3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

For each resource area that may be affected by the proposed Coachella Canal Lining Project, this chapter describes the existing conditions (affected environment) of the project area, lists the impact significance criteria by which impacts were evaluated, and assesses the impacts that would occur with implementation of the Conventional Lining, Underwater Lining, Parallel Canal, and No Action alternatives. This chapter also identifies mitigation for those resource areas where project impacts would be significant—the discussion generally includes both the project impact as if mitigation were not included and the result with mitigation. The environmental analysis in this document is adequate for construction of any of the alternatives. Attachment C describes environmental resources on which the project would not have a significant effect and which, consequently, are not discussed in this chapter.

This EIS/EIR also evaluates the effects of the conserved water being diverted to MWD's service area, an action which is considered reasonably foreseeable if the canal is lined. The environmental effects of this action would be imperceptible within MWD's service area under any of the canal lining alternatives. Accordingly, effects within MWD's service area are not described separately for each of the specific resource areas included in this chapter.

3.1 GEOGRAPHIC SETTING, GEOLOGIC RESOURCES, AND SEISMICITY

3.1.1 Affected Environment

Geographic and Geologic Setting

The Coachella Canal traverses the eastern edge of the Salton Trough, a topographic and structural depression about 130 miles long and up to 70 miles wide. The Salton Trough is a landward extension of the Gulf of California, from which it is separated by the broad fan delta of the Colorado River (Loeltz et al. 1975).

The Coachella Valley fill (filling the bedrock trough) is composed of unconsolidated deposits and partly consolidated deposits. The partly consolidated deposits are primarily in the Indio and Mecca Hills. These deposits have low permeability and are poor aquifers. The recent unconsolidated deposits make up the alluvial basin and constitute the main water-bearing aquifer and part of the Coachella Valley.

The central part of the Salton Sea basin historically has been an area of playas and periodic lakes similar to, but commonly larger than, the present Salton Sea. Prehistoric Lake Cahuilla, which extended as far north as Indio, deposited the predominant lacustrine silts and clays found from the land surface to a depth of 50 to 100 feet. These deposits, distributed in the area that is now the major agricultural center of the Coachella Valley, form a confining layer and are responsible for the partly perched (held up by impermeable layers) water table located in the lower (southeastern) half of the Coachella Valley.

The canal does not traverse any known valuable mineral resource deposits or any locally important mineral resource recovery areas designated on either the Riverside County or Imperial County general plans.

Several areas and features near the Coachella Canal were examined in this study. The Salt Creek area consists of the area between the Coachella Canal and the Salton Sea and extends approximately from canal siphon 23 to siphon 29. Within the general Salt Creek area are various tracts of marsh/aquatic and desert riparian habitat, as well as the portion of Salt Creek in which perennial flow once occurred, all of which are collectively referenced as the "Salt Creek complex."

The Salt Creek area also includes the Dos Palmas Area of Critical Environmental Concern (ACEC), which contains most of the habitat of the Salt Creek complex. (This area was previously referenced as the Salt Creek ACEC.) The habitat on federal and State lands in the ACEC is managed by the Bureau of Land Management (BLM) and the California Department of Fish and Game (DFG). In addition, the California Department of Parks and Recreation has management responsibility for land along Salt Creek between the railroad tracks near Highway 111 and the Salton Sea. Several springs, including the historic Dos Palmas Spring, are located within the Dos Palmas ACEC.

Seismicity

The structural trough occupied by the Salton Sea is one of the most active seismic zones of North America. The Salton Sea basin (Imperial and Coachella Valleys) is partially bounded and crosscut by many active faults. All of these faults are part of the San Andreas Fault system.

Numerous earthquakes have occurred in the area. Several of these earthquakes have been accompanied by surface rupturing in the Imperial Valley. Some have caused appreciable damage to structures there and, on at least three occasions, loss of life. Slow tectonic creep also occurs in the Imperial Valley.

From siphon 7 to siphon 29, the Coachella Canal is generally between two and five miles east of the mapped location of the San Andreas Fault. From siphon 29 to siphon 32, the canal approaches within one mile of the fault's mapped location (Geologic Map of California, Salton Sea Sheet, Compilation by Charles Jennings, California Division of Mines and Geology 1967, Fifth Printing 1992; and Fault Activity Map of California and Adjacent Areas, Compilation and Interpretation by Charles Jennings, California Division of Mines and Geology 1994). However, historic seismic activity has caused only minor damage to the canal in the past.

3.1.2 Significance Criteria

Impacts would be considered significant if an alternative would:

- expose people or property to substantial geological and seismic hazards, such as landslides, mudslides, ground failure or similar hazards or soil and/or seismic conditions so unfavorable that they could not be overcome by design using reasonable construction and/or maintenance practices,

- locate a structure within an Alquist-Priolo earthquake fault zone, a known active fault zone, or an area characterized by surface rupture that might be related to a fault,

- result in substantial erosion or loss of topsoil,

- be located on a geologic unit that is unstable or that would become unstable as a result of the project,

- result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state, or

- result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

3.1.3 Environmental Consequences

Conventional Lining Alternative

The canal lining project would not change the existing seismic risks associated with its location, and the project would not cause significant impacts with regard to geographic or geologic resources or seismicity; accordingly, no mitigation for geologic or seismicity impacts would be required.

Under this alternative, there would be an import of sand and gravel and concrete to the site (see Section 3.16, "Sand and Gravel Supplies"). As described above, the canal does not traverse known valuable mineral resource deposits or designated mineral resource areas. Accordingly, lining the canal would not affect any such resources.

Lining the canal with concrete would not cause erosion; rather, erosion would be reduced because the concrete lining would stabilize the canal banks. Similarly, the addition of a concrete lining would strengthen the canal, and it would, therefore, not make the canal more susceptible to earthquake damage, and it would not expose local residents to an increased risk of seismic-related hazards. Accordingly, no mitigation for geologic or seismic impacts would be required.

Underwater Lining Alternative

For the same reasons described for the Conventional Lining Alternative, this alternative would not cause significant impacts to geographic or geologic resources, and it would not expose people to increased seismic hazards. Accordingly, no mitigation for geologic or seismic impacts would be required.

Parallel Canal Alternative

As described below, the Parallel Canal Alternative would not cause significant impacts to geographic or geologic resources, and it would not expose people to increased seismic hazards. Accordingly, no mitigation for geologic or seismic impacts would be required.

The parallel canal alignment would not traverse any known valuable mineral resource deposits or any locally important mineral resource recovery areas designated on either the Riverside County or Imperial County general plans. When the parallel canal is completed, the existing unlined canal would be partially filled with soil excavated from the new canal and abandoned in place. The unmaintained banks of the old canal would not pose a hazard and would not constitute a significant project impact.

A new, parallel canal with a concrete lining would be structurally stronger than the existing unlined canal. As a result, this alternative would not expose any populations to an increased seismic risk. Accordingly, no mitigation for geologic or seismic impacts would be required.

3.2 SURFACE WATER

3.2.1 Affected Environment

The Coachella Canal delivers approximately 330,000 acre-feet of Colorado River water from the AAC each year to irrigate farmland in the CVWD service area. The canal loses approximately 32,350 acre-feet of water per year through seepage from siphon 7 to siphon 32. The canal is in service all year. The first official water delivery from the canal occurred in March 1949. However, water was in the canal intermittently beginning in 1945. Colorado River water is diverted at Imperial Dam, flows down the AAC, and is diverted into the Coachella Canal above Drop 1. Although the project area is approximately 95 canal-miles downstream from the Colorado River, the water conveyed by the canal system passes through remote and undeveloped lands that have little effect on its physical or chemical properties.

In the project area, the canal traverses sloping desert land between the bases of the Chocolate and Orocopia Mountains and the Salton Sea. Prior to construction of the canal, surface water in the area consisted of the discharge of a few perennial springs or dug wells used as way stations or by isolated homesteads. The portion of Salt Creek east of the canal is a major drainage wash that flows only when carrying runoff from rainstorms. The canal alignment also crosses numerous dry washes that flow only during heavy rains, usually thunderstorms in the summer. The locations of these washes are indicated by the canal siphons.

During construction of the canal, isolated wells were installed to support construction activities; one of these wells continues to flow. After the canal began operation, seepage water appeared, which is now evident from the increased vegetative area between the canal and the Salton Sea. Later, private landowners drilled additional wells to supply water for household landscaping and aquaculture (fish farming in ponds), the runoff from which flows from the properties. Together, these water sources have contributed to flows in Salt and Frink Creeks, and they have also created many small seeps and trickles that support linear tracts of vegetation downslope of the unlined portion of the canal.

Some canal seepage is ultimately discharged into the Salton Sea through Salt Creek. Although at one point there was perennial (year-round) flow from Salt Creek into the Salton Sea, U.S. Geologic Survey (USGS) stream flow records indicate that since 1994 creek flows have been intermittent, meaning that there has been no surface flow for many days each year, typically in the summer and early fall (USGS 1999). The mean annual flow from Salt Creek into the Salton Sea during the four-year period ending in September 1999 was approximately 623 acre-feet (USGS 1996, 1997, 1998, 1999).

Numerous fish rearing and recreation ponds exist in the area. Some are fed by seepage water, some by well water, and some by both. Fish farmers depend on warm well water to maintain the temperature in aquaculture ponds in the winter. The warm water originates in geothermal wells in the area which supply water from the deeper, regional aquifer, not from the shallow, perched aquifer maintained by canal seepage.

Coachella Canal Operation

The existing canal was constructed mostly with a 46-foot-wide bottom, 6-foot depth of water, and side slopes of 2:1, which generally continued about 8 feet above the water line. The canal was designed with a capacity ranging from 1,600 cubic feet per second (ft^3/s) at siphon 7 to a capacity of 1,300 ft^3/s at siphon 32 (see Chapter 2.0, "Existing Canal Configuration"). The canal contains deposits of water- and wind-borne silt, minor local depressions from scour on the bottom and lower side slopes, and an approximately one-foot-wide band of nonnative grasses and herbs at the water line.

The section of the canal to be lined is presently operated in a less-than-full condition to keep seepage to a practical minimum. The flow rate in the canal is typically 500 ft^3/s, but during the course of a year, the rate of flow may occasionally be greatly reduced for a few days during the winter or rise as high as 800 ft^3/s for a day or two when irrigation water demand is high.

There are three check structures in the unlined canal (at siphons 15, 24, and 31) at which the flow is checked up to a depth of six feet. Upstream from each check structure, the depth of flow decreases as the ponding effect of the check structure gives way to the normal flow depth of 4.8 feet several miles upstream from the check. The CVWD may add additional check structures to the canal in the future to improve operational flexibility.

The flow velocity in the canal at a typical flow rate of 500 ft^3/s is approximately 1.5 feet per second (ft/s) directly upstream from a check structure and increases to approximately 2.0 ft/s several miles upstream from the check structure.

The volume of water in the canal at 500 ft^3/s under typical operating conditions is estimated to be approximately 1,180 acre-feet between siphon 7 and siphon 32. The water surface area of the canal under typical conditions is estimated to be approximately 270 acres.

Coachella Canal Seepage

Seepage and Geohydrology Studies

The assessment of canal seepage for this study is based primarily on the engineering and geohydrology appendices prepared for the Coachella Canal Lining Project by Reclamation in 1993. More recently, Section 12565(a) of the California Water Code called for the Salton Sea Authority to commission a study that would determine (i) the nature of subsurface and drainage canal water movements from the AAC and Coachella Canal to the Salton Sea and to existing adjacent wetlands, and (ii) quantify the amount of water that may be lost to the Salton Sea and to those wetlands due to the proposed AAC and Coachella Canal lining projects. Prior to the addition of § 12565(a) of the Water Code, Reclamation undertook extensive engineering and geohydrologic investigations of the Salton Sea area that included the drilling of numerous wells, collection of groundwater elevation data, chemical and isotope analysis of groundwater samples, procurement and analysis of aerial infrared photography, review and incorporation of past studies, and development of a groundwater model. Reclamation's work incorporated the findings of geohydrologic investigations conducted by the USGS in the 1960s and 1970s. Reclamation's investigations and its findings as to items (i) and (ii) identified above were incorporated into the geohydrology appendices for the previous Coachella Canal Lining Project Draft EIS/EIR (Reclamation 1994) and the Draft EIS/EIR for the AAC Lining Project (Reclamation/IID 1994).

Pursuant to § 12565(a) of the Water Code, Tetra Tech, Inc., under contract with the Salton Sea Authority, produced a computer geohydrologic model of the Salton Sea region and a final report entitled *A Study on Seepage and Subsurface Inflows to the Salton Sea and Adjacent Wetlands* dated July 9, 1999 (Seepage Study). The scope of the Seepage Study did not include field investigations and documentation of new data. Rather, the Seepage Study summarized previously documented information that was used to produce the computer model. The Seepage Study was reviewed and found not to change the outcome of the geohydrologic studies included in the previous Coachella Canal Lining Project Draft EIS/EIR.

Therefore, based on the project-specific studies and fieldwork undertaken during the preparation of Reclamation's 1993 engineering and geohydrology appendices, the relatively consistent level of seepage losses that have continued since that report was published (see Table 3-1), and that the subsequent study undertaken by the Salton Sea Authority did not materially change the previous studies, Reclamation's 1993 engineering and geohydrology appendices remain the appropriate basis for the environmental analyses contained in this EIS/EIR. These appendices have been updated to reflect the most recent data collected in the project area.

Estimated Seepage from the Coachella Canal

The rate of seepage varies along the canal, depending on the amount of sandy material (highly permeable) or clay (relatively impermeable) in which the canal was constructed. In some areas, the canal was excavated entirely in clay; in others, the canal was excavated through several feet of gravel and sand into clay; and elsewhere, the canal was excavated entirely in sand and gravel.

Annual seepage was estimated by subtracting the measured canal flow at siphon 32 from the flow at siphon 7 and subtracting the evaporation from the canal. The Engineering Appendix prepared in association with the previous Draft EIS/EIR contains additional discussion of the measured flows and calculated seepage losses. The period of flow record used during the preparation of the previous Draft EIS/EIR was 1982 to 1990. Based on the measured flow losses, and based on an estimated 1,500-acre-foot per year evaporation loss, the average annual amount lost to seepage during this period was estimated at 32,350 acre-feet per year. The annual seepage determined in this manner fluctuated between 27,000 acre-feet and 43,000 acre-feet. Some of the year-to-year variation may be attributed to measurement error. In addition, variations in flows diverted from year to year and annual weather conditions can affect the seepage loss computations.

The previous estimates of flow losses along the canal were updated using more recent flow measurements (through 1996). This new flow data show an average loss over the period of 1982 to 1996 of just under 32,100 acre-feet per year. This 250-acre-foot change from the previous estimate represents a deviation of less than one percent. Accordingly, the previous estimate of 32,350 acre-feet per year remains valid, and it forms the basis for the seepage-related analyses contained in this Final EIS/EIR. Table 3-1 shows the measured flow losses, and estimated seepage losses, from 1982 through 1996.

An additional study of seepage was conducted in 1988 and is documented in the draft geohydrology appendix that was completed in 1993, during the preparation of the previous Draft EIS/EIR. That study estimated seepage by canal reach based on the increase of vegetation downslope from the canal. The basic premise of that study (based on geology) was that the increase in downslope

Table 3-1. Estimated Canal Seepage Based on Flow Measurements at Siphons 7 and 32 (in acre-feet)

Year	Total Measured Loss in Flows[1]	Estimated Loss to Evaporation	Estimated Loss to Seepage
1982	36,915	1,500	35,415
1983	44,367	1,500	42,867
1984	26,525	1,500	25,025
1985	28,845	1,500	27,345
1986	28,585	1,500	27,085
1987	29,963	1,500	28,463
1988	34,443	1,500	32,943
1989	36,747	1,500	35,247
1990	37,834	1,500	36,334
1991	36,212	1,500	34,712
1992	38,982	1,500	37,482
1993	37,840	1,500	36,340
1994	30,043	1,500	28,543
1995	32,307	1,500	30,807
1996	24,365	1,500	22,865
Average	33,598	1,500	32,098

Source: Unpublished CVWD flow measurements

[1] This total represents the flows recorded at siphon 7 minus the flows recorded at siphon 32.

vegetation area between 1949 and 1988 was mostly induced by, and is presently supported by, unlined canal seepage.

To estimate seepage by reach and assist in the formulation of alternatives, the canal was divided into five hydrologic units, whose boundaries are based on geology and downslope hydrologic features.

The unit boundaries are shown in Figure 3-1, and the geologic characteristics of each unit are described under "Groundwater." Downslope vegetation area in each hydrologic unit was determined from aerial photos taken in 1949 and 1988.[1] The analysis of vegetation along the canal was recently

[1] Although the canal was in operation for one year prior to 1949, vegetation density and area in 1949 is believed to represent pre-canal conditions.

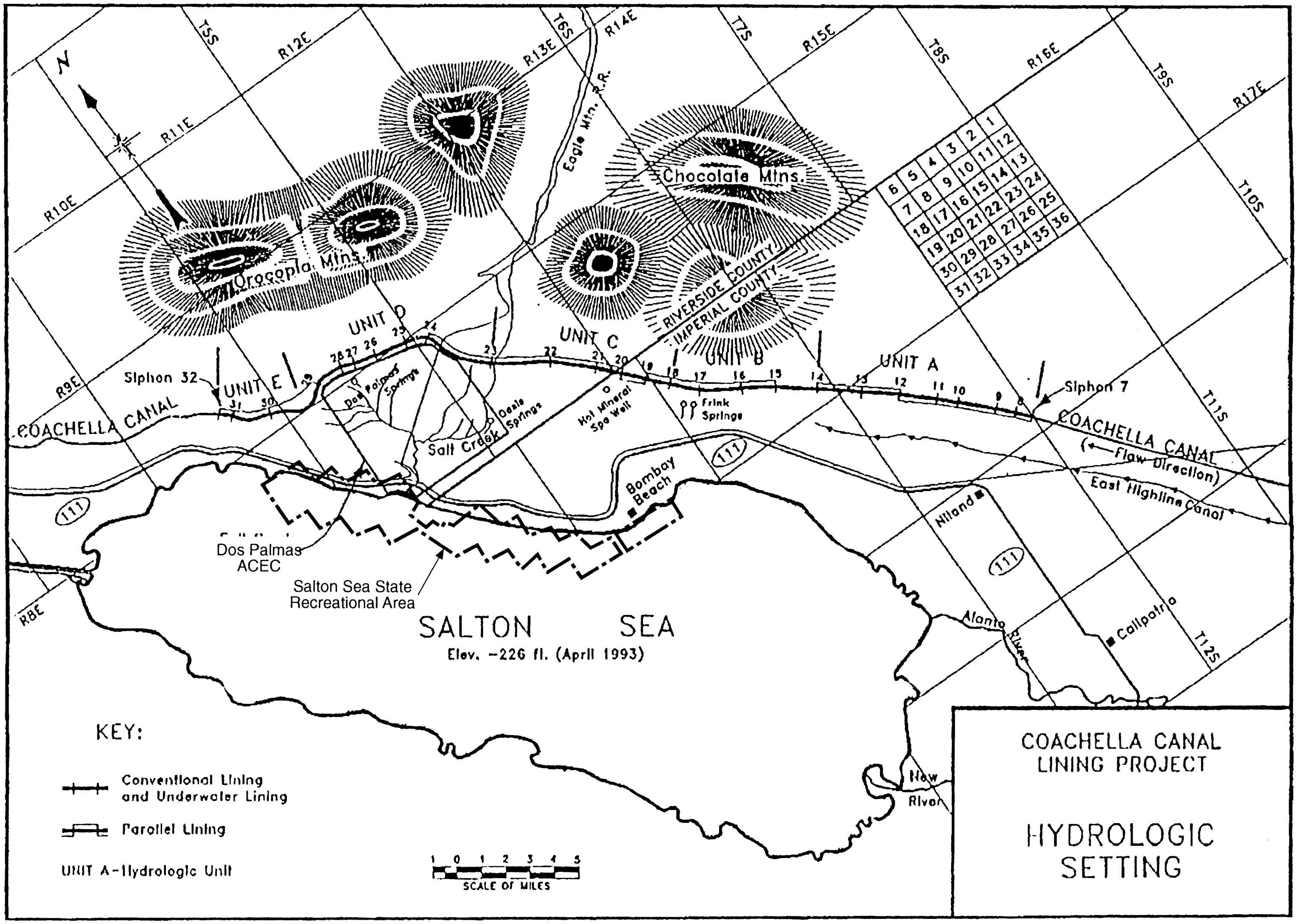


Figure 3-1
Hydrologic Setting

updated using 1998 satellite images. The increase in vegetation in each hydrologic unit was converted to a percentage of the total increase in vegetation area. The percentage of seepage in each hydrologic unit was assumed to be the same as the percentage of vegetation increase. The results of that study produced a seepage estimate that, when considered with regard to the amount of seepage-dependent vegetation mapped using 1998 satellite imagery, provides further support that the previous estimated seepage loss of 32,350 acre-feet per year is a suitable basis for the environmental analyses contained in this study.

Public Water System

CVWD serves much of the area between the canal and the Salton Sea with domestic water conveyed through a pipe system. The water is obtained from wells in the Coachella Valley. No canal water is used for the public water supply. CVWD expands its domestic water distribution system as needed to serve its new customers.

Surface Seeps and Flows

General Surface Conditions

The canal is crossed by many desert washes and runoff channels, all of which are dry except when carrying runoff from winter rains or summer thunderstorms.

Downslope from the canal, between the canal and the Salton Sea, scattered perennial surface flows occur. These areas of perennial flow are relatively limited and include Dos Palmas and Frink Springs. Some of the flow is from the relatively deep artesian aquifer (discharging through springs or wells), and some is canal seepage.

In November 1999, the BLM installed a flow meter in the well at Folger's Grove (one of the wells that collectively constitute "Dos Palmas Spring" as referenced in this EIS/EIR). Flow rates remained at 200 gallons per minute (gpm) until March 2000, when they steadily declined to 120 gpm, where they have remained constant to date. The combined flows from what is referred to in this EIS/EIR as Dos Palmas Spring have held steady at 350 gpm (as measured at a weir). This flow information was provided by the BLM in Comment L-14 on the Revised and Updated Draft EIS/EIR (see Volume II of the Final EIS/EIR).

Surface Flow Related to Seepage

Surface manifestation of the seepage water (and artesian aquifer water) ranges from scattered natural vegetation on an otherwise dry landscape to obviously wet conditions in the form of moist soil, surface trickles, and pools downslope from the canal. The wet spots tend to form in topographic low areas, particularly along the natural desert washes and runoff channels. The perennially wet areas support phreatophytes, plants that thrive on a high groundwater table.

Salt Creek

The effect of groundwater discharge is particularly noticeable in the Dos Palmas Spring area, the source of the north branch of Salt Creek. Before the canal was constructed, the artesian spring flow from the Dos Palmas Spring area was consumed by phreatophytes above the current location of the Salt Creek stream gauge (U.S. Geological Survey gauge 10254050). Although Salt Creek once had perennial surface flows at the gauge (0.2 miles upstream from the Salton Sea) and in various sections of the creek upstream from the gauge since 1994, it has returned to an intermittent flow regime (USGS 1999). Not all of the flow in Salt Creek is from canal seepage. For example, a portion of the Salt Creek flow is from the artesian wells installed after the canal began operation. However, a portion of the flow from some artesian wells is canal seepage.

When the previous Draft EIS/EIR was circulated in 1994, the Salt Creek flow records suggested that the base flow was stabilizing at about 2,000 acre-feet per year. However, there have been large historic fluctuations in creek flow. A large increase in the perennial base flow occurred in 1981, probably the result of the new artesian wells installed by Aqua Farms International in the Dos Palmas Spring area in 1980 and 1981. This increase was followed by an equally large and rapid decrease in base flow. USGS stream gauge data (1996 through 1999) indicate that current mean annual flow from Salt Creek into the Salton Sea is approximately 623 acre-feet per year.

The decreases in flows are believed to have been caused by increased phreatophyte use of water. Salt Creek flow response in the early 1970s seems to support this hypothesis. Beginning in about 1970, measured loss from the canal increased markedly. From about 1975 to the present, the loss remained much higher than in the 1960s. Salt Creek flow also increased rapidly in the early 1970s, and, in 1980 and 1981, new artesian wells were installed by Aqua Farms International in the Dos Palmas area. The increases in flows during these periods were likely in response to the increased leakage and new artesian wells, respectively. However, there was a substantial and subsequent decrease in Salt Creek flow, probably a result of consumptive use of the water by increasing phreatophyte acreage and density upslope of the mouth of the creek.

Local Uses of Seepage Water

Some of the seepage water is used by local residents and resorts for landscaping and garden maintenance and by aquaculture farmers for raising fish. The amount appears to be roughly five percent of the total seepage.

In the Dos Palmas Spring area, there is no intervening clay layer to keep canal seepage from mixing with regional groundwater. Thus, discharges from artesian wells and springs contain a mix of regional water and seepage water. A major aquaculture enterprise in the area closed its business and sold the fish rearing property to The Nature Conservancy (TNC), a non-profit agency under whose auspices the land and water was devoted to wetlands habitat for wildlife. The Nature Conservancy's land holdings in the Dos Palmas ACEC have since been transferred to another non-profit agency, the Center for Natural Lands Management, which also manages them for the benefit of wildlife habitat. About two-thirds of Dos Palmas Spring flow is seepage water, as is an estimated one-half of the water from artesian wells in that area. The basis for this is discussed under "Groundwater."

In other instances, shallow wells in the alluvium produce seepage water that is used for landscaping and to supplement geothermal water at commercial spas and recreation areas, such as the spas in the Hot Mineral Springs area. However, as described in Section 3.3 under "Groundwater," these spas are also supported by non-seepage induced groundwater because artesian wells were known to be present in the Hot Mineral Springs area prior to canal operation.

The seepage may also emerge from the ground as trickles of surface water and be collected in ditches and ponds for use, as occurs at the Frink Springs/Hot Mineral Spa area. In other cases, there may be little or no free water, but the soil may be sufficiently moist because of seepage to grow trees and shrubs as landscaping on private property.

The seepage water used by local citizens is subject to recovery by the Federal Government. The Federal Government owns the Coachella Canal, through which Colorado River water is delivered to CVWD in accordance with a contract between CVWD and the Secretary of the Interior.[2] The

[2] Contract for Construction of Capacity in Diversion Dam, Main Canal and Appurtenant Structures and for Delivery of Water, Coachella Valley County Water District and Secretary, October 15, 1934.

terms of canal construction and water delivery were authorized by the Congress.[3] Most of the land lying along the unlined sections of the canal is not eligible to receive canal water under the contract. The land that is eligible under the contract has not been formed into an appropriate improvement district nor made the necessary contractual arrangements to receive water from the canal. Thus, while the seepage water has been temporarily available for use by local landowners, such use is unauthorized and does not establish a right to the continued use of the water. However, CVWD could provide domestic water at standard rates to such users within its service area.

The State of California controls surface water rights through the State Water Resources Control Board's Division of Water Rights. Users of seepage water may also file an application for a Small Domestic Registration or a water rights permit, either of which establish a priority for such use. However, the State would condition such registration or permit with the following standard term (California State Water Resources Control Board 1993):

> To the extent that the water available for the use under this registration/permit is return flow, imported water, or wastewater, this registration/permit shall not be construed as giving any assurance that such supply will continue.

State records indicate that only two permits have been granted in the vicinity of the unlined portion of the canal. One was an application filed in 1985 by the BLM. The BLM's El Centro Resource Area office has identified this permit as supplying Public Water Reserve 107 at nine gallons per minute (gpm) (see the BLM's El Centro Resource Area comment letter on the previous Draft EIS/EIR, which is contained in Appendix G to this document). The other was an application filed in 1982 by David Lee for 0.89 ft^3/s from Salt Creek for fish culture (location is in T. 8 S., R. 11 E., NW¼ SE¼ sec. 15). No additional permits have been granted since the previous Draft EIS/EIR for this project was prepared (pers. comm., L. Vasquez, State Water Resources Control Board 2000).

Salton Sea

The Salton Sea, which lies to the west of the canal, currently has an elevation of 227 feet below sea level. The Salton Sea is sustained by irrigation return flows from Imperial Valley and Coachella Valley and by New River discharges from Mexico. Surface runoff from precipitation contributes minor flows to the Salton Sea.

[3] Boulder Canyon Project Act of December 21, 1928.

The water level has, throughout history, changed continually in response to changes in these sources and changes in annual precipitation and evaporation. The precipitation that occurred in Coachella and Imperial Valleys in January and February 1993 raised the water level by nearly one foot. In the early 1970s, the level was about four feet lower than at present, but the level is projected to recede in the future as the result of reductions in irrigation drainage and discharge from Mexico.

Surface runoff, including the discharge of Salt Creek, flows to the Salton Sea downslope of the canal; however, there are no perennial sources of surface runoff to the Salton Sea that are fed by canal seepage. Surface runoff downslope from the canal is ephemeral, representing runoff following storms. In addition, emergency spills from two wasteways along the canal flow into the sea, generally when stormwater flows into the canal.

As described in Section 1.8.11, the Salton Sea Authority is evaluating potential measures to stabilize the water elevation, create and/or enhance habitat for species that use the Sea, and restore its recreational use.

Colorado River

Colorado River flow between Parker and Imperial Dams is generally maintained by Reclamation to meet delivery requirements in the United States (including the AAC) plus delivery to Mexico. During the spring, summer, and fall, the average monthly flow of the river as it approaches Imperial Dam varies between 9,000 and 11,000 ft^3/s. During winter months, the average monthly flow drops to about 5,000 ft^3/s. Exceptions occur during periods of surplus river flow when deliveries are higher or during unanticipated rainstorms when delivery requirements are less than 2,000 ft^3/s. Then, the minimum flow rate of 2,000 ft^3/s is provided.

Releases at Parker Dam are varied on an hourly basis to optimize the production of electrical power at Parker Powerplant. This is achieved by increasing releases during the day and reducing releases to approximately 2,000 ft^3/s at night. Such "cycling" results in a diurnal water level fluctuation on the river, which may be several feet immediately downstream from Parker Dam, but gradually reduces to about one-half foot above Imperial Dam.

The 145-mile reach of the river between Parker Dam and Imperial Dam has a relatively low gradient and a substantial number of backwaters.[4] The area of the backwaters is estimated to be

[4] Backwaters are irregularly shaped ponds, sloughs, and former river channel segments that are connected to the river channel and whose water levels are influenced by the river level.

approximately 3,300 acres, while the area of the river itself is estimated to be approximately 7,500 acres (Reclamation 1996).

The combined impacts of the projects contained in California's Colorado River Water Use Plan, including those contributed to by this project, are being evaluated in separate CEQA and NEPA documents. The incremental contribution of the Coachella Canal Lining Project to cumulative impacts on the Colorado River is addressed in Chapter 4.0 of this Final EIS/EIR.

3.2.2 Significance Criteria

An alternative would have a significant impact on surface water resources if it would:

- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site,

- create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial sources of polluted runoff,

- expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam, or

- expose people or structures to innundation by seiche, tsunami, or mudflow.

Additional significance criteria that relate to water resource impacts are included in Sections 3.3 (Groundwater), 3.4 (Water Quality), and 3.5 (Marsh/Aquatic and Desert Riparian Habitat Along the Coachella Canal).

3.2.3 Environmental Consequences

Conventional Lining Alternative

Without mitigation, while implementation of this alternative would not result in significant surface water resource impacts when evaluated against the criteria in Section 3.2.2, it would substantially decrease seepage flow to Salt Creek which would adversely affect biological resources. Those biological resource impacts would be mitigated to less than significant levels as described in Sections 3.5 and 3.8.

Coachella Canal Operation

The newly lined section of canal would be operated with a greater depth of water than under the present operation discussed under "Affected Environment, Coachella Canal Operation" without affecting allotted delivery requirements and, thus, not increasing but decreasing water requirements from the Colorado River. At the check structures, the water would generally be "checked up" to a depth of approximately 11 feet. The water depth would diminish in an upstream direction as the ponding effect of the check structure gradually changes to normal flow depth of 7.6 feet at the outlet of the next upstream check structure.

The flow velocity at a typical flow rate of 500 ft^3/s would be approximately 1.4 ft/s at the check structure and would increase in an upstream direction to as much as 2.9 ft/s at the outlet of the previous check structure upstream.

The volume of water in the canal at 500 ft^3/s under typical operating conditions would be approximately 1,131 acre-feet between siphon 7 and siphon 32, which is a decrease of 49 acre-feet from present conditions. The water surface area of the canal under the same conditions is estimated to be approximately 190 acres.

Coachella Canal Seepage

As described above, this analysis is based on Reclamation's 1993 engineering and geohydrology appendices, as updated, for the previous Coachella Canal Lining Project Draft EIS/EIR.

Seepage Reduction by Lining. The amount of current seepage along the unlined portion of the Coachella Canal is estimated to be 32,350 acre-feet. The amount of leakage through the lining (leakage allowance) is estimated to be .035 cubic feet per square foot of submerged lining per day, which is derived from the operating experience of the first 49 miles of the Coachella Canal. The leakage allowance was applied to the entire length of hydrologic units C and D. However, it was applied only to those portions of units A, B, and E that are in pervious soils. The portions of the canal with a clay bottom would continue to have no significant seepage. Based on these factors, seepage through the lining would occur at a rate of approximately 1,500 acre-feet per year. Thus, seepage reduction would equal approximately 30,850 acre-feet per year.

Present seepage	32,350 acre-feet
Minus leakage through lining	(1,500) acre-feet
Seepage reduction (conserved water)	30,850 acre-feet

Public Law (P.L.) 100-675 provided that the estimate of leakage after lining is subject to adjustment in the future. The leakage after lining would be monitored by flow measurements on the lined canal and tests of lining integrity.

Water Conserved by Lining. The amount of water conserved by lining equals the present seepage, minus leakage through the lining, as shown above.

Some of the conserved water may be used for mitigation (e.g., supplying water to Salt Creek or providing water for the creation of marsh/aquatic or desert riparian habitat). As a result, the amount of conserved water available for other uses would probably be less than 30,850 acre-feet. The proposed Quantification Settlement Agreement identifies the net (post-mitigation) amount of conserved water that would be made available by the Coachella Canal Lining Project as 26,000 acre-feet per year, and this is considered a reasonable estimate of net water conservation. For the purposes of the environmental analyses contained in this document, it is assumed that 26,000 acre-feet per year would be the net water conservation, and the remaining 4,850 acre-feet per year would be managed be CVWD for environmental mitigation. It is understood, however, that less canal water may be needed to support mitigation.

As authorized under P.L. 100-675, it may be feasible to provide some water required for mitigation from the post-lining discharge of existing wells and springs on public lands in the Dos Palmas ACEC, plus groundwater from new wells to be drilled on public lands in the ACEC. Groundwater would be used in combination with water diverted from the Coachella Canal.

Surface Seeps and Flows. If the canal was lined, the shallow groundwater table would gradually lower in most locations. The seeps and rivulets supported by seepage from the canal would no longer have canal seepage as a source, and, as discussed previously, the discharge of wells and springs producing a percentage of seepage water would decrease. The reduction in surface flows, in and of itself, is not considered significant because the objective of the project is to conserve water presently being lost as seepage. The reduction in flows would affect local biological resources. Those potential impacts are discussed separately in this chapter.

Salt Creek. Without mitigation, lining the canal would reduce the amount of water in Salt Creek. A reduction of 623 acre-feet per year (i.e., the recent mean annual flow of the creek) at the Salton Sea was estimated to be the worst case. Because Salt Creek includes habitat for the federally endangered desert pupfish and Yuma clapper rail, this impact would be avoided by provision of this 623-acre-foot level of flow, which would provide for no net loss of suitable habitat for these species, as discussed under "Special Status Species."

Local Uses of Seepage Water. People who use seepage water for irrigating landscaping or for aquaculture would eventually lose this water source. Although the loss would be perceived as significant to some users of this water, the impact is not significant and no mitigation is required because the users have no legal standing to a continued supply of previously available Coachella Canal seepage. However, as mentioned before, legal alternatives exist by which these users may continue to use water. For example, private individuals losing seepage water could replace it by drilling wells or purchasing domestic (potable) water from CVWD at standard rates.

Salton Sea. This alternative is not estimated to measurably change the inflow to the Salton Sea. The flow of Salt Creek into the Salton Sea would be maintained, as discussed previously under "Salt Creek," and surface runoff from rainfall would not be affected. Virtually all seepage can be accounted for in consumptive use by phreatophytes, Salt Creek flow, and local uses.

Colorado River. Based on the technical appendix prepared by Reclamation for the 1994 All-American Canal Lining EIS, the proposed project would reduce the average flow of the lower Colorado River by approximately one-third of one percent, and it would reduce the level of the river downstream from Blythe, California by approximately one-tenth of an inch. More recent analysis completed by Reclamation for the "Final Biological Assessment for Proposed Surplus Water Criteria, Secretarial Implementation Agreements for California Water Plan Components and Conservation Measures on the Lower Colorado River (Lake Mead to Southerly International Boundary)" (Reclamation 2000c) confirmed the inconsequential nature of this reduction in flow. Based on the data used for the analysis in the Biological Assessment, a 26,000-acre-foot reduction in flow was calculated to reduce surface water elevation in the Colorado River between 0.0 inch and 0.19 inch at various locations between Parker Dam and Imperial Dam. This change would not be significant to the resources along the river, but the change is included among the cumulative impacts discussed in Chapter 4.0

Summary. The Conventional Lining Alternative would not result in significant impacts related to surface water; however, without mitigation, impacts to biological resources would result from the reduction in surface flows to Salt Creek. Accordingly, mitigation measures are provided in Section 3.5 to restore flows to Salt Creek. This alternative would not cause a change to surface waters of the Salton Sea or the public water system in the project area. Changes in the flow of the canal, the amount of emergency storage in the canal, and flow of the Colorado River would not be significant; therefore, no mitigation would be required for these impacts. No mitigation is required for changes in available supply to seepage users; however, other sources of water are available to these users.

Underwater Lining Alternative

Similar to the Conventional Lining Alternative, the Underwater Lining Alternative would not have a significant impact on surface water resources, although reductions in Salt Creek flows would be mitigated as described in Section 3.5.

Coachella Canal Operation

The newly lined section of canal would be operated with a greater depth of water than under the present operation discussed under "Affected Environment." At the check structures, the water would typically be checked up to a depth of approximately nine feet. The water depth would diminish in an upstream direction as the ponding effect of the check structure gives way to a normal flow depth of 4.5 feet at the outlet of the next upstream check structure.

The flow velocity at a typical flow rate of 500 ft^3/s would be approximately 0.8 ft/s at the check structure and would increase in an upstream direction to as much as 2.0 ft/s at the outlet of the previous upstream check structure.

The volume of water in the canal at 500 ft^3/s under typical operating conditions would be approximately 1,679 acre-feet between siphon 7 and siphon 32, an increase of 499 acre-feet over present conditions. The water surface area of the canal under the same conditions is estimated to be approximately 340 acres.

Coachella Canal Seepage

The amount of leakage through the lining is assumed to be 0.035 cubic foot per day per square foot of submerged lining. This assumption was made in the absence of operating experience with this type of lining. The annual amount of leakage through the lining would be greater than for the

Conventional Lining Alternative because the canal would be wider. The estimated amount of water conserved would be as follows:

Present seepage	32,350 acre-feet
Minus leakage through lining	(2,500) acre-feet
Seepage reduction (conserved water)	29,850 acre-feet

As with the Conventional Lining Alternative, some of the conserved water may be used for mitigation, meaning that the amount of conserved water available for other uses may be less than 29,850 acre feet.

Surface Seeps and Flows. The effects would be the same as for the Conventional Lining Alternative.

Salt Creek. The effects would be the same as for the Conventional Lining Alternative.

Local Uses of Seepage Water. The effects would be the same as for the Conventional Lining Alternative.

Salton Sea. The effects would be the same as for the Conventional Lining Alternative.

Colorado River. The effects would be the same as for the Conventional Lining Alternative.

Summary. The Underwater Lining Alternative could not cause significant impacts to water resources; however, impacts to biological resources would result from the reduction in surface flows to Salt Creek. Accordingly, mitigation measures are provided in Section 3.5 to restore flows to Salt Creek. No significant impacts to surface water resources would result from this alternative, and no surface water mitigation would be required.

Parallel Canal Alternative

The effects of this alternative, and the required mitigation for impacts to Salt Creek, would be the same as for the Conventional Lining Alternative.

No Action Alternative

Under the No Action Alternative, the Coachella Canal would continue to lose an estimated 32,350 acre-feet of water per year to seepage. This alternative would have no effect on the Coachella Canal, Salt Creek, Salton Sea, or Colorado River. Because the No Action Alternative would not reduce seepage losses along the Coachella Canal, it would not provide for public use of conserved water in accordance with California's Colorado River Water Use Plan. The No Action Alternative would also not provide a source of conserved water to help facilitate implementation of the San Luis Rey Indian Water Rights Settlement Act (P.L. 100-675, Title I), and there would be no beneficial effects on Indian Trust Assets associated with this alternative. It is also expected that salt cedar would continue to displace native plant species in the project area. This would increase the amount of surface water used by salt cedar and decrease surface water flows, including those in Salt Creek.

3.3 GROUNDWATER

3.3.1 Affected Environment

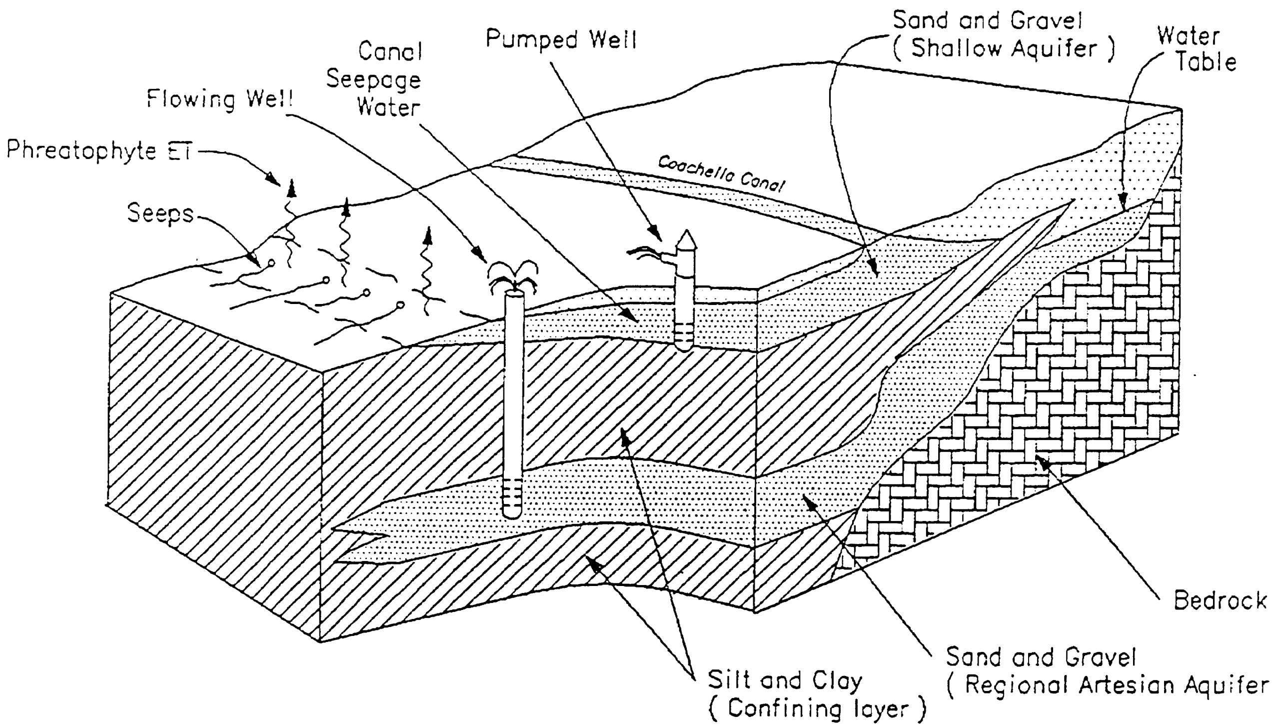
Groundwater conditions vary along the unlined section of the canal, depending on the depth of the uppermost clay layer and whether it lies directly under the canal. As discussed previously, ancient lakes in the valley have deposited layers of clay on alluvial sand and gravel. Between siphon 7 and about siphon 18, the canal is mostly constructed in such clay. Between about siphon 18 and just downstream from siphon 29, the upper clay layer, where present, generally lies several feet to tens of feet below the ground. Here, the canal was constructed in sand and gravelly sand deposits of an alluvial fan. From just downstream of siphon 29 to siphon 32 (end of unlined canal), the canal was mostly constructed in sandstone and siltstone. Where the clay layer is located directly below the canal, it perches the canal seepage to form a thin, shallow, southwestward sloping and draining perched groundwater table. A deeper regional aquifer, generally unaffected by canal seepage, is below the clay. Figure 3-2 shows the general geologic structure under the canal. The regional aquifer is affected by canal seepage in the Dos Palmas area.

Precanal Groundwater

Prior to construction of the canal, the only surface manifestations of groundwater were artesian springs and wells downslope from where the canal is currently located. The principal ones are shown on Figure 3-1. This groundwater was, and still is, confined below layers of clay. The uppermost clay layer generally lies tens of feet below the ground under the high leakage sections of the canal and gradually reaches the surface a mile or two downslope from the canal.

Although many springs are shown on United States Geologic Survey (USGS) topographic maps and are called springs by local residents, there is reason to believe that most are actually deteriorated artesian wells. The most persuasive indications come from maps made in conjunction with the railroad survey in the mid-1850s. These maps show the springs that were later named Frink Springs, San Andreas Springs, and a very small spring 2 miles southwest of Imperial Hot Mineral Spa, which is still unnamed on the latest (1992) 7½ minute USGS topographic map for this area.

Conspicuously absent is Dos Palmas Spring, even though "Brown's Road" (Ehrenberg to San Bernardino) is mapped as passing very close (one-quarter mile at most) to the present location of Dos Palmas Spring. As important as water was in the 1850s on a desert trail, it is difficult to believe that



General geologic structure under Coachella Canal. This block diagram illustrates Coachella Canal seepage isolated from the artesian aquifer by a clay layer extending, in the subsurface, upslope of the canal trace.

Figure 3-2
Generalized Geologic Structure

Dos Palmas Spring, later described as a copious flow, would be missed. It is concluded that a few years after the railroad survey, a shallow well was dug as part of the stagecoach way station construction. Also, seismic activity in the region since 1850 may have created Dos Palmas Spring.

Post-canal Groundwater

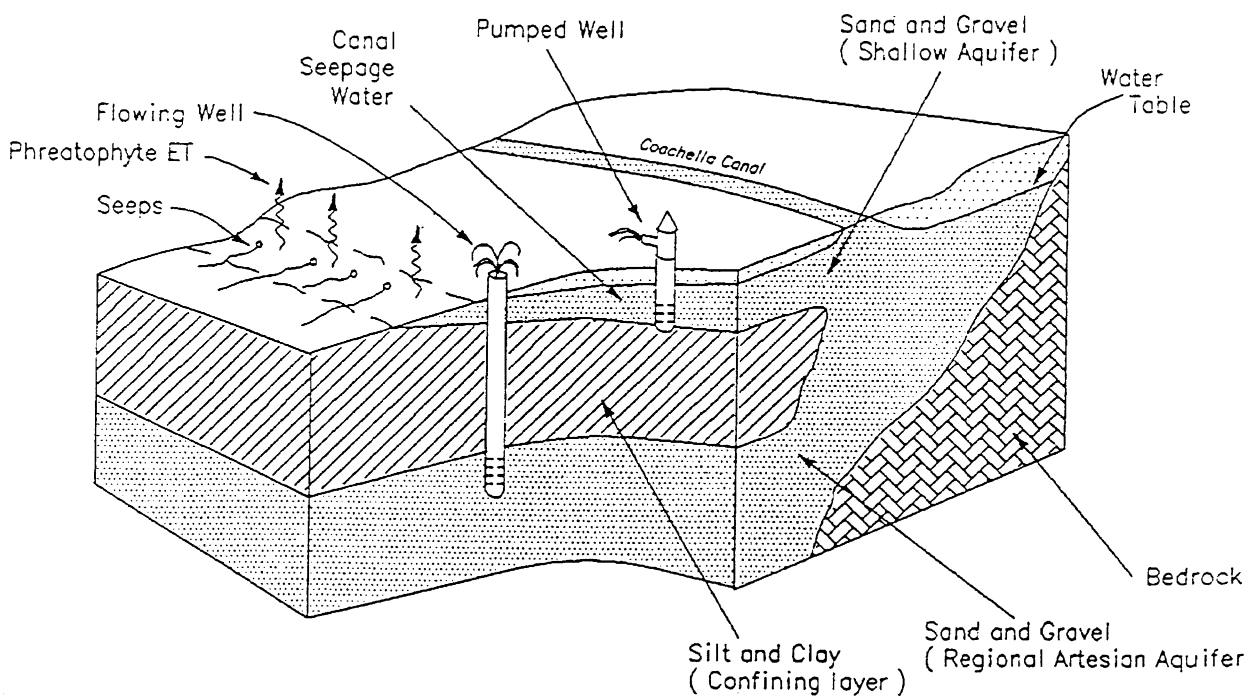
The shallow groundwater under the canal (on top of the shallowest clay layer) and west of the canal is mostly canal seepage. However, some of this groundwater does originate from precipitation wash flows. Most of the canal seepage occurs where the canal was excavated through sand and gravelly sand. This sandy material is either an alluvial fan deposit on lakebed clay or alluvial fill in channels cut in the clay. A mostly seepage-dependent and partially precipitation-dependent perched water table has formed in the sand and gravelly sand overlying the clay in those sections where the top of the clay is below the canal bottom.

This mostly seepage-dependent perched groundwater drains toward the Salton Sea because the top of the clay, like the ground surface, slopes toward the sea. At some distance downslope from the canal, because of the downslope thinning of the alluvium, the perched water table eventually outcrops and has induced the growth of phreatophytes (plants that draw their water supply from groundwater), including the nonnative invasive weed salt cedar and native plants such as mesquite and palms. Phreatophytes are discussed in Section 3.5, "Marsh/Aquatic and Desert Riparian Habitat along the Coachella Canal."

Seepage-Induced Shallow (Perched) Groundwater

Canal seepage is very low in the sections constructed in the clay and sandstone and high in the sections constructed in sand and gravelly sand.

Between about siphons 18 and just downstream of siphon 29, where the clay layer lies under the canal, seepage forms a body of shallow groundwater in the sand and gravelly sand alluvium on top of the clay (see Figure 3-2). Drainage is downhill (south and west) through the relatively permeable alluvium. Then, as the alluvium thins out downslope, the shallow groundwater surfaces a mile or two downslope from the canal. In the Dos Palmas Spring area, where there is no clay layer directly under the canal, seepage mixes with regional groundwater and becomes part of the deeper system (see "Regional Deep Groundwater" and Figure 3-3).



Shallow geology in the Dos Palmas Spring area. This block diagram illustrates that Coachella Canal seepage supplements the artesian aquifer in the area around Dos Palmas Spring because the clay layer does not extend, in the subsurface, to the canal trace.

Figure 3-3
Geologic Structure of the Dos Palmas Springs Area

Since the construction of the canal, the shallow, seepage-induced groundwater has induced the growth of phreatophytes.

In the Frink Springs area, the shallow groundwater also seeps from the ground in some places downslope from the canal and forms rivulets or pools of surface water. As discussed previously, some of the seepage water is used by local residents and resorts for landscaping and garden maintenance and by aquaculture farmers.

Between siphon 7 and about siphon 18, where the uppermost clay layer is at or near the ground surface, seepage occurs in the short stretches of canal where the canal crosses desert wash deposits. These deposits of sand and gravel fill channels cut in the clay. As in those sections where the clay is tens of feet below the canal bottom, the seepage water ponds on the clay and flows downslope, generally westward. A short distance downslope (less than a mile), the seepage water (shallow groundwater) becomes shallow enough to outcrop or feed vegetation as the wash channel alluvium thins out.

Regional Deep Groundwater

Prior to construction of the canal, the only obvious indications of groundwater were artesian springs and wells downslope from where the canal is currently located. The artesian Dos Palmas Spring and Frink Springs are local landmarks. This groundwater migrates to the vicinity of the canal from an unknown source area (probably from the mountains and washes to the southeast), where it is "trapped" under clay layers. The groundwater becomes pressurized as it flows under the clay (see Figure 3-2). In places such as Dos Palmas and Frink Springs, this trapped groundwater is under enough pressure to drive it to the surface between the canal and the Salton Sea. At the springs, faults probably provide a conduit up through the confining clay layers. It is also discharged from wells drilled through the confining clay layers.

The eastern (upslope) boundary of the clay layers is irregular. Along most of the unlined section of canal, the uppermost clay layer extends upslope past the canal and prevents canal seepage from mingling with the water below the clay. In the area around Dos Palmas Spring, the uppermost clay layer begins to the west (downslope) of the canal (see Figure 3-3). Absence of the clay layer directly below the canal allows seepage water to supplement the water feeding the artesian wells and springs.

Shallow groundwater along the section of unlined canal is directly related to canal seepage. The following discussion explains the interrelationship among seepage, groundwater, and the water supply for areas of marsh/aquatic and desert riparian vegetation.

Description of Hydrologic Units

Because of apparent variations in seepage along the canal, the canal and its underlying geologic setting were divided into "hydrologic units" to facilitate the seepage analysis. The hydrologic unit boundaries were selected to separate high seepage reaches of canal from low-seepage reaches. Figure 3-1 shows the units and geographic features discussed in the following.

Hydrologic Unit A - Siphons 7 to 14

In hydrologic unit A, the canal was excavated in soil that contains a high percentage of clay. Consequently, seepage from the canal is relatively low.

The only significant seepage in this unit occurs where the canal was excavated through desert wash deposits (sand and gravelly sand) filling channels cut in the clay. The seepage supports phreatophytes downslope from these locations. Since the phreatophytes thin out downslope, even though the substrate is the same farther downslope, it is likely that all the seepage is consumed by the vegetation.

The boundaries for this unit were chosen so as to confine the East Highline Canal and related irrigated agriculture to one unit. Wetlands vegetation occurs near the East Highline Canal which is influenced by that canal. This confines errors of assumption about the source of water (Coachella Canal or East Highline Canal) supporting the vegetation to one unit.

Hydrologic Unit B - Siphons 14 to 18

As in the case of hydrologic unit A, the wetted perimeter of the canal also contains a high percentage of clay, along with some sand and gravel-filled channels normal to the canal. The average unit seepage is relatively low over the full segment length, but it is high (per square foot of wetted perimeter) in the short gravelly sand reaches. In these reaches, where the top of the clay is below the canal, a seepage-dependent water table develops on the clay. Downslope drainage of the seepage supports phreatophytes where it outcrops.

Hydrologic Unit C - Siphons 18 to 23

The wetted perimeter of the canal in this reach is sand and gravelly sand (a massive alluvial fan), except for some relatively short clay reaches in the transition zone near siphon 18. Although lined with clay before operational water deliveries, seepage in this unit is much greater than in units A and B. Seepage water moves downward through the relatively permeable alluvium and ponds on the relatively impermeable clay. Then the water moves downhill on top of the clay until, by virtue of the downslope thinning of the alluvium, it becomes shallow enough to support phreatophytes. This is illustrated in Figure 3-2.

The area extending from Frink Springs (near siphon 17 in unit B) to the Imperial Hot Mineral Spa area (near siphon 21 in unit C) also exhibits significant pre-canal phreatophytes. Based on 1949 aerial photos, many of the downslope phreatophyte areas are believed to have been established before the canal was filled, even those areas close to the canal, such as the area south of siphon 19 and the area west of siphon 21.

The 1949 photographs also show phreatophytes filling the wash channels that drain the artesian flow from the original "hot mineral well." This well was drilled in 1938 by the contractor building the Coachella Canal and has been reported to have a flow of 900 gpm. Currently, the well is owned by the Imperial Hot Mineral Spa and appears to be discharging 100 to 200 gpm. These flows do not appear to be connected to canal seepage.

Siphon 23 was selected as the end unit so as to isolate a portion of the canal excavated through sand from the downslope complications of the area around Dos Palmas Spring.

Hydrologic Unit D - Siphons 23 to 29

The wetted perimeter of the canal in this unit is sand and gravelly sand, essentially the same as in unit C, and the seepage is therefore relatively high. The downstream boundary of this unit (about 2,500 feet downstream from siphon 29) is the contact between alluvium and claystone/sandstone. The canal in this unit was also lined with clay prior to operational deliveries.

Two different geohydrologic conditions exist below the canal in this unit. At the railroad crossing, the subsurface lakebed clay extends at least 1,400 feet upslope from the canal (determined by drilling) and thereby prevents seepage from reaching the artesian aquifer below. This is illustrated in Figure 3-2. However, the clay was not encountered in a canal bank drill hole about 3,900 feet downstream from siphon 25. Without a clay barrier at some depth under the canal, seepage water supplements the artesian aquifer. The interconnection is illustrated in Figure 3-3. However, one or more of the lower artesian aquifers (geologic logs from the artesian wells show multiple aquifers and clay layers) may be isolated from canal seepage by a clay layer that extends upslope beyond the canal. Thus, it is difficult to determine how much recharge of the artesian acquifer occurs from seepage from the canal.

In the Dos Palmas Spring and Salt Creek area, estimating the area of phreatophytes induced by canal seepage is complicated by pre-canal artesian springs (old wells) and by artesian wells installed after the canal became operational (see "Pre-canal Groundwater"). Both of these are supplemented by canal seepage. Some phreatophytes were induced by the pre-canal springs and some by the overflow from post-canal artesian wells.

Moreover, the California fan palm population and, most likely, other phreatophytes, were increasing before the canal was constructed. In the winter of 1920, Randall Henderson reported, "There were three or four grown palms at the springs (Dos Palmas) then, and several smaller trees. Also several mesquites." In October 1946, he reported, "Today the original two palms have increased to 27... I believe the original two palms are still standing. I cannot be sure of them, but two of the 27 are fire-scarred veterans which have the appearance of having lived 75 or 100 years" (Henderson 1947). The full extent of fan palm and phreatophyte acreage without seepage influence is not known.

Pre-canal flow in the Salt Creek branch (north branch) at Dos Palmas Spring was consumed by phreatophytes (1949 aerial photos). After the canal was constructed, seepage supplemented flow from natural sources to such an extent that surface flow reached the Salton Sea. The USGS has been recording daily flow since 1961.

<u>Hydrologic Unit E - Siphons 29 to 32</u>

This unit actually begins about 2,500 feet downstream from siphon 29 and ends with the start of the lined canal at siphon 32. The wetted perimeter in this unit appears to be mostly sandstone and claystone. As in units A and B, there are channels filled with wash sand cutting through the sandstone and claystone normal to the canal. Seepage in this unit is believed to be relatively low and is mostly confined to the sand-filled channels.

Although lakebed clay does not outcrop downslope from the canal in this unit, as in all the other units, it is believed that the clay/sandstone is as or nearly as impermeable as the clay. Consequently, seepage draining via the sand-filled channels under the canal is locally forced to the surface or near the surface by the downslope outcropping of the underlying sandstone and claystone. Phreatophytes were induced by and are supported by near-surface seepage downslope of the canal.

3.3.2 Significance Criteria

Groundwater resource impacts would be considered significant if the alternative would substantially deplete non-seepage induced groundwater supplies or interfere with non-seepage groundwater recharge such that legally authorized use of extracted groundwater would be adversely affected.

The significance of groundwater impacts on vegetation is addressed in Section 3.5, and the related effects on special status species are addressed in Section 3.8.

3.3.3 Environmental Consequences

Conventional Lining Alternative

The Conventional Lining Alternative would not cause significant groundwater impacts and would not require mitigation.

General Groundwater Changes

In general, the canal-fed shallow groundwater in the area of the unlined canal would gradually diminish after lining until none would remain. This, in turn, would reduce the amount of water available to the seepage-induced vegetation, the impact of which is discussed in Section 3.5, "Marsh/Aquatic and Desert Riparian Habitat Along the Coachella Canal."

The effect on wells and springs would depend on the amount of canal seepage contained in the discharges. Where the upper clay layer extends up under the canal, the seepage is prevented from mixing with the groundwater below. Under these conditions, lining the canal would affect only the wells completed above the upper clay and springs outcropping upslope of the upper clay outcrop. Lining would not affect wells with openings below the clay. However, where the upper clay layer does not extend up under the canal, seepage mixes with the deeper groundwater and shows up in springs or wells. Limited data appears to support this theory, but it is not complete enough for full confirmation as to the extent this actually occurs. The following paragraphs present the predicted effects on three local spring areas.

The predicted effects were estimated using a combination of two methods—location of the clay layer and analysis of the tritium concentration of the water.

Tritium, a radioactive isotope, indicates the last recent exposure of water to the atmosphere. The occurrence of tritium in waters of the hydrologic cycle arises from both natural and manmade sources. The tritium level in groundwater permits a determination of whether the last atmospheric exposure of the groundwater was more than 50 years ago (no detectable tritium), less than 50 years ago but prior to atmospheric nuclear weapons testing (low levels of tritium), or after the start of nuclear weapons testing (tritium exceeding levels prior to nuclear testing).

Oasis Springs Area. In the vicinity of this spring in unit C, the upper clay layer extends upslope under the canal, indicating that the source of the spring is isolated from canal seepage. A water sample from the spring shows no measurable tritium, which confirms the separation. Therefore, lining would have no effect on the flow at the Oasis Springs area.

Dos Palmas Spring Area. While the extent of the clay layer indicates that the springs in this area discharge some seepage, tritium analysis was used to estimate the proportion. Based on the measured tritium concentration at Dos Palmas Spring (unit D) and assuming that the artesian aquifer source is tritium free (as is Oasis Springs), two-thirds of the spring flow is estimated to be canal seepage. The percentage of canal water exiting from the artesian wells may be less since the wells may be discharging water from a deeper artesian zone, one that might be more isolated from canal seepage. For this reason, it is estimated that overall, lining would reduce flow from the artesian wells in the Dos Palmas Spring area by about 50 percent. Samples for tritium analysis were not collected from the high flow Dos Palmas Spring area wells because the owner denied access.

Frink Springs/Imperial Hot Mineral Springs Area. This area is located in unit C. Shallow wells located above the clay layer in the Imperial Hot Mineral Spa area probably would go dry after canal lining. According to one owner, production in his well ceased for a period of time when the canal was drained for inspection and repair.

As discussed above, however, the area extending from Frink Springs (near siphon 17 in unit B) to the Imperial Hot Mineral Spa area (near siphon 21 in unit C) exhibited significant precanal phreatophytes. Based on 1949 aerial photos, many of the downslope phreatophyte areas are believed to have been established before the canal was filled, even those areas close to the canal. Accordingly, not all of the well production in this area is expected to be dependent on canal seepage.

Discharge from the deep artesian wells would not be affected because the near-surface lakebed clay extends under the canal and prevents canal seepage from supplementing the artesian aquifer below.

Salton Sea. No canal-seepage dependent groundwater currently reaches the Salton Sea. Accordingly, lining the canal would not affect groundwater discharges to the Sea.

Summary. This alternative would result in a drop in perched groundwater levels, and this would directly affect users of canal seepage, including aquaculture farms. Based on the significance criteria listed above, this effect would not be considered significant because the affected groundwater users have no legal standing to continued use of recharge of previously available Coachella Canal seepage. However, as described in Section 3.2.3, users within CVWD's service area could offset their loss of canal-seepage water through the direct purchase of domestic water from CVWD.

Along the majority of the unlined canal section, canal seepage is separated from regional, deep groundwater aquifers by an impermeable clay layer (see Figure 3-2). In areas where canal seepage may intermix with deep groundwater, such as near Dos Palmas Spring, much of the canal-seepage is consumed by phreatophytes near the canal or used for landscaping or aquaculture operations. However, as described above, canal seepage currently results in no groundwater discharge to the Salton Sea. Based on these factors, lining the canal would not have a significant effect on regional, deep-water aquifers.

The resulting significant effects of groundwater changes on other environmental resources due to a reduction in perched groundwater levels, as discussed in subsequent sections of this chapter, would be mitigated to below levels of significance.

Underwater Lining Alternative

The effects of the Underwater Lining Alternative on groundwater resources would be the same as for the Conventional Lining Alternative (less than significant).

Parallel Canal Alternative

The effects of the Parallel Canal Alternative on groundwater resources would be the same as for the Conventional Lining Alternative (less than significant).

No Action Alternative

Without the project, groundwater levels would remain at current depths and salt cedar would continue to displace native vegetation, increasing this nonnative species' use of groundwater in the project area.