Chapter 5 Operations Forecasting

Forecasting

The Project Purposes include water supply, flood control, environmental requirements, power generation, and recreation. A forecast model is used to represent these varied demands on the water system.

The operations forecast model is currently a Lotus 1-2-3 for Windows spreadsheet application designed to assist in the water and power operations planning of the Central Valley Project (CVP). An Excel spreadsheet forecast is in development. A monthly time step is used for what is usually a 1-year forecast period. Several variables are entered for half-month time increments to allow calculation of the special flow and Delta pumping conditions called for during the 31-day spring pulse flows that extend from mid-April to mid-May.

The State Water Project (SWP) also performs spreadsheet-based annual operations forecasts using a monthly time step. These forecasts are used to help plan SWP operations and determine allocations. Although separate forecasts are often required to analyze specific SWP or CVP operations, both projects work together so that hydrologic forecasts and assumptions are consistent between the various studies.

Use of the spreadsheet model initially requires the development of a set of input data to describe the hydrologic conditions, regulatory requirements, and certain of the operations objectives. The user may then interactively manipulate values that are presented on a set of "screens" referred to as the "reservoir" screen, the "Delta" screen, and the "split-month" screen. The "Reservoir" screen shows month-by-month how reservoir releases affect storage and river flows from Trinity, Whiskeytown, Shasta, Oroville, and New Melones reservoirs.

The "Delta" screen is used to examine variations in SWP and CVP Delta exports and the resulting consequences to Delta outflow, position of X2, or Rock Slough chlorides. As operations are varied, calculated Delta outflow is compared to required Delta outflow. Adjustments to Delta exports or reservoir releases are made to correct deficits between calculated and required Delta outflow. Calculated results for other parameters such as X2 and Export/Inflow (E/I) ratio are also manipulated to meet the appropriate standard through adjustments to Delta exports and reservoir releases.

The "split-month" screen comes into play in describing April-May operations. San Joaquin River flows above the Stanislaus confluence, Stanislaus flows, and Delta pumping at Tracy and Banks are entered for four separate periods, two each in April and May. This enables the user to specifically simulate the 31-day pulse flow period as occurring partly in April and partly in May. The user can also specify the starting date. The model separately calculates Vernalis flow, Delta outflow, and E/I ratio for each of the partial months.

The user of the model determines which factors constrain operations, given a particular set of inputs and assumptions. Ultimately, this determines what mixture of objectives is achievable by the project operations. The following list of considerations may affect operations decisions within any particular operations forecast being prepared. The water supply objective has several constraints on the system:

- Geography – most of the water supply is in the northern portion of the State and the largest demand is in the south.
- Hydrology – water supply is greatest in the winter and spring, and demand is greatest in the summer.
- Physical Capacity – concerns the reservoirs and pumping plants. The CVP has most of the storage in the northern reservoirs (Trinity at 2.4 maf, Shasta at 4.5 maf, Folsom at about 1.0 maf). The pumping at Tracy is limited to 4,100 to 4,600 cubic feet per second (cfs). The SWP has most of the pumping capacity and some storage north of the delta. The pumping at Banks is about 6,680 cfs and Oroville storage is 3.5 maf.
- Flood Control Requirements – each reservoir has different requirements and restricts upstream storage in the late fall through early spring. Flood control mandates release rates during flood control encroachment. Environmental obligations include water quality standards, minimum river flow requirements, Delta outflow requirements, and Endangered Species Act (ESA) curtailments.
- Contractual and Water Rights Requirements – the various categories of CVP water demands and the contractual amounts and deficiency criteria associated with each. These water demands may be categorized as Water Rights Settlement and Exchange Agreements, Municipal and Industrial Water Service Contracts, Legislative Mandates, Agricultural Water Service Contracts, and Delivery Losses.

Water rights settlement contracts and water service contracts are readily documented, consisting of agreements and contracts with specific terms and conditions. These terms and conditions may include deficiency provisions, terms for payment of water, repayment of capital obligations, etc. These terms and conditions vary depending on whether a contract is water rights, agricultural water service, or municipal and industrial type.

Water Demands

Estimated 2001 level demands for the CVP are about 3.5 million acre-feet (maf) for the Delta export service areas, and 3.3 maf for the Sacramento Basin demands (including the American Basin demand). Tables 5-1 and 5-2 give a breakdown of these demands. The U.S. Bureau of Reclamation (Reclamation) has water right settlement contracts totaling about 2.2 maf on the Sacramento River and San Joaquin River Exchange contracts plus other water rights settlement contracts on the San Joaquin River, which total about 0.9 maf. These annual contract amounts must be supplied in full, unless the forecasted Shasta inflow constitutes a “Critical” water year as described in the terms of these contracts. When Shasta inflow is “Critical,” San Joaquin Exchange contractors’ supplies may be limited to 650,000 acre-feet and Sacramento River and other San Joaquin water rights supplies may be reduced by 25 percent.

Table 5–1 Annual water demand in CVP- OCAP

Project	Regions	Millions of Acre-feet
SWP	Delta and South	3.8
	Feather River Service Area	1.0
CVP	Delta and South	3.5
	Sacramento Basin	3.4

Table 5–2 CVP-OCAP annual CVP deliveries by category of use (Units: million acre-feet)

	Water Rights	Project Agriculture	M&I	Refuge with Losses
Delta and South	.9	2.1	.3	.2
Sacramento Basin	2.2	.4	.5	.3
Total	3.1	2.5	.8	.5
NOTE: Water rights and Refuges subject to maximum 25 percent reduction in CVP-OCAP				

The other major components of the CVP water demands are: 1) Refuge water supplies, 2) Municipal and Industrial (M&I) water supplies, and 3) agricultural water service contracts. Water allocation policy for M&I contracts. Legislative requirements of the Central Valley Project Improvement Act (CVPIA) for refuge water deliveries provide a level of annual supply with no greater than 25 percent reductions (per the Draft M&I shortage policy). Agricultural water service contracts have no such limits on reductions in supplies. As can be inferred from Table 5-2, because of the limitations of reductions in all other components of CVP water demands, agricultural water service contracts are vulnerable to any and all reductions in supply that cannot be apportioned to Refuge, M&I, or Water Rights settlement contracts. Given the existing CVP operations criteria and the estimated 2001 level of demands, agricultural water service contracts South of the Delta seldom receive 100 percent of their contract supplies. In each of the last 5 years, CVP water deliveries have been limited because of insufficient supply, lack of conveyance capacity, or operational constraints on Delta pumping resulting from either endangered species protection or implementation of CVPIA actions using a portion of the CVP yield.

To operate the CVP efficiently, allocations for all types of water contractors must be combined with the pattern of requests for water. Schedules of water deliveries throughout the CVP must be coordinated with reservoir operations, release capability stream flow requirements from the northern CVP reservoirs, the capability to divert the water in the Delta, and the pattern of fill and drawdown of San Luis reservoir.

Central Valley Operations Office does a monthly forecast in a spreadsheet model. In the beginning of the water year, forecasts for 50 percent hydrology and 90 percent hydrology are calculated. As the difference between the hydrologies disappears, generally in May, only the 90 percent hydrology is used in the forecast. With the (b)(2) forecasts and the Environmental Water Account (EWA), a series of forecasts are made. A D-1485 base operation is done for (b)(2) accounting of conditions in 1992 (before CVPIA) including the winter-run Chinook

salmon Biological Opinion. The second run is the updated Water Quality Control Plan (WQCP), D-1641 operation. The third run adds the (b)(2) actions to attain the 800,000 acre-feet (700,000 acre-feet in Dry years, and 600,000 acre-feet in Critical years). Then the EWA actions are added in a fourth run of the operations. The forecasts are coordinated closely with California Department of Water Resources (DWR) and their operations.

Determining Factors for CVP & SWP Allocations

Water deliveries to SWP and CVP contractors are made all year. Contractor delivery patterns peak during spring and summer and are satisfied by direct diversions from the Delta combined with releases from San Luis Reservoir and SWP reservoirs in southern California. At times, unused Delta pumping capacity may be available to move additional water for direct delivery, groundwater recharge, pre-irrigation, storage south of the Delta, or water transfers. Allocation of CVP and SWP water supplies for any given year is based primarily on six variables:

- Forecasted reservoir inflows and Central Valley hydrologic water supply conditions
- Current amounts of storage in upstream reservoirs and in San Luis Reservoir
- Projected water demands in the Sacramento Valley
- Instream and Delta regulatory requirements
- Annual management of 3406(b)(2) resources
- Efficient use of CVP-SWP export capacity through Joint Point of Diversion flexibility

Beginning each year (in December for SWP, and February for CVP), initial allocations of entitlement deliveries are determined based on the above criteria. Generally, allocations are updated monthly until May, although increases may occur later based on reservoir storage.

Water Allocation – CVP

In most years, the combination of carryover storage and runoff into CVP reservoirs is sufficient to provide the water to meet CVP contractors' demands. Since 1992, increasing constraints placed on operations by legislative and ESA requirements have removed some of the capability and operations flexibility required to actually deliver the water to CVP contractors. Water allocations south of the Delta have been most affected by changes in operations ensuing from passage of the CVPIA and the biological opinions covering protection of the winter-run Chinook salmon and the Delta smelt.

The water allocation process for CVP begins in the fall when preliminary assessments are made of the next year's water supply possibilities, given current storage conditions combined with a range of hydrologic conditions. These preliminary assessments may be refined as the water year progresses. Beginning February 1, forecasts of water year runoff are prepared using precipitation to date, snow water content accumulation, and runoff to date. All of CVP's Sacramento River water rights contracts and San Joaquin Exchange contracts require that contractors be informed no later than February 15 of any possible deficiency in their supplies. In recent years, February 15th has been the target date for the first announcement of all CVP contractors' forecasted water allocations for the upcoming contract year.