THE DELTA STORAGE CONCEPT

The Sacramento - San Joaquin Delta (Delta),in its natural state, was a reservoir, not a stream. The inflow to the Delta could drop to near nothing, and the Delta water users would still have water of usable quality for a great many months. The quality remains acceptable in most of the Delta for a very long time, even during low inflow events, due to the configuration of the Delta. The water availability, of course, never diminishes in the Delta, due to the support provided by the tide.

The term "delta" is usually applied to the existence of a fan-shaped extension at the discharge where the flow of a river discharges into the sea. That is where the river deposits its silt, a result of the flow slowing down as it meets tide water. The river then builds up material and is constantly attempting to find an outlet, resulting in the creation of numerous islands and channels called a "delta". The word "delta" comes from the usual fan shape which resembles the Greek letter "d" or "delta". That letter has a triangular shape.

The Delta of the Sacramento and San Joaquin Rivers is different however. It does not fan out in a triangle as it reaches tide water, but has created a more circular shape. The expansion into that shape has resulted from the confined outlet at the Carquines Straight (Straight). This confined outlet has also resulted in the quality of Delta water being retained long after the inflow from the several rivers has fallen to nearly nothing. That sustained quality is attributable to the inflow of salty water being slowed by the Straight acting as a confined inlet for the salty water.

The Delta must be recognized as a natural storage reservoir. Prior to the modification of flows by the various upstream dams (as to which no criticism is intended) the high flows of the several tributaries during the winter and spring seasons of upstream rainfall and snow melt, pushed water out through the Straight making the tidal area within the Delta fresh, sometimes far out into the Bay. As the inflow diminished, the salt water from the Bay was gradually able to intrude through the Sraight into the Delta and the water quality in the lower portions would gradually diminish as a result. This intrusion was, however, a slow and gradual process as a result of the confined inlet created by the Straight.

Evidence exists of this extended period of good water quality as a result of this Delta reservoir or "storage" effect. Water quality has been recorded at the intake to the East Contra Costa Irrigation District (ECCID) on Indian Slough, in the Western Delta since 1914. That record shows that water of usable quality was available during the period between 1914, when measurements began, and the completion of the Shasta dam in the

1940's. It was continuously available at that location throughout the entire irrigation season except in October of 1931 which was a severely dry year. That, however, occured only after the need for irrigation water was virtually finished for the season.

Nature was, therefore, effectively storing water of a usable quality in the Delta during the winter and making it available throughout nearly all of the irrigation season, at least prior to the completion of the dams upstream. Indeed, farther into the Delta than the ECCID intake, the quality of water would never have dropped below an acceptable standard throughout the entire irrigation season.

Due to the effect of the tides, there was never, of course, a problem of water being phisically available. The water, though sometimes at a lower elevation in the Delta, was always physically available, unlike lands adjacent to a flowing stream which would at times find the source nearly absent.

During the negotiations leading to the 1981 North Delta Water Agency's (NDWA) contract with the State of California for assurances of water quality and quantity, and during the hearings for the permits issued to the US Bureau of Reclamation (USBR) for the operation of the Shasta Dam, there were those who questioned the continuous availability of usable water in the Delta. Some assumed that if the flows of the tributaries into the Delta fell to only nominal amounts then the Delta was essentially out of business and needed a supplemental supply. This would be on the assumption that the Delta acted as a continuance of the flowing streams. But it did not. It was effectively a reservoir, storing fresh water in the winter for use in the summer and so did not directly rely upon a continuous inflow of any particular amount.

There are said still to be some who believe that the Delta is receiving a tremendous benefit from the operation of the upstream storage dams in sustaining the availability of usable water and that without the releases from those dams, the Delta supply of usable water would be in doubt for much of the year. That is a serious misunderstanding of the way the Delta functioned prior to the dams. Without the dams, the Delta was storing water during high flows for use during the balance of the season. Those high flows pushed out the intruding salt in the Delta and turned virtually all of the Delta fresh. It was, in effect a reservoir which slowly "leaked" through gradual intrusion of saline water. The slowness was due to the limited inflow of salty water permitted by the Straight. It was not perfect and the quality gradually diminished from the extreme westerly portion toward the upper edge of the tidal effect, but it was indeed a valuable and important natural storage operation for the better part of the irrigation season.

So, what has been the impact of the upstream storage on the Delta? The high flushing flows which historically pushed salty water from the Delta channels each winter and turned them fresh, have been substantially reduced by storage of these flows in the upstream dams. The pull of the federal and State export pumps has added to the speed of the salinity intrusion into the Delta. The Project operations have a benefit from the standpoint of flood control and effective Statewide water usage. It must also be recognized, however, that the Project opertions have an adverse impact on the natural "storage effect" in the Delta. The Project operations have ha the effect of turning the natural Delta "reservoir" into more of a flowing stream, diminishing the natural storage effect.

When considering the question of what benefit the Delta water users have received from the operation of the storage reservoirs upstream on the tributaries by the State and federal governments, it must therefore be recognized that the operation of these storage reservoirs upstream, and the operation of the export pumps, have reduced the natural seasonal storage of fresh water in the Delta which existed prior to their construction. The extent of the benefit which the Delta may receive from artificial upstream storage must therefore be offset to the extent of the detriment from reduction of the storage effect which nature provided to the Delta lands prior to that upstream storage and the pull of the export pumping of the Projects.

There are those who may yet believe that the Delta water users owe their continued success to the operation of the reservoirs and that when the inflows reached a low point, the Delta irrigators were essentially out of business. Such an assumption ignores the way in which the Delta operated before the dams and the addition of the export pumps which, in effect have turned the Delta "reservoir" into more of a running stream.

This analysis deals only with the Delta water quality issue. It is not intended to analyze impacts on fish or flooding. All of these issues are connected, but in analyzing the benefits of upstream storage on Delta water quality, any benefits must be offset by the loss of the benefit which nature provided as a result of the narrow channel which limited both the outlet of fresh water and the inlet of salinity.

The 1981 Contract Between State of California Department of Resources and the North Delta Water Agency, for the Assurance of a Dependable Water Supply of Suitable Quality includes a determination of the appropriate compensation for the average benefits to the North Delta from the State Water Project operations. In so doing, it has properly weighed the issue of Project benefits along with the availability of the historic natural Delta storage in light of the Delta storage concept described above.

These comments owe their source to Gerald H. Jones, a distinguished water and flood control engineer who began his career with the East Contra Costa Irrigation District in about 1914 and retired as an Assistant State Engineer in the 1950's. He was a walking history of Delta operations. He continued to work with Delta interests until his death in the 1960's and was the first to understand and explain the "Delta Storage Concept" described above. The Delta owes a great deal of gratitude to "Jerry" Jones.

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