

Notes on Problems, Issues, and Insights Revealed by CALFED Game 6A
David Fullerton
July 5, 2000 Draft

This paper is solely the product of the author and does not represent any sort of official perspective on any of these issues.

Baselines, Accounting, and Rights: The Projects vs. EWA

The EWA operates on a credit/ debit basis vis a vis the Projects, with storage in SLR representing the bank. Increases in Project exports relative to baseline conditions generate EWA credits in SLR.¹ Reductions in exports relative to baseline conditions are debited from the SLR account. Reductions in deliveries resulting from EWA actions south of the Delta are credited the EWA in SLR. Increases in deliveries are debited.² The movement of water from SLR to its groundwater storage is debited from its account in SLR. Recovery of groundwater storage generates credits in SLR.

The CALFED Framework has defined the baseline upon which the EWA operates in general terms. However, baseline issue still remain. Until these are cleared up, EWA accounting cannot be put onto a firm footing. The baseline issues uncovered so far are as follows:

- State Gain of AFRP Releases. The SWP currently picks up AFRP releases to the extent it can under the COA. The EWA receives a credit in SLR for 50% of this pumping. Is State Gain part of the operational baseline? If so, then the is obligated to repay the SWP for any State Gain lost during EWA export cuts. If not, then we simply treat State Gain as an opportunity, but not a right.
- EWA debts and JPOD. When the EWA borrows water from the SWP, it creates a hole in SLR. Naturally, this hole forces the SWP to pump longer during the next winter before it can fill. If SWP takes longer to fill, then the onset of JPOD and unscheduled water delivery is delayed. In both cases, the effect is to reduce supplies available to the Projects. As a result, CALFED's policy has been to assume that the EWA will be responsible for repaying the CVP for any lost JPOD opportunities and for supplying water to meet SWP unscheduled water opportunities.
- EWA surpluses and JPOD. Conversely, the existence of EWA water in SLR will cause the SWP side of SLR to fill earlier. In order to be consistent, such filling should not trigger JPOD and should not trigger unscheduled deliveries by the SWP, but should simply lead to a gradual shift in the location of EWA storage from the SWP side of SLR to the CVP side of SLR. When the SWP would have filled, even without the EWA storage, the all the EWA credits storage would have been shifted to the CVP side and JPOD would begin. CALFED policymakers have never discussed this particular issue, but the logic seems fairly clear.
 - Thus, the Projects should neither be harmed by nor gain a benefit from JPOD as a result of EWA operations.
- B(2) export cuts and JPOD. The application of b(2) export cuts on the CVP will reduce CVP storage in SLR. Reduced CVP storage in SLR increases opportunities for JPOD during the winter and spring. Should JPOD opportunities that arise solely as a result of b(2) cuts made previously in the water year be split between the CVP and the EWA? Or should the water go exclusively to the CVP? For example, say that JPOD would normally have operated for 1 month during February until the CVP portion of SLR filled. But as a result of b(2) cuts in January, the opportunity for JPOD is extended by 2 weeks into March. Should this new JPOD be split between the CVP and the EWA? Should the CVP get it all? If export cuts are made during this extended JPOD, should the EWA be obligated to compensate for all of the lost JPOD opportunity? 50% of the opportunity? None of the opportunity?

¹ Export increases credited to the EWA may result from E/I relaxations, the EWA share of JPOD, the eWA share of State Gain, the EWA right to 500 cfs July- September, or from shifts of storage or purchases from upstream,

² Decreases in deliveries could result from south of Delta purchases or from source shifting (in which MWD would defer deliveries). Repayment of MWD for source shifting would again reduce the EWA account in SLR.

The issue comes down to whether the b(2) export cuts are treated as part of the operational baseline or not. If they are part of the baseline, then any resulting JPOD should be split with the EWA. If they are not part of the baseline, then policymakers can decide what priority b(2) export impact recovery has vis a vis the EWA. In game 6, the assumption was made that this sort of JPOD was split 50/50 with the EWA. Similarly, the EWA must compensate the CVP for 50% of any lost JPOD opportunities during a JPOD opportunity created by b(2) cuts.

Collateral and Risk Management

The fundamental constraint on EWA export cuts is the rule that EWA operations must not lead to changes in Project delivery patterns, except on a voluntary market basis.

Additional work is needed to translate the "no harm" rule into operational terms. For purposes of gaming, the gaming team assumed that the EWA could take actions as long as it had the collateral to (1) avoid a low point problem in SLR in the current year and (2) repay any loans before low point in the following year. The collateral calculation for getting through low point in the current year assumed:

- Export area water purchases slated for the current year through August of the current year.
- EWA transfers from upstream of the Delta projected for the current year through August.
- EWA supplies projected from excess flows pumped through the 500 cfs through August.
- Groundwater storage retrievable through August.
- EWA storage in SLR.
- Supply shifting opportunities available through August.

The collateral calculation for the following year was similar, but added export purchases slated for the following year and subtracted source shifting opportunities. Note that E/I relaxations, JPOD, the EWA share of State Gain, and upstream purchases in the following year are not part of the collateral calculation, since they are uncertain.

Most participants in Game 6A felt that these rules were overly mechanistic. In some cases the rules may have been overly constraining on the EWA. In other cases, they may have placed undue risk on the Projects. The reasons are as follows:

- Predictable, favorable hydrology may reduce Project risk dramatically. During 1982, the EWA took actions well beyond what was allowed under its 1983-horizon collateral. However, end-of-year 1982 SLR storage was a very healthy 800 kaf, even after major EWA cuts. Moreover, since 1982 was wet, the probability of high fall flows and an early fill of SLR was high. For this reason, the gaming team elected not to invoke Tier 3, but to allow the debt, noting that the size of the debt violated the strict rules placed on the EWA.
- Unpredictable, unfavorable hydrology may increase Project risk dramatically. During the 1987 – 1992 drought, the gaming team continued to assume that 150 kaf of export water purchases would be available in the following year under all circumstances. Such an assumption was probably overoptimistic.
- Contingency analysis may increase effective collateral. In some cases, the EWA might be very likely to pick up water, whether next year is wet or dry. For example, following a wet year (with healthy upstream storage), the EWA is likely to pick up substantial amounts of water through its share of State Gain, particularly if the following year is dry. Moreover, if the next year is dry, the EWA should be able to purchase and move large amounts of water from upstream of the Delta into the export area. If the following year is wet, then the EWA is very likely to pick up water (and pay off debts) through AFRP early in the water year, and JPOD and the filling of SLR during the winter. No credit is given for these types of contingencies in the current formulation of borrowing rules.

A better approach would be to move toward a more expansive definition of collateral, based upon statistical analysis. For example, EWA borrowing rights could be based upon the following rule:

The EWA may borrow water as long as the likelihood of an EWA-induced low point problem in the current year is less than 5% and provided that the probability of failing to repay of all debts before low point in the following year is less than 10%, assuming no further EWA actions.

The higher risk for the following year seems justified in that the standard of performance is higher (repayment of all loans, rather than just avoidance of a low point problem) and because the extra year would allow for Tier 3 remedial actions.

Such a statistical analysis should not be too difficult, since CALSIM is currently being configured to run this type of Monte Carlo analysis using a weekly time step.

Offset

The calculation of offset water is now relatively straightforward. Whenever a CVP b(2) export cut (whether due to WQCP or discretionary) coincides with a reduction in net upstream releases, relative to the CVP D 1485 baseline, an offset occurs. The reduced exports are likely to lead to reduced deliveries. The b(2) account is credited for this offset only to the extent that the new upstream storage can be converted back into increased export deliveries.

The most obvious way to maintain deliveries would be to re export the water early enough in the summer that increases in allocations can be justified. Such deliveries early in the summer require that the year be dry enough that surplus capacity exists in the Delta.

There are other possible scenarios. If SLR storage is high enough (due to favorable conditions, or source shifting, or and EWA loan), then could allocations be increased and credit given if projections indicated that CVP SLR storage levels could be recovered through pumping in August and September?

EWA Storage in Upstream Reservoirs

SWP operators have expressed concern that projected EWA control over water in Oroville may violate SWP policy. The CVP may have a similar concern over EWA control over storage in Shasta and other federal reservoirs.

EWA control over, or at least credit for, upstream storage is critical to the proper operation of the account. When the EWA initiates an export cut, it is taking on an obligation to repay the Projects for the export reduction. If the EWA is not able to get credit for water backed upstream into storage during these export cuts, the Projects will gain at the EWA's expense. If the Projects are able to re export the water backed upstream while maintaining deliveries, then they are made whole. It would not be fair to charge the EWA for export cuts that did not reduce exports or deliveries. Doing so would allow the Projects to actually increase deliveries.

Ideally, the EWA would retain control over water backed upstream due to EWA export cuts. Then the EWA would be able to release the water, either for export or to enhance instream flows, according to biological priorities. Another solution would be to keep track of water backed upstream and to credit the EWA account to the extent that such storage was used to meet Project purposes (such as export).

EWA and Level 4 Refuge Supplies

The potential exists for competition between the EWA and the CVPIA Level 4 Refuge Supplies for water purchases and export capacity. The gaming team feels that the two programs should be coordinated as much as possible in order to reduce competition and increase synergies.

During Game 6, the gaming team noted opportunities to move Level 4 Refuge water from upstream of the Delta into the export area. During dry years capacity was generally available, provided that water could be purchased upstream. During wet years, Delta capacity was generally not available, since the pumping plants were at capacity all summer. Space sometimes opened up in the pumping schedule in October and

November. However, such periods may not be ideal for transfers based upon reservoir releases, since increased upstream releases usually must be maintained into the winter to protect spawning salmon. Thus, the transfer cannot be moved in a short burst. On the other hand, SLR filled in many wet years, meaning that a surplus in pumping capacity exists in those years. These considerations lead to some possibilities for coordination with the EWA:

- Give Level 4 Refuge Supplies second priority for use of the EWA's 500 cfs of capacity during July – September. This will expand the number of years in which capacity exists to move Refuge water across the Delta.
- Allow the EWA to sell or trade water to meet refuge needs. After or during wet years, the EWA may frequently be able to sell water to the refuges at a reasonable cost, without taking a large risk that fish supplies will be shorted as a result. Alternatively, since the EWA has means of moving water across the Delta denied to the refuge program, the EWA might be willing to trade export supplies for upstream water controlled by the refuge program.
- The combination of these rights, combined with refuge purchases in its own behalf may well eliminate most conflicts between these programs and, in fact, should allow refuge needs to be met at minimal cost to the fish.

Interaction Between b(2) Accounting and EWA Accounting

The gaming team generally spent the b(2) account first each water year, then relied upon the EWA for remaining needs. This was done for several reasons:

- B(2) water can be used to boost upstream flow. EWA assets are not oriented toward boosting upstream flows. The major upstream flow needs occur at the beginning of the water year.
- Unused b(2) credits generally disappear at the end of each water year. EWA assets do not. Therefore, the group wanted to assure that no b(2) would be left at the end of the water year.
- Export reductions from b(2) cannot total more than 640 kaf from February 1 through the end of September. Therefore, at least 160 kaf must be spent during the period from October 1 through January 1 to assure that all b(2) will be spent each year.

This procedure generally appeared to work well. However, it did lead to some oddities worth noting:

- In some years, upstream AFRP costs + WQCP costs charged to b(2) were greater than 800 kaf (e.g., 1985). As a result, the EWA was charged with some of the WQCP costs in order to bring total b2 costs down to 800 kaf. The accounting is straightforward. However, the propriety of meeting WQCP standards with the EWA is a policy, and perhaps a legal issue. If the EWA is not able to help support WQCP impacts after the 800 kaf is already used up, then the b2 account will need to release less AFRP water upstream to save credits for WQCP costs. In compensation, the EWA would need to shift more of its assets into the upstream areas.

Underdelivery in the CALSIM Baseline. Interpretation of CVP Delivery Results

In analyzing previous games, the gaming team has noted that export delivery impacts from b(2) on the CVP are surprisingly small, in the range of just a 2% reduction on average. To some extent this results from operational shifts and regulatory changes assumed for the games. In particular:

- As noted above, the existence of the EWA allows the b2 managers to spend more b2 credits on upstream releases and less on export cuts. This shift increases CVP exports and deliveries.
- The inclusion of JPOD in recent games leads to significant increases in CVP exports and deliveries.
- The tightening of rules on credits given for reset and offset has effectively reduced the ability of the b2 managers to get double duty out of b2 water. This results in fewer export cuts.
- During 1989 and 1990, the EWA actually carried a net surplus in SLR during low point. The Projects effectively borrowed this storage in order to maintain deliveries at levels they could not otherwise have met.

That said, there is reason to suppose that the loss of export deliveries due to b2 is somewhat larger than previously reported. The algorithm used within CALSIM used estimate CVP deliveries (and perhaps SWP deliveries?) was thought to deliver less water than actual CVP practice during a number of years. That is, the CVP export operations tend to put more weight on deliveries in the current year and less weight on keeping carryover storage in SLR than the model outputs. Presumably the emphasis on present year deliveries will only grow once JPOD is activated, since the CVP will have a much greater opportunity to recover from low storage levels. As a result, baseline storage levels within SLR appear to be too high during a number of years in the models. This means that b2 export impacts can be sustained by the CVP without additional delivery reductions. That is, the b2 export impacts are reflected in lower storage rather than lower deliveries. If baseline deliveries were adjusted to reflect actual practice, SLR would not have extra storage and b2 cuts would more frequently be reflected in reduced CVP deliveries. The gaming team attempted to correct for this problem in Game 6A by adjusting baseline deliveries to reflect higher base deliveries.

Benefits of the 500 cfs

During past games, the Daily model frequently showed that “surplus” water was available during July – September period, even during some relatively dry years. Upon reflection, it appears that at least some of this water is an artifact of applying flow historical patterns onto assumed operations. In practice, Project operators would generally operate to reduce or eliminate this surplus water. The 500 cfs would still be available to the EWA, but the space would be filled less with surplus water and, perhaps, more with purchased water than previously reported. The gaming team attempted to correct for this problem by not attributing EWA supply benefits to the 500 cfs capacity except when surplus flows clearly existed in the Delta.

The 640 KAF Limit on B2 Export Impacts During February – September

Game 6A uncovered what may be considered an anomaly in the b2 accounting. Total B2 export impacts (including both WQCP and discretionary b2 cuts) for the period February – September are limited to 640 kaf. During 1989, b2 export cuts during this period totaled 693 kaf, a violation of the policy. However, prior to this period – from October through January, exports increased by some 200 kaf compared to the baseline. Counting the earlier period, the total export impact was less than 640 kaf. Should the policy have been applied to the letter? If so, then some of the export cuts should have been loaded onto the EWA, increasing its carryover debt.