepla nitens	Phainopepla	SOC	Yes	Yes	Yes
Piranga rubra	Summer tanager	SOC	Yes	Yes	Yes
Plegadis chihi	White-faced ibis	SOC	Yes	-	Yes
Pyrocephalus rubinus	Vermilion flycatcher	SOC	Yes	Yes	Yes
Rallus longirostris yumanensis	Yuma clapper rail	LE	Yes	-	Yes
Sterna antillarum	Least tern	LE(PS)	Yes	-	Yes
Vermivora luciae	Lucy's warbler	SOC	Yes	-	Yes
Vireo bellii arizonae	Arizona Bell's vireo	SOC	Yes	Yes	Yes
Mammals					
Corynorhinus townsendii pallescens	Pale Townsend's big-eared bat	SOC(PS)	-	-	Yes
Euderma maculatum	Spotted bat	SOC	Yes	-	Yes

Table 3.2-2 Special Status Wildlife Species Evaluated for Potential Occurrence in the SCOP Study Area (continued).

Species		Protection Status			Suitable Habitat Present
Scientific Name	**Common Name**	**Federal[1]**	**State of Nevada[2]**	**MSHCP Covered[3]**	
Mammals					
Eumops perotis californicus	Greater western mastiff bat	SOC	-	-	Yes
Idionycteris phyllotis	Allen's big-eared bat	SOC	Yes	-	Yes
Macrotus californicus	California leaf-nosed bat	SOC	Yes	-	Yes
Myotis ciliolabrum	Small-footed myotis	SOC	-	-	Yes
Myotis thysanodes	Fringed myotis	SOC	Yes	-	Yes
Myotis velifer	Cave myotis	SOC	-	-	Yes
Myotis volans	Long-legged myotis	SOC	-	Yes	Yes
Myotis yumanensis	Yuma myotis	SOC	-	-	Yes
Nyctinomops macrotis	Big free-tailed bat	SOC	-	-	Yes
Ovis canadensis nelsoni	Desert bighorn sheep	-	Yes	-	Yes

Notes:

[1] Federal (USFWS) Status for listing under the ESA:
- LT Listed as Threatened
- LE Listed as Endangered
- C Candidate for listing
- PS Partial Status (a sub-species or part of a taxon's range has listed or candidate status but not in Nevada)
- SOC Species of Concern

[2] Nevada State protected species under NRS 501-503.

[3] Species covered by the Clark County MSHCP.

Source: Clark County 2000a, NNHP 2002, and USFWS 2003.

Mojave Desert Tortoise. The Mojave population of the desert tortoise, a federally listed as threatened and Nevada state-protected species, occurs throughout the Mojave Desert in California, Nevada, Arizona, and Utah. It is found most often on flats and bajadas characterized by sandy to sandy gravelly soils, but may also occur on slopes and in rocky soils, typically in association with desert creosote bush scrub communities. These communities are dominant below elevations of 5,000 ft (1,524 m) and are characterized by creosote bush, white bursage, yuccas, cacti, grasses, and a wide variety of other perennial and annual plants. Preferred desert tortoise habitat includes scattered shrubs and a sufficient herbaceous understory, which provide a source of food, complementary hydration, and shelter. No designated critical habitat for the tortoise occurs in the study area.

Approximately 531 acres (215 hectares) of Mojave creosote bush scrub, Mojave wash scrub, desert saltbush scrub, and ruderal vegetation were identified in the study area as potentially suitable desert tortoise habitat. A total of 11 tortoise burrows, 2 carcasses (disarticulated and scattered), and 5 sites with scat present were recorded during surveys. The approximate location of the tortoise burrows and carcasses are shown on Figure 3.2-1. The carcasses and the scat found near burrows were located in dry wash beds. None of the tortoise burrows or sign indicate evidence of recent activity. No live tortoises and no additional tortoise sign were observed in the study area.

Based on results of these field surveys and previous surveys conducted in the area (PBS&J 2002, SWCA 2000a), the desert tortoise population density is estimated to be very low (0 to 10 animals per square mile). For further discussion and to review a summary of the tortoise data collected, refer to Appendix E.

Southwestern Willow Flycatcher. The southwestern willow flycatcher is a federally listed as endangered and Nevada state-protected species. It is one of four subspecies of the willow flycatcher commonly recognized in North America (Hubbard 1987, Unitt 1987). Three of the these subspecies *E.t. extimus*, *E.t. adastus*, and *E.t. brewsteri* occur west of the Rocky Mountains, though the subspecies *E.t. extimus* is the only one listed under the ESA. *Empidonax* flycatchers are notoriously difficult to distinguish in the field, and separation of the four willow flycatcher subspecies is even more problematic. The willow flycatcher subspecies are distinguished primarily by subtle differences in color and morphology, including wing formula, bill length, wing to tail ratio (Unitt 1987 and 1997, Browning 1993), vocalization, and habitat use.

The historical breeding range of the southwestern willow flycatcher includes southern California, southern Nevada, southern Utah, Arizona, New Mexico, western Texas, southwestern Colorado, and extreme northwestern Mexico (Hubbard 1987, Unitt 1987, Browning 1993). The current breeding range for the southwestern willow flycatcher is similar to the historical range, but the quantity and quality of suitable habitat within this range has been reduced from historical levels.

Historically, the southwestern willow flycatcher nested in native vegetation such as willow (*Salix* sp.), box elder (*Acer negundo*), buttonbush (*Cephalanthus* sp.), and cottonwood (*Populus fremontii*) (Grinnell and Miller 1944, Sogge et.al. 1997, Unitt 1987). Following conversion of most riparian vegetation in the southwestern U.S. from native to non-native species, the flycatcher still nests in native vegetation where available, but also nests in thickets of non-native salt cedar and Russian olive, and in habitats with a mixture of native and non-native species (Hubbard 1987, Brown 1988, Sogge et al. 1997). Habitat characteristics such as plant species composition, size and shape of habitat patch, canopy structure, vegetation height, and vegetation density all vary throughout the species' range. However, vegetation in the interior of the patch is generally dense, particularly within the first 10 to 13 ft (3 to 4 m) above the ground, and in almost all cases, slow-moving or still surface water or saturated soil is present at or near breeding sites.

The southwestern willow flycatcher has been observed nesting in riparian habitats dominated by tamarisk along perennial waterways and reservoirs in southern Nevada and Arizona. McKernan and Braden (2000, 2001a) documented flycatchers during surveys conducted in the spring and summer of 2000 and 2001 along the Nevada portion of the Virgin River, including the Virgin River-Lake Mead delta. Most of the shorelines of Lake Mead lack suitable amounts of riparian vegetation and proper structural and hydrological characteristics required by the flycatcher (NPS 2002). Currently, suitable habitat is limited to inflow areas of the Colorado River and other tributaries and major washes. However, migrating or dispersing flycatchers may use areas less suitable for nesting, such as tamarisk-dominated riparian habitats, during spring and fall. No critical habitat has been designated or is proposed for southwestern willow flycatcher in the Las Vegas Wash.

Intensive systematic surveys conducted annually from 1998 through 2004 in the Las Vegas Wash within the Wetlands Park boundary, have detected flycatchers in most of the years, but breeding activity has not yet been observed (Marshall 2004; SWCA 1998, 1999, 2000b, 2000a, 2001, 2002, 2003). It is important to note that the flycatchers previously documented in the Las Vegas Wash by SWCA have not been identified down to subspecies using standardized survey protocols. This means the birds observed could be *E.t. extimus*, *E.t. adastus*, or *E.t. brewsteri*, or any combination of these. Therefore, it cannot be assumed that *E.t. extimus* occurs or has ever occurred in the Las Vegas Wash.

SWCA (2003) conducted a qualitative evaluation of habitat conditions along the Las Vegas Wash in spring of 2003 and reported that construction of ECSs in the interval between the 2002 and 2003 survey periods, and the vegetative cover lost to wildfire between 2001 and 2002, have substantially reduced the amount of potentially suitable flycatcher nesting habitat. Additional factors that affect habitat conditions for the flycatcher are lateral erosion of the Las Vegas Wash floodplain and the presence of a parasitic bird species, the brown-headed cowbird.

Bald Eagle. The bald eagle, federally listed as threatened (Bald Eagle Protection Act of 1940 as amended, 16 USC 668a-d PL 86-70, 87-884, 92-535, 95-161) and Nevada state-protected species, is found primarily along coasts, inland lakes, and large rivers throughout North America and Mexico, but may also be found along mountain ranges during migration. The species requires open water habitats that support an adequate food base and provide appropriate roosting and nesting sites, such as cliffs and tall trees. Food base for the eagle primarily includes fish, small mammals, and waterfowl (Terres 1980). Bald eagles are generally present in the LMNRA from November to March. The NPS conducts annual surveys in January for wintering bald eagles. The bird surveys are conducted by boat along all shorelines of both Lake Mead and Lake Mohave. As many as 79 eagles have been recorded in the LMNRA in a single year. Eight bald eagles were observed wintering in 2003 and 2004 in the Boulder Basin (Boyles 2004). Five bald eagles were recorded in 2005 (Boyles 2005).

Yuma Clapper Rail. The Yuma clapper rail, a federally listed as endangered and Nevada state-protected species, regularly inhabits freshwater marshes throughout the interior southwestern U.S. where moderately extensive emergent vegetation is persistent. The species is also known to occur in moderately dense cattail-bulrush marshes, and flooded tamarisk and willow stands (Eddleman 1989). The Yuma clapper rail is predominantly found in the lower Colorado River drainage system and the Salton Sea in Imperial County, California (Anderson and Ohmart 1985). However, occurrences of the species have been documented in extreme southern Nevada, along the Las Vegas Wash, dating back to 1959 (Alcorn 1988), and a more recent observation made in 1998 just upstream of Pabco Road (SWCA 2000b). No clapper rails have been detected within the boundaries of the Wetlands Park since 1998, despite intensive, systematic surveys conducted annually for the species from 1999 through 2004 (SWCA 2003, McKernan and Braden 2002, and Marshall 2004).

Least tern. The least tern is federally listed as endangered in a portion of its range that does not include Nevada. Federal protection is restricted to populations of least terns occurring in interior North America, which includes Arkansas, Colorado, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, North Dakota, Nebraska, New Mexico, Oklahoma, South Dakota, Tennessee, and Texas. A recovery plan for the species has been established.

Premier nesting sites are salt flats, broad sandbars, and barren shores along wide, shallow rivers. Least terns arrive from late April to early June and spend 4 to 5 months at their breeding grounds. Important breeding habitat characteristics include presence of bare or nearly bare ground and alluvial islands or sandbars for nesting, availability of food (primarily small fish), and favorable water levels during the nesting season to ensure the nests remain above water. They usually nest on sites devoid of vegetation, but have been found on sites with small amounts of vegetative cover composed of grasses, shrubs, and trees and ranging from 39 to 95 centimeters (1 to 3 inches) in height (Whitman 1988). One least tern sighting along the Las Vegas Wash was reported in 1986 (NNHP 2003) and no sightings are known to have been reported since. The least tern is considered an incidental migrant to the area.

3.2.2.2 Federal Candidate Species and Species of Concern, Nevada State-protected Species, and Clark County MSHCP-covered Species

There is 1 species, the western yellow-billed cuckoo (Coccyzus americanus occidentalis), that is a candidate for federal listing, and 24 federal species of concern known to occur in the project area. Twenty three of these species are also protected by the State of Nevada due to rarity or other factors (Table 3.2-2).

The western yellow-billed cuckoo, a candidate for federal protection under the ESA and a Nevada state-protected species, is a migratory bird historically found in very limited patches of riparian habitat in California, Arizona, New Mexico, and Mexico. The western yellow-billed cuckoo is considered a rare species in Nevada. It breeds in the southwestern U.S. from June to mid-July and uses dense cottonwood and willow-dominated thickets along broad floodways of large river systems for nesting and foraging. Nests are located on branches in dense riparian foliage 5 to 46 ft (1 to 14 m) above ground. One observation of the western yellow-billed cuckoo was made in 1998 during systematic surveys conducted along the Las Vegas Wash (McKernan and Braden 2001b). No observations were made in years 1999 to 2001 (McKernan and Braden 1999, 2001a, 2001b; McKernan and Carter 2002). The SWCA conducted surveys along the Las Vegas Wash for the western yellow-billed cuckoo in 2003 and 2004. No detections were made as part of those surveys.

The desert bighorn sheep (Ovis canadensis nelsoni) is a Nevada state-protected species. A population of desert bighorn sheep occurs in the study area in the River Mountains. This sheep population, referred to as the River Mountains herd, is valued by the NPS, NDOW, and the Arizona Game and Fish Department because the herd is highly productive. Individual sheep are translocated, as part of an interagency program, to enhance herds in other regions of the southwestern U.S, and are a popular subject of recreational wildlife viewing.

The boundaries of sheep habitat, lambing areas, and major movement corridors in the study area are shown on Figure 3.2-2. Desert bighorn sheep are relatively common in the rugged terrain of

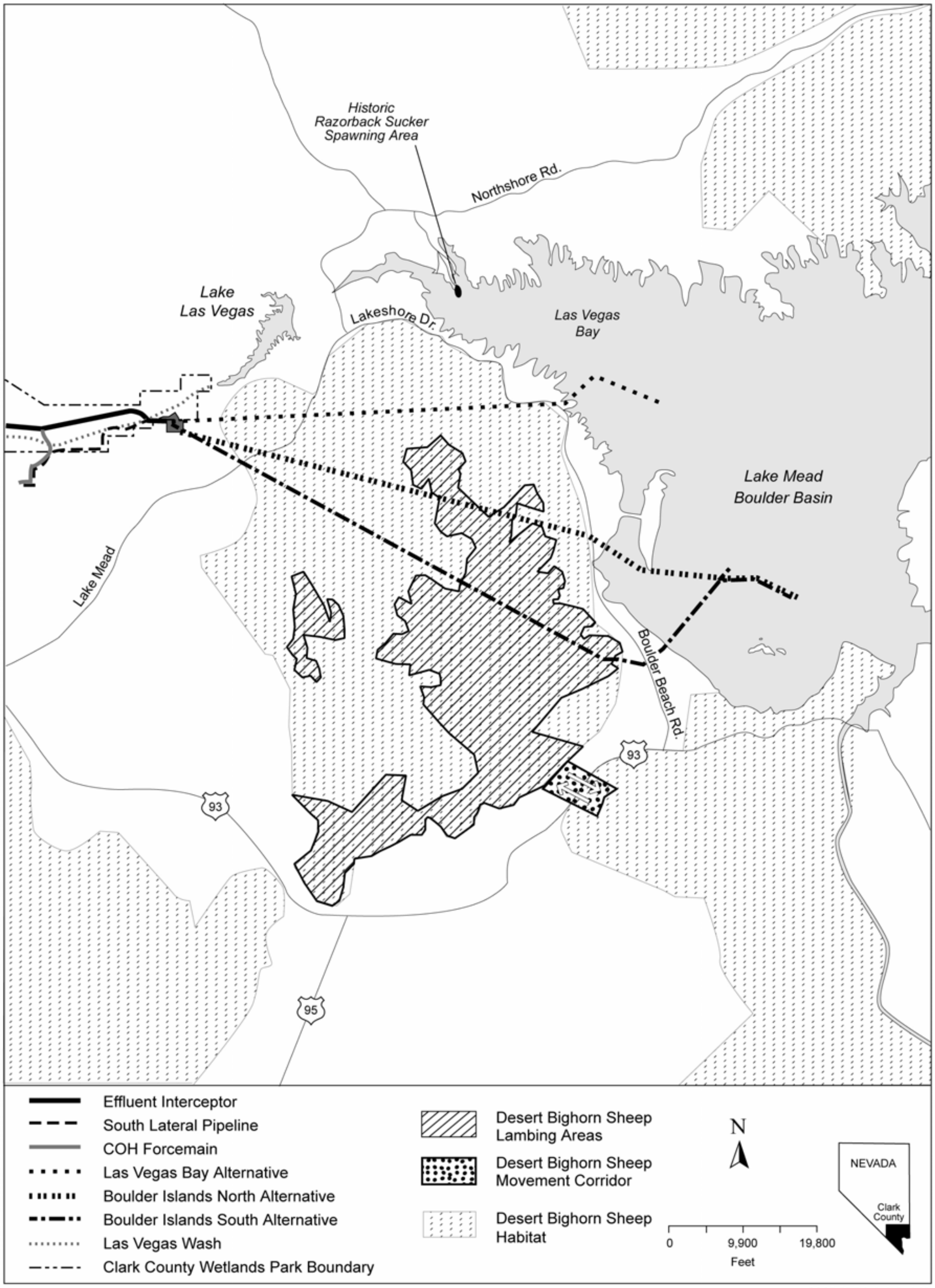

Figure 3.2-2 Sensitive Species – Lake Conveyance System Segment.

the River Mountains adjacent to the project area, but are rarely seen in the lower elevations near Lakeshore Drive. Additional information about the desert bighorn sheep and their habitat is provided in Appendix E.

The species of concern listed in Table 3.2-2 have the potential to occur in the study area. Descriptions of these species of concern and their specific habitat requirements are presented in Appendix E.

3.2.3 Aquatic Resources

Aquatic wildlife occupies suitable aquatic habitat throughout the proposed project area. These areas include the Las Vegas Wash and Lake Mead. A brief history of the riverine/reservoir environment of Lake Mead and its relation to the aquatic resources of the Lower Colorado River System is presented in Appendix E.

Amphibians known to occur in the Las Vegas Wash and the LMNRA include the southwestern toad (*Bufo microscaphus*), red-spotted toad (*Bufo punctatus*), pacific treefrog (*Pseudacris regilla*), North American spadefoot frogs (*Scaphiopus* spp.), and the candidate species the relict leopard frog (*Rana onca)*. The Woodhouse's toad (*Bufo woodhousii*) and the bullfrog (*Rana catesbeiana*), a non-native species, are the most common amphibians found within the Las Vegas Wash (LVWCC 2002).

Seven non-native fish species are known to occur in the Las Vegas Wash system. These species include the black bullhead catfish (*Ameiurus melas*), common carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), mosquitofish (*Gambusia afinnis*), fathead minnow (*Pimephales promelas*), red shiner (*Cyprinella lutrensis*), and the aquaria suckermouth catfish (*Hypostomus plecostomus*). Other aquatic species known to occur in the Las Vegas Wash include the red swamp crayfish (*Procambrus clarkii*), red eared slider (*Trachemys scripta*), and spiny softshell turtle (*Apalone spinifera*) (LVWCC 2002).

Several fish species inhabit Lake Mead and Lake Mohave, including game, non-game, and endemic fish species. Non-game species known to occur in both lakes is common carp. Game fish species inhabiting the lakes include bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), crappie (*Pomoxis* sp.), largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), and rainbow trout (*Onchorhynchus mykiss*). Species with the potential to occur in the Lower Colorado River, Lake Mead, or Lake Mohave are listed in Appendix E.

Six special status aquatic species were identified to potentially occur in the study area based on information obtained through a literature search and agency consultation. The scientific and common names, federal and state protection status, and indication of presence or absence of suitable habitat for special status aquatic species in the study area are provided in Table 3.2-3. Additionally, some of these special status species are addressed in the Clark County MSHCP. Of the fish species, only the razorback sucker is identified as occurring in Lake Mead, and Lake Mead is designated by the USFWS as critical habitat (*Federal Register* 1994).

Table 3.2-3 Special Status Aquatic Species Evaluated for Potential Occurrence in the SCOP Study Area.

Species		Protection Status			Suitable Habitat
Scientific Name	**Common Name**	**Federal [1]**	**State of Nevada [2]**	**MSHCP Covered [3]**	
Fish					
Xyrauchen texanus	Razorback sucker	LE	yes	no	yes
Gila elegans	Bonytail chub	LE	yes	no	yes
Catostomus latipinnis	Flannelmouth sucker	SOC	no	yes	no
Gila robusta	Roundtail chub	SOC	no	no	no
Amphibians					
Rana onca	Relict leopard frog	C	yes	yes	yes
Bufo microscaphus	Southwestern toad	SOC, N	no	yes	yes

Notes:

[1] Federal (USFWS) Status for listing under the ESA:

LE Listed as Endangered
C Candidate for listing
SOC Species of Concern
N Nevada BLM Special Status Species-Sensitive

[2] Nevada State special status species protected under NRS 501.

[3] Species addressed in the Clark County MSHCP.

Source: Clark County 2000a, NNHP 2002, and USFWS 2003.

3.2.3.1 Federally Listed as Threatened or Endangered

The razorback sucker and bonytail chub (*Gila elegans*) are federally listed as endangered. However, the bonytail chub has not been identified in Lake Mead since the early 1950s. Therefore, the bonytail chub is not discussed in this section. Detailed descriptions of the razorback sucker and bonytail chub are provided in Appendix E.

Razorback Sucker. Currently, the razorback sucker are endemic to the Colorado River Basin System. In the lower basin, isolated populations occur in Lake Mead, Lake Mohave, and in the Lower Colorado River below Parker Dam (USFWS 1998a). Two known populations and spawning sites have been documented in Lake Mead in the vicinity of Las Vegas Bay and Echo Bay.

Historical records indicate that the razorback sucker was previously abundant throughout the Colorado River watershed. However, extensive dam building altered habitat, and introductions of non-native fish resulted in a decline in razorback sucker populations that resulted in them being formally listed as endangered on November 22, 1992. On March 24, 1994, a final rule for critical habitat was approved (*Federal Register* 1994) and a recovery plan was approved for the razorback sucker on December 23, 1998 (USFWS 1998a).

Razorback suckers have been successful in utilizing reservoir habitat. This has been documented in the continuing presence of populations in Lake Mead, Lake Mohave, and Lake Havasu. However, these populations are located in waters that contain many species of introduced fish that prey on the young suckers. During low-water years, predators become more of a problem as less shoreline habitat is available to protect young native fish.

Population demographics of the razorback sucker can change yearly and are tied to the river conditions at the time of spawning (USFWS 2002a). The razorback sucker has adapted to a range of habitat conditions and can spawn successively in a variety of habitats, including reservoirs such as Lake Mead.

Spawning in lakes and streams occurs over loosely packed gravel or cobble substrate, and always at velocities less than 4.9 fps (1 mps) (Bradford and Vlach 1995). In Lake Mead, spawning has been observed from mid-February until early May (Holden et al. 1997). In the current reservoir system, ideal water conditions for razorback suckers include temperatures ranging from 59°F to 79°F (15 to 26°C), DO levels ranging from 3.5 to 10.5 mg/L, and pH ranging from 7.5 to 8.5 (Benke and Bensen 1983).

Currently, a small population of razorback suckers is present in Lake Mead, and directly behind Hoover Dam, in limited numbers. All of Lake Mead, to its full pool elevation (1221.4 ft [372 m] above msl), and downstream of the Hoover Dam through Lake Mohave, to Davis Dam is designated critical habitat for the species. Lake Mohave is significant for having the largest and most genetically diverse population of razorback suckers along the entire Colorado River. Lake Mead's population is very small, but it is significant because it is the only documented area to contain a successful group of sexually mature fish following creation of a reservoir.

3.2.3.2 Federal Candidate Species and Species of Concern, Nevada State-protected Species, and Clark County MSHCP-covered Species

One candidate species for federal listing as threatened and endangered, and three species of concern are known to occur in the vicinity of the proposed project as shown in Table 3.2-3.

Relict leopard frog. The relict leopard frog was assigned as a candidate species for federal listing as threatened or endangered in June 2002 (*67 Federal Register 40657*). It is a Clark County endemic, except for one relict leopard frog population near Littlefield, Arizona, thought to be this species (Clark County 2000a). In Clark County, relict leopard frog populations remain within small areas on NPS lands, in the Rogers and Blue Point springs area south of Overton, and in springs in Black Canyon below Hoover Dam.

The relict leopard frog is found in desert riparian habitat along permanent streams, tributaries, springs, and other water impoundments up to 2,500-ft (762-m) elevation. Considered a habitat generalist, relict leopard frogs occupy a variety of habitats including springs, streams, and wetlands characterized by clean, clear, deep and shallow water, and cover/forage such as submerged, emergent, and perimeter vegetation. The frog utilizes water, root stock, and grassy banks as cover when disturbed (Stebbins 1985).

The project area is located adjacent to the known historic and current range of relict leopard frog. Small, isolated areas of potential habitat may exist within the project area, but it is unlikely that the relict leopard frog occupies these areas because of the distance from known populations.

The species of concern that have the potential to occur in the study area include the Flannelmouth sucker (*Catostomus latipinnis*), roundtail chub (*Gila robusta*), and southwestern toad. These species are described in Appendix E.

3.3 Cultural Resources

Cultural resources are the tangible remains of past human activities. Cultural resources are prehistoric and historic archaeological sites, districts, structures, or locations considered significant to a culture, a subculture, or a community for scientific, traditional, religious, or other reasons. To be eligible for the National Register of Historic Places (NRHP), an archaeological site or other property must satisfy at least one of the National Register criteria as set forth at 36 CFR 60.4 (National Register of Historic Places, 36 CFR 60.4). The site or property must:

a. be associated with events that have made a significant contribution to the broad patterns of our history; or

b. be associated with the lives of persons significant in our past; or

c. embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d. have yielded, or may likely to yield, information in prehistory or history.

Typical prehistoric archaeological resources in the study area include:

- Campsites,
- Tool procurement sites,
- Food-processing areas, and
- Rock-art locations.

Typical historic sites may include structures with features such as mine shafts or adits, transportation routes, and refuse deposits.

A TCP is "….[a property] that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (NPS 1998).

Cultural resource investigations were conducted between December 2002 and January 2003 for the proposed alignment of the EI pipeline. Between April and October 2004, archaeologists conducted a Class I inventory of approximately 12 miles (19 km) of proposed tunnels and a Class III inventory of approximately 186 acres (75 hectares) of land associated with tunnel shafts, construction areas, and access roads for the proposed LCS alignments. In January and March 2005 nautical archaeologists conducted an underwater remote-sensing survey of approximately 889 acres (360 hectares) within the LMNRA including the area containing the Hoover Dam Aggregate Plant facility. The investigations included a review of the existing data inventory for portions of the project area that had already been surveyed for cultural resources and Class III inventory of portions of the project area that had not been previously examined. This chapter summarizes the data collected, compiled, and reported in *Archaeological Inventory of the Effluent Interceptor Pipeline Clark County, Nevada* (HRA, Inc. 2004) and *Archaeological Inventory for the Systems Conveyance and Operation Program, Lake Conveyance System Pipeline, Clark County, Nevada* (HRA, Inc. 2005). The investigations were conducted in compliance with NEPA, NHPA, the ARPA, and their respective implementing regulations and guidelines. Under Section 106 of the NHPA, federal agencies are required to consider the effects of their undertakings on cultural resources found eligible for listing on the NRHP and provide the Advisory Council on Historic Preservation an opportunity to comment on the action if such a property will be adversely affected.

3.3.1 Cultural Overview

In the Valley most of the sites that have been excavated cover only a brief span of time or have been too heavily disturbed to provide much useful chronological information. However, there are indications from locations along the Las Vegas Wash, Duck Creek, and nearby River Mountains that the Wetlands Park area could have been used as early as 12,000 years ago, and during later Archaic times (Roberts and Ahlstrom 2000a). Information from archaeological sites in the Wetlands Park indicates the area was definitely inhabited from AD 600 through the historic period. The cultural history of southern Nevada can be discussed with reference to five major periods:

- Paleo–Archaic (10,000–5500 B.C.),
- Archaic (5500 B.C.–A.D. 300),
- Ceramic (A.D. 300–1800),
- Historic Paiute/Chemehuevi/Mojave (A.D. 1800–1905),
- Historic Euroamerican (A.D. 1500–1950).

The first three periods deal with Native American history and the fourth and fifth periods deal with both Native American and Euro–American history.

Paleo-Archaic Period (10,000 – 5500 B.C.)

Two artifact traditions are generally distinguished within the Paleo-Archaic period: the Fluted Point (Paleo-Indian) and the Stemmed Point (Lake Mohave) (Grayson 1993, Schroedl 1991).

Fluted points have been identified at sites in the Mojave Desert of California. Stemmed points are rare in the Valley.

During the survey of the eastern half of the Wetlands Park (Roberts and Ahlstrom 2000a), a Clovis point base (the oldest type of fluted point) was found within the Wetlands Park boundary on the terrace north of the Las Vegas Wash. This point is the first confirmed evidence of the Clovis tradition reported in Clark County. Evidence of the Clovis tradition, primarily in the form of isolated projectile points, has been found elsewhere in southern Nevada, southwestern Utah, southeastern California, and northwestern Arizona. At this time, no sites have been located in the Valley that can be convincingly attributed to a late Paleo-Archaic period occupation (HRA, Inc. 2004).

Archaic (5500 B.C. – A.D. 300)

The Archaic tradition is characterized by a broad-spectrum adaptation to the animal and plant resources of a Holocene environment that is more or less like the modern-day environment. Characteristic artifacts of the Middle (5000–3000 B.C.) and Late Archaic (3000 B.C.–A.D. 1) periods include large projectile points that would have been hafted to darts that were propelled with atlatls, (a wooden device used to throw long, stone-tipped darts). Late Archaic subperiod sites are more common than Middle Archaic sites in southern Nevada, and several have been investigated within a few miles of the Wetlands Park.

Several sites located along Duck Creek appear to contain Middle Archaic occupations (Ezzo and Majewski 1995), while two sites in the Wetlands Park may contain Middle Archaic components based on the presence of a large expanding stemmed projectile point on one (Ferraro 1975a) and a Gatecliff projectile point on the other (Harper et al. 2004, Woodman et al. 2001). In the nearby River Mountains, excavation at the Basic Site led to the recovery of a Gypsum point (Brooks and Larson 1975) indicative of a Late Archaic occupation (Harper et al. 2004).

3.3.1.3 Ceramic (A.D. 300 – 1800)

The introduction of the bow and arrow, and the adoption of pottery for cooking and storage, marks the beginning of the Ceramic period (A.D. 300–1800). The replacement of lightweight basketry with heavier ceramic containers is usually associated with a farming economy and greater sedentism. The Valley straddles the boundary between the Virgin Anasazi and Patayan culture areas. The ceramic assemblages from various sites in the Valley frequently contain equal numbers of Patayan and Virgin ceramics. Southern Paiute Brown Ware sherds are also well represented (Seymour 1997). The Ceramic period is delineated by three subperiods: Early (A.D. 300-100), Middle (A.D. 1000-1500) and Late (A.D. 1500-1800).

The earliest ceramics identified in the Valley are a handful of Virgin Anasazi sherds. The Middle Ceramic subperiod is possibly the best represented subperiod in the Valley. During the Middle Ceramic subperiod, Paiute ceramics first appeared in the Valley. The Wetlands Park contains one site that dates to this subperiod.

3.3.1.4 Historic Paiute/Chemehuevi/Mojave and Historic Euroamerican (A.D. 1800-1905)

The identity of the people who lived in and around the Valley just before the Historical period has been established by archaeological, linguistic, and Native American origin myth sources. Generally, there is agreement that Numic speaking peoples who occupied this region were engaged in hunting, gathering, and foraging practices that were supplemented by horticulture. Historic and archaeological evidence suggest that Southern Paiute and Patayan/Mojave people occupied the Las Vegas Wash area in the Historical and possibly Late Historic periods (Fowler 1999, Seymour and Hatzenbuehler 1995).

The Las Vegas Wash represented an important travel corridor, habitation/camping locale, and resource procurement area for the Mojave/Yumans. These people settled along the Las Vegas and Duck Creek washes, relying on the mesquite trees and farming for subsistence. Duck Creek begins in the southwestern end of the Valley and drains northeast until it flows into the Las Vegas Wash inside the current boundaries of the Wetlands Park. There are two occupation sites in or near the Las Vegas Wash, and the Southern Paiute and Mojave tribal members have identified the Las Vegas Wash as an area of cultural significance (Stoffle and Dobyns 1983, Roberts and Woodman 1999).

Intaglios are large designs created on the ground by scraping away the desert pavement, and are generally associated with Yuman groups. In 1990, an intaglio located less than a mile south of the Wetlands Park was recorded. Known today as the Las Vegas Wash Intaglio (26CK4509), it is one of the few known intaglios in southern Nevada. Soon after the feature was recorded, Reclamation fenced the area and took aerial photographs of the site.

The first documented European entry into the Valley was by Antonio Armijo in 1829 (Warren 1974). Other early explorers such as Jedediah Smith and James O. Pattie traveled near the Las Vegas Wash on their trapping expeditions down the Virgin and Colorado rivers. Blue glass and ceramic trade beads, which were recovered from two sites (26CK1138 and 1139) in the Wetlands Park, may date to this early period. Members of the Church of Jesus Christ of the Latter Day Saints, known as Mormons, made the first attempt to settle in Las Vegas in 1855. The Mormons built a small adobe fort along the Las Vegas Wash near what is now Las Vegas Boulevard and Washington Avenue, but the group was ordered to leave the mission after two years.

3.3.1.5 Historic (A.D. 1905 - 1960)

The Bishop family established the Glendale Ranch, a cattle and horse ranch, in the vicinity of the Las Vegas Wash in 1905 (Ritenour 1979). By 1912, the ranch was 800 acres (324 hectares) with a house and outbuildings. Two archaeological sites related to the Glendale Ranch were excavated during the Colorado River Salinity Project for Reclamation (Brooks and Larson 1975, Ferraro and Ellis 1982). Artifacts, maps, and other sources suggest that the Glendale Ranch buildings may continue to have been occupied until the main house burnt down after 1933.

The remains of the Three Kids Mine and its town site are located at the southeastern edge of the Wetlands Park. This mining operation ran sporadically from 1941 through 1961. Most of the mining sites recorded within the Wetlands Park boundary appear to post date 1940, and are associated with gypsum mining and prospecting.

On December 21, 1928, Congress passed the Boulder Canyon Project Act that authorized the building of the Boulder (later renamed Hoover) Dam on the Colorado River. From 1931 until completion in 1936, the construction of the Hoover Dam was the largest water project in the U.S. and one of the largest in the world. This construction project included the dam, four diversion tunnels, a hydroelectric power generation plant at the base of the dam, and the establishment of a construction community called Boulder City (ACRE 2003).

Construction of the dam could not begin until a transportation system was established. This system included a series of railroads and a highway to transport the thousands of workers and millions of tons of equipment and materials to the dam site. The use of the railroad and road system for dam construction was the most extensive at the time, and included three distinct railroads and a paved highway. Approximately 52 miles (84 km) of railroad comprised the overall Hoover Dam railway system (Myrick 1963). The three railroads were:

- The Boulder City Branch Railroad, which connected the Union Pacific Railroad near Las Vegas to Boulder City;
- The U.S. Construction Railroad (USCRR), which connected Boulder City to the dam site; and
- The Six Companies, Inc. Railroad (SCIRR), which was used to haul aggregate materials (sand and gravel) for dam construction (ACRE 2003).

An aggregate-classification plant (Aggregate Plant) was built in Hemenway Wash at the convergence of the three railroad systems (Stevens 1988). One fork of the rail system delivered raw material from Arizona, while the other two forks of the rail system delivered processed aggregates to the mixing plants (Stevens 1988, Park 1986). The Aggregate Plant was an imposing complex consisting of an intricate system of bunkers, sieves, conveyers, tunnels, and towers that had the ability to process 9 million tons of aggregate over a 2.5 year period (Stevens 1988, Reclamation 1941). The Aggregate Plant was in operation from 1932 until 1935.

Following construction of Hoover Dam, a Civilian Conservation Corps (CCC) consisting of 500 men was established in Boulder City to support the NPS with lakeside developments and related issues. The CCC worked on projects around Lake Mead including visitor facilities, beach improvements, at least one boat ramp, campgrounds, cabins, water and sewage systems, and irrigation to vegetation in the Hemenway Wash area (ACRE 2003, Daron 1999). The CCC was disbanded in 1942.

3.3.2 Effluent Interceptor

A portion of the EI project area is located within the Wetlands Park, which accounts for much of the project area. A site-file search was conducted to identify known archaeological sites in the vicinity of the proposed EI. A 200-ft (61-m) wide corridor was surveyed for portions of the EI alignment that had not been previously surveyed for archaeological sites. The tunnel portals, which require approximately 300 x 300 ft (91 x 91 m) activity areas at the entrance shafts and approximately 240 x 240 ft (73 x 73 m) at the exit shafts, were also surveyed. Survey transects were spaced at intervals of no more than 65 ft (20 m). Ground visibility was good except in dense stands of tamarisk and salt bush where intensive survey was not possible. In addition, some areas were found to have been heavily disturbed through the removal or re-contouring of sediments, and these areas received minimal reconnaissance (HRA, Inc. 2004).

3.3.2.1 Effluent Interceptor File Search

The site-file search was conducted at the Harry Reid Center for Environmental Studies, UNLV during April 2000.

In addition to referring to the results of the site-file search, the following files and curated artifacts relating to sites within the Wetlands Park were examined:

- Previous surveys within the Wetlands Park;
- Items that are held by Reclamation, Lower Colorado Regional Office in Boulder City, Nevada;
- General Land Office maps and mineral claim records at the BLM, Las Vegas Field Office; and
- Special Collections section of the Emily Dickenson Library at UNLV (examined by Reclamation staff).

There have been 74 archaeological sites recorded in the Wetlands Park or the immediate vicinity. The current project area includes linear ROWs through the Wetlands Park, which has been intensively inventoried. As the result of previous investigations within the Wetlands Park, a total of 49 sites have been recorded that are considered contributing elements to the Las Vegas Wash Archaeological District. In addition, 23 sites have been recorded that were found to be non-contributing elements to the district and not eligible for the NRHP though located within the district. Two additional sites are located within the Wetlands Park but are located outside the existing archaeological district boundaries.

As a result of previous surveys within and adjacent to the Wetlands Park, a total of six archaeological sites have been identified within the EI area (Table 3.3-1). Of these six sites, four have been determined to be eligible for nomination to the NRHP.

Site 26CK1300

In two surveys conducted in this area (Roberts and Ahlstrom 2000a, Woodman et al. 2002), HRA recorded 15 rock-ring features, three rock clusters, and a number of artifacts including a quartzite bifacial core, a battered cobble, a retouched flake, and a few flakes distributed over an area that measures approximately 320 m (1,050 ft) north/south by 250 m (820 ft) east/west. In addition to the bifacial core that was recorded at the site during HRA's earlier survey, other lithic materials identified near some of the features include:

- A white chalcedony flake,
- Two quartzite flakes,
- A retouched tan chert flake,
- A battered chert pebble, and
- Four pieces of debitage.

Table 3.3-1 Previously Identified Archaeological Sites within the Effluent Interceptor Project Area.

Site No.	Period	Site Type	Ownership	NRHP Eligibility	NRHP Criterion
26CK1300	Prehistoric	Rock Rings	Clark County	Eligible contributing element	d
26CK1301	Ceramic	Rock Shelter	Clark County	Eligible contributing element	d
26CK1303	Historic	Rock Alignment	Clark County	Eligible contributing element	d
26CK4877	Prehistoric	Rock Ring	Clark County	Not eligible	--
26CK6150	Historic	Power Line	Clark County/Private/ Reclamation	Eligible	a
26CK6150	Historic	Power Line Road	Clark County/Private/ Reclamation	Non-contributing element	--

Source: HRA, Inc 2004.

Site 26CK1301

This rock shelter was originally recorded in March 1975 by Bussard and Olson of the Nevada Archaeological Survey during the survey for the Colorado River Basin Salinity Control Project (Ferraro 1975a, 1975b). The site form describes the site in the following manner:

- This site contains a rock shelter formed by the erosion of unconsolidated Horse Springs sediments from beneath the Basal Muddy Creek conglomerate. The site dimensions are approximately 12 ft (4 m) from the drip line north to the rear, 20 ft (6 m) from east to west, and 3 ft (1 m) from floor to ceiling.
- Artifacts observed at this site included a knife/scraper, a projectile point base, and numerous waste flakes-all made of chert. Charcoal fragments were also noted. There is at least 2 ft (1 m) of midden depth as determined by the removal of a pollen core sample (Site Form, on file at the Harry Reid Center, UNLV).

In the final report for this survey, Ferraro described the site and noted that test excavations would be needed if the site were to be impacted. In 2000a, Ahlstrom and Roberts found that the site remained in excellent condition and has not been vandalized. This may be because the site is hidden from view by a thick stand of salt bush and tamarisk. The shelter is approximately 10-m (33-ft) long and 2-m (6-ft) deep. Cultural materials include:

- Stained ashy silt,
- Flaked stone,
- Ground stone,
- Sherds,

- Calcined bone, and
- Charcoal.

Most of the artifacts occur in the eroded, sloping deposits in front of the shelter, outside the dripline. Flaked stone artifacts included secondary and tertiary flakes of white, red, gray, mustard, and brown chert. A small grinding slab was also identified in the deposits in front of the shelter. Sherds identified included a Colorado Red-on-Buff sherd and a Plain Buffware sherd with fine temper, buff-colored paste, and a red wash. A small rock wall was identified west of the shelter at the top of a small rill. The level area located in front of the shelter, about 33 ft (10 m) from the dripline, has the potential to contain deeply buried cultural deposits.

Site 26CK1303

This historic camp was first recorded in 1975 by David Ferraro of the Nevada Archaeological Survey during the survey for the Colorado River Basin Salinity Control Project (Ferraro 1975a), and is described as:

Feature 1: A rectangular rock alignment that is approximately 12-ft (4-m) long and 8-ft (2-m) wide, with the remnants of two wooden pegs found projecting above the surface.

Feature 2: To the south of this feature there is a “U” shaped rock alignment, which is composed of mud-mortared rock fragments. No artifacts were found in association with this site (Site Form, on file at the Harry Reid Center, UNLV).

In their 2000a survey, Ahlstrom and Roberts recorded that the site was found to be essentially the same as it was when Ferraro first described it. The site is located on a low narrow ridge spur that projects into the floodplain from the base of the terrace north of the Las Vegas Wash. The site measures 40 ft (12 m) north-south by 60 ft (18 m) east-west and includes the two features described above.

Site 26CK4877

Dr. Kevin Rafferty originally recorded this site in 1992 during a survey for the Lake Las Vegas Sewer Pipeline (Rafferty 1992). Rafferty noted that the site was in poor condition and had been impacted by erosion, blading, and development. He recommended that the site not be considered significant because it lacked artifacts, depth of deposits, and integrity. In the 2000a survey, Ahlstrom and Roberts could not relocate the site, and it is presumed to have been destroyed during construction of the sewer line.

Site 26CK6150

The site consists of a power line running from the Hoover Dam/Lake Shore switchyard to Pioche, Nevada and a road that parallels much of the power line. The site passes through the Wetlands Park, crossing a series of alluvial fans and the shallow drainages that divide them. The soil consists of poorly developed, highly disturbed desert pavement.

A records search of *Reclamation’s Master Title Plats* (HRA, Inc. 2004) revealed that the ROW for the power line was issued on February 21, 1939. A map of the proposed ROW, dated 1934, indicates that it runs from Hoover (then Boulder) Dam to the Pioche Switch Station. The map shows the power line running in a straight line through the Wetlands Park. Currently, the power line curves where it diverges from the road, which could mean that the poles in the southeastern portion of the site were erected in a post-1939 realignment of the line.

3.3.2.2 Effluent Interceptor Survey Results

The project components include three Reaches 1, 2, and 3, the South Lateral Pipeline alignment, the COH Forcemain, two short connections to existing treatment plants (the CCWRD CP and AWP Connections), and the EI Terminus site. The areas investigated for the EI components are shown in Figure 3.3-1.

Reach 1 of the EI alignment would be located in an area that had not been previously subjected to intensive or recent archaeological investigations. Reaches 2 and 3 would be located within the Wetlands Park boundary. Substantial portions of Reaches 2 and 3 have previously been surveyed extensively (Roberts and Ahlstrom 2000b, Woodman et al. 2001, Woodman et al. 2002, White 1996, Jones 1991).

No new archaeological sites or isolated occurrences were identified in the course of this survey. In addition, HRA considers it unlikely that the areas with dense stands of tamarisk and salt bush contain significant, undiscovered cultural remains, for two reasons. First, no sites or isolated objects were found in adjacent, less densely vegetated areas. Second, the densely vegetated areas are surrounded by areas of surface disturbance and have probably undergone considerable disturbance. Some areas were found to have been heavily disturbed through the removal or re-contouring of sediments, and these areas received minimal reconnaissance (HRA, Inc. 2004).

3.3.3 Lake Conveyance System

There are three LCS alignments associated with the three action alternatives. A site-file search was conducted to identify known archaeological sites in the vicinity of the three LCS alignments. Field surveys were performed in areas not previously surveyed and areas that had been previously surveyed, but that warranted a resurvey.

A significant portion of the three LCS pipelines would be installed in a tunnel located more than 56-ft (17-m) below the ground surface. Therefore, no survey was conducted along the tunnel segments except in the areas where surface disturbance would occur including the working shaft locations, PRS locations, and access roads. The proposed locations of the working shaft and PRS locations were surveyed. The areas surveyed for the working shaft and PRS locations varied depending on the proposed size described in Sections 2.2, 2.3, and 2.4. A 165-ft (50-m) wide corridor was surveyed along each of the proposed access roads. The LCS above-water cut-and-cover segments were surveyed by HRA, Inc. between April and October 2004 for the three alignments.

In March 2005, PBS&J nautical archaeologists surveyed the underwater segments of the Boulder Islands North and Boulder Islands South alignments. The survey consisted of 13 parallel transects, spaced 100-ft (30-m) apart. Prior to the March 2005 survey, no underwater segments of the railroad had been evaluated.

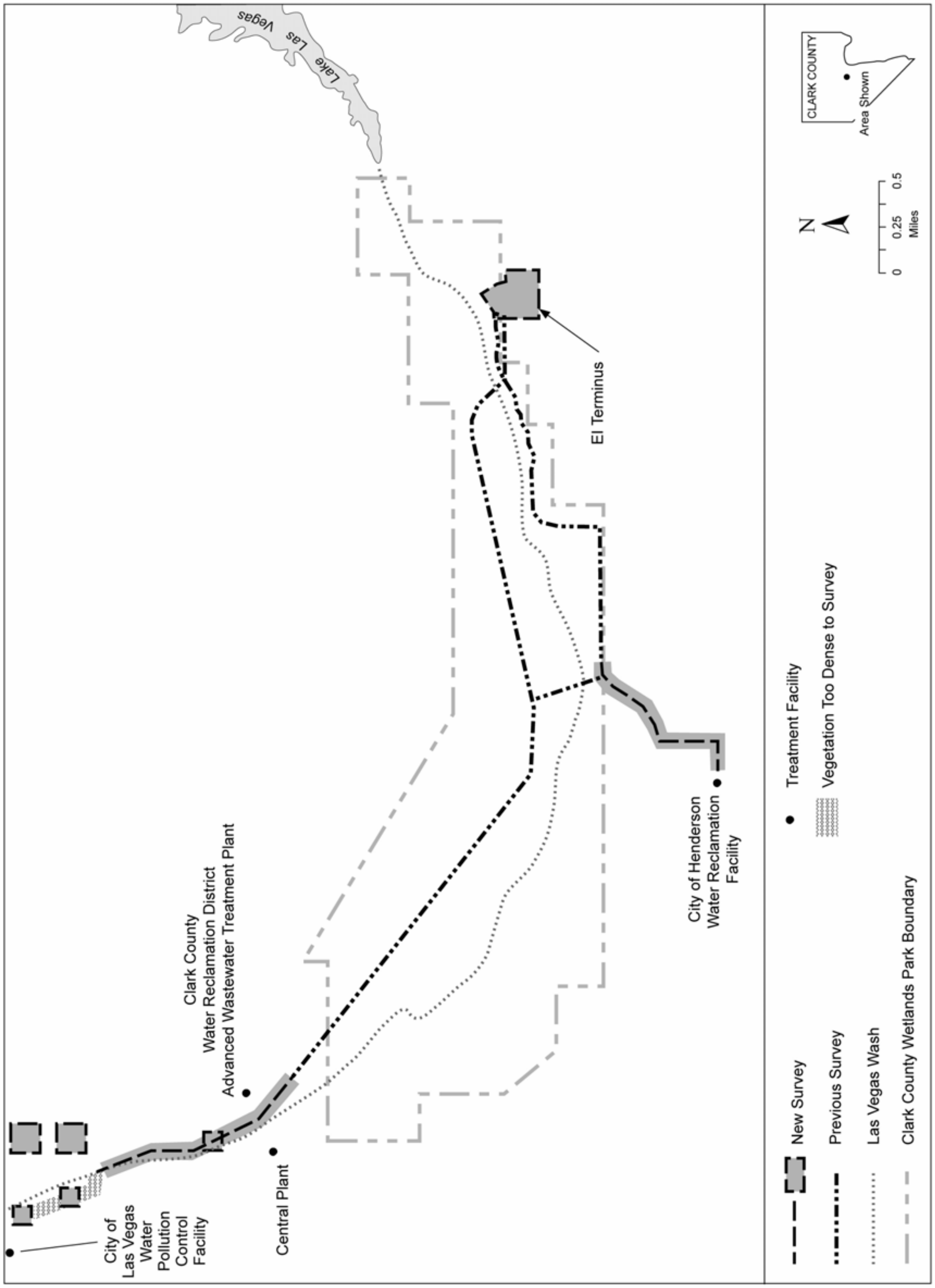

Figure 3.3-1 Areas Investigated for Cultural Resources in the Vicinity of the Effluent Interceptor.

An Aggregate Plant (Site 26CK7285) that was used during the construction of Hoover Dam is located at the western base of the Boulder Islands. The Aggregate Plant is not located within the area of potential effect (APE) for any of the proposed LCS alignments, and will not be described further in this EIS. However, at the request of the NPS, PBS&J nautical archaeologists surveyed the Aggregate Plant, which is described in Section 3.3.1.5. The Aggregate Plant has been recommended eligible for listing on the NRHP.

3.3.3.1 Lake Conveyance System File Search

Seventeen sites were identified within the area of the LCS alignments during previous surveys. Of these 17 sites, 13 sites are located in areas that would not experience surface disturbance. They are located in areas where the LCS would be installed in a tunnel more than 56-ft (17-m) deep. Table 3.3-2 contains information regarding the 17 sites. There are four sites (26CK4046A, 26CK4046B, 26CK6247, and 26CK6249) located in areas where surface disturbance would occur. Portions of 26CK4046A and 26CK4046B, the U.S. Construction Railroad and Six Companies, Inc. Railroad, respectively, in the vicinity of the project are considered to be non-contributing segments of these eligible properties. Site 26CK6247 is a non-eligible site, and Site 26CK6249 is an eligible site. In addition to the previously recorded sites, one newly recorded site (26CK7115) was investigated by HRA, Inc.

Site 26CK4046A

This site is the remains of the USCRR, which was owned by the federal government and was built to transport materials and equipment from Boulder City to the Nevada Rim of the dam construction site (ACRE 2003). A portion of the railroad has been damaged by sheet wash action of Hemenway Wash. This section of the railroad has been previously determined as a non-contributing element to the overall line because of damage from natural disturbances (HRA, Inc. 2005).

Site 26CK4046B

This site is the remains of the SCIRR, which was used to transport aggregate for the construction of Hoover Dam. Three lines primarily comprised the SCIRR: a section of the main line that was used to transport mined aggregate from the Arizona gravel pit to the Aggregate Plant (Gravel Pit Line), an extension of the main line from the Aggregate Plant to a junction with the USCRR (USCRR Junction Line), and a branch line traveling through Black Canyon to the Hoover Dam construction site.

The total length of the SCIRR main line consisted of more than 19 miles (30 km), and approximately 3 miles (5 km) of railroad grade remain above the high-water level of Lake Mead (ACRE 2003). The rails, ties, and other connection hardware were removed prior to 1962. Portions of the railroad grade above the high-water level of Lake Mead were destroyed or altered by the construction of Lakeshore Road or pipelines. Approximately 164 ft [50 m] of the railroad grade was destroyed or altered for each crossing of Lakeshore Road and the railroad grade. In addition, the railroad grade has been severely eroded at several locations including in the central portion of Hemenway Wash, where an approximately 0.5 mi (1 km) segment no longer retains integrity (ACRE 2003).

Table 3.3-2 Previously Identified Prehistoric and Historic Sites in the Project Area.

Site No.	Period	Site Type	NRHP Eligibility	Surface Disturbance Would Occur (Yes or No)
26CK1118	Prehistoric	Lithic Scatter	Not-eligible	No
26CK1119	Prehistoric	Stone Circles, Lithic Scatter	Not-eligible	No
26CK1120	Prehistoric	Lithic Scatter	Eligible	No
26CK1124	Prehistoric	Cleared Circles, Rock Rings	Eligible	No
26CK1126	Prehistoric	Cleared Circles, Artifact Scatter	Not-eligible	No
26CK1134	Prehistoric	Cleared Circles, Lithic Scatter	Eligible	No
26CK1293	Prehistoric	Cleared Circles, Lithic Scatter	Not-eligible	No
26CK1294	Prehistoric	Lithic Scatter	Not-eligible	No
26CK1298	Prehistoric	Lithic Scatter	Not-Eligible	No
26CK4046A	Historic	U.S. Construction Railroad Grade	Non-contributing element	Yes
26CK4046B	Historic	Six Companies, Inc. Railroad Grade	Non-contributing element	Yes
26CK4509	Prehistoric	Lithic Scatter, Intaglio, Trail	Eligible	No
26CK4510	Prehistoric	Lithic Scatter	Not-eligible	No
26CK5383	Historic	Lakeshore Road	Eligible	No
26CK6247	Historic	Hemenway Road/Old Lake Highway	Not-eligible	Yes
26CK6249	Historic	Southern California Edison North Transmission Line	Eligible	Yes
26CK6756	Historic	Transmission Line	Not-eligible	No

Source: HRA, Inc. 2005.

Site 26CK6247

Site 26CK6247 is the remains of the Hemenway Wash Road (or Old Lake Highway), which was the main access to the Colorado River for the area prior to the construction of Hoover Dam. The road today consists of fragments of paved and washed out or eroded roadbed in various degrees of integrity. Overall, the road within the LMNRA has been cut, crossed, repaved, and neglected. Much of the site's integrity has been severely impacted by erosion. However, one section of the road has been well preserved, lacks any erosion damage, and contains intact and passable pavement. Schweigert, in 2001, recorded this site, and recommended that the site was not eligible for the NRHP because he did not believe that the road existed prior to the construction of Hoover Dam (Schweigert 2001A). However, additional information noted by ACRE (2003) combined with his original recordation (Schweigert 2001a) and observations made by HRA suggest that the original recommendation of not eligible is not appropriate at this time. The NPS may recommend that site 26CK6247 is indeed eligible for the NRHP under Criterion A for its association with the construction of Hoover Dam, for its association with the initial recreational use of Lake Mead, and because it served as part of the original access to the Colorado River. While most of the road within the LMNRA has no integrity due to disturbance and removal by erosion and past construction projects, the 1,700 ft (518m) segment does retain sufficient integrity to be eligible for the NRHP under Criterion A, and should be included as a contributing element of the overall historic district associated with Hoover Dam as part of a Multi-Property Historic District of properties associated with Hoover Dam (Kurt Schweigert 2005).

Site 26CK6249

This site is the Southern California Edison North Transmission Line, or the Hoover to Chino No. 1. This high-voltage transmission line ran from the Southern California Edison switchyard located at Hoover Dam to Chino, California (Schweigert 2001b). This early transmission line is important for its direct association with the early operation of Hoover Dam, but it was also extremely important for providing the energy for war industries in California during World War II (Schweigert 2001). Because of the direct association, this site has been recommended eligible for the NRHP under Criterion A.

3.3.3.2 Lake Conveyance System Survey Results

A Class III inventory of approximately 186 acres (75 hectares) of land associated with the proposed working shaft locations, PRS locations, and access roads was conducted by HRA, Inc. between April and October 2004. Underwater remote-sensing surveys of approximately 889 acres (360 hectares) of the LMNRA were conducted by PBS&J between January and March 2005. The terrestrial areas investigated for the LCS components are shown in Figure 3.3-2.

The results of the terrestrial and underwater surveys are described in this section.

3.3.3.2.1 Terrestrial Surveys

One newly recorded archaeological site (26CK7115) and one previously recorded site (26CK6247) were investigated in the course of the LCS terrestrial archaeological surveys. Both sites are linear historic sites related to the construction of Hoover Dam and the resulting recreational use of Lake Mead (HRA, Inc. 2005).

Site 26CK7115 consists of the above-ground features of a buried water line, portions of which were constructed by the CCC in the early 1940s. The site includes three loci (A, B, and C) that consist of a large earthen covered concrete cistern, two concrete vaults, and two small valve boxes with a buried tank (HRA, Inc. 2005). The site has been recommended eligible for list on the NRHP under Criterion a, association with events or broad patterns important in history.

Site 26CK6247 is the remains of the Hemenway Wash Road (or Old as described in Section 3.3.3.1. HRA, Inc. investigated this site to determine the potential effects that the proposed LCS may have on Site 26CK6247. The potential impacts are described in Section 4.3.2.2.1.

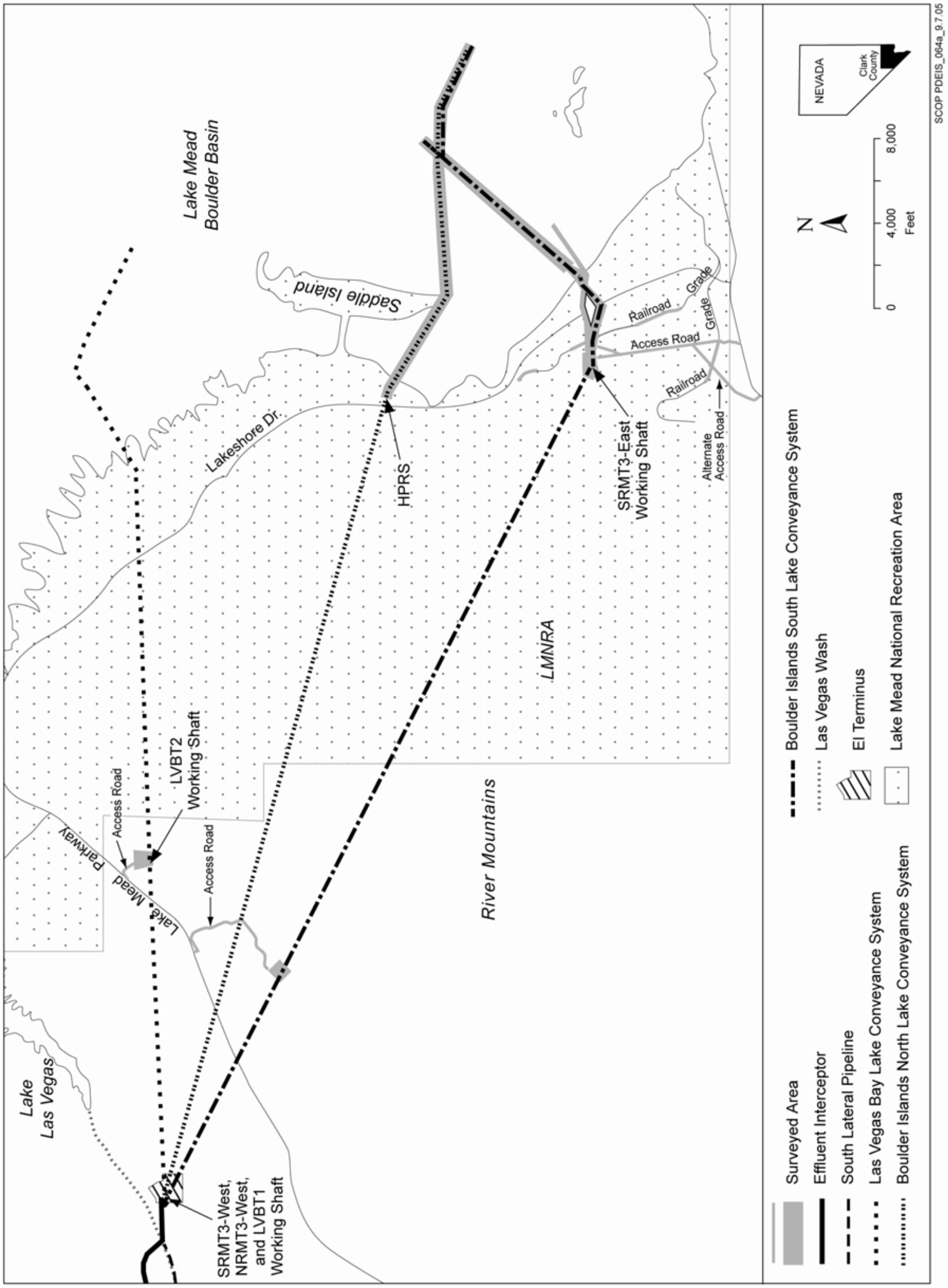

Figure 3.3-2. Terrestrial Areas Investigated for Cultural Resources in the Vicinity of the LCS Alignments.

Two isolated occurrences were noted during the 2004 surveys. Isolated Occurrence 1 is a survey marker consisting of a 4-inch (10-cm) interior diameter metal pipe set into the ground that was filled with mortar and a wire nail. This marker may have been for use with the gravel pit operation located to the west and up the Hemenway Wash. Isolated Occurrence 2 is a metal keg hoop with nails. The hoop is of the type typically seen on kegs that were used for bulk hardware shipments. Railroad connection hardware such as spikes, rail bolts, washers, and nuts typically were shipped in wooden kegs; as well as other bulk hardware such as nails, screws, and other fasteners (HRA, Inc. 2005).

3.3.3.2.2 Underwater Surveys

Elements of Site 26CK4046B were investigated using remote-sensing equipment. The underwater portions of Site 26CK4046B located within the APE of the two Boulder Islands LCS alignments include the Gravel Pit Line and the USCRR Junction Line. All reusable railroad materials, including tracks and ties, were reportedly removed from this portion of the SCIRR route in 1934.

A relatively static environment on the Lake floor in the survey area has minimized the effects of erosion, siltation, and other destructive forces on bottom features. Railroad grades appear to be well preserved. The Gravel Pit Line and USCRR Junction Line segments of the SCIRR are identifiable by a clearly defined and continuous linear pattern on the sonar record, signifying a uniform integrity of the grade across the survey area (HRA Inc. 2005).

In addition to the segments of the SCIRR, the underwater portions of Site 26CK4046B include a track siding, service road, and raw aggregate storage pile. The isolated track siding spans the full width of the APE. The track-siding grade is approximately 39-ft (12-m) wide throughout the APE. The aggregate storage pile was created as a reserve of raw material in case there was an interruption of aggregate delivery from the Arizona gravel pit. The aggregate pile spans the full width of the Boulder Islands South APE and extends into the southern half of the Boulder Islands North APE. An unpaved service road parallels the SCIRR within the survey area. The service road was likely the primary access road between the Aggregate Plant and the Arizona gravel pit. The road is approximately 1,608-ft (490-m) long within the survey area.

3.4 Recreation

The project area comprising the east-central portion of the Valley is used for multiple recreational activities. The surrounding mountain and desert ecosystems provide open space for OHV activities, mountain bicycling, sightseeing, rock collecting, hunting, hiking, nature observation, and horseback riding. The Colorado River and associated tributaries and reservoirs, including Lake Mead, support water-associated activities such as fishing and boating.

Local, county, state, and federal agencies manage the various public recreation areas. The NPS, BLM, Reclamation, and Clark County manage the largest recreational parcels that would be adjacent to or transected by the proposed alignments (Figures 3.4-1 and 3.4-2). Several small

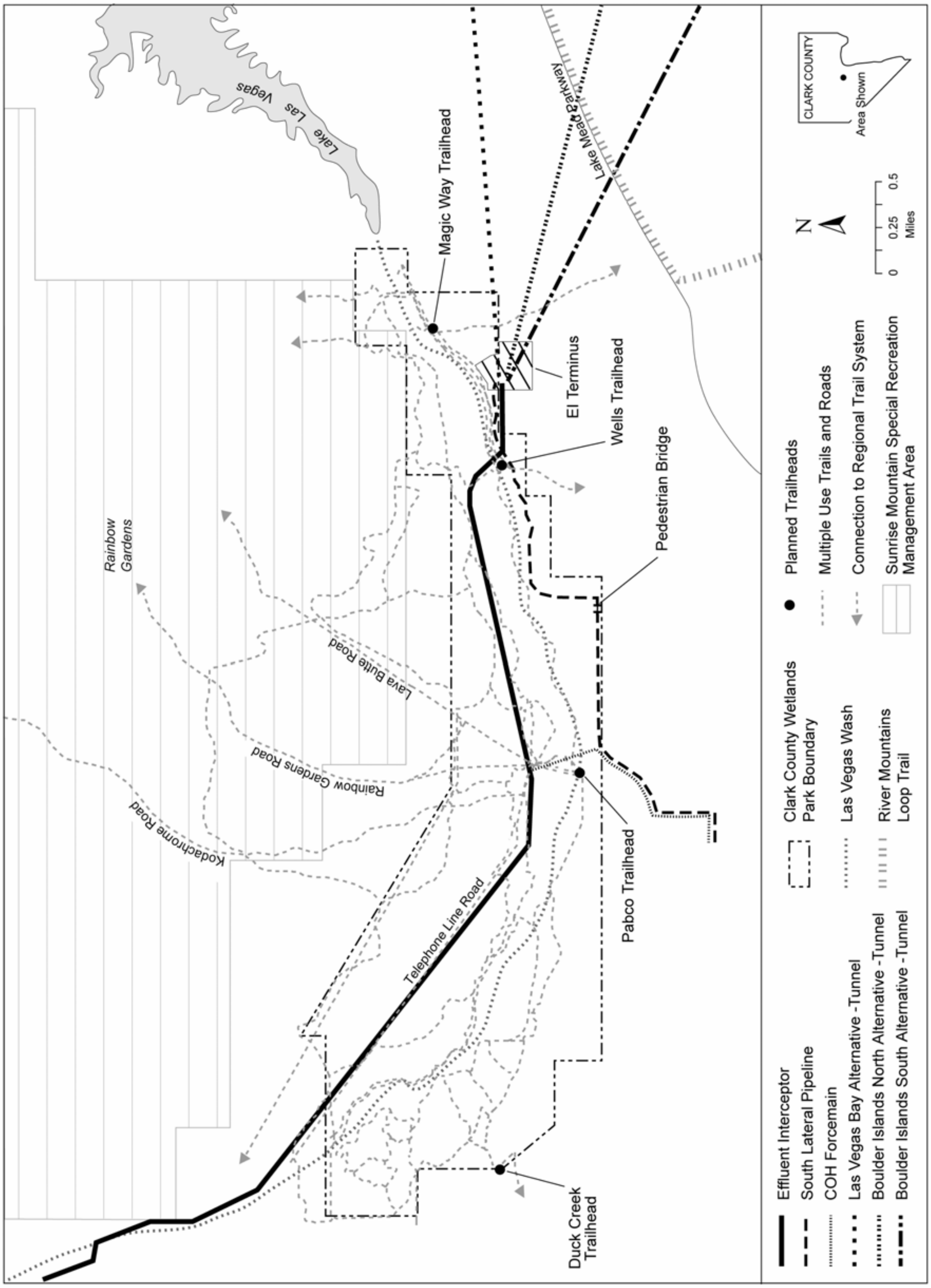

Figure 3.4-1 Recreation Areas in the Project Vicinity – Effluent Interceptor Segment.

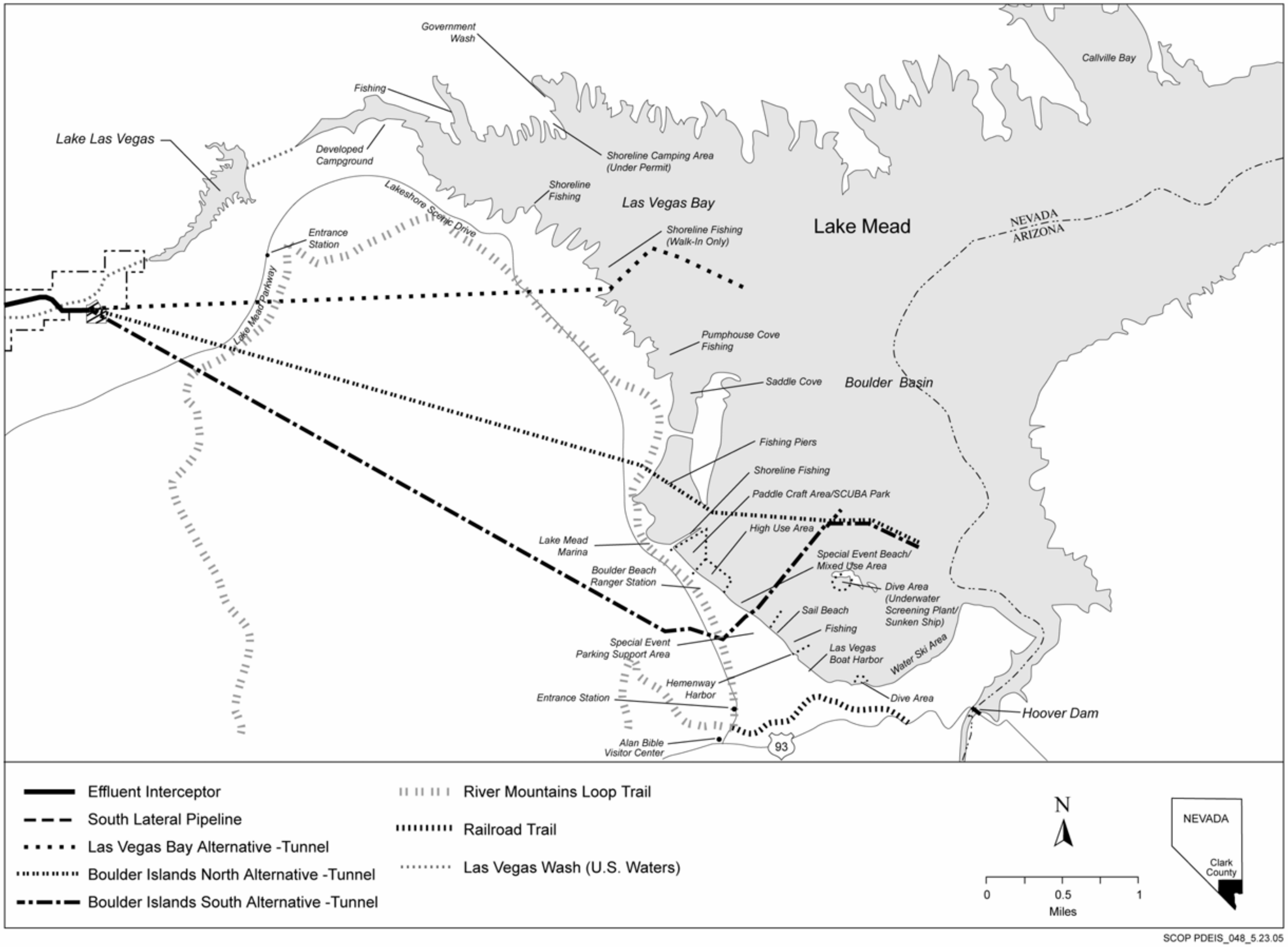

Figure 3.4-2 Recreation Areas in the Project Vicinity – Lake Conveyance System Segment.

open-space parcels and general recreation opportunities occur within the project area. This section focuses on organized public recreational uses.

3.4.1 Lake Mead National Recreation Area

The NPS has administered the LMNRA since 1936, first under a cooperative agreement with Reclamation until 1964 when it was established by Congress as a unit of the National Park System. Lake Mead and Lake Mohave comprise the LMNRA encompassing approximately 1.5 million acres (607,028 hectares), and 110 miles (177 km) of the Colorado River (NPS 2003a). The LMNRA ranks as the fifth most visited unit of the National Park System with recreational visits totaling more than 8.2 million in 2003 (NPS 2003b). The majority of the LMNRA visitation occurs during the summer months between May and September, and primarily involves water-based recreation. However, visitation is increasing in the spring and fall as visitors discover the backcountry regions of the recreation area through hiking and travel on the approved road system (NPS 2003c).

The project area is located in the western portion of the LMNRA in the Boulder Basin Developed Area on Lake Mead (Figure 3.4-2). In the recently approved *Lake Management Plan*, the NPS designated the Boulder Basin as an Urban Park Zone a recreational management setting for areas that may experience intense visitor use (NPS 2002). The Boulder Basin is located within 30 minutes of most locations within the Valley as well as Henderson and Boulder City. It serves as the primary access point to the LMNRA. Approximately half of the visitors to LMNRA go to Boulder Basin.

Available facilities in the Boulder Basin area include four concession-operated marina and service facilities including: Callville Bay Resort, Lake Mead Resort, Lake Mead Cruises, and Las Vegas Boat Harbor. The marina facilities include restaurants, stores, trailer villages, and mooring services. Public launch ramps are located at Callville Bay, Government Wash, Las Vegas Bay, Boulder Harbor, and Hemenway Wash. Additional public facilities include Lakeshore Drive and Northshore Road scenic overlooks with parking and picnic facilities, and campgrounds. There are also employee housing areas, trailer villages, a state-operated fish hatchery, the SNWA AMSWTF, and the Alan Bible Visitor Center.

A wide variety of recreational opportunities are available including camping at Callville Bay, Las Vegas Bay, and Boulder Beach. Primitive camping opportunities are available along the north shore of Boulder Basin at Boxcar Cove, Crawdad Cove, Montana Agate Wash, and mile post 8.0 of Northshore Road. These shoreline areas are accessible by gravel roads. These areas are also popular for swimming, sun bathing, shoreline hiking, boating, and personal watercraft (PWC) use.

The Callville Bay Developed Area is the most popular boating location in the Boulder Basin. The marina includes 647 slips, a store, restaurant, trailer village, dry-boat storage, maintenance area, and lounge. Public facilities include a 160-ft (49-m) wide public launch ramp and improved parking, along with an 80-unit campground and picnic area. The area also supports an NPS and concession housing area.

The Government Wash area was developed in 1992 to improve Lake access. These facilities include a public launch ramp, restroom, and parking area. The shoreline below the public launch ramp is popular for shoreline camping and other water-based recreation activities. Additional improvements are proposed for the Government Wash area to support increasing visitor use.

The Las Vegas Bay Developed Area has been dramatically affected by lowering water levels on Lake Mead. The floating 635-slip marina complex has been temporarily relocated to Horsepower Cove. The area still supports the concession-operated dry-boat storage area and maintenance area. Public facilities include the 89-space campground, and picnic areas. The public launch ramp is closed. The Las Vegas Wash, a tributary to Lake Mead, conveys surface-water runoff and treated municipal and industrial wastewater flows from the Valley to the Las Vegas Bay. The nutrient load in these flows encourages growth of algae, a food base for fish. This food source supports the local game fishery in Las Vegas Bay and creates conditions ideal for sport fishing. Underwater visibility in the Las Vegas Bay near the terminus of Las Vegas Wash is poor all year due to high silt content and algae growth (NPS 2004a). Therefore, conditions are not favorable for SCUBA diving in this area.

Within the 3-mile long Boulder Beach area there are two concession-operated marinas and Lake Mead Cruises. The slip capacity of these two marina operations is in excess of 1,200 slips and there are two public launch ramps, making this a high use area for boats. Each of the marinas includes floating restaurants and stores.

The Boulder Beach area is developed and zoned to support a wide variety of visitor activities. The northern end of Boulder Beach is designated as a dive park and includes the placement of sunken artifacts to support diving operations. The center portion of Boulder Beach is buoyed off to allow swimming and other shoreline activities. Additional SCUBA opportunities are provided at the Boulder Islands where two 45- to 50-ft (14- to 15-m) long boats (Tortuga and Cold Duck) have been placed on the lake floor to support exploring and training dives. The Special Events Beach provides for a variety of activities including areas for sailboat and PWC use. Accessible shoreline fishing facilities are provided at Fishing Point with other shoreline fishing improvements provided at other locations within the Boulder Basin.

In addition to the water-based development, the NPS has also developed a Boulder Beach Trail on the east side of Lakeshore Drive between the Alan Bible Visitor Center and the Lake Mead Marina. This trail will be incorporated into the 35-mile (56-km) River Mountains Loop Trail connecting the Boulder Basin with Boulder City, Henderson, and the Valley. While the trail today only measures approximately 3 ft (1 m) in width, as it is developed to be part of the larger trail, the width will increase to 10 ft (3 m) and the surface will be paved.

There are numerous backcountry roads that access the shoreline of Lake Mead in the Boulder Basin. These include four gravel roads along the north shore of the Boulder Basin. There are four additional access points in the Saddle Cove area of the Boulder Basin. There are two additional backcountry roads in the project area. One of these roads, AR-77, provides access to the Cholla Forest in the River Mountains. The other backcountry road, AR-76, provides access to NPS administrative facilities.

In addition to NPS managed recreation facilities, there are a number of tour operations that originate outside the LMNRA. These include scenic air tours that fly over portions of the Boulder Basin. It is estimated there may be as many as 400 such air tours daily.

3.4.2 Sunrise Management Area

The SMA is located approximately 5 miles (8 km) east of Las Vegas, and is managed by the BLM (Figure 3.4-1). The 37,620-acre (15,224-hectares) area includes the Sunrise Mountain Special Recreation Management Area and the Rainbow Gardens Area of Critical Environmental Concern (ACEC). The SMA management goals are to provide recreational opportunities and to protect biological, geological, hydrological, and cultural resource values (BLM 2000).

The SMA is dominated by Frenchman Mountain, with an elevation of 4,054 ft (1,236 hectares), and to a lesser extent by Sunrise Mountain. The Rainbow Gardens area of Frenchman Mountain was designated as an ACEC for its unique geologic features, which include wide sections of exposed rock strata, tilting and other formations influenced by fault activity, and large outcrops of gypsum-bearing soil. These geologic formations are one of many features that attract visitors to the area. The SMA also provides panoramic views of the surrounding desert, geologic features of Rainbow Gardens, Lake Mead, and Las Vegas.

Mountain bicycling and OHV use are the primary recreational activities in the area. Other recreational opportunities that attract visitors to the area include sightseeing, rock collecting, hunting, hiking, wildlife viewing, and horseback riding. Visitation occurs year-round, but the use and volume of visitors vary seasonally. No consistent visitor counts have been recorded and no visitation data exists for the SMA.

Primary access to the SMA from the south is via Telephone Line Road. Existing unpaved roads and trails in the SMA that connect to Telephone Line Road include Kodachrome Road, Rainbow Gardens Road, and Lava Butte Road. These roads and trails are designed for moderate to high use.

3.4.3 River Mountains Loop Trail

The River Mountains Trail Partnership was formally organized in 1998 and is an association of public agencies, community groups, businesses, and individuals committed to the development of a 35-mile (56-km) trail around the River Mountains. The River Mountains Loop Trail would encircle the River Mountains and connect the LMNRA to Hoover Dam, Boulder City, Henderson, and the rest of the Valley (Figure 3.4-2).

The trail portion within the LMNRA would be about 16-miles (26-km) long and would extend from the Lake Mead Parkway entrance station, near the LMNRA boundary with the COH and the Lake Las Vegas community, and continue in close proximity to Lakeshore Drive, primarily following disturbed corridors and existing trails, to the LMNRA boundary with Boulder City (NPS 2003c). The River Mountains Loop Trail system is under construction and completion is anticipated for fall 2005 (Holland 2004).

3.4.4 Clark County Wetlands Park

The 2,800-acre (1,133-hectares) Wetlands Park, managed by Clark County and Reclamation, is an extensive special-use regional park located along the Las Vegas Wash (Figure 3.4-1). The *Wetlands Park Master Plan* (Clark County 1995) includes a system of hiking, equestrian, and bicycle trails, and a nature center. Wildlife viewing areas will be constructed in phases over the next 10 to 15 years. The trails will eventually connect the Wetlands Park to the River Mountains Loop Trail and to the overall trail system for the Valley. Visitation occurs year-round but varies seasonally. Visitation to the Wetlands Park in 2003 was 6,637 visitors, based on numbers derived from individuals that signed in at the visitor center and from groups registered for guided and unguided tours of the park (Clark County 2004a).

3.4.5 Las Vegas Valley Primary Trails System

The Southern Nevada Regional Planning Coalition (SNRPC), created in 1999, consists of participants from, but not limited to, the cities of Las Vegas, North Las Vegas, Henderson, Mesquite, and Boulder City; Clark County; BLM; and Nellis Air Force Base. The goal of this cooperative planning effort is to recognize and support the continued development of an interconnected regional trail system that provides an alternative mode of transportation. The trail system would be designed to create convenient, non-motorized, access routes between neighborhoods, major commuter destinations, schools, parks, libraries, and other similar public spaces. The trail system would also include access to open-space features on federal lands in the deserts, mountains, foothills, lakes, and riparian areas that surround the Valley. The Las Vegas Valley Primary Trail System Map was created and is periodically updated by the SNRPC to reflect the existing and planned trail systems on lands managed by federal, state, and local entities (SNRPC 2003).

3.5 Hazardous Materials and Items of Special Concern

This section provides a description of the existing hazardous materials and items of special concern that may be encountered during implementation of the proposed project. The section is based on a *Phase I Hazardous Materials Environmental Site Assessment* prepared in April 2004 (Ninyo & Moore 2004). The Phase I analysis for the proposed project included review of topographical maps and aerial photographs to identify historic or current features that may be of concern. A description of adjacent and historic land uses within the proposed project area is described in the *Phase I Environmental Assessment Systems Conveyance and Operations Program* (Ninyo and Moore 2004), which is available upon request.

3.5.1 Environmental Databases Reviewed

A review of state and federal regulatory agency databases was conducted for reported release locations of hazardous substances to soils and/or groundwater in the project area. The purpose of this review is to ascertain the location of existing hazardous materials and the impact those materials have had on the environment.

The summary of environmental databases was searched on March 19, 2004, and listed sites are presented in Table 3.5-1. No sites listed in federal and state databases were found to exist within the linear search distances from the proposed alignment. There are 13 sites from the environmental database search that were located within 1 mile (2 km) on either side of the center line of the proposed alignment. The sites have been identified as having significant unauthorized releases of hazardous substances or other events with potentially adverse environmental effects.

A description of each site is presented in Section 5.0 of the *Phase I Environmental Site Assessment*. Three sites were identified as having recognizable environmental concerns (RECs) and are described in Section 3.5.3. All other sites were considered to have a low likelihood of presenting an environmental concern to the proposed project.

Table 3.5-1 Summary of Environmental Database Search.

Database Name	Agency	Search Radius [1] (miles)	Sites Listed
National Priority List (NPL)	EPA	1.00	0
Sites currently or formerly under review by EPA (Comprehensive Environmental Response, Compensation, and Liability Information System)	EPA	0.50	1
No Further Remedial Activities Planned	EPA	0.125	0
Resource Conservation and Recovery Act (RCRA) Treatment, Storage, and Disposal (TSD) Facilities	EPA	0.50	0
RCRA Corrective Action with out TSD	EPA	1.00	0
RCRA Generators List	EPA	0.25	0
Emergency Response Notification System List	EPA	0.12	2
State Sites	NDEP	1.00	8
Permitted as solid waste landfills, incinerators, or transfer stations	NDEP	0.50	0
Registered Underground Storage Tanks (UST) and Aboveground Storage Tanks (AST) Lists	NDEP	0.25	1
Leaking UST Lists	NDEP	0.50	1

Note:

[1] Search radius along the proposed alignment was 1 mile from the centerline on both sides of the alignment.

3.5.2 Site Reconnaissance

A site reconnaissance was conducted 1 mile (2 km) on either side of the alignment centerline on March 24, 2004. No stored hazardous substances or petroleum products; unidentified containers; or evidence of ASTs, USTs, and chemical releases (e.g., odors, stressed vegetation, stains, leaks, pools of liquids, and spills) were observed during the site reconnaissance. No pole- or pad-mounted transformers that may contain polychlorinated biphenyls (PCBs) were observed during the site investigation along the proposed alignment. No evidence of pits, sumps, or drywells were observed during the site investigation.

Visible evidence of prior agriculture or landscaping activity that may indicate historic use of pesticides or herbicides within the project area was not present. There were numerous piles of waste rock and miscellaneous household debris in the vicinity. Solid waste observed in the proposed project area included construction waste, automobile parts, and domestic debris, but not to the extent of being an environmental concern.

3.5.3 Recognizable Environmental Conditions

The conclusion of the *Phase I Hazardous Materials Environmental Site Assessment* states that there was no evidence of hazardous materials or past spills in the proposed project area. However, the following RECs were noted:

- Portions of the SRMT3 would pass through the Three Kids Mine Site, an area with known metal (e.g., manganese, lead, and arsenic) and petroleum contamination from historical mining operations. The facility, located in the River Mountains west of Lake Mead and south of Lake Mead Parkway, mined manganese from 1917 to 1961. Part of the mining process entailed using diesel fuel flotation tanks. The waste liquid from the flotation tanks was pumped to evaporation ponds. Site investigation activities have occurred at the site, but no remedial actions have been performed. Groundwater does not appear to have been impacted.
- The Henderson Landfill has known metal contamination as a result of its use as a landfill. The facility located west of Calico Hills and north of Lake Mead Parkway, was operated as a municipal landfill until 1975. Site investigation activities are currently ongoing. Land use in the area is deed-restricted, with no residential development or water supply well construction allowed. Portions of the South Lateral Pipeline would be located near the facility.
- A known perchlorate groundwater plume, originating from the BMI Complex located to the southwest of the EI, COH Forcemain, and South Lateral Pipeline, exists in the project area. The plume migrated off the BMI site in a northeasterly direction and enters the Las Vegas Wash in the vicinity of the Pabco Road ECS. The source of the perchlorate has been traced to Kerr McGee Chemical Corporation and American Pacific Corporation facilities located in Clark County, Nevada. A groundwater interception system, overseen by NDEP, has been installed to intercept and treat the contaminated groundwater. Treated groundwater is returned to the Las Vegas Wash.

Portions of the COH Forcemain, South Lateral Pipeline, and EI pipeline alignment near the EI Terminus would be located in areas of known perchlorate groundwater contamination. Based on data received from SNWA, concentrations of perchlorate in the area of the Pabco ECS on the Las Vegas Wash range from 4.8 to 83.2 ppb, and perchlorate concentrations in the Las Vegas Wash near the EI Terminus range from 190 to 200 ppb. Concentrations of perchlorate in the groundwater obtained from soil borings located west of the EI Terminus on the south bank of the Las Vegas Wash ranged from 2,600 to 3,900 ppb (Ninyo and Moore 2004).

3.6 Noise and Vibration

Noise is defined as any unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. It may be intermittent or continuous, steady or impulsive, stationary, or transient. The region of influence (ROI) for noise includes those areas associated with construction and maintenance of the proposed project and those areas (e.g., neighborhoods, parks, wildlife) that could be adversely impacted from exposure to related activities.

The physical characteristics of noise, or sound, include its intensity, frequency, and duration. Various "weighting" factors are applied to noise measurements to produce measured values that correspond to human response because noise events have a range of characteristics, and the human ear does not respond to sounds of varying frequency and intensity in a linear fashion. The commonly used weighting scales are the "A" and "C" scales.

The normal human ear can usually detect sounds that range in frequency from about 20 hertz (Hz) to 20,000 Hz. However, all sounds throughout this range are not heard equally well. Therefore, some sound meters are calibrated to emphasize frequencies in the 1,000- to 4,000-Hz range. The human ear is most sensitive to these frequencies, and sounds measured with these instruments are termed "A-weighted." The A-weighted scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. The "A-weighted" scale is normally used to describe noise from transportation and other human activities. The "C-weighted" scale is normally used to describe large amplitude, impulsive sounds such as explosions and weapons noise. Values of A-weighted and C-weighted noise are described in terms of A-weighted decibels (dBA) and C-weighted decibels (dBC), respectively. Table 3.6-1 provides a range of noise conditions.

Noise conditions in the vicinity of the proposed project area are generated by residential activities, outdoor recreational activities, aircraft, vehicle traffic, and construction-related disturbances. Ambient noise conditions were not measured along the alignment for this proposed project. However, a noise assessment for the EI construction was conducted in November 2003 and is provided in Appendix F. Estimated noise emissions associated with construction of the proposed EI portion of the alignment were used to determine potential impacts to nearby residential and public-use areas.

3.6.1 Applicable Regulations and Policies

The project area is located in the cities of Las Vegas and Henderson in Clark County, Nevada, and is subject to local regulations regarding noise emissions. The CLV noise regulations are in *Title 9, Health and Safety*, of the municipal code (City of Las Vegas Municipal Code Title 9). The COH noise regulations are in *Title 8, Public Peace and Safety*, of the municipal code (City of Henderson Municipal Code Title 8). The COH noise ordinance requires that no noise disturbance, due to alteration or repair of building or streets, occur in residential areas between the hours of 6 p.m. and 6 a.m. except in case of urgent necessity (COH 1988, 1989). Excessive noise that unreasonably interferes with the workings or sessions of nearby schools, hospitals, churches, or other sensitive receptors are considered violations. Likewise, a noise disturbance

Table 3.6-1 Typical Sound Pressure Levels Associated with Common Noise Sources.

Sound Pressure Level (dBA)	Subjective Evaluation	Outdoor Environment	Indoor Environment
140	Deafening	Jet aircraft at 75 ft	
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 ft	
120	Threshold of feeling	Elevated train	Hard rock band
110		Jet flyover at 1,000 ft	Inside propeller plane
100	Very loud	Power mower, motorcycle at 25 ft, auto horn at 10 ft, crowd noise at football game	
90		Propeller plane flyover at 1,000 ft, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately loud	Diesel truck (40 miles per hour) or heavy construction equipment at 50 ft	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner, electric typewriter
60	Moderate	Air-conditioner condenser at 15 ft, near highway traffic	General office
50	Quiet		Private office
40		Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without T.V. and stereo)
20		Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		

Source: Black & Veatch 2003.

across residential boundaries from loading and unloading building materials or similar objects between the hours of 11 p.m. and 7 a.m. is a violation (COH 1989). No exemptions for construction activities are provided in the municipal code. The COH municipal code contains a vibration performance standard. The standard states that no operation shall produce vibration, which is perceptible without the use of instruments for more than 3 minutes during any 1-hour period between the hours of 7 a.m. and 10 p.m. or for more than 30 seconds during any 1-hour period between the hours of 10 p.m. and 7 a.m. (COH 1989).

Clark County noise regulations are included in the *Site Environmental Standards*, *Title 30 of the Clark County Unified Development Code* (Part 68.20). However, the requirements of the County noise code do not apply to construction or demolition activities when conducted during daytime hours (generally, 6:00 am to 6:00 pm.). Table 3.6-2 shows the maximum permitted sound levels from the County noise code.

The NPS states that activities causing excessive or unnecessary unnatural sounds in or adjacent to the LMNRA would be monitored, and action would be taken to prevent or minimize unnatural sounds that adversely affect LMNRA resources, values, or visitors' enjoyment.

Sound-pressure levels produced by any noise source must comply with the values shown in Table 3.6-2. Enforcement of the noise ordinance is initiated upon receipt of public complaints. The County determines the severity of the violation using a subjective assessment. The magnitude of the violation is also dependent upon the number of complaints filed each day.

Table 3.6-2 Maximum Permitted Sound Levels Clark County.

Octave Band Center Frequency, Hz	**Within Residential Districts, dB**		**Within Business and Industrial Districts, dB**	
	Daytime	**Nighttime**	**Daytime**	**Nighttime**
31.5	72	65	76	65
63	65	58	69	62
125	58	50	62	54
250	53	44	58	49
500	50	40	55	45
1000	47	37	52	42
2000	43	33	49	38
4000	40	30	46	35
8000	37	27	43	32

Source: Clark County 2003.

3.6.2 Sensitive Receptors

Residences, motels and hotels, schools, libraries, religious institutions, hospitals, nursing homes, auditoriums, parks, and outdoor recreation areas are generally more affected by noise than commercial and industrial areas.

Residential properties located along the proposed project are considered to be sensitive receptor sites. The habitats of listed threatened and endangered animals and fowl are to be considered sensitive receptor sites when located at or near construction activities. Sensitive receptor sites within the project area are discussed in the following subsections.

3.6.2.1 Parks

Parks within the vicinity of the proposed project include the Wetlands Park and the LMNRA. Portions of the EI alignment, COH Forcemain, and South Lateral Pipeline would be located within the Wetlands Park as shown on Figure 3.6-1. The environment of the Wetlands Park is generally quiet, characterized by open marshland and desert accessed by local or unpaved roads (Reclamation et al. 1998). However, ongoing construction of ECSs and bank stabilization within the Wetlands Park adds to background noise levels. Also, construction outside the Wetlands Park at golf course and residential developments (Tuscany Hills and Weston Hills), and overflights of commercial aircraft contribute to the existing noise conditions within the Wetlands Park.

The area on the west shore of Lake Mead's Boulder Basin is a major tourist area, and includes the Lake Mead Marina and Boulder Beach campground and lodges. Noises in the LMNRA include naturally occurring sounds, such as wind, birds calling, rocks falling, and waves on the Lake. Human-caused sounds at LMNRA include watercraft, automobiles, horns, trucks, aircraft, generators, and electronic devices such as music players. Noise levels emitted from PWC vary from vessel to vessel depending upon many factors. Literature states that recently manufactured watercraft emit fewer than 80 decibels at 50 ft (15 m) from the vessel; however, other sources claim levels as high as 102 decibels may be reached (NPS 2002). Additionally, residences and campgrounds located along Lakeshore Drive and Boulder Beach contribute to the abovementioned background noise levels at the LMNRA.

3.6.2.2 Residential Properties

Rose Garden Estates, South Valley Ranch, Calico Ridge, John Laing Homes, Tuscany Hills, Weston Hills, and Lake Las Vegas are residential developments in the vicinity of the EI as shown on Figure 3.6-1. Currently, the nearest residences are located approximately 4,000 ft (1,219 m) southwest of the transition point between Reach 1 and Reach 2 of the EI. Future development plans in the project area indicate residences to be located adjacent to tunnel shafts in Reach 1 and a 1,390-ft (424-m) portion of the Reach 1 alignment. Also, residences are planned adjacent to approximately 3,400 ft (1,036 m) of the proposed South Lateral Pipeline alignment.

Noise conditions at existing and planned residential areas near the proposed EI were not collected. However, it is assumed that background noise levels in these areas are typical of residential communities. Typical background levels for residential properties range from 31 to 35 dBA in very quiet rural areas to 56 to 60 dBA for very noisy urban residential communities (EPA 1971).

3.6.2.3 Other Sensitive Receptors

Other sensitive receptors to noise in the project area include wildlife species, which are discussed in Section 3.2. The study of animal responses to noise is a function of many variables including characteristics of the noise, duration of the noise, life history characteristics of the species, habitat type, season and current activity of the animal, sex, age, and previous exposure (Manci et al. 1988). Existing sources of noise that may affect wildlife in the proposed

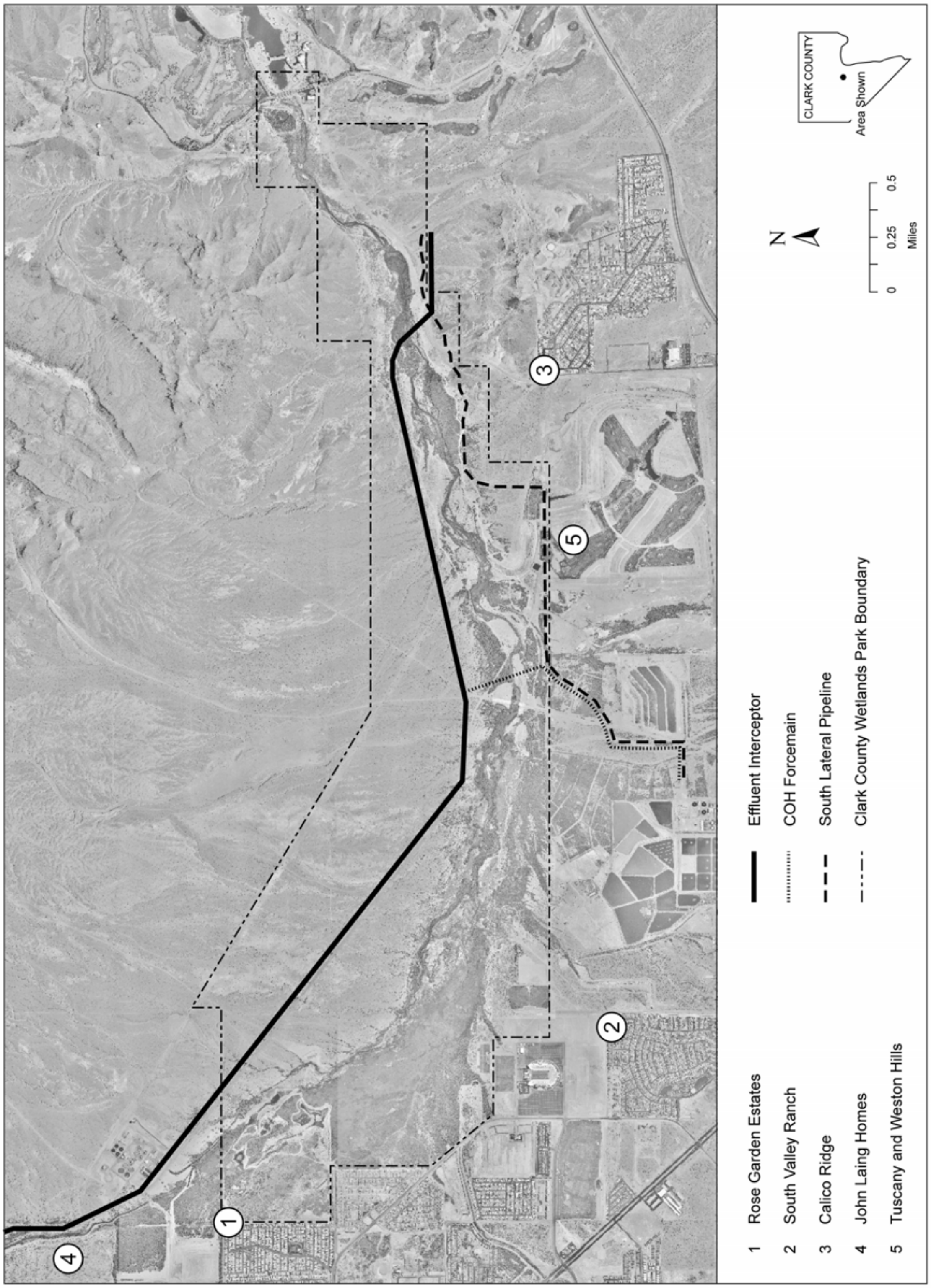

Figure 3.6-1 Sensitive Noise Receptor Locations.

project area include recreational activities such as OHV use and motor craft within LMNRA, automobile traffic, heavy machinery, and construction equipment.

3.7 Air Quality

The project area is located in the southwestern desert region of Nevada and the northeastern portion of the Mojave Desert. Climate in the Mojave Desert is usually characterized by high temperatures and low precipitation throughout the year, with warm, dry winters, and hot summers, with occasional thunderstorms. Surface evaporation rates are extremely high, even in wet years. Temperatures and amounts of precipitation are dependent on elevation, with lower elevations generally experiencing the warmest temperatures and receiving the least rainfall. Temperatures vary significantly along elevation gradients and may decrease approximately 5.3°F (15°C) for every 1,000-ft (305-m) increase in elevation. Daily and seasonal temperatures can vary greatly. Daytime to nighttime temperatures may vary by 20º to 30°F (-7°C to -1°C) in the winter and 30° to 40°F (-1° to 4°C) in the summer. Maximum temperatures in the summer exceed 100°F (38°C) at the lower elevations. Minimum winter temperatures drop below freezing at the higher elevations.

The proposed project would be constructed in the most populous and developed airshed of Clark County, and consequently, in the region of Clark County with existing air quality concerns. For air quality purposes, Clark County has been divided into 13 different airsheds (Clark County Health District [CCHD] 1996), as shown in Figure 3.7-1. Airshed regions within the County are roughly based on hydrographic areas determined by the State Engineers' Office. The first two segments of the EI are located within the Las Vegas Valley airshed, which roughly encompasses all of hydrographic region 212. The EI Terminus and the LCS for the action alternatives traverse the Las Vegas Valley airshed and enter the Black Mountains Area airshed. The Las Vegas Valley airshed and Black Mountains Area airshed are shown on Figure 3.7-1 and designated as LV and BA, respectively.

3.7.1 Regulatory Background

The air quality of an airshed is classified by the concentrations of criteria pollutants (carbon monoxide [CO], nitrogen oxides [NO_x], sulfur dioxide [SO_2], lead [Pb], particulate matter [PM], and ozone [O_3]) in the ambient air. Two different sizes of PM are regulated: PM_{10}, which denotes particulate matter with an aerodynamic diameter less than 10 microns, and $PM_{2.5}$, for particulate matter with an aerodynamic diameter less than 2.5 microns. The EPA has set acceptable concentrations of criteria pollutants in the ambient air (the outside air that we breathe), called the NAAQS. The NAAQS are concentrations of the pollutant in the ambient air presumed to be protective of human health and the environment. The NAAQS have been set for CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$, Pb, and O_3. Of these pollutants, only O_3 is not emitted directly from sources, but is formed in the atmosphere by the reaction of nitrogen oxides and volatile organic compounds (VOCs) in the presence of sunlight.

The EPA established the NAAQS in order to specify acceptable pollutant concentrations that may be equaled continuously and, in the case of short-term standards, exceeded a specific number of

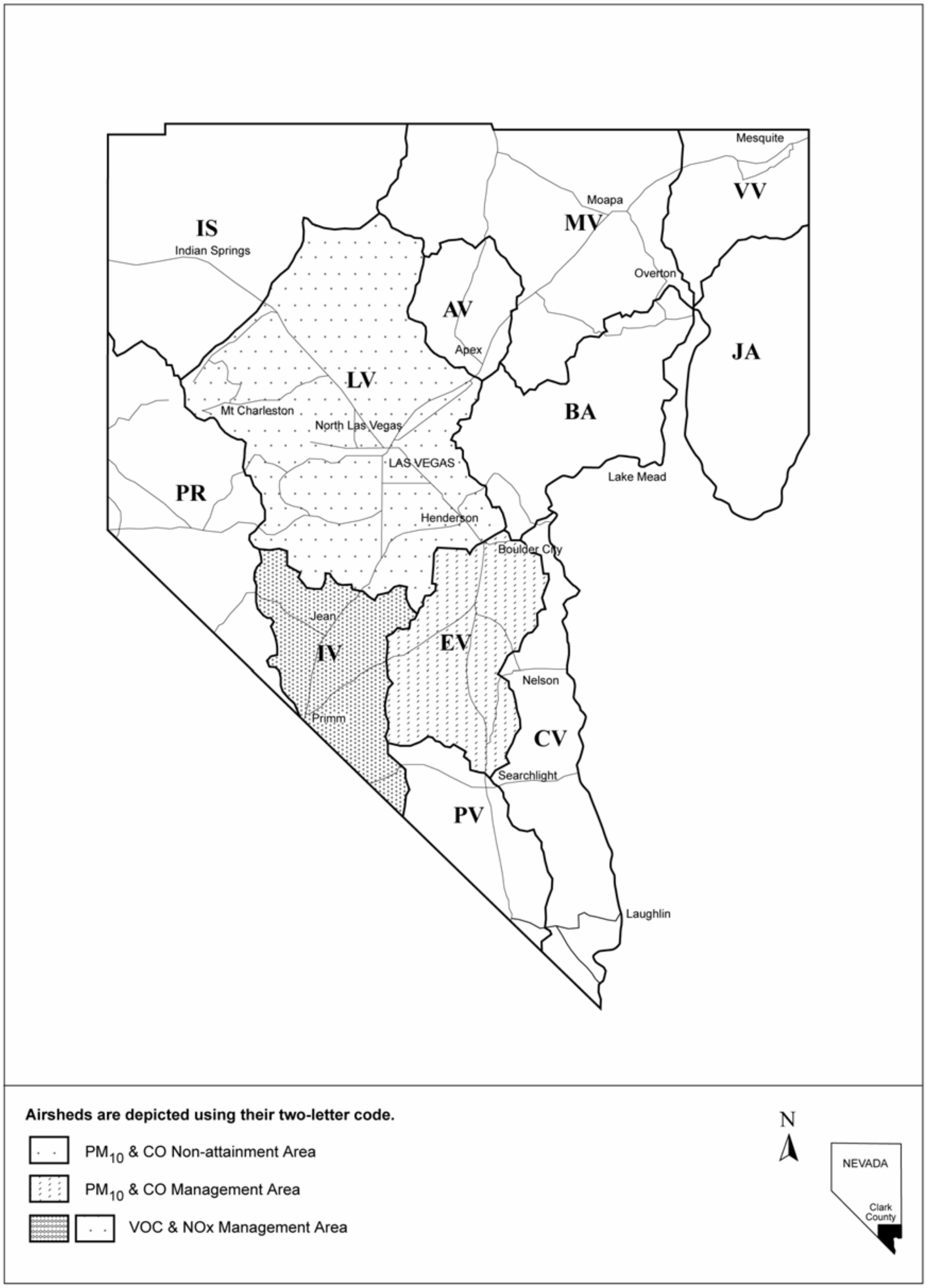

Figure 3.7-1 Clark County Airsheds.

times per year (EPA 2004a). Typically, each pollutant has two ambient air quality standards: the primary standard, which is protective of public health; and the secondary standard, which is protective of public welfare.

Public welfare includes quality of life issues such as visibility (clearness of air, visual distance), and damage to vegetation, crops, and buildings. The State of Nevada and the Clark County Division of Air Quality and Environmental Management (DAQEM) have established primary standards for ambient air quality (NDEP 2002b, Clark County 2003a).

The CAA requires the classification of geographic areas based on their air quality. An area is classified as "attainment" for a pollutant if the concentration of the pollutant measured at official monitoring stations is equal to or below the NAAQS set for that pollutant. Areas that attain the NAAQS are subject to the Prevention of Significant Deterioration (PSD) program. The PSD program is designed to prevent the air quality in attainment areas from further degrading to the point where pollutant concentrations increase to levels close to the NAAQS. The PSD program defines two types of attainment areas.

A Class I designation is given to areas where only a minimal increase in air pollutant concentrations is allowed and is mandatory for international parks, and certain national wilderness areas, national parks, and national monuments, as specified in the CAA. A Class II designation is given to areas whose criteria pollutant concentrations are below the NAAQS, and can sustain a moderate increase in air pollutant concentrations without significant deterioration of air quality. The LMNRA is designated as a Class II air quality area under the CAA. However, park management laws and policies require the NPS to maintain the best possible air quality in order to “preserve natural resources and systems, preserve cultural resources; and sustain visitor enjoyment, human health, and scenic vistas” (NPS 2001a).

In a non-attainment area, the measured concentration of a pollutant has exceeded the NAAQS on one or more occasions. Once an area is classified as non-attainment for a pollutant, several steps must be implemented to bring the area back into attainment. One step is to develop a written plan for improving the air quality in that area. These plans are called SIPs. In the SIPs, states outline the steps that will be implemented to reduce the levels of the non-attainment pollutant and bring the non-attainment area back into attainment. A non-attainment classification also triggers the conformity regulations, which apply to federal projects and transportation projects in those areas.

The conformity regulations prohibit a federal agency from supporting a federal action that does not conform to a SIP. A federal action is any activity engaged in by a department, agency, or instrumentality of the federal government, or any activity that the federal government supports in any way, provides financial assistance for, licenses, permits, or takes approval action.

Clark County has one additional air quality classification. The term “management area” is given to certain airsheds in Clark County whose monitored pollutant concentrations are below the NAAQS. However, the difference between the NAAQS and the concentration of the monitored pollutant may not be large. New emission sources that locate in these areas may be required to reduce emissions and obtain emission offsets so that any area-wide increases in air pollutant concentrations do not result in or contribute to an exceedance of the NAAQS.

Some Nevada ambient air quality standards and Clark County air quality standards are more stringent than the NAAQS. Federal, state, and local ambient air quality standards are provided in Table 3.7-1.

Table 3.7-1 Local, State, and National Ambient Air Quality Standards.

Pollutant	Averaging Time	Clark County Standards	Nevada Standards	NAAQS Primary/ Secondary
O_3	8-hour	0.08 ppm	NA [1]	0.08 ppm
O_3 (Statewide except Lake Tahoe Basin)	1-hour	0.12 ppm	0.12 ppm	0.12 ppm/ 0.12 ppm
O_3 (Lake Tahoe Basin)	1-hour	--	0.10 ppm	0.12 ppm/ 0.012 ppm
NO_2	Annual Mean	0.053 ppm	0.053 ppm	0.053 ppm/ 0.053 ppm
CO (any elevation)	1-hour	35 ppm	35 ppm	35 ppm/None
CO (elevation < 5,000 ft)	8-hour	9 ppm	9 ppm	9 ppm/None
CO (elevation > 5,000 ft)	8-hour	--	6 ppm	9 ppm/None
SO_2	3-hour	0.50 ppm	0.50 ppm	None/0.5 ppm
SO_2	24-hour	0.10 ppm	0.14 ppm	0.14 ppm/None
SO_2	Annual Mean	0.03 ppm	0.03 ppm	0.03 ppm/None
PM_{10}	24-hour	150 µg /m ^{3}	150 µg/m ^{3}	150/150 µg/m ^{3}
PM_{10}	Annual Mean	50 µg /m ^{3}	50 µg /m ^{3}	50/50 µg/m ^{3}
$PM_{2.5}$	24-hour [1]	65 µg /m ^{3}	NA	65/65 µg /m ^{3}
$PM_{2.5}$	Annual Mean [1]	15 µg /m ^{3}	NA	15/15 µg /m ^{3}
Lead	Calendar Quarter	1.5 µg /m ^{3}	1.5 µg /m ^{3}	1.5 µg /m ^{3}
Hydrogen Sulfide	1-hour	--	112 µg /m ^{3}	None
Visibility	Observation	--	In sufficient amount to reduce the prevailing visibility to less than 30 miles when humidity is less than 70%	None

Note:
[1] NA = not available.
Sources: EPA 2004a, NDEP 2002b, Clark County 2003a.

Portions of the project would traverse the LMNRA, which is managed by the NPS. The NPS is charged with protecting elements of a park environment that are sensitive to air pollution. These elements are called air quality related values (AQRVs) and consist of visibility, water quality, wildlife, historic structures and objects, cultural landscapes, and vegetation. The AQRVs can be adversely impacted at pollutant levels that are lower than the NAAQS, or by pollutants for which no federal, state, or local standard exists.

3.7.2 Existing Air Quality Conditions

Construction of this project would occur in two different airsheds, the Las Vegas Valley airshed and the Black Mountains Area airshed. The existing air quality in the Las Vegas Valley airshed does not meet air quality standards set for PM_{10}, CO, or O_3 (EPA 2004a). Further, the CCHD has designated the region as a management area for NO_x and VOCs, pollutants that are precursors to ozone formation (CCHD 1996). The region is designated as in attainment for SO_2 and Pb (EPA 2004a). The EPA is expected to assign a classification with respect to $PM_{2.5}$ in 2005. Based on available monitoring information, the Las Vegas Valley airshed is likely to be designated as an attainment area for $PM_{2.5}$. The Black Mountains Area airshed and LMNRA are classified as attainment/unclassified for all criteria pollutants (EPA 2004a). There are no air-quality monitoring stations located in the Black Mountains Area airshed or the LMNRA. The majority of the land in the Black Mountains Area airshed is under control of the federal government.

The past 5 years of data from air quality monitoring stations located within a 25-mile (40-km) radius of the proposed project were used to characterize the background air quality (EPA 2004b, Clark County 2004b). The air quality is good, with concentrations of SO_2, NO_2, $PM_{2.5}$, and O_3 measured within this radius generally falling well below the NAAQS, Nevada standards, and Clark County standards. Recent monitoring data from one monitoring station located in the Valley indicates that the 8-hour ozone standard was exceeded. As a result, the Valley has been classified as "basic non-attainment" for the ozone 8-hour standard.

The last exceedance of the 8-hour CO standard occurred in 1998 at the East Charleston monitoring station. The 24-hour CO concentrations measured at all of the monitoring stations are well below the NAAQS, Nevada standards, and Clark County standards. The CO SIP states that air pollution collects at lower elevations, under certain weather patterns, due to topography of the Valley. The East Charleston station is located at one of the lowest elevations in Clark County. Since 1998, the CO standard has not been exceeded at any of the air quality monitors within a 25-mile (40-km) radius of the project.

Two criteria must be satisfied to be in attainment with the PM_{10} ambient air quality standard – the 24-hour average concentration and the annual arithmetic mean. The PM_{10} concentrations exceeded the 24-hour federal, state, and local standards in 5 out of the past 5 years of available data. The highest concentrations occurred when wind speeds exceeded 25 miles per hour (mph) (40 km per hour). The annual arithmetic mean for PM_{10} was below the NAAQS at all monitoring stations within a 25-mile (40-km) radius of the project during calendar years 1999, 2000, 2001, and 2003. During calendar year 2002, the annual arithmetic mean PM_{10} at one monitoring station exceeded the standard.

These exceedances, as well as other exceedances of the PM_{10} standard in Clark County, have all occurred within an area known as the BLM land disposal area. The BLM land disposal area is the name given to that area of Clark County where growth and development may occur and the lands are eligible for public auction. The *Southern Nevada Public Land Management Act of 1998* established a boundary between public lands that could be developed from those that would remain in their native state (Figure 3.7-2) (PL 105-263). Portions of the EI and LCS would be located in both the BLM land disposal area and on public lands that cannot be developed.

The land-use surrounding the proposed pipeline routes varies from undisturbed, vacant land, to recently constructed housing developments. The BLM land disposal area is classified as non-attainment for PM_{10} and ozone. The public land areas are classified as attainment for all pollutants.

The PM_{10} SIP was prepared to address how the Valley will attain compliance with the PM_{10} standard. The significant sources of PM emissions identified in the SIP are wind-blown dust, re-entrained road dust, and construction activities (Clark County 2001). Wind-blown dust is difficult to control or reduce because of the lack of protective vegetation in this arid region. The emissions inventory prepared to support the SIP estimated that nearly 40 percent of the PM_{10} emissions in the non-attainment area were due to emissions from disturbed vacant lands. However, in the Valley, over 60 percent of the PM_{10} emissions are estimated to arise from construction and road dust emissions. The EPA approved the PM_{10} SIP for the Valley on May 3, 2004.

3.8 Earth Resources

The topography, geology, and soil conditions in the vicinity of the EI alignment and LCS are discussed in this section. Additional detailed geotechnical information is presented in the *Effluent Interceptor Preliminary Design Report* (Black & Veatch 2004a) and the *Draft Lake Conveyance System Conceptual Engineering Report* (Black & Veatch 2004c).

3.8.1 Topography

The project area is located within the physiographic feature known as the Las Vegas Valley, which is located in the southern part of the Basin and Range Physiographic Province. Linear valleys and mountains with a northwest trend characterize this Valley. The Valley is bordered on the north by the Las Vegas Range, on the east by the Frenchman, Sunrise, and River mountains, on the west by the Spring Mountains, and on the southeast by the McCullough Range (Figure 3.1-1). The River Mountains and the Rainbow Gardens area of Frenchman Mountain separate the Valley from Lake Mead to the east. Topography in the area is the result of repeated episodes of deposition, uplift, igneous activity, and erosion (Bedinger et al. 1989).

The existing topography along most of the proposed EI alignment generally slopes from the northwest to the southeast at an average gradient of less than 1 percent (Converse Consultants 2002). Ground-surface elevations along the alignment range from about 1,690 ft (515 m) above msl at Desert Inn Road to about 1,490 ft (454 m) above msl near the EI Terminus. The topography in the vicinity of Reach 3 includes moderate slopes.

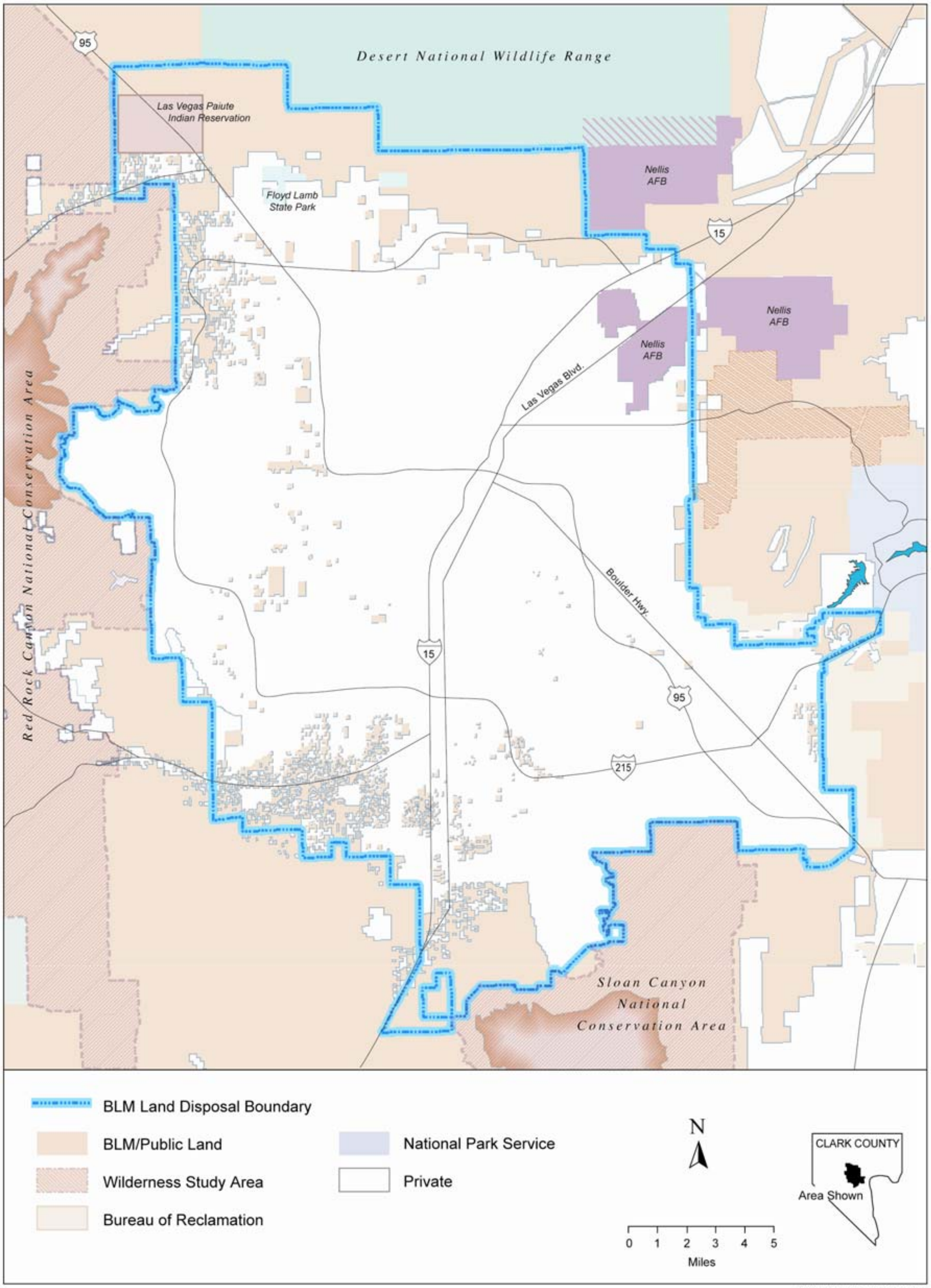

Figure 3.7-2 BLM Land Disposal Boundary.

The existing topography along the proposed LCS alignments is generally characterized by gentle slopes with an average gradient of less than one percent.

The principle drainage channel in the Valley is the Las Vegas Wash. It drains from north to south near the eastern edge of the valley floor and continues southeast out of the basin to Lake Mead. Several major natural drainage channels that are tributaries to the Las Vegas Wash dissect the Valley and have locally eroded channels up to 30-ft deep (9-m) (Reclamation et al. 1998).

3.8.2 Geology

The Valley is a structural basin that contains Miocene to Recent unconsolidated sediments overlying bedrock of Paleozoic age. The Valley is bounded by several mountain ranges that have developed through offset of faults present in the region. The mountain ranges expose rocks from Precambrian to Tertiary age. Precambrian gneiss crops out at the base of Frenchman Mountain to the east of Las Vegas, and on Saddle Island in Lake Mead. Thick sequences of Paleozoic, Mesozoic, and Tertiary sedimentary rocks overlie the Precambrian gneiss higher on Frenchman Mountain. Tertiary volcanics overlie the Saddle Island Precambrian rocks.

Structurally, the Frenchman Mountain-Rainbow Gardens area is tilted eastward and is separated from the Valley by a major northwest-trending lateral shear zone. Right-lateral movement along this zone ceased during the late Cenozoic era, but was followed by normal faulting with the downthrown block to the west (Converse Consultants 2002). The southeast end of the zone near the Las Vegas Wash appears to spread into several strands. There is no clear evidence that this zone extends across the Las Vegas Wash toward the River Mountains to the south. Nevertheless, numerous northwest-trending faults traverse the River Mountains to the south. In addition, some evidence indicates that a fault zone may parallel the Las Vegas Wash (Bell and Smith 1980).

3.8.2.1 Stratigraphy

Bedrock and Valley-fill sediments are the two main geologic units that characterize the proposed EI project area. The mountain ranges to the west, east, and north consist primarily of Paleozoic and Mesozoic sedimentary rocks including sandstone, limestone, siltstone, and conglomerates. The mountain ranges to the south and southeast consist primarily of Tertiary volcanic rocks including basalts, andesites, rhyolites, and associated intrusive rocks that overlie Precambrian metamorphic and granitic rocks. The Valley-fill sediments predominantly consist of Miocene to Holocene age fine to coarse grained deposits (Longwell et al. 1965).

The western portion of the EI project area has underlying Quaternary deposits while the eastern portion is underlain by Tertiary sedimentary rocks. Miocene basin deposits including the Thumb, Horse Spring, and Muddy Creek formations occur on the lower slopes of the north, south, and east sides of Frenchman Mountain and at the base of the River Mountains (Longwell et al. 1965). The Thumb and Horse Spring formations occur under the Valley and are comprised of siltstone, sandstone, conglomerate, freshwater limestone, gypsum beds, and lava flows. The Miocene and Pliocene Muddy Creek Formation and overlying younger deposits are generally thought to comprise the Valley-fill sediments.

The Muddy Creek Formation is overlain by up to 1,000 ft (305 m) of Tertiary and Quaternary basin fill deposits in the Valley. These fill deposits of gravel, sand, silt, clay, and conglomerates contain abundant carbonate clasts, and consist of coarse-grained deposits, fine-grained deposits, and thin interbedded coarse- and fine-grained deposits. Coarse-grained deposits generally occur on alluvial fans and pediments near the Valley margins and along the Las Vegas Wash (Longwell et al. 1965).

3.8.2.2 Faults and Seismicity

The current level of seismicity in southern Nevada is relatively low compared to more active parts of the Basin and Range Province (Rogers et al. 1991, Harmsen 1991). There have been no major earthquakes (greater than 6.0 magnitude) in the vicinity of Las Vegas since at least 1852. The record of seismicity in southern Nevada is dominated by small earthquakes (less than 4.0 magnitude) that generally occur in two areas: in the vicinity of the Nevada Test Site, which suggests the seismographs were recording nuclear explosions; and in the Lake Mead area, which may be related to strain release in the crust after the Lake was filled (Rogers et al. 1991, Rogers and Lee 1976).

Active faults in the Basin and Range physiographic province are categorized as follows:

- Holocene Active Fault, a fault that has moved within the last 10,000 years;
- Late Quaternary Active Fault, a fault that has moved within the last 130,000 years; and
- Quaternary Active Fault, a fault that has moved within the last 1,600,000 years (Nevada Earthquake Safety Council 1998).

The proposed EI alignment crosses several Late Quaternary Active Faults (Figure 3.8-1). A large fault zone (Sunrise-Frenchman-River Mountain) is located on the west side of the Frenchman Mountain in the Rainbow Gardens area (Longwell, et al. 1965, Bell and Smith 1980). This fault zone begins to split and form splays (divergent smaller faults) as it nears the Las Vegas Wash (Converse Consultants 2002). One such southeast trending splay was observed near the Las Vegas Wash crossing (Converse Consultants 2002). A second fault (Las Vegas Wash Fault) runs east/west perpendicular to the Sunrise-Frenchman-River Mountain Fault near the south bank of the Las Vegas Wash. The Las Vegas Shear Zone Fault is a strike slip fault located parallel to and west of the Sunrise-Frenchman-River Mountain Fault (Bell and Smith 1980). A strike slip fault is a type of fault that moves parallel to the alignment of the fault surface and the fault blocks move sideways or past each other. The Cashman-Whitney Mesa Fault is located parallel to the proposed EI alignment along Hollywood Boulevard.

Figure 3.8-2 shows the faults in the vicinity of the LCS portion of the project area. A major fault zone (Lake Mead Fault Zone) runs in a northeast/southwest direction in the Boulder Basin (Black & Veatch 2004a). Other smaller unnamed faults are located along the west side of the Boulder Basin (USGS 1978).

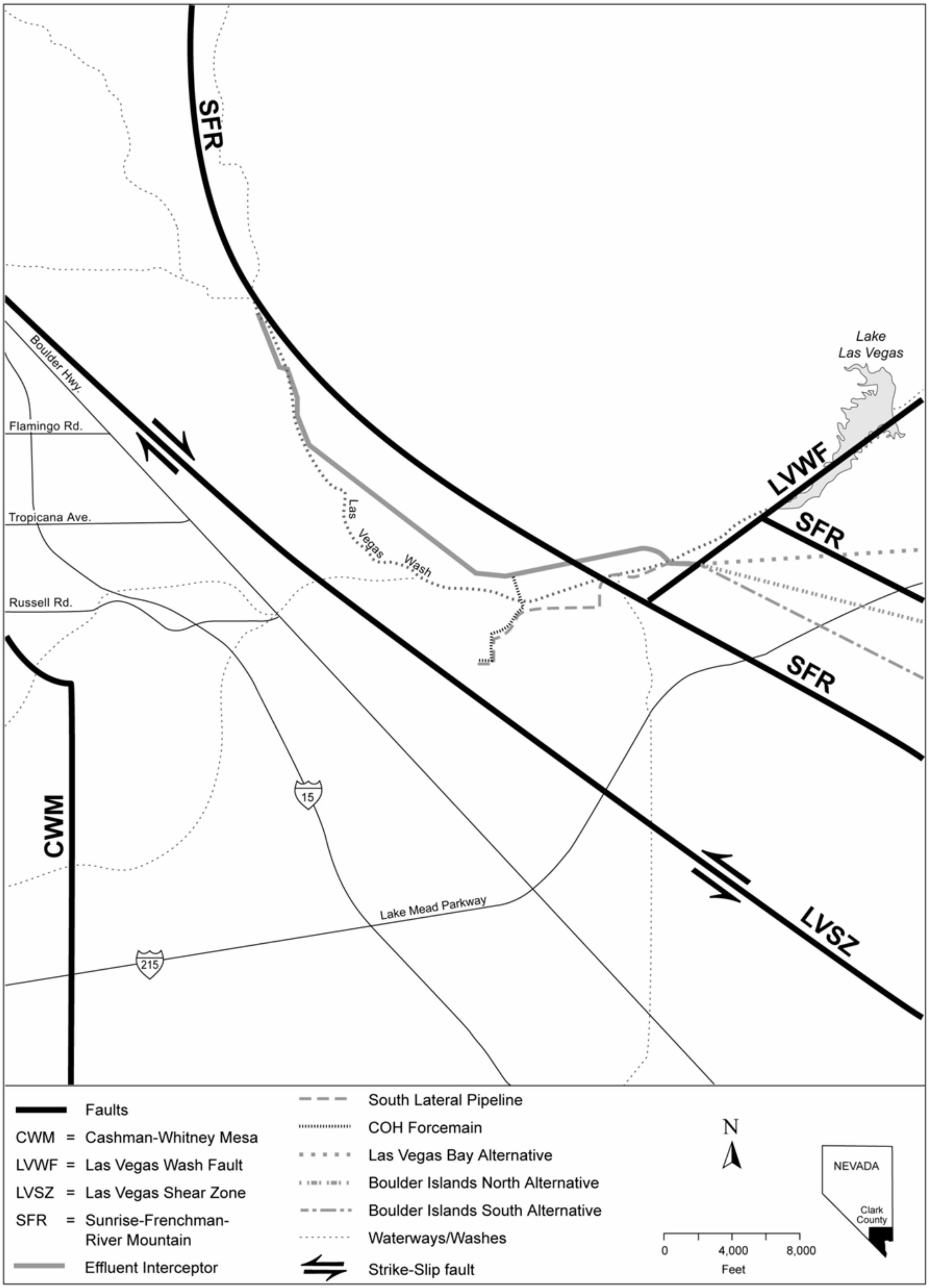

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Figure 3.8-1 Faults in the Vicinity of the Effluent Interceptor.

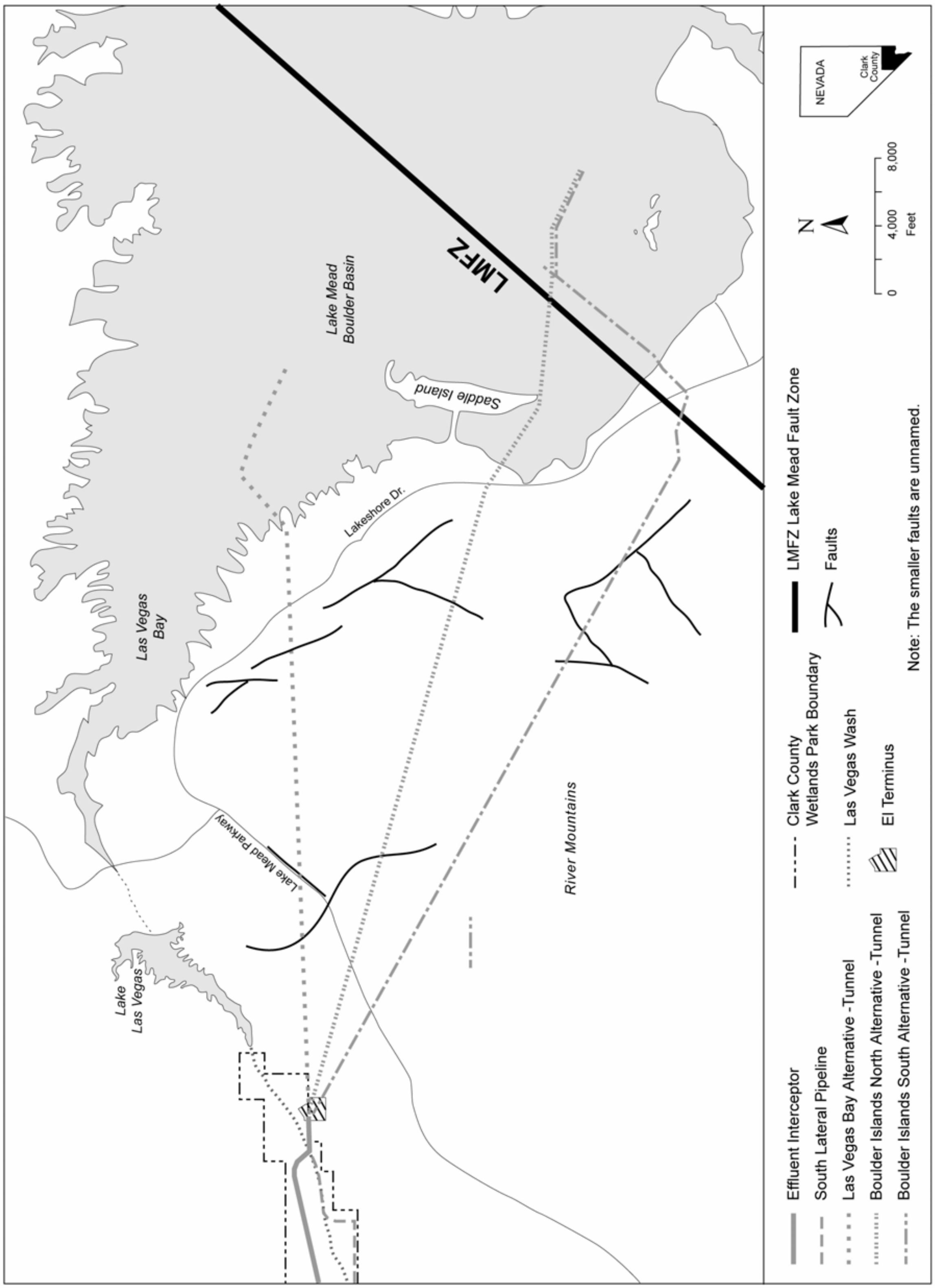

Figure 3.8-2 Faults in the Vicinity of the Lake Conveyance System.

The project site is located within Seismic Zone 2B as defined in the *Uniform Building Code* (International Conference of Building Officials 1997). Zone 2B represents a low to moderately active seismic area and is defined as an area with moderate damage potential. The potential for damage from seismic activity becomes more severe in Zones 3 and 4. Current design practices require all proposed facilities in southern Nevada to be built to Seismic Zone 4 standards.

3.8.2.3 Minerals

Potential mineral resources within the Valley include sand, gravel, gypsum, copper, gas/oil, and manganese. The primary mineral resources along the EI alignment are sand and gravel. These materials are used as construction and building materials in southern Nevada and southern California. There are two gravel pits within the Wetlands Park boundary (Reclamation et al. 1998). A small pit is located on the east side of the Las Vegas Wash across from the eastern extension of Flamingo Road. A second, larger gravel pit is located east of the Henderson rapid infiltration basins.

Gypsum deposits are abundant in the Valley, and several have been mined. However, no gypsum deposits are currently being mined in the project area.

The project area is classified by the BLM (1998) as having a moderate potential for development of oil and gas. Numerous oil and gas wells were drilled in the Valley, but none have become producers and most wells are now abandoned (Longwell et al. 1965, Garside et al. 1988). There are no active leases on federal lands in the project area listed in the DOI's land status database.

Southern Nevada contains no known favorable locations for development of geothermal energy (BLM 1998). A water temperature of 145°F (63°C) (the hottest water in Clark County) occurs at Black Canyon Springs near Hoover Dam. Commercial development requires temperatures of at least 194°F (90°C). Higher temperatures of not less than 350°F (177°C) are needed for direct application uses (such as power generation). The low temperatures of waters in southern Nevada preclude their use as a geothermal energy source, except for small-scale uses (BLM 1998).

Within the project area there are no active mining claims filed under the Mining Act of 1872 listed in the DOI's land status database.

3.8.3 Subsidence

Land subsidence is caused by the compaction of aquifer systems that are subject to overdraft conditions. Overdraft occurs when more water is pumped from an aquifer than is recharged. Subsidence results when the water-bearing layers no longer contain groundwater and compress downward, resulting in a lowered ground level elevation at the area subsidence has occurred. Subsidence has occurred to a degree at various locations in the Valley as groundwater overdraft has occurred (Amelung et al. 1999).

Subsidence has been limited in the project vicinity because of its location at the lower end of the regional drainage basin. Groundwater levels are relatively high in this area.

3.8.4 Soils

The U.S. Department of Agriculture Soil Conservation Service (SCS) (1985) has mapped the soils in the EI project area but not in the LCS project area. Quaternary deposits in the area consist of poorly sorted, unconsolidated to cemented gravel and sandy gravel on alluvial fans, and fine sand along the Las Vegas Wash. Sand along the Las Vegas Wash is less than 10-ft (3-m) thick, and coarse-grained deposits on alluvial fans and pediments are generally less than 30-ft (9-m) thick. The Muddy Creek Formation includes clayey silt and silty clay; interbedded gravel, sand, silt, and clay; fanglomerates; and fine sandstone, siltstone, and clay (Longwell et al. 1965). Most of the soils in the project area can be generally described as having a permeability ranging from moderately slow to moderately rapid, low to moderate shrink-swell potential, a slight to moderate potential for water erosion, and a moderate to high potential for wind erosion.

3.9 Land Use

This section details land ownership, existing land-use, land use plans, and planned land-use within the proposed project area and vicinity. The study area for land-use includes the land traversed by the proposed alignment alternatives and the lands adjacent to the proposed alignments (Figure 1.1-1).

Land use in the study area was analyzed using data and information from field surveys, planning documents, and communication with relevant planning departments. Information considered includes land ownership, existing land use, land use plans, and mining claims. There are no prime or unique farmlands within the project area.

3.9.1 Land Ownership

The proposed pipeline alignments would traverse lands owned by Reclamation, BLM, NPS, Clark County, CLV, COH, and private entities (Figure 1.1-2). Portions of the EI alignment would be located within the Wetlands Park boundary. Clark County Parks and Community Services own some of the land within the Wetlands Park and leases a portion of the land from Reclamation. The CLV WPCF is located on land owned by the CLV. The CCWRD CP and AWT are located on lands owned by Clark County and lands patented under the Recreation and Public Purposes Act from the BLM. The COH WRF is located on land owned by the COH.

The majority of the proposed LCS alignments are located within the LMNRA, which is managed by the NPS. The western portion of the LCS traverses land managed by Reclamation, BLM, and land owned by the COH and private entities (Figure 1.1-2).

3.9.2 Existing Land Use

The information about existing land use is separated into two subsections, the EI and the LCS.

3.9.2.1 Effluent Interceptor and Ancillary Facilities

No commercial or agriculture land uses currently exist in the vicinity of the proposed EI alignment. A portion of the EI alignment traverses the 2,900-acre (1,174-hectare) Wetlands Park. Existing land uses within the Wetlands Park include undeveloped land and recreation. The Wetlands Park currently has a 130-acre (52-hectare) Nature Preserve, a Visitor and Education Center, and pedestrian and equestrian trail systems.

Residential communities in the vicinity of the EI alignment include Rose Garden Estates, South Valley Ranch, Calico Ridge, John Laing Homes, Tuscany Hills, Weston Hills, and Lake Las Vegas. The location of these residential communities is shown on Figure 3.6-1.

Public facilities within the project area include the CLV WPCF, the CCWRD CP and AWT, and the COH WRF (Figure 1.1-2). The CLV WPCF is located at the north end of the EI alignment. The CCWRD CP and AWT is located to the east and west of the Las Vegas Wash near Flamingo Road and Hollywood Boulevard. The COH WRF is located to the south of the Wetlands Park.

Major road ROWs in the vicinity of the proposed EI alignment include Desert Inn Road, Flamingo Road, Vegas Valley Drive, Hollywood Boulevard, Pabco Road, Lake Mead Parkway, Lake Las Vegas Parkway, and Northshore Road (Figure 2.2-5). Additional information regarding roads is presented in Section 3.13.

Utilities within the proposed EI alignment area include drinking-water main and distribution lines, natural-gas distribution lines, electric-power distribution lines, and sewer lines (Figure 3.9-1).

Several flood control facilities exist along the Las Vegas Wash within the project area. The majority of these facilities are SNWA erosion control and bank protection structures, which are described further in Section 3.1.1.

There are no active mining claims along the EI alignment or within the EI Terminus site (Kennedy/Jenks et al. 2003).

3.9.2.2 Lake Conveyance System

The eastern segment of the LCS would be located on lands owned or managed by Reclamation or BLM. The majority of the LCS would be located within the LMNRA, which is managed by the NPS.

No industrial or agriculture land uses currently exist in the vicinity of the proposed LCS alignment. Existing land uses within the LCS project area include:

- Undeveloped land,
- Recreation,
- Tourist/Commercial,
- Public facility,
- Public ROW, and
- Utilities (Figure 3.9-1).

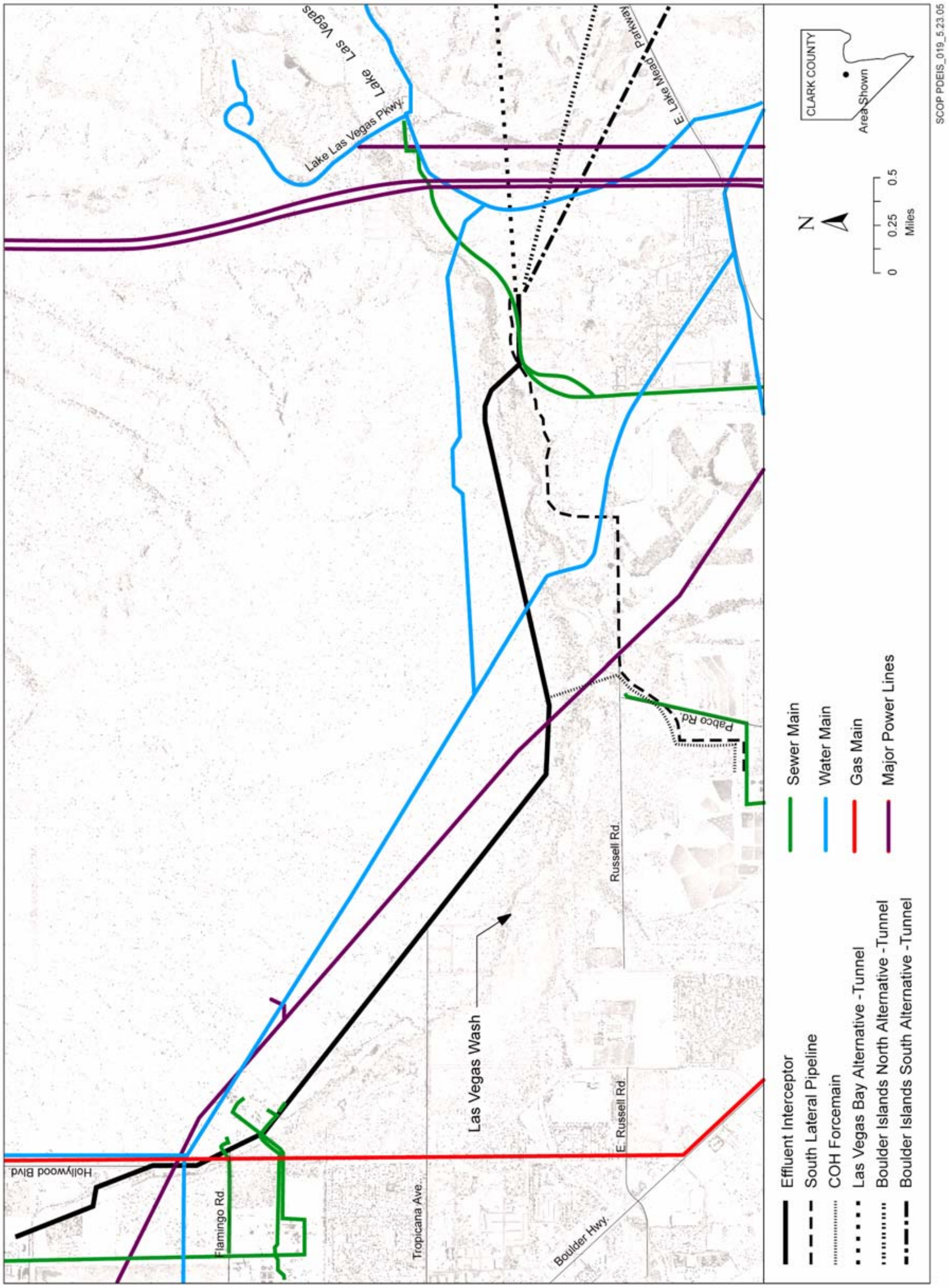

Figure 3.9-1 Effluent Interceptor, Utilities, and Rights-of-way.

Recreational uses include, but are not limited to, water activities, hiking, camping, and auto touring. Tourist/commercial areas include concessions such as food service, general stores, and boat/auto fuel at the Lake Mead Marina and Las Vegas Bay Marina. Lodging is offered at the Lake Mead Resort and campgrounds at Las Vegas Bay and Boulder Beach. Recreational vehicle campgrounds with hook-ups, laundry, and showers are located at the Lakeshore Trailer Village. Section 3.4 discusses recreational areas in further detail.

Boulder Beach is open to motor vehicles from 6:00 a.m. to 10:00 p.m. from Memorial Day weekend through Labor Day weekend, and from 6:00 a.m. to dusk from Labor Day weekend to Memorial Day weekend. It is open to pedestrian use 24 hours a day.

Hoover Dam is located to the east and southeast of the LCS project area. The dam was constructed for the purposes of flood control, improvement of navigation and regulation of the Colorado River, storage and delivery of Colorado River waters for public use, and hydroelectric power production. Hoover Dam is a regional tourist attraction, which provides tours, a visitor center, educational presentations/exhibits, and concessions.

Public facilities in the vicinity of the LCS project area include the SNWA AMSWTF and the drinking-supply intake structures located at Saddle Island (Figure 3.9-2). Utilities within the project area include water distribution lines, natural-gas distribution lines, electric-power distribution lines, and sewer lines (Figure 3.9-2).

Major roads in the vicinity of the proposed LCS alignment include Lake Mead Parkway, Lake Las Vegas Parkway, Northshore Road, and Lakeshore Drive. Additional information regarding roads is presented in Section 3.13.

The proposed project area is in the Gold Butte or St. Thomas mining district. The BLM has declared that certain lands in this district are not available for appropriation under the Mining Law of 1872 (30 USC 22-24, 26-30, 29-30, 33-35, 37, 39-42, 47). Lands within the proposed project area are designated for mineral segregation (Figure 3.9-3) (Kennedy/Jenks Consultants and Tri State Surveying 2003).

The CCWRD AWT Plant is located on land that has recently been patented (Patent No 27-80-001) to Clark County. The BLM withheld mineral rights from that patent.

The Three Kids mining area consists of patented mining claims. According to the Nevada Division of Minerals, this property is not being actively mined, and the land is for sale (Lombardo 2004).

3.9.3 Land Use Planning

Land-use Plans relevant to the project include the:

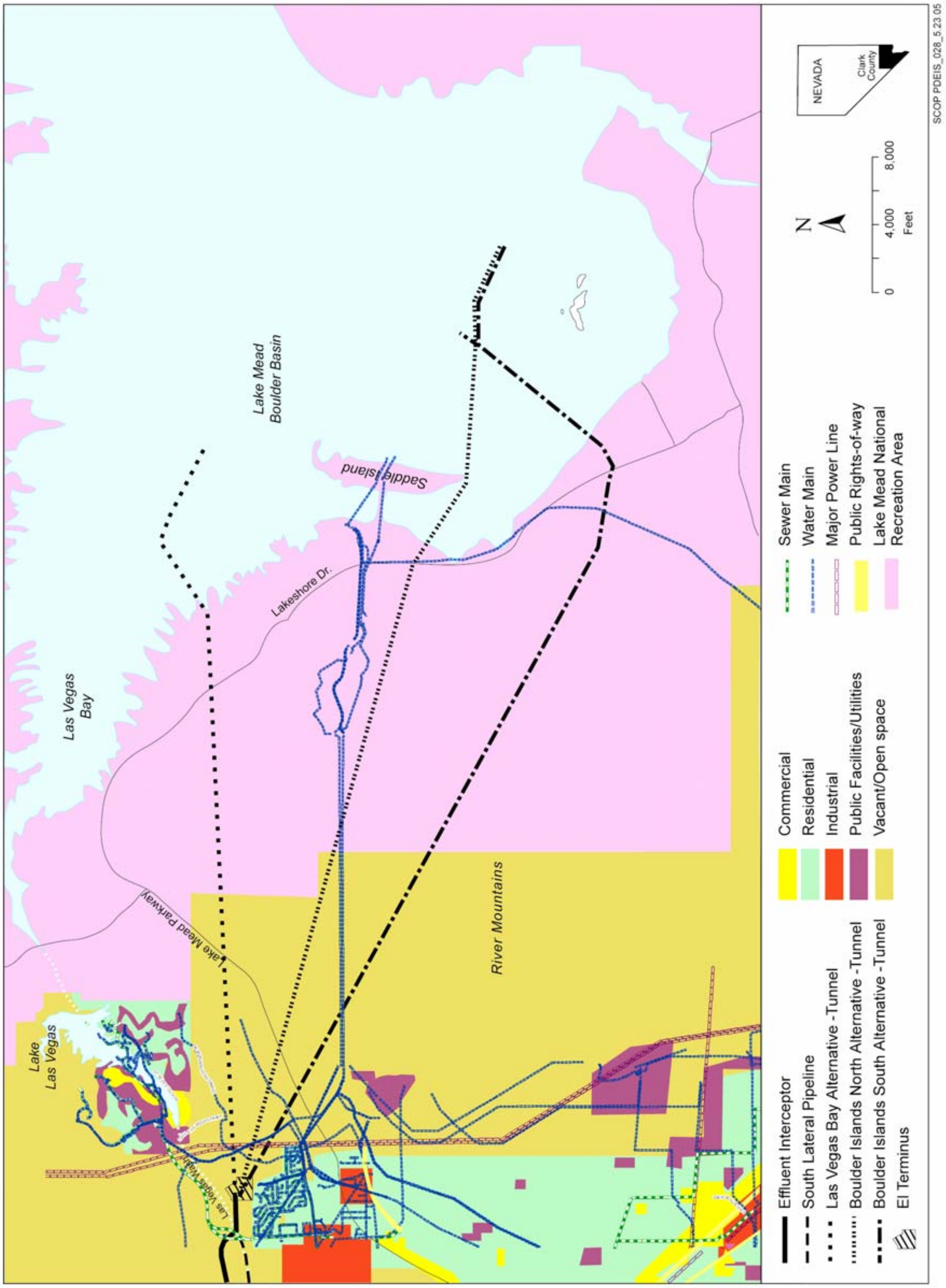

Figure 3.9-2 Existing Land Use, Utilities, and Rights-of-way in the vicinity of the Proposed Lake Conveyance System Alignments.

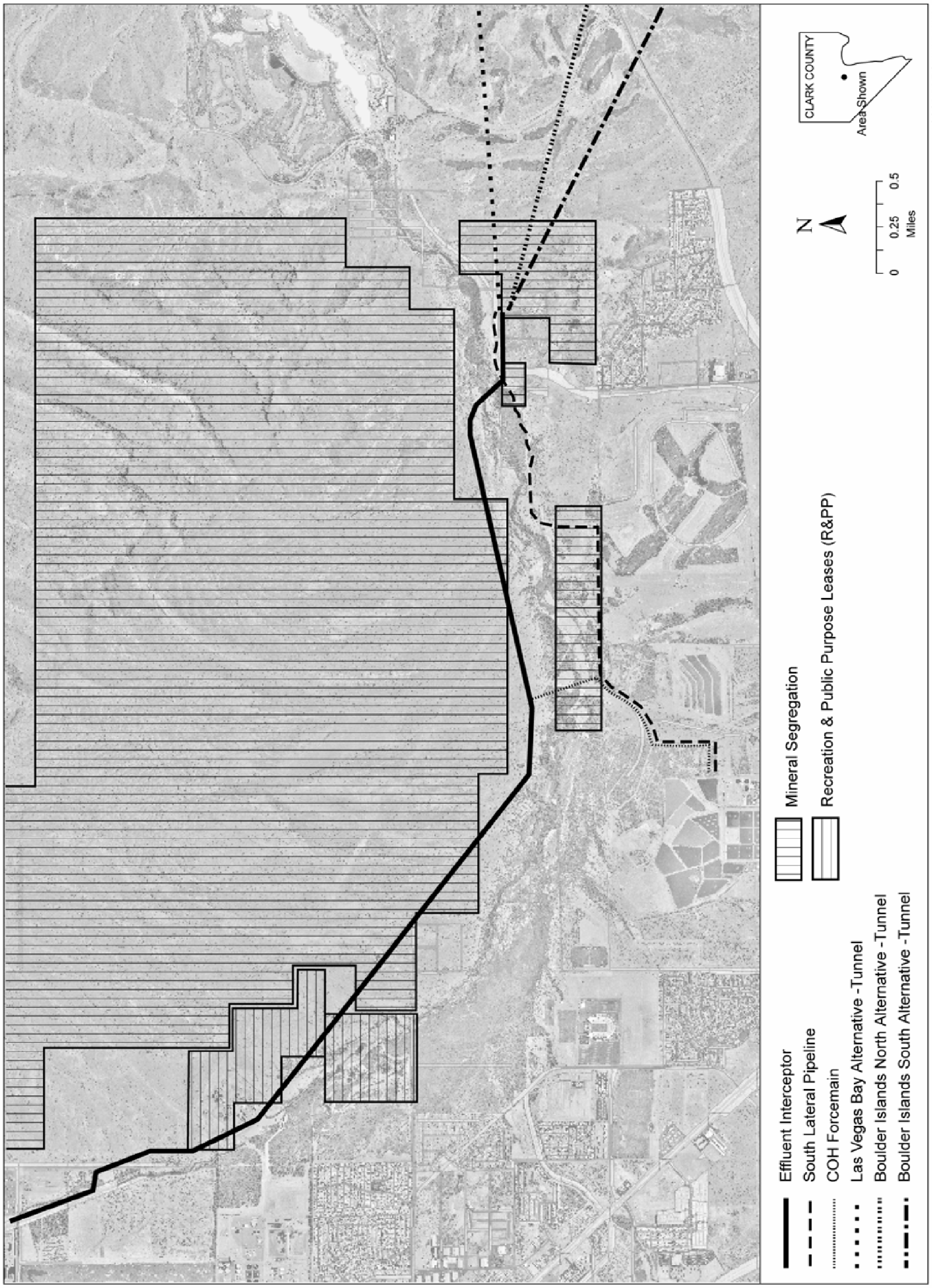

Figure 3.9-3 Lands Designated for Mineral Segregation and R&PP Leases.

- *Clark County Comprehensive Master Plan,*
- *Sunrise Manor Land Use Plan,*
- *Whitney Land Use Plan,*
- *City of Henderson Comprehensive Plan,*
- *Las Vegas Resource Management Plan and Final Environmental Impact Statement, and*
- *Lake Mead National Recreation Area General Management Plan 1986 and 2002 Lake Management Plan and Final Environmental Impact Statement.*

Clark County Comprehensive Master Plan. The *Clark County Comprehensive Plan* (Clark County 1983) applies to Clark County. However, individual plans for planning communities such as unincorporated towns and incorporated cities within Clark County were created as guidance for land-use planning and decision making specific to those areas (Sunrise Manor and Whitney).

Sunrise Manor Land Use Plan. The *Sunrise Manor Land Use Plan* (Clark County 1999) covers a planning area of 40 square miles (104 square km) (25,600 acres [10,360 hectares]) in the eastern part of the Valley. However, only the extreme northern portion of the EI (north of Desert Inn Road including the CLV WPCF connection) is located within this planning area. Planned land use within the Sunrise Manor planning area in the vicinity of the project is business park/industrial. This land-use plan is contained within the *Clark County Comprehensive Master Plan*.

Whitney Land Use Plan. The *Whitney Land Use Plan* (Clark County 2000b) covers a planning area of 36 square miles (93 square km) (23,240 acres [9,405 hectares]) in the southeastern part of the Valley. This area includes the BLM SMA, the lower Las Vegas Wash, and the Wetlands Park. The majority of the EI project is within this planning area. Planned land use within the EI project area includes open land, rural estates, parks/public facilities, and public lands management areas.

City of Henderson Comprehensive Plan. A section within the *City of Henderson Comprehensive Plan* addresses land use. The *City of Henderson Comprehensive Plan* covers 96 square miles (249 square km) (61,440 acres [24,864 hectares]) of land in the southeast portion of the Valley. The South Lateral Pipeline alignment is located within the COH Pittman Neighborhood Planning Area (COH 2002a). The planned Tuscany Hills residential/golf course development is depicted as the Tuscany Hills Redevelopment Area in the *City of Henderson Future Development Plan*, which is located to the south of the project area (COH 2002b). Another master planned community in Henderson within the EI project area is Calico Ridge (COH 2002c). Planned land use within the project area includes business/industry, public/semi-public, and low and medium residential.

Lake Mead National Recreation Area General Management Plan 1986 and 2002 Lake Management Plan and Final Environmental Impact Statement (NPS 1986, 2002). The 1986 *General Management Plan* established a development zone within the Boulder Basin Zone, which includes the Las Vegas Bay and Boulder Beach areas. The 2002 *Lake Management Plan* designated the Boulder Basin Zone as an urban park setting, which is characterized by paved roads, campgrounds with hookups, commercial facilities, a high level of boating and water activity, intense visitor use, artificial lighting, motorized vessels and automobile traffic, highly modified landscape, and full emergency services.

3.9.4 Zoning

Zoning classifications within the project area are designated by Clark County, the COH, and the NPS depending on the jurisdiction. Zoning designations are intended to implement the policies of a land use plan within a specific planning area such as those discussed in Section 3.9.3. Zoning classifications define the use or development standards of a parcel of land to be compatible with the surrounding and planned land use.

Clark County zoning within the EI project area is characterized by low and very low density residential and public facility use designations (Clark County 2002). Land within the LCS project area is primarily zoned for very low density residential and other appropriate uses of the vast areas of rural land.

The COH zoning designations in the vicinity of the project include low and medium density residential, public/semipublic use, and a small portion of mixed commercial (COH 2002c). A portion of the project area within the COH maintains a base, or original zoning classification called general industrial. This classification serves to protect existing industrial sites and allow for continued operation of existing general industry, manufacturing, extraction, salvage, and related activities. However, these land-use areas are subject to requirements that minimize potential environmental impacts.

The NPS-planned land-use designations for the LMNRA are described in the 1986 *General Management Plan* and 2002 *Lake Mead National Recreation Area Lake Management Plan and Final Environmental Impact Statement* and discussed in Section 3.9.3.

3.10 Visual Resources

The visual resources evaluation for this project is being conducted in accordance with the objectives and methods described in the BLM *Visual Resource Management (VRM) Guidelines* (BLM 1986a) and the BLM *Manual Handbook* - *Visual Resource Contrast Rating* (BLM 1986b). The objective of the VRM Guidelines is to manage federal lands in a manner that would protect the quality of the scenic or visual values of those lands.

The BLM VRM guidelines were used for visual resource assessment because Reclamation and the NPS do not have any formalized guidance procedures for assessing visual resources. The visual resource inventory process provides Reclamation and NPS managers with a means for determining visual values.

The baseline inventory consists of the evaluation of the scenic quality, sensitivity level, and delineation of distance zones. Based on these three factors, federally administered lands are placed into one of four visual resource inventory classes. Classes I and II are the most valued, Class III represents a moderate value, and Class IV is of least value. Appendix H, Visual Resources, provides a description of the evaluation factors and visual resource inventory classes.

A discussion of the methodology used to classify the existing visual resources in the area of the proposed project and the results of the classification are also presented in Appendix H.

A total of 12 key observation points (KOPs) were established throughout the study area (Figure 3.10-1). These KOPs were selected based on three factors:

(1) the major, potentially sensitive, viewer groups that may be affected by the action under study; (2) the types of planned improvements that would have varied visual impact consequences; and (3) the orientation of the viewers toward the project areas. The visual characteristics in the vicinity of the proposed EI alignment are different than those in the vicinity of the LCS. Therefore, the existing visual resources for the EI and the LCS are discussed in separate subsections.

3.10.1 Effluent Interceptor

An analysis of the scenic quality, sensitivity level, and distance zone delineations was completed for each segment of each EI alignment that has not been previously assigned a VRM classification by the BLM. The scenic quality rating for the EI and EI Terminus is category C, low scenic quality. Generally, the sensitivity level in the areas of the EI and ancillary facilities is low. However, the Wetlands Park and Rainbow Garden/Lava Butte Roads have a medium sensitivity. The viewing areas along the EI are mostly within the foreground-middleground (F/M) distance zones from travel routes or observation points. Based on the analysis of the scenic quality, sensitivity level, and distance zones, all of the EI segments and ancillary facilities' settings were designated as Class IV.

The area is generally characterized by a flat basin with rugged mountain ranges to the east and north of the Las Vegas Wash. Ground surface elevations along the EI alignment range from about 1,690 ft (515 m) above msl at Desert Inn Road to about 1,490 ft (454 m) above msl near the EI Terminus. The Las Vegas Wash, which runs north to south, turns to the southeast at approximately the middle of the Reach 2 alignment, and eventually flows into Lake Mead.

3.10.1.1 Reach 1

The terrain along Reach 1 of the EI is scarred with unpaved maintenance roads and construction activities for residential housing on both sides of the Las Vegas Wash. Reach 1 has been cleared of most vegetation and is being developed for John Laing Homes and Woodside Homes residential housing. Remaining vegetation exists sporadically between existing unpaved roads and disturbed areas, and is dominated by tamarisk. The Las Vegas Wash has a constant flow of water that meanders in a southeast direction. Visually, this area appears drab, limited in contrast with a minimal variety of vegetative shades of green, gray, and brown.

The adjacent scenery consists of wastewater treatment plants, development, poorly maintained and unpaved roads, and illegally dumped trash and debris. The horizon to the north is overshadowed by the relatively undisturbed Frenchman Mountain, which moderately enhances the overall visual experience of the area.

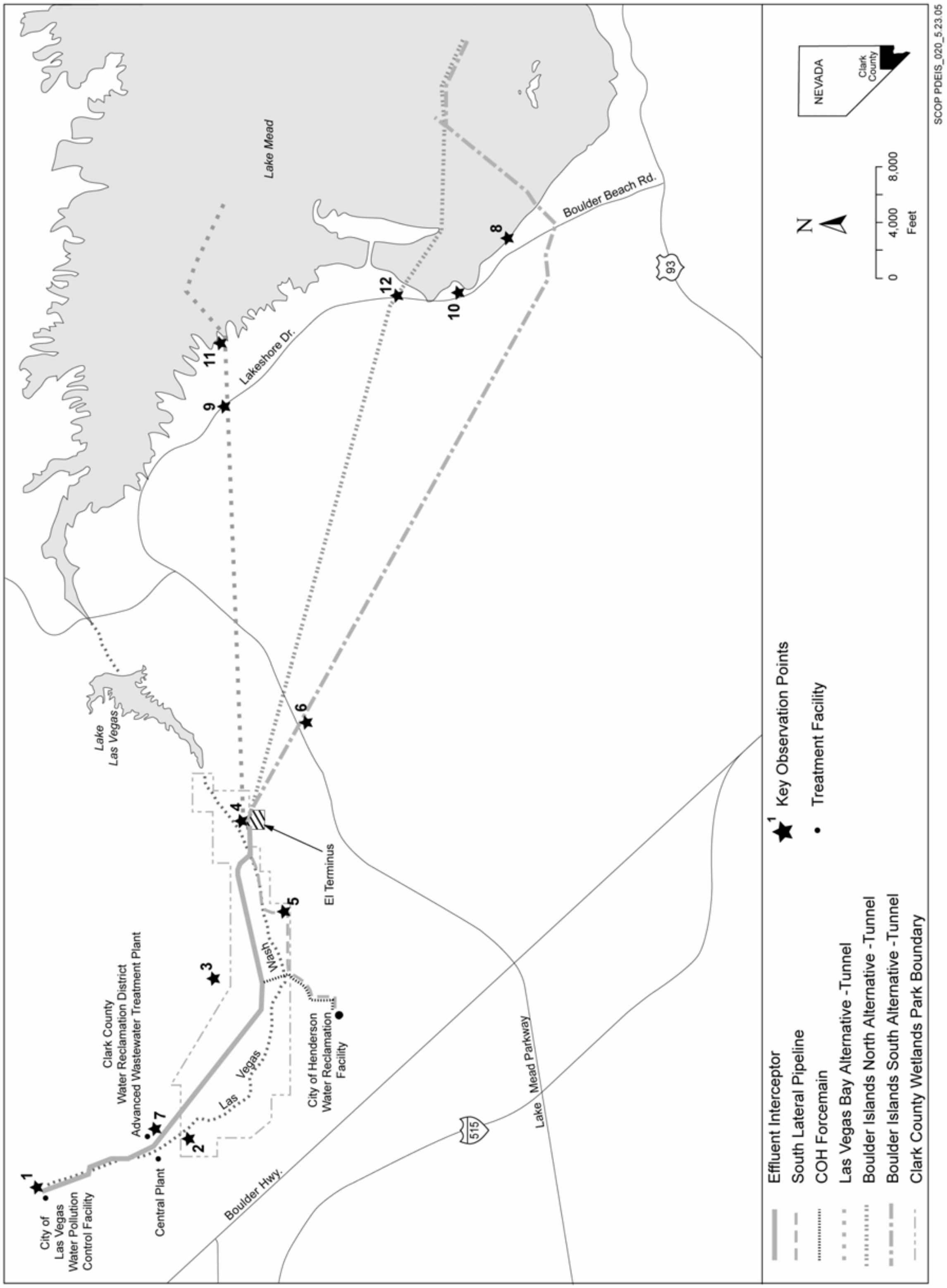

Figure 3.10-1 Key Observation Points.

3.10.1.2 Reach 2

Reach 2 is scarred with unpaved maintenance roads on both sides of the Las Vegas Wash. Reach 2 of the alignment is within the ROW of Telephone Line Road, which is a two-lane paved access road north of the Las Vegas Wash that is in poor condition. An historic utility line that runs in a southeastern direction is located along the northern side of Telephone Line Road. The area includes unpaved roads and illegally dumped trash and debris. The topography along the cross-country portion of EI-Alignment B Reach 2 consists of rolling hills with sparse vegetation containing several species of Mojave Desert scrub including creosote bush, four-wing saltbush, desert holly (*Atriplex hymenelytra*), and shadscale (*Atriplex confertifolia*). The vegetation is brownish grey, blends in with the soil, and does not distinctly stand out against the mountain range in the background.

The Las Vegas Wash is located south of the EI alignments in Reach 2. The Las Vegas Wash is lined with a variety of vegetation, including but not limited to, cattail, cottonwood, mesquite, tamarisk, and the common reed. The vegetation of the Las Vegas Wash adds the only line of color variety to the surrounding Mojave Desert scrub landscape.

3.10.1.3 Reach 3

The terrain along Reach 3 is very similar to the southern portion of Reach 2. The area includes unpaved roads and illegally dumped trash and debris. The topography in this area consists of rolling hills with sparse vegetation located throughout the landscape. The Las Vegas Wash in the vicinity of Reach 3 is approximately 300-ft (91-m) wide and 50- to 60-ft (15- to 18-m) deep. The stream banks of the Las Vegas Wash in this area are heavily eroded due to the velocity of runoff during storm events. High flows during storm events have created islands of vegetation and patches of reeds within the Las Vegas Wash. The thicker vegetation adds a variety of different heights and shades of green and brown to the banks of the Las Vegas Wash and is conspicuous against the surrounding brownish-gray landscape. The upland vegetation is brownish grey, blends in with the soil, and does not distinctly stand out against Rainbow Gardens, which is located in the background to the north of the Reach 3 alignment.

3.10.1.4 South Lateral Pipeline and COH Forcemain

The majority of the South Lateral Pipeline and COH Forcemain follow existing paved and unpaved roads and ROW. Surrounding vegetation is dispersed in clumps along the side of the road. Chain-link property boundary fences meander through the vegetation on both sides of the road. In addition, trash and debris is scattered throughout this area.

The Las Vegas Wash and Wetlands Park are located to the north and west of the South Lateral Pipeline. A small portion of the pipeline would follow a proposed walking trail within the Wetlands Park. Vegetation along this portion of the proposed alignment consists mainly of cattails, tamarisk, and common reed. The vegetation provides variety in green colors to the surrounding brownish-gray terrain. The surrounding landscape consists of small rolling hills and washes. Visually, the majority of this area appears drab and limited in contrast, with a minimal variety of vegetative shades of green, gray, and brown.

Much of the area proposed for the South Lateral Pipeline and COH Forcemain is on previously disturbed land. The color variety is minimal and consists mainly of shades of brown. In the area where the C-1 Channel converges with the Las Vegas Wash, the brown shades are divided by a meandering line of gray-green vegetation. The C-1 Channel area is basically a concrete channel. The calico colored hills to the east provide a colorful panoramic view and add texture to the overall sparsely vegetated area.

3.10.1.5 EI Terminus Site

This area is highly disturbed from both vegetation removal and numerous dirt roads. These roads are used mainly by maintenance/construction crews for access to the Las Vegas Wash and flood control facilities. Visually, this area appears drab and limited in contrast, with a minimal variety of vegetative shades of green, gray, and brown. Large rocks from previous earth-moving activities and adjacent man-made slopes characterize the area, and vegetation is sparse. Man-made slopes are prominent to the west, south, and east. The Las Vegas Wash is located to the north, where tamarisk is the dominant species. Small portions of the Lake Las Vegas development can be seen from the EI Terminus site. Large power lines influence the line of vision to the east. The area is surrounded by steep slopes, which add variety to the overall line of sight; however, disturbed land dominates the panoramic view.

3.10.2 Lake Conveyance System

The NPS is congressionally directed to not allow LMNRA resources and values to be impaired. Actions that create impacts to LMNRA may be allowed when necessary and consistent with NPS policy, applicable regulations, and resource objectives.

The proposed LCS alignment includes three alignment alternatives, with discharge in the vicinity of the Boulder Islands or the Las Vegas Bay. Each of the alternatives has a unique location, shape, and function. The visual quality of the three alternatives is described in general terms. For the purposes of the visual analysis, the sites of the proposed alternatives are defined as separate areas to potentially be affected by construction and operation of the LCS and the ancillary facilities (Figure 3.10-1).

Generally, except for the area along Lake Mead Parkway, the LCS alternatives are of a high scenic quality. There is a high degree of sensitivity in the vicinity of the three proposed alternatives with the exception of the Lake Mead Parkway thoroughfare. Views from the designated KOPs are within the F/M distance zones from travel routes or observation points. Based on the analysis of the scenic quality, sensitivity level, and distance zones, the LCS area, except for KOP #6 – Lake Mead Parkway, was designated as Class II.

3.10.2.1 Boulder Islands North Alternative

The terrain along the Boulder Islands North alternative varies from rolling hills to mountains to bajadas to washes, ending at the Lake Mead shoreline. Vegetation exists sporadically and is typical of a Mojave desert scrub environment. The vegetation is dominated by several species including creosote bush, four-wing saltbush, desert holly, and shadscale.

The area from the EI Terminus to Lake Mead Parkway provides views of rolling hills and a background of the River Mountains to the east. This portion of the Boulder Islands North Alternative offers limited distance views because of the closeness of the River Mountains. The dominant color scheme is gray-green and is typical of the Mojave desert scrub environment.

The area where the NRMT3-East working shaft would be located near Lakeshore Drive provides views of rolling hills and a background of the River Mountains to the east. This portion of the Boulder Islands North Alternative offers panoramic views of the River Mountains to the east and Lake Mead to the west and south from Lakeshore Drive. The AMSWTP dominates the view to the northeast. The dominant color scheme is gray-green broken by the blue-green of Lake Mead.

The area as seen from Lake Mead, provides panoramic views of the east side of the River Mountains. The dominant color scheme is gray-green and is typical of the Mojave desert scrub environment. The adjacent scenery consists of rolling hills and washes, sloping toward Lake Mead. The horizon to the north is dominated by views of Lake Mead, which provides a focal point in the area. The Boulder Islands are to the east of Boulder Beach, and are visually dominated by gray rock. The high-water mark surrounding Lake Mead provides a focal point of a white horizontal line around the Lake.

3.10.2.2 Boulder Islands South Alternative

The scenic quality and conditions in the vicinity of the Boulder Islands South Alternative are the same as those described for the Boulder Islands North Alternative as described in Section 3.10.2.1, except for the view at Lakeshore Drive. This alternative would not include the NRMT3-East working shaft at Lakeshore Drive.

3.10.2.3 Las Vegas Bay Alternative

The terrain along the Las Vegas Bay alignment includes rolling hills and washes, ending at the Las Vegas Bay and delta. Vegetation exists sporadically and is dominated by several species of Mojave Desert scrub.

The area from the EI Terminus to Lake Mead Parkway provides views of rolling hills and a background of the River Mountains to the east. This portion of the Las Vegas Bay Alternative offers limited distance views because of the closeness of the River Mountains. The dominant color scheme is gray-green and is typical of the Mojave desert scrub environment.

The area as seen from the Las Vegas Bay overlook at Lake Mead, provides panoramic views of distant mountains. The foreground scenery consists of rolling hills and washes sloping toward Lake Mead. The horizon to the north and east is dominated by views of Lake Mead, which provides a focal point and adds a blue gray color to the otherwise brown/gray background. Las Vegas Wash and delta are to the west of Las Vegas Bay, and are visually dominated by sediment deposits. The dominant colors are gray and brown. Generally, the line of sight from the overlook is flat with background mountain views.

3.11 Socioeconomics

Socioeconomic data and information are provided at two geographic levels for the purposes of this analysis: the Project Region and the Study Area. Each is defined differently in this section than in other sections of this document.

The Project Region includes the Las Vegas Metropolitan Statistical Area (MSA) (which includes all of Clark County, Nevada, and Mohave County, Arizona) as well as the CLV, COH, City of Boulder City, and the unincorporated Town of Whitney (all located in Clark County, Nevada). The Project Region provides a broad perspective for the region within which the proposed project occurs.

The Study Area covers 64 square miles (166 square km) or approximately 40,960 acres (16,576 hectares) and comprises the area within a 1-mile (2-km) buffer that surrounds the perimeter of the proposed project alternatives. It is located mostly within unincorporated areas of Clark County southeast of the CLV, and west and northwest of Lake Mead, and includes portions of the unincorporated Town of Whitney, the COH, and a small portion of Boulder City. Also, portions of the Study Area occur within the LMNRA, where there is little permanent population. Mohave County, Arizona makes up a very small portion of the Study Area at its extreme southeastern edge. Therefore, very little analysis, if any, is dedicated to Mohave County, Arizona in this section. The Study Area boundary is shown in Figure 3.11-1, along with the year 2000 U.S. Census Bureau (USBOC) census tracts that overlap the Study Area either partially or fully.

Socioeconomic data was collected primarily through government resources, information available through the Internet, and telephone interviews with government personnel.

3.11.1 Employment and Economy

The employment, industry, and earnings data presented in this section were obtained from the U.S. Bureau of Economic Analysis (BEA): *Form CA25, CA25N Total full-time and part-time employment* and *Form CA05 and CA05N Personal income by major source and earnings by industry* (BEA 2004). Forms CA25N and CA05N use the North American Industry Classification (NAICS), and forms CA25 and CA05 use the Standard Industrial Classification (SIC) system. The SIC classification system is an organizational system that identifies business establishments by the principal activity in which they are engaged. The NAICS system, like the SIC system, uses a coding system that classifies industries by the principal activity in which they are engaged and is used in the U.S., Canada, and Mexico. Because the industry categories used in the NAICS and SIC systems are slightly different, it is difficult to make direct comparisons concerning industry changes overtime in terms of the number of employees, the number of establishments, and earnings.

Table 3.11-1 provides the Economic Census data by industrial sector for Clark County from 1990 to 2002. The data show the number of employees and the annual payroll by industry for Clark County. Appendix I provides information on per industry number of employees, establishments, and annual payroll for 1993, 1997, and 2000.

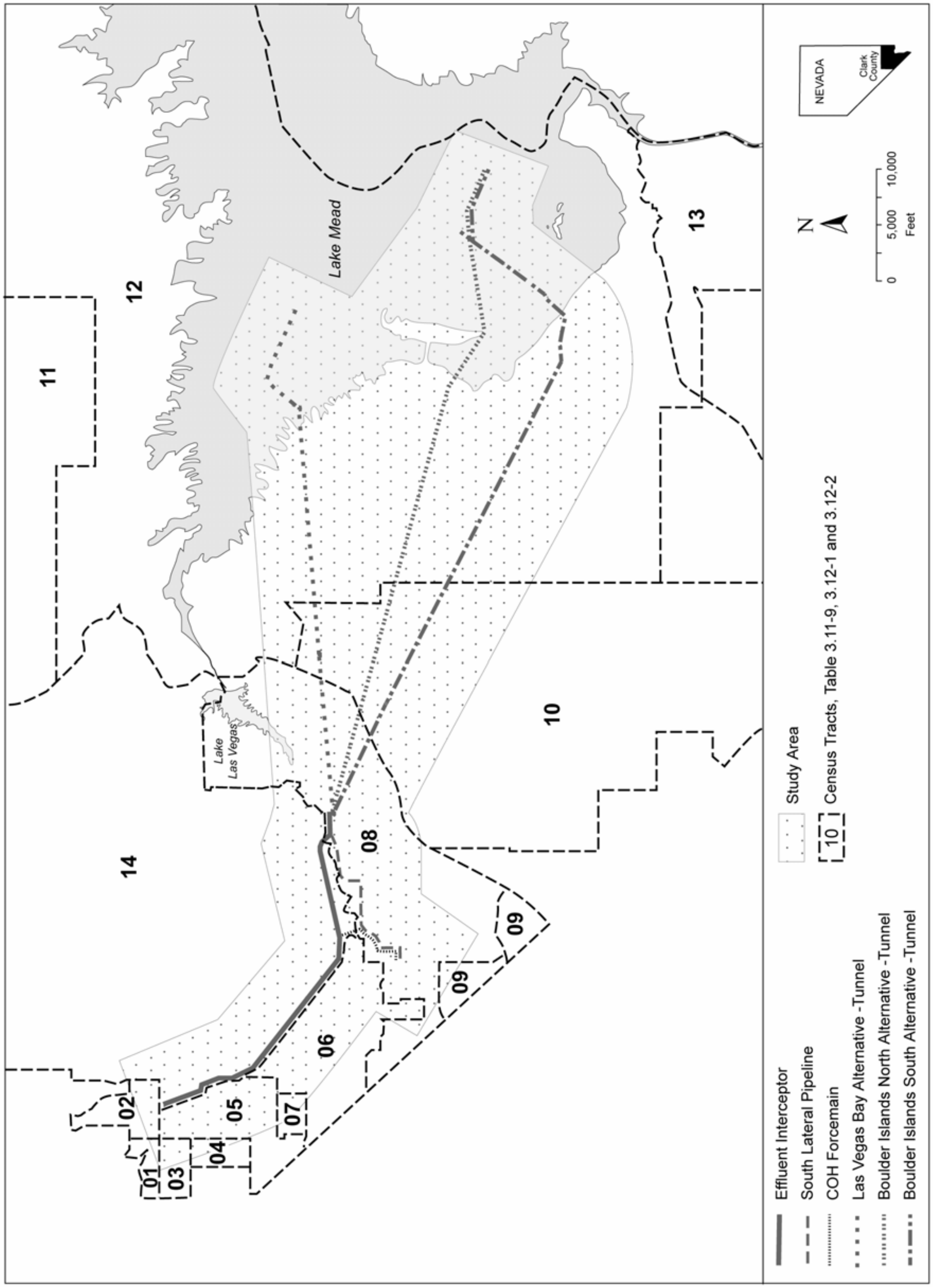

Figure 3.11-1 Socioeconomic Study Area and Census Tracts.

Table 3.11-1 Employment and Earnings by Industry in Clark County, Nevada, 1990 – 2002.

Industry Sector	1990 Number of Employees	2002 Number of Employees	Percent of Change	1990 Earnings by Industry (in $1,000)	2002 Earnings by Industry (in $1,000)	Percent of Change
Agricultural, forestry and other	3,915	289	-93	$65,163	$4,131	-94
Mining	832	1,256	51	$11,726	$46,174	294
Construction	40,525	79,061	95	$1,401,817	$4,038,243	188
Manufacturing	11,711	22,695	94	$357,842	$1,101,393	208
Transportation/Public Utilities	21,095	31,873	51	$713,699	$1,366,685	91
Wholesale trade	14,360	23,376	63	$469,277	$1,283,363	173
Retail trade	72,492	95,243	31	$1,222,319	$2,750,867	125
Finance, insurance and real estate	32,451	106,239	227	$509,672	$3,965,281	678
Services	210,796	444,509	111	$5,434,079	$15,857,134	192
Government	50,783	85,978	69	$1,831,088	$4,713,624	157
Total	**458,960**	**890,519**	**94**	**$12,016,682**	**$35,126,895**	**192**

Source: BEA 2004.

The service industry (which includes hotels, gaming, and food services) had the greatest number of employees and was highest in earnings in 2002. The Las Vegas service industry is dominated by the gaming/hotel industry, which is the single-largest attraction for tourists to the Las Vegas metropolitan area. There were approximately 35 million visitors to the Las Vegas metropolitan area in 2002, and there was approximately $7.6 billion in gross gaming revenue generated (UNLV 2003a).

The Lake Mead recreational industry (which includes boating, food services, boat storage, marina services, and other recreational activities) generates approximately $500 million annually with an additional $45 million in gross revenues generated by Lake Mead concessionaires (Turner 2004).

Starting in 2001, the NAICS system added the information industry to its employment categories. This has been incorporated into the finance, insurance, and real estate category for purposes of this report. As stated earlier, the industry categories used in the NAICS and SIC systems are slightly different, and this difference partially accounts for the large increase in the finance category.

New job growth within the Las Vegas MSA was relatively steady from 1990 to 2003, adding an average of 29,500 new jobs per year, or an average annual growth rate of 6.3 percent. Growth in Clark County was also relatively steady from 1990 to 2003, adding an average of 26,800 new jobs per year, or an average annual increase of 6.5 percent. In the State of Nevada, during the same 13-year period, the labor force increased from approximately 667,000 employees to 1,113,200 employees, or a 66.9 percent increase. New job growth in Nevada was also relatively steady from 1990 to 2003, adding an average of 31,900 new jobs per year, or an average annual increase of 4.8 percent (UNLV 2003b).

Table 3.11-2 provides labor force and unemployment data for the Las Vegas MSA, Clark County, the State of Nevada, and the U.S. as a whole, from 1990 to 2003. As defined by the USBOC, employment and unemployment are identified as all civilians 16 years old and over who are currently employed or actively looking for work. Excluded from the employed are people whose only activity consisted of work around the house or unpaid volunteer work for religious, charitable, and similar organizations. Labor force, as defined by the USBOC, includes all people classified in the civilian labor force, plus members of the U.S. Armed Forces that are on active duty. The labor force consists of people classified as either unemployed or employed.

The Las Vegas MSA and Clark County had very similar rates of unemployment from 1990 to 2003 (Table 3.11-2), with the Las Vegas MSA recording slightly higher rates than Clark County in 8 of the 13 years. The highest unemployment rate in the Las Vegas MSA during the 13-year period occurred in 1993 when unemployment reached 7.2 percent, and the lowest unemployment rate occurred in 1997 when it was 4.1 percent. Generally, unemployment in the Las Vegas MSA was equal to or higher than that of the State of Nevada (11 out of 13 years), but no clear trend emerged when compared to the national average unemployment rate.

Unemployment in Clark County was highest in 1993, at 7.1 percent, and it reached its low point in 2000, when it was 4.1 percent. Generally, unemployment rates in Clark County were either lower than or equal to the State of Nevada rates (10 out of 13 years), and were usually lower than or equal to the national average unemployment rates (10 out of 13 years).

Table 3.11-3 lists the 20 largest employers in Clark County in 2003. The largest single employer in Clark County is the Clark County School District with more than 20,000 employees. But, by far, the largest group of employers in Clark County was gaming/hotel companies along the Las Vegas Strip. In 2003, 13 of the top 20 employers in Clark County were hotel and casino companies, employing a combined total of between 55,000 and 63,988 workers, which represented approximately 10.4 percent of the total Clark County workforce.

Table 3.11-2 Labor Force and Unemployment Las Vegas MSA, Clark County, and State of Nevada, 1990 – 2003.

Year	Las Vegas MSA		Clark County, NV		State of Nevada		United States
	Total Labor Force (in 1,000s)	Un-employment Rate (Percent)	Total Labor Force (in 1,000s)	Un-employment Rate (Percent)	Total Labor Force (in 1,000s)	Un-employment Rate (Percent)	Un-employment Rate
1990	468.7	4.7	414.7	4.7	667.0	4.9	5.6
1991	491.4	5.7	437.1	5.6	693.0	5.5	6.8
1992	507.3	6.8	450.7	6.6	715.0	6.6	7.5
1993	530.3	7.2	470.1	7.1	739.0	7.2	6.9
1994	572.4	6.4	507.3	6.1	779.5	6.2	6.1
1995	597.1	5.5	525.2	5.4	802.3	5.4	5.6
1996	630.9	5.5	557.4	5.3	839.9	5.4	5.4
1997	665.3	4.1	593.3	4.0	882.5	4.1	4.9
1998	697.6	4.2	624.2	4.2	919.9	4.3	4.5
1999	727.3	4.4	650.0	4.4	941.6	4.4	4.2
2000	767.7	4.2	688.5	4.1	986.1	4.1	4.0
2001	803.1	5.5	719.9	5.5	1023.5	5.3	4.8
2002	886.1	5.7	794.5	5.7	1121.7	5.5	5.8
2003	882.1	5.3	789.5	5.3	1113.2	5.2	5.7

Source: State of Nevada 2003, Bureau of Labor Statistics 2004.

3.11.2 Population

Table 3.11-4 shows population trends for the region's cities, the Las Vegas MSA, Clark County, and the State of Nevada. Clark County, NV was the fastest growing county in the U.S. during the 1990s. The Las Vegas MSA includes all of Clark County and the westernmost portion of Mohave County, Arizona. The three most populous cities in Clark County -- Las Vegas, North Las Vegas, and Henderson -- have grown tremendously from 1990 to 2003.

The State's high population growth reflects the fact that Clark County's population made up 71 percent of the State's population in 2003. Clark County's population growth during the 1990s far outpaced the national average of 13.2 percent (USBOC 1990, 2000a).

Primary causes of the recent population surge is an influx of new residents moving to the Las Vegas metropolitan area to take advantage of increased economic opportunity, relatively low housing costs, a relatively low cost of living, outdoor recreation possibilities, and a warm, dry climate. Booming employment in the construction, hotel/casino, public schools, government, and services industries provides an incentive for new residents to the Las Vegas metropolitan area.

Table 3.11-3 Twenty Largest Employers, Clark County, Nevada, 2003.

Ranking	Employer Name	Number of Employees
1	Clark County School District	20,000 +
2	Clark County	8,000-8,899
3	Bellagio Hotel and Casino	7,000-7,999
4	MGM Grand Hotel	7,000-7,999
5	Mandalay Bay Resort & Casino	6,000-6,999
6	Mirage Hotel & Casino	5,000-5,999
7	State of Nevada	4,000-4,999
8	Caesar's Palace Hotel & Casino	4,000-4,999
9	Las Vegas Metropolitan Police Department	4,000-4,999
10	UNLV	4,000-4,999
11	Rio Suite Hotel & Casino	4,000-4,499
12	Luxor Hotel & Casino	3,000-3,999
13	University Medical Center	3,000-3,999
14	Bally's & Paris Casino Hotels	3,000-3,999
15	Treasure Island	3,000-3,999
16	Excalibur Hotel & Casino	3,000-3,999
17	Flamingo Hilton Corporation	3,000-3,999
18	Circus Circus Hotel & Casino	3,000-3,999
19	City of Las Vegas	3,000-3,999
20	Harrah's Las Vegas	3,000-3,999

Source: Clark County 2003e.

The average annual growth rate is predicted to increase 2.7 percent in Clark County and 2.3 percent in the State from 2000 to 2020.

3.11.3 Urban Growth and Housing

Housing in Clark County, NV is concentrated almost entirely in the Las Vegas metropolitan area, in the cities of Las Vegas, North Las Vegas, Henderson, Boulder City, and the unincorporated areas in the Valley.

Table 3.11-4 Project Region Historic Population Trends, 1990 – 2003.

Place	Population			Percent Change	
	1990	2000	2003	1990-00	2000-2003
City of Boulder, NV	12,760	14,906	14,394	17%	0.2%
City of Henderson, NV	69,390	179,144	217,448	158%	21%
Town of Whitney,[1] NV	N/A	15,683	20,640	N/A	32%
City of North Las Vegas, NV	50,030	117,650	146,005	135%	24%
City of Las Vegas, NV	268,330	482,389	528,617	80%	10%
Las Vegas, NV/AZ MSA	741,459	1,563,282	N/A	111%	N/A
Study Area Census Tracts	N/A	57,615	N/A	N/A	N/A
Clark County, NV	770,280	1,394,440	1,620,478	81%	16%
State of Nevada	1,236,130	2,023,378	2,296,566	64%	14%

Note:
[1] Estimates began in 1996.
Source: NV State Demographer 2004.

In Clark County, the number of new homes bought in 2002 was 22,502 while there were 38,621 homes resold. The median price of a new home in Clark County was $239,145 in May 2004, which represents an increase of 19 percent from 2003. The median resale price for a home in Clark County was $230,000 in May 2004, which was 41 percent higher than in 2003 (UNLV 2004). Even with the rise in housing costs, the average home price is very affordable compared to the Los Angeles metropolitan area, where a majority of new residents originate. The median monthly rent for an apartment in Clark County was $747 in 2004 (UNLV 2004).

Table 3.11-5 provides housing characteristics for the Project Region and the Study Area. Within the Project Region, Boulder City had the highest rate of owner-occupied housing units (76.2 percent); Las Vegas had the lowest (59.1 percent). The percentage of owner-occupied housing units in the Las Vegas MSA, Clark County, and the State of Nevada were all slightly lower than the national average, which is 66.2 percent.

On average, the study area census tracts recorded a percentage of owner-occupied housing units (at 74.6 percent) that was consistent with rates in Boulder City and Henderson, but substantially higher than Las Vegas, the town of Whitney, the Las Vegas MSA, Clark County, and the State of Nevada. Study area census tracts that recorded unusually low percentages of owner-occupied housing units included Clark County tracts 50.08, 49.11, and 50.06. The majority of the study area census tracts had unusually high percentages of owner-occupied housing units.

Table 3.11-5 Project Region and Study Area Housing Characteristics, 2000 [1].

Place/Study Area Census Tracts (Refer to Figure 3.11-1)	Number of Occupied Household Units	Owner Occupied Units	Percent Owner Occupied Units	Renter Occupied Units	Percent Renter Occupied Units
Clark County, NV Census Tracts					
49.11 (01)	1,359	637	46.9	722	53.1
49.22 (02)	1,492	1,422	95.3	70	4.7
50.06 (03)	1,988	983	49.4	1,005	50.6
50.07 (04)	155	145	93.5	10	6.5
50.08 (05)	1,335	594	44.5	741	55.5
50.09 (06)	1,548	1,370	88.5	178	11.5
50.12 (07)	1,121	1,048	93.5	73	6.5
54.11 (08)	1,900	1,573	82.8	327	17.2
54.31 (09)	1,465	1,352	92.3	113	7.7
55.01 (10)	2,116	1,864	88.1	252	11.9
56.13 (11)	1,383	1,070	77.4	313	22.6
61.01 (12)	651	625	96.0	26	4.0
Mohave County, AZ Census Tract					
95.04 (13)	2,143	1,913	89.3	230	10.7
Total/Average of Census Tracts	22,156	16,537	74.6	5,619	25.4
Project Region					
Boulder City, NV	6,385	4,863	76.2	1,522	23.8
Henderson, NV	66,541	46,948	70.6	19,593	29.4
Las Vegas, NV	176,848	104,514	59.1	72,334	40.9
Town of Whitney, NV	6,922	4,468	64.5	2,454	35.5
Las Vegas, NV/AZ MSA	588,371	359,233	61.1	229,138	38.9
Clark County, NV	512,253	302,842	59.1	209,411	40.9
State of Nevada	751,165	457,245	60.9	293,920	39.1

Note:

[1] Latest data available at the census tract level.

Source: USBOC 2000a.

Most new building permits (94 percent each year) were for single-family homes, and the number of permits increased each year. Home valuation for single-family homes increased from $801 million in 1999 to $1,453 million in 2003. The total number of residential building permits increased from 7,470 in 1999 to 11,824 in 2003 (Clark County 2003b).

3.11.4 Schools

The Clark County School District is the only school district in the County. It was ranked as the sixth largest school district in the U.S. for the school year 2003-2004 and is one of the fastest growing districts. Enrollment increased by 50 percent from the 1996-1997 school year to the 2003-2004 school year. Enrollment has been growing by approximately 5 percent per year and is projected to continue at that rate through the 2006-2007 school year. A typical year of growth planning for the school district includes 14,000 new students, 12 to 14 new schools, 2,300 new teachers, 100 new buses, and 560 portable classrooms. For the 2004-2005 school year there are seven new elementary schools, three middle schools, and three high schools scheduled to open (Clark County School District 2003).

3.11.5 Government Taxation and Revenue

In Clark County the sales and use tax is 7.5 percent. This 7.5 percent tax is several taxes combined, based on Nevada's Statutes and locally adopted option taxes. All counties in Nevada charge a 6.5 percent tax, as follows: Sales Tax-General Fund (2.00 percent), Local School Support Tax (2.25 percent), Basic City-Council Relief Tax (0.50 percent), and Supplemental City-County Relief Tax (1.75 percent). Clark County charges an additional 1 percent tax: Public Mass Transportation and Construction of Roads (0.50 percent), Control of Floods (0.25 percent), and Infrastructure (0.25 percent) (Nevada Department of Taxation 2003).

Clark County receives the local-option infrastructure tax back from the State of Nevada, and allocates this funding primarily to water and wastewater projects. The CCWRD is allocated the wastewater portion of this funding, and will use these funds (in part) to finance the proposed project (King 2003).

Sales tax is charged at retail on the sale of tangible personal property unless exempt by statute. There is no sales tax on food items used for home consumption or prescribed medical goods (Nevada Department of Taxation 2003). Gasoline is taxed at 23 cents per gallon and diesel fuel is taxed at 27 cents per gallon. There is also a motor vehicle tax in which the valuation of the vehicle is determined at 35 percent of the manufacturer's suggested retail price, without accessories (Nevada Development Authority 2003). There are five principle types of gaming taxes. Gross gaming revenue tax, taxable tax, and slot taxes are levied by the state. The counties levy the county table tax. There are no corporate or personal income taxes in Nevada (Nevada Development Authority 2003).

Nevada's constitutional limit on property tax is $5 per $100 of assessed valuation while the statutory limit is $3.64 per $100. Assessment is at 35 percent of taxable value, and the tax rate is applied to the assessed value. The tax rate for 2003-2004 in the City of Las Vegas is $3.2877 per

$100 of assessed value (Clark County 2003c). The taxable value for real property (land) is full cash value. The Assessor is required by Nevada law to physically reappraise all property at least once every 5 years.

Table 3.11-6 provides property tax information for tax jurisdictions that are within the study area. Within the study area, during the 2003-2004 fiscal year, the tax per $100 of property value is between $2.4571 and $2.9342. Also, the net assessed value and the property taxes collected for the 2003 tax year are provided for each property tax jurisdiction.

Table 3.11-6 Study Area Tax Jurisdictions.

Tax District Number and Name (Tax Districts Located within the Detailed Study Area)	2003 - 2004 Tax Rate (dollars per $100 value)	Net Assessed Value 2003-2004	Property Taxes Collected 2003-2004
050 Boulder City Library	$2.4929	$306,259,500	$7,191,088
051 Boulder City Colorado River	$2.4929	$19,119,782	$462,649
060 Boulder City Library	$2.5691	$0	$0
061 Boulder City Library Colorado River	$2.5691	$6,529,676	$172,500
100 Unincorporated Clark County	$2.5013	$37,448,010	$581,227
340 Sunrise Manor	$2.9342	$2,165,968,775	$59,903,302
500 Henderson City	$2.8879	$460,806,958	$12,331,562
505 Henderson Artesian Basin	$2.8897	$4,193,070,897	$112,693,786
507 Henderson Library	$2.9339	$544,229,056	$18,039,030
510 Henderson Library	$2.4571	$3,609,413	$86,316
513 Henderson City Redevelopment	$2.9125	$14,436,247	$280,535
515 Henderson Library Fire	$2.6818	$6,300	$166
550 Whitney Town	$2.9324	$2,905	$78
570 Whitney Artesian Basin	$2.9342	$299,630,238	$8,166,287

Sources: Clark County 2003c, f.

3.12 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), directs federal agencies to determine whether their programs, policies, and activities have disproportionately high and adverse human health or environmental effects on minority and low-income populations.

An environmental justice population is a population group being at least half minority status or at least half low-income status. A minority is defined as Black or African American, Hispanic or Latino, Asian, American Indian and Alaskan Native, Native Hawaiian and other Pacific Islander. The USBOC data was used to assess population groups within the project study area.

3.12.1 Environmental Justice Populations

Census tracts and block data from the USBOC were used to determine the census tracts located within the project area. Census tracts are small, relatively permanent statistical subdivisions of a county and usually have between 2,500 and 8,000 persons. When the census tracts are first delineated, they are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Census tracts do not cross county boundaries. The study area for the proposed project includes 12 census tracts (Figure 3.12-1).

Statistics for the State of Nevada, Clark County, Las Vegas MSA (regional area), and incorporated cities adjacent to the project area have been included in this study for comparison purposes (Table 3.12-1).

On average there is a smaller percentage of ethnic minorities in the study area than in Clark County and the State of Nevada. Census tract 49.11 has the highest percent of minority populations and census tract 55.01 has the lowest. There is however, a wide variety in minority populations among the 12 census tracts. There are no census tracts within the study area that have a minority population of 50 percent or higher.

Although minority populations are found in most census tracts in the study area, the demographic profile of the populations within each census tract is predominantly white (Figure 3.12-1).

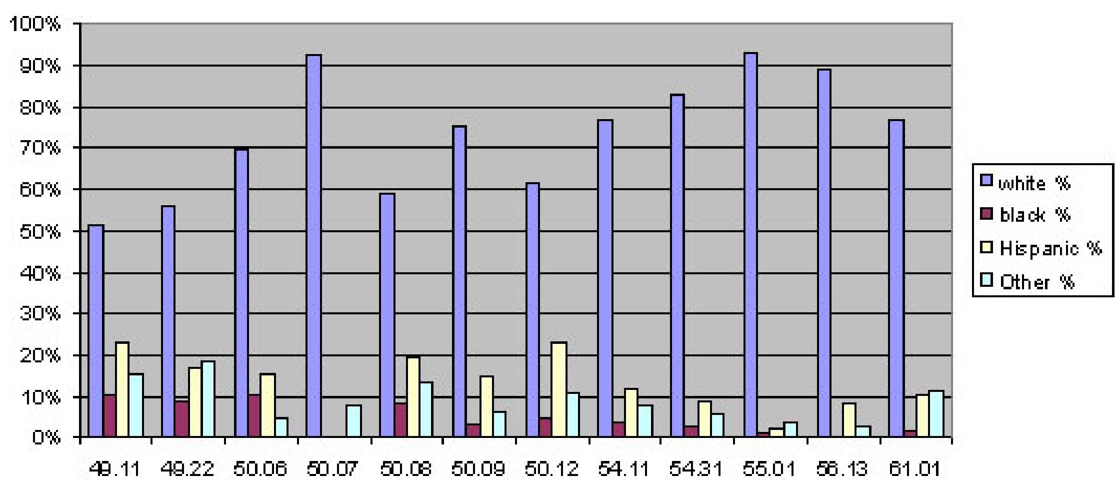

Figure 3.12-1 Population Demographics Census Tracts.

Table 3.12-1 Study Area Ethnic Profile.

Area Census Tracts (Key to Figure 3.11-1)	Population	Percent White	Percent African American	Percent Hispanic	Percent Other
49.11 (01)	3,567	51.6	10.2	22.9	15.3
49.22 (02)	4,973	56.1	8.9	16.8	18.2
50.06 (03)	4,752	69.6	10.3	15.2	4.8
50.07 (04)	327	92.4	0.0	0.0	7.6
50.08 (05)	3,097	59.1	8.1	19.4	13.5
50.09 (06)	3,686	75.5	3.4	14.8	6.3
50.12 (07)	3,080	61.7	4.7	22.8	10.9
54.11 (08)	4,865	76.8	3.7	11.9	7.6
54.31 (10)	4,353	82.7	2.6	8.8	5.9
55.01 (11)	4,365	93.2	0.9	2.4	3.5
56.13 (12)	4,222	88.8	0.3	8.2	2.6
61.01 (14)	1,897	76.8	1.7	10.3	11.3
Total/Aver. of Study Area Census Tracts	43,184	73.7	4.6	12.8	8.0
Project Region					
Boulder City, NV	14,966	92.7	0.4	4.2	2.7
Henderson, NV	176,048	78.0	3.8	10.6	7.6
Las Vegas, NV	478,868	57.9	10.1	23.6	8.4
Whitney, NV	17,731	58.4	6.9	27.0	7.7
Las Vegas, NV/AZ MSA	1,563,282	63.0	7.7	20.6	8.7
Clark County, NV	1,375,765	60.1	8.7	21.9	9.2
State					
Nevada	1,998,257	65.1	6.5	19.7	8.7

Source: USBOC 2000a.

3.12.2 Income and Poverty Levels

The USBOC defines the average poverty threshold for a family of four as a maximum annual income of $18,725 or less for the year 2003 (USBOC 2004). There is a wide range in income and percent of populations living below poverty levels among the 12 census tracts (Table 3.12-2).

On average, the median household income is higher in the study area than in the project region. The percent of populations living below the established poverty level in the census tracts is lower than in Las Vegas, Clark County, and the State of Nevada. The percent of populations living below the established poverty level (Figure 3.12-2) is higher than in Boulder City and Henderson, NV. None of the study area tracts have 50 percent or more of the population living at or below poverty levels.

The proposed project traverses through several areas that contain an extensive variety of populations. Some of the study area census tracts contain higher percentages of minority and low-income populations, but none of the census tracts have at least half minority status or at least half low-income status.

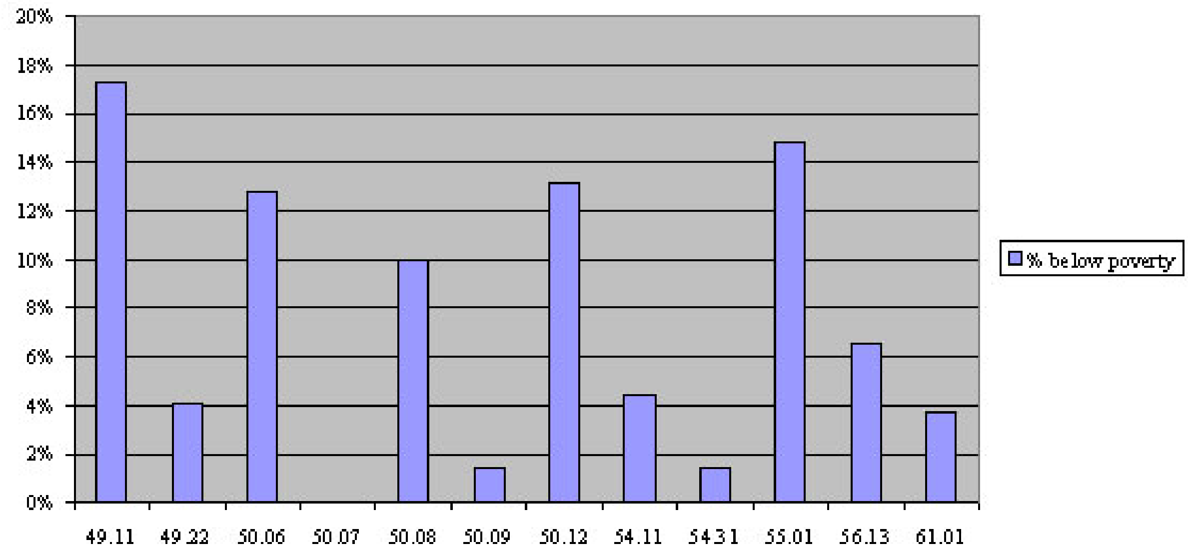

Figure 3.12-2 Percent of Population Below Poverty Census Tracts.

3.13 Traffic

This section describes the existing transportation and traffic conditions within the proposed project areas. Brief descriptions of the highways and roads are presented. Information regarding traffic conditions and levels of service is presented as background to describe the current operating conditions for the roadway segments in the proposed project area.

Table 3.12-2 Income and Poverty Levels State, Region, and Census Tracts.

Area CensusTracts (Key to Figure 3.11-1)	Total Population[1]	Percent Below Poverty (average)	Median Household Income (1999)[2] (average)
49.11 (01)	3,567	17.3	$41,238
49.22 (02)	4,973	4.1	$59,219
50.06 (03)	4,752	12.8	$39,721
50.07 (04)	327	0.0	$79,578
50.08 (05)	3,097	10.0	$32,188
50.09 (06)	3,686	1.4	$41,451
50.12 (07)	3,080	13.1	$51,054
54.11 (08)	4,865	4.4	$55,763
54.31 (10)	4,353	1.4	$66,356
55.01 (11)	4,365	14.8	$47,083
56.13 (12)	4,222	6.5	$45,417
61.01 (14)	1,897	3.7	$89,497
Total of the Study Area Census Tracts	43,184	8.0	$54,047
State of Nevada	1,998,257	10.3	$44,581
Region			
Boulder City, NV	14,966	6.6	$50,523
Henderson, NV	176,048	5.6	$55,949
Las Vegas, NV	478,868	11.7	$44,069
Whitney, NV	17,731	9.7	$36,536
Las Vegas, NV/AZ MSA	1,563,282	10.9	$42,468
Clark County, NV	1,375,765	10.6	$44,616
Average of Region			$53,124

Notes:

1 Population figures from USBOC 2000a.

2 Latest figures available.

Source: USBOC 2000a.

3.13.1 Existing Roadway Network

The roadway network in the study area is primarily located in the outskirts of the Valley. Principal regional highways and local arterials comprise the roadway network in the vicinity of the proposed project.

3.13.1.1 Principal Regional Highways

The following principal regional highways are located within the study area.

3.13.1.1.1 US 93

A major highway, US 93 extends from Hoover Dam northwest through Boulder City and Henderson. The highway crosses through the LMNRA as shown on Figure 2.2-5. Eventually, US 93 turns into US 95/US 515 north of the Railroad Pass interchange. Traffic on US 93 includes all types of recreational vehicles at Lake Mead, commuter vehicles, construction vehicles, and large commercial trucks traveling between Arizona and Nevada.

3.13.1.1.2 Boulder Highway

Boulder Highway, also known as State Route (SR)-582, proceeds northwest from Boulder City, through Henderson, and into Las Vegas. Once within the City of Las Vegas, Boulder Highway becomes a primary route that bisects the City of Las Vegas. In the vicinity of the proposed project, Boulder Highway is a one or two lane road in each direction. Traffic on Boulder Highway consists mainly of commuter vehicles and commercial vehicles traveling to and from work or places of business.

3.13.1.1.3 Lake Mead Parkway

Lake Mead Parkway, also known as SR-146, runs east-west along the southern portion of the Valley through Henderson between US 515 and I-15, and turns into Lakeshore Drive (Figure 2.2-5). In the vicinity of the proposed project, Lake Mead Parkway is a local highway that has a functional classification of principal and minor arterial. The roadway has between two and three travel lanes in each direction and is located south of the proposed project. The majority of the vehicles on Lake Mead Parkway are recreational vehicles traveling to Lake Mead, or construction vehicles going to project sites.

3.13.1.1.4 Lake Mead Boulevard

Lake Mead Boulevard, also known as SR-147, a state highway, runs east-west between North Las Vegas and Lake Mead (Figure 2.2-5). The highway changes direction on the east side of Frenchman Mountain and runs southwest through the LMNRA to the City of Henderson. State Road-147 carries mostly recreational vehicles and has one travel lane in each direction within the proposed project area. State Road-147 turns into SR-146 at US 515.

3.13.1.1.5 Lakeshore Drive

Lakeshore Drive, also known as Boulder Beach Road, is a rural highway that runs north-south along the western shoreline of Lake Mead. The roadway primarily carries recreational vehicles. Lakeshore Drive has one travel lane in each direction.

3.13.1.2 Local Arterials

South Hollywood Boulevard is an open public road that would provide access to the EI portion of the proposed project (Figure 2.2-5). This road is currently unpaved and under construction in association with other project improvements in the area (e.g., Desert Inn Master Planned community), therefore the conditions of the road are expected to improve. Continuing further south along the EI alignment, South Hollywood Boulevard turns into Telephone Line Road just east of the CCWRD AWT. Both roads are open to the public. The majority of the traffic on these roads consists of construction and maintenance vehicles (e.g., trucks and large earth-moving equipment) accessing the Las Vegas Wash and the AWT facility. Minimal residential vehicles use this road.

Other roads north of the proposed EI and perpendicular to Telephone Line Road include Kodachrome Road, Rainbow Gardens Road, and Lava Butte Road. The roads lead into Rainbow Gardens and the SMA. Traffic on these roads is minimal consisting of recreational vehicles.

Roads located south and east of the EI include Lake Las Vegas Parkway, Montelago Boulevard, Pabco Road, and Rebel Road (Figure 2.2-5). Traffic on these roads is mainly construction vehicles.

3.13.2 Level of Service

Perhaps the single most reliable statistic available to guide the highway engineer and the project planners are the type and volume of traffic on each section of highway that may be impacted by the proposed project. The Nevada Department of Transportation (NDOT) collected traffic volumes in short periods (7 days) and calculated to Annual Average Daily Traffic (AADT) at various intersections throughout the Valley (NDOT 2002).

The Level of Service (LOS) is a term that describes the quality of traffic flow. There are six defined LOSs, A through F, which relate to traffic congestion from best to worst, respectively. In general, level A represents free-flow conditions with no congestion or delay. Conversely, level F represents severe congestion with stop-and-go conditions.

Table 3.13-1 summarizes the LOS definitions. These criteria are based upon the *Highway Capacity Manual* (Transportation Research Board [TRB] 1985). Calculating LOS for roadway segments involves the computation of a roadway's supply and demand characteristic. Supply is characterized as the roadway segment's carrying capacity expressed in some unit of time such as vehicles per day. Demand is characterized as the volume of traffic on the roadway segment, also expressed in a unit of time such as vehicles per day.

Once the supply and demand of the roadway segment are determined, the segment's volume to capacity ratio (V/C) is calculated and the LOS for a particular traffic demand is identified. Maximum traffic carrying capacities for typical roadway cross sections would be used for volume to capacity calculations, as shown in Table 3.13-2. Existing LOS conditions for major roadways and intersections, potentially within the proposed project area, are provided in Table 3.13-3. All roadway segments for which traffic data is available currently operate at favorable conditions LOS A, except one. Boulder Highway north of Water Street currently operates at a LOS F (Table 3.13-1).

Table 3.13-1 Level of Service Criteria for Roadway Segments.

Level of Service	Interpretation	Nominal Range of Volume-to-Capacity Ratio
A	Low volumes, primarily free-flow operations. Density is low, and vehicles can freely maneuver within the traffic stream. Drivers can maintain their desired speeds with little or no delay.	0.00 – 0.60
B	Stable flow with potential for some restriction of operating speeds due to traffic conditions. Maneuvering is only slightly restricted. The stopped delays are not bothersome, and drivers are not subject to appreciable tension.	0.61 – 0.70
C	Stable operations, however, the ability to maneuver are more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signed coordination or longer queues cause delays.	0.71 – 0.80
D	Approaching unstable traffic flow, where small increases in volume could cause substantial delays. Most drivers are restricted in their ability to maneuver and in their selection of travel speeds. Comfort and convenience are low but tolerable.	0.81 0.90
E	Operations characterized by significant approach delays and average travel speeds of one-half to one-third the free-flow speed. Flow is unstable and potential for stops of brief duration.	0.91 – 1.00
F	Forced-flow operations with high approach delays at critical signaled intersections. Speeds are reduced substantially, and stops may occur for short or long periods of time because of downstream congestion.	1.01 +

Table 3.13-2 Level of Service E Maximum Traffic-Carrying Capacities.

Facility Cross Section	Daily Capacity (vehicles/day)
2-Lane	15,000
4-Lane	30,000
6-Lane	45,000

Source: TRB 1980.

Table 3.13-3 Existing Roadway Characteristics.

Segment	Volume [1] (vehicles/day)	Capacity [2] (vehicles/day)	Lanes	V/C [3]	Level of Service
Lake Mead Blvd. north of SR-146 (Lake Mead Parkway) and Lakeshore Drive	1,920	15,000	2	0.13	A
Lakeshore Drive north of US 93	2,350	15,000	2	0.10	A
Lakeshore Drive north of Lake Mead Fish Hatchery Road	1,700	15,000	2	0.11	A
US 93 North of Lakeshore Drive	13,300	22,500	3	0.59	A
SR-582 (Boulder Highway) north of Water Street	36,700	30,000	4	1.22	F
Lake Las Vegas Parkway north of SR-146 (Lake Mead Parkway)	3,800	15,000	2	0.25	A
Hollywood Blvd. south of Vegas Valley Drive	1,500	15,000	2	0.10	A

Notes:

[1] Actual volume of traffic.

[2] Roadway capacity.

[3] V/C ratios are calculated based on typical traffic-carrying capacities from the Highway Capacity Manual (TRB 1985) Table 3.13-3.

Sources: NDOT 2002, TRB 1985.

3.14 Paleontological Resources

Paleontological resources (fossils) are the evidence of past life found in the geologic record. This evidence contains the remains or traces of plants and animals that existed during the 600 million year geological history of southern Nevada. Because of the infrequency of fossil preservation, fossils are unique, non-renewable resources that provide clues to the history of life on earth and, as such, have scientific value.

The State of Nevada made statutory provisions for the protection of paleontologic resources in the *State of Nevada Antiquities Law of 1959* (NRS 382-195-227). This statute made the Board of Trustees of the Nevada State Museum responsible for the preservation of prehistoric and historic sites on state lands through the issuance of antiquities permits to qualified persons and institutions.

Section 3.8 provides a description of the geologic formations in the SCOP project area. Areas that have a high potential for containing significant paleontologic resources are designated as high sensitivity areas. The Horse Spring Formation and Muddy Creek Formation were determined to have high paleontologic sensitivity (Figure 3.14-1).

The Horse Spring Formation has been characterized as being poorly fossiliferous (containing fossils). Longwell and others (1965) stated, "(t)he only fossils reported from the Horse Spring Formation in and near Moapa Valley are fragmentary plant stems and leaves." However, certain zones within this formation have documented occurrences of plant fossils and ichnites (fossilized animal trackways) near the SCOP project area.

The Muddy Creek Formation has long been recognized as having high paleontologic sensitivity. Vertebrate fossils of extinct Miocene (23.3 million years before present), and Pliocene (5.2 million years before present) taxa including camels, rhinoceroses, horses, and smaller animals such as amphibians and reptiles, have been previously reported. Ichnites are also known to occur in the Muddy Creek Formation. Although fossils recovered from this formation are occasionally locally abundant, when found they often consist of isolated and poorly-diagnostic remains. "Diagnostic" refers to the usefulness of the fossil with regard to obtaining information of scientific worth. Therefore, while the Muddy Creek Formation is fossiliferous, and consequently assigned high paleontologic sensitivity, diagnostic fossils are infrequent at best; only occasionally are localized concentrations of diagnostic fossils found (San Bernardino County Museum [SBCM] 2004).

Field surveys were conducted by SBCM from September 2003 through February 2004 at areas in the Valley. One previously unrecorded paleontologic resource locality was identified from the Horse Spring Formation. The location of the site was recorded using handheld GPS transceivers, and the presence of the fossils was documented in field notes that included preliminary field identifications. The locality data for this site has been entered into the Regional Paleontologic Locality Inventory at the SBCM. In accordance with the survey permit requirements no fossils were collected. There were no paleotological resources found in the Muddy Creek Formation (SBCM 2004).

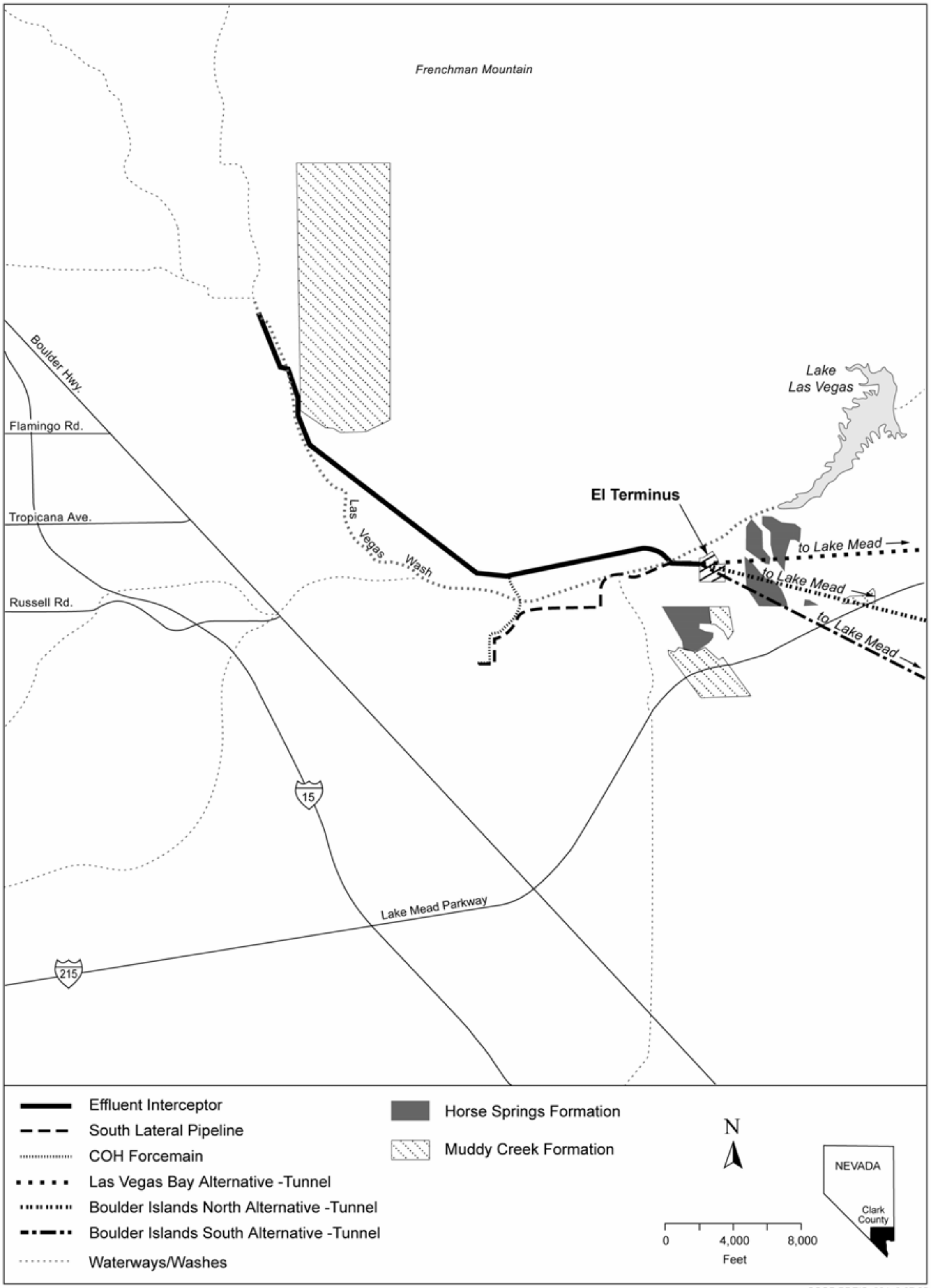

Figure 3.14-1 Areas of Potentially High Paleontological Sensitivity.

Based on the level of existing disturbance in relation to the proposed EI alignment, any paleontological resources that may have existed previously have been destroyed through previous construction activities. The LCS portion of the proposed project would include underground drilling up to 515 ft (157 m) below the surface. The LCS portion of the proposed project is not in an area designated as having high paleontologic sensitivity (Figure 3.14-1).