Briefing Paper on Spring Head of Old River Barrier

Design

The design of the Head of Old River (HOR) barrier changed significantly over the last year from its original design. Instead of a simple rock barrier to provide blockage of San Joaquin River from flowing into the Old River area, the current design includes six 48-inch operable culverts, a slide gate control structure, a fish monitoring structure, and a clay weir section that can be breached at high flow. The opening of the culverts are controlled by a slide gate control structure located on the upstream side of the barrier. DWR determines how many culverts to open and how long to operate the culverts based on daily modeling and field data on water levels at three locations in the south Delta. The culvert outlet works provide for attachment of fyke nets by the California Department of Fish and Game, which can be lowered onto the culverts for fish sampling. A clay weir section allows DWR to breach and remove the barrier under a more controlled condition. Plans, profiles, and sections are shown in Figures 1-3.

The current HOR barrier is considerably larger than the barriers constructed in past years. The rock barrier cross-section is trapezoidal with a top width of 12 ft and bottom width of approximately 85 ft. The length of the barrier from north bank to south bank is approximately 225 feet. The top of the barrier is elevation +10.0 ft. MSL. The base of the barrier was increased to 85 feet to resist higher flows, and the top of the barrier is built with a 75-foot wide clay section protected with concrete grid mats on the downstream side. An impermeable membrane protects the upstream side of the clay section from wave erosion. This clay section can be breached to help control flow over the barrier in the event the HOR barrier needs to be removed in an emergency. Prior to the main barrier construction, a 100-foot riprap scour pad is constructed to prevent channel erosion downstream of the culvert exits.

Emergency Response

The larger barrier can safely withstand stages on the San Joaquin River side of about 8.5 feet MSL. This provides the barrier with a minimum 1 ½ feet of freeboard before the barrier is overtopped. A stage of 8.5 feet MSL at the HOR barrier translates roughly to 15 feet MSL at Vernalis (see attached plot of Vernalis and HOR barrier stages). Based upon current USGS rating curves[1] for Vernalis, this 15 foot stage corresponds to about 7,000 cfs Vernalis flows.

Flows of about 8,500 cubic feet per second (cfs) at Vernalis would result in Vernalis river stages of about 16 ½ feet MSL. This higher stage at Vernalis corresponds roughly to about 10 feet MSL at the HOR barrier site, which would result in overtopping.

[1] Flow/stage rating curves are subject to change as channel bathymetry and riparian growth change. The USGS updates tables weekly. Check their web site at http://water.wr.usgs.gov.

If stages were predicted to rise above 8.5 feet MSL at the barrier site, and upstream operations could not reduce flows sufficiently, DWR would probably order a breach of the clay weir and ultimately, the removal of the rest of the HOR barrier as conditions allowed.

The plan to breach the HOR barrier if flows are projected to exceed 8,500 cfs was part of the Emergency Operations Plan for the Spring 2000 Head of Old River Barrier. This plan was agreed to by the South Delta Water Agency. Compliance with this plan and a separate culvert operations plan was made a part of our Temporary Entry Permit with the Reclamation District 544 on the north side of the barrier.

The emergency removal plan for 2001 and beyond will likely have a trigger for barrier removal that is stage-based, and not flow-based as was the situation in 2000. DWR is not confident that the flow at Vernalis can be depended upon to provide a consistent stage relationship at the HOR barrier site. DWR found during the Spring 2000 operation that flows above 7,000 cfs encroached upon the minimum freeboard for the barrier. Consequently, a barrier removal trigger well below the previous 8,500 cfs flow is recommended for future operations. DWR engineers are supportive of a trigger based upon stage, rather than flow, as extreme head differences across the HOR barrier is the condition that could result in an uncontrolled barrier failure.

A 7,000 cfs VAMP target flow is likely to fluctuate plus or minus 500 cfs under normal conditions, which would drive stages at the HOR barrier well into the minimum freeboard zone. With these higher flows, an sudden storm event could raise stages enough to cause the barrier to overtop. ***Given the experience with the HOR barrier in Spring 2000, and the current rating curve information for Vernalis, DWR does not recommend a 7,000 cfs Vernalis flow target for VAMP while the HOR barrier is in place.***

The maximum allowable flow on the San Joaquin River during installation and removal is 5,000 cfs. DWR engineers have indicated that in an emergency breach condition, San Joaquin River upstream operators would need to coordinate reservoir releases to ensure that after a breach, San Joaquin River flows could be quickly reduced to 5,000 cfs to allow the remaining barrier to be safely removed. If flows could not be reduced, then the barrier would likely experience a "controlled failure," with the breached weir section facilitating the failure from the center of the barrier outward. This is not a situation with which DWR engineers are comfortable, as the possible consequences of such a failure include damage to the adjacent levees. As a precaution, DWR has re-armored the levee faces with riprap for several hundred yards downstream of the barrier site.

South Delta Water Supply

SDWA has raised a concern that the six culverts might not be able to convey enough water in times when San Joaquin River flows are low and SDWA irrigation demand is

high. This could occur in drier years when VAMP target flows are lower than 5,700 cfs. DWR is currently conducting modeling of a dry year hydrology that will look at stages in the south Delta when the HOR barrier culverts are open, closed, and when the HOR barrier is removed. DWR does not expect to see large swings in stages under these different scenarios, as stages in the south Delta are more influenced by the strength of the tides and the installation of agricultural barriers. SDWA has argued for the installation of the Grant Line Canal barrier when the HOR barrier is in place, to help relieve low water levels in the south Delta. If approved by the regulatory agencies, the additional ag barrier would reduce the dependence on flows through the HOR barrier culverts to raise water levels in the south Delta.

Permanent HOR Barrier

The South Delta Improvement Program includes a permanent HORB with radial gates and a boat lock. Construction start is expected about 2003. Completion is planned about December 2006.

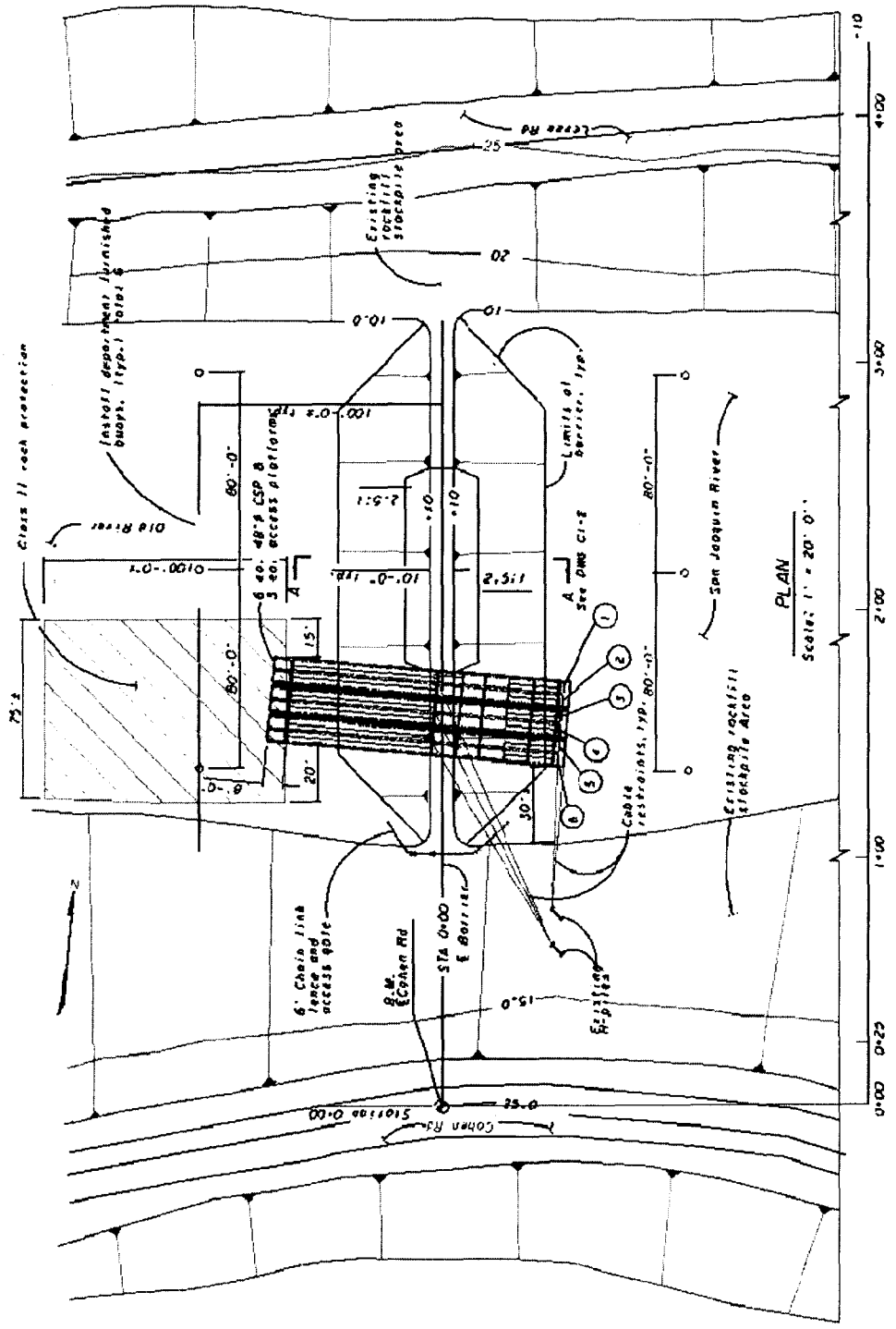

Figure 1. Head of Old River Spring Barrier Plan

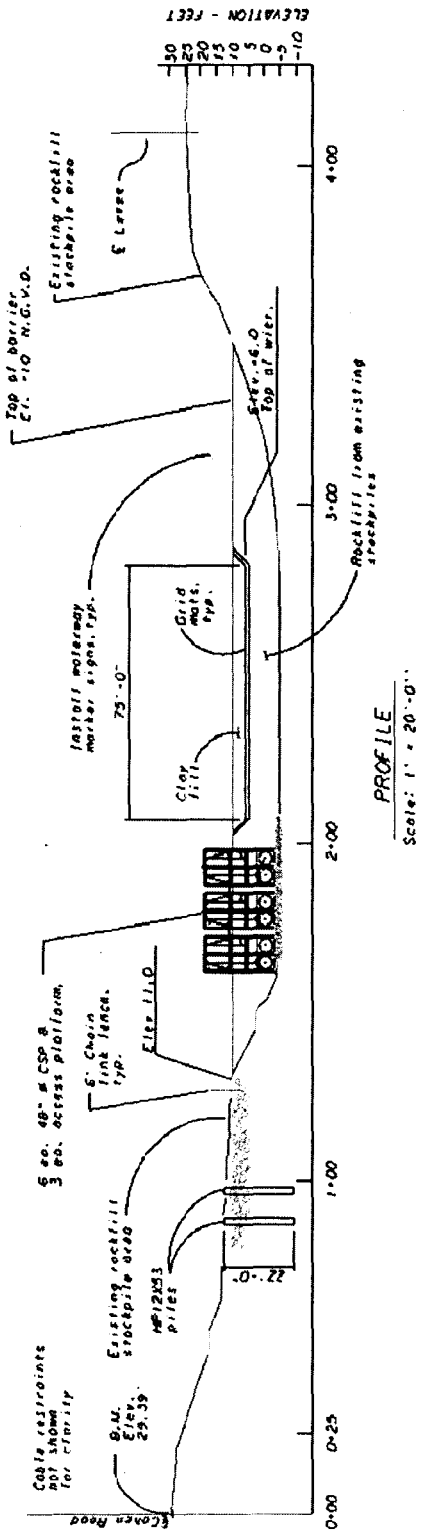

Figure 2. Head of Old River Spring Barrier Profile

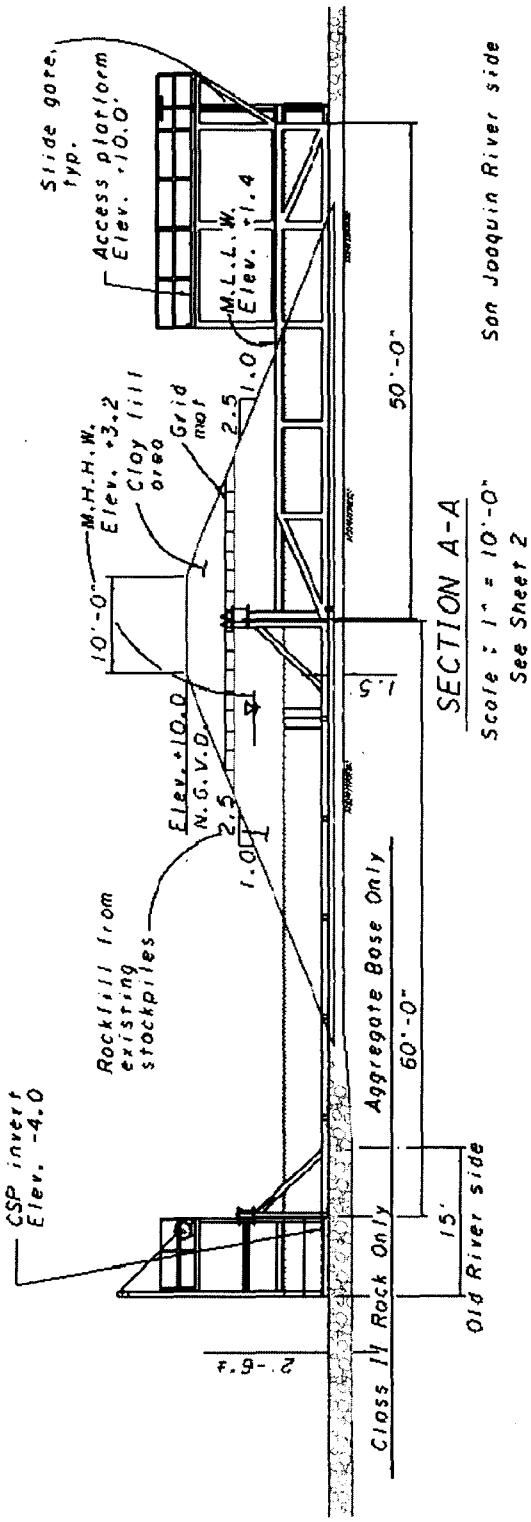

Figure 3. Head of Old River Spring Barrier Section

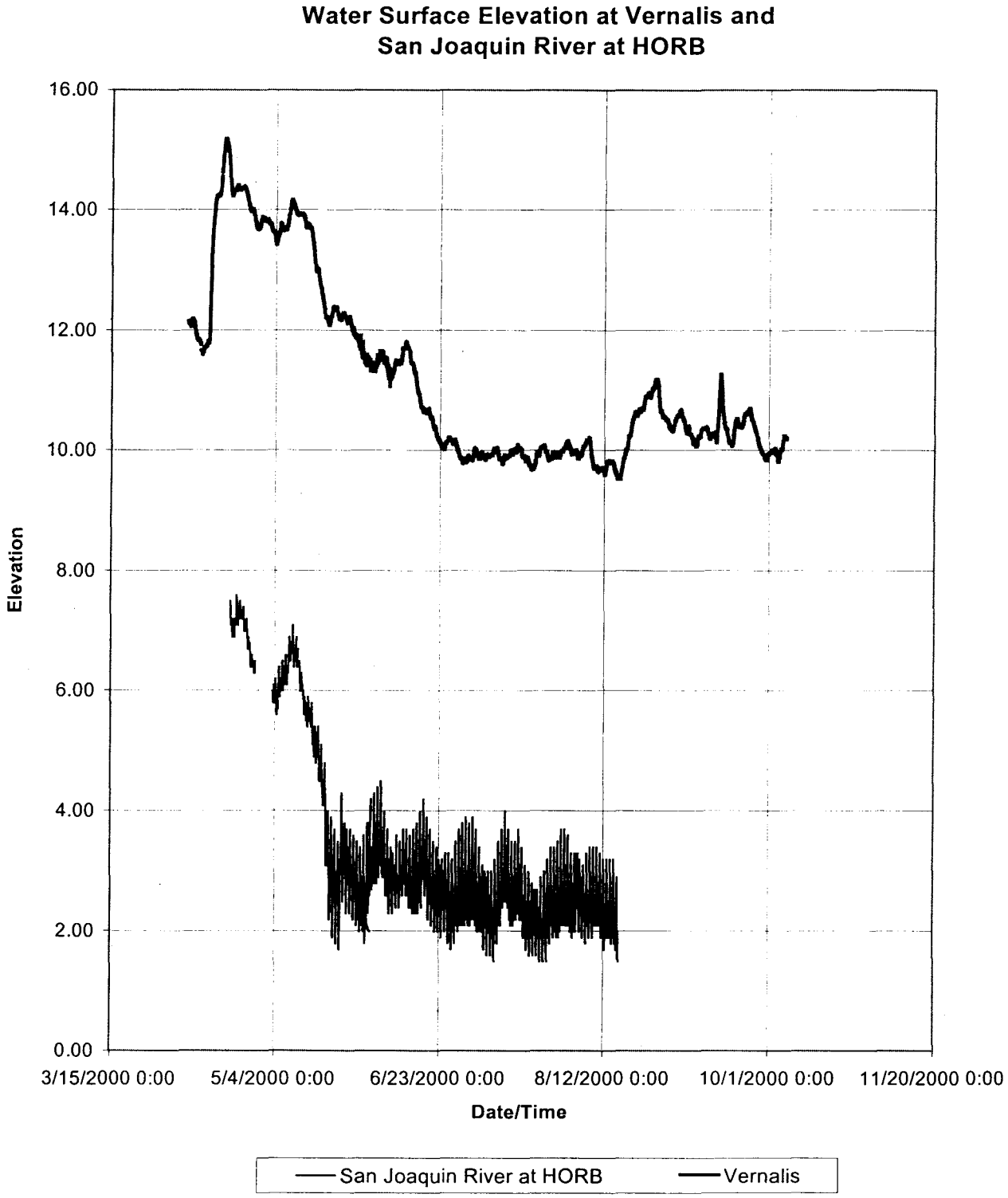

Figure 4. Water Surface Elevations at Vernalis and San Joaquin River at HORB