VALUE ENGINEERING STUDY

DEPARTMENT OF WATER RESOURCES

FRANKS TRACT PILOT PROJECT
SACRAMENTO, CA

Final Report

June 2007

Functions Resources

Strategic Value Solutions, Inc.

Final

Value Engineering Study Report

for

Franks Tract Pilot Project

Sacramento, CA

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SECTION 1

EXECUTIVE SUMMARY

SECTION 1
EXECUTIVE SUMMARY

This report presents the results of a Value Study conducted by Strategic Value Solutions, Inc. (SVS) on the plan for the Franks Tract Pilot Project for the Department of Water Resources (DWR). The project was reviewed at the end of the planning phase.

The project plan being reviewed was developed by DWR using in-house staff.

The Value Study included a 5-day (40-hour) value methodology workshop that was conducted with a multidisciplinary team in Sacramento, CA on March 19-23, 2007.

PROJECT DESCRIPTION SUMMARY

This project focuses on alternatives to manage flows within the Central Delta to reduce salinity at the export locations in the Southern Delta by reducing seawater intrusion. As the Delta flows are reduced due to withdrawals during dry and critically dry periods the seawater encroaches further into the Delta during high tide cycles. This high salinity water is drawn to the export pump stations and transfers the salinity to downstream users. This is driving up treatment costs.

The project team narrowed down a number of alternative concepts to four that were presented to the Value Team:

1. Alternative #1 places a bottom-hinged pneumatically operated gate structure in the False River between Franks Tract and the San Joaquin River.

2. Alternative #2 constructs a levee on the east side of Franks Tract adjacent to the historic Old River channel with operable gates on the north and south ends of the levee to allow flushing flows and to accommodate boat passage.

3. Alternative #3 places a bottom-hinged pneumatically operated gate structure in the Holland Cut south of Franks Tract and another such structure in the Old River east of Franks Tract.

4. Alternative #4 places a bottom-hinged pneumatically operated gate structure in the Three Mile Slough between the Sacramento River and the San Joaquin River.

The project is intended to operate as a pilot project to learn about managing tidal flows in the Delta.

The preferred alternative is Alternative #4.

SCOPE OF THE VALUE STUDY

This study is the only Value Study currently planned for this project. The scope of this Value Study encompasses:

- A preferred alternative for the pilot project

- Type of gate for the pilot project
- Construction method for the gate structure
- Operational criteria for the gated facility to improve water quality, benefit fisheries, and keep impacts to a minimum
- Cost-sharing options among state and local water users

Cost minimization is expected to be an important factor for the project. This may be a temporary project, or possibly a permanent project depending on its success or failure.

VALUE STUDY TEAM

The team members that comprised this multidisciplinary Value Study Team are listed on the introductory pages of this report. All other participants of the study are provided in Appendix A.

In general, the Value Study Team members were independent of the DWR in-house planning team. This ensured maximum objectivity towards identifying alternative solutions.

VALUE METHODOLOGY

This Value Study used the international standard Value Methodology established by SAVE International, the Value Society. The Value Methodology (VM) uses a six-phase process executed in a workshop format with a multidisciplinary team. Value is expressed as the relationship between functions and resources where function is measured by the performance requirements of the customer and resources are measured in materials, labor, price, time, etc. required to accomplish that function. VM focuses on improving Value by identifying the most resource efficient way to reliably accomplish a function that meets the performance expectations of the customer.

With this process, the Value Team identifies the essential project functions and alternative ways to achieve those functions, and then selects the best alternatives to develop into workable solutions for value improvements.

Additional information about the Value Study processes used in the generation of the results presented is provided in Section 3 of this report.

Value Study Constraints

Often constraints or limits are imposed on the Value Study to define the boundaries between project aspects that the project stakeholders will consider changing and those that cannot be changed. These constraints may result from a variety of political, technical, schedule, or environmental causes. For this Value Study, no such constraints were placed on the team's ability to identify and pursue creative solutions for value improvements.

PROJECT COST ANALYSIS

The Value Team was provided a construction cost estimate as part of the project documentation. This estimate indicated an anticipated construction cost of $20 million for Alternative #4 in Three Mile Slough and $30 million for Alternative #1 in False River. These costs include a 25% contingency. Since there is no specific construction schedule at this time, escalation was not included.

As a part of this workshop, the team developed individual conceptual construction cost estimates for Three Mile Slough and False River gates. Quantities for each estimate were provided by DWR based on preliminary layout drawings. Quantities were reviewed and found to be generally reflective of the information on the drawings. Construction unit prices were based on current DWR experience. Each alternative utilizes Obermeyer type, bottom-hinged gates. Obermeyer had provided quotations for similar gates. These quotations were adjusted to reflect the height and width of the Three Mile Slough and False River Locations. These conceptual estimates can be utilized in the future by DWR to assess other alternatives.

There were no opportunities to reconcile the discrepancies between the Value Team's estimate and DWR's earlier cost estimate. DWR had stated that its earlier estimates were based on assumed water depths since recent bathymetric information of the project areas was not available.

The review concluded that:

- The estimate for Alternative 1 for the operable barrier in West False River should be increased from $30 million to $52 million.

- The estimate for Alternative 4 to use an operable barrier in Three Mile Slough should be increased from $20 million to $43 million.

The detailed estimates are included in the Cost Data Appendix of this report.

WORKSHOP RESULTS

The purpose of the workshop is to identify and develop alternative concepts that will improve the overall value of the project. In order to be successful at identifying alternatives, it is essential that the Value Team first understand the project objectives and the problems that must be solved. For this reason, the workshop began with presentations by DWR's project management to define the project objectives and to provide background information on the project. This was followed by a more detailed presentation of the project plan by the project development team on how the plan will accomplish the project's objectives. To give the Value Team a better perspective on the project the team participated in a site visit following the presentations.

This Information Phase of the workshop was followed by an in-depth analysis of the functional requirements of the project. A complete understanding of the basic functions that must be accomplished in order to successfully achieve the mission of the project is essential for the team to identify feasible alternatives to the current concept. From this Function Analysis Phase of the workshop the team gained the following understanding about the basic functions of the project.

Using function analysis and Function Analysis System Technique (FAST) diagramming, the team defined the mission of the project as improving water quality at the export locations by reducing salinity levels. While there are multiple sources of salinity into the Delta, the basic function of this project is to reduce salinity by reducing seawater intrusion. The project team then considered two possible ways to functionally accomplish this reduction. For Alternative #1, this function is accomplished by excluding the peak salinity flows from Franks Tract. For Alternative #4 this function is accomplished by increasing the net flow in the San Joaquin River. Analysis of the functions intended to be performed by the project, helped the team focus on the mission of the project and, consequently, how to identify alternative concepts that would still meet the mission while exploring opportunities for value enhancement.

Analyzing the functions of this project gave the team the following key insights:

- Alternatives 2, 3, and 4 all work on reducing saltwater intrusion by increasing the net outflow from the San Joaquin to the ocean
- Alternative 1 reduces saltwater intrusion by excluding the salinity peak in-flow to Franks Tract
- Increasing the net outflow is effective at reducing saltwater intrusion over a wide range of conditions from wet years to dry years but not as effective in critically dry years
- Excluding the peak salinity in-flow to Franks Tract is most effective at reducing saltwater intrusion during dry and critically dry years

With an understanding of the functional requirements, the Value Team transitioned to the Creative Phase of the workshop and brainstormed on all of the possible ways to accomplish each of those functions. The team generated 119 ideas for potential changes to the current plan.

Value Alternatives

Table 1-1, at the end of this section, includes a complete list of all the Value Alternatives developed. This table shows the number and title of each alternative as well as a summary of the construction cost savings compared to the revised cost estimates for the Three Mile Slough barrier and the False River barrier.

It should be noted that Value Studies are working sessions for the purpose of developing and recommending alternative approaches to the current plan. As such, the results presented are of a conceptual nature and are not intended as a final design. Detailed feasibility assessment and final design development of any of the alternatives or suggestions presented herein, should they be accepted, remain the responsibility of DWR.

Some alternatives presented in this report are variations of a common concept and others are alternatives to a specific aspect of the plan. Thus, not necessarily all alternatives in this report can be implemented as selection of some may preclude or limit the use of others.

These potential savings do not reflect any costs for redesign, which must be considered. Moreover, the full benefit and impact of many of the alternatives goes beyond the cost savings to include improved project performance of required functions.

Design Suggestions

In addition to the Value Alternatives, the team also identified 4 design suggestions. These are suggestions for changes or clarifications to the project documents that did not have an identifiable or quantifiable cost impact that could be determined within the scope of the workshop. The design suggestions from this study are included in Section 5 of this report.

Validation of Plan

In the process of identifying recommendations for change, the value team evaluated all aspects of the plan. In general, an absence of recommendations pursuant to certain portions of the project investigated can serve as a validation of the plan for those portions of the project. If a portion of the project is investigated and no recommendation for change results from that investigation, then it can be assumed that the Value Team agrees with the plan as originally presented. Through this process, many of the current plan decisions proved to be appropriate to accomplish the required functions. Some of the more significant decisions that were validated through the scrutiny of the Value Study include:

- The team concurs with the project team's conclusion that an operable barrier in Three Mile Slough is very effective at reducing salinity by increasing the net outflow from the San Joaquin River.

- The team concurs with the project team's conclusion that an operable barrier in False River is very effective at reducing salinity by eliminate the peak salinity in-flow to Franks Tract.

RESOLUTION OF VALUE ALTERNATIVES

The objective of this study was to use the Value Methodology to identify which of the four alternatives presented by DWR should be further evaluated in a feasibility study. In addition, the team was asked to identify any other alternatives that should be considered.

This Value Study helped DWR eliminate Alternative #2 and Alternative #3 from further consideration and converge to two alternative locations for a barrier: Three Mile Slough and West False River.

During the EIR/EIS phase, DWR will evaluate both locations further and select one final location for the barrier. Additionally, DWR will evaluate the full height versus partial height gates, and the use of a rock barrier on the West False River.

The concept to modify the Delta Cross Channel will not be part of the Franks Tract feasibility study. This concept was also presented as an alternative in a Value Study on the Through Delta Facility with the addition of a fish screen across the widened section. This alternative will be given further consideration during the feasibility study on the Through Delta Facility.

CONCLUSIONS

At the conclusion of the study, the Value Team offered the following recommendations:

- Based on the information available to the Value Team, it appears that the most economical solution to reducing saltwater intrusion into the Delta would be to increase the hydraulic capacity of the Delta Cross Channel. There are still many uncertainties that would have to be verified to substantiate our assumptions. For example, this facility is owned and operated by the Bureau of Reclamation so it is uncertain how much this facility could be modified, if at all. Also, no modeling has been performed to demonstrate that increased flow from the DCC would in fact sufficiently increase the net outflow in the San Joaquin River to reduce the salinity levels. Nor is it known whether the receiving streams have adequate capacity to handle the additional flows without inducing or compromising flood conveyance capacity of these streams. However, the potential $80 million savings over the Three Mile Slough option does provide a significant contingency for additional work.

- If the DCC modifications are not a viable option, then a barrier should be constructed in the Three Mile Slough. Based on modeling, this offers the best reduction in salinity intrusion by increasing the net outflow in the San Joaquin River. Increasing net outflow seems to produce the best results in a wide range of conditions from wet years to very dry years. This will provide the desired salinity reduction over the majority of conditions.

- A barrier in the False River between Franks Tract and the San Joaquin River offers the best reduction in salinity during critically dry years by excluding the peak in-flow during high tides. Since the critically dry years only occur a relatively small percentage of the time, it may not be economical to construct and operate a barrier for these relatively infrequent occasions. The Value Team did not have access to the cost for removing salt at the treatment point in the system to be able to evaluate this option on a life cycle cost basis. The Department should use the estimation of how many critically dry years are anticipated over the next fifty years and consider the cost of removing the additional salt if the barrier were not provided. All costs should be based on a net present value. This will provide the data necessary to determine if the barrier in False River is economically feasible. Furthermore, before considering a barrier in False River, additional modeling should be done to compare the effectiveness of an operable barrier in False River with either the DCC modifications in place or Three Mile Slough barrier in place. Both of these solutions will likely reduce the peak salinity in-flow even during critically dry years.

- The barriers should use the bottom-hinged gate with pneumatic actuators. These barrier gates will minimize impact on flood neutral status, minimize visual impact to the public, minimize impact to fisheries, reduce foundation and construction requirements, and are generally lower cost than other potential gate options.

- The Value Team also believes DWR should investigate the use of partial height gates instead of full height gates. We believe that modeling will demonstrate that the partial height gates are just as effective at stopping the salinity in-flow since the saltwater will tend to create a wedge from the channel invert to the surface. Further, the Three Mile Slough barrier functions more to regulate flow through the slough than to stop the flow of salt water. The barrier only has to be high enough to create the required blockage of the flow. There is concern, however, that the submerged gate will cause unsafe surface conditions for boats due to the increased velocity over the top of the submerged gate.

- The construction method should be “in-the-wet” using lift-in foundation sections.

Table 1-1
Summary of Value Alternatives

Alt. No.	Description	Capital Cost Savings	Decision
RS-01	Increase the hydraulic capacity of Delta Cross Channel diversions	$80,092,000	R
RS-10a	Construct and operate full-height barrier in Three Mile Slough	$1,215,000	A
RS-10b	Construct and operate partial-height barrier in Three Mile Slough	$13,215,000	A
RS-34	Close False River with non-operable barrier during low and critical years	($22,193,000)	A
RS-41a	Construct and operate full-height barrier in False River	($2,033,000)	A
RS-41b	Construct and operate partial-height barrier in False River	$15,260,000	A

A = Accepted for further consideration in Feasibility Study R = Rejected

Original Concept Costs:

Three Mile Slough	$42,753,000
False River	$59,215,000
	$101,968,000

SECTION 2

PROJECT DESCRIPTION

SECTION 2
PROJECT DESCRIPTION

Introduction

The Flooded Islands Pre-Feasibility Study Report (EDAW, 2005) identified several project alternatives to alter the Delta hydrodynamics in the vicinity of Franks Tract to reduce salinity intrusion into the central and south Delta during the late summer and fall months. The Franks Tract Pilot Project proposes to design, construct, and operate one of four alternative tidal gate structures and evaluate its performance over a minimum period of three years. The proposed gates will be used to regulate tidal flows in strategic channels near Franks Tract to provide a physical barrier to salt water intrusion, reduce mixing of freshwater and Bay-derived salt water within Franks Tract, and/or hydraulically isolate Franks Tract from the South Delta. The primary objectives of the Pilot Project are to:

a) Confirm water quality benefits predicted by numerical models;

b) Evaluate benefits and impacts to ecosystem, fisheries, and recreation; and

c) Modify project operations to improve benefits and minimize impacts.

The Pilot Project provides opportunities to evaluate potential water quality and ecosystem benefits, test various operational criteria, and assess potentially adverse impacts. Additional ecosystem benefits may also be achieved with the modified tidal operations. The Pilot Project must also satisfy numerous constraints including no increase in flood stage (flood neutral), no decrease in minimum (low-flow) stage levels, no adverse impact to surrounding levees (no increase to scour potential), maximum differential head of 3 feet, and minimal impacts to navigation.

The four Pilot Project alternatives are discussed in detail below and include:

a) Alternative #1: West False River;

b) Alternative #2: East Levee + 2 Gates;

c) Alternative #3: Holland Cut and Old River (Cox); and

d) Alternative #4: Three Mile Slough.

The first three Pilot Project alternatives were evaluated in the Pre-Feasibility Study Report (EDAW, 2005). The fourth alternative, Three Mile Slough, was developed by the Department of Water Resources' (DWR) Bay Delta Office. The Three Mile Slough location is the current preferred alternative. This alternative is projected to provide the greatest water quality benefits (based on preliminary modeling results), lowest estimated construction cost, and least potential impacts.

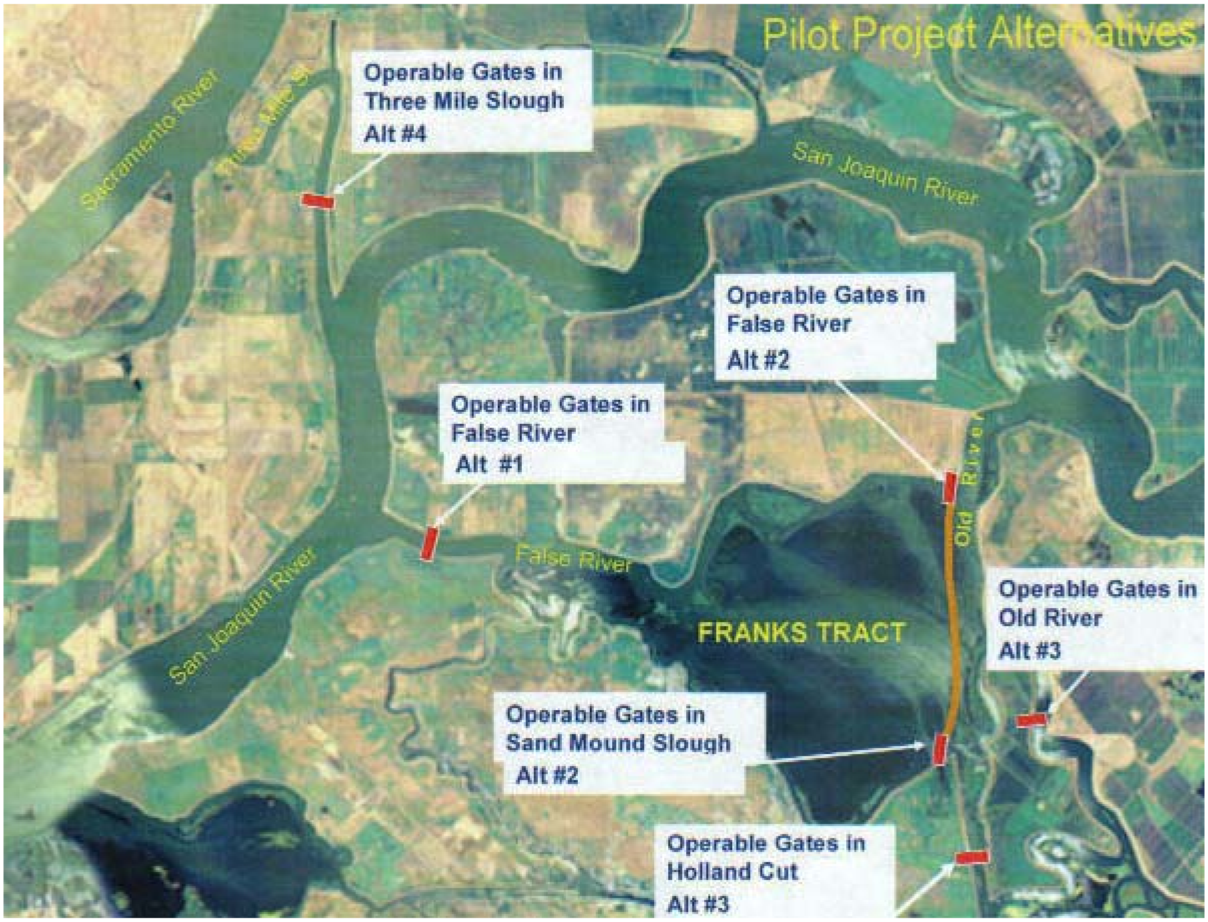

Figure 2-1 - Location Map

Operations and Benefits

For each alternative, the gates would only be operated in the dry portions of the year, typically August through November, when freshwater outflows from the Delta are typically low and saltwater intrusion is high. To date, modeling efforts have focused on changes in hydrodynamics and water quality improvements (primarily salinity reduction), thus the potential impacts to fisheries and local ecosystem are currently being investigated.

Four operating criteria have been developed for the Pilot Project:

a) Salinity Intrusion (gates closed during peak salinity intrusion);
b) Gates 20% open during operating season;
c) Tide Sipping (gates open during flood tide, closed during ebb tide); and
d) Flood operations (gates fully open during non-operating period).

Operating criteria selected for modeling are discussed in the detailed alternative descriptions below.

The numerical model analyses use the finite element method to simulate Delta hydrodynamics and water quality using electrical conductivity (EC) was as a surrogate measure for salinity. The efficacy of each alternative is evaluated by comparing the predicted EC concentrations at various locations in the Delta to the baseline (current) conditions. These modeled locations typically reflect current water quality sampling stations and water supply diversion locations. A summary of EC modeling results for all four alternatives is presented in Table 2-1. Additional modeling is currently in progress to optimize operational criteria for each alternative and may result in predicted water quality benefits greater than the results presented in Table 2-1.

Table 2-1 - Comparison of EC Reduction — September 2002 (Dry Year)

Alternative	SWP	CVP	CCWD (Old River)	CCWD (Rock Slough)	CCWD (Victoria Canal)
West False River	13.3%	10.2%	16.9%	18.9%	2.0%
East Levee + 2 Gates	9.1%	5.4%	16.0%	21.2%	-13.6%
Old River/Holland Cut (Cox)	6.8%	2.4%	15.7%	19.7%	-22.4%
Three Mile Slough	27.5%	22.5%	30.0%	31.1%	18.6%

Potential Impacts
Each of the four alternatives has the potential to create adverse impacts to fisheries, local ecosystem, water quality, and/or recreation. Some impacts such as navigation restrictions, possible increased predation of native fish species, and impediments to migrating fish may be common to all four alternatives, though the magnitude of these impacts varies amongst the alternatives.

Local ecology and water quality may be impacted by the modified circulation patterns in the vicinity of Franks Tract. Changes in channel velocities, residence time with Franks Tract, and other freshwater/salt water mixing mechanisms may hinder or promote the growth of various aquatic species including phytoplankton, invasive submerged (i.e.., Egeria) and floating (i.e., hyacinth) aquatic vegetation, and algae. Potential impacts to fisheries and the local ecosystem are not well-understand and are currently being investigated.

Recreational impacts from the Pilot Project and full-scale operations are generally limited to restriction of boat traffic along channels where the tidal gate structure(s) would be constructed. Bethel and Brannon Islands are home to numerous marinas with boaters that transit the Franks Tract Recreational Area and nearby channels. The proposed tidal gate structures would limit navigation in one or more channels for certain times of the year depending on the selected gate type. Boat locks are proposed for all four alternatives, though the increased transit time through the lock is still considered an impediment to navigation. The proposed locations of the gate structures dictate the magnitude of this navigation impact (i.e., gates constructed in high traffic channels would create a greater impact to navigation than gates located channels with less boat traffic or nearby alternate routes).

Gate Type
Several types of tidal gate systems have been considered for the Pilot Project. Various gate types were evaluated and categorized as navigable or non-navigable. Navigable gates were defined as those that would permit boat passage when the gates were left in the open position for the non-operating period (typically December through July). Boat locks would be required to

allow passage during the operational season (typically August through November). Navigable gates considered for the Pilot Study included wicket gates, bottom-hinged gates, sliding gates, and radial segment gates.

Non-navigable gates were defined as those requiring a boat lock for passage regardless of the operating conditions. These gate types typically included piers and overhead structures that remain in the waterway year round. Non-navigable gates evaluated for the project included radial gates, hinged crest gates, vertical lift gates, roller gates, butterfly gates, flap gates, pendants, and louvers.

The bottom-hinged gate developed by Obermeyer Hydro (Figure 2-2) is currently the preferred navigable gate alternative. This gate system uses an inflatable air bladder system to raise and lower the stainless steel gates. The life expectancy of the rubber bladders is 50 years. Restraining straps allow the gates to accommodate several feet of differential head on either side of the barrier which makes the system well suited for tidal flow conditions. Multiple gate modules can be installed to create flow control barriers of various lengths and allow portions of the gate structure to be raised and lowered independently or simultaneously. The modular system depicted in Figure 2-2 also allows for in-the-wet construction as DWR has planned for the South Delta Improvements Program permanent flow control structures.

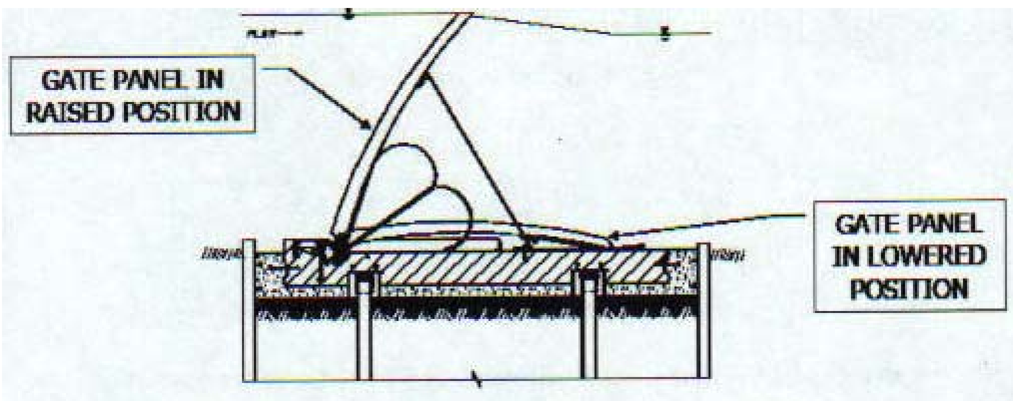

Figure 2-2 - Obermeyer Gate Schematic

Preliminary Construction Costs

Preliminary cost estimates are primarily a function of the control structures length (i.e., number of Obermeyer gates needed). The cost of levee rehabilitation is a significant contributor to the cost of Alternative #2 (East Levee + 2 gates). Limited access and need for improvements to roads, bridges, etc. also factor into the preliminary construction costs summarized in Table 2.

Table 2-2 - Alternative Features and Cost Summary

Alternative	Length of Control Structure	Length of Levee Repair	Est. Construction Cost ($M)
West False River	790 ft	—	$36M
East Levee + 2 Gates	Sand Mound Sl: 500 ft False River: 400 ft	8,682 ft	$65M
Old River/Holland Cut (Cox)	Holland Cut: 550 ft Old River: 600 ft	—	$49M
Three Mile Slough	600 ft	—	$23M

Description of Pilot Project Alternatives

Alternative #1: West False River

This alternative includes constructing a 790-foot long control gate structure on False River near the confluence with the lower San Joaquin River. This alternative would provide a physical barrier to salt intrusion entering Franks Tract via False River.

The West False River alternative would block flow on False River near the western junction with the San Joaquin River. Three operating criteria were modeled for this alternative: a) gates fully closed, b) gates 20% open and c) gates tidally operated. For this alternative, the fully closed operation produces the greatest reduction in salinity at the State Water Project (SWP) pumping plant, though other hydraulic criteria make the tidally operated sequence more favorable. Modeling results for this alternative indicate salinity reductions of 2% to 19% may be achievable throughout the central and south Delta (Table 2-1).

The currently preferred operating criteria for this alternative anticipate closing the gates approximately 12 hours per day. Base condition peak tidal flow in False River is about 50,000 cfs. With False River closed, this flow would be largely be diverted to the San Joaquin River north of Bradford Island and. Webb Tract. A portion of the flow would reenter the western end of Franks Tract along Fisherman's Cut. Tidal flow in Fisherman's Cut would increase from about 2,000 cubic feet per second (cfs) to near 10,000 cfs. Channel velocities would increase from about 0.5 feet per second (fps) to about 2.5 fps. The bulk of the diverted flow would reenter the northeast corner of Frank Tract along the Old River channel connecting Franks Tract to the San Joaquin River. Peak tidal flow would increase from the base condition value near 13,000 cfs to near 40,000 cfs. South of Franks Tract, the gate closure would reduce tidal flow in Old River near Bacon Island approximately 20%. Tidal flow in Middle River near Bacon Island would remain largely unchanged, and tidal flow increases for Turner Cut are predicted, although peak velocity would remain under 1.0 fps.

This option poses navigation impacts to boats traversing False River between the San Joaquin River and Franks Tract. However, because of its location, this alternative may pose the least disruption to navigation. Boaters could avoid delays through the boat locks by using Fisherman's Cut and the San Joaquin River.

Preliminary construction costs are estimated at $36 million, based on the size of the large gate structure (Table 2-2).

Alternative #2: East Levee + 2 Gates
This alternative includes the reconstruction approximately 8,700 feet of the east levee on Frank Tract and control gate structures on the east end of False River and Sand Mound Slough to isolate Franks Tract from Old River. The False River and Sound Mound Slough gate structures would be 400 feet and 500 feet long, respectively. Tidal flow would be permitted into Franks Tract from the west, but blocked on the east end. This alternative would allow salt water mixing within Franks Tract, but provide a physical barrier to reduce salt intrusion into Old River.

Two operational scenarios were modeled: a) gates fully closed and b) gates tidally operated. For this alternative, the fully closed operation produces the greater reduction in salinity at the SWP. Modeling results for this alternative indicate salinity reductions of -14% (i.e., increase) to 21% may be achievable throughout the central and south Delta (Table 2-1).

Franks Tract itself represents significant tidal prism, so less tidal flow would be diverted from False River to the San Joaquin River in order to fill Franks Tract. Still, tidal flow on Fisherman's Cut would increase to about 8,500 cfs from 2,000 cfs, with peak tidal velocities about 1.8 fps. With gates closed, current velocities in the eastern half of Franks Tract are small. Opening the operable gate on the east end of False River would restore some current velocities in the northern portion of Franks Tract. The tidal flow to the southern Delta normally conveyed by Franks Tract would be transferred to the Old River channel connecting the northeast corner of Franks Tract to the San Joaquin River. Peak velocities in this channel would more than double to about 2 fps when the gates are closed. Tidal flows in Old River and Holland Cut immediately south of Franks Tract would be reduced about 25%. Corresponding tidal flow increases are predicted in Middle River to the east. Further south, flows in Old River and Middle River near Bacon Island would approximate the base condition.

Depending on gate operation, this alternative may increase residence time, promote Egeria production, and adversely affect Chinook salmon, Delta smelt, and native fish species during the late fall and early winter. This alternative poses the greatest navigation impacts to boats traversing False River between the San Joaquin River and Franks Tract, as boaters would experience delays passing through the boat locks.

Preliminary construction costs are estimated at $65 million with approximately half the cost attributed to the levee construction (Table 2-2).

Alternative #3: Cox Alternative (Holland Cut & Old River)
This alternative includes a 600-foot long control gate structure on Old River, 550-foot long gate across Holland Cut, and a temporary bridge across Holland Cut. This alternative would partially isolate Franks Tract from the central Delta during flood tides.

Two operational scenarios were modeled: a) gates fully closed and b) gates tidally operated. For this alternative, the fully closed operation produces the greater reduction in salinity at the SWP. Modeling results for this alternative indicate salinity reductions of -22% (i.e., increase) to 20% may be achievable throughout the central and south Delta (Table 2-1).

This alternative largely maintains tidal flow through Franks Tract. However, flow which in the base condition exited out the southeast corner of Franks Tract to the Holland Cut and Old River channels would be redirected out the northeast corner of Franks Tract to the San Joaquin River. Peak tidal flow in this channel would approximately double. Flow formerly conveyed via Old River would be transferred to Middle River. Flow in the Middle River channel north of Mildred Island to the San Joaquin River would nearly double when the gates are closed. The excess flow from Middle River would travel back to Old River south of the barriers mainly through Connection Slough, north of Bacon Island. Peak flows through the Connection Slough channel would nearly double the peak base condition flows. The two east-west channels, north and south of Woodward Island transfer additional flow from the Middle River to Old River. Flow in Victoria Canal would remain relatively unchanged. With the Cox Alternative gates closed, peak flows in Turner Cut would be more than double the base condition values. Of the four alternatives, the Cox Alternative has the greatest modeled effect on south Delta stage. When the export pumps are in operation, average stage for Old River near the Contra Costa Water District (CCWD) intake is lower about 0.15 feet.

This alternative poses navigation impacts to boats traversing the heavily traveled Old River and Holland Cut channels near the lower San Joaquin River and Franks Tract.

Preliminary construction costs for this alternative are estimated at $49 million (Table 2-2).

Alternative #4: Three Mile Slough Alternative
This alternative includes construction of a 600-feet long control gate structure on Three Mile Slough between the Sacramento and San Joaquin Rivers north of Franks Tract. Under this alternative, the gates would be closed during portions of the ebb tide to force more central Delta freshwater down the lower San Joaquin River channel rather than the allowing it to enter the Sacramento River via Three Mile Slough.

Preliminary modeling results for this alternative indicate salinity reductions of 19% to 31% may be achievable throughout the central and south Delta (Table 2-1).

The Three Mile Slough Gate alternative should affect the Delta hydrodynamics the least of the four alternatives. Three Mile Slough connects the two major tidal flow channels in the western Delta, the Sacramento River, and the San Joaquin River. Peak tidal flow for the Sacramento River near Emmaton and the San Joaquin River near Jersey Point are over 120,000 cfs. Blocking ebb flow at Three Miles Slough for a few hours each day has only minor effects on the tidal flows and velocities in the Delta. The Three Mile Slough alternative is designed to divert a few thousand cfs in daily averaged flow from the Sacramento River to the San Joaquin River.

This option poses recreational impacts to boats traversing Three Mile Slough between the Sacramento and San Joaquin Rivers. There is also potential for this facility to be operated during other times of the year as a fish control barrier similar to the temporary rock barrier and proposed permanent barrier at the Head of Old River This is the most-recently developed alternative. Thus, potential benefits, operating criteria, and adverse Impacts are currently being evaluated.

Preliminary construction costs are estimated at $23 million (Table 2-2).

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SECTION 3

VALUE STUDY PROCESS

SECTION 3
VALUE STUDY PROCESS

This section describes the process used to conduct this Value Study and the significant findings of the Value Team. This Value Study used the international standard Value Methodology established by SAVE International, the Value Society. The standard establishes the specific 6-Phase, sequential process, and the objectives of each of those phases, but does not standardize the specific activities in each phase.

Value Methodology (VM) is the general term that describes the structure and process for executing the Value Workshop. This systematic process was used with a multidisciplinary team to improve the value of the project through the analysis of functions and the identification of targets of opportunity for value improvement.

The **VM Job Plan** provides the structure for the activities associated with the Value Study. These activities are further organized into three major stages:

1. Pre-Workshop preparation
2. VM Workshop
3. Post-Workshop documentation and implementation

Figure 3-2 at the end of this section shows a diagram of the VM Job Plan used for this Value Study.

DEFINING VALUE

Within the context of VM, Value is commonly represented by the following relationship:

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

In this expression, functions are measured by the performance requirements of the customer, such as mission objectives, risk reduction, and quality improvements. Resources are measured in materials, labor, price, time, etc. required to accomplish the specific function. VM focuses on improving Value by identifying the most resource efficient way to reliably accomplish a function that meets the performance expectations of the customer.

It can be seen from this relationship that Value is improved or increased by:

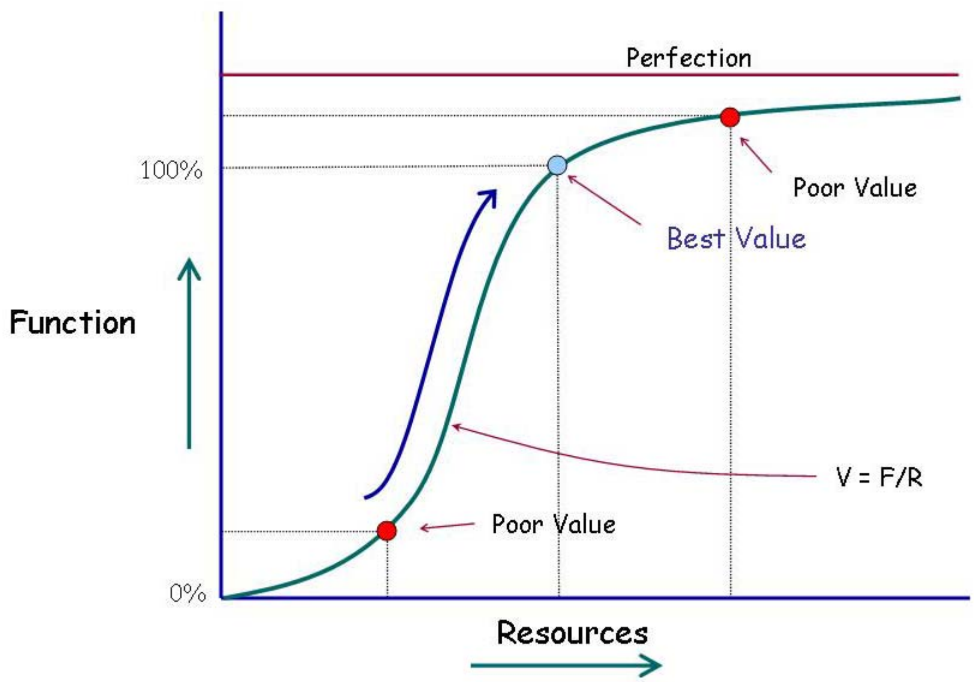
1. Increasing function without increasing resource consumption. Some increase in resources is acceptable as long as there is a greater increase in function performance.
2. Decreasing resources without decreasing function. Again, some decrease in function may be acceptable if the corresponding decrease in resources is significant enough.

Ideally, the Value Team looks for opportunities to increase function and concurrently decrease resource requirements. This will achieve the best value solution.

This Value concept is illustrated in the Figure 3-1, The Value Curve. This figure shows a hypothetical curve from plotting the value expression above. This curve will asymptotically approach perfection. The best value solution for a given project or project element will be found at the knee of the curve. At this point, the required function or functions have been achieved to 100% of the required level with a corresponding minimum resource commitment. To attempt to increase the function performance beyond this level will result in a resource consumption that has a higher worth than the marginal increase in function. This results in a poor value solution. Conversely, a poor value solution can also be the result of not achieving the function to 100% of the requirement. In this case, an incremental increase in resources delivers significant increase in function performance. The Value Methodology is used to identify the poor value decisions in a project and then develop alternative solutions to better align the project along this curve to achieve a best value solution.

Figure 3-1

The Value Curve



This understanding of how Value is affected by changes in function or resources provides the foundation for all SVS Value Studies. The following paragraphs describe the process we used to understand the functional requirements and how we identified value improvement alternatives.

PRE-WORKSHOP

Prior to the start of the workshop, the team was tasked with reviewing the most current documentation on the project development. This was done to familiarize them with the project plan and to prepare them for asking questions of the project stakeholders during the project presentations at the beginning of the workshop. Much of the background information for this study was generated by DWR in-house staff. Other pre-workshop activities included:

- Coordinating workshop logistics and communicating those to the various participants
- Providing guidance to DWR on presentation content for the project introduction
- Scheduling workshop participants and assigning tasks to ensure the team is prepared for the workshop
- Gathering necessary background information on the project and making sure project documentation is distributed to the team members

Materials furnished to the team by DWR are listed in the Appendix.

VM WORKSHOP

The VM workshop was an intensive session during which the project plan was analyzed to optimize the balance between functional requirements and resource commitments (primarily capital and O&M costs).

The VM Job Plan used by SVS includes the execution of the following phases during the workshop:

1. Information Phase
2. Function Analysis Phase
3. Creative Phase
4. Evaluation Phase
5. Development Phase
6. Presentation Phase

Information Phase

At the beginning of the workshop, it was important to understand the background of the project from which the plan was developed. This background was provided in an oral overview by DWR. The overview and subsequent project analysis provided information on the following topics:

- Rationale why this project is necessary
- Project objectives that have governed the proposed plan

- Rationale for the proposed plan configuration
- Explanation of plan features, criteria, and assumptions
- Value Study constraints
- Project cost

The DWR project management presentation provided the team with an overview of the goals, issues, and expectations for the project. DWR and the Value Team also finalized the Value Study constraints. This was followed by DWR's project development team's more detailed presentation on the project plan and an explanation of the rationale behind key plan decisions. Further, this gave the project development team an opportunity to share their issues and concerns about the project from their perspective.

From these presentations, the Value Team noted the following key information:

- Increasing the net out-flow from the San Joaquin has a significant effect on water quality by reducing salinity as measured by the electrical conductivity (EC).
- In dry to critically dry years, a salinity barrier in False River has a significant effect on water quality by excluding the peak salinity flow associated with the high-high tide.
- The water quality analysis really focused on dry and critically dry years and did not analyze relatively normal years of precipitation.
- Electrical conductivity is an acceptable measure for salinity by the downstream water users.

The Value Team has developed construction cost estimates as part of the project documentation. This estimate indicated an anticipated construction cost for Three Mile Slough gate of $37.9 million and False River gate of $52.1 million, based on current prices. Construction duration for Three Mile Slough is 8 Months; False River is 10 Months.

As a part of this workshop, the team reviewed the following items. The review verified the reasonableness of the:

- ☒ estimated quantities
- ☒ estimated unit costs
- ☒ estimated contingencies
- ☒ mark-ups for overhead, profit, bonds, etc.
- ☒ overall project cost

This was done to ensure that the value team had reliable data to use as the basis for cost comparisons of alternatives.

The result of this review of the project cost estimates resulted in a recommended increase of the estimated project costs from $20 million to $43 for Three Mile Slough, and from $30 million to $52 million for False River.

Review of the costs included comparison of unit prices to recently received prices for similar projects and to published unit price indices. Unit prices for unique project elements were compared to prices based on applicable crew compositions and production rates. Vendor quotations were obtained for unique and/or major equipment and compared to those in the project cost estimate. Adjustments were made where appropriate to bring unit prices and quantities into conformance with the current design documents and presentation information provided to the value team.

A complete review all of the estimate's supporting backup data was not attempted due to time limitations and availability of information; however, limited reviews were made of some quantities for the larger cost items within the estimate.

Function Analysis Phase

Function Analysis is the heart of the VM process and is the key activity that differentiates the VM process from other problem solving or improvement practices. During the Function Analysis Phase of the VM Job Plan, functions are identified that describe the expected outcomes of the project under study. Function Analysis also defines how those outcomes are expected to be accomplished by the plan. These functions are described using a two-word, active verb and measurable noun pairing.

This identification and naming convention of project functions enables a more precise understanding by limiting the description of a function to an *active verb* that operates on a *measurable noun* to communicate what work an item or activity performs. This naming convention also helps multidisciplinary teams to build a shared understanding of the functional requirements of the project.

Function Determination

Defining functional requirements for the project allowed DWR to be sure that the facility, as planned, would fulfill the needed purposes. The entire project was analyzed to determine what functions are being accomplished by the current plan. Required functions were retained. Some functions were not necessary to accomplish the mission of the project and thus became candidates for deletion.

During the Function Analysis Phase, the Value Team used various function analysis techniques to analyze the project. This analysis helped the team confirm its understanding of the overall project objectives and analyzed the functions of key project elements. The Value Team Leader led the team through an in-depth discussion of the possible functions of each key project element to clearly and precisely identify the purposes of each.

FAST Diagram

Function analysis was enhanced by using a graphical mapping tool known as the *Function Analysis System Technique* (FAST), which allows team members to understand how the functions of a project relate to each other. The resulting FAST Diagram allowed quick visualization of the logical relationship between project functions and the project as a whole. The FAST diagram is in the Function Analysis section of the Appendix.

The FAST Diagram is structured such that moving to the right of any function answers the question, “How are we accomplishing this function?” Moving to the left of any function answers the question, “Why are we accomplishing this function?” Elements that are vertically connected occur “When” or as a consequence of the function it is connected to on the horizontal path.

The diagram shows on the far left that the ultimate function or the mission that must be accomplished by this project is to insert higher order function. This is accomplished by (Narrate or read the FAST diagram for the reader)

The functions between the two dashed lines, called Scope Lines, represent the functional elements of the project which are within the scope of the Value Study. The first column of functions (basic functions) within the left Scope Line represents the functions that must occur in order for this project to successfully accomplish its mission. The remaining functions (secondary or support functions) represent how the current plan has chosen to accomplish those basic functions.

Function Findings

From the function analysis of this project, the team concluded that:

- Alternatives 2, 3, and 4 all work on reducing saltwater intrusion by increasing the net outflow from the San Joaquin to the ocean
- Alternative 1 reduces saltwater intrusion by excluding the salinity peak in-flow to Franks Tract
- Increasing the net outflow is effective at reducing saltwater intrusion over a wide range of conditions from wet years to dry years but not as effective in critically dry years
- Excluding the peak salinity in-flow to Franks Tract is most effective at reducing saltwater intrusion during dry and critically dry years

In addition to identifying the essential project functions, this phase of the workshop also serves two other objectives:

1. the unification of the individual Value Team members into a synergistic, cohesive team, and
2. the stimulation of creative ideas prior to beginning the subsequent creative phase.

The function analysis worksheets are included in the Appendix.

Creative Phase

This step in the VM process involved generating ideas using creativity techniques. The team recorded all ideas regardless of their feasibility. In order to maximize the Value Team’s creativity, evaluation of the ideas was not allowed during the creative phase. The team’s effort was directed toward a large quantity of ideas. These ideas were later screened in the Evaluation Phase of the workshop.

The creative ideas generated by the team are included in the Appendix. The list also includes ratings for each idea based on the Evaluation Phase of the workshop. These lists should be carefully reviewed, as there may be other good ideas not developed by the team because of time constraints. These should be further evaluated or modified to gain the maximum benefit for the project.

Evaluation Phase

In this phase of the workshop, the team selected the ideas with the most merit for further development.

After an initial vote, the Value Team Leader assessed how many ideas could be developed into Value Alternatives within the remaining duration of the workshop. From this assessment, all ideas with a certain number of votes were selected for development. However, prior to the final selection, all of the ideas were revisited collectively by the Value Team to ensure that those selected by the voting process truly represented the best ideas for development. This gave the team the opportunity to down-rate some ideas and to up-rate other ideas based upon team discussion of the ideas.

The criteria used for selection were:

1. The inherent value, benefit and technical appropriateness of the idea;

2. The expected magnitude of the potential cost savings, both capital and life cycle; and

3. The potential for DWR acceptance of the idea

Ideas were selected for development as Value Alternatives based on all three criteria.

Other ideas were selected for development as design suggestions based primarily on the first and third criteria rather than for cost savings. Some design suggestions may save costs, others may increase costs, and the cost impact of some could not be predicted adequately with information and time available to the team. Not all ideas were developed. This evaluation process is designed to identify those ideas with the greatest potential for value improvement that can be developed into Value Alternatives within the time constraints of the workshop and the production capacity of the team.

The remaining ideas were eliminated from further consideration by the team; however, the ideas not developed should also be reviewed, as there may still be other good ideas not developed by the team because of time constraints or other factors. These could be further evaluated or modified to gain the maximum benefit for the project.

To further ensure the Value Team is focused on developing the best ideas, a mid-point review meeting is conducted with the Value Team Leader and DWR representatives. This mid-point review allowed DWR to identify any fatal flaws in the ideas that were not apparent to the Value Team but were apparent to DWR project team because of their greater institutional knowledge of the project. These fatal flaws may be technical, operational, political, etc.

Development Phase

During the Development Phase of the workshop, each idea was expanded into a workable alternative to the original project concept. Development consisted of preparing a description of the value alternative, evaluating advantages and disadvantages, and making cost comparisons.

Each alternative is presented with a brief narrative to compare the original concept and the alternative concept. Sketches and brief calculations were also developed, if needed, to clarify and support the alternative. The value alternatives developed during the workshop are presented in Section 4 – Value Improvement Alternatives.

The Value Team Leader and, to the extent possible, other team members reviewed each alternative to improve completeness and accuracy.

Redesign costs are not included in the cost comparison of alternatives. DWR will be responsible for determining these costs.

Presentation Phase

The last phase of this workshop was the presentation of the Value Alternatives. The presentation was made by the Value Team on March 23, 2007 to representatives of DWR's project team. The Value Team described each Value Alternative and the rationale that went into the development. This was followed by answering the audience's questions. The acceptability of the Value Alternatives was deferred pending DWR's review of our Preliminary Report.

POST-WORKSHOP

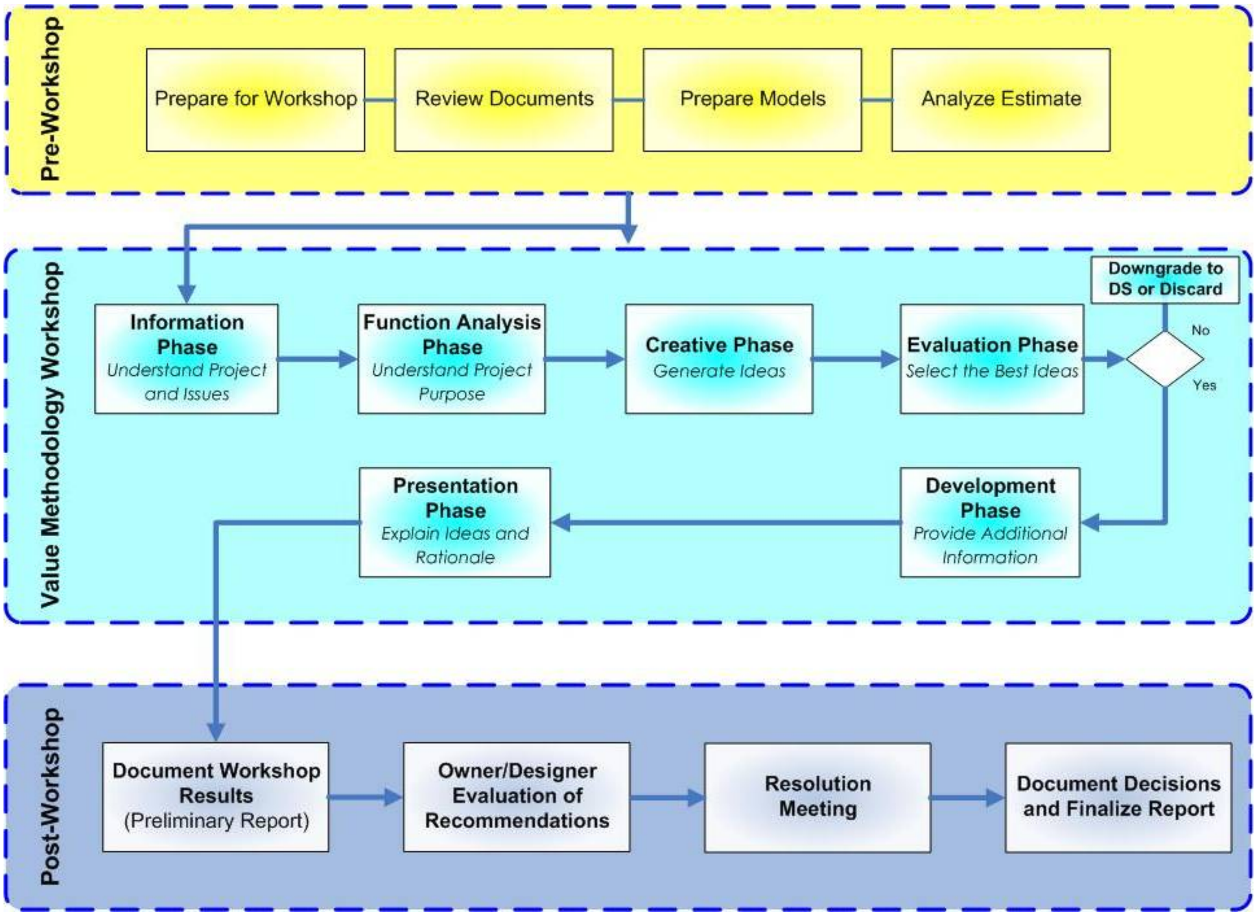
The Post-Workshop activities of this Value Study consisted of preparing the Value Study Reports and coordinating with DWR to help them make decisions regarding the acceptance of the value alternatives.

Shortly after the conclusion of the workshop, our Preliminary Report was submitted to DWR for review. Upon receipt of the report, DWR's project team analyzed each Value Alternative. The project team provided a response to management either recommending incorporation of the Value Alternative into the plan or presenting reasons for rejection.

Upon completion of the review, a meeting was held between DWR's project team and the Value Team Leader for resolution of any outstanding questions and for making decisions regarding the appropriate implementation action for each Value Alternative and Design Suggestion. The results of that meeting are presented in Section 6 – Implementation Decisions.

This Final Value Study Report includes the Value Alternatives developed during the workshop and the subsequent implementation decisions.

FIGURE 3-2
VALUE ENGINEERING PROCESS DIAGRAM



SECTION 4

VALUE IMPROVEMENT ALTERNATIVES

SECTION 4
VALUE IMPROVEMENT ALTERNATIVES

The results of this Value Study represent the value improvement opportunities that can be realized on this project. They are presented as individual alternatives for specific changes to the current plan.

Each alternative includes:

- a summary of the original concept
- a description of the alternative concept
- a brief narrative comparing the original plan and the recommended change
- sketches, where appropriate, to further explain the alternative
- calculations, where appropriate, to support the technical adequacy of the alternative
- a capital cost comparison
- and a life cycle cost analysis, if appropriate

Cost was the primary resource that was compared to the functions being accomplished in the project. To ensure that costs were compatible within the Value Alternatives proposed by the team, the validated cost estimate was used as the basis of cost.

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REDUCE SALTWATER INTRUSION

Value Alternative

Project: Franks Tract Pilot Project
Location: Sacramento-San Joaquin Delta, California

Alternative No: RS-01

Title:
Increase diversion capacity of the Delta Cross Channel (DCC)

Description of Original Concept:

The existing DCC facilities connect the Sacramento River with the central and southern Delta via Snodgrass Slough and the Mokelumne River system (see photo). The diversion facilities, which are owned and operated by the U.S. Bureau of Reclamation (USBR), are capable of diverting up to approximately 9,000 cubic feet per second (cfs) of water from the Sacramento River. The existing DCC radial gates were installed in approximately 1950. It is our understanding that USBR is reluctant to operate the gates on a frequent basis because of their age.

Studies that have been completed to date for the Frank's Track Project assumed that the existing DCC is fully open during the period of late July through early November and closed during the remaining part of the year. These studies indicate that the diverted water results in a significant reduction in salinity at the Delta export facilities located in the southern Delta.

Description of Alternative Concept:

This alternative involves refurbishment of the existing DCC gates and increasing the diversion capacity of the DCC to either increase the amount of water that can be diverted to the south Delta or allow the same amount of water to be diverted on an alternative diversion schedule. It is assumed that additional salinity reductions at the Delta export facilities could be realized by these improvements.

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Construction Cost Summary

Original Concept:	$ 101,968,000
Alternative Concept:	$ 21,876,000
Cost Savings:	$ 80,092,000

Advantages/Disadvantages

Alternative No.: RS-01

Advantages of Alternative Concept

- Refurbishment of the existing DCC gates will add reliability of diversions toward the Delta export facilities
- Increasing the diversion capacity of the DCC will add flexibility to the facility operation schedule by allowing more water diversion to the south, or allowing periodic closure of the gates during the diversion months, while not reducing the total amount of diverted water
- The ability to periodically close the diversion may be used during some periods to reduce entrainment of fish; closure of the DCC gates can be operated on real-time monitoring of fish movements
- The alternative improvements do not impact boat traffic in the area and, therefore, do not require mitigation

Disadvantages of Alternative Concept

- The extent of downstream channel improvements required to accommodate the increased DCC diversions are not known and may incur additional costs
- This alternative may result in frequent and rapid changes in downstream water surface elevations that may be detrimental to both the downstream channels and water users
- The increased diversions may encourage additional withdrawals by downstream users

Discussion

Alternative No.: RS-01

A diversion capacity increase of 1,000 to 3,000 cfs at the DCC may be appropriate, but this increase requires confirmation with additional model studies. Increasing diversions at the DCC would result in some decrease in flows to the south, via Georgiana Slough, but that net increase in southward flow could be realized.

Increasing the diversion capacity of the DCC will involve adding one or more gates adjacent to the existing structure. It might also involve lowering the sill of the existing gate structure, increasing the discharge efficiency of the existing sill, widening the channel between the Sacramento River and the Snodgrass Slough and/or other downstream channels, or a combination of these improvements. The assumption is that the existing radial gates can be refurbished and reused. The new gates would also be radial gates, however, alternative types of gates, which may be more efficient, should be considered. A conceptual sketch of an enlarged DCC facility is included within this recommendation.

With the exception of required channel widening or deepening, improvements for this alternative can be constructed primarily in the dry. It is assumed that there are existing stop log facilities that can be used to isolate the existing radial gates.

Operation of the DCC under this alternative should be developed based on hydraulic model studies. Impacts on salinity levels at the Delta export facilities should be determined, assuming the enlarged DCC is fully open during the same late July through early November period that was used in the previous studies. Alternative operations should also be modeled that closes the DCC during some portion(s) of the tide cycle, such that a pulse of water is sent down the Sacramento River and arrives at Three Mile Slough when:

a. flow in the Three Mile Slough is from the Sacramento River to the San Joaquin River and the pulse of water increases this flow, and/or

b. flow in the Three Mile Slough is from the San Joaquin River to the Sacramento River and the pulse of water increases the Sacramento River water surface elevation and decreases this flow.

These operations would tend to flush salt water in the lower Sacramento and San Joaquin Rivers downstream toward the San Francisco Bay or reduce upstream flows in the San Joaquin River and reduce upstream movement of salt water in the lower portion of the river. The increased DCC diversion capacity will allow the same amount of fresh water to be diverted toward the south, with part-time closure, to allow pulses of water to be sent to the Three Mile Slough when it would be most beneficial.

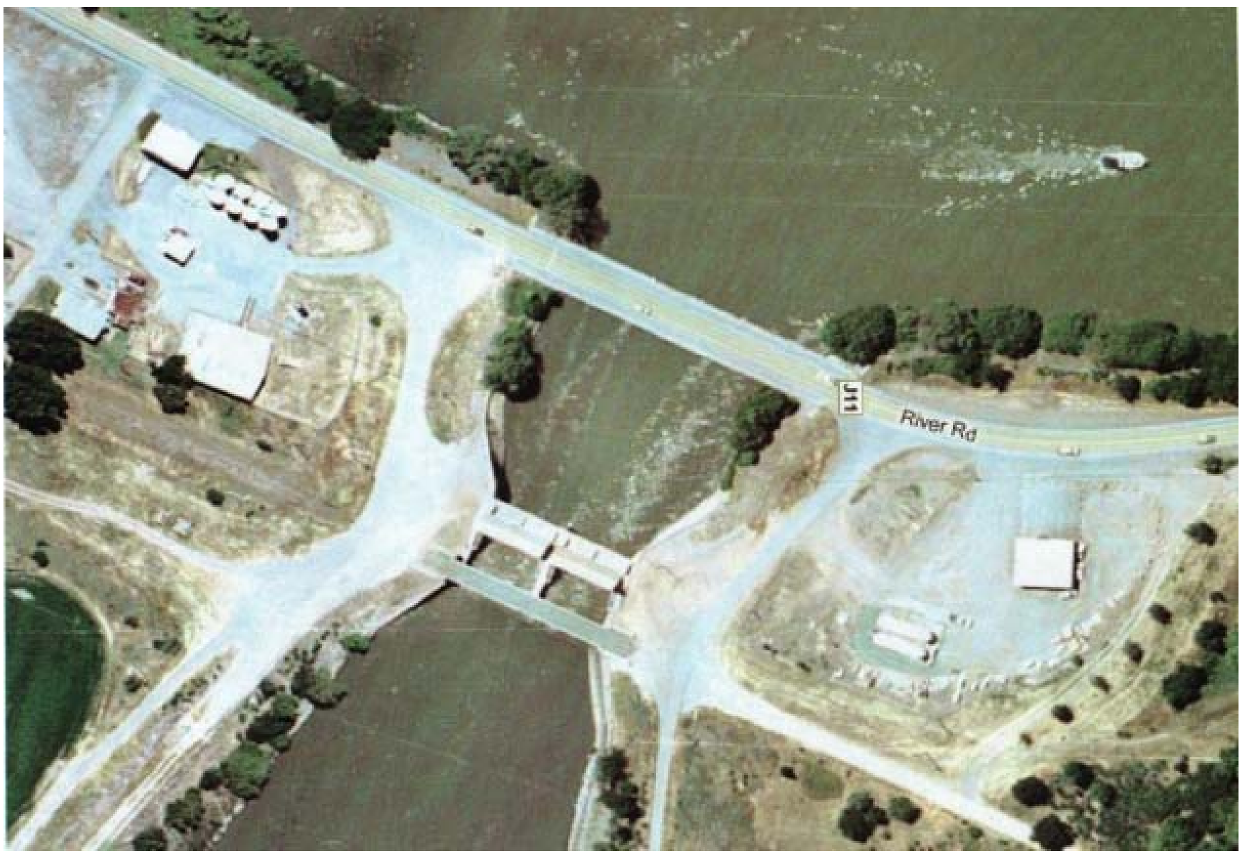
This alternative can be used in conjunction with other Frank’s Track Project barrier options. The pulsing of water down Sacramento River may be particularly beneficial when used in conjunction with the Three Mile Slough barrier (Alternative 4).

There may be a reasonable likelihood that the costs associated with refurbishment and enlargement of the DCC can be shared with the USBR and other beneficiaries of the project. The USBR recognizes that the existing facilities are nearing the end of their useful life and that refurbishment will be necessary, whether or not a Frank’s Track Project is constructed.

Sketch

Alternative No.: RS-01

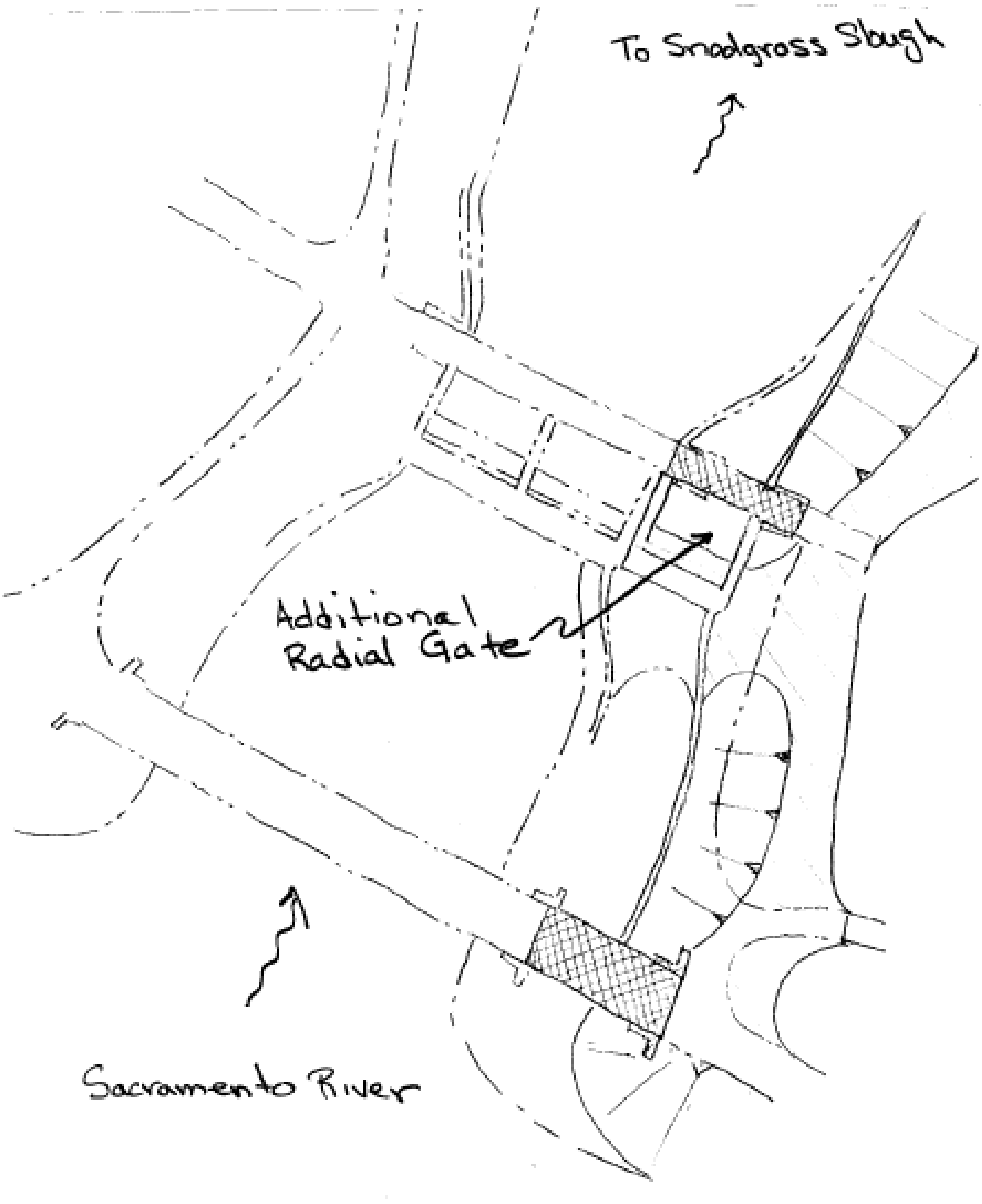
☒ Original ☐ Alternative



Sketch

Alternative No.: RS-01

☐ Original ☒ Alternative



Construction Cost Estimate

Alternative No.: RS-01

Construction Cost	Quantity	Unit	Unit Price	Total
Mobilization, General Conditions				$1,000,000
River Road Bridge Work				
Allowance For Traffic Staging and Control	1	ls	$100,000	$100,000
Mob/De-mob Pile Rig	1	ls	$35,000	$35,000
Temporary Support South End River Road Bridge	1	ls	$150,000	$150,000
Demolish Bridge Abutment	1	ls	$42,000	$42,000
Temporary Sheet Piling, Pier	8000	sf	$40	$320,000
Dewater, Pier	1	ls	$1,000	$1,000
Excavation, Pier	120	cy	$30	$3,600
H pile. Pier	320	lf	$55	$17,600
Bridge Pier Concrete	270	cy	$1,200	$324,000
H pile, Abutment	320	lf	$55	$17,600
Install New Bridge Abutment Concrete	405	cy	$1,300	$526,500
Install New Bridge Structure Concrete	550	cy	$1,700	$935,000
Bridge Rail	280	lf	$80	$22,400
West End Base/Paving	5,625	sy	$25	$140,625
Allowance For Traffic Staging and Control	1	ls	$10,000	$10,000
Allowance For Existing Utility Issues	1	ls	$100,000	$100,000
Gate work				
Temporary Sheet Piling, Gate Structure	24,000		$40	$960,000
Dewater	1	ls	$15,000	$15,000
Demolish Wing Wall	1	ls	$42,000	$42,000
Excavation, Entire Gate Area	120,000	cy	$15	$1,800,000
H Pile	2,880	lf	$55	$158,400
Gate Structure	2,600	cy	$1,300	$3,380,000
H pile	320	lf	$55	$17,600
Install New Bridge Abutment	350	cy	$1,300	$455,000
Install New Bridge Structure	250	cy	$1,700	$425,000
Bridge Rail	240	lf	$80	$19,200
West End Paving	500	sy	$25	$12,500
Allowance For Traffic Staging and Control	1	ls	$10,000	$10,000
Radial Gate, Including Mechanism, Controls	2,700	sf	$1,000	$2,700,000
Temporary Sheet Piling, walls	23,000	sf	$40	$920,000
Install Downstream Training Wall	600	cy	$1,300	$780,000
Install Upstream & Downstream Walls	1,100	cy	$1,300	$1,430,000
Rock Slope Protection, South Bank	17,000	ton	$80	$1,360,000

Subtotal				**$18,230,025**

Construction Cost Estimate

Alternative No.: RS-01

Contingency			20%	$3,646,005
Total				**$21,876,030**
Refurbish other 2 gates	**1**	**Allo w**	**1,000,000**	**$1,000,000**

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Value Alternative

Project: Franks Tract Pilot Project
Location: Sacramento-San Joaquin Delta, California

Alternative No:
RS-10a

Title:
Construct and operate barrier in Three Mile Slough with no freeboard on gates

Description of Original Concept:

The Original Concept uses an operable bottom-hinged Obermeyer gate. The gate is a 540-foot long gated structure with a top of sill elevation of -23 feet and a gate height of approximately 30 feet.

The planned operation is to close the gates during portions of the ebb tide to force more central Delta freshwater down the lower San Joaquin River channel rather than allowing it to enter the Sacramento River via Three Mile Slough. The result is a reduction in salinity from 19 percent to 31 percent in the central and south Delta, as modeled for 1992.

Description of Alternative Concept:

The Alternative Concept also uses an operable bottom-hinged Obermeyer gate. The gate would remain as a 540-foot long gated structure with a top of sill elevation of -23 feet. Reduced freeboard (shorter gate leaf) would result in a gate height of approximately 28 feet and a slightly narrower sill width. The selected location should be as close as possible to the San Joaquin River.

Planned operation is to close the gates during portions of the ebb tide to force more central Delta freshwater down the lower San Joaquin Rive channel, rather than allowing it to enter the Sacramento River via Three Mile Slough. Additionally, this alternative will investigate operation of the gates for two hours each ebb tide.

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

Original Concept:	$ 42,753,000
Alternative Concept:	$ 41,538,000
Cost Savings:	$ 1,215,000

Advantages/Disadvantages

Alternative No.: RS-10a

Advantages of Alternative Concept

- The concept is flood neutral
- The bottom-hinged gate can be operated on a daily basis on the ebb tides
- The in-the-wet construction allows the gates to be fabricated, delivered, and preinstalled on the sills prior to being transported to the site; the site can be dredged and the sheet piles and H-piles can be installed during this time
- The proposed site may be able to be located with DWR property on both banks, which should reduce the time for property acquisition
- If the location selected is close to the confluence of the San Joaquin, the upstream levees that are affected by the longer rise in higher water elevation will be kept to a minimum, which may result in reduced seepage through the levees
- Bottom-hinged gates without freeboard results in shortening of the leaf (by 1.25 feet) and a slightly narrower sill width; this minor change positively affects the excavation width
- Operating the gates for a shorter period (~two hours) on each tidal cycle rather than for a longer period (~four hours) on just one tidal cycle may reduce fish passage delay times and further reduce the risk of predation; however, evaluation with model studies and by fishery personnel is necessary
- If the gate operation is performed only during nighttime tides, the need for lock facilities for boat passage may be eliminated. The DWR must inform boaters of the Three Mile Slough blockage during each nighttime ebb tide. Barges could transit over the bottom-hinged gates when the gate is in the down position.
- Fish traveling down the Sacramento River to the ocean on the nighttime ebb tide will be prevented from entering the Three Mile Slough, which reduces the risk of delay or becoming lost in the Delta

Disadvantages of Alternative Concept

- Operating a bottom-hinged gate in the Three Mile Slough for a four-hour once daily period or a two-hour twice daily period will increase the amount of time that the upstream levees are subjected to higher water elevations, increasing seepage through the levees and thus increasing the adjacent farms' pumping costs
- Boaters cannot cross the gate location when the gate is in the open position; however, this could be mitigated if the gate is only operated during nighttime ebb tides
- Provides limited salinity benefit for "critical" years

Discussion

Alternative No.: RS-10a

Gate Operation
Bottom-hinged Obermeyer gates along the Three Mile Slough would be operated at nighttime ebb tides for approximately four hours or at both daytime and nighttime ebb tides for approximately two hours on each tide. DWR should investigate whether this operation will provide the same water quality and, since the fish will be delayed for about two hours twice daily rather than for four hours once daily, if predation may be reduced.

Location
The proposed barrier at Three Mile Slough is located in one of the most challenging areas of the Delta, where soft organic soils can extend as far as 40 to 50 feet below original ground. Extensive geologic exploration was performed along the crest and landside toe of Sherman and Twitchell Islands, and to a lesser extent, Brannan Island.

The DWR owns approximately 90 percent of Sherman Island and 85 percent of Twitchell Island. Brannan Island State Recreation Park is located on the south end of Brannan Island.

Two boating areas are located along Three Mile Slough. Brannan Island State Recreation Area includes a boat ramp and docking area. The Outrigger marina is located on Sherman Island just east of Brannan Island State Recreation Area. A third boating area is located on Sherman Island, along the San Joaquin River (just south of the confluence of the San Joaquin River and False River).

Construction
Construct the gates in-the-wet with a lift-in technique using either catamarans made of Flexi-floats or barge-mounted cranes. The estimate contained herein uses barge-mounted cranes capable of lifting in the sills with the gates attached. If the DWR owns a catamaran barge, purchased for the Permanent Barrier Project, then this equipment may be used to install the gates.

Fish Strategy
A Three Mile Slough barrier, when closed, will block fish passage through the slough when traveling to the ocean. This is positive; as it could shorten the time it takes out-migrants to reach the ocean.

For fish traveling from the San Joaquin to the Sacramento River, the gate will be open for all flood tides and the fish will be unimpeded during this time. Predation on delayed fishes may be reduced if the gates operate for fewer hours at both the daytime and nighttime ebb tides.

Boat/Recreation Strategy
Several marinas exist on, or adjacent to, the Three Mile Slough and boaters will be somewhat impacted by the location of a gate. This impact could be minimized if the gate closure is limited to four hours during nighttime ebb tides and, even more so, if the closure is two hours for both the daytime and nighttime ebb tides. DWR should investigate this affect to boaters if the shorter daytime and nighttime gate openings are incorporated into the gate operation.

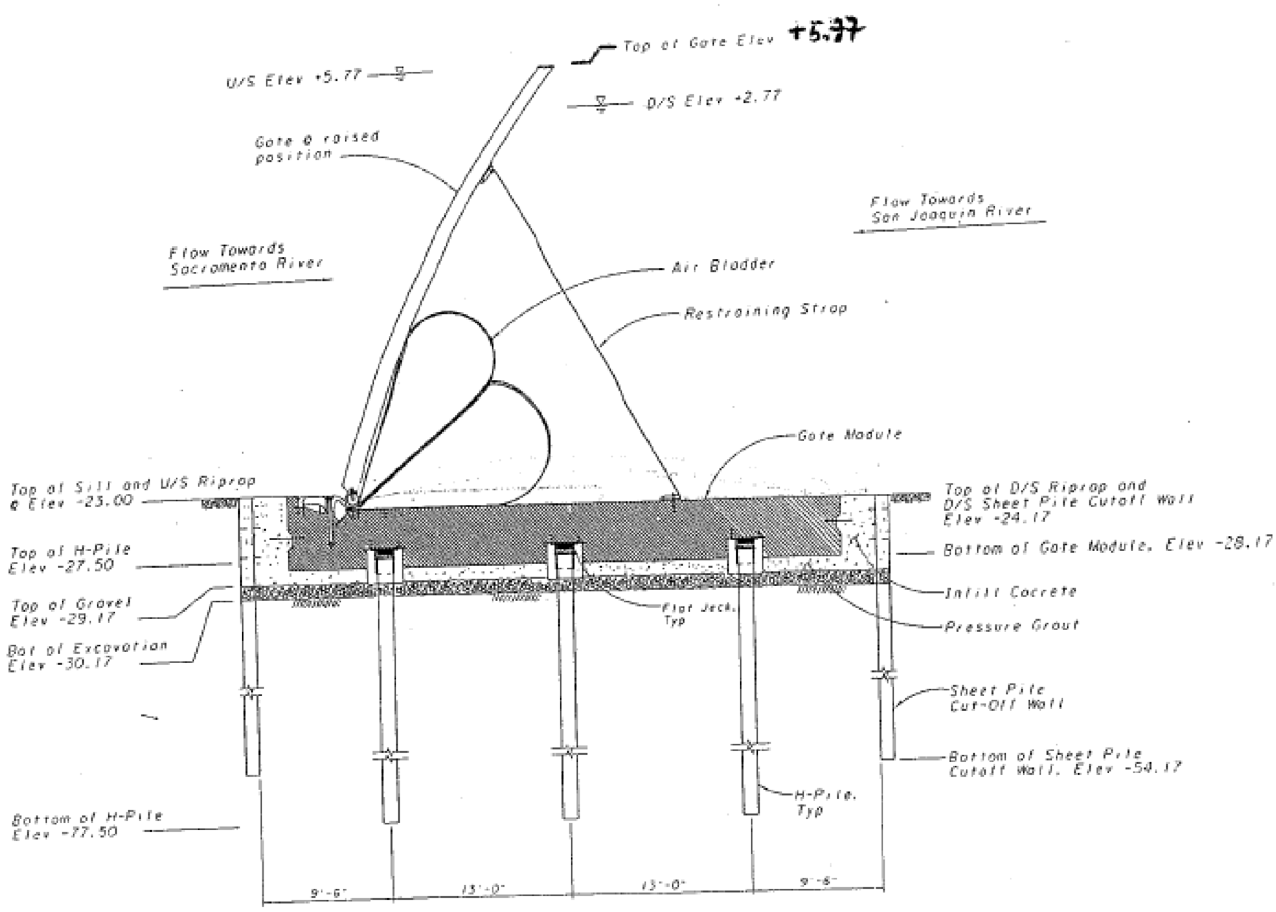
Sketch

Alternative No.: RS-10a

☒ Original ☐ Alternative

Alternative No.: RS-10a

☐ Original ☒ Alternative



TRANSVERSE SECTION

Scale: 1/4" = 1'

Construction Cost Estimate

Alternative No.: RS-10a

Construction Cost	Quantity	Unit	Unit Price	Total		
Gate Fixed Costs						
Mobilization				500,000		
Contractor General Conditions				1,500,000		
Demonstration Test	1	ls	190,000	190,000		Needed or not?
Subtotal Gate Fixed Cost				**2,190,000**		
Construct 540' x 30' gate						
Underwater Excavation	58,800	cy	30	1,764,000		From Quantity Table
Screeding	1	lot	142,120	142,120		
Underbase Gravel	1,440	ton	50	72,000		From Quantity Table Or Modified, 900 cy based on drawing
Underbase Gravel Cleaning	1	lot	27,720	27,720		
Steel Sheet Piles	65,940	lf	73	4,813,620		From Quantity Table
Driven H Piles	6,750	lf	180	1,215,000		From Quantity Table
Infill concrete	600	cy	703	421,800		From Quantity Table, modified
Pressure Grout	880	cy	644	566,720		From Quantity Table
Precast Concrete	3,200	cy	710	2,272,000		From Quantity Table
Rebar, Precast	480,000	#	1.50	720,000		
Furnish and Deliver Gate ,Rio Vista	15,120	sf	900	13,608,000		Obermeyer Quote Factored $900/sf tall gate, $800/sf for short gate
Assemble Gate to Precast	115	Day	2,500	287,500		Allow 5 days /gate for small crew with hydro crane
Load Precast and Gates	23	hr	1,000	23,000		2 cranes and misc support at Rio Vista, 1 module/gate assy/hr
Transport Modules, Gates	25	day	7,000	175,000		2 deck barges, 1 tug for the duration

Construction Cost Estimate

Alternative No.: RS-10a

Installation Spread	25	day	28,000	700,000		2 cranes, 2 deck barges, Crane and Barge Crews, Small Tug, 23 precast Modules, allow one per day, plus move in and out
Subtotal Gate				**26,808,480**		
		540' wide gate =		**49,645**	/lf	
		16,200 sf gate =		**1,655**	/sf	
Support Structures Fixed Cost						
Control House & Misc						
Dewatering	1	lot	100,000	100,000		Allowance
Clear & Grub	2.1	ac	4,400	9,240		From Quantity Table
General Excavation	10,900	cy	20	218,000		From Quantity Table
Riprap	15,011	ton	35	525,392		From Quantity Table
Geotechnical Fabric	22,800	sy	4	79,800		
Communication Tower	1	ea	17,300	17,300		From Quantity Table
LPG Tank/Distribution System	1	lot	17,000	17,000		
Compacted Backfill	2,700	cy	8	21,600		
Chain Link Fence	131	lf	60	7,860		
Chain Link Gate	3	lot	4,300	12,900		
Metal Beam Guard Rail	32	lf	40	1,280		
Driven Pipe Piles	400	lf	135	54,000		From Quantity Table
Concrete	150	cy	600	90,000		From Quantity Table
Reinforcing Steel	22,650	#	2	33,975		From Quantity Table
Structural Steel Framing	33,000	#	3	99,000		
Concrete Masonry Unit	360	sf	15	5,400		From Quantity Table
Metal Deck, 1.5"	900	sy	30	27,000		
Miscellaneous Metal	21,300	#	3	63,900		
Railing/Handrail	5,300	#	4	18,550		
Building Joint Filler / Water Stop	1	lot	5,600	5,600		
Buoys	28	ea	300	8,400		
Job Sign	1	lot	3,000	3,000		
Sheet Water Proofing	1	lot	5,300	5,300		

Construction Cost Estimate

Alternative No.: RS-10a

Building Insulation	1	lot	6,700	6,700		
Metal Roofing	1,100	sf	8	8,800		
Metal Siding	1	lot	1,420	1,420		
Flashing & Trim	1	lot	14,700	14,700		
Roof Accessories	1	lot	4,800	4,800		
Metal Doors & frames	1	lot	2,000	2,000		
Door Hardware	1	lot	600	600		
Aluminum Windows	1	lot	2,200	2,200		
Resilient Tile Flooring	1	lot	800	800		
Gypsum Board & accessories	930	sf	2.4	2,232		
Architectural Painting	1	lot	22,000	22,000		
Coatings	1	lot	44,000	44,000		
Louvers and Vents	1	lot	1,400	1,400		
Lightning Protection System	1	lot	145,000	145,000		
Flow Meters	1	lot	50,000	50,000		
PLC	1	lot	25,000	25,000		
Fire Alarm System	1	lot	6,700	6,700		
Piping	3,600	lf	27	97,200		
Butterfly Valve	4	ea	570	2,280		
Ball Valve	45	ea	1,650	74,250		
Air Compressor, Receiver	with Gate					
Sump Pump	1	lot	3,600	3,600		
Heat Pump	1	lot	8,100	8,100		
Ducts	1	lot	1,700	1,700		
Exhaust Fans	1	lot	25,000	25,000		
Job Electrical	1	lot	250,000	250,000		
Emergency Generator	1	lot	20,000	20,000		
Distribution Transformer	1	lot	16,000	16,000		
Lighting	1	lot	25,000	25,000		
Communication System	1	lot	50,000	50,000		
Boom Floats	1,290	lf	1,470	1,896,300		2 rows x 600'
Subtotal Other Fixed Cost				**4,232,279**		
Subtotal				**33,230,759**		
Contingency			25%	8,307,690		
Total Estimated Cost				**41,538,449**		

*Source: Grant Line Fabian Canal unless otherwise stated

Value Alternative

Project: Franks Tract Pilot Project
Location: Sacramento-San Joaquin Delta, California

Alternative No:
RS-10b

Title:
Operate barrier in Three Mile Slough using a partial-height structure with optimized operations

Description of Original Concept:

The Original Concept uses an operable bottom-hinged Obermeyer gate. The gate is a 540-foot long gated structure with a top of sill elevation of -23 feet and a gate height of approximately 30 feet.

The planned operation is to close the gates during portions of the ebb tide to force more central Delta freshwater down the lower San Joaquin River channel rather than allowing it to enter the Sacramento River via Three Mile Slough. The result is a reduction in salinity from 19 percent to 31 percent in the central and south Delta, as modeled for 1992.

Description of Alternative Concept:

The Alternative Concept uses an operable bottom hinged partial-height Obermeyer gate. The gate would be a 540-foot long gated structure and the top of sill elevation would remain at -23 feet. The partial-height gate results in a gate height of 18 feet, a narrower sill width, and fewer piles. The selected location should be as close as possible to the San Joaquin River.

Planned operation would continue to be to lift the gates during portions of the ebb tide to force more central Delta freshwater down the lower San Joaquin River channel, rather than allowing it to enter the Sacramento River via Three Mile Slough.

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Construction Cost Summary

Original Concept:	$ 42,753,000
Alternative Concept:	$ 29,538,000
First Costs Savings:	$ 13,215,00

Advantages/Disadvantages

Alternative No.: RS-10b

Advantages of Alternative Concept

- The concept is flood neutral
- The bottom-hinged gate can be operated on a daily basis during San Joaquin River ebb tides
- In-the-wet construction allows the gates to be fabricated, delivered, and preinstalled on sills prior to being transported to the site. The site can be dredged and the sheet piles and H-piles installed while this activity is taking place.
- The proposed site may possibly be located with DWR property on both banks, which should lessen time for property acquisition
- If the location selected is close to the confluence of the San Joaquin River, the upstream levees subjected to higher water elevation will be minimized, resulting in reduced seepage through the levees
- The partial-height gate need only be 18-feet high, which results in a narrower sill width and reduces the excavation width and number of H-piles. The 18-foot gate height was determined by requiring approximately seven feet of water over the gate at MLLW (El. +1.9).
- Since the gate operates only during ebb tides when boat traffic is minimal, boat lock facilities may not be required. The water surface profile over the gate requires further investigation to determine if the hydraulic profile over the submerged gates would be safe for boat passage. It is anticipated that the hydraulic profile will allow shallow draft boat traffic passage while the gate is in the raised position.
- Blockage to ocean bound fish during ebb tides will be less than the blockage caused by the full-height gate
- Eliminates the floating boom requirement due to boat impediment elimination

Disadvantages of Alternative Concept

- Operating a partial-height bottom-hinged gate in Three Mile Slough during nighttime ebb tides will increase the amount of time that upstream levees are subjected to higher water elevations. Higher water elevations for an increased amount of time will increase seepage through the levees, which may increase pumping costs for adjacent farms. Locating the gate structure close to the San Joaquin River will reduce the length of levees that will be subjected to these higher water levels for increased times and thus mitigates the issue.

Advantages/Disadvantages

Alternative No.: RS-10b

- Barges and deep draft vessels would be able to transit over the bottom-hinged gates only during times when the gate is in the down position.

Discussion

Alternative No.: RS-10b

Location
The proposed barrier at Three Mile Slough is located in one of the most challenging areas of the Delta, where soft organic soils can extend as far as 40 to 50 feet below original ground. Extensive geologic exploration was performed along the crest and landside toe of Sherman and Twitchell Islands, and to a lesser extent, Brannan Island.

The DWR owns approximately 90 percent of Sherman Island and 85 percent of Twitchell Island. Brannan Island State Recreation Park is located on the south end of Brannan Island.

Two boating areas are located along Three Mile Slough. Brannan Island State Recreation Area includes a boat ramp and docking area. The Outrigger marina is located on Sherman Island just east of Brannan Island State Recreation Area. A third boating area is located on Sherman Island, along the San Joaquin River (just south of the confluence of the San Joaquin River and False River).

Construction
Construct the gates in-the-wet with a lift-in technique using either catamarans made of Flexi-floats or barge-mounted cranes. The estimate contained herein uses barge-mounted cranes capable of lifting in the sills with the gates attached. If the DWR owns a catamaran barge, purchased for the Permanent Barrier Project, then this equipment may be used to install the gates.

Operation
Gates will be operated during nighttime ebb tides. A partial-height gate may achieve similar water quality standards with a lower initial cost. As well, the partial-height gate will cause only limited obstructions to boat traffic and little to no affects to fish passage. Model studies should be performed to determine the effects of a partial blockage to the channel bottom during the ebb tide. The possibility exists that the gates will need to be operated for a longer time to attain the same water quality provided by the full height gate, since less of the channel will be blocked.

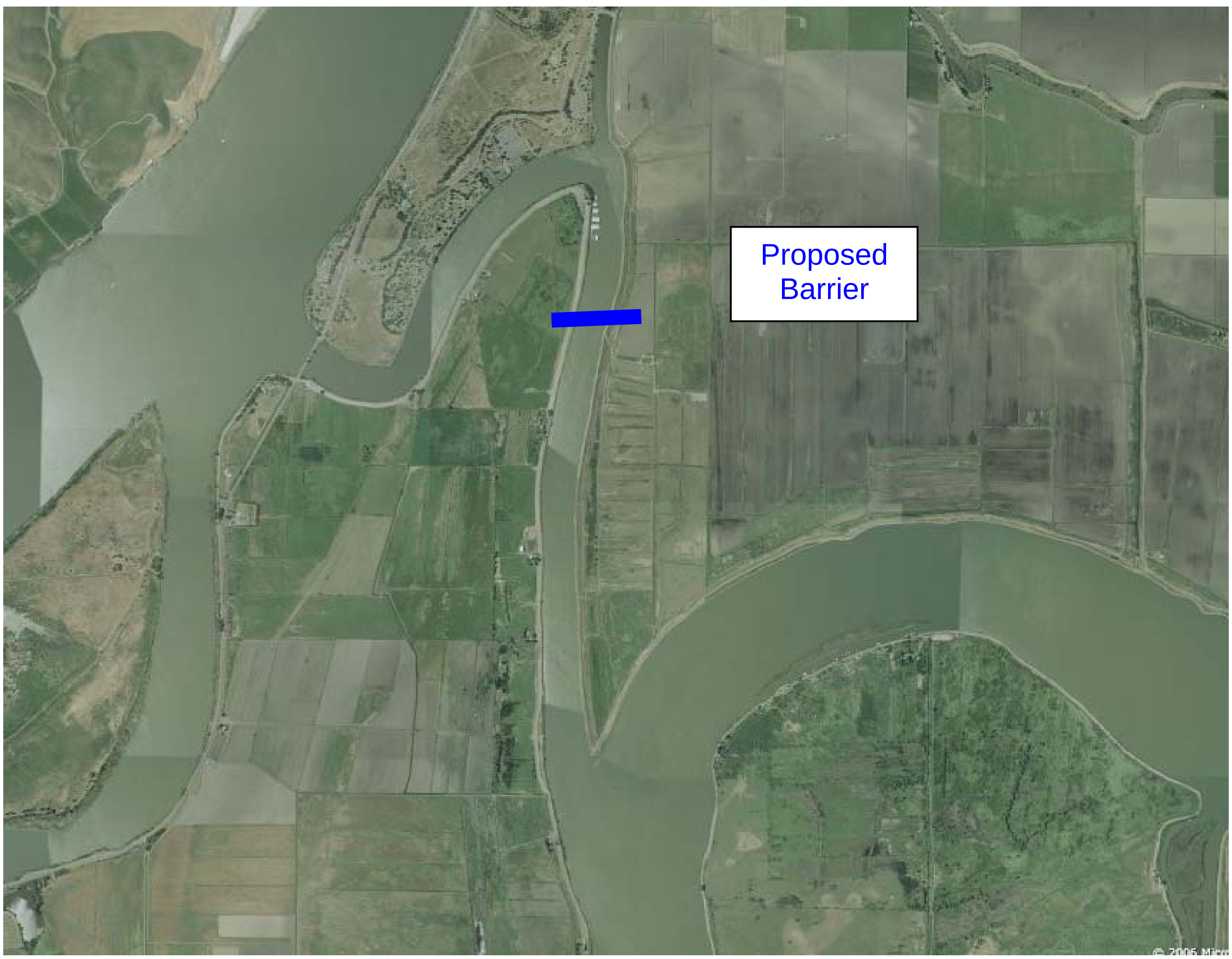
Fish Strategy
Little or no fish effects are anticipated since the partial-height gate blocks only a portion of the channel.

Boat/Recreation Strategy
Several marinas exist on or adjacent to Three Mile Slough. The effects of a partial-height gate on boat traffic must be determined. It is possible to allow boat traffic to travel over the gate while the gate is in the raised position, but the results of the hydraulic model must be investigated to determine if the hydraulic jump over the gate is significant to boat safety.

Sketch

Alternative No.: RS-10b

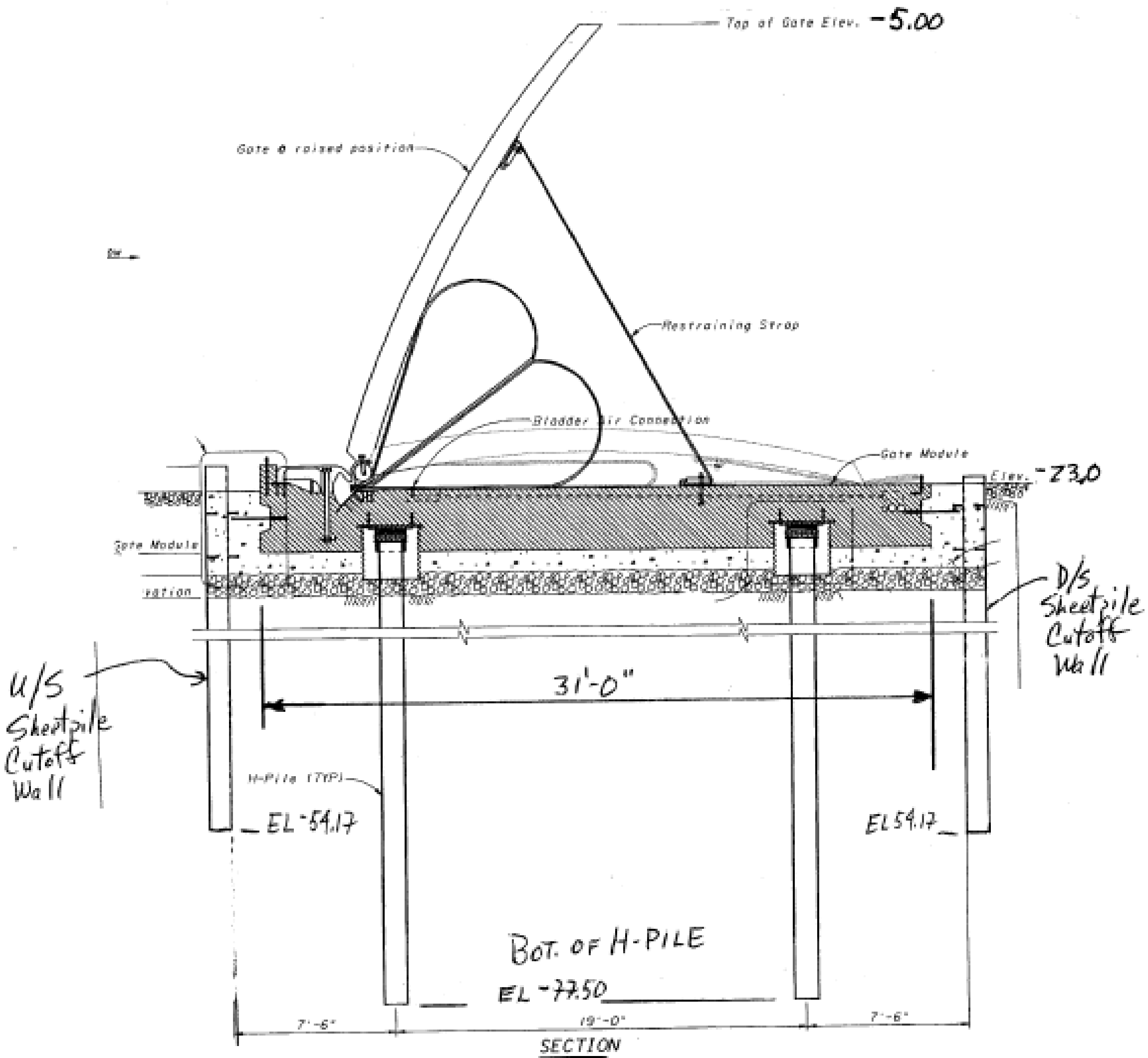
☒ Original ☐ Alternative



Sketch

Alternative No.: RS-10b

☐ Original ☒ Alternative



Construction Cost Estimate

Alternative No.: RS-10b

Construction Cost	Quantity	Unit	Unit Price	Total	
Gate Fixed Costs					
Mobilization				$500,000	
Contractor General Conditions				$1,500,000	
Demonstration Test	1	ls	$190,000	$190,000	
Subtotal Gate Fixed Cost				**$2,190,000**	
Construct 540' x 18' gate					
Underwater Excavation	43,512	cy	$30	$1,305,360	Note **
Screeding	1	lot	$105,169	$105,169	Note **
Underbase Gravel	1,066	ton	$50	$53,280	Note **
Underbase Gravel Cleaning	1	lot	$20,513	$20,513	Note **
Steel Sheet Piles	65,940	lf	$73	$4,813,620	From Quantity Table Same XY
Driven H Piles	4,995	lf	$180	$899,100	Note **
Infill concrete	444	cy	$703	$312,132	Note **
Pressure Grout	651	cy	$644	$419,373	Note **
Precast Concrete	2,368	cy	$710	$1,681,280	Note **
Rebar, Precast	355,200	#	$2	$532,800	Note **
Furnish and Deliver Gate ,Rio Vista	9,720	sf	$800	$7,776,000	Obermeyer Quote Factored $900/sf tall gate, $800/sf for short gate
Assemble Gate to Precast	115	Day	$2,500	$287,500	Allow 5 days /gate for small crew with hydro crane
Load Precast and Gates	23	hr	$1,000	$23,000	2 cranes and misc support at Rio Vista, 1 module/gate assy/hr
Transport Modules, Gates	25	day	$7,000	$175,000	2 deck barges, 1 tug for the duration
Installation Spread	25	day	$28,000	$700,000	2 cranes, 2 deck barges, Crane and Barge Crews, Small Tug, 23 precast Modules, allow one per day, plus move in and out
Subtotal Gate				**19,104,126/lf**	
		540' wide gate =		**35,378/sf**	

Construction Cost Estimate

Alternative No.: RS-10b

		9,720 sf gate =		**1,965**	
Support Structures Fixed Cost					
Control House & Misc					
Dewatering	1	lot	$100,000	$100,000	Allowance
Clear & Grub	2.1	ac	$4,400	$9,240	From Quantity Table
General Excavation	10,900	cy	$20	$218,000	From Quantity Table
Riprap	15,011	ton	$35	$525,392	From Quantity Table
Geotechnical Fabric	22,800	sy	$4	$79,800	
Communication Tower	1	ea	$17,300	$17,300	From Quantity Table
LPG Tank/Distribution System	1	lot	$17,000	$17,000	
Compacted Backfill	2,700	cy	$8	$21,600	
Chain Link Fence	131	lf	$60	$7,860	
Chain Link Gate	3	lot	$4,300	$12,900	
Metal Beam Guard Rail	32	lf	$40	$1,280	
Driven Pipe Piles	400	lf	$135	$54,000	From Quantity Table
Concrete	150	cy	$600	$90,000	From Quantity Table
Reinforcing Steel	22,650	#	$2	$33,975	From Quantity Table
Structural Steel Framing	33,000	#	$3	$99,000	
Concrete Masonry Unit	360	sf	$15	$5,400	From Quantity Table
Metal Deck, 1.5"	900	sy	$30	$27,000	
Miscellaneous Metal	21,300	#	$3	$63,900	
Railing/Handrail	5,300	#	$4	$18,550	
Building Joint Filler / Water Stop	1	lot	$5,600	$5,600	
Buoys	28	ea	$300	$8,400	
Job Sign	1	lot	$3,000	$3,000	
Sheet Water Proofing	1	lot	$5,300	$5,300	
Building Insulation	1	lot	$6,700	$6,700	
Metal Roofing	1,100	sf	$8	$8,800	
Metal Siding	1	lot	$1,420	$1,420	
Flashing & Trim	1	lot	$14,700	$14,700	
Roof Accessories	1	lot	$4,800	$4,800	
Metal Doors & frames	1	lot	$2,000	$2,000	
Door Hardware	1	lot	$600	$600	

Construction Cost Estimate

Alternative No.: RS-10b

Aluminum Windows	1	lot	$2,200	$2,200	
Resilient Tile Flooring	1	lot	$800	$800	
Gypsum Board & accessories	930	sf	$2	$2,232	
Architectural Painting	1	lot	$22,000	$22,000	
Coatings	1	lot	$44,000	$44,000	
Louvers and Vents	1	lot	$1,400	$1,400	
Lightning Protection System	1	lot	$145,000	$145,000	
Flow Meters	1	lot	$50,000	$50,000	
PLC	1	lot	$25,000	$25,000	
Fire Alarm System	1	lot	$6,700	$6,700	
Piping	3,600	lf	$27	$97,200	
Butterfly Valve	4	ea	$570	$2,280	
Ball Valve	45	ea	$1,650	$74,250	
Air Compressor, Receiver	with Gate				
Sump Pump	1	lot	$3,600	$3,600	
Heat Pump	1	lot	$8,100	$8,100	
Ducts	1	lot	$1,700	$1,700	
Exhaust Fans	1	lot	$25,000	$25,000	
Job Electrical	1	lot	$250,000	$250,000	
Emergency Generator	1	lot	$20,000	$20,000	
Distribution Transformer	1	lot	$16,000	$16,000	
Lighting	1	lot	$25,000	$25,000	
Communication System	1	lot	$50,000	$50,000	
Boom Floats	0	lf	$1,470	$0	Not Required with lower gate
Subtotal Other Fixed Cost				**2,335,979**	
Subtotal				**23,630,105**	
Contingency			25%	5,907,526	
Total Estimated Cost				**29,537,632**	

*Source: Grant Line Fabian Canal unless otherwise stated

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Project: Franks Tract Pilot Project
Location: Sacramento-San Joaquin Delta, California

Alternative No:
RS-34

Title:
Close False River with non-operable barrier during low and critical years

Description of Original Concept:

The Original Concept includes constructing an 800-foot-long concrete control gate structure on the False River near the confluence with the San Joaquin River. The height of the barrier is approximately 30 feet. This alternative would provide a physical barrier to salt intrusion entering Franks Tract (and the DWR and USBR export facilities) via the False River. The operating criteria for this alternative includes having the gates closed 12 hours per day and open 12 hours per day. Essentially the gates are open continuously over a complete flood and ebb cycle and closed over the next flood and ebb cycle.

Three operating criteria were modeled for this alternative: a) gates fully closed, b) gates 20 percent open, and c) gates tidally operated. The models were based on September 2002, a dry year. Modeling results for this alternative indicate salinity reductions of two percent to 19 percent may be achievable throughout the central and south Delta. Salinity reductions of 13.3 percent and 10.2 percent were determined at DWR's and USBR's export facilities, respectively.

Description of Alternative Concept:

The alternative concept includes a temporary rock barrier with a center notch in the same location as the original concept. The notch, located in the center of the barrier, is 200 feet wide and 15 feet deep. The barrier is to be constructed in dry or critically dry years. Over 25 years, it is assumed that the barrier will be placed and removed eight times. If needed, the barrier will be in place during the dry portions of the year, typically August through November, and it will be removed before the rainy season. A result of water quality modeling has demonstrated the benefit of such a facility.

The alternative concept is similar to a recommendation provided in the Flooded Islands Pre-Feasibility Study Report (dated June 30, 2005).

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☒ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☐ Decreased

Construction Cost Summary

Original Concept:	$ 59,215,000
Alternative Concept:	$ 81,408,000
Cost Savings:	($ 22,193,000)

Advantages/Disadvantages

Alternative No.: RS-34

Advantages of Alternative Concept

- Simplified design and construction
- Minor operation and maintenance
- Only used in dry and critical years, approximate every third year
- Can be placed and removed relatively quickly
- Opening is sufficient for most boats

Disadvantages of Alternative Concept

- May increase potential for stagnation of Franks Tract and reduced water quality to fisheries and local ecosystem.
- May restrict fish movement
- May result in high velocities through the notch
- The barrier is expected to be constructed and removed, on average, every three years.

Discussion

Alternative No.: RS-34

A barrier at False River will prevent higher salinity water in the San Joaquin River from entering Franks Tract and the DWR / USBR export facilities.

The original concept includes a concrete control gate structure. The operating criteria for this alternative includes having the gates closed 12 hours per day and open 12 hours per day. Essentially the gates are open continuously over a complete flood and ebb cycle and closed over the next flood and ebb cycle. It is anticipated that the gates will only be operated in the dry portions of the year, typically August through November, when freshwater outflows from the Delta are low and saltwater intrusion is high. A boat lock was not incorporated as part of the structure. For cost comparisons, a design life of 25 years was assumed.

The alternative concept includes constructing the barriers at the False River with rock instead of concrete. There are no gates to operate, but the barrier would be designed with a notch in the middle of the channel. The notch is assumed to be 200 feet wide and 15 feet high. The size of the notch was crudely estimated to allow approximately 20 percent of the total normal flow to pass. The barrier is to be constructed in dry or critically dry years. If needed, the barrier will typically be in place during the dry portions of the year, typically August through November, and it will be removed before the rainy season. Over 25 years, it is assumed that the barrier will be placed and removed eight times.

Several comparisons can be made between the gated control structure (original concept) and the rock barrier (alternative concept):

In terms of the “pilot program,” the gated control structure, which is concrete, is more of a permanent type of structure than a temporary structure. The rock barrier has advantages in that it is constructed with rock and would only be necessary during dry or critically dry years. It would not be in place during times when it is not needed.

In terms of design, gated control structure will require more detailed engineering analyses, including aspects related to excavation, stability, concrete, and gate design. The rock barrier is a relatively simple design and requires less analysis.

In terms of construction, the gated control structure would be challenging. Work would likely be performed in the wet (under water) and would include driving piles, placing concrete pads, and setting the gate structures. The rock barrier is relatively simple and requires rock placed from a crane. DWR routinely performs these types of rock barriers across rivers within the south Delta for agriculture and fish benefits. Construction (and removal) of the rock barrier, however, would be performed, on average every three years. It is estimated that the rock fill barrier would be in place eight out of 25 years. Consequently, construction efforts for the rock barrier would be extensive in that the barrier would need to be placed and removed multiple times.

In terms of operation and maintenance, the gated control structure could have as many as 30 gates, and operation and maintenance efforts would likely be extensive. The rock barrier has no gates and operation and maintenance activities would be minor.

Discussion

Alternative No.: RS-34

In terms of fish passage, the gated control structure, when operated, would restrict fish movement 12 hours out of each day when the gates are in the closed position. In addition to blocking migration, gate operation has the potential for predation. The rock barrier has a fixed notch to allow for some fish passage to occur when it is in place. It is difficult to compare the impacts to fish movement and predation between the two alternatives.

In terms of navigation impacts to boats, neither the gated control structure or the Rock barrier is designed with boat locks. Although not included in the original concept of the gated control structure, a boat lock could be added relatively easily. The rock fill barrier has a notch in the middle of the barrier to allow recreational boats to pass.

In terms of reducing salinity, model studies of both alternatives have indicated significant and comparable reductions at water export locations.

In terms of flooding, the gated control structure is designed to be flood neutral and, consequently, should not have adverse impacts in terms of flooding. The Rock barrier is not flood neutral, but it is to be removed before the flood season. In an emergency, rock can be removed relatively quickly to allow additional water to pass.

In terms of water circulation and water quality impacts within Franks Tract, both alternatives would reduce the amount of water that currently goes into Franks Tract. Because of this, both alternatives could lead to water circulation and water quality impacts within Franks Tract.

Sketch

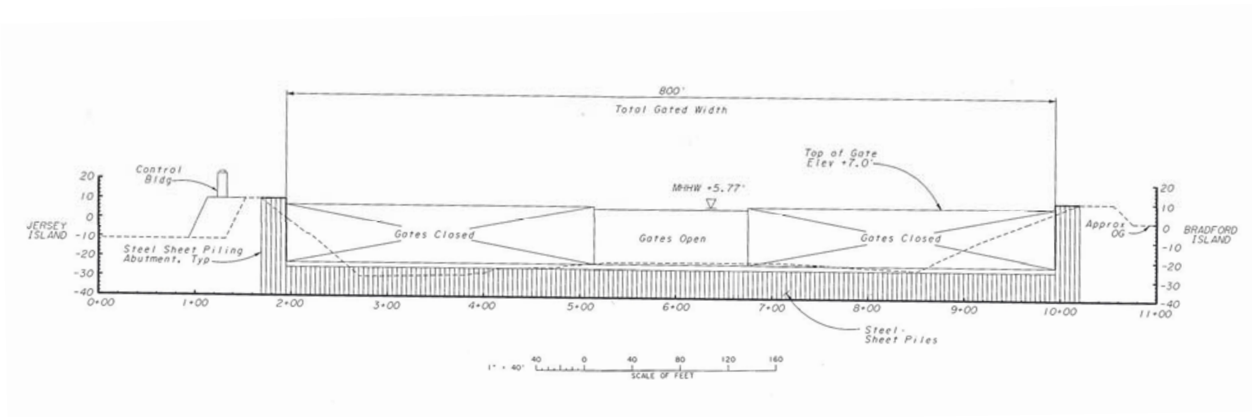
Alternative No.: RS-34

☒ Original ☐ Alternative

Sketch

Alternative No.: RS-34

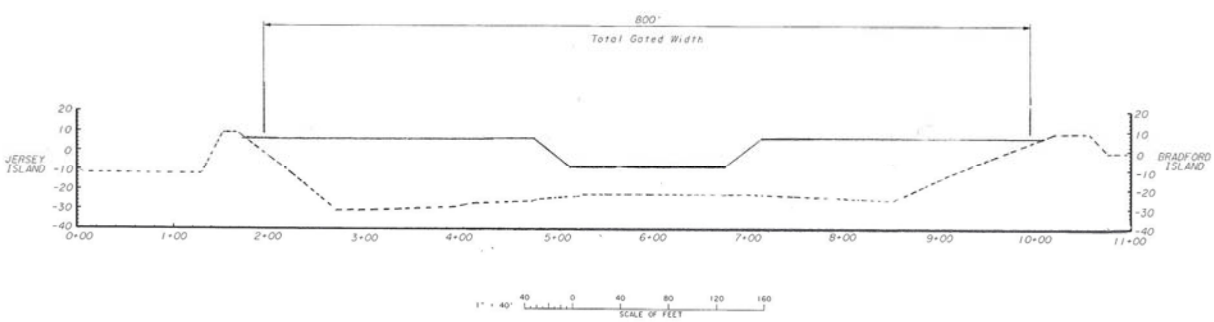
☒ Original ☐ Alternative



Sketch

Alternative No.: RS-34

☐ Original ☒ Alternative



Construction Cost Estimate

Alternative No.: RS-34

False River Rock Barrier				**3/23/2007**
800' long Barrier	**Quantity**	**Unit**	**Unit Price**	**Total**
Year One				
Mob/De-mob				$75,000
Furnish and Place Rock	125,000	Ton	$80	$10,000,000
Remove and Stockpile 80% Rock	100,000	Ton	$30	$3,000,000
Contingency			20%	$2,615,000
Total Year One				**$15,615,000**
Subsequent Years				
Mob/De-mob				$75,000
Furnish & Place 20% Lost Rock	25,000	Ton	$80	$2,000,000
Load And Place 80% Rock From Stockpile	100,000		$30	$3,000,000
Remove and Stockpile 80% Rock	100,000	Ton	$30	$3,000,000
Contingency			20%	$1,615,000
Total Subsequent Years				**$9,690,000**

Present Worth Value	**Year**	**PWF**	
First Cost			$15,615,000
Remove Replace Barrier	3	0.8890	$8,614,375
Remove Replace Barrier	6	0.7903	$7,658,148
Remove Replace Barrier	9	0.7026	$6,808,065
Remove Replace Barrier	12	0.6246	$6,052,345
Remove Replace Barrier	15	0.5553	$5,380,513
Remove Replace Barrier	18	0.4936	$4,783,256
Remove Replace Barrier	21	0.4388	$4,252,298
Remove Replace Barrier	24	0.3901	$3,780,277
Remove Replace Barrier	27	0.3468	$3,360,653
Remove Replace Barrier	30	0.3083	$2,987,608
Remove Replace Barrier	33	0.2741	$2,655,973
Remove Replace Barrier	36	0.2437	$2,361,150
Remove Replace Barrier	39	0.2166	$2,099,054
Remove Replace Barrier	42	0.1926	$1,866,051
Remove Replace Barrier	45	0.1712	$1,658,913
Remove Replace Barrier	48	0.1522	$1,474,767
Total Present Worth Cost			**$81,408,445**

Value Alternative

Project: Franks Tract Pilot Project
Location: Sacramento-San Joaquin Delta, California

Alternative No:
RS-41a

Title:
Construct and operate barrier in West False River (Original DWR Design Alternative 1)

Description of Original Concept:

This 30' high Obermeyer gated barrier is 800' wide across the West False River and is open for a continuous 12 hours and closed 12 hours per day. The top of the gate is at El. +7.0' and the top of the sill is at El. -23.0'. The gate barrier would be built "in-the-wet" using off-site prefabricated sill/gate assemblies that would be delivered to the site by barge, lifted by cranes, and set underwater on pre-driven pile foundations and between sheet pile cut-off walls. Underwater grout would be used to connect the precast sills to the pre-installed foundations.

Description of Alternative Concept:

This 28.77' high Obermeyer gated barrier is 800 feet wide across the West False River, and is open for a continuous 12 hours and closed 12 hours per day. It includes a boat lock within the 800' width, and the lock would be operable when the gates are up. The boat lock is assumed to use two 20' wide Obermeyer gates (one at each end), with a 120' long lock chamber, with a gate sill elevation at approximately El. -10'. The lock chamber is assumed to use Z-sheet piles for the river wall, and a rip-rapped levee slope for the land wall.

The top of the barrier gates is at El. +5.77' and the top of the sill is at El. -23.0'. The gate barrier would be built "in-the-wet" using off-site prefabricated sill/gate assemblies that would be delivered to the site by barge, lifted by cranes, and set underwater on pre-driven pile foundations and between sheet pile cut-off walls. Underwater grout would be used to connect the precast sills to the pre-installed foundations.

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☒ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☐ Decreased

Construction Cost Summary

Original Concept:	$ 59,215,000
Alternative Concept:	$ 61,248,000
Cost Savings	($ 2,033,000)

Advantages/Disadvantages

Alternative No.: RS-41a

Advantages of Alternative Concept

- Shortens the gate leaf by 1.23 feet by eliminating the freeboard from the structure
- Reduced obstructions to boat traffic
- Increased chance of being permitted due to presence of boat lock
- Works for both “dry” and “critical” years
- Provides best salinity reduction in critically dry years

Disadvantages of Alternative Concept

- Higher cost than original West River Barrier case due to the addition of a boat lock
- If boat lock is deemed inadequate for fish passage, then a ladder for bottom-oriented fish (e.g. Sturgeon) may be needed

Discussion

Alternative No.: RS-41a

The original concept reduces saltwater intrusion by physically blocking the salinity intrusion peak during the 12-hour period including one flood and one ebb tide coming up the West False River into Frank's Tract, using pneumatic bottom-hinged Obermeyer Gates across the 800' width of the river. This alternative works the same way except that: a) the freeboard on the gate leaves has been eliminated, and b) a boat lock has been added to facilitate boat passage during the 12-hour period when the gates are up (note that the lock would be open when the navigable pass is open in order to facilitate water circulation to stop Frank's Tract from stagnating).

The estimated construction period for this barrier is 10 months from Notice to Proceed, assuming that DWR has pre-ordered the Obermeyer gates (and control/operating equipment) so that they are not on the critical path. This assumes that: a) the offsite precast sills are built concurrently with the onsite dredging and pile driving operations; b) the gates are pre-installed on the precast sills and delivered by barge to derrick cranes that lift the sill/gate assemblies off the barges and on to the underwater pile foundation; c) the sill/gate assemblies are connected to the foundations using underwater/underbase grout; d) the controls and pneumatic air lines are then connected to operate the gates; and that e) scour stone is placed both upstream and downstream of the barrier in operations concurrent with all of the previous activities.

It should be noted that the presence of any barrier will increase the duration of increased hydraulic head on the levees which: a) can slightly reduce the stability of the levees and b) can slightly increase the water seepage into adjoining farm lands (requiring more pumping). Note that the barrier uses gates along its full length in order to maintain a flood neutral condition for the river.

It is probable that both the original barrier and this alternative may need to have fish ladders and/or fish culverts added in order to receive permits

Sketch

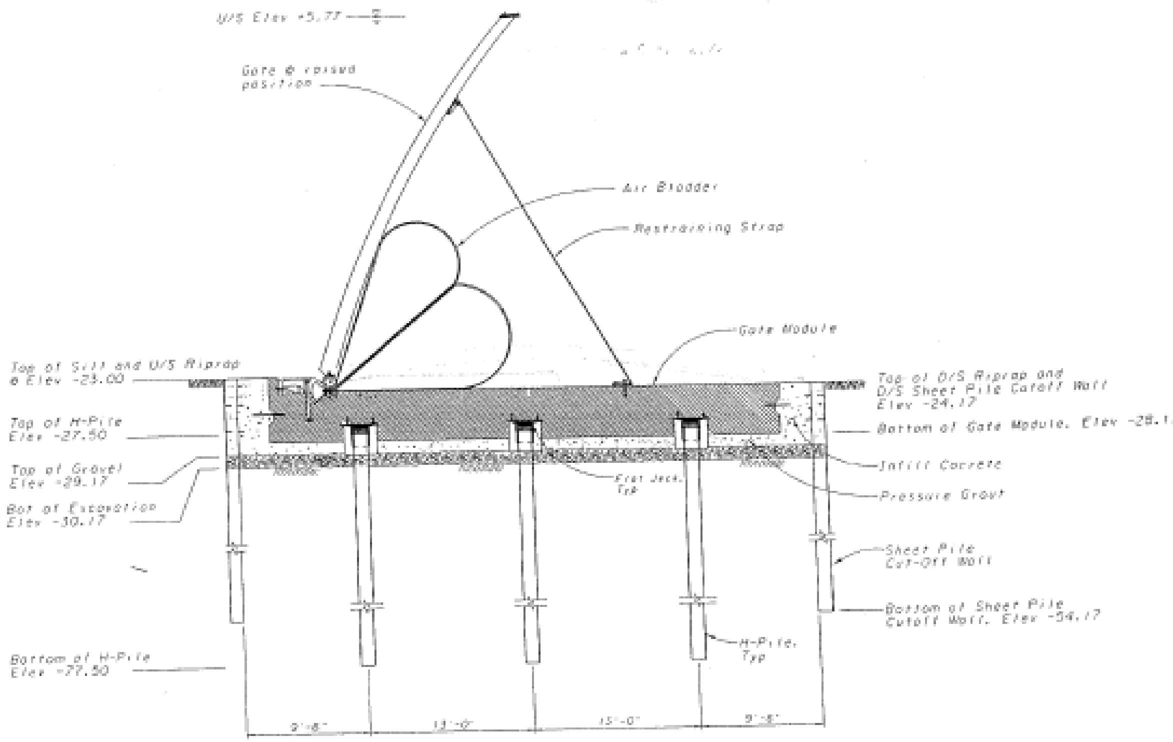
Alternative No.: RS-41a

☒ Original ☐ Alternative

Sketch

Alternative No.: RS-41a

☒ Original ☐ Alternative



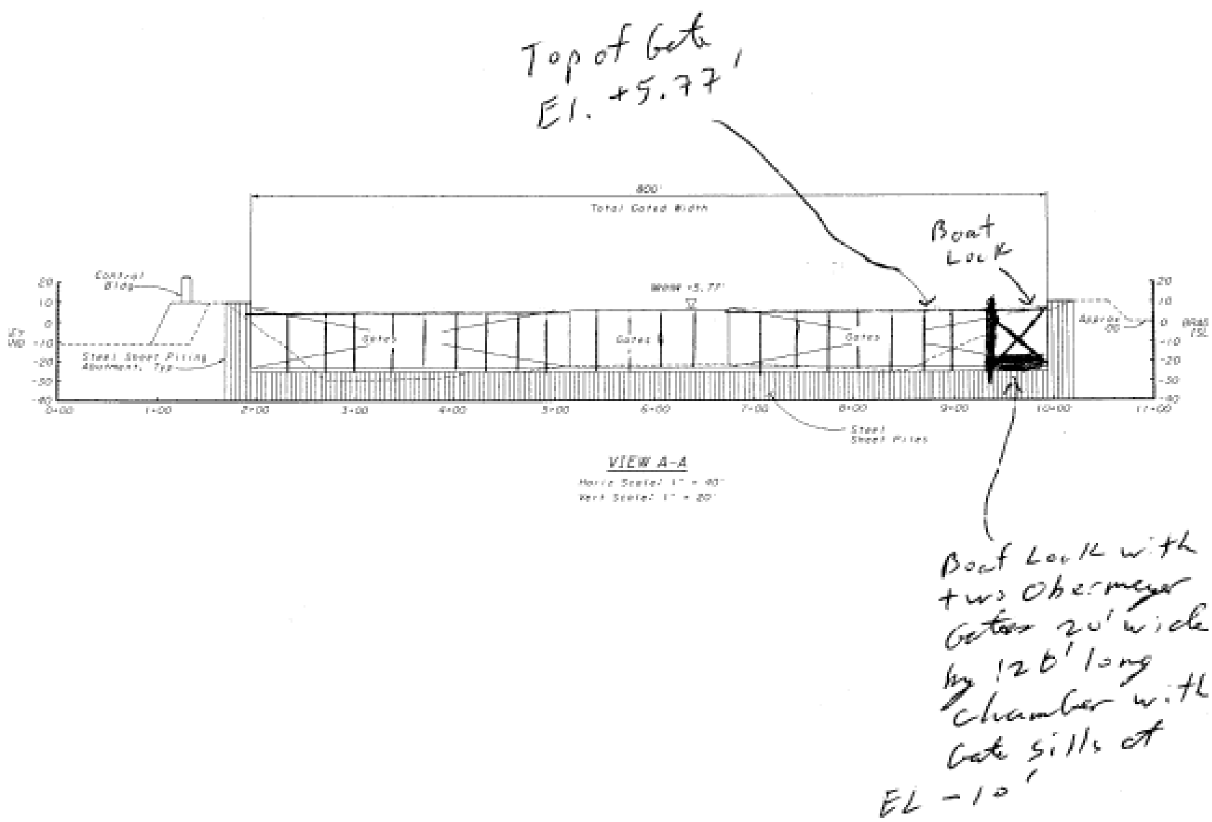
TRANSVERSE SECTION

Scale: ¼" = 1'

Sketch

Alternative No.: RS-41a

☐ Original ☒ Alternative



Construction Cost Estimate

Alternative No.: RS-41a

Construction Cost	Quantity	Unit	Unit Price	Total		
Gate Fixed Costs						
Mobilization				$500,000		
Contractor General Conditions				$2,000,000		
Demonstration Test	1	ls	$190,000	$190,000		
Subtotal Gate Fixed Cost				$2,690,000		
Construct 800' x 30' gate						
Underwater Excavation	70,700	cy	$30	$2,121,000		From Quantity Table
Screeding	1	lot	$213,180	$213,180		
Underbase Gravel	2,240	ton	$50	$112,000		From Quantity Table , 1400 cy based on drawing
Underbase Gravel Cleaning	1	lot	$41,580	$41,580		
Steel Sheet Piles	81,540	lf	$73	$5,952,420		From Quantity Table
Driven H Piles	9,750	lf	$180	$1,755,000		From Quantity Table
Infill concrete	700	cy	$703	$492,100		From Quantity Table
Pressure Grout	1,185	cy	$644	$763,140		From Quantity Table
Precast Concrete	4,650	cy	$710	$3,301,500		From Quantity Table
Rebar, Precast	697,500	#	$2	$1,046,250		From Quantity Table
Furnish and Deliver Gate ,Rio Vista	23,015	sf	$900	$20,713,500		Obermeyer Quote Factored Tall gate $900/sf, Short gate $800/sf

Construction Cost Estimate

Alternative No.: RS-41a

Assemble Gate to Precast	185	Day	$2,500	$462,500		Allow 5 days /gate for small crew with hydro crane
Load Precast and Gates	37	hr	$1,000	$37,000		2 cranes and misc support at Rio Vista, 1 module/hr, 1 gate/hr
Transport Modules, Gates	39	day	$7,000	$273,000		2 deck barges, 1 tug for the duration
Installation Spread	39	day	$28,000	$1,092,000		2 cranes, 2 deck barges, Crane and Barge Crews, Small Tug, 37 precast Modules With Gates Assembled, allow one per day, plus move in and out
Subtotal Gate				$38,376,170		
		800' wide gate =		**47,970**	/lf	
		24000 sf gate =		**1,599**	/sf	
Support Structures Fixed Cost						
Control House & Misc						
Dewatering	1	lot	$100,000	$100,000		Allowance
Clear & Grub	2.1	ac	$4,400	$9,240		From Quantity Table
General Excavation	10,900	cy	$20	$218,000		From Quantity Table
Riprap	23,080	ton	$35	$807,800		From Quantity Table
Geotechnical Fabric	22,800	sy	$4	$79,800		

Construction Cost Estimate

Alternative No.: RS-41a

Communication Tower	1	ea	$17,300	$17,300		From Quantity Table
LPG Tank/Distribution System	1	lot	$17,000	$17,000		
Compacted Backfill	3,700	cy	$8	$29,600		
Chain Link Fence	131	lf	$60	$7,860		
Chain Link Gate	3	lot	$4,300	$12,900		
Metal Beam Guard Rail	32	lf	$40	$1,280		
Driven Pipe Piles	400	lf	$135	$54,000		From Quantity Table
Concrete	150	cy	$600	$90,000		From Quantity Table
Reinforcing Steel	22,650	#	$2	$33,975		From Quantity Table
Structural Steel Framing	33,000	#	$3	$99,000		
Concrete Masonry Unit	360	sf	$15	$5,400		From Quantity Table
Metal Deck, 1.5"	900	sy	$30	$27,000		
Miscellaneous Metal	21,300	#	$3	$63,900		
Railing/Handrail	5,300	#	$4	$18,550		
Building Joint Filler / Water Stop	1	lot	$5,600	$5,600		
Buoys	28	ea	$300	$8,400		
Job Sign	1	lot	$3,000	$3,000		
Sheet Water Proofing	1	lot	$5,300	$5,300		
Building Insulation	1	lot	$6,700	$6,700		
Metal Roofing	1,100	sf	$8	$8,800		
Metal Siding	1	lot	$1,420	$1,420		
Flashing & Trim	1	lot	$14,700	$14,700		
Roof Accessories	1	lot	$4,800	$4,800		
Metal Doors & frames	1	lot	$2,000	$2,000		
Door Hardware	1	lot	$600	$600		
Aluminum Windows	1	lot	$2,200	$2,200		
Resilient Tile Flooring	1	lot	$800	$800		
Gypsum Board & accessories	930	sf	$2	$2,232		
Architectural Painting	1	lot	$22,000	$22,000		
Coatings	1	lot	$44,000	$44,000		
Louvers and Vents	1	lot	$1,400	$1,400		
Lightning Protection System	1	lot	$145,000	$145,000		
Flow Meters	1	lot	$50,000	$50,000		
PLC	1	lot	$25,000	$25,000		

Construction Cost Estimate

Alternative No.: RS-41a

Fire Alarm System	1	lot	$6,700	$6,700		
Piping	3,600	lf	$27	$97,200		
Butterfly Valve	4	ea	$570	$2,280		
Ball Valve	45	ea	$1,650	$74,250		
Air Compressor, Receiver	with Gate					
Sump Pump	1	lot	$3,600	$3,600		
Heat Pump	1	lot	$8,100	$8,100		
Ducts	1	lot	$1,700	$1,700		
Exhaust Fans	1	lot	$25,000	$25,000		
Job Electrical	1	lot	$250,000	$250,000		Solar power system
Emergency Generator	1	lot	$20,000	$20,000		
Distribution Transformer	1	lot	$16,000	$16,000		
Lighting	1	lot	$25,000	$25,000		
Communication System	1	lot	$50,000	$50,000		
Boom Floats	1,900	lf	$1,470	$2,793,000		2 rows x 850'
Subtotal Other Fixed Cost				**$5,419,387**		
Subtotal				**$46,485,557**		
Contingency			25%	$11,621,389		
Total Estimated Cost				**$58,106,946**		

*Source: Grant Line Fabian Canal unless otherwise stated

Construction Cost Estimate

Alternative No.: RS-41a

Boat Lock

Construction Cost	Quantity	Unit	Unit Price	Total	
Mobilization				$50,000	
Contractor General Conditions				$100,000	
				$150,000	
Construct 120' x 22' lock					
Underwater Excavation	1,000	cy	$30	$30,000	
Screeding	1	lot	$15,000	$15,000	
Underbase Gravel	500	ton	$50	$25,000	
Steel Sheet Piles	5,500	lf	$85	$467,500	
Infill concrete	300	cy	$703	$210,900	
Gate Mechanisms Installed	1	ls	$1,000,000	$1,000,000	DWR Information
Subtotal Lock				**$1,748,400**	
Support Structures Fixed Cost					
Controls Misc					
Clear & Grub	2.1	ac	$4,400	$9,240	
General Excavation	500	cy	$20	$10,000	
Riprap	500	ton	$35	$17,500	
Geotechnical Fabric	200	sy	$4	$700	
Communication Tower	1	ea	$17,300	$17,300	
LPG Tank/Distribution System	1	lot	$17,000	$17,000	
Compacted Backfill	500	cy	$8	$4,000	
Chain Link Fence	80	lf	$60	$4,800	
Chain Link Gate	1	lot	$4,300	$4,300	
Concrete	20	cy	$600	$12,000	
Reinforcing Steel	3,000	#	$2	$4,500	
Structural Steel Framing	10,000	#	$3	$30,000	
Metal Deck, 1.5"	12	sy	$30	$360	
Miscellaneous Metal	2	#	$3	$6	
Building Joint Filler / Water Stop	1	lot	$1,000	$1,000	
Buoys	4	ea	$300	$1,200	
Job Sign	1	lot	$3,000	$3,000	
Building Insulation	1	lot	$1,000	$1,000	
Metal Roofing	1,200	sf	$8	$9,600	

Construction Cost Estimate

Alternative No.: RS-41a

Metal Siding	1	lot	$1,420	$1,420	
Flashing & Trim	1	lot	$500	$500	
Roof Accessories	1	lot	$500	$500	
Metal Doors & frames	1	lot	$2,000	$2,000	
Door Hardware	1	lot	$600	$600	
Louvers and Vents	1	lot	$1,400	$1,400	
Lightning Protection System	1	lot	$20,000	$20,000	
Fire Alarm System	1	lot	$6,700	$6,700	
Piping	3,600	lf	$27	$97,200	
Butterfly Valve	4	ea	$570	$2,280	
Ball Valve	45	ea	$1,650	$74,250	
Air Compressor, Receiver	with Gate				
Job Electrical	1	lot	$250,000	$250,000	
Lighting	1	lot	$10,000	$10,000	
Subtotal Other Fixed Cost				**$614,356**	
Subtotal				**$2,512,756**	
Contingency			25%	$628,189	
Total Estimated Cost				**$3,140,945**	
Total Cost (Barrier w/ lock)				**$61,247,891**	

Value Alternative

Project: Franks Tract Pilot Project
Location: Sacramento-San Joaquin Delta, California

Alternative No: RS-41b

Title:
Construct and operate partial-height barrier in West False River

Description of Original Concept:

The 30' high Obermeyer gated barrier is 800' wide across the West False River, and is open for a continuous 12 hours and closed 12 hours per day (see accompanying sketch). The top of the gate is at El. +7.0' and the top of the sill is at El. -23.0'. The gate barrier would be built "in-the-wet" using off-site prefabricated sill/gate assemblies that would be delivered to the site by barge, lifted by cranes, and set underwater on pre-driven pile foundations and between sheet pile cut-off walls. Underwater grout would be used to connect the precast sills to the pre-installed foundations.

Description of Alternative Concept:

This 21.5' high Obermeyer gated barrier is 800' wide across the West False River, and is open for a continuous 12 hours and closed 12 hours per day. The top of the gate is at El. -1.5' and the top of the sill is at El. -23.0'. The abutments stair-step down from the top of the levee to El. +7.0. The gate barrier would be built "in-the-wet" using off-site prefabricated sill/gate assemblies that would be delivered to the site by barge, lifted by cranes, and set underwater on pre-driven pile foundations and between sheet pile cut-off walls. Underwater grout would be used to connect the precast sills to the pre-installed foundations. It is assumed that the tops of the partial-height gates will be low enough so that floating protective booms will not be needed to protect the gates from pleasure boat impacts (note that passage of deep draft vessels would need to be scheduled for periods when the gates are in the down position). It is further assumed that having the top of the partial-height gates at El -1.5' will roughly correspond to the 20% open option already modeled by DWR; however, if this is verified by future numerical modeling then the elevation of the top of the partial height gate should be adjusted until this assumption is correct.

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Construction Cost Summary

Original Concept:	$ 59,215,000
Alternative Concept:	$ 43,955,000
Cost Savings:	$ 15,260,000

Advantages/Disadvantages

Alternative No.: RS-41b

Advantages of Alternative Concept

- Significantly lower cost than the original West False River Barrier case
- 8.5’ shorter gate leaf
- Reduced foundations
- Reduced sill width
- Reduced abutments
- Possible elimination of floating protective booms
- Reduced obstructions to boat traffic
- Reduced impact on some types of fish.
- Reduced lifted weight of prefabricated modules
- Reduced visual impact
- Works for both “dry” and “critical” years
- Provides best salinity reduction in critically dry years

Disadvantages of Alternative Concept

- Risk that deep draft pleasure boats may impact the raised gates
- Risk that the hydraulic gradient across the partial-height gates may adversely affect boat passage
- Slightly higher predicted EC levels than for the original West False River case
- May still require a boat lock and protective booms for boats
- Either a boat lock or fish ladder may be required for bottom-oriented migrating fish, such as sturgeon

Discussion

Alternative No.: RS-41b

The original concept reduces saltwater intrusion by physically blocking the seawater intrusion up West False River into Frank's Tract during a continuous 12-hour period each day. The 12-hour blockage of flow through West False River is accomplished using pneumatic bottom-hinged Obermeyer Gates across the 800' width of the river. The proposed alternative works in a similar manner except that: a) the gates are normally up 24 hours per day, and b) the gates are partial-height allowing for the equivalent of a continuous 20% opening.

The estimated construction period for this barrier is 10 months from Notice to Proceed, assuming that DWR has pre-ordered the Obermeyer gates (and control/operating equipment) so that they are not on the critical path. This assumes that: a) the offsite precast sills are built concurrently with the onsite dredging and pile driving operations; b) the gates are pre-installed on the precast sills and delivered by barge to derrick cranes that lift the sill/gate assemblies off the barges and on to the underwater pile foundation; c) the sill/gate assemblies are connected to the foundations using underwater/underbase grout; d) the controls and pneumatic air lines are then connected to operate the gates; and that e) scour stone is placed both upstream and downstream of the barrier in operations current with all of the previous activities.

It should be noted that the presence of any barrier will increase the duration of increased hydraulic head on the levees which: a) may slightly reduce the stability of the levees and b) may slightly increase water seepage into adjoining farm lands (requiring more pumping). Note that the barrier uses gates along its full length in order to maintain a flood neutral condition for the river when the gates are in the down position. The original barrier may need to have fish ladders and/or fish culverts added in order to receive permits; however, it is believed that proposed alternative may not need these features.

Sketch

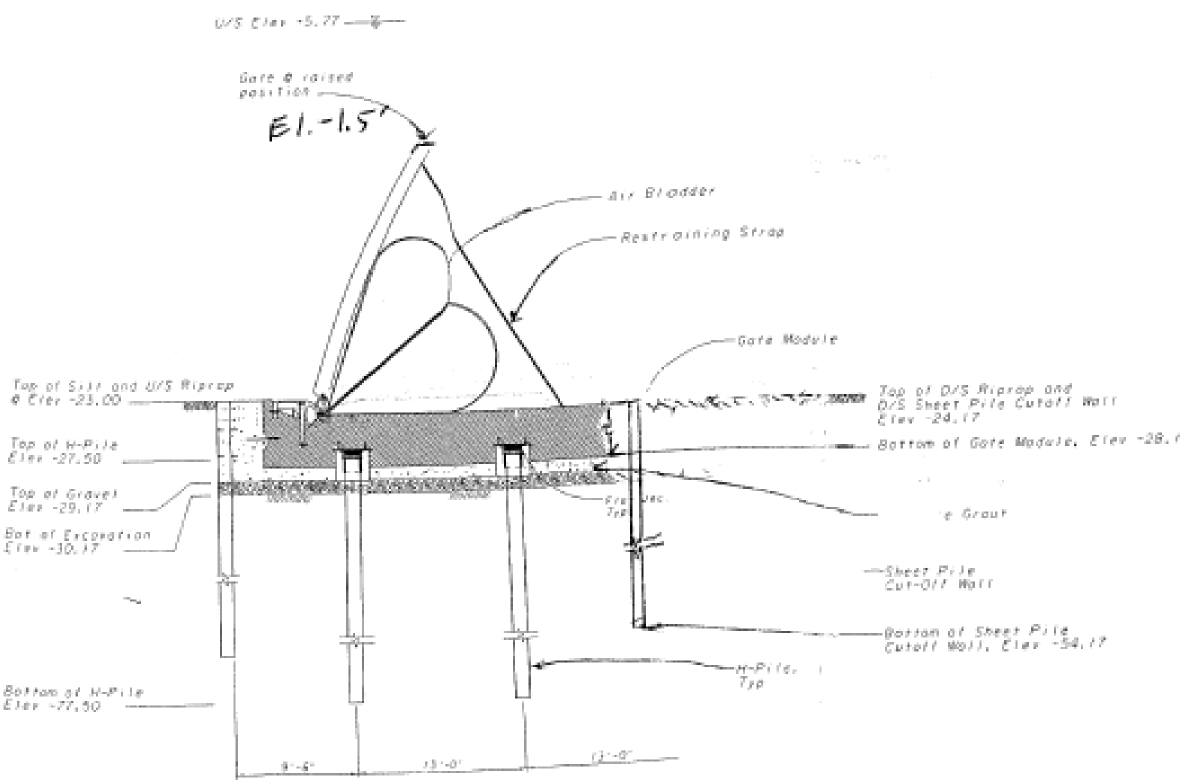
Alternative No.: RS-41b

☒ Original ☐ Alternative

Sketch

Alternative No.: RS-41b

☐ Original ☒ Alternative

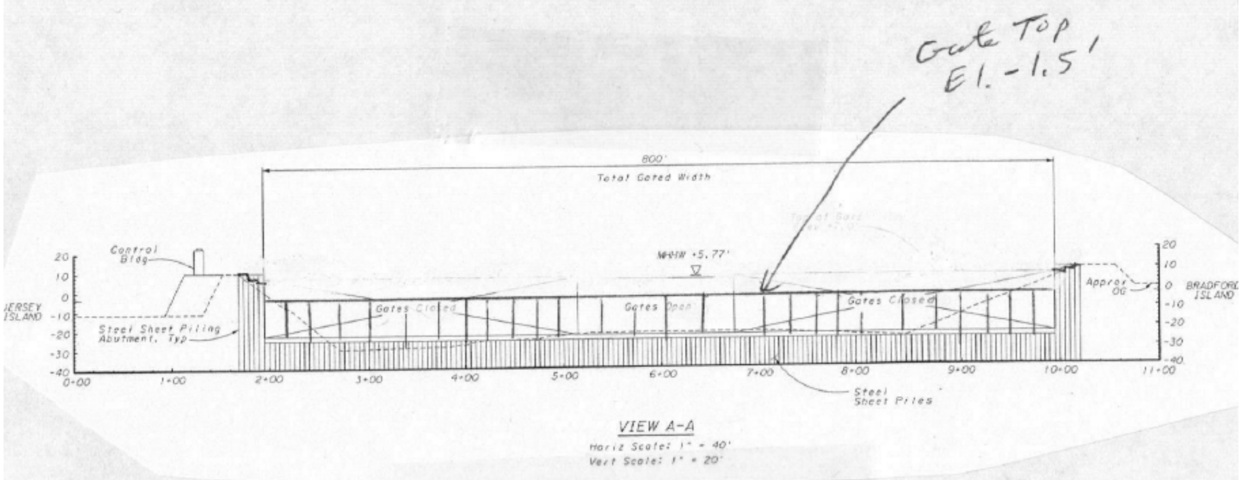


TRANSVERSE SECTION
Scale: 1/4" = 1'

Sketch

Alternative No.: RS-41b

☐ Original ☒ Alternative



Construction Cost Estimate

Alternative No.: RS-41b

Construction Cost	Quantity	Unit	Unit Price	Total	
Gate Fixed Costs					
Mobilization				$500,000	
Contractor General Conditions				$2,000,000	
Demonstration Test	1	ls	$190,000	$190,000	
Subtotal Gate Fixed Cost				**$2,690,000**	
Construct 800' x 21.5' gate					
Underwater Excavation	59,388	cy	$30	$1,781,640	Note **
Screeding	1	lot	$179,071	$179,071	Note **
Underbase Gravel	1,882	ton	$50	$94,080	Note **
Underbase Gravel Cleaning	1	lot	$34,927	$34,927	Note **
Steel Sheet Piles	81,540	lf	$73	$5,952,420	From Quantity Table Same XY
Driven H Piles	8,190	lf	$180	$1,474,200	Note **
Infill concrete	588	cy	$703	$413,364	Note **
Pressure Grout	995	cy	$644	$641,038	Note **
Precast Concrete	3,906	cy	$710	$2,773,260	Note **
Rebar, Precast	585,900	#	$2	$878,850	Note **
Furnish and Deliver Gate ,Rio Vista	17,200	sf	$800	$13,760,000	Obermeyer Quote Factored Tall gate $900/sf, Short gate $800/sf
Assemble Gate to Precast	185	Day	$2,500	$462,500	Allow 5 days /gate for small crew with hydro crane
Load Precast and Gates	37	hr	$1,000	$37,000	2 cranes and misc support at Rio Vista, 1 module/hr, 1 gate/hr
Transport Modules, Gates	39	day	$7,000	$273,000	2 deck barges, 1 tug for the duration

Construction Cost Estimate

Alternative No.: RS-41b

Installation Spread	39	day	$28,000	$1,092,000	2 cranes, 2 deck barges, Crane and Barge Crews, Small Tug, 37 precast Modules With Gates Assembled, allow one per day, plus move in and out
Subtotal Gate				**$29,847,350**	
		800' wide gate =		**$37,309/lf**	
		17200 sf gate =		**$1,735/sf**	
Support Structures Fixed Cost					
Control House & Misc					
Dewatering	1	lot	$100,000	$100,000	Allowance
Clear & Grub	2.1	ac	$4,400	$9,240	From Quantity Table
General Excavation	10,900	cy	$20	$218,000	From Quantity Table
Riprap	23,080	ton	$35	$807,800	From Quantity Table
Geotechnical Fabric	22,800	sy	$4	$79,800	
Communication Tower	1	ea	$17,300	$17,300	From Quantity Table
LPG Tank/Distribution System	1	lot	$17,000	$17,000	
Compacted Backfill	3,700	cy	$8	$29,600	
Chain Link Fence	131	lf	$60	$7,860	
Chain Link Gate	3	lot	$4,300	$12,900	
Metal Beam Guard Rail	32	lf	$40	$1,280	
Driven Pipe Piles	400	lf	$135	$54,000	From Quantity Table
Concrete	150	cy	$600	$90,000	From Quantity Table
Reinforcing Steel	22,650	#	$2	$33,975	From Quantity Table
Structural Steel Framing	33,000	#	$3	$99,000	
Concrete Masonry Unit	360	sf	$15	$5,400	From Quantity Table
Metal Deck, 1.5"	900	sy	$30	$27,000	
Miscellaneous Metal	21,300	#	$3	$63,900	

Construction Cost Estimate

Alternative No.: RS-41b

Railing/Handrail	5,300	#	$4	$18,550	
Building Joint Filler / Water Stop	1	lot	$5,600	$5,600	
Buoys	28	ea	$300	$8,400	
Job Sign	1	lot	$3,000	$3,000	
Sheet Water Proofing	1	lot	$5,300	$5,300	
Building Insulation	1	lot	$6,700	$6,700	
Metal Roofing	1,100	sf	$8	$8,800	
Metal Siding	1	lot	$1,420	$1,420	
Flashing & Trim	1	lot	$14,700	$14,700	
Roof Accessories	1	lot	$4,800	$4,800	
Metal Doors & frames	1	lot	$2,000	$2,000	
Door Hardware	1	lot	$600	$600	
Aluminum Windows	1	lot	$2,200	$2,200	
Resilient Tile Flooring	1	lot	$800	$800	
Gypsum Board & accessories	930	sf	$2	$2,232	
Architectural Painting	1	lot	$22,000	$22,000	
Coatings	1	lot	$44,000	$44,000	
Louvers and Vents	1	lot	$1,400	$1,400	
Lightning Protection System	1	lot	$145,000	$145,000	
Flow Meters	1	lot	$50,000	$50,000	
PLC	1	lot	$25,000	$25,000	
Fire Alarm System	1	lot	$6,700	$6,700	
Piping	3,600	lf	$27	$97,200	
Butterfly Valve	4	ea	$570	$2,280	
Ball Valve	45	ea	$1,650	$74,250	
Air Compressor, Receiver	with Gate				
Sump Pump	1	lot	$3,600	$3,600	
Heat Pump	1	lot	$8,100	$8,100	
Ducts	1	lot	$1,700	$1,700	
Exhaust Fans	1	lot	$25,000	$25,000	
Job Electrical	1	lot	$250,000	$250,000	Solar power system
Emergency Generator	1	lot	$20,000	$20,000	
Distribution Transformer	1	lot	$16,000	$16,000	
Lighting	1	lot	$25,000	$25,000	
Communication System	1	lot	$50,000	$50,000	
Boom Floats	0	lf	$1,470	$0	Not Required with lower gate

Construction Cost Estimate

Alternative No.: RS-41b

Subtotal Other Fixed Cost				**$2,626,387**	
Subtotal				**$35,163,737**	
Contingency			25%	$8,790,934	
Total Estimated Cost				**$43,954,671**	

*Source: Grant Line Fabian Canal unless otherwise stated

GATE SELECTION

GATE SELECTION

Recommended gate selection for Franks Tract General Discussion

A bottom hinge type gate is recommended for a new Frank's Tract barrier (such as at Three Mile Slough or West False River) for reasons including:

- minimal impact on flood neutral status of barrier
- minimal visual impact
- reduced foundation requirements
- reduced sill requirements
- general low cost
- ability to operate and maintain gates
- minimal obstruction to fish passage with gates in the down position
- minimal hiding areas for predatory fish.

Comparative Discussion of Different Types of Bottom Hinge Gates

The following table addresses comparative issues between the following types of bottom hinge gates:

- pneumatically operated (Obermeyer) gates (see Figure 1)
- hydraulically operated wicket gates
- Venice Storm Surge Barrier Type buoyancy operated gates (see Figure 2)
- manually operated wicket gates.

Comparative Table

Issue	Obermeyer Gate	Hydraulic Wicket	Manual Wicket	Buoyancy Operated
Proprietary	Yes	No	No	No
Can Be Operated With a	Yes	Yes	No	Yes

Issue	Obermeyer Gate	Hydraulic Wicket	Manual Wicket	Buoyancy Operated
Head Difference				
Risk of Hydraulic Fluid Leaking	None	Yes (but can be reduced by using biodegradable fluid or water to actuate)	None	None
Relative Ease of Ability to Maintain Gate In-The-Wet	Moderate	Difficult	Easy	Easy
Relative Head Difference that Can be Resisted	Can Risk Substantial Head Differences	Can Risk Large Head Differences	Can Risk Large Head Differences	Risks Relatively Low Head Differences
Relative Cost	Intermediate (risk of sole source mark-up)	Relatively High for High Quality Actuator	Low	Intermediate
Past Experience	Good	Low (e.g. Seine River)	Good	Low
Ease of Operation in Bad Weather	Good	Good	Low	Good
Field Personnel Required for Operation	Can be avoid with SCADA	Can be avoid with SCADA	Yes	Can be avoid with SCADA
Speed of Operation	Intermediate	Fast	Slow	Intermediate

Obermeyer Spillway Gates are manufactured under license under one or more of the following patents:
U.S. PATENT 4,780,024 • U.S. PATENT 5,092,707 • U.S. PATENT 5,538,360 • U.S. PATENT 5,642,963
U.S. PATENT 5,709,502 • U.S. PATENT 5,713,699 • OTHER U.S. AND FOREIGN PATENTS PENDING
©2003 Obermeyer Hydro, Inc. - www.obermeyerhydro.com

Figure 1 Typical Obermeyer Gate

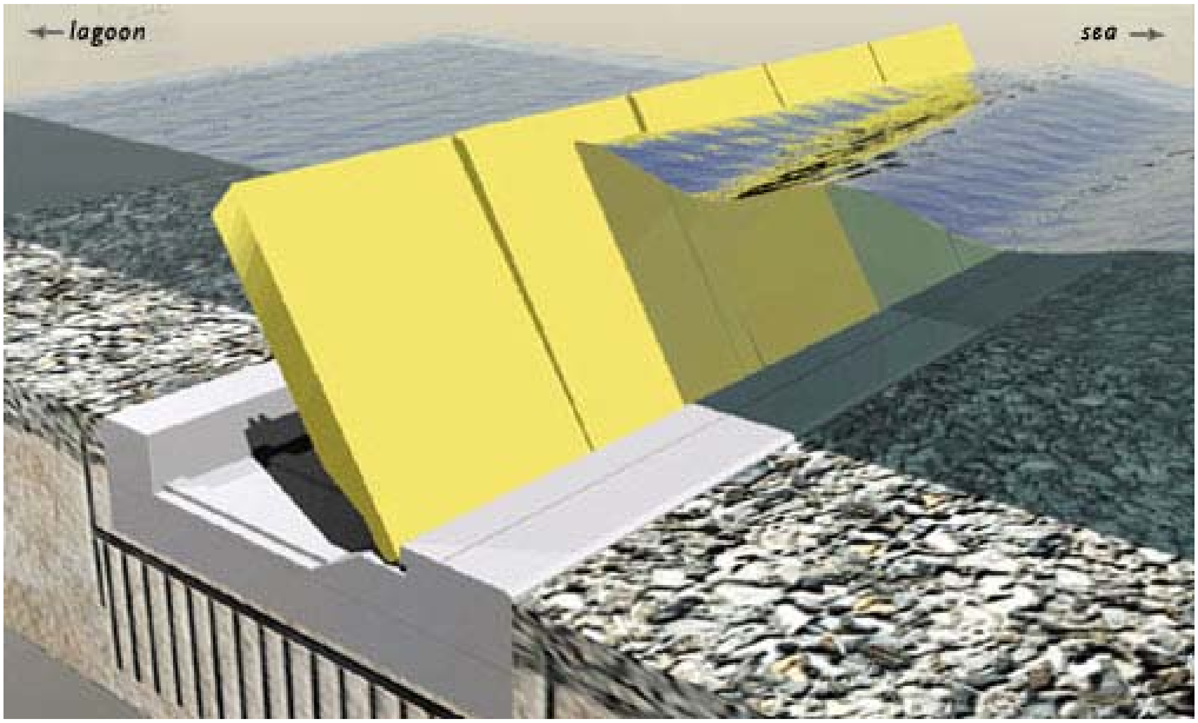


Figure Venice Storm Surge Buoyant Gate Type Bottom Hinge Gate with Raft Pile Foundation

CONSTRUCTABILITY

CONSTRUCTABILITY

Note that "in-the-wet" construction can use either "float-in," or "lift-in" approaches; however, the following discussion assumes only the use of lift-in modules due to the thin nature of the precast sills for the Obermeyer type gates. Note also that "in-the-dry" construction can use either braced cofferdams (using extension of the cut-off wall sheet piles), or cellular sheet pile cofferdams (which do not use internal bracing but have a relatively large foot print); however, the following discussion only assumes the use of a braced cofferdam with a tremie seal pour.

The recommended construction method is lift-in in-the-wet construction as described in the following sequence:

Simplified construction sequence

- Excavate river/canal bottom as required
- Place 1' thick gravel layer
- Drive H-piles and sheet piles
- Simultaneously build precast concrete sill shells
- Pre-install the bottom hinged gates as possible on the shells in-the-dry
- Install guidance systems for installing shells (use pintles on previously installed shells, and horn guides on spotting towers attached to the shells)
- Place lift-in prefabricated shells, and level using the production piles as landing piles with flat-jacks on top of the selected landing piles
- Grout-in the sockets around the piles using grout lines pre-installed in the precast sills and attached to the spotting tower (note the sockets are sealed to the gravel using compression polyurethane foam seals)
- After placing 5 to 6 precast segments (one week's worth of placements, then inflate the grout bag seals allowing for the underbase grouting operation)
- Place underbase grout both under and on the sides (between the modules and the sheet piles) of the 5 to 6 precast segments
- Complete hook-up of gate pneumatics and control systems

Comparison of selected issues associated with in-the-wet and in-the-dry construction

- As both in-the-wet and in-the-dry construction would probably require pile driving in-the-wet, both would require a template for driving piles
- Both in-the-wet and in-the-dry construction require extensive use of floating support equipment, such as: Flexifloats, barges, floating cranes, and floating pile drivers, as construction of the cofferdam is in-the-wet work.
- Construction in-the-dry will probably require partial construction of the barrier (at best half of the cofferdam/barrier can be built at a time due to fish/boat/flow passage), which will considerably lengthen the construction time.
- The in-the-wet installed gates are planned to be maintained in-the-wet in order to avoid the need to resisted de-watering uplift forces on the foundation; while the cofferdam must provide many additional feet of tremie concrete to resist these dewatering uplift

forces, which is both a major cost and a seismic problem due to the mass of the tremie concrete.

- For regulatory reasons associated with fish passage and flood neutral requirements for the levees, the cofferdams associated with in-the-wet construction will need to be designed in a manner to allow them to be readily removed and re-installed. Furthermore, the bracing in a braced cofferdam seriously delays construction time. The cofferdam may need to be removed before half of the dam can be completed and thus three or more stages of cofferdams may be required.
- Limiting the length of the gate monoliths/shells to approximately 24' facilitates installation using a reasonable sized derrick, or catamaran crane
- Many lessons regarding in-the-wet construction techniques have already been learned on other major projects and can readily be applied to these barriers via the use of consultants.

Advantages	Disadvantages
Faster construction	More sophisticated contractors required
Less expensive	Fewer bidders
Less risk of flood damage	QC is more expensive/more difficult
No tremie seal pour required, which results in lower mass and less seismic demand	If required; compaction of liquefiable soils may be more difficult/costly, although this compaction is not currently planned
Less likely to experience delays due to regulatory restraints due to full, or partial closure of rivers/canals	More logistical planning is required
Eliminates the design, cost, and risk of using braced cofferdams	Requires more sophisticated design
Ease of mobilizing floating equipment for work around sensitive levees	Perception of increased risk by contractors may require contractual risk sharing between the government and the Contractor in order to minimize Contractor contingencies
If the gates are pre-installed on the shells, then they can be pre-tested for performance, prior to shell installation	Requires planning in order to minimize the use of divers, which are not efficient underwater

Allows the use of pre-established prefabrication yards for construction of the shells where work and inspection is easier than at the bottom of a cofferdam; furthermore, work in a fabrication yard allows for easier reuse of formwork.	Final connection of the gates must be performed underwater (unless a dewatering box is used; which is not recommended); however, these operations would be the same/comparable to maintenance operations that would be part of the base design
Eliminates the excavation associated with the 8' to 10' thick tremie concrete seal pour associated with in-the-dry construction	
Avoids the risk associated with: 1) over-topping the cofferdam; 2) being required by regulators to remove and replace cofferdams	
The absence of a thick tremie concrete seal pour reduces both dead loads and seismic loads on the foundations	

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FISH STRATEGY

FISH STRATEGY

The fish strategy adopted for this exercise was to minimize the fisheries effect of each alternative, thus avoiding (or minimizing) the mitigation required. Two very different approaches to the solution were presented in the four alternatives developed by the Project Owner.

The first group of alternatives (1, 2, and 3) was represented by the West False River example (Alternative 1). Here, a closure of a major fish migratory corridor, for extended periods of time, is proposed. Such a closure will require fish passage facilities for several species of fish including salmonids (Chinook salmon and steelhead), striped bass, Delta smelt and sturgeon,

The other alternative (4), the Three-Mile Slough example, is located on a less important channel connecting the Sacramento and San Joaquin rivers, and is designed to operate only four hours a day, during the evening ebb tide. The blockage is such a minor portion of the day that fish passage facilities were deemed unnecessary.

The other two alternatives (2 and 3), the East Levee with Two Tide Gates (on False River and Sand Mound Slough), and the Cox Alternative (Gates on Holland Cut and Old River), were not developed to the same level of detail as the first two. It is safe to conclude that fish passage would be a concern with either of these options.

Alternative 1 – Operable Gates on False River – This project, as designed, would block the west end of False River, west of Fishermen's Cut, with an operable gate structure. Three operational scenarios were presented, the gates closed, the gates 20% open, and the gates open and closing with the tide (closed for one ebb to flood tide cycle – twelve hours). Operation studies showed that the open and closing and the 20% open scenarios provided about the same level of salinity reduction at the export facilities, while the full closure scenario provide the greatest benefit. However, the latter also has the greatest fishery effects.

Although anadromous fisheries have declined in the San Joaquin River at a faster rate than in the Sacramento, remnant populations of Chinook salmon continue to utilize the San Joaquin migratory corridor between tributary spawning grounds and the ocean. An approved project yet to be implemented seeks to increase flows down the San Joaquin River from Friant Dam, and reestablish a salmon run in the San Joaquin immediately below the dam. Passage through Frank's Tract is considered an important migratory route for anadromous San Joaquin River fishes. Also, despite the risk of predation by non-native, warm water fishes, Delta smelt have been found in significant numbers in Frank's Tract. Finally, some fish out-migrating from the Sacramento River and entrained in the Delta are likely to end up in Frank's Tract. For these reasons, any barrier that inhibits fish passage through Frank's tract, including obstructions in False River, would have a significant impact on fisheries.

Options for minimizing the closure, partial closures both horizontal and vertical, and duration of closure, were considered and water quality results for a 20% closure were presented.

Because of these concerns resulting from the closure, the alternative would require fish passage facilities (a fish ladder) to ensure migratory fish passage. It is possible that the boat lock (which we also believe will be required), could serve as the fish passage path if the gates could be left open when not in use. Such a mode of operation is being used at the Suisun Marsh (Montezuma Slough) Salinity Control Structure.

Alternative 4 – Operable Gates on Three Mile Slough – Three Mile Slough (TMS) is a channel connecting the Sacramento and San Joaquin rivers, a few miles above their confluence, and is not believed to be a major migration route utilized by anadromous fishes traveling up or down those rivers.

It is possible that adult anadromous fishes returning from the ocean to spawn in the Sacramento River could swim up the San Joaquin River as a result of the current operation of the Delta Cross Channel (DCC) and seasonal diversion of Sacramento River water into the San Joaquin River upstream of TMS. In that event, some of these fishes could use TMS to cross back over to the Sacramento River and get back on track.

Planned operation of a barrier at TMS, however, involves closure for only four hours once daily (or two hours twice daily) during summer and fall. It is unlikely that such infrequent and short interruptions of adult anadromous fish migrations would impact their ability to reach spawning grounds or result in increased predation. Such limited operation is not likely to significantly affect resident fishes either. Furthermore, TMS is only one of several options available for fishes headed for the Sacramento River but accidentally in the San Joaquin River to get back on track. The options include Georgiana Slough, the DCC, and falling back to the tip of Sherman Island.

Because TMS is not a major migratory route, a barrier in the slough would require only short periods of closure for water quality benefits, and other passages exist for fishes in the San Joaquin River headed for the Sacramento River, the proposed barrier in TMS is not likely to affect migration of adult anadromous fishes.

Although out-migrating juvenile anadromous fishes may occasionally pass through TMS on route to the ocean, such passage would essentially be a short detour, and at best would do nothing to facilitate their journey. Occasional closure of TMS, therefore, would not impede out-migrating juvenile fishes either. On the other hand, out-migrating juvenile anadromous fishes traveling down the Sacramento River that pass through TMS are at a higher risk of entrainment in the Delta than they would be if they traveled the more direct path to the ocean provided by the Sacramento River. Closure of TMS, therefore, could benefit out-migrating juveniles. Although operation of the barrier during summer months would be largely restricted to the schedule proposed to manage water quality, this proposal does not include use of the TMS barrier to manage water quality outside of (months?). The TMS barrier, therefore, could be closed in (months?), whenever necessary, to reduce the number of out-migrating juveniles potentially entrained in the Delta via TMS.

Another advantage to fisheries of the TMS barrier is its ability to (sometimes) maintain acceptable export water quality during summer months, even when the DCC is closed. Operation of the DCC is known to result in entrainment of fishes in the central and south Delta, and fisheries concerns sometimes result in closure of the DCC at considerable expense to export water quality. If the moveable barrier at TMS is constructed it may be possible to increase management (closure) of the DCC to benefit fisheries and still maintain acceptable water quality. By monitoring fish migrations and operating both the DCC and TMS barriers it may be possible to reduce entrainment of fishes in the central and south Delta and simultaneously improve export water quality.

We have not identified any significant adverse fisheries impacts likely to result from the proposed construction and operation of a movable barrier in TMS. Rather, by using the TMS barrier to reduce entrainment through TMS, and by managing the TMS and DCC barriers in conjunction to minimize entrainment through the DCC, a movable barrier at TMS is likely to have an overall positive impact on fisheries in the Sacramento River system. From a fisheries perspective the proposed construction and operation of a movable barrier in TMS is the preferred alternative.

Alternative 2 – East Levee + 2 Gates Alternative – This alternative, like the first, closes the migratory path, but at the east end of Frank's Tract False River and Sand Mound Slough. In concept, the impacts are not significantly different from those described for Alternative 1 – Operable Gates on False River. As a result, the same issues will need to be confronted, and mitigated.

Alternative 3 – Cox Alternative – This alternative, as alternatives 1 and 2, closes the migratory path, and like alternative 2 does so at the East end of Frank's Tract. It has the same problems and benefits as alternative 2.

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SECTION 5

DESIGN SUGGESTIONS

SECTION 5
DESIGN SUGGESTIONS

In addition to the Value Alternatives in the previous section, the team generated several other ideas that we have termed design suggestions. These are presented to bring attention to areas of the plan which, in the opinion of the team, should be changed. In general, these ideas were designated as design suggestions rather than Value Alternatives for one of two reasons:

1. The value improvement opportunity is relatively small

2. The concept could not be adequately evaluated or developed within the constraints of the workshop resources

Design suggestions typically are associated with issues such as:

- improved operation
- ease of maintenance
- easier construction
- reduced risk of construction claims
- clarification of construction documents
- or safer working conditions

G-05

Define economic benefits of salinity reduction

The main driver of the project is to reduce salinity at export by eliminating seawater intrusion. While there are substantial economic benefits to be gained by accomplishing this goal, the magnitude of the economic benefit has not yet been quantified. Some of the non-quantified economic benefits that would be experienced from this project include an increase in productivity for agricultural users, reduced costs to urban supply users due to a decrease in stored water required to dilute the exported Delta water, and an increase in stored fresh water available for other users.

In order to accurately measure the benefit of the project and in order to successfully recruit partners for cost sharing, an economic benefit must be demonstrated. Associating a dollar value with the salinity reduction of water exports expected to result from the implementation of this project would assist in selecting the appropriate alternative for the project based on an actual benefit to cost analysis. This would improve how the pilot project information is received and analyzed, and should improve the likelihood of the project being completed.

G-05: One report, prepared for the statewide Salinity Task Force, showed the CUP exported an average of 900,000 tons of salt per year to the San Joaquin River Basin, while the SWP exported an average 1.2 million tons of salt to the Tulane Lake Basin.

Resolution of these exports would reduce the salinity returns from the San Joaquin River.

G-06

Evaluate fishery impacts on a species, alternative, and operation-specific basis

Fisheries impacts of this project should not be oversimplified. It is important to recognize that the Delta supports numerous fish species, including four sensitive species, each with unique habitat movement and life history requirements. Additionally, each project alternative has potentially different impacts. While a movable barrier in Three Mile Slough would minimize fisheries impacts over other alternatives, evaluation of impacts under other alternatives should be considered on a species, alternative, and operationally specific basis.

G-09

Quantify water quality impacts during full range of water years

Over the past 100 years roughly one-third of water years were wet, one-third were normal, and one-third were dry or critical, the four years selected for mathematical modeling were all among the lower one-third, or dry and critical water years. Reiteration of the model utilizing data from a wider range of water years, including below normal, above normal, wet years, and historic periods of multiple dry and critical years, would allow for a more accurate analysis of overall project performance and benefit. This would assist project stakeholders in accurately comparing the project alternatives and ultimate selection. If DWR's Delta Modeling Center has completed model studies similar to the Franks Tract model studies, these should be presented to validate this studies.

G-11

Evaluate potential funding from EPA due to reduction of desertification potential

Desertification of prime agricultural land in the San Joaquin Valley has been identified as a major issue by state agencies. Desertification may be an unpreventable outcome of intensive irrigated agriculture, as salts gradually accumulate in the soil. The application of water with a high EC value from the south Delta to San Joaquin Valley agricultural lanes accelerates this process and the rate of desertification. Considering the value of these agricultural lands and the potential for their loss to impact the food supply of the entire nation, it might be possible to recruit the EPA as a funding partner for this project.

SECTION 6

IMPLEMENTATION DECISIONS

SECTION 6
IMPLEMENTATION DECISIONS

VALUE ALTERNATIVES

The last stage of the Value Study addressed decisions by DWR on which alternatives would be carried forward to the feasibility study for Franks Tract.

The following paragraphs show the decisions reached.

Value Alternatives Accepted for Feasibility Study

These Value Alternatives were accepted for implementation generally as presented in the Value Alternative write-up included in Section 4 of this report.

Alt. No.	Description	Comments
RS-10a	Construct and operate full-height barrier in Three Mile Slough	
RS-10b	Construct and operate partial-height barrier in Three Mile Slough	There are concerns of potentially high velocity flows close to the gates. This may also reduce operational flexibility.
RS-34	Close False River with non-operable barrier during low and critical years	There are concerns of potentially high velocity flows in the vicinity of the notch in the barrier. This non-operable barrier will also reduce operational flexibility.
RS-41a	Construct and operate full-height barrier in False River	
RS-41b	Construct and operate partial-height barrier in False River	There are concerns of potentially high velocity flows close to the gates. This may also reduce operational flexibility.

Rejected Value Alternatives

Some Value Alternatives were rejected from further consideration. A brief discussion is provided below to help explain and to document the rationale behind the rejection of these Value Alternatives.

Alt. No.	Description	Comments
RS-01	Increase the hydraulic capacity of Delta Cross Channel diversions	This concept was also presented in the Value Study Report for the Through Delta Facility with a fish screen on the widened portion of the DCC. It has been rejected from further consideration in the Franks Tract feasibility study but will be further evaluated in the Through Delta Facility feasibility study.

APPENDICES

APPENDIX
A - PARTICIPANTS

APPENDIX A – PARTICIPANTS

FRANKS TRACT — March 19, 2007

Workshop Introduction Meeting

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FRANKS TRACT March 19, 2007

Workshop Introduction Meeting

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FRANKS TRACT

March 19, 2007

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Workshop Introduction Meeting

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Mid-Workshop Review Meeting

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APPENDIX
B - COST INFORMATION

APPENDIX B – COST INFORMATION

Basis for Pricing

The following pricing information was provided to the Value Team for the current project cost estimate.

- Project costs are based on the work being performed by a contractor with prices prevailing during the second quarter of 2007.

- Project costs have not been escalated as there is no schedule. Estimates are in current dollars.

Significant Cost Issues

The price of the gate mechanism has been based on a single quotation for a similar width gate but only 18’ height. We require 30’ of height. The cost of the increase in height has been extrapolated using the “six tenths rule.” This is a common cost engineering adjustment method based on the premise that if something physically changes its cost does not change linearly. The cost of the gate represents about 30% of the construction cost so the quotation price should be further explored and substantiated.

Conclusions

Revised project cost estimates are attached.

Franks Tract VE Study				**3/22/2007**		
Three Mile Slough Gate 540' x 30'						
Construction Cost	**Quantity**	**Unit**	**Unit Price**	**Total**		
Gate Fixed Costs						
Mobilization				500,000		
Contractor General Conditions				1,500,000		
Demonstration Test	1	ls	190,000	190,000		Needed or not?
Subtotal Gate Fixed Cost				**2,190,000**		
Construct 540' x 30' gate						
Underwater Excavation	58,800	cy	30	1,764,000		From Quantity Table
Screeding	1	lot	142,120	142,120		
Underbase Gravel	1,440	ton	50	72,000		From Quantity Table Or Modified, 900 cy based on drawing
Underbase Gravel Cleaning	1	lot	27,720	27,720		
Steel Sheet Piles	65,940	lf	73	4,813,620		From Quantity Table
Driven H Piles	6,750	lf	180	1,215,000		From Quantity Table
Infill concrete	600	cy	703	421,800		From Quantity Table, modified
Pressure Grout	880	cy	644	566,720		From Quantity Table
Precast Concrete	3,200	cy	710	2,272,000		From Quantity Table
Rebar, Precast	480,000	#	1.50	720,000		
Furnish and Deliver Gate ,Rio Vista	16,200	sf	900	14,580,000		Obermeyer Quote Factored $900/sf tall gate, $800/sf for short gate
Assemble Gate to Precast	115	Day	2,500	287,500		Allow 5 days /gate for small crew with hydro crane
Load Precast and Gates	23	hr	1,000	23,000		2 cranes and misc support at Rio Vista, 1 module/gate assy/hr
Transport Modules, Gates	25	day	7,000	175,000		2 deck barges, 1 tug for the duration
Installation Spread	25	day	28,000	700,000		2 cranes, 2 deck barges, Crane and Barge Crews, Small Tug, 23 precast Modules, allow one per day, plus move in and out
Subtotal Gate				**27,780,480**		
		540' wide gate =		**51,445**	/lf	
		16,200 sf gate =		**1,715**	/sf	
Support Structures Fixed Cost						
Control House & Misc						
Dewatering	1	lot	100,000	100,000		Allowance
Clear & Grub	2.1	ac	4,400	9,240		From Quantity Table
General Excavation	10,900	cy	20	218,000		From Quantity Table
Riprap	15,011	ton	35	525,392		From Quantity Table
Geotechnical Fabric	22,800	sy	4	79,800		

Communication Tower	1	ea	17,300	17,300	From Quantity Table
LPG Tank/Distribution System	1	lot	17,000	17,000	
Compacted Backfill	2,700	cy	8	21,600	
Chain Link Fence	131	lf	60	7,860	
Chain Link Gate	3	lot	4,300	12,900	
Metal Beam Guard Rail	32	lf	40	1,280	
Driven Pipe Piles	400	lf	135	54,000	From Quantity Table
Concrete	150	cy	600	90,000	From Quantity Table
Reinforcing Steel	22,650	#	2	33,975	From Quantity Table
Structural Steel Framing	33,000	#	3	99,000	
Concrete Masonry Unit	360	sf	15	5,400	From Quantity Table
Metal Deck, 1.5"	900	sy	30	27,000	
Miscellaneous Metal	21,300	#	3	63,900	
Railing/Handrail	5,300	#	4	18,550	
Building Joint Filler / Water Stop	1	lot	5,600	5,600	
Buoys	28	ea	300	8,400	
Job Sign	1	lot	3,000	3,000	
Sheet Water Proofing	1	lot	5,300	5,300	
Building Insulation	1	lot	6,700	6,700	
Metal Roofing	1,100	sf	8	8,800	
Metal Siding	1	lot	1,420	1,420	
Flashing & Trim	1	lot	14,700	14,700	
Roof Accessories	1	lot	4,800	4,800	
Metal Doors & frames	1	lot	2,000	2,000	
Door Hardware	1	lot	600	600	
Aluminum Windows	1	lot	2,200	2,200	
Resilient Tile Flooring	1	lot	800	800	
Gypsum Board & accessories	930	sf	2.4	2,232	
Architectural Painting	1	lot	22,000	22,000	
Coatings	1	lot	44,000	44,000	
Louvers and Vents	1	lot	1,400	1,400	
Lightning Protection System	1	lot	145,000	145,000	
Flow Meters	1	lot	50,000	50,000	
PLC	1	lot	25,000	25,000	
Fire Alarm System	1	lot	6,700	6,700	
Piping	3,600	lf	27	97,200	
Butterfly Valve	4	ea	570	2,280	
Ball Valve	45	ea	1,650	74,250	
Air Compressor, Receiver	with Gate				
Sump Pump	1	lot	3,600	3,600	
Heat Pump	1	lot	8,100	8,100	
Ducts	1	lot	1,700	1,700	
Exhaust Fans	1	lot	25,000	25,000	
Job Electrical	1	lot	250,000	250,000	
Emergency Generator	1	lot	20,000	20,000	
Distribution Transformer	1	lot	16,000	16,000	
Lighting	1	lot	25,000	25,000	
Communication System	1	lot	50,000	50,000	

Boom Floats	1,290	lf	1,470	1,896,300	2 rows x 600'
Subtotal Other Fixed Cost				**4,232,279**	
Subtotal				**34,202,759**	
Contingency			25%	8,550,690	
Total Estimated Cost				**42,753,449**	

*Source: Grant Line Fabian Canal unless otherwise stated

Franks Tract VE Study False River Gate, 800' x 30'				3/22/2007	
Construction Cost	**Quantity**	**Unit**	**Unit Price**	**Total**	
Gate Fixed Costs					
Mobilization				500,000	
Contractor General Conditions				2,000,000	
Demonstration Test	1	ls	190,000	190,000	Needed or not?
Subtotal Gate Fixed Cost				**2,690,000**	
Construct 800' x 30' gate					
Underwater Excavation	70,700	cy	30	2,121,000	From Quantity Table
Screeding	1	lot	213,180	213,180	
Underbase Gravel	2,240	ton	50	112,000	From Quantity Table , 1400 cy based on drawing
Underbase Gravel Cleaning	1	lot	41,580	41,580	
Steel Sheet Piles	81,540	lf	73	5,952,420	From Quantity Table
Driven H Piles	9,750	lf	180	1,755,000	From Quantity Table
Infill concrete	700	cy	703	492,100	From Quantity Table
Pressure Grout	1,185	cy	644	763,140	From Quantity Table
Precast Concrete	4,650	cy	710	3,301,500	From Quantity Table
Rebar, Precast	697,500	#	1.50	1,046,250	From Quantity Table
Furnish and Deliver Gate ,Rio Vista	24,000	sf	900	21,600,000	Obermeyer Quote Factored Tall gate $900/sf, Short gate $800/sf
Assemble Gate to Precast	185	Day	2,500	462,500	Allow 5 days /gate for small crew with hydro crane
Load Precast and Gates	37	hr	1,000	37,000	2 cranes and misc support at Rio Vista, 1 module/hr, 1 gate/hr
Transport Modules, Gates	39	day	7,000	273,000	2 deck barges, 1 tug for the duration
Installation Spread	39	day	28,000	1,092,000	2 cranes, 2 deck barges, Crane and Barge Crews, Small Tug, 37 precast Modules With Gates Assembled, allow one per day. Plus move in and out
Subtotal Gate				**39,262,670**	
		800' wide gate =		**49,078**	/lf
		24000 sf gate =		**1,636**	/sf
Support Structures Fixed Cost					
Control House & Misc					
Dewatering	1	lot	100,000	100,000	Allowance
Clear & Grub	2.1	ac	4,400	9,240	From Quantity Table
General Excavation	10,900	cy	20	218,000	From Quantity Table
Riprap	23,080	ton	35	807,800	From Quantity Table
Geotechnical Fabric	22,800	sy	4	79,800	
Communication Tower	1	ea	17,300	17,300	From Quantity Table
LPG Tank/Distribution System	1	lot	17,000	17,000	

Compacted Backfill	3,700	cy	8	29,600	
Chain Link Fence	131	lf	60	7,860	
Chain Link Gate	3	lot	4,300	12,900	
Metal Beam Guard Rail	32	lf	40	1,280	
Driven Pipe Piles	400	lf	135	54,000	From Quantity Table
Concrete	150	cy	600	90,000	From Quantity Table
Reinforcing Steel	22,650	#	2	33,975	From Quantity Table
Structural Steel Framing	33,000	#	3	99,000	
Concrete Masonry Unit	360	sf	15	5,400	From Quantity Table
Metal Deck, 1.5"	900	sy	30	27,000	
Miscellaneous Metal	21,300	#	3	63,900	
Railing/Handrail	5,300	#	4	18,550	
Building Joint Filler / Water Stop	1	lot	5,600	5,600	
Buoys	28	ea	300	8,400	
Job Sign	1	lot	3,000	3,000	
Sheet Water Proofing	1	lot	5,300	5,300	
Building Insulation	1	lot	6,700	6,700	
Metal Roofing	1,100	sf	8	8,800	
Metal Siding	1	lot	1,420	1,420	
Flashing & Trim	1	lot	14,700	14,700	
Roof Accessories	1	lot	4,800	4,800	
Metal Doors & frames	1	lot	2,000	2,000	
Door Hardware	1	lot	600	600	
Aluminum Windows	1	lot	2,200	2,200	
Resilient Tile Flooring	1	lot	800	800	
Gypsum Board & accessories	930	sf	2.4	2,232	
Architectural Painting	1	lot	22,000	22,000	
Coatings	1	lot	44,000	44,000	
Louvers and Vents	1	lot	1,400	1,400	
Lightning Protection System	1	lot	145,000	145,000	
Flow Meters	1	lot	50,000	50,000	
PLC	1	lot	25,000	25,000	
Fire Alarm System	1	lot	6,700	6,700	
Piping	3,600	lf	27	97,200	
Butterfly Valve	4	ea	570	2,280	
Ball Valve	45	ea	1,650	74,250	
Air Compressor, Receiver	with Gate				
Sump Pump	1	lot	3,600	3,600	
Heat Pump	1	lot	8,100	8,100	
Ducts	1	lot	1,700	1,700	
Exhaust Fans	1	lot	25,000	25,000	
Job Electrical	1	lot	250,000	250,000	Solar power system
Emergency Generator	1	lot	20,000	20,000	
Distribution Transformer	1	lot	16,000	16,000	
Lighting	1	lot	25,000	25,000	
Communication System	1	lot	50,000	50,000	
Boom Floats	1,900	lf	1,470	2,793,000	2 rows x 850'
Subtotal Other Fixed Cost				**5,419,387**	
Subtotal				**47,372,057**	

Contingency	25%	11,843,014
Total Estimated Cost		**59,215,071**

*Source: Grant Line Fabian Canal unless otherwise stated

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APPENDIX
C - CREATIVE IDEA LISTING

APPENDIX C – CREATIVE IDEA LISTING

IDEA NO.	IDEA DESCRIPTION	RATING
RS-1	Increase the hydraulic capacity of Delta Cross Channel diversions	4
RS-2	Reduce export	3
RS-3	Do nothing to Franks Tract. Build peripheral canal or Through Delta Facility	3
RS-4	Enlarge Georgianna Slough	0
RS-5	Fill in Franks Tract	0
RS-6	Construct barrier across San Joaquin River	0
RS-7	Convert Franks Tract into fresh water reservoir by isolating tidal prism	0
RS-8	Use pipeline from Sacramento River to export location	1
RS-9	Construct permanent, non-operable barrier at False River. Enlarge Fishermans Cut to retain circulation of Franks Tract	0
RS-10	Increase fresh water supply to Delta system	1
RS-10	Operate barrier in Three Mile Slough	7
RS-11	Operate barriers in Three Mile Slough and False River	0
RS-12	Restore Franks Tract levee system to create dry island	0
RS-13	Flood additional islands to increase fresh water storage	0
RS-14	Store high tide south of False River	0
RS-15	Construct salinity barrier at Carquinez Straight	0
RS-16	Construct salinity barrier at Golden Gate Bridge	0
RS-17	Construct another cross channel from Sacramento River to San Joaquin system	2
RS-18	Connect Three Mile Slough to Sacramento River further north	2
RS-19	Divert Sacramento into San Joaquin at delta cross channel	0
RS-20	Increase the hydraulic efficiency of the Mokelumne River	3
RS-21	Flood Staten Island to increase fresh water storage	0
RS-22	Flood islands to create string of lakes north of Franks Tract	1
RS-23	Dredge rivers to increase capacity of river systems upstream of export locations	0
RS-24	Isolate Old River from Franks Tract using levee system and two gates	0
RS-25	Isolate Franks Tract by constructing barriers on Holland Cut and Old River	0
RS-26	Install artificial kelp to reduce river velocity	0
RS-27	Construct in-delta reservoir to capture fresh water for direct delivery to pump that operates above high tide	1
RS-28	Enlarge Dutch Slough and Sand Mound Slough. Construct barrier to capture flood flows and extract ebb flows	2
RS-29	Install tidal barrier on False River. Enlarge Dutch and Sand Mound Sloughs to discharge San Joaquin	1
RS-30	Construct permanent barrier on False River. Construct small, operable barrier on Little Franks Tract outlet	0
RS-31	Construct check valve on Dutch Slough at Big Break to eliminate eastern flow	1
RS-32	Use siphon to pump water from Sacramento River to San Joaquin	0
RS-33	Increase allowable salinity limits at Emmanton	0
RS-34	Close False River permanently during critical years	4
RS-35	Construct groins on Sacramento River downstream of Three Mile Slough	1
RS-36	Construct operable groins on Sacramento River to increase head into Three Mile Slough	4

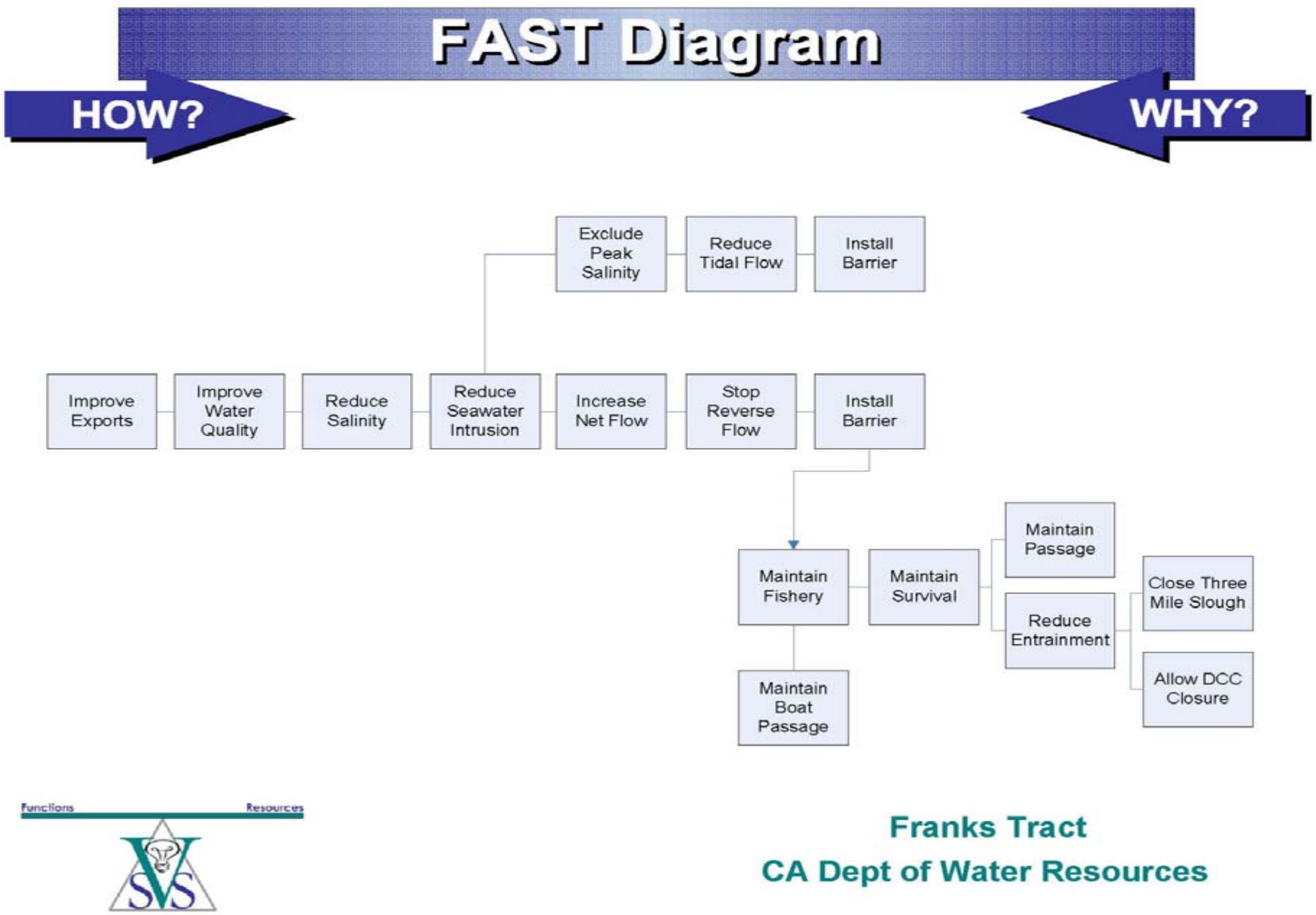
IDEA NO.	IDEA DESCRIPTION	RATING
RS-37	Construct levee across Sherman Island to increase diversion potential from Sacramento to San Joaquin	0
RS-38	Construct hydraulic impediments on San Joaquin to reduce sea water advancement	3
RS-39	Construct treatment plant to treat agricultural outflows to San Joaquin	0
RS-40	Rehab Delta Cross Channel and optimize operations to maximize water quality at export	7
RS-41	Construct operable barrier on False River	4
MF-1	Use Three Mile Slough to allow closure of Delta Cross Channel when sensitive fish species are potentially moving through the channel	4
MF-2	Use Three Mile Slough as barrier to fish crossing	5
MF-3	Construct fish ladders	0
MF-4	Construct culverts	1
MF-5	Construct shallow diversion channel around barriers for fish movement	2
MF-6	Use boat lock for fish passage	1
MF-7	Collect and transport fish around barriers	0
MF-8	Allow salt water intrusion to system to reduce/eliminate invasive species	0
MF-9	Operate barriers tidally to optimize benefits to fish species	2
MF-10	Incorporate gaps in barriers to allow fish to pass	0
MF-11	Leave barriers open to maximum extent minimize fish impacts	DS
MF-12	Operate Three Mile Slough barrier on both ebb tides for reduce time to accommodate fish. Use boat lock for boat traffic.	4
MF-13	Minimize fish cover provided by structures	1
MF-14	Do not allow fish passage through False River to reduce Delta Smelt at export station	0
MF-15	Use salinity barriers to control salinity in water to the advantage of fish species based on the time of year	2
MB-1	Construct boat lock	6
MB-2	Utilize boat hoist	0
MB-3	Provide boat portage system	1
MB-4	Construct boat bypass channel	3
MB-5	Minimize barrier closure times during active boating times	5
MB-6	Construct barrier that does not impede surface traffic	1
MB-7	Utilize alternate routes in lieu of boat passage structure	0
MB-8	Prohibit boat passage at barriers	0
MB-9	Operate barriers for emergency vehicles only	1
MB-10	Provide manually operated boat locks for boat operators to control	0
MB-11	Use operable groins to eliminate requirements for barrier	4
B-1	Reduce number of Obermeyer gates, replace with culverts	4
B-2	Utilize partial height, submerged barriers	5
B-3	Use curtain with culverts for barrier	0
B-4	Use rock for barrier	4
B-5	Use sector gates	0
B-6	Use wicket gates	0
B-7	Use float-in, sinkable structure for barrier	7

IDEA NO.	IDEA DESCRIPTION	RATING
B-8	Use sliding gate	0
B-9	Use butterfly gate	0
B-10	Use louvered gates	0
B-11	Use Thames River-type gate	0
B-12	Use tidally activated gates	2
B-13	Use one-way check valves on culverts	0
B-14	Use stop logs structure	0
B-15	Use curtain barrier to isolate Old River in lieu of levees	0
B-16	Narrow gate structure on Three Mile Slough, allow flooding of adjacent island to maintain flood neutral	2
B-17	Construct concrete sheetpile for Franks Tract levee	2
B-18	Use dump rock levee to isolate Old River from Franks Tract	1
B-19	Construct rock dike across False River with culverts	0
B-20	Construct sheetpile levee to isolate Old River	0
B-21	Use sheetpile levee with Culvert across False River	0
B-22	Use hydraulically inflated barriers	2
B-23	Use bottom-hinged gate with pneumatic actuator	7
B-24	Use bottom-hinged gate with hydraulic actuator	2
B-25	Use floating miter gates	3
B-26	Construct frame structure for use with rocks, curtain, etc.	1
B-27	Construct fixed barrier with siphon pumps	0
C-1	Prepare in-wet abutments, with float-in gates	5
C-2	Use lift-in, prefabricated bottom-hinge gates	3
C-3	Install bottom-hinge gates with bottom-dump barge	0
C-4	Use sinkable barges with prefab gates installed	3
C-5	Use geotubes in lieu of rock for barrier construction	0
C-6	Construct half coffer dam at one time using dry construction	0
C-7	Phase construction to accommodate fish	2
C-8	Phase construction limit impacts to boat traffic (Labor Day to Memorial Day)	0
G-1	Channel encroachment to be easily removable in flood emergencies	1
G-2	Evaluate flood neutral requirements of project	2
G-3	Evaluate whether alternatives other than Alternative 4 affect operations of Delta Cross Channel	1
G-4	Evaluate phased operations of Delta Cross Channel to enhance water quality impacts of alternatives	2
G-5	Define economic benefits of salinity reduction	5
G-6	Evaluate fishery impacts on a species, alternative, and operation-specific basis	2
G-7	Evaluate effectiveness of partial barriers vs. full-width barriers	1
G-8	Quantify reservoir impacts due to water quality improvements	1
G-9	Quantify water quality impacts during full range of water years including multiple year evaluation	3
G-10	Coordinate data with DWR's Delta Modeling Center	0
G-11	Evaluate potential funding from EPA due to reduction of potential desertification of agriculture land due to salt reduction	1
G-12	Coordinate EC reduction relationship with water quality standards	0

IDEA NO.	IDEA DESCRIPTION	RATING
G-13	Check export water rights to limit water quantity usage with increase in water quality	0
G-14	Evaluate impacts of barriers on seepage through levees	1
G-15	Conduct further geotechnical investigations at proposed locations prior to final selection	0
G-16	Every possible opportunity to gather data after implementation should be exploited	1

APPENDIX
D - FAST DIAGRAM

APPENDIX D – FAST DIAGRAM



APPENDIX
E – MATERIALS PROVIDED

APPENDIX E – MATERIALS PROVIDED

Ref#	Document	Prepared by	Date
1	Flooded Island Pre-Feasibility Study Report	EDAW	January 30, 2005
2	Flooded Island Pre-Feasibility Baseline Report	EDWA	February, 2005
3	Flooded Islands Pre-Feasibility Study; Alternative Modeling Report	RMA	June 30, 2005
4	Flooded Islands Pre-Feasibility Study; Delta Model Calibration Report	RMA	June 30, 2005
5	Hydrodynamic Modeling Results for each of the four alternatives	DWR	March 19, 2007
6	Engineering Drawings for Each Alternative a. Site Plan b. Elevations c. Section (Three mile Slough).		
7	Quantity Estimates for Franks Tract Pilot Project		March 15, 2007
8	VE Kickoff Meeting Powerpoint Presentations Handouts a. Background Information, Don Kurosaka, DWR b. Project Overview, Ajay Goyal, DWR c. Fisheries Impacts, Mark Bowen		
9	Franks Tract Pilot Project Summary Paper		March 19, 2007
10	Status of Trends of Delta-Suisun Services	URS Corporation	March 2007