# Chapter 2.  Project Alternatives and Points of Reference

This chapter describes the project alternatives and points of reference for impact assessments.

The first major section describes the process for developing the water rights alternatives.  The alternative development process included preparing several numerical models for predictive purposes.  The assumptions underlying these models are explained in this section.  Diversion management rules that constitute the alternatives, and were used in modeling simulations of them, also are described in this section.

The second major section describes each alternative.  Alternatives represent different sets of terms and conditions, or diversion rules, that could be incorporated into LADWP's water rights licenses to achieve certain desired results.  This section focuses on intended effects of the alternatives, including lake levels, streamflows, and exports to the Los Angeles Aqueduct predicted through model simulations.

Seven alternatives have been defined.  The No-Restriction and No-Diversion Alternatives define the full range of possibilities, but the No-Restriction Alternative cannot meet the project objectives as described in the preceding chapter.  Five intermediate alternatives are formulated that can meet project objectives to varying degrees; they entail minimum required streamflows supplemented as needed through additional streamflow releases intended to keep the lake surface above selected target elevations whenever possible.

For all simulations of the alternatives, the historical 1940-1989 hydrologic record was used to represent the normal range of climatic variation that could be expected to occur in the future.  The simulations revealed that the assumed diversion rules would generally, but not always, prevent the lake surface from falling below the target lake level of the alternative.  Estimates of minimum lake elevations under each alternative for prolonged droughts also were estimated based on data from the current drought and other dry years of record.

The third major section of this chapter presents the points of reference and baseline scenarios for assessing environmental impacts of the project alternatives and cumulative impacts of ongoing water diversions in Mono Basin.

## PROCESS FOR DEVELOPING PROJECT ALTERNATIVES

### Introduction

Project alternatives must be formulated to functionally link possible streamflow and lake level. Requirements for each cannot be independently specified because streamflows affect lake level.

Snowpack is highly variable in the Sierra Nevada, and runoff to Mono Lake fluctuates substantially from year to year. This natural variation in runoff will continue to cause substantial fluctuations in the lake level. Nonetheless, under a particular diversion management regime, the long-term average inflows produce lake surface elevations that fluctuate around some average elevation. This condition is termed "dynamic equilibrium". One of the major needs in developing each alternative is to establish streamflow requirements that are consistent with desired lake surface elevations.

The simulations of the project alternatives considered in this EIR assume two streamflow release components. Some of the needed long-term lake inflow can be obtained by specifying minimum monthly flows in the four tributaries below the diversions. For example, possible fish flows to satisfy the Fish and Game Code could be provided by specifying such minimum streamflows. Additional long-term average inflow to Mono Lake can then be secured by annually specifying additional lake releases into the streams, specified as fractions of the projected annual runoff every spring. These fractions could depend on the elevation of the lake surface in relation to the target management level at that time.

To develop such alternatives, the streamflow patterns of the four diverted tributaries were first analyzed using observed monthly runoff from the 1940-1989 historical period. These hydrologic data are described in Chapter 3A, "Hydrology", and are summarized in the first section below.

Second, the relationships between streamflows and lake volume and surface elevation were identified through the development of a monthly Mono Lake water balance model, as described in Appendix A and summarized in the second section below.

The relationship between lake volume and water quality is described in Chapter 3B, "Water Quality". The patterns of fluctuation in lake salinity were not used as standards to define the alternatives but were derived from model simulations of each alternative.

Third, relationships were established between available water exports from Mono Basin and the city's water demand, other supplies available to the aqueduct from Owens Valley streams and the groundwater basin, and water conveyance and storage constraints throughout the system. The relationships of these factors were simulated with a monthly model of the LADWP aqueduct system, described in Auxiliary Report No. 5, "Los Angeles Aqueduct Monthly Program Documentation" (Luhdorff & Scalmanini 1992), which is summarized in the third section below.

Finally, the aqueduct model was used to develop simulations of specific project alternatives that embody consistent sets of streamflow requirements and lake levels, by providing minimum specified streamflows, accounting for in-basin irrigation, triggering supplemental lake releases when needed, respecting aqueduct-operating constraints, and meeting water supply targets whenever possible. The assumptions governing the alternatives are described in the last section below, and the detailed simulation results are available in Auxiliary Report No. 18, "Summary of Hydrologic Simulations" (Jones & Stokes Associates 1993).

## Determining Tributary Streamflow Patterns

### Characterizing Normal Runoff Conditions

The available runoff at the LADWP aqueduct diversion locations in Rush, Lee Vining, Walker, and Parker Creeks in Mono Basin is the basic variable affecting alternative diversion rules. The runoff is a combination of baseflow and seasonal snowmelt. Streamflow generally varies slowly, allowing the use of monthly average streamflow data in the modeling. Southern California Edison (SCE) operates hydroelectric power plants with seasonal storage reservoirs upstream on Rush and Lee Vining Creeks, so the observed historical monthly streamflows, called "runoff" herein, include the effects of that seasonal storage.

LADWP has maintained streamflow measurement stations (flumes or weirs) on all four diverted streams since before diversions began. These daily streamflow records have been adjusted to account for upstream irrigation uses. Figure 1-6 in the preceding chapter shows the total annual runoff for the four tributary streams for the 1940-1989 runoff years. The runoff year begins on April 1, just before the seasonal snowmelt runoff period of May through July.

The runoff from each of the four streams reflects the snowmelt runoff and baseflow from its watershed, each having a different area, elevation distribution, and aspect relative to the Sierra Nevada crest. The distribution of annual runoff among the four diverted streams for the 1940-1989 period is shown on Table 2-1 in the order that these streams are located along the diversion facility.

### Characterizing Annual Runoff Variations

Because of variations in annual snowpack, snowmelt runoff is highly variable from year to year. The minimum observed runoff was a little less than one-half of normal (44% in 1977), whereas the maximum observed runoff was almost twice normal (194% in 1983). During the drought period beginning in 1987, runoff averaged about 60% of normal. Runoff variations for each of the four streams generally follow the same pattern.

The historical distribution of annual runoff volumes can be used to predict the likelihood of encountering a particular runoff volume in the future. The frequency with which runoff in the four streams was less than specific amounts in the 50-year period is given in Table 2-2. For example, the 10 lowest runoff years of the 50-year sequence represent the lowest 20% of the cumulative runoff distribution. The maximum runoff of these 10 years (i.e., 85,150 af) was approximately 69% of average runoff (i.e., 123,405 af). Thus, a runoff volume less than or equal to this value occurred 20% of the time in the 50-year historical record, or, put another way, can be expected to occur once each 5 years on average.

Under feasible project alternatives, allowed diversion amounts in a particular year should vary with the amount of runoff. Runoff probabilities have been used to classify "dry", "normal", and "wet" runoff years. The 20% and 80% cumulative runoff occurrence frequencies were used to classify runoff years into these three types. Thus, the dry year category (i.e., the 20% of the years that were driest) corresponds to less than 69% of average runoff and the wet year category represents those years having more than 132% of average runoff (Table 2-2).

### Characterizing Monthly Runoff Variations

The monthly runoff variations of the four diverted streams are typical of eastern Sierra Nevada streams. Monthly runoff is dominated by spring snowmelt in May through July, but a substantial baseflow is sustained throughout late summer, fall, and winter. Years with lower-than-normal snowpack produce almost as much baseflow, but without the high runoff peak during snowmelt. Because Lee Vining and Rush Creeks are regulated upstream for hydropower, some of the spring snowmelt is redistributed into summer and fall months, providing a very uniform baseflow. Walker and Parker Creeks are not regulated and therefore have greater variations in baseflow.

## Developing the Mono Lake Water Balance Model

The monthly Mono Lake water balance model (Appendix A) was developed to identify and quantify the relationships between Mono Lake tributary streamflows, groundwater inflows, precipitation on the lake surface, and evaporation from the lake surface with the lake water volume, surface area, and surface elevation. A monthly water budget approach was used. Because Mono Lake is in a closed basin, the only outflow from the lake is surface evaporation. Inflows include direct precipitation, measured and unmeasured streamflow, and groundwater seepage.

## Determining Mono Lake Bathymetry

The relationships between lake elevation, surface area, and water volume are defined by the bathymetry of Mono Lake. Bathymetric data for elevations below 6,370 feet were obtained from nearly 30,000 measurements from ship-based soundings (Pelagos 1987). Data for higher elevations were obtained from photogrammetric interpretation of aerial photographs taken when the lake surface was at an elevation of 6,372.7 feet, just above its historic lowstand (Pacific Western Aerial Surveys 1986).

The data for elevations above 6,365 feet were recently (October 1992) revised by SWRCB consultants during preparation of this report, based on mapping of lakeshores and relict shorelines of known lake surface elevations that appear on aerial photographs taken over the past several years (Appendix G). The sensitivity of the water balance model to the new bathymetric data was evaluated by applying the model to extreme drought conditions (see "Predicting Minimum Lake Levels from Prolonged Drought" below). The effect of using the revised bathymetric data in lakewide water balance proved to be minor, and for this reason the original Pacific Western Aerial Surveys data continued to be employed in water balance model.

## Estimating Evaporative Losses

Evaporative losses are the largest quantity in the water balance model for Mono Lake, but they are the most difficult to estimate. No direct measurements are available. An average annual evaporation rate was therefore estimated through two approaches. First, a range of values was used iteratively in the model to simulate lake surface elevation changes over the past 50 years of hydrologic record. This approach revealed the range of evaporation rates that would give reasonable correlation with the actual changes in lake level over the historical period.

The second approach was to identify evaporation rates that would adequately explain observed surface water temperature data based on models developed by the University of California (UC) Santa Barbara group studying the lake's aquatic productivity (Romero 1992).

The selected evaporation rate represents a balance between those rates obtained by the two approaches. The selected rate, 48 inches per year, and the monthly distribution of rates consistent with the annual rate were assumed to be constant for all years and are applied to the surface area of the lake at the beginning of the month in model simulations.

## Estimating Precipitation Gains

The monthly direct precipitation contribution to the lake volume was estimated using the observed monthly Cain Ranch rainfall multiplied by the lake area. The average 1940-1989 Cain Ranch annual precipitation was approximately 11 inches, although precipitation varied considerably from year to year.

This approach may overestimate lakewide average precipitation, because the Cain Ranch is near the base of the Sierra Nevada, whereas the lake extends several miles eastward. No other weather monitoring stations are situated around the lake, however. Any amount overestimated is probably not substantial and is accounted for in the "residual" of the water balance equation, described below.

**Estimating Tributary Inflows**

Monthly tributary flows above the aqueduct conduit for the four diverted tributary streams, as well as the releases made to the streams below the conduit, are available from LADWP and were used in the water balance model. Uncertainties in these records include unmeasured irrigation diversions and returns, local runoff and channel losses between the conduit gages and the lake, and measurement errors during high runoff. These unknown quantities also are part of the residual term.

Streamflow records also are available for Mill Creek and DeChambeau Creeks, which are not diverted by the LADWP. Because both streams are used extensively for irrigation purposes, monthly inflows to the lake from them cannot be accurately estimated from the records.

**Estimating Other Inflows and Accommodating Estimation Errors**

Other inflows include streamflows reaching the lake from Mill and Dechambeau Creeks and other streams (as just noted) and groundwater inflows. Groundwater inflows arise principally from infiltrating precipitation, irrigation water, and tributary streamflow.

Estimation errors arise from assumptions employed regarding the constancy of monthly evaporation rates from year to year, the use of monthly Cain Ranch precipitation to represent monthly lakewide totals, and the accuracy with which gauged streamflow releases represent actual releases.

The combination of other inflows and estimation errors are called the "residual" in the water balance model. To determine the monthly residual, the monthly lake volume changes for the historical 1940-1989 period were first calculated. These monthly volume changes were obtained by multiplying measured monthly lake surface elevation changes by the surface area of the lake at the beginning of the month (taken from the bathymetry tables described previously).

The difference between estimated gains (the measured monthly releases to Mono Lake from the four diverted streams and the monthly direct precipitation) and the estimated monthly evaporation losses were then compared to the calculated monthly volume change to yield the monthly residual.

Because a significant portion of the residuals were inflows from other tributary streams (e.g., Mill and DeChambeau Creeks), the monthly residuals were correlated with the undiverted runoff in the LADWP-diverted tributary streams. As expected, higher residuals generally corresponded to higher runoff, subject to considerable scatter. A relationship was developed from this correlation, characterizing the predicted monthly residual as a constant plus an amount equal to some fraction of the runoff in the LADWP-diverted streams for that month.

Thus, the residual term in the water balance was estimated to be a monthly inflow of a constant 33,780 af plus an amount equal to 22.8% of undiverted runoff from the four LADWP-diverted streams. The constant term embodies chiefly groundwater inflows, while the variable term embodies chiefly flows in the other tributaries. As described previously, estimation errors also are included in these residuals.

### Evaluating Performance of the Water Balance Model

To gauge the accuracy of its predictive capability, the water balance model was applied to the historical runoff, diversion, and precipitation data from 1940 to 1989 to assess how accurately the observed variations in lake surface elevation were predicted. Discrepancies between predicted and actual data are dependent primarily on the magnitude of scatter in the residual terms that were averaged.

A series of such model runs were made, varying the assumed annual evaporation rate in each (Luhdorff & Scalmanini 1992). Using the adopted annual evaporation rate of 48 inches, the model accurately reflected rises and fall of the lake surface, with an average error of an estimated 0.5 foot.

### Adjusting the Water Balance Model for Extreme Drought Conditions

During formulation and use of the water balance model, it became apparent that extreme drought conditions, unprecedented in the historical period of record, were prevailing in Mono Basin. Because the minimum lake surface elevation that might be reached under lake management alternatives is important to the assessment of some environmental impacts, it was determined that the water balance model, for application to extreme drought scenarios as described later in this chapter, should be adjusted to precisely embody relationships between annual runoff, precipitation, and lake volume changes occurring during the current drought. During the drought period, observed runoff and local precipitation were about 60% of the 50-year average.

This adjustment approach led to the estimation of a new constant residual term based solely on data for 1987 through fall 1992 for extreme drought scenarios (Appendix H). The 1987-1992 residual constant was found to be about 70% of the 50-year average residual constant, presumably reflecting the reduction in groundwater inflows during the drought period.

## Developing the LADWP Aqueduct Operations Model

The aqueduct operations model was developed to allow simulation of alternative water rights terms and conditions to predict their effects on Mono Lake level, diverted tributary streamflows, and downstream aqueduct water and power supply over a period of assumed representative hydrologic conditions.

The Los Angeles aqueduct system, from the Mono tributary streams, through the Owens River and its impoundments, and into the aqueduct intake portals, was represented in the model. These impoundments and many other water sources, including springs, streams, and groundwater in the Owens Valley, as well as irrigation uses there, are characterized in the model. The model simulates the entire aqueduct system because it was recognized that exports from Mono Basin cannot be made independently of events and conditions in the Owens River basin and the need for additional water supplies in Los Angeles during any given period.

### Using the Historical Hydrological Record

The historical records of local rainfall and runoff in the tributary steams from 1940 through 1989 compiled by LADWP were adopted for all uses of the aqueduct model to characterize the normal range of hydrologic events that would reasonably be expected in the future. Use of the historical hydrologic data also is needed for consistency with use of historical aqueduct-operations data needed to provide realistic simulations of aqueduct system operations. These operational characterizations are described below.

For some model simulations, such as managing the lake at a considerably higher or lower elevation than the present level, the historical 50-year period is not of sufficient length. In these cases, the historical sequence is used repeatedly as required.

### Setting Targets for Water Exports to Los Angeles

Monthly export targets for water exports to Los Angeles from the whole aqueduct system, including Owens River, tributaries, and groundwater pumping, were used in the model. In model simulations, exports are constrained to meet but not exceed these targets when possible, subject to other model constraints. Different export targets were established for dry, average, and wet runoff years based on average historical annual exports during the years classified into these types in the 1971-1989 period when both aqueduct barrels were operating. These total export targets for system deliveries to Los Angeles are 400, 480, and 540 thousand acre-feet per year (TAF/yr) for dry, average, and wet runoff years, respectively, for a long-term average of 470 TAF/yr.

The system export targets vary through the seasons; they are set at the aqueduct capacity of 1,600 af/day for April-September when alternative sources of supply are most expensive and are reduced in the other months to meet the annual export target.

### Limiting Mono Basin Exports to Conveyance Capacities

Two constraints reflecting maximum rates of Mono Basin exports are used in the model. First, the flow capacity of the Mono Craters Tunnel, approximately 290 cubic feet per second (cfs), is imposed for basin exports. Second, the maximum flow of the Upper Owens River downstream of the tunnel discharge (or East Portal) is limited to 400 cfs, reflecting a current operational constraint to prevent channel damage adopted by LADWP in consultation with one of the landowners along the stream. The flow in the river is a combination of the natural streamflow, the Mono Basin export, and a relatively constant groundwater inflow to the tunnel, all of which can be characterized from historical gauge data.

### Managing Reservoir Storage

Controls on reservoir water levels are provided in the model, particularly for Grant Lake reservoir (on Rush Creek, the largest tributary of Mono Lake) and Lake Crowley reservoir (on the Upper Owens River). In the model, when sufficient water is available, reservoir storage is kept near maximum storage targets of 30 TAF and 150 TAF, respectively, which are about two-thirds to three-fourths of storage capacities. During periods of water shortage, however, water levels are allowed to decline to minimum levels of 20 and 120 TAF, respectively. Exports are curtailed, if needed, to maintain these minimum levels.

Additional but relatively minor storage in Tinemaha and Haiwee Reservoirs that regulate aqueduct intake also is included in the model.

### Accounting for Owens Valley Gains and Losses

The aqueduct system obtains most of the water for export to Los Angeles from runoff in Owens Valley. Historical monthly runoff data for Owens Valley streams are used in the model.

Average rates of Owens Basin gains or losses due to reservoir evaporation, irrigation diversions, enhancement and mitigation uses, channel losses, and other gains or losses for each month were developed from LADWP records from the 1970-1989 period. They were derived from 1970-1989 runoff and export volumes to provide an accurate water balance for that period. These constant monthly rates were incorporated into the model.

### Limiting Owens Valley Groundwater Pumping

Groundwater historically has been pumped from Owens Valley aquifers by LADWP during drier years to supplement reduced surface water supplies. The operational manual adopted to implement the recent agreement between Inyo County and the City of Los Angeles to limit groundwater pumping prescribes a maximum annual withdrawal of approximately 190 TAF/yr (County of Inyo and City of Los Angeles 1990); this constraint is used in the model.

The agreement also has the effect of limiting the average annual groundwater withdrawal to about 110 TAF/yr. Initial model runs simulating maximum exports from Mono Basin, subject to the other aqueduct operations constraints described, resulted in a annual sequence of groundwater withdrawals averaging about this amount. This sequence was therefore adopted in the model to specify the annual Owens River basin groundwater withdrawals for all subsequent simulations.

The effect of these constraints is to limit the degree to which groundwater pumping in the Owens River basin can be used to replace water that is being retained in Mono Basin under the various alternatives.

## Developing an Extended Drought Model

During periods of extended drought, the balance of water gains and losses in Mono Lake differs from that developed from the 50-year period of record, as described earlier. In such periods, the applicability of the aqueduct operations model is diminished, because under most lake management alternatives diversions would cease. A revised water balance model is needed to depict the minimum lake surface elevation that would be expected to occur under each management alternative during extended drought periods. This model is described in Appendix H and is generally discussed below.

### Predicting Probabilities of Prolonged Drought

The frequency with which sequences of dry years has occurred, compared to the frequency of any particular year being dry, indicates that dry years are not randomly distributed, but that they do occur as sequences, or "droughts".

The probable duration of an extended drought was estimated from the historical record, which was expanded for this purpose from 1895 to fall 1992 for a 98-year period. During this time, two major droughts occurred: the 1923-1935 drought (13 years), when runoff averaged 74% of the historical average, and the 1987-1992 drought (6 years), when runoff averaged 60% of the historical average (Appendix H). During a 7-year portion of the earlier drought, runoff averaged 65% of the historical average. Thus, two droughts having 60-65% of historical average runoff lasting 6-7 years have occurred in the last 100 years, implying an annual probability of occurrence of 2%.

To estimate the duration of a drought having a 1% annual probability of occurrence, it is necessary to calculate cumulative frequencies of dry-year (less than 69% of average historical runoff) sequences of different duration from the historical record (Appendix H). This approach leads to a conclusion that the duration of a drought with runoff averaging 60% of the long-term average having 1% chance of being initiated in any given year is estimated to be 8 years.

### Predicting Minimum Lake Levels from Prolonged Drought

Minimum lake levels during drought conditions having a 1% probability for various lake level management alternatives can be directly estimated using the adjusted water balance model for extended drought conditions having 60% of historical average runoff. The 1% probability lake level estimates were obtained by starting drought simulations at the median lake level of the lake level alternative, once dynamic equilibrium is attained, and running the adjusted model for 8 simulated years.

## Formulating Alternatives

Alternative terms and conditions for the relicensing of the City of Los Angeles' water rights have been formulated according to three objectives:

- the full range of feasible alternatives is considered,
- the alternatives are implementable, and
- the effects of the alternatives are predictable.

Diversion alternatives meeting these objectives have been formulated by:

- assuming specified minimum streamflows and ecosystem maintenance flows for the four diverted streams,

- characterizing future diversions of the diverted streams for in-basin irrigation purposes, and

- prescribing alternative target lake levels and operational mechanisms to attain them.

**Making Streamflow Assumptions**

Assumptions about minimum and periodic maintenance streamflows below the diversions are major elements of most of the alternatives. Both types of assumptions are based on the historical record of streamflows above the diversions so that assumed minimum flows to the lake are distributed among the diverted streams in proportion to stream size. Simulated releases below the diversions must equal or exceed the assumed minimum and maintenance streamflows except under very dry conditions when runoff is below these levels. Streamflow simulations, described below, assume that 45-52% of runoff remains in the streams below the diversions on the average, depending on the particular alternative.

**Minimum Streamflows**. Minimum monthly streamflows are assumed in simulating the alternatives for all but the No-Restriction Alternative. The assumed flows are not necessarily the minimum flows needed to keep fish in good condition in the tributary streams. SWRCB will determine minimum required flows for fisheries after it considers impact assessment information in Chapter 3D, "Fisheries", and after development of DFG recommendations based on instream flow studies conducted in each creek. DFG instream flow studies were not completed and available for simulating the alternatives evaluated in this EIR.

Minimum monthly flows assumed for simulating the alternatives are those with a 10% cumulative frequency of occurring (Table 2-2) based on the 1940-1989 historical period. If runoff is sufficient, these are the minimum flows that are simulated to be released. These streamflows for each creek are given in Table 2-3. These monthly minimum flows would provide approximately 55.6 TAF inflow to Mono Lake, which is about 45% of the average runoff.

**Ecosystem Maintenance Flows**. Periodic high flows are useful in the tributary stream system for a variety of reasons. The preliminary court injunction of 1990 specifies "flushing" flows for channel maintenance purposes. Seasonal high flows are potentially valuable for flushing debris and sediment from the channel, cleansing spawning gravel beds, germinating seeds of riparian species, and watering overflow channels and basins to promote vegetative growth.

For simulations of most alternatives, maintenance flows are assumed to occur every June in each creek at a level corresponding to the median June flow above the diversions during the historical 1940-1989 period (Table 2-3), if sufficient runoff is present. The median June flows provide an additional 9.3 TAF of annual inflow to the lake.

For the 6,372-Ft Alternative, the additional water provided by the median June flows would be excessive, causing the lake level to frequently rise well above the target lake level, so simulation of this alternative does not involve specified stream maintenance flows. No minimum streamflows are assumed for the No-Restriction Alternative.

### Accommodating Mono Basin Irrigation Uses

Irrigation of LADWP-owned lands in Mono Basin from the stream diversions is being substantially curtailed. Diversions for irrigation began in the previous century by early ranchers and continued through summer 1990 by LADWP. LADWP recently has expressed an intent to permanently reduce irrigation uses (Kodama pers. comm.). Because a substantial amount of irrigation water is lost through evapotranspiration, irrigation diversions must be accounted for in formulating the alternatives.

Under all alternatives, except the No-Restriction Alternative, only 1 TAF/yr of water is assumed to be diverted from the four streams for irrigation (specifically, for USFS lands along Lee Vining Creek using the O-Ditch). For the No-Restriction Alternative and the 1989 point-of-reference condition for evaluating impacts, however, the average historical LADWP water diversion of about 8 TAF per year for irrigation of the Cain Ranch is assumed.

## Providing Control of Lake Level

**Targeting Lake Levels**. Alternatives correspond to specified target lake levels. As described below, the alternatives are chosen to span the range from a low lake level that would result from assuming only minimum streamflows to a high level that represents no diversions. The alternative targets are levels at or above which the lake surface would generally remain as it fluctuates from year to year according to runoff variations. The target lake levels are reference levels to which actual lake level is annually compared, triggering appropriate releases, prescribed below, to achieve or maintain the target level.

Runoff that would be released to maintain the target lake level is called lake release. (Lake releases also include the assumed minimum flows and any operational spills downstream during periods when diversions are less than the maximum allowable.) In simulation of the alternatives, runoff in excess of the assumed minimum flows and lake releases required to maintain the target lake level can be exported by LADWP if needed to meet export demands. To ensure operational feasibility, the annual lake releases would be determined at the beginning of each runoff year (April 1) according to the lake surface elevation at that time. Lake level fluctuations during the remainder of the year would not influence the lake release amount.

**Establishing Lake Level Triggers**. The lake level triggers simulated for the alternatives are fractions of the projected runoff on April 1 that must be released to the lake. They vary according to the actual lake level in relation to the target lake level. The lake release rules are shown in Table 2-4.

Once the target elevation is first attained, the lake release rules for all alternatives are relatively simple, requiring 25%, 50%, and then all the runoff to be released as the lake surface fell within 3, 2, and 1 foot of the target elevation, respectively.

Preliminary simulations of the alternatives showed that for the higher lake level alternatives (6,383.5 feet elevation and above), many years could pass with no exports until the lake level rose from its present elevation and the target level was first reached. Only then would some runoff be available for export under these lake release rules. The elimination of all Mono Basin exports for several decades would not provide a balance between need for water supply and protection of public trust values.

For this reason, some exports would be allowed in wet and average years during the period of transition to dynamic equilibrium lake level in these alternatives (Table 2-4). Note, however, that in dry years when the lake elevation is less than 3 feet above the target level, no exports would be allowed during these transition periods.

**Reducing Lake Level Fluctuation and Protecting the Upper Owens River Channel.** Historically, LADWP used Mono Basin runoff as a supplemental water supply for its Owens Valley aqueduct system so that most of the available water was exported in dry years and a smaller fraction of available water was exported in wet years. This historical strategy created relatively large fluctuations in the lake level. Magnified fluctuations in lake level may have adverse environmental consequences (e.g., shore erosion, tufa undercutting, loss of vegetation).

Lake level fluctuations can be reduced by maintaining water exports from Mono Basin in wet periods even though other sources of water may be available to the downstream reservoirs and the aqueduct. This management concept is incorporated into the alternatives by increasing Mono Basin exports to a target level in all years once assumed lake releases and minimum streamflows in the diverted streams are provided.

Peak flows exceeding 400 cfs in the Upper Owens River below the East Portal can damage the channel as described previously. To achieve a balance between exporting surplus water and protecting the river channel, a flow of 300 cfs in the Upper Owens River is assumed in the simulations of alternatives as both a target and a maximum streamflow. This management rule was incorporated into the model simulations for all alternatives except one representing historical management. SWRCB may adopt other management rules after development of DFG instream flow recommendations or other identified requirements.

## Prescribing Operational Protocols

For all alternatives, required lake releases in excess of minimum monthly flows are taken from runoff in excess of the minimums as soon as it is available until the total lake releases are satisfied for the year. This delays the period of diversion for export until all the supplemental releases have been made.

Supplemental lake releases are made in Lee Vining and Rush Creeks under all alternatives, but not in Walker or Parker Creeks. Lee Vining Creek diversions must remain less than the conduit capacity of 300 cfs. Although Lee Vining Creek runoff is usually less than the conduit capacity, any excess runoff is spilled down Lee Vining Creek and counted as lake release flow. Walker and Parker Creek runoff greater than their monthly minimum flows is diverted into the LADWP conduit to Grant Lake Reservoir. All available Rush Creek runoff is passed through Grant Lake Reservoir and released to Mono Lake until the supplemental lake release volume has been satisfied.

## PROJECT ALTERNATIVES

Seven EIR alternatives have been formulated to span the possible range of tributary-streamflow and lake-level management alternatives. Two of them, the No-Restriction and No-Diversion Alternatives, define the extremes of the range. The No-Restriction Alternative does not meet the project objectives of restoring the conditions that benefited the prediversion fisheries in the tributary streams and protecting public trust resources where feasible in Mono Basin. The No-Diversion Alternative would preclude all export of water for urban uses. The five intermediate alternatives are based on operational rules specifying minimum streamflows, supplemented as needed to promote a surface elevation of Mono Lake at or above a particular target elevation.

### Using Model Simulations to Predict Effects of the Alternatives

The alternative terms and conditions for the water rights licenses are alternative diversion operation rules intended to achieve specified lake level targets. The operation rules specify minimum streamflows and annual supplemental releases to Mono Lake based on the April 1 runoff forecast of each year, as described in the preceding section. The rules also include management actions to manage reservoir levels within specified ranges and to systematically export surplus water from the basin subject to conveyance capacities.

The effects of all these operation rules, as well as of downstream management of the entire Los Angeles aqueduct system, have been simulated through the aqueduct model (Appendix B). Although the model simulations are useful in predicting the effects of the alternatives, they do not in themselves constitute the alternatives.

The use of the historical hydrological record in the simulations illustrates this difference. The historical sequence of runoff years provides only one of many possible simulations of future events. In the characterizations of the alternatives below, simulations using the historical hydrological sequence are used to indicate the approximate normal range of lake levels, streamflows, reservoir levels, and water supplies that can reasonably be expected in the future. Frequency data for these variables derived from that simulation will be generally valid for runoff between the 10% and 90% cumulative runoff occurrence frequencies (as defined previously).

Because sequences of dry years may have important consequences for some public trust values, a separate extended drought analysis (Appendix H) has been used to predict extreme low lake levels. This analysis is especially useful because in the historical period, the extreme 1987-92 drought began when lake level was relatively high from a preceding wet period. Thus, using the historical sequence tends to underestimate the effects of the most severe drought of record. The extreme drought analysis results in a minimum lake level prediction that has a 1% probability of being initiated each year, based on the past 98 years of hydrological data.

## Characterizing the Alternatives

The following sections on each alternative present the following information:

# general description of the alternative;

# the normal range of lake level fluctuation under the alternative, the time of transition to the normal range, and the minimum lake level predicted for an extended drought;

# the predicted water export volume; and

# tributary streamflow patterns.

Two figures illustrate each alternative. The first figure is a time series graph showing fluctuation of the lake surface elevation based on the particular management regime of the alternative simulated with hydrological data of the past 50 years. The second figure is a map showing the lake configuration at the target lake level in relation to the configurations before the diversion began and in 1989. Details of the simulation data are provided in Chapter 3A, "Hydrology", and in Auxiliary Report No. 18.

## Comparing the Alternatives

A summary comparison of the alternatives is provided in Figures 2-1 and 2-2 and in Table 2-5. These exhibits compare the ranges of lake levels, tributary streamflow patterns, and lake level frequencies of the alternatives, respectively. Table 2-5 shows the percentage of the time that the lake surface would be at or below specific elevations after dynamic equilibrium is attained. For example, the 50% values indicate the median lake levels for the various alternatives; 50% of the time the lake level will be at or below these elevations. The 50% values are higher than the target minimum lake levels.

## The No-Restriction (No-Project) Alternative

Under this alternative, no new restrictions would be placed on the diversions of water by LADWP under its existing water right licenses. Minimum streamflows and lake levels would not be required. LADWP would be allowed to divert water based entirely on availability and need. Irrigation of in-basin lands would be discretionary and is assumed to continue at historical levels. Maximizing exports to the Upper Owens River during periods when surplus water is available would not be pursued. The alternative would entail continuation of practices that prevailed prior to the courts' involvement in the diversion of Mono Basin waters and is therefore considered to be the "no-project" alternative.

**Lake Elevation Pattern**

Under this alternative, the lake surface, fluctuating in response to annual variations in runoff, would tend to fall until evaporation losses from the diminishing surface area of the lake were sufficiently reduced to balance the flows released to the lake (Figure 2-3). The transition period would be between 50 and 100 years. Thereafter, a dynamic equilibrium would prevail with a mean lake elevation of about 6,355 feet (Figure 2-4) and normal fluctuations of about 21 feet. During extreme drought, the lake surface might fall as low as 6,336-6,337 feet (Table 2-5).

**Mono Basin Export and Lake Release Pattern**

On the average under this alternative, approximately 85 TAF/yr (73%) would be exported from Mono Basin and 32 TAF/yr (27%) would be released to Mono Lake from the four streams diverted by LADWP. Exports would range from 0 to 135 TAF/yr, and releases would range from 0 in many years to more than 220 TAF in infrequent, very wet periods.

**Streamflow Pattern**

During an average water year, none of the diverted tributary streams would have any flows below the diversions in any months (Figure 2-2). Even in very wet years, Parker and Walker Creeks would usually have no flow. In wet years, some flows in Rush and Lee Vining Creeks would occur, usually in June and July, and perhaps August.

Rush and Lee Vining Creeks would be subject to floodflows from time to time that could exceed 500 cfs in Rush Creek and 300 cfs in Lee Vining Creek. These flows, called "spills", occur when runoff exceeds the capacity of LADWP's diversion and storage system or when excess water in the Owens River basin reduces the need for Mono Basin exports.

## The 6,372-Ft Alternative

This target elevation for long-term management of Mono Lake corresponds to the lowest lake level that the lake has reached in historical time, occurring at the end of 1981 after 40 years of streamflow diversions. The lake surface rose above this level through the remainder of the 1980s and, although declining toward it again, remains above it today. (This level is slightly lower than the lake level shown on the 7.5-minute U.S. Geological Survey [USGS] topographic maps for Mono Basin.)

### Lake Elevation Pattern

Under this alternative, the lake surface would normally fluctuate about 6.5 feet in elevation (Figure 2-5) and would have an average elevation of 6,375 feet (Figure 2-6). A very short transition period to this dynamic equilibrium condition would be required after the current drought ended. During extreme drought, the lake surface might fall as low as about 6,370.4 feet (Table 2-5).

### Mono Basin Export and Lake Release Pattern

Under this alternative, approximately 64 TAF/yr (51%) would be exported from Mono Basin and 61 TAF/yr (49%) would be released to Mono Lake on the average. Exports would range from 8 to 140 TAF/yr, and releases would range from 48 to 102 TAF/yr in very wet periods.

### Streamflow Pattern

During most years, flows in Rush Creek would seasonally vary between 20 and 60 cfs, and flows in Lee Vining Creek would vary between 15 and 95 cfs. Flows in the Rush Creek tributaries also would remain relatively constant, seasonally varying 2-10 cfs in Walker Creek and 3-21 cfs in Parker Creek (Figure 2-2). These flows would remain constant in most years because they are the minimum flows assumed in the simulation (occurring at least 10% of the time above the diversions) (Table 2-3), and all excess runoff would be diverted for export in most years.

Larger ecosystem maintenance flows in June are not specified for this alternative, as they are for other alternatives, because, if they were specified, the lake level would rise substantially above the target level of the alternative. Thus, June flows under this alternative are about one-half to two-thirds of the median June flows above the diversions for the other alternatives. Rush and Lee Vining Creeks would be subject to spilling flows from time to time that could exceed 300 cfs in both Rush and Lee Vining Creeks.

## The 6,377-Ft Alternative

This target elevation corresponds to that level beneath which no diversions are currently allowed under the preliminary injunction first mandated by the El Dorado County Superior Court in 1989 and reaffirmed in 1991. It is the interim protected lake level, intended to protect the lake's public trust resources until action can be taken by SWRCB.

The lake level dropped below this elevation in late 1976 after 35 years of streamflow diversions but rose above it temporarily between 1983 and 1989 because of a wet period.

### Lake Elevation Pattern

Under this alternative, the lake surface would normally fluctuate about 6.5 feet in elevation (Figure 2-7) and would rise to an average elevation of 6,379 feet (Figure 2-8). A short transition period to this dynamic equilibrium condition would be required after the current drought ended. During extreme drought, the lake surface might fall as low as about 6,373 feet (Table 2-5).

### Mono Basin Export and Lake Release Pattern

Under this alternative, approximately 52 TAF/yr (41%) would be exported from Mono Basin and 74 TAF/yr (59%) would be released to Mono Lake on the average. Exports would range from 2 to 140 TAF/yr, and releases would range from 30 to 130 TAF/yr in very wet periods.

### Streamflow Pattern

During a normal year, flows in Rush Creek would seasonally vary between 20 and 160 cfs. Flows in Lee Vining Creek would generally vary between 15 and 180 cfs. Flows in the Rush Creek tributaries, remaining relatively constant from year-to-year, would seasonally vary between 2-21 cfs in Walker Creek and 3-32 cfs in Parker Creek (Figure 2-2). The high ends of these flow ranges represent assumed ecosystem maintenance releases equal to historical median June flows above the diversions (Table 2-3). Rush and Lee Vining Creeks also would be subject to spilling flows from time to time that could exceed 340 cfs in Rush Creek and 250 cfs in Lee Vining Creek.

## The 6,383.5-Ft Alternative

This target elevation corresponds to the midpoint of the range of lake levels (6,390-6,377 feet) recommended by the USFS (1989) in its management plan for the Mono Basin National Forest Scenic

Area. The declining lake surface passed through this elevation in 1973 after 32 years of streamflow diversions. During the wet period of the mid-1980s, this elevation was not attained.

### Lake Elevation Pattern

Under this alternative, the lake surface would normally fluctuate about 6 feet in elevation (Figure 2-9) and would rise to an average elevation of 6,385.7 feet (Figure 2-10). The transition period to this dynamic equilibrium condition would require 5-10 years after the present drought ended. During extreme drought, the lake surface might fall as low as about 6,378 feet (Table 2-5).

### Mono Basin Export and Lake Release Pattern

Under this alternative, approximately 44 TAF/yr (35%) would be exported from Mono Basin and 82 TAF/yr (65%) would be released to Mono Lake on the average. Exports would range from 2 to 120 TAF/yr, and releases would range from 48 to 140 TAF/yr in very wet periods.

### Streamflow Pattern

The streamflow pattern for this alternative would be very similar to that for the 6,377-feet alternative described previously, except that higher flows would be released in wetter periods (Figure 2-2). Ecosystem maintenance flows would be provided annually, equaling median historical June flows above the diversions.

Rush and Lee Vining Creeks would be subject to spilling flows from time to time that could exceed 340 cfs in Rush Creek and 300 cfs in Lee Vining Creek.

## The 6,390-Ft Alternative

This target elevation corresponds to the upper lake level recommended by the USFS (1989) management plan.

The lake surface dropped below this elevation in 1965 after 24 years of streamflow diversions and has remained lower.

## Lake Elevation Pattern

Under this alternative, the lake surface would normally fluctuate about 6 feet in elevation (Figure 2-11) and would reach an average elevation of 6,391.6 feet (Figure 2-12). The transition period to this dynamic equilibrium condition would require about 30 years. During extreme drought, the lake surface might fall as low as about 6,383 feet (Table 2-5).

## Mono Basin Export and Lake Release Pattern

During the first 50 years under this alternative, approximately 30 TAF/yr (24%) would be exported from Mono Basin and 96 TAF/yr (76%) would be released to Mono Lake on the average. After dynamic equilibrium is attained, exports would rise to 37 TAF/yr (29%) and lake releases would fall to 89 TAF/yr (71%).

Exports would range from 2 to 120 TAF/yr, and releases would range from 58 to 126 TAF/yr in very wet periods.

## Streamflow Pattern

The streamflow pattern for this alternative would be similar to that for the 6,377-Ft and 6,383-Ft Alternatives, except that higher flows would be released in wetter periods (Figure 2-2). Ecosystem maintenance flows would be provided annually, equaling median historical June flows above the diversions. Rush and Lee Vining Creeks would be subject to large spilling flows from time to time that could exceed 490 cfs in Rush Creek and 320 cfs in Lee Vining Creek.

# The 6,410-Ft Alternative

This target elevation corresponds to an intermediate elevation between the 6,390-Ft Alternative and the No-Diversion Alternative, providing an alternative that could reflect substantial streamflows if required by SWRCB for purposes of compliance with the Fish and Game Code or for protection of public trust resources.

The lake surface dropped below this elevation in 1951 after 10 years of streamflow diversions and has remained below this elevation.

## Lake Elevation Pattern

Under this alternative, the lake surface would normally fluctuate about 7 feet in elevation (Figure 2-13) and would eventually reach an average elevation of 6,410.8 feet (Figure 2-14). The transition period to this dynamic equilibrium condition would require about 80 years. During extreme drought, the lake surface might fall as low as about 6,401 feet (Table 2-5).

### Mono Basin Export and Lake Release Pattern

During the transition period for this alternative, approximately 11 TAF/yr (9%) would be exported from Mono Basin and 115 TAF/yr (91%) would be released to Mono Lake on the average. After dynamic equilibrium is obtained, exports would rise to 22 TAF/yr (17%) and lake releases would fall to 104 TAF/yr (83%).

Exports would range from 0 to 120 TAF/yr, and releases would range from 64 to 184 TAF/yr in very wet periods.

### Streamflow Pattern

The streamflow pattern for this alternative would be similar to that for the previous alternatives, except peak flows in spring in Rush and Lee Vining Creeks would be slightly higher in normal years, and even higher flows would be released in wetter periods (Figure 2-2). Rush and Lee Vining Creeks would be subject to large spilling flows from time to time that could exceed 490 cfs in Rush Creek and 350 cfs in Lee Vining Creek.

## The No-Diversion Alternative

Under this alternative, diversions of the four tributary streams would be entirely curtailed. Streamflow and lake level would be determined by natural weather events and patterns, and the lake surface would rise toward the prediversion level.

### Lake Elevation Pattern

Under this alternative, the transition period to this dynamic equilibrium condition would require longer than 100 years (Figure 2-15). The lake surface would eventually reach an estimated average elevation of about 6,425-30 feet (Figure 2-16) and would normally fluctuate about 10 feet in elevation thereafter. During extreme drought, the lake surface might fall as much as 11 feet below the equilibrium level (Table 2-5).

### Mono Basin Export and Lake Release Pattern

No water would be exported from Mono Basin, and 124 TAF/yr would be released to Mono Lake on the average. Releases would vary annually between 55 and 240 TAF.

### Streamflow Pattern

The pattern of streamflows above the diversion also would occur below them. This pattern constitutes natural runoff as modified by SCE's seasonal storage upstream on Rush and Lee Vining Creeks.

The spring streamflow pattern for this alternative, including spilling flows, would be similar to that for the 6,410-Ft Alternative, but flows in the other seasons would be considerably larger. During normal years, flows in Rush Creek would seasonally vary between 50 and 165 cfs. Flows in Lee Vining Creek would vary between 30 and 190 cfs. During snowmelt, Lee Vining Creek would experience higher flows than Rush Creek because of less upstream regulation by SCE for power generation. Flows in the Rush Creek tributaries would vary seasonally from 3 to 21 cfs in Walker Creek and 4 to 33 cfs in Parker Creek (Figure 2-2).

## Other Alternatives Considered but Not Studied in Detail

This report identifies the environmental impacts associated with the SWRCB's proposal to add conditions to LADWP's water right licenses for protection of fish and other public trust resources. The selected alternatives described in this chapter span the range of feasible alternatives to be considered in balancing the protection of public trust values with other uses for Mono Basin water. Each of the described alternatives corresponds to an approximate level of inflow to Mono Lake on a long-term basis and a corresponding amount of water available to LADWP for export. No other alternatives are needed to provide information about the environmental effects of the range of feasible alternatives.

Other diversion and export management approaches, including other rules for determining annual lake releases not discussed above, can be considered as needed for purposes of mitigating significant environmental impacts of the alternatives. Where appropriate, other diversion and export management approaches are addressed in the impact sections of this report.

## Relation of Identified Alternatives to Fishery Protection Flows

### Identification of Fishery Protection Flows

The subject of instream flows needed to maintain the conditions that benefited the prediversion fishery is discussed in Chapter 3D, "Fisheries". SWRCB's decision on amendment of LADWP's water right licenses must include conditions for the protection of fish, as well as appropriate conditions for protection of other public trust values in Mono Basin. For purposes of this report, the definition of alternatives is based primarily on differing lake levels rather than on the quantity of water needed to provide instream fishery flows. Whatever fishery flows are eventually determined to be appropriate, however, will be associated with some net quantity of inflow to Mono Lake. The range of alternatives defined in this report is sufficiently broad to cover any potential level of inflow that would result from those fishery flows.

At this time, SWRCB has not determined the quantity of water needed for fishery protection or for other public trust purposes. In accordance with the Court of Appeal decision in *California Trout, Inc. v. Superior Court*, (1990) 218 Cal. App. ed. 187, 266 Cal. Rptr. 788, the quantity of water needed for protection of fish pursuant to Fish and Game Code Sections 5937 and 5946 is not subject to reduction to satisfy competing demands for water. The need for any additional water that may be needed for protection of public trust values, however, is subject to balancing against the public interest in meeting competing demands for water.

**Implications of Fishery Protection Flows in DFG Stream Evaluation Reports**

DFG has produced stream evaluation reports for the four diverted tributary streams (Beak Consultants 1991; EBASCO Environmental and Water Engineering and Technology 1991b, 1991c; Aquatic Systems Research 1992) and the Upper Owens River (EBASCO Environmental et al. 1993). These reports contain preliminary instream flow recommendations for each stream (Table 2-6).

The aqueduct model was used to predict long-term Mono Lake surface elevations resulting from these recommended flows, including the specified minimum, maximum, and flushing flow values. As for the alternative simulations, these diversion rules were combined with aqueduct operations constraints and applied to the 1940-1989 historical hydrology. In this simulation, however, no lake level targets and lake release rules were specified.

Two simulations were conducted, the first based on DFG's consultants' original flow recommendations for Rush Creek, which specify a maximum release of 60 cfs during the peak runoff period (Beak Consultants 1991), and the second based on DFG's subsequent flow recommendations, which specify a maximum release of 100 cfs (Gibbons pers. comm.). Recommended flows for Lee Vining, Parker, and Walker Creeks were identical for the two simulations.

The recommendation for flows for the Upper Owens River below the East Portal (a maximum flow limit of 200 cfs and a constant release rate) could not be modeled explicitly because changes would be required in operation of Grant Lake reservoir to distribute exports more evenly throughout the year. Model applications, however, suggest that total annual exports and Mono Lake surface elevations would not change appreciably with this additional constraint.

The recommended flows would cause the surface elevation of Mono Lake to rise to an average elevation of 6,381 feet, for the maximum Rush Creek flow of 60 cfs, or to 6,385 feet for the maximum Rush Creek flow of 100 cfs (Figure 2-17). The transition period to the dynamic equilibrium would be about 40 years, and lake levels would fluctuate 6-7 feet thereafter. The simulations indicate that uncontrolled spills would not likely occur in the Mono Basin tributaries under the conditions specified. Minimum instream flow recommendations for Rush Creek would be met in most years, but available flows in Lee Vining, Parker, and Walker Creeks would often be insufficient to meet the specified minimum flows in dry and normal runoff years.

These simulated lake level ranges, when compared to the lake level regimes described for each alternative, indicate the degree to which each alternative is capable of meeting the pending DFG instream flow recommendations for protection of fishery resources.

## POINTS OF REFERENCE FOR EVALUATING ENVIRONMENTAL CHANGES

Impacts of the project alternatives must be measured as changes in environmental conditions from some baseline condition, called the "point-of-reference" in this EIR.

### Point-of-Reference for Comparison of Project Impacts

As a point of reference for comparison of the environmental impacts of various alternatives, this EIR used the existing environmental conditions at Mono Lake and the tributary streams, which were present before the issuance of a preliminary injunction by the El Dorado County Superior Court on August 22, 1989. The preliminary injunction, as described in the court's August 22 minute order, effectively prohibited LADWP from diverting water from Mono Basin streams any time the lake level was below 6,377 feet. The point of reference used in this report included the approximate water level elevation of Mono Lake and streamflows present before the August 22 order.

#### Basis in CEQA

CEQA requires that the "environmental setting" be described in an EIR. CEQA guidelines define the environmental setting as the environment "as it exists before the commencement of the project" (State CEQA Guidelines, Section 15125). CEQA requires that resource conditions at the initiation of the environmental review and permitting process, rather than future conditions without the project, be considered as the environmental setting.

### Resource Conditions

For most topic areas, actual resource conditions in 1989 define the environmental setting for this point of reference. Actual resource conditions are germane to the vegetation, wildlife, fisheries, visual quality, air quality, and cultural resource topics. It is recognized that court-mandated streamflows in effect in August 1989, had they remained in effect, would have caused the lake level to gradually fall even during average runoff conditions. Nonetheless, the environmental setting for these topics is considered to be the resource conditions associated with the lake level at that time, together with the mandated streamflows.

### Point-of-Reference Scenario

Severe drought conditions prevailed during 1989 in California, so that water and power supply from Mono Basin exports were not representative of average conditions. Consideration of these topics, as well as associated economic effects, therefore requires that a point-of-reference scenario be established. For this purpose, the aqueduct model was used to simulate the pattern of water and power supply that would result from the pattern of observed runoff variations, if streamflows mandated in 1989 remained in effect. In this way, realistic water supply and power production implications of the 1989 point-of-reference conditions can be characterized.

The simulation of the point-of-reference scenario also provides a characterization of the pattern of lake levels that would have resulted from permanent adherence to the court-mandated streamflows in effect in 1989. After a transition period of generally declining lake level lasting about 20 years, a dynamic equilibrium would prevail with a mean lake elevation of about 6,365 feet and normal fluctuations of about 16 feet.

### Mono Lake Level

In August 1989, the surface elevation of Mono Lake was 6,376.3 feet and in a generally declining trend. No legal mandate existed to maintain any specified lake level before issuance of the preliminary injunction by the El Dorado County Superior Court on August 22, 1989.

### Diversions and Tributary Streamflows

Before the August 22, 1989 preliminary injunction discussed above, LADWP's diversions from the Mono Basin streams were subject to preliminary injunctions issued by the Mono County Superior Court. These injunctions established minimum flows in Rush Creek and Lee Vining Creek as follows:

# Rush Creek - 19 cfs minimum throughout the year, and
# Lee Vining Creek - 5 cfs minimum throughout the year.

No minimum stream flow requirements were in effect for Walker and Parker Creeks. The minimum stream flow requirements for Rush Creek and Lee Vining Creek, applied to the historical runoff record and accounting for a loss of 8 TAF/yr for in-basin irrigation, determine the pattern of streamflows at this point-of-reference (Figure 2-2). The aqueduct model shows that these minimum flows would have persisted throughout the year in normal and all drier years.

In wetter years these flows would have been exceeded in spring and early summer, and in the wettest years they could be exceeded year-round. Spring flows as high as about 550 cfs and 340 cfs could occur in Rush and Lee Vining Creeks, respectively.

## Prediversion Conditions for Assessing Cumulative Impacts

Environmental conditions prior to the beginning of LADWP diversions in Mono Basin for export (i.e., pre-1941) define the resource values for examining cumulative impacts of the diversion alternatives.

### Basis in CEQA

Cumulative impacts are environmental changes resulting from project impacts in combination with impacts of "closely related past, present, and reasonably foreseeable probable future projects" (State CEQA Guidelines, Section 15355). LADWP's diversions from 1941 to the 1989 point-of-reference constitute a closely related past project. Prior diversions by early ranchers also may be considered as closely related projects for certain impacts, although the magnitude of the impacts from these early diversions was less than impacts of LADWP diversions. Impacts of early diversions also are more difficult to accurately assess.

The construction of LADWP's diversion facilities in Mono Basin and the Upper Owens River basin is generally not considered to be a closely related project. Construction impacts, usually of a different character than diversion impacts, are therefore generally not added to project impacts in this EIR to identify cumulative impacts. Exceptions exist, however, such as the loss of riparian vegetation upstream on Rush Creek due to enlargement of Grant Lake reservoir, that must be added to the subsequent loss of downstream riparian vegetation from diverted streamflow.

With some exceptions, therefore, conditions in Mono Basin on completion of the diversion facilities but before actual diversion of waters is considered to be the resource values and environmental setting in this EIR for examining cumulative impacts of the diversion alternatives.

## Mono Lake Level

At the time that LADWP began diverting water from the tributary streams in 1941, the water surface elevation of Mono Lake was 6,417 feet, or 41 feet higher than the 1989 point of reference for project impacts. This level was 11 feet lower than the historical highstand of 6,428 feet.

## Tributary Streamflows

Runoff into the tributary streams in the water year ending on April 1, 1941, was very near the long-term average runoff. The preceding year had been a dry year, preceded by a wet year and three average years.

As noted previously, streamflows existing before LADWP diversions for export were diminished by irrigation diversions, which began in the 1860s. Diversions from Rush, Parker, and Walker Creeks were relatively large, resulting in dewatering of certain reaches during the irrigation season, especially during dry years. Much of the irrigation occurred on very permeable soils, resulting in the creation of springs in the Rush Creek bottomlands likely augmenting streamflow there. (Stine 1991.)

The fraction of streamflow diverted from Lee Vining Creek was relatively smaller than from the other streams, and none of its reaches were dewatered in dry years by irrigation (Stine 1991).

Because storage facilities on these streams available to the early irrigators were relatively small, highflows during snowmelt runoff were relatively unregulated. These high flows are therefore similar to high flows of the No-Diversion Alternative (Figure 2-2).

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