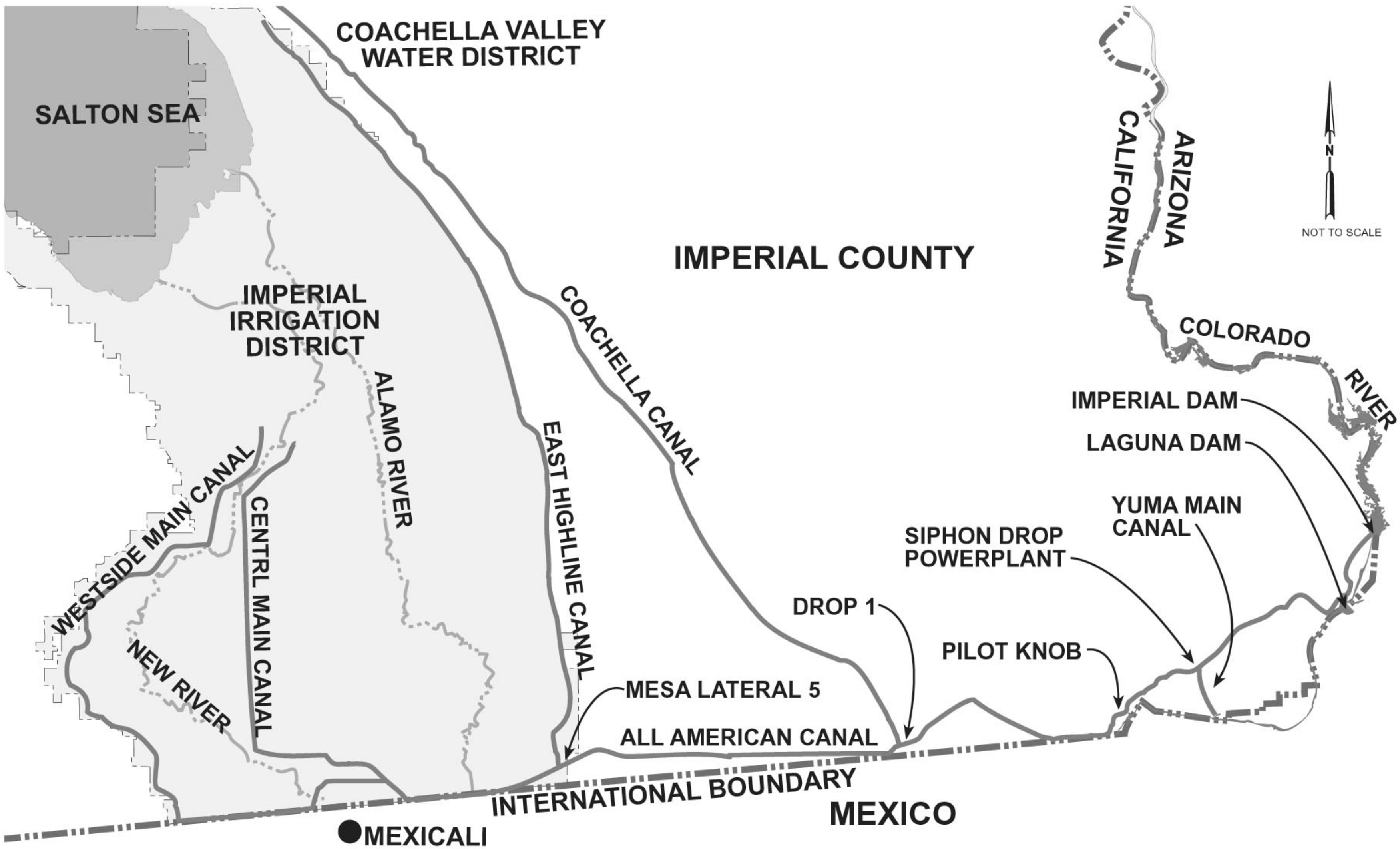
Knob Power Plant, and the Coachella Canal—before it reaches the IID water service area and branches off to three primary main canals: East Highline, Central Main, and Westside Main. The East Highline Canal, an unlined 49-mile canal, serves the eastern part and a portion of the central part of the IID water service area. The canal follows the eastern boundary of the irrigated portion of the IID water service area and conveys irrigation water to agricultural fields via a series of east-to-west laterals. The second primary main canal, the Central Main Canal, connects to the AAC just north of Calexico and serves most of the central part of the IID water service area. The Central Main Canal is about 27 miles long and is also unlined. The Westside Main Canal joins the AAC near the western edge of the IID water service area and serves the western portion of the IID water service area. It is nearly 45 miles long and is unlined, except for 5.5 miles at its northern end. These three primary main canals serve as the main arteries of an irrigation system consisting of approximately 1,667 miles of canals and laterals that distribute irrigation water to individual farm fields within the IID water service area (see Figure 3.1-9).

Flow measurements (collected from 1986 to 1999 at Drop No. 1, just before the AAC enters the IID water service area) show that Colorado River irrigation deliveries generally range from approximately 2.4 MAFY to more than 3.1 MAFY. The average annual delivery of irrigation water during the same period is approximately 2.8 MAFY (see Figure 3.1-10). The remaining balance of diverted water is discharged into the Yuma Main Canal, smaller canals serving the Yuma Project Reservation Division, Pilot Knob Power Plant and Wasteway, or the Coachella Canal, or is lost to spillage, evaporation, or seepage along the length of the AAC.

Colorado River diversions account for approximately 90.5 percent of all water flowing through the IID water service area. The remaining sources include: flow from the New River across the International Boundary (5.2 percent), rainfall (3.6 percent), net groundwater discharge into the irrigation system (less than 1.0 percent), and flow from the Alamo River across the International Boundary (less than 0.1 percent). A summary of the average overall water input to the IID water service area for the period 1987 to 1998 is presented in Figure 3.1-11.

Water delivered for agricultural use accounts for approximately 85 percent of IID's diversion from the Colorado River, as measured at Pilot Knob. Approximately 2 percent of IID's diversion is delivered to municipal, industrial, and other uses. Approximately 3 percent of IID's diversion is lost as seepage from the AAC. The remaining 10 percent is lost to seepage and evaporation within the IID delivery system, or discharged to the drainage system as operational discharge.

Delivery of Colorado River water to farms in the IID water service area is driven by user demand. This demand is not constant throughout the year but varies in response to a combination of influences, such as changes in climate and local rainfall conditions, crop cycles, crop prices and government crop programs. Demand is typically highest in April and remains fairly high until August, at which time it starts to decline. This period of time is also the driest and hottest of the year in the Imperial Valley.



Note: Other canals with turnouts from the AAC that are not shown on this digram include Reservation Main Canal, Titsink Canal, Yaqui Canal, Pontiac Canal, Ypsilanti Canal and the Pilot Knob Power Plant and Wasteway.

Figure 3.1-9
Project Site Features
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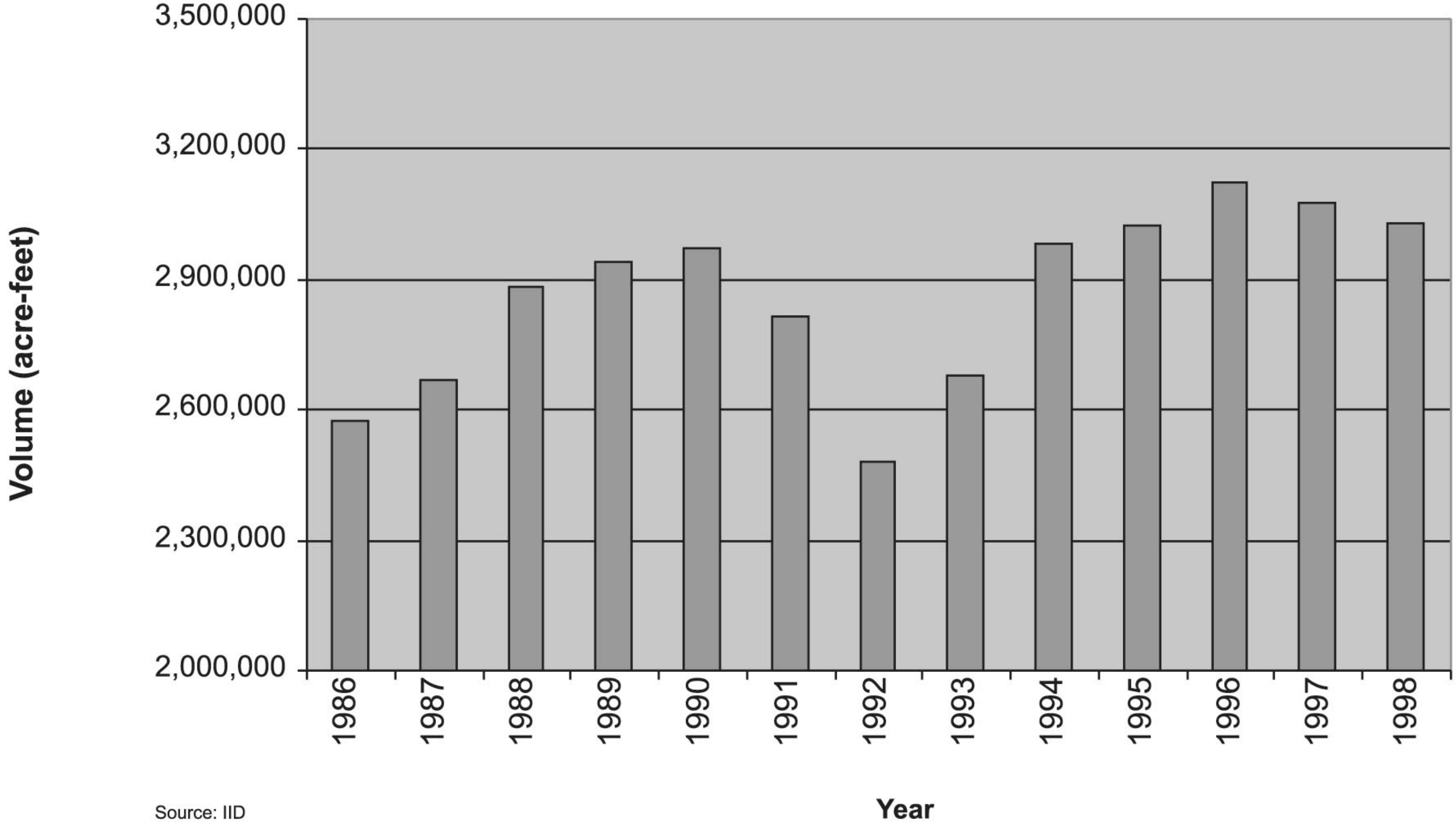

Source: IID

Figure 3.1-10
Colorado River Water Delivered to IID (1986-1998)
Measured at All American Canal Drop No.1
IID Water Conservation and Transfer Project Final EIR/EIS

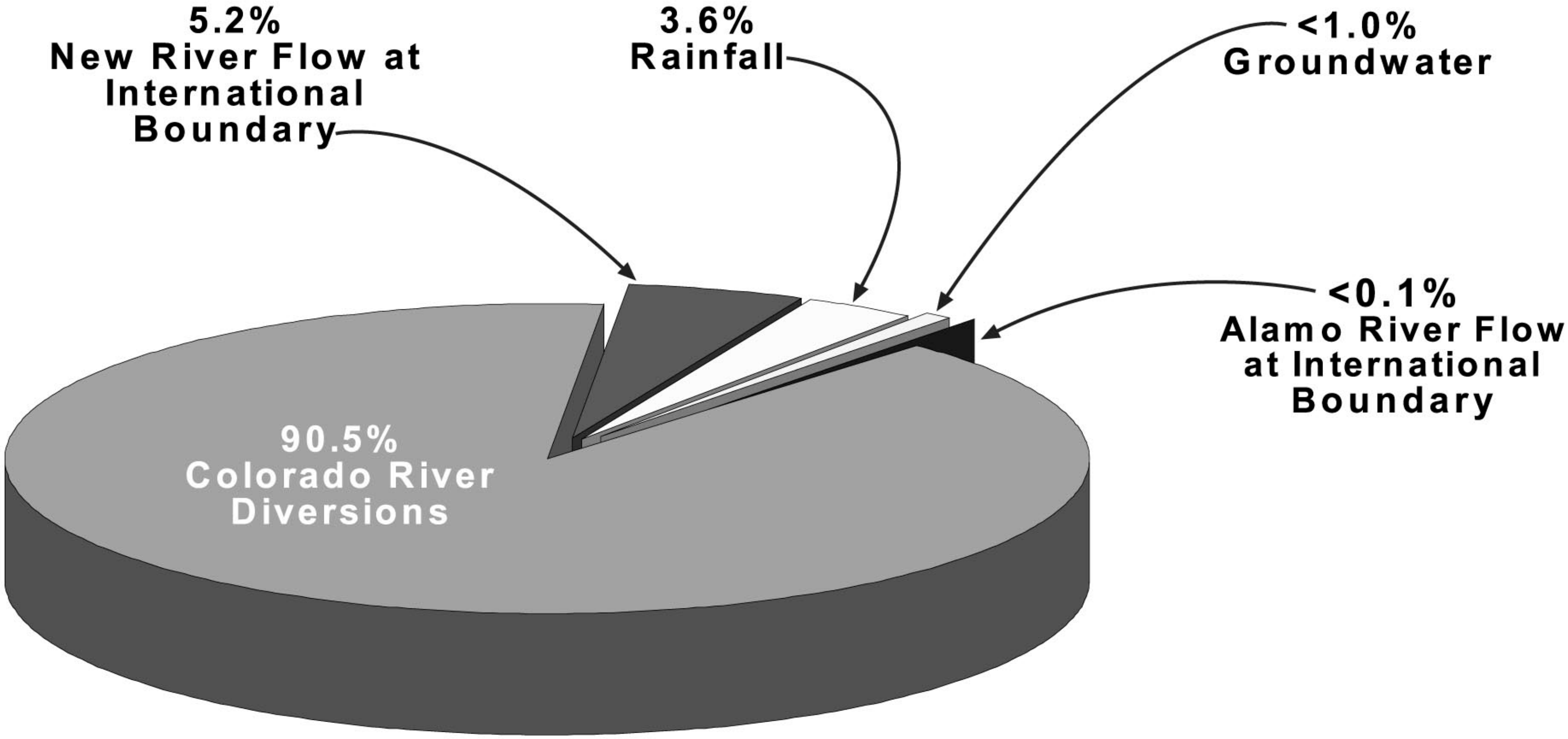

Figure 3.1-11
Percent of Surface Water Inputs to the IID Water Service Area
IID Water Conservation and Transfer Project Final EIR/EIS

IID Drainage System. IID's drainage system includes a network of 1,456 miles of open and closed (pipeline) drains, 750 surface and subsurface drainage pumps, thousands of miles of subsurface drains (tile) and associated collection pipelines and water recovery systems. Water entering the drainage system can originate from the following sources (see Figure 3.1-12):

- Delivery system losses include canal seepage and operational discharge. Operational discharge is water that has traveled through portions of the distribution system to ensure full farm deliveries and is ultimately discharged to the drains from the surface canals and laterals of the system. Canal seepage is water lost to shallow groundwater and intercepted by the drains;
- On-farm tailwater runoff (i.e., surface water runoff occurring at the end of an irrigated field when total water applied exceeds the soil infiltration rate);
- On-farm tilewater (i.e., water passing the crop root zone which normally enters a tile drain, also referred to as tilewater or leach water);
- Stormwater runoff; and
- Groundwater (i.e., intercepted groundwater that has moved up into the drains from the deeper aquifer near the east boundary of the irrigated area (Loeltz et al. 1975).

Approximately 15 percent of the water applied to fields runs off as tailwater. Except in fields with tailwater recovery systems (TRSs), this water is no longer available for on-farm use and is discharged into either the drainage system or rivers within the IID water service area. Irrigation water that percolates through the soil into the drainage system is collected by subsurface tile drains and, to a lesser extent, by surface drains. The open drains (mostly the lateral drains) collect tailwater and tilewater from farms as well as operational discharge and canal seepage water emanating from IID's delivery system.

Collectively, tilewater and tailwater drainage accounts for roughly 67 percent (34 and 33 percent, respectively) of all of the drainage discharged either directly to the Salton Sea or via the New and Alamo Rivers. The Alamo and New River drainage water and the surface drains that discharge directly to the Salton Sea represent significantly different water regimes and are affected by different segments of the IID water service area. The Alamo River receives approximately 61 percent of the discharge from the drainage system, and the New River receives roughly 29 percent of the drainage. The remaining 10 percent is discharged to surface drains that flow directly to the Salton Sea (see Figure 3.1-13).

Drainage to the Salton Sea. With the exception of drainage water that is returned to the fields as irrigation water or flow lost to shallow and deep groundwater aquifers (through percolation that is not captured by the tile drains), essentially all flow collected by the drainage system is ultimately conveyed to the Salton Sea. Total discharge to the Salton Sea from the IID water service area averaged approximately 0.98 MAF (1.16 MAF with inflow from Mexico) during the period 1986 to 1999. Figure 3.1-14 shows the annual variability of the IID water service area's total surface discharge to the Salton Sea during the same time period.

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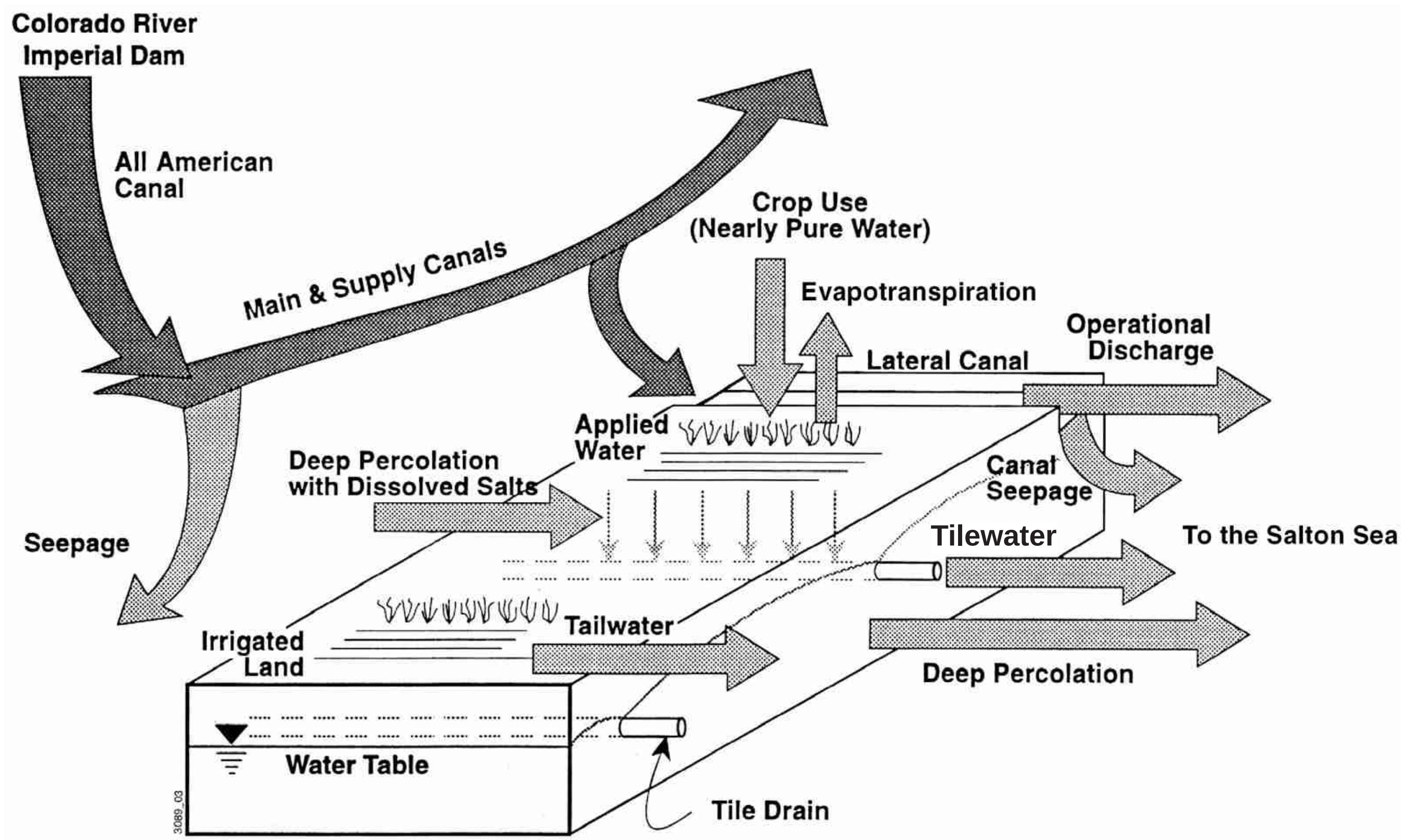
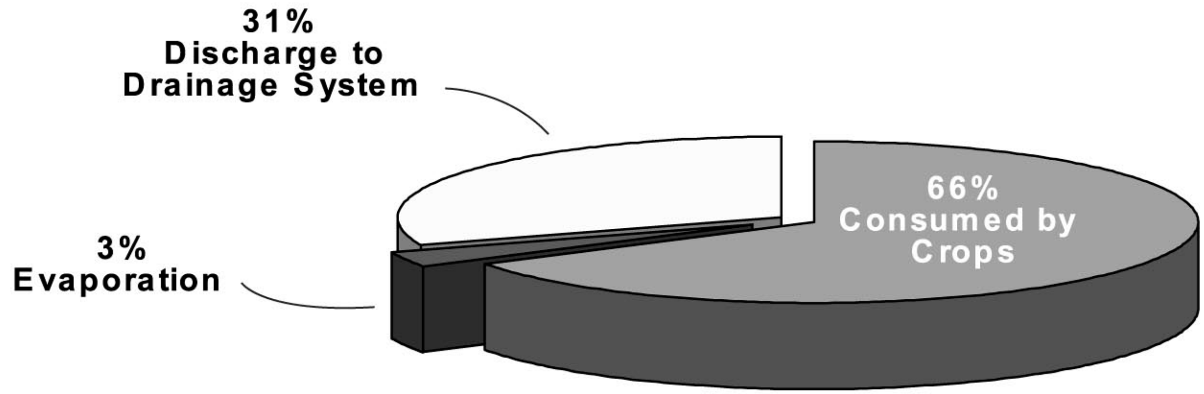
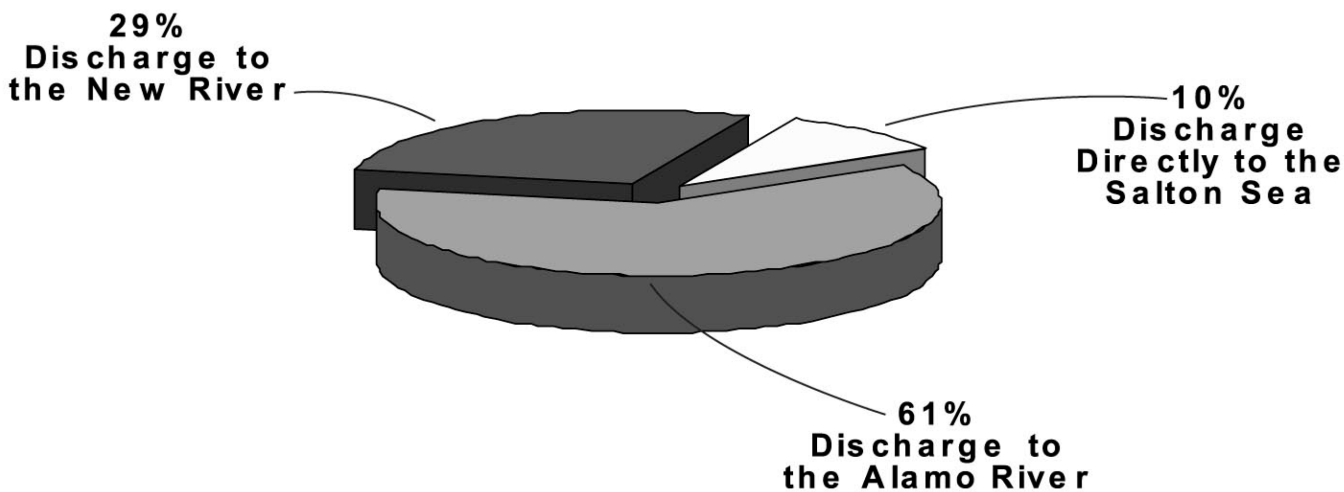


Figure 3.1-12
Water Schematic
IID Water Conservation and Transfer Project Final EIR/EIS



Water Delivery for On-Farm Water Use



Distribution of IID Drainage to the New and Alamo Rivers and the Salton Sea

Figure 3.1-13
On-Farm Water Use and Distribution of IID Farm Drainage
IID Water Conservation and Transfer Project Final EIR/EIS

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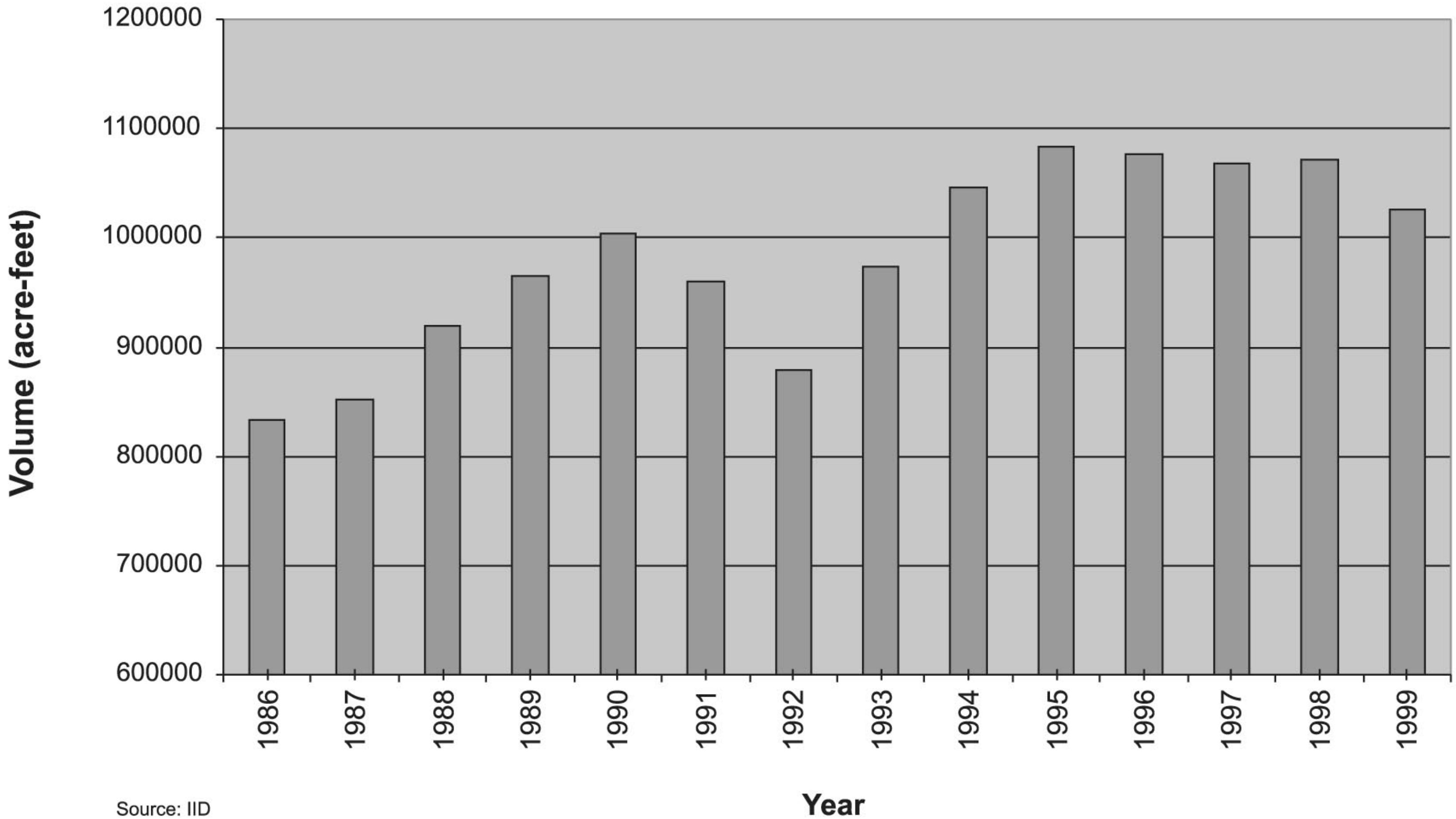

Figure 3.1-14
Total IID Discharge to the Salton Sea (1986-1999)
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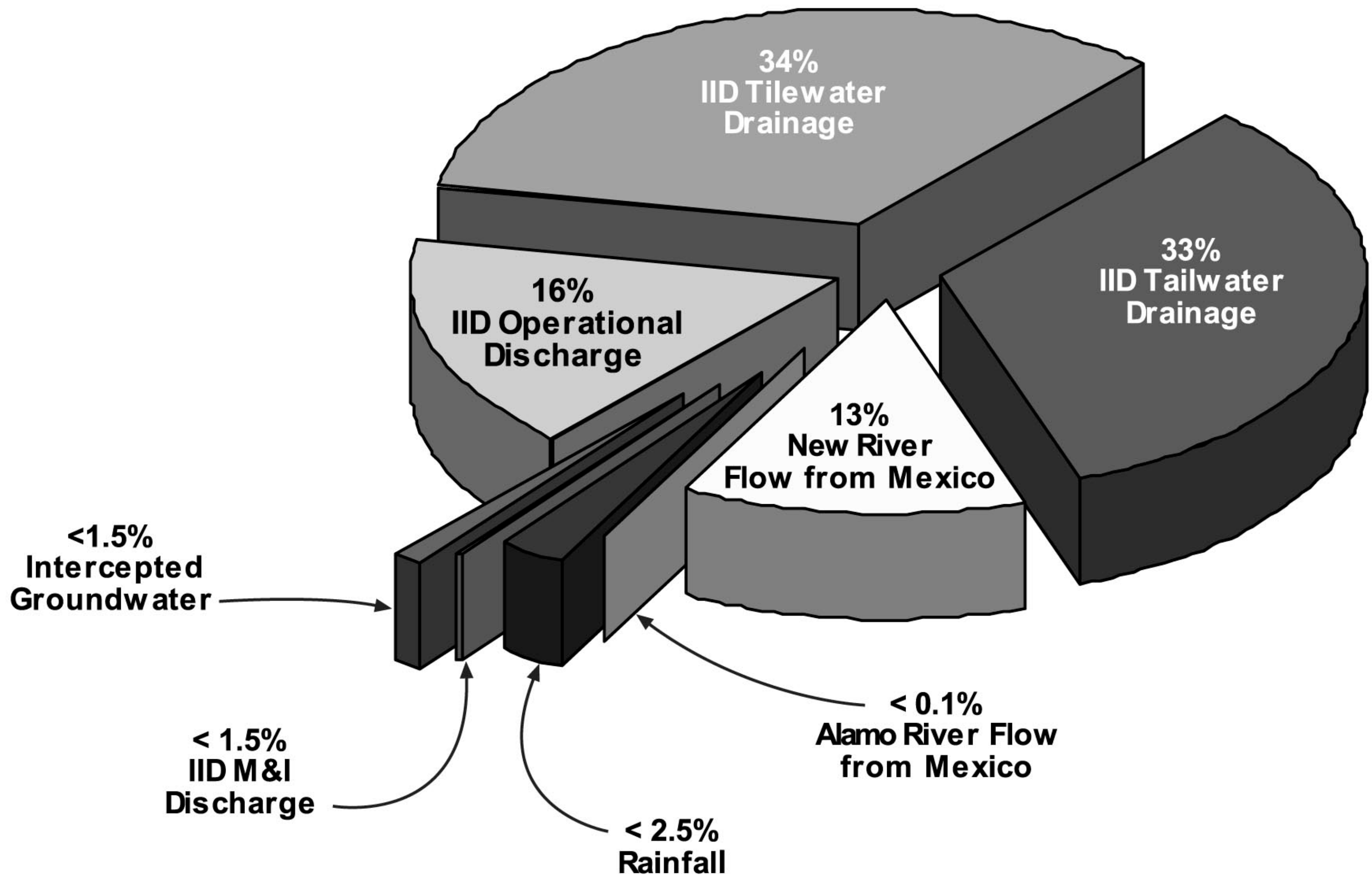
A diagram showing the distribution of surface water outputs from the IID water service area sources (i.e., on-farm drainage, and operational, and municipal and industrial discharge) and other sources (i.e., surface flows from Mexico, groundwater, rainfall) to the Salton Sea is presented in Figure 3.1-15. A schematic depicting each of the actual component's discharge from IID for the period 1987 to 1998 is presented in Figure 3.1-16.

Drainage Through the Alamo River. As shown in Figure 3.1-17, the annual river flows into the IID water service area have varied over time, recently ranging from a low of about 1.7 KAF in 1996 to a high of about 4.2 KAF in 1987. The Alamo River receives drainage from about 58 percent of the IID water service area and accounts for about 61 percent of IID's drainage discharge. Based on an IID surface drainage balance (see Appendix F), measured flow from the Alamo River at its outlet to the Salton Sea is approximately 604 KAF, with approximately 168 KAF from rainfall, municipal and industrial and operational discharge and seepage, 216 KAF from tailwater, and 228 KAF from on-farm tile water (see the Average Overall Water Balance in Figure 3.1-16 and Appendix F).

Drainage through the New River. The New River also enters IID from Mexico, but, unlike the Alamo, the New River serves as an open conduit for untreated municipal sewage, heavy metals, and agricultural drainage waters high in pesticide residues from northern Mexico. The average annual flow volume of the New River at the International Boundary during the period 1987 to 1998 was about 165 KAFY, which comprised approximately one-third of the total flow of the New River at its discharge to the Salton Sea. Therefore, the New River is a significant source of pollutant loading into the Salton Sea. Water demand and discharges in Mexico might affect annual flows, and flow volumes at the boundary have changed dramatically during the period of record. Gage data shows flow in the New River at an average annual low of 41 KAFY from the period 1950 to 1957, increasing to an average of 110 KAFY during the period 1958 to 1978. Flows across the boundary increased again to an annual average of 150 KAFY during the period 1979 to 1982, and then again from 1983 to 1988 to values higher than 250 KAFY. The discharge from Mexico leveled back to approximately 100 KAFY for the period 1987 to 1999 (see Figure 3.1-17).

The New River receives approximately 29 percent of the drainage from IID, and including input from Mexico, accounts for about 39 percent of the total discharge from the IID water service area to the Salton Sea. The average annual flow from the New River to the Salton Sea is made up of approximately 81 KAFY from rainfall, municipal and industrial effluent, IID operational discharge, and canal seepage; 102 KAFY from tailwater; and 108 KAFY from on-farm tile drainage, for a total of 291 KAFY, with the remainder of the flow coming from Mexico and net river losses (see the Average Overall Water Balance in Figure 3.1-16 and Appendix F).

Surface Drains Discharging Directly to the Salton Sea. Surface drains that flow directly to the Salton Sea account for roughly 10 percent of the total discharge from the IID water service area to the Sea. The direct drain discharge to the Salton Sea is estimated at approximately 96 KAF. Rainfall, IID operational discharge, and canal seepage account for approximately 27 KAF of the total flow, 33 KAF originates from tailwater, and 36 KAF originates from on-farm tile drainage (see the Average Overall Water Balance in Figure 3.1-16 and Appendix F).



Note:
Flow numbers are approximate.

Figure 3.1-15
Distribution of Surface Water Outputs to the Salton Sea from IID Farm Drainage and Other IID Waters
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NOTES:

1. DOES NOT INCLUDE APPROXIMATELY 300,000 ac-ft/yr DELIVERY TO COACHELLA CANAL.
2. INCLUDES APPROXIMATELY 3,400 ac-ft/yr DELIVERY TO IID USERS VIA THE AAC UPSTREAM OF THE MESA LATERAL 5 AND 4,100 ac-ft/yr DELIVERY TO IID USERS VIA THE COACHELLA CANAL.
3. THE RAINFALL (RUNOFF AND DEEP PERCOLATION) COMPONENT RESULTS FROM NON EFFECTIVE PRECIPITATION AND IS CALCULATED AS A CLOSURE TERM FOR THE DRAINAGE WATER BALANCE.

SIMULATED MEAN ANNUAL FLOWS FOR TIME PERIOD 1987-1998 IN THOUSANDS OF ACRE FEET.

WATER BALANCE DATA ARE APPROXIMATE AND MINOR VARIATIONS IN THE MODELED FLOW DATA ARE EXPECTED.

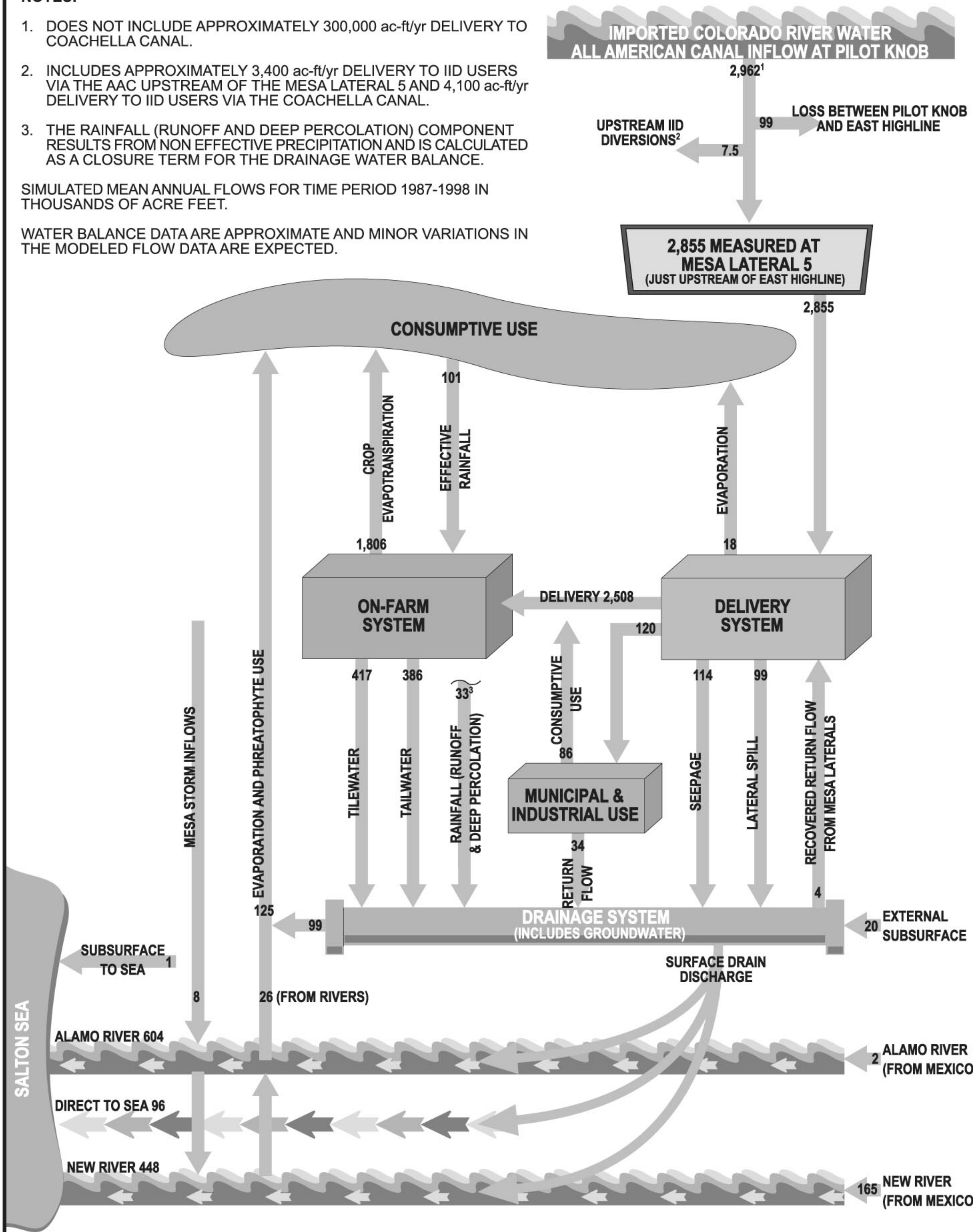

Figure 3.1-16
Existing Setting
Average Overall Water Balance
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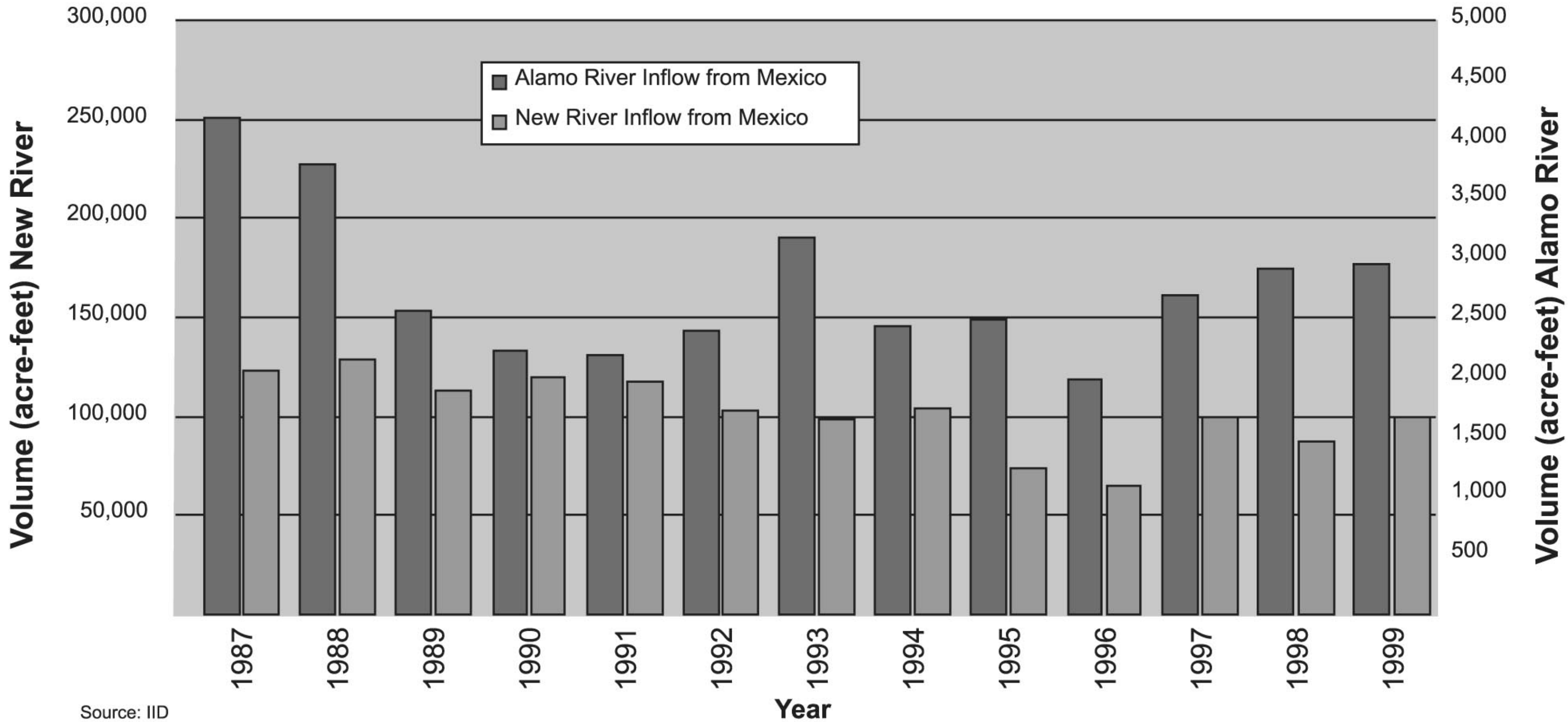

Source: IID

Figure 3.1-17
Annual Alamo and New Rivers Flow Volumes at the International Boundary (1987-1999)
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Drainage Water Quality. The following provides an evaluation of the influence of agricultural operations within the IID water service area on New and Alamo River water quality and describes the quality of drainage discharged directly from the IID water service area to the Salton Sea. The COCs in the New and Alamo Rivers at the International Boundary are compared with those at the outlets to Salton Sea, and with those in drainage water discharged to the New and Alamo Rivers and the Salton Sea. Other than changes resulting from evaporation, the difference between the constituent concentrations in the New and Alamo Rivers at the International Boundary and at the outlets to the Salton Sea can be largely attributed to drainage water discharges from fields within the IID water service area.

COC concentration values for the collective drains that discharge directly to the Salton Sea could not be determined because of the lack of reliable flow data for these drains. As a result, this information is not provided in this EIR/EIS.

Constituents of Concern. Various studies in the IID water service area have identified a number of COCs in IID drainage water. The rationale for identifying these constituents is presented in Section 3.1.4.2, Significance Criteria. The COCs identified in irrigation and drainage water include the following:

- Salinity (also referred to as TDS)
- Selenium
- Total suspended solids (also referred to as TSS)
- Nitrogen and phosphorus
- Organochlorine insecticides (DDT and its metabolites DDE and DDD, and toxaphene)
- Organophosphorus insecticides (diazinon and chlorpyrifos (Lorsban, Dursban))
- Organochlorine herbicides (Dacthal)
- Boron

A brief discussion of the COCs is provided below. For information on the effects that these constituents might have on biological resources, see Section 3.2, Biological Resources.

Salinity: Salinity (also referred to as TDS —these terms are interchangeable throughout this document) is one of the most prevalent COCs in the IID water service area. Chlorides and other dissolved solids all contribute to soil and water salinity. At high concentrations, soil salinity can be detrimental to seed germination and crop yields. Salt compounds include elements, such as selenium, that can also be toxic to humans, fish, and wildlife if the elements are biologically available in high enough concentrations.

The primary source of salts in the IID water service area soils is imported Colorado River water. These salts are applied to fields with irrigation water and are carried off by tailwater or tilewater drainage into surface drains. Evapotranspiration removes only water; therefore salts are concentrated in or below the root zone. Additional irrigation water is used to leach the salts out of the root zone and into the tile drainage system. As noted previously, the IID drainage system discharges to the Salton Sea either directly or via the New and Alamo Rivers. Thus, the Salton Sea ultimately serves as a sink for salts.

Selenium: Selenium is the constituent of greatest concern for toxic risk in the IID water service area and Salton Sea system (Setmire and Schroeder 1998). Selenium, in trace concentrations, is an essential element for both plants and animals but can be toxic at higher concentrations (Rosenfeld and Beath 1946). Selenium enters IID's soils, groundwater, and surface waters through imported Colorado River irrigation water. As described in the salinity discussion above, selenium is also concentrated in irrigated lands through evapotranspiration and flushed into water sources through irrigation practices.

Sediment: Surface runoff carries suspended sediment (also referred to as TSS when measured in solution) to agricultural drains and to the New and Alamo Rivers. These sediments might be deposited in slow-moving portions of drains, such as the mouths and vegetated areas of the drains, and/or transported into rivers where deposition can occur in vegetated areas, slow-moving backwaters, and at the New and Alamo River deltas at the Salton Sea. Sediment can carry DDT, its metabolites, and other insoluble pesticides, including toxaphene.

Nitrogen and Phosphorus: The IID water service area has a long history of agricultural use of fertilizers. Therefore, high concentrations of nitrogen and phosphorous are present in soils and drainage waters as these elements are primary components of fertilizers.

*Organochlorine Insecticides***:** Organochlorine insecticides have been measured in drainage water, and in some sediments. Although banned in 1972, DDT and its metabolites are still present in the environment. In addition, organochlorine insecticides can be mobilized from soils and carried into the drainage system by irrigation water.

Organophosphorus Insecticides: Like the organochlorine insecticide DDT, the organophosphorus insecticides diazinon and chlorpyrifos were first introduced into the IID water service area as agricultural insecticides. The main concern about these chemicals relates to their toxicity to aquatic organisms. Because of their molecular weight and density, organophosphate compounds, such as chlorpyrifos, typically settle in sediments and persist in soil. Even though they are less persistent than organochlorines, organophosphates can also be transported into surface waters through irrigation and drainage practices.

Organochlorine Herbicides: As in the case of insecticides, irrigation systems mobilize organochlorine herbicides, depositing them in surface drainage systems throughout the IID water service area. It is likely that organochlorine herbicides have been introduced into the Salton Sea via runoff and irrigation drains.

Boron: Boron exists in several forms in soil in the IID water service area and appears to be leaching from its irrigated soils. Though beneficial in small quantities, elevated concentrations of boron can lead to adverse effects in organisms. In aquatic environments, sediments often absorb boron.

Laboratory analysis of water discharging to the IID drainage system indicates the following:

- Operational discharges are considered to have the best water quality because they are not applied to the land. Operational discharges have a water quality similar to that entering the IID water service area directly from the LCR.
- Tailwater is considered to have the next best water quality, relative to operational discharge. However, tailwater accumulates sediment and solutes (including potentially significant concentrations of agricultural fertilizers and pesticides) from the soil as it flows across cultivated fields.

- Tilewater is generally considered to have the poorest water quality because dissolved salts and other constituents tend to concentrate in the water as it percolates through the root zone and is collected in subsurface drainage.

Data Collection Parameters. The data presented below provide an average concentration of the COCs in IID drains and rivers under existing conditions.

Historical Water Quality Data: Historical water quality data include data collected during numerous monitoring events from sites located throughout the IID water service area. This database was compiled for modeling purposes and was obtained from various sources, including EPA's Storage and Retrieval Environmental Data System, USGS' Water Quality Network, RWQCB, and published papers and documents. These sources contained water quality data collected within the IID water service area over many years. However, for this EIR/EIS, the data were limited to those collected for the period between 1970 to 1999.

Although the water quality data set contained many samples, the data tended to be collected sporadically over time and favored readily accessible sites. For example, even though the time period for sample collection ranged from 1970 to 1999, samples were not collected on a regular (e.g., monthly, annual, etc.) basis or at a uniform group of sites. Furthermore, the numbers of analyses of any one COC ranged from very few to several hundred. Because of the lack of good temporal coverage, the data were grouped by month throughout the entire study period. The data were then grouped spatially and assigned to distinct geographic locations to quantify flow and COC concentrations from each of the various sources that flow into and discharge out of the IID water service area. As a result, the data are reported as mean concentrations of COCs, which represent cumulative flows at the following geographic locations:

- IID irrigation delivery water
  - AAC
- Alamo River drainage basin
  - Alamo River at the International Boundary
  - IID surface drain discharge to the Alamo River (South Central and Holtville drains)
  - Alamo River at the outlet to the Salton Sea
- New River drainage basin
  - New River at the International Boundary (Greeson and Trifolium 12 drains)
  - IID surface drain discharge to the New River
  - New River at the outlet to the Salton Sea

A summary of the historical water quality data associated with each of the individual drains and the cumulative drainage is provided below. Following these summaries, a list of the mean flows and COC concentrations according to particular drains and geographic sources is presented in Table 3.1-4. The table also shows state and federal water quality criteria.