Appendix A

Structure Siting Summary

THE FREEPORT REGIONAL WATER PROJECT

INTAKE STRUCTURE SITING SUMMARY

NOVEMBER 2003

FREEPORT
REGIONAL WATER AUTHORITY
Sacramento County Water Agency
East Bay Municipal Utility District

Freeport Regional Water Project Intake Structure Siting Summary

The Freeport Regional Water Authority (FRWA) is proposing the Freeport Regional Water Project (FRWP) to meet the basic project purpose and other purposes summarized below in "Project Purpose/Objectives and Need." FRWA is the lead agency under the California Environmental Quality Act, and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation), is the lead agency under the National Environmental Policy Act. The FRWP will be funded, designed, constructed, and operated by FRWA and its member agencies.

The FRWA agencies (i.e., Sacramento County Water Agency [SCWA] and East Bay Municipal Utility District [EBMUD], together with the City of Sacramento, an associate member) have undertaken extensive water supply planning studies over many years. In recent years, efforts of all three entities have focused on specific project alternatives along the lower American and Sacramento Rivers. Previous studies in the late 1990s explored a joint project with all three entities along the lower American River. However, with the formation of the Sacramento Water Forum and substantial concerns about water availability and flows in the lower American River, all three FRWA entities agreed to pursue water supplies from the Sacramento River. This mutual support of a Sacramento River diversion provides a solution to a 30-year debate between EBMUD and the Sacramento community and allows both agencies to exercise their contractual rights.

The City of Sacramento is currently expanding and updating its current intake on the Sacramento River just downstream of the confluence with the lower American River. This location was also examined as an alternative to meet SCWA and EBMUD needs. However, there is not sufficient capacity at this location to meet the needs of SCWA and EBMUD. Therefore, an extensive evaluation of other potential sites that were feasible and capable of meeting the project objectives was undertaken.

The analysis determined that the site needed to be located between approximately the town of Freeport and the Pocket area. There are no practicable locations upstream (north) because of development and lack of east-west alignment opportunities for the required pipelines. Opportunities are similarly limited to the south (downstream) because of existing development, lack of east-west alignments, pipeline distances required to meet the project objectives, and water quality concerns associated with the Sacramento Regional County Sanitation District Waste Water Treatment Plant (SRCSD WWTP) outfall in the river.

Within the general area determined to be feasible, four alternative locations were examined in detail. Environmental concerns, engineering, water quality, and costs were the key factors considered. Each site had some constraints associated with it. Based on the detailed analysis conducted and described in this report, it was determined that the only practicable location is the city-owned property between Interstate-5 (I-5) and the Sacramento River. The site contains a large, highly visible water tower, a stormwater pumping station capable of pumping approximately 400 cfs into the Sacramento River, and an abandoned wastewater treatment facility. The site is owned by the City of Sacramento Department of Utilities and has long been considered suitable for public water facilities. The other sites explored had more significant environmental, engineering, and/or water quality limitations associated with their implementation.

Introduction

The FRWA was created by exercise of a joint powers agreement between the SCWA and EBMUD. FRWA's basic project purpose is to increase water service reliability for customers, reduce rationing during droughts, and facilitate conjunctive use of surface water and groundwater supplies in central Sacramento County. This document describes the need of each of the FRWA agencies, as well as the process undertaken to define an appropriate project to meet FRWA's purpose in general, and a feasible intake location in particular.

Freeport Regional Water Authority Member Agencies

Sacramento County Water Agency

SCWA provides water to areas in central Sacramento County. SCWA is responsible for providing water supplies and facilities throughout these areas, including the Laguna, Vineyard, Elk Grove, and Mather Field communities, through a capital funding zone known as *Zone 40*.

The long-term master plan for Zone 40 envisions meeting present and future water needs through a program of conjunctive use of groundwater and surface water. SCWA presently has a contract with Reclamation for 22,000 acre-feet (af) of water. SCWA has subcontracted 7,000 af of this entitlement to the City of Folsom. Central Valley Project (CVP) water for SCWA is currently delivered through the City of Sacramento's intake and treatment facilities based on SCWA need and available city capacity. SCWA's CVP contract also allows it to divert at the location identified as *Freeport* on the Sacramento River south of downtown Sacramento. This site is on the Sacramento River just south of Pocket Road, west of Freeport Boulevard, and south east of the residential neighborhood known as "South Pocket." SCWA expects to be able to provide additional anticipated surface water entitlements to serve Zone 40 demands, including an

assignment of a portion of the Sacramento Municipal Utility District's (SMUD's) existing CVP water supply contract, potential appropriative water rights on the American and Sacramento Rivers, and potential transfers of water from areas within Sacramento Valley. Total long-term average Zone 40 water demand is estimated to be 109,500 af per year (AFA). Long-term average surface water use is expected to be 68,500 AFA.

East Bay Municipal Utility District

EBMUD is a multipurpose regional agency that provides water to more than 1.3 million municipal and industrial customers in portions of Contra Costa and Alameda Counties in the region east of San Francisco Bay (East Bay). EBMUD obtains most of its supply from Pardee Reservoir on the Mokelumne River, with the remainder collected from local runoff in East Bay terminal reservoirs. On July 26, 2001, EBMUD and Reclamation entered into an amendatory CVP contract that sets forth three potential diversion locations to allow EBMUD to receive its CVP supply. One of these locations is on the Sacramento River in the vicinity of the Town of Freeport, the same site described above. EBMUD's CVP supply is 133,000 af in any 1 year, not to exceed 165,000 af in any consecutive 3-year period of drought when EBMUD total system storage is forecast to be less than 500,000 af. Total long-term average surface water use is estimated to be 23,000 AFA, with a maximum annual diversion rate of 99,000 AFA. Subject to certain limitations, the contract also provides for a delivery location on the lower American River, and EBMUD retains the opportunity to take delivery of water at the Folsom South Canal should other alternatives prove infeasible.

City of Sacramento

The City of Sacramento has joined FRWA as an associate member. The city's main interests are in the design and construction of FRWA project facilities that may be located in the city or on various city properties or rights-of-way. A city representative sits on the FRWA Board of Directors as a nonvoting member.

Project Purpose/Objectives and Need

The FRWP is intended to contribute to meeting the objectives of SCWA and EBMUD. The need for the project and its primary purposes and objectives are described below.

Needs

The project is needed because:

- SCWA and Sacramento County have concluded that:
  - reliance solely on groundwater to serve development authorized in Sacramento County's General Plan will deplete the central county groundwater aquifer, resulting in shallow wells drying up, degradation of groundwater quality, increased pumping costs, land subsidence, and potential changes to local floodplains, and
  - the provision of surface water is necessary to meet the anticipated demand;
- EBMUD forecasts water shortages during drought periods, based on maintenance of existing Mokelumne River basin supply, or catastrophic events exacerbated by increased flows for senior water right holders, resource protection, and increasing population.

Purposes/Objectives

The project's primary purposes and objectives are to:

- support acquisition of additional SCWA surface water entitlements to promote efficient conjunctive use of groundwater in its Zone 40 area, consistent with the Sacramento Area Water Forum Agreement and County of Sacramento General Plan policies;
- provide facilities through which SCWA can deliver existing and anticipated surface water entitlements to Zone 40 area;
- provide facilities through which EBMUD can take delivery of a supplemental supply of water that would substantially meet its need for water and reduce existing and future customer deficiencies during droughts; and
- improve EBMUD system reliability and operational flexibility during droughts, catastrophic events, and scheduled major maintenance at Pardee Dam or Reservoir.

Planning Processes Background

Both SCWA and EBMUD, in close coordination with the City of Sacramento, have been involved in lengthy planning processes leading up to the identification of the FRWP as a feasible project. Below is a summary of these processes.

East Bay Municipal Utility District

Since signing the original CVP contract with Reclamation in 1970, EBMUD has pursued obtaining water supplies from the American River to supplement its current customer needs. In 1972, the Environmental Defense Fund challenged EBMUD's contract with Reclamation in a lawsuit that was later joined by the County of Sacramento. The lawsuit alleged that delivery of the water from the Folsom South Canal would be an "unreasonable" use of American River water. In June 1988, the California State Water Resources Control Board adopted findings that EBMUD's contract is a reasonable use of American River water. On June 2, 1990, after a lengthy trial, Alameda County Superior Court Judge Richard Hodge affirmed those contractual rights, subject to a specific set of conditions known as the "Hodge Decision."

During this timeframe, EBMUD updated its Water Supply Management Program. The purpose of the 1993 Updated Water Supply Management Program was to provide an adequate water supply at the projected year 2020 level of development, with rationing limited to 25% of normal water demand levels during drought. Nearly 200 alternatives were considered during the preparation of the Updated Water Supply Management Program.

As a result of the Hodge Decision and the Updated Water Supply Management Program, EBMUD proposed the Supplemental Water Supply Project to take delivery of its American River entitlement consistent with the Hodge Decision, in order to decrease existing and future customer deficiencies during droughts and to enhance the reliability of the East Bay's water supply.

The environmental impacts of the Supplemental Water Supply Project were analyzed in the 1997 *East Bay Municipal Utility District—Supplemental Water Supply Project Draft Environmental Impact Report and Environmental Impact Statement* (1997 Draft EIR/EIS). EBMUD and Reclamation received numerous comment letters during the public comment period. A recirculated environmental impact report and environmental impact statement (REIR/EIS) on the Supplemental Water Supply Project was prepared in 2000 and included additional alternatives for evaluation. The selection of additional alternatives for evaluation in the REIR/EIS was based in large part on comments and suggestions made by the City of Sacramento, County of Sacramento, and other Sacramento area interests during the 1997 Draft EIR/EIS public review period and during subsequent discussions following the completion of the public comment period. A strong emphasis was made by the City of Sacramento regarding its reservations on the feasibility of constructing a pipeline through the downtown metropolitan area of Sacramento.

The additional alternatives included an EBMUD–Only Lower American River Delivery (intake upstream of I-5), a Sacramento River Delivery (intake at the City of Sacramento Water Treatment Plant), Freeport East Delivery (intake at the City of Sacramento site with the pipeline running east to the Folsom South

Canal), Freeport South Delivery (intake at the City of Sacramento site with the pipeline running south along I-5 to the Mokelumne Aqueducts), and a Bixler Delivery (located in the Delta just east of the town of Brentwood).

Based in large part on comments received during the public review period for the REIR/EIS, Reclamation and EBMUD developed and adopted an Amendatory Contract that specified three potential water delivery locations. These locations are:

- the Sacramento River approximately 1 mile north of the town of Freeport,
- the lower American River at a location approximately 4 miles upstream of the confluence with the Sacramento River, and
- a diversion from the Folsom South Canal, if neither of the other two sites can feasibly be completed.

Sacramento County Water Agency

The framework for SCWA's planning process lies in its participation in the Sacramento Area Water Forum and the preparation of the updated Zone 40 Water Supply Master Plan.

Sacramento Area Water Forum Agreement

Public agencies in the Sacramento area have been involved in a cooperative effort known as the Sacramento Area Water Forum (Water Forum), designed to explore acceptable project alternatives that could bring additional high-quality water to Sacramento County, the City of Sacramento, and entities in Placer and El Dorado Counties. The common goal is to provide a safe, reliable water supply for the entire region, while preserving fish, wildlife, recreational, and aesthetic values along the lower American River.

The Water Forum is a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments in the Sacramento area. In 1995, these groups were joined by water managers in Placer and El Dorado Counties. The members of the Water Forum developed a Water Forum Proposal for the effective long-term management of the region's water resources. The Water Forum Proposal was analyzed and reviewed in an EIR prepared and certified by the City and County of Sacramento. To signify approval of the proposal, 40 Water Forum members signed the Water Forum Agreement in April 2000.

To achieve the Water Forum goals, all signatories of the Water Forum Agreement are committed to support and, where appropriate, participate in seven elements of the agreement. These elements are:

- increased surface water diversions,
- actions to meet customers' needs while reducing diversion impacts on the lower American River in drier years,
- support for an improved pattern of fish flow releases from Folsom Reservoir,
- lower American River habitat management,
- water conservation,
- groundwater management, and
- participation in Water Forum successor effort.

SCWA participated in the Water Forum process and is a signatory to the Water Forum Agreement. The Water Forum Agreement supports SCWA's pursuit of additional water supplies and includes SCWA's need for increased surface water diversions. SCWA's "Purveyor Specific Agreement" also commits it to certain limitations on its use of water supplies. SCWA agreed to divert surface water at or near the mouth of the American River or from the Sacramento River.

This agreement is consistent with the 1999 P.L. 101-514 (Fazio) Contract issued by Reclamation to SCWA, which allows a Sacramento River diversion location, including one in the vicinity of river mile (RM) 46.5, which is near the city-owned site. The contract also allows diversions at the intake for the Sacramento River Water Treatment Plant owned by the City of Sacramento and at other locations at the discretion of Reclamation.

During the process of finalizing the Fazio Contract, Reclamation petitioned for and received from the State Water Resources Control Board a new Point of Diversion on the Sacramento River in the vicinity of the site owned by the City of Sacramento Department of Utilities adjacent to the Pocket Area neighborhood. The petition process is a public quasi-judicial process that allows for public protest, legal briefs, and settlements.

Zone 40 Master Plan Update

The 2002 Zone 40 Water Supply Master Plan, prepared by the SCWA with the Water Forum Agreement (January 2000) as its foundation, provides a flexible plan of water management alternatives that can be implemented and revised as availability and feasibility of water supply sources change in the future. The Zone 40 Master Plan describes the studies performed and presents the findings, conclusions, and recommendations to meet future water demands in the Zone 40 study area through the year 2030.

The Zone 40 Master Plan presents the results of various studies such as assessment of future water needs, including projected demand, demand management, and availability of supply. The Master Plan also defines and evaluates alternative water management options, including treatment requirements, the supply components and capital facilities, and presents the evaluation and selection of the recommended alternative. Financing methods and an implementation plan, including program management recommendations, are also discussed.

Based on the alternative evaluation process included in the Zone 40 Master Plan, the FRWP is selected as the preferred alternative.

Summary of Water Supply Planning Processes

The City of Sacramento, County of Sacramento, and EBMUD have together studied numerous potential joint and individual project alternatives for obtaining surface water supplies from the lower American and Sacramento Rivers. After exploring all of the technical, institutional, environmental, and regulatory considerations, all three entities have determined that the city-owned property on the Sacramento River near Freeport is the most viable location for a new water intake facility to meet Sacramento County and EBMUD needs. The city has maintained ownership of that property, as well as property to the east across Freeport Boulevard that is currently in use as a park facility, specifically to support a new intake facility, and also a new water treatment plant, on the properties.

In its comment letter on the 2000 REIR/EIS, the City of Sacramento noted,

> The Sacramento River-Freeport alternatives (Alternatives 6 and 7 in that document) avoid the potentially significant construction, pipeline, alignment, and water quality impacts associated with the other alternatives… Accordingly, the Sacramento River-Freeport alternatives are environmentally preferable….

Similarly, the County of Sacramento stated in its comments on 2000 REIR/EIS that, “All factors ….. focus on the Sacramento River at Freeport … as the proper preferred alternative.”

Recent Milestones

In 2000, a document titled *Principles of Agreement between City of Sacramento, County of Sacramento and EBMUD* specified the city-owned site as the diversion location for the joint project that was then under consideration.

In January 2001, the City of Sacramento, County of Sacramento, Reclamation, and EBMUD signed a Memorandum of Agreement stating that the city, county, and EBMUD shall jointly work to construct a diversion structure near the city-owned property approximately 1 mile north of the Town of Freeport. Furthermore, the agreement stated that the project shall be referred to as the Freeport Regional Diversion Project (later modified to read the Freeport Regional Water Project). The agreement was signed by the following parties:

- City of Sacramento—Heather Fargo, Mayor; Robert P. Thomas, City Manager;
- County of Sacramento—Roger Niello, Chairperson; Terry Schutten, County Executive;
- EBMUD—John Coleman, President; Dennis Diemer, General Manager; and
- Reclamation—Lester Snow, Regional Director.

In February 2002, a ceremony was held adjacent to the city-owned site to announce the formation of the Joint Powers Authority (the FRWA) between EBMUD and the SCWA. The City of Sacramento is a supporting member of that agency. The meeting was attended by numerous elected officials from EBMUD, Sacramento County, and the City of Sacramento.

In March 2002, a Notice of Preparation and Notice of Intent for the FRWP EIR/EIS was issued and sent to an extensive mailing list that included public agencies, elected officials, community groups, and many residents in the project areas.

The 2003 FRWP Draft EIR/EIS (2003 Draft EIR/EIS) was published in August 2003. The comment period was originally scheduled to end on October 8 but has been extended until December 15, 2003, to provide additional time for the public to comment and to address those concerns.

Recent Planning Efforts

As a part of preparing the 2003 Draft EIR/EIS, FRWA prepared the *Alternatives Screening Report for the Freeport Regional Water Project* and conducted numerous technical evaluations. The alternatives screening report was intended to reconfirm the conclusions of the water supply planning processes described above and identify a reasonable range of alternatives to include in the 2003 Draft EIR/EIS. The technical evaluations were intended to support the screening process and more clearly define the proposed FRWP.

Alternatives Screening Process

The development of potential project alternatives was based on information regarding EBMUD's and SCWA's existing facilities and capabilities, as well as on the results of extensive planning efforts initiated by each agency (described above) and by the environmental scoping process implemented for the FRWP. Many alternatives have been fully examined by each agency during the past 15 years. Each alternative that was previously described and analyzed and rejected as infeasible because of significant institutional, technical, or environmental issues has been reviewed to determine whether any changes in circumstances warrant a reevaluation of the alternatives.

FRWA's alternative screening analysis was intended to identify a reasonable range of alternatives to include in the draft EIR/EIS. The screening analysis considered various types of project alternatives, ranging from local river diversions, enlarged reservoir storages, new reservoir storages, groundwater use (including banking/exchange), and desalination. Multiple intake sites were represented by various alternatives considered in the alternatives screening analysis, including sites on the lower American River, the Sacramento River, and the Sacramento–San Joaquin Delta. The alternatives considered in the 2003 Draft EIR/EIS include a no-project alternative, four Sacramento River diversion alternatives, and a Sacramento River/Enlarge Pardee Reservoir alternative. The four Sacramento River diversion alternatives involve the diversion of water from the Sacramento River to the Mokelumne Aqueducts. All four of these alternatives include an intake site on the Sacramento River, just upstream from the town of Freeport; each intake site has a different pipeline alignment from the river to the aqueducts. The Sacramento River/Enlarge Pardee Reservoir alternative involves diversion of water from the Sacramento River to Sacramento County and enlargement of the existing Pardee Reservoir. This alternative includes an intake site on the Sacramento River, at the same location as the four Sacramento River diversion alternatives.

Technical Evaluations

As a result of identifying a surface water supply project with a diversion structure near Freeport as a feasible alternative, FRWA conducted several technical evaluations to better define the FRWP in general and, in particular, identify a suitable location for the necessary water intake structure. Results of the first evaluations were included in Technical Memorandum No. 1, dated October 22, 2001 (TM No. 1), which investigated alternative intake sites between the SRCSD WWTP discharge pipeline and the southern edge of the Pocket Area. Considerations in that analysis included:

- proximity to the SRCSD WWTP outfall,
- profile and elevation of river bottom,

- property ownership, and
- accessibility for operation and maintenance vehicles.

With limited detail, the city-owned site was selected for the purpose of the memorandum, which was to determine whether a pier, or in-river, intake structure was better suited and whether a pumping plant should be integral to or separate from the intake. Using the criteria above, it is logical that within the limits of the TM No. 1 study area, the city site is best for the following reasons.

- It is the farthest from the WWTP outfall. This distance minimizes the impact on diverted water quality.
- It is at the outside of a bend in the river, with the deepest part of the channel relatively near shore. Flows are fastest at the outside of bends, minimizing sedimentation and increasing the flow velocity parallel to the fish screens, which makes the fish screens more effective.
- The land is publicly owned, eliminating the need to acquire private property.
- The site is readily accessible from public roadways using public land.

A second memorandum, Technical Memorandum No. I-1 (draft), dated June 25, 2002 (TM I-1), is an update of the October 2001 memorandum. Its preparation was motivated primarily by the City of Sacramento changing its level of project participation from a full-fledged project partner to an interested party with no financial interest in the project. Because the owners of the preferred site (City of Sacramento) were no longer as actively involved, the FRWA agreed to reevaluate alternative intake sites.

The evaluation criteria and study area used in TM I-1 were more extensive than in TM No. 1. TM I-1 investigated potential sites between the SRCSD WWTP outfall and the City of Sacramento's combined sewer overflow (CSO) upstream of the Pocket. The general evaluation criteria included (i.e., were not limited to):

- proximity to SRCSD and CSO outfalls and marinas (e.g., water quality),
- river depth and cross section,
- right-of-way and property acquisition issues,
- site accessibility,
- recreation impacts,
- hydraulics (e.g., movement of river water),
- operation and maintenance issues,
- construction impacts, and
- cost.

Major Considerations

An initial screening of potential sites was performed based primarily on water quality and potential sources of contamination. The potential sources of contamination are documented in Technical Memorandum No. 3, Sacramento River Watershed Sanitary Survey 2000 Update. Three primary items were considered:

- keep the site sufficiently upstream of the SRCSD outfall (Figure 1) to limit shutting down the intake during reverse flow events,
- locate the site sufficiently downstream of the CSO discharge to ensure full mixing of sewer discharges and river water, and
- avoid the potential fuel spills and solid and sanitary waste disposal associated with marinas.

This initial screening greatly reduced the number of possible locations.

On occasion, when river flow is low and tides in the Pacific Ocean are high, water in the Sacramento River in the project vicinity can flow northwards (i.e. backwards, upstream). Should the SRCSD WWTP be discharging at those times (and it typically discharges constantly), the reverse flow in the river could cause treated wastewater to reach the intake. Therefore, the farther upstream from the outfall the intake is located, the better. The reverse flow events are typically of such duration that treated wastewater reaches a limited distance upstream of the outfall. FRWA's technical team set a target criterion of finding a site where treated wastewater would reach the site on no more than 20% of the occasions when reverse flow occurs. Computer modeling revealed that this distance is at least 3,500 feet. Therefore, the 3,500 feet of river closest to the SRCSD outfall was excluded from further analysis.

Locating the intake within any reasonable distance downstream of the WWTP outfall would be a breach of the member agencies' duty to protect the public's health and could be forbidden by regulatory agencies such as the Department of Health Services. The waste discharges carried by reverse flows that FRWA is attempting to avoid are infrequent events, yet are still of great concern. Downstream of the outfall, those waste discharges will be continuous and impossible to avoid.

In addition to the water quality issues posed by the SRCSD WWTP, the City of Sacramento operates a CSO that serves a portion of the City and County of Sacramento. Under most conditions, the combined flow of the sewers is directed to the SRCSD WWTP and is treated (secondary treatment) before discharge to the river. On occasion, however, storm flows are so great that the capacity of the WWTP is exceeded, and the excess flow is diverted to a series of smaller treatment plants, which treat the water to a lesser degree (primary treatment) than the SRCSD WWTP before discharge to the river. On even less frequent

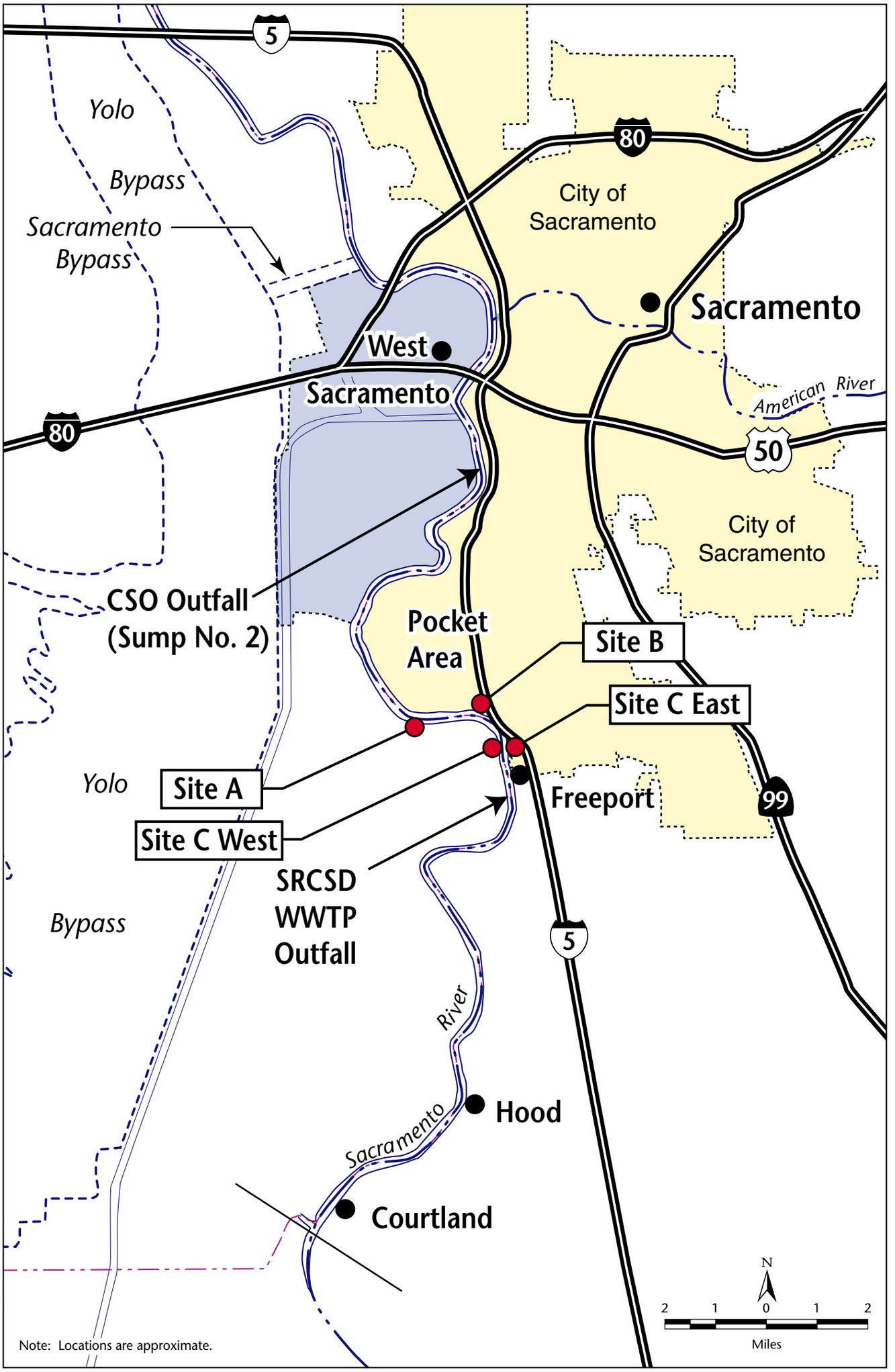

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Figure 1
FRWP Intake Site Limitations

occasions, the capacity of both the WWTP and the primary treatment facilities is exceeded, and raw sewage combined with storm drainage is discharged to the river with no treatment at all. It is these events that are of concern to the FRWA.

The only way to avoid completely the effect of untreated CSO discharges on the intake would be to locate it upstream of any untreated CSO discharge sites, which would require relocating the intake upstream of Sump No. 2, which is west of William Land Park. Locating the intake upstream of Sump No. 2 would add at least 5 miles to the length of the pipeline, running through some of the most densely developed parts of Sacramento. Conservatively, project construction costs would increase by at least $20 million, if a vacant site with sufficient room could be found. The permanent environmental impacts associated with a site this far upstream would be at least as much as the preferred site, but the construction impacts would be much greater. An additional environmental impact would result from the increased electrical power required to pump the water through the longer pipeline required.

As an alternative to placing the intake upstream of any untreated CSO discharge, FRWA tried to find a location where untreated discharges would mix fully with river water before reaching the intake. If untreated discharges could not be completely avoided, the next best thing is to make sure the discharges are as diluted with river water as possible. Computer modeling indicated that approximately 9,000 feet of river length was necessary for full mixing.

It was also a criterion to locate the intake a similar distance below any marinas, which might be the source of fuel spills or other waste discharges. These criteria limited the study reach to approximately 3,500 feet above the SRCSD discharge to approximately 9,000 feet below Sump No. 2. This stretch of river extends from Chicory Bend (RM 54.6) to the northern limits of the developed portion of Freeport (RM 46.7).

The only undeveloped areas on the left bank (looking downstream) within this water quality–constrained reach are the preferred site and a site approximately 3,000 feet downstream of the preferred site, near the northern limits of development in Freeport. Potentially suitable sites with less development exist on the right bank.

After public health and safety were addressed, several engineering criteria were applied to the site selection. The first of these criteria is river geometry. In general, deep water and fast-flowing water are desirable. The pumps must be placed under water, and naturally deep water provides this pump submergence and minimizes environmentally harmful and costly dredging. High-flow velocities across the intake minimize sedimentation accumulation and improve the functioning of the required fish screens. The high velocities help to sweep sediment past the intake. Sediment buildup can interfere with the flow of water to the pumps, causing noisy operation and possibly damage to the pumps. Buildup can also damage the pumps as a result of erosion and create locally

higher velocities of flow through the fish screens. Fish screens protect fish best with even, slow flow through the screens.

Deeper, faster-flowing water is found at the outside of bends. Within the reach defined by water quality constraints, five bends exist: Oak Hall Bend (RM 53.7), Clay Bank Bend (RM 52), Garcia Bend (RM 51), RM 48.8, and Freeport Bend (RM 47.2).

The outside of Oak Hall Bend is on the left bank. Dense development (the Greenhaven area) exists adjacent to the river, and no vacant sites are available. Construction of an intake at that site would require obtaining private property and constructing approximately 4 miles of additional pipeline (approx. $15 million) through a very densely populated area. This bend is the only one on the left bank in the study area, other than the preferred site, and is either inferior or equivalent to the preferred site in every evaluation criterion.

The three bend sites on the right bank all have some similarity with respect to the evaluation criteria: they all have comparable levels of adjacent development, and they all require additional pipeline length and an expensive river crossing. The biggest difference between these sites is the length of pipeline added to the project. Therefore, only the site requiring the least additional pipe (RM 48.8) will be addressed herein, and all the other right-bank bends will be considered to have flaws of relatively greater magnitude.

Site-Specific Considerations

As a result of the major considerations described above, four sites were identified as having the most potential and warranting further consideration. These sites are addressed as sites A, B, C (East Bank), and C (West Bank) in TM I-1 and in the discussion below. Table 1 provides additional summary information.

Site A

The site at RM 48.8 was addressed as Site A in TM I-1 (Figure 2). It is in a good location for river geometry but has a number of flaws, mostly caused by its location on private property and the presence of the county roadway (South River Road) on top of the levee.

FRWA strongly prefers to avoid acquiring privately owned land, and as much of the project as possible will be located on public land. Approximately 5–10 acres of private land would be required for constructing an intake on Site A. In addition, some 1,500 feet of South River Road along the levee would have to be relocated, requiring the acquisition of another 2–2.5 acres of private land. The additional 10,000 feet of pipeline required would also have to be located on private land (approximately 11 acres of permanent easement). All of the land is

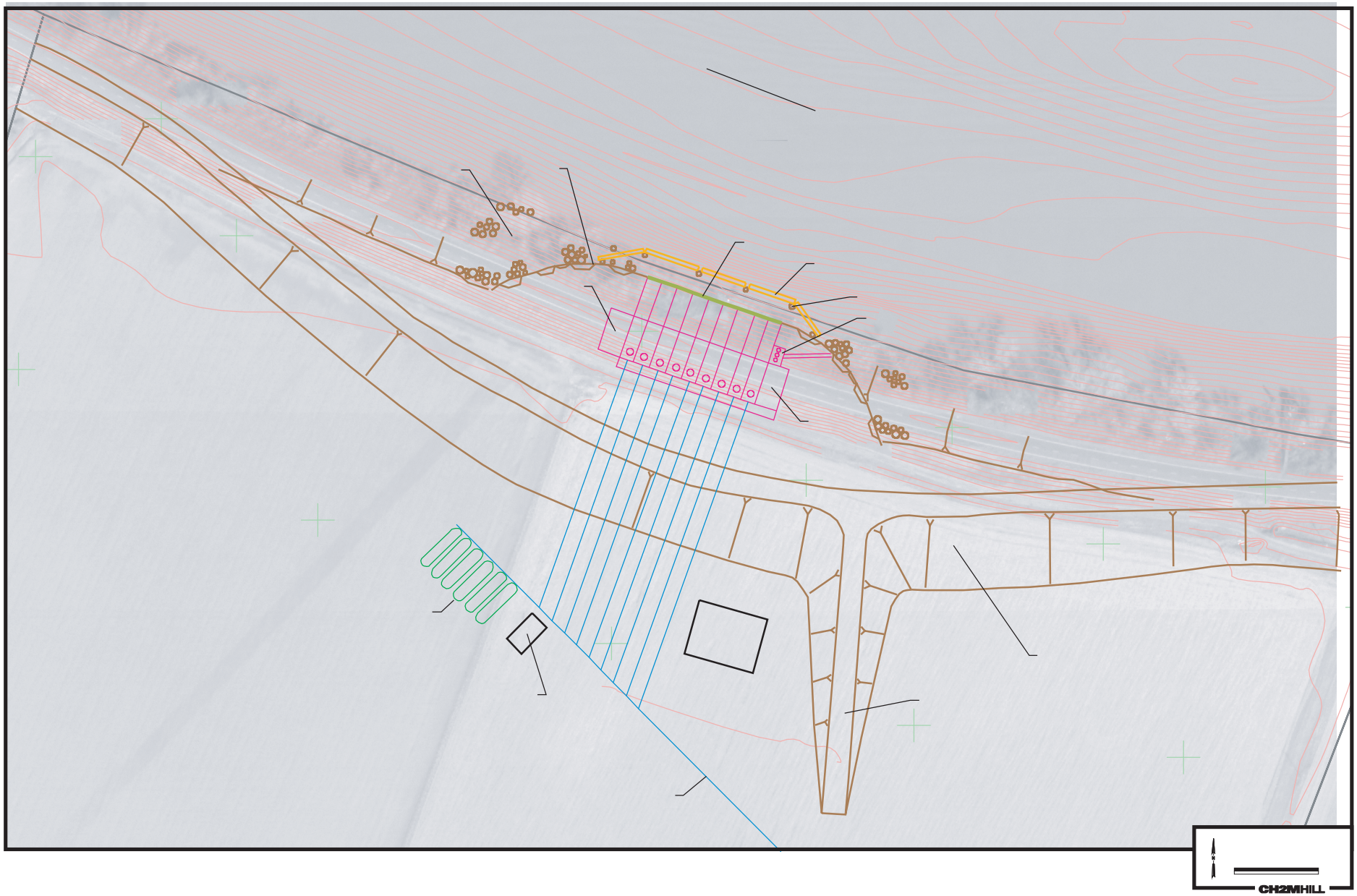

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Figure 2
Site A

currently used for agriculture, which is a rapidly disappearing land use in the Sacramento area.

Constructing the intake on the right bank would create relatively greater visual impacts than the preferred site. The intake would be generally more visible from the Pocket side of the river and visible to many more people. It would be very difficult, if not impossible, to mask the intake with landscaping on the river side.

Site B

Site B is the preferred site and is located at the City of Sacramento site owned by the Department of Utilities. Site B is similar to Site A in that it satisfies most of the criteria for a bank side intake structure, including those regarding water quality and river geometry. Additionally, it has several advantages over Site A. Site B:

- would require a shorter pipeline,
- would not require the pipeline to cross underneath the river,
- would not require realignment of any roadways, and
- is located on public property owned by the City of Sacramento.

Construction of a bank side intake structure at this location could also increase the integrity of the flood control levee, which is an important consideration for the Sacramento region.

Site C (East Bank)

Site C (East Bank) is located on the left bank (east side) of the river, approximately 3,500 feet upstream of the Freeport Bridge and approximately 3,000 feet downstream of the preferred site. It is as close to the WWTP outfall as the FRWA feels is prudent. This section of the river is straight, and preliminary investigations concluded that this location should provide adequate sweeping flows across the facility to reduce potential maintenance dredging at the site. However, further evaluation identified several flaws relative to the preferred site, the most notable of which is that it is not on the outside of a bend. As a result, the high-velocity flows, which are so important for minimizing sediment deposition and aiding in protection of fish, are not present near the bank. The deepest water in this straight stretch of river is near the center of the river. Accessing that deep water would require extensive, environmentally harmful dredging, likely on an ongoing basis.

Because of its proximity to the WWTP, diversions would have to be interrupted as a result of reverse flow events and discharges from the WWTP more

frequently than for any upstream site. Also, the location of a stormwater outfall just upstream of this site would increase impacts to water quality in the event of spills within the urban drainage area. To maintain a safe level of water quality, the stormwater outfall would likely require monitoring or relocation downstream of this site.

Also, the site would require relocation of an extensive portion of the railroad and Highway 160, a well-traveled state highway, and the available options for modifying the levee to accommodate the intake structure are very limited. Private land would have to be acquired for construction of the intake, and relocation of the railroad and highway would also require the acquisition of private land.

While the above information is generally applicable to both a bank side intake and a pier intake, or in-river, structure, some conditions are applicable only to a pier intake structure. The following information is applicable only to the pier intake considered at Site C (East Bank).

A pier intake structure could affect flood control as a result of higher water surface elevations caused by the structure being placed in the river because it is relatively narrow at this location. Additionally, the long-term performance and integrity of the levee could be endangered because of the high potential for scour around the pier, which would potentially further erode/undercut the levee section. (It should be noted that a bank side intake, which is different than a pier intake, can actually strengthen the levee.) Also, physical conditions could result in poor hydraulic performance, and the potential for the design of fish screens to meet resource agency criteria for protected fish species would be problematic. Finally, this section of the river is narrow, and a pier intake structure could result in a hazard to recreation along the river.

Site C (West Bank)

Intake Site C (West Bank) is located on the right bank (west side) of the river, directly across the river from Intake Site C (East Bank). This site was also considered for both a bank side structure and a pier, or in-river, structure. Given the proximity of these two sites, Site C (West Bank) had identical issues to Site C (East Bank), with two exceptions. For Site C (West Bank), levee modifications and widening necessary for locating a structure at this site would require the realignment of South River Road (a well-traveled levee road). The realignment of South River Road would be difficult because of the project's right-of-way needs, limited existing right-of-way, existing high bank, and necessary vertical and horizontal curve changes. The site would also likely result in the permanent relocation of two nearby residences. Private land would have to be acquired for construction of the intake, and relocation of South River Road would also require the acquisition of private land. In addition to these negative factors, Site C (West Bank) would require the pipeline to cross underneath the river, which poses additional environmental risks and construction costs.

Cost Summary

Technical Memorandum I-1 presented preliminary estimated construction costs for selected intake site alternatives. All estimates included the costs necessary to construct intake facilities at the respective sites, including roadway and railroad locations, if required, and include the costs of the discharge pipeline from the intake sites to a common point on the east side of Interstate 5, just east of Site C.

preliminary estimated construction costs for alternative intake sites and intake configurations	
Site A – Pier Type	$84,118,000
Site A – Bank Type	$75,760,000
Site B – Pier-Type	$69,236,000
Site B – Bank Type	$60,230,000
Site C (East Bank) – Bank Type	$66,875,500

Conclusion

In conclusion, Sites C and D were eliminated for numerous reasons. Primarily as a result of their location along a straight stretch of river with shallow shores, their proximity to the regional WWTP, and the need to relocate heavily used roadways and acquire private property.

Site A was eliminated because of its slightly greater environmental impacts, the longer pipeline and river crossing that would be required, and the need to relocate a heavily used roadway and acquire private property.

Site B was selected as the preferred site because of its ability to better meet the identified criteria, ability to minimize impacts on the environment, and location on public property owned by the City of Sacramento (i.e., does not require acquisition of private property).

Table 1. Freeport Regional Water Project: Intake Location Comparison Matrix

Criteria	Site A: Yolo County West Bank Site	Site B: City of Sacramento Utility Yard East Bank Site	Site C: East and West Banks Upstream of Freeport Bridge
Water Quality/Proximity to Storm Water Outflows	Close downstream proximity to stormwater/sewage outfall (Sump 32) and Marina.	Close proximity but upstream of stormwater outfall (Sump 28).	Downstream of stormwater outfall (Sump 28).
Water Quality/Reverse Flow	Least likely to have operational disturbance from reverse flow events (<1% of events with reverse flow).	Possible operational disturbance from reverse flow events. (2% of events with reverse flow)	Most likely to have operational disturbance from reverse flow events (8% of events with reverse flow).
General Location	Outside bend of river, wide river cross-section, sufficient depth.	Outside bend of river, wide river cross-section, sufficient depth.	Straight stretch of river, relatively narrow river cross-section, not optimal.
Sedimentation/Scour	Good site for intake due to sweeping flows on outside bend of river. Stable levee and river section.	Good site for intake due to sweeping flows on outside bend of river. Stable levee and river section.	Sweeping flows not present, resulting in build-up of sediment.
Groundwater Movement	Possible impacts due to pipeline placement.	No anticipated impacts.	No anticipated impacts.
Land Availability/Facility Access	Requires purchase of several parcels of land. Requires removal of existing homes and farmland. Pipeline requires multiple easements. Limited access from freeway.	Site is undeveloped and suited for proposed land use. Temporary and permanent access from Freeport Blvd. Good access from freeway.	Requires purchase of land. Requires removal of residential or commercial structures.
Road Alignment/Traffic Impacts	Greater levee impacts. Requires more than 1,500 ft of levee changes to accommodate road realignment.	Levee inspection road and bike/pedestrian path minor realignment as part of levee modification.	Greater levee impacts. Requires levee changes to accommodate road realignment and railroad realignment.
Proximity to Residents	Individual farmhouses in vicinity may require relocation due to road realignment. Various impacts during construction.	Adjacent to existing housing tract. Various impacts during construction.	Individual houses in vicinity may require relocation due to road realignment. Various impacts during construction.
Noise	Can be mitigated by buildings and associated sound dampening measures.	Can be mitigated by buildings and associated sound dampening measures.	Can be mitigated by buildings and associated sound dampening measures.
Visual Impacts	Intake facility visible. Site layout could allow for substantial visual screening of facilities from neighboring residents.	Intake facility visible. Site layout allows for substantial visual screening of facilities from neighboring residents.	Intake facility visible. Site layout less likely to allow substantial visual screening of facilities from neighboring residents.
Construction Impacts	Many impacts can be mitigated; noise impacts remain significant. Construction up to a year longer due to road and levee realignment work.	Many impacts can be mitigated; noise impacts remain significant.	Many impacts can be mitigated; noise impacts remain significant. Construction up to a year longer due to road and levee realignment work.
Agricultural Production	Impact existing farm production. Permanently removes farmland from service.	None.	None.
River Crossing Risk	River crossing could cause increased flooding hazard, possible subsidence during tunneling and possible voids in ground as result of tunneling.	No river crossing.	River crossing (Site C West only) could cause increased flooding hazard, possible subsidence during tunneling, and possible voids in ground as result of tunneling.
Operations/Maintenance	Potential dredging needs.	Potential dredging needs.	Dredging needs.

City Utility Site Impacts	None.	Site can be utilized without impeding current operations.	None.
Recreation Impacts	Potential hazard to boating/waterskiing.	Potential hazard to boating/waterskiing. Existing bikeway currently ends near the site, but can be routed around the site to maintain access.	Potential hazard to boating/waterskiing.
Institutional Considerations	Subject to permitting and approval by Yolo County; No SWRCB water right at this location; Subject to CVP contract amendment for EBMUD; Subject to CVP contract amendment for SCWA Fazio Contract; Subject to Caltrans and Yolo County road re-alignment approval.	Subject to purchase agreement with City of Sacramento.	1. Subject to Caltrans and City of Sacramento road realignment approval. 2. Subject to State railroad realignment approval.
Cost	$75 million.	$60 million.	$66+ million.