GEI Consultants
Bookman-Edmonston Division

Memo

To: Mr. Bob Kelley, General Manager

From: Naser Bateni

CC:

Date: May 27, 2011

Re: Water Transfer Proposal, Stevinson Water District, Merced County, California

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Stevinson Water District (District) is proposing to transfer a portion of the water conserved during their three phases of lateral ditch replacements with pipes in accordance with the District's Integrated Water Resources Management Plan. Piping of the laterals conserved water that was lost to evaporation, evapotranspiration by vegetation growing along the laterals, and deep percolation. This technical memorandum summarizes the benefits of the conservation program and the proposed transfer to the San Joaquin River and the Delta.

A meeting was held on May 20, 2011, among staff of United State Bureau of Reclamation (USBR), Department of Water Resources (Department) and Stevinson Water District (District), to address concerns voiced by the Department regarding a water transfer proposal submitted by District. The key concern raised by the Department was that, because of the proximity of the District to the San Joaquin River and potential connectivity between the aquifer underlying the District and the river, the proposed transfer may reduce the volume of groundwater flowing from the District's groundwater basin to the river, a diminution that could reduce the volume of flow reaching the Delta.

The Department's concerns were based on documentation that describes the District's conservation activities and that demonstrates how the quantity of water conserved by these activities is more than sufficient to support the requested transfer. However, an important aspect of the District's water conservation efforts that was not adequately discussed in the documentation provided to the State Water Resources Control Board, and was discussed during the meeting with the Department and USBR are the benefits of the conservation measures to the San Joaquin River water quality. This technical memorandum discusses technical issues related to the proposed water transfer.

The United States Geological Survey (USGS) performed a study entitled Quantity and Quality of Ground-Water Inflow to the San Joaquin River, California (Water-Resources Investigations Report 91-4019, 1991). They investigated three locations, one of them being the "Newman" site, located on the northwest corner of the confluence of the Merced and San Joaquin Rivers. Eight clustered monitoring wells were constructed at the Newman site; three wells on the west side of the San Joaquin River, two within the river channel, and three on the east side of the San Joaquin River. The boring found the site to be underlain by a relatively thin clay to sand clay layer at a depth of about 7 feet below ground surface. The monitoring wells were used to acquire groundwater levels and water quality samples. A groundwater flow model was developed and calibrated to these measurements.

The groundwater model results for the groundwater flow system at Newman indicates that most groundwater enters the study cross-section from the west and then either discharges to the San Joaquin River or passes beneath the river to the east. After the water passes beneath the river some of the water rising through the groundwater aquifer toward the ground surface, resulting a poor groundwater quality along the San Joaquin River. Figure 15, from the USGS report, shows the results of the calibrated flow model as simplified flow nets with arrows showing the general directions of groundwater flow.

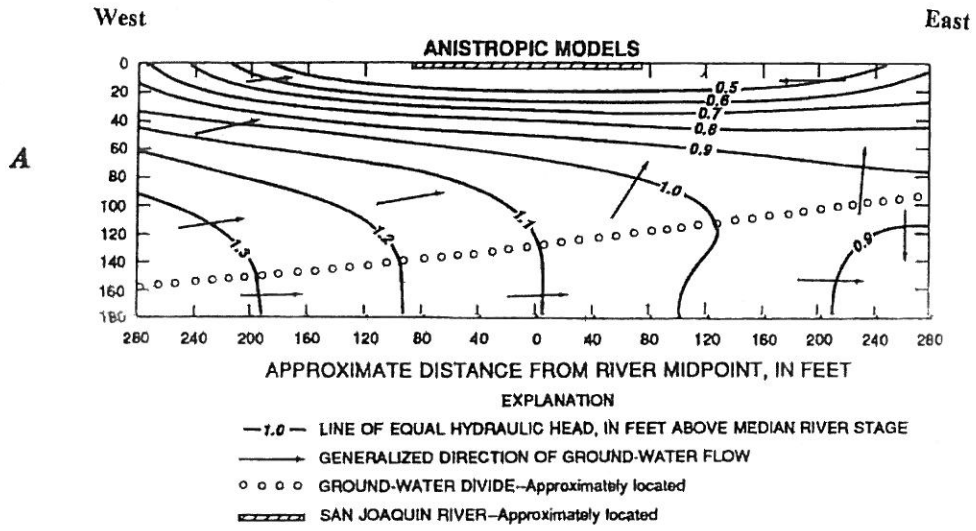


Figure 15. General directions of ground-water flow for the six calibrated solutions. *A*, Newman site. *B*, Crows Landing site. *C*, Patterson site.

Two different water qualities were identified at the Newman study site. The most prevalent is groundwater from the Coast Ranges, represented by samples from seven of the eight observation wells at the Newman site. This includes groundwater sampled from all wells except from the shallowest well on the east side of the river, which was classified as a mixture of flood water recharge and underlying poor groundwater. For the seven groundwater samples typical of the Coast Ranges groundwater, the median concentrations are 2,210 mg/L total dissolved solids (electrical conductivity of 2,850 to 6,670 microsiemens per centimeter).

In 2006, additional investigations were performed as part of the District's Integrated Water Resources Management Plan to understand and attempt to improve the water quality in the western portion of the District (GEI, 2006). Fourteen cluster monitoring wells were constructed to evaluate the water quality beneath the western portion of the District and the groundwater flow directions. Figure 2 from the Integrated Water Resources Management Plan shows the location of monitoring wells constructed during this program

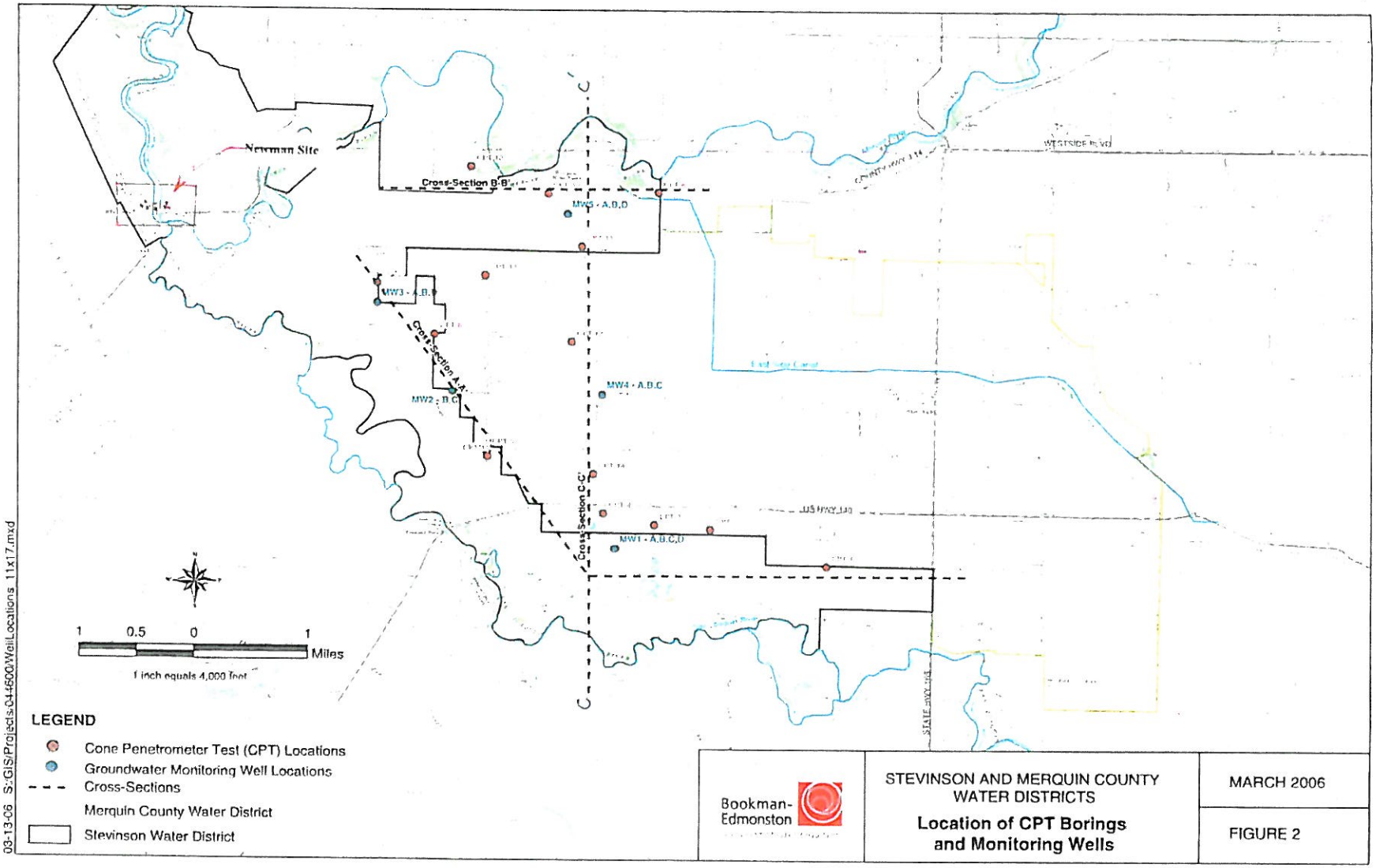
Figure 9, Cross-Section C-C', shows the soils and groundwater quality between the Merced and San Joaquin Rivers. At this location the San Joaquin River has been incised into sands that constitute the shallow aquifer. Further east the San Joaquin River is incised into a thick clay layer (Bookman

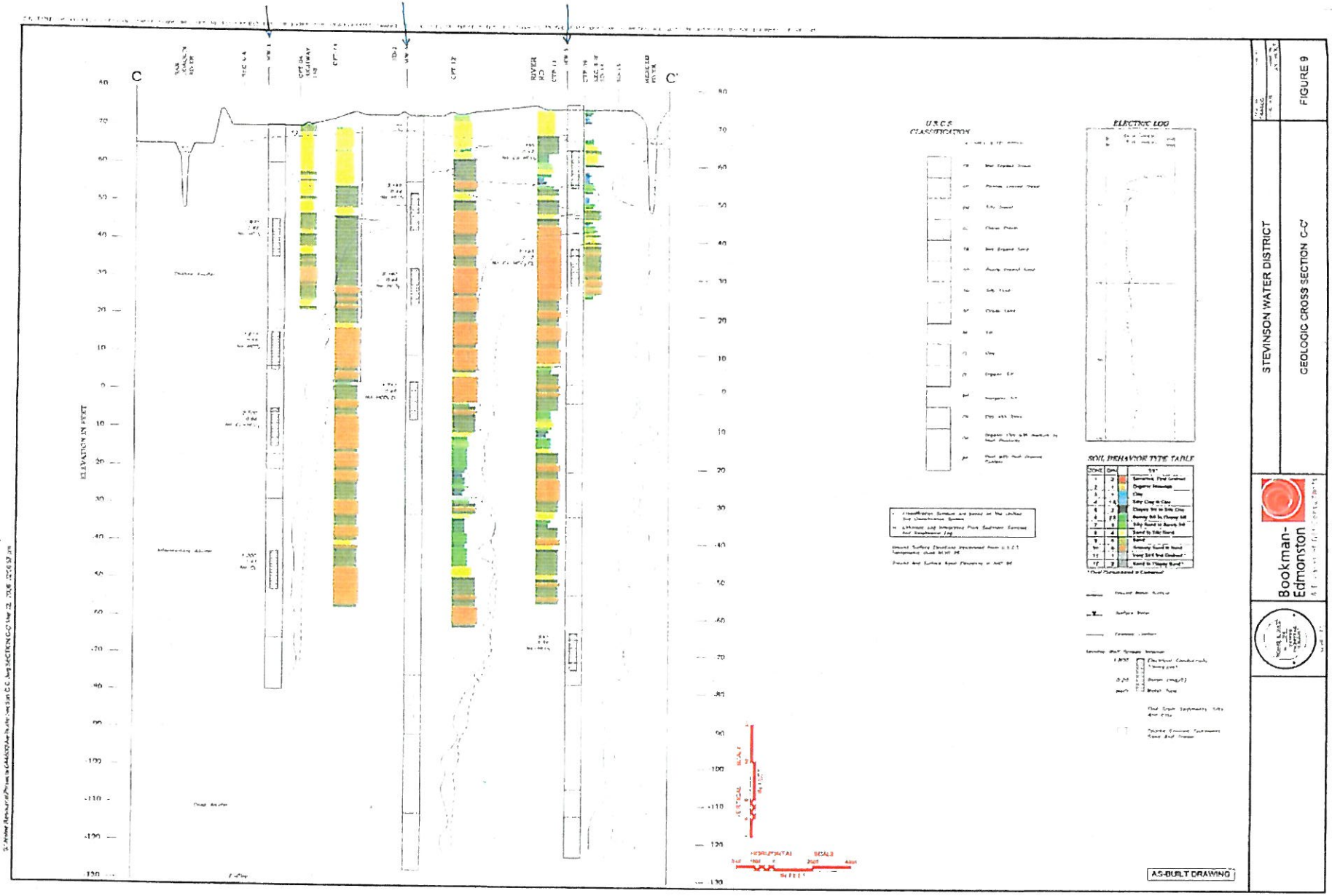
Edmonston, 2003). Figure 9 shows groundwater quality is of moderate quality near the Merced River and degrades to poor quality as one moves toward the San Joaquin River. The concentrations are similar near the San Joaquin River to what was found in 1991 by the USGS. Also similar to the USGS findings, MW-1 showed an upward vertical flow gradient adjacent to the river.

Figure 9 demonstrates that, to the degree that there is connectivity between the groundwater and the river, the quality of groundwater adjacent to the river is so poor that it would degrade the quality of water in the San Joaquin River, jeopardize attainment of water quality standards at Vernalis, and potentially would require releases from New Melones Reservoir to compensate for the reduction in water quality resulting from the influx of poor groundwater. As presented above, the poor water quality in the District along the San Joaquin River is the result of an upward push of poor quality water that moves from the west side of the Valley, under the San Joaquin River and into the District groundwater aquifer. The District conservation projects have resulted in reduction of good quality surface water percolation into the unusable groundwater.

One of the purposes of the Stevinson Water District's Integrated Water Resources Management Plan was to develop a package of measures that would address an array of water management problems faced by the District. Among these problems were high water tables and poor groundwater quality observed in lands near the San Joaquin River. In this instance, implementation of water conservation measures provided benefits to the District by reducing seepage from laterals, saving water and improved agronomic conditions. In addition, the conservation measures, when reduces flow of the groundwater to the river, benefits the State by controlling discharge of poor quality groundwater to the San Joaquin River. For this reason, the water conservation measures related to the District's proposed water transfer also support the State's objectives with respect to management of water quality in the Delta. These objectives are also supported by the District's Agricultural Drainage Management Project that uses enhanced wetlands to manage agricultural drainage to improve water quality in the San Joaquin River. Another benefit of the District conservation program is that the program saves good quality surface water that is available for transfer to other Delta water users in the San Joaquin River system, and therefore reduces overall stresses (demand) for the water that otherwise needs to be pumped from the Delta.

If you have any questions pertaining to this memorandum, please call Naser Bateni at 916-631-4562.


Newman Site
Cross-Section B-B'
MW5 - A,B,D
MW3 - A,B,D
Cross-Section A-A'
MW2 - B,C
MW4 - A,B,C
Cross-Section C-C'
MW1 - A,B,C,D
WESTSIDE BLVD
COUNTY HWY J14
US HWY 140
STATE HWY 165
1 0.5 0 1 Miles
1 inch equals 4,000 feet
LEGEND
Cone Penetrometer Test (CPT) Locations
Groundwater Monitoring Well Locations
Cross-Sections
Merquin County Water District
Stevinson Water District
Bookman-Edmonston
STEVINSON AND MERQUIN COUNTY WATER DISTRICTS
Location of CPT Borings and Monitoring Wells
MARCH 2006
FIGURE 2
03-13-06 S:\GIS\Projects\044600\WellLocations 11x17.mxd


C
C'
ELEVATION IN FEET
U.S.C.S. CLASSIFICATION
ELECTRIC LOG
SOIL BEHAVIOR TYPE TABLE
AS-BUILT DRAWING
STEVINSON WATER DISTRICT
GEOLOGIC CROSS SECTION C-C'
FIGURE 9
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