Contra Costa County
Flood Control
& Water Conservation District

LOWER WALNUT CREEK CORRECTIVE ACTION PLAN

PREPARED FOR THE US ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT

JUNE 28, 2007

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EXECUTIVE SUMMARY

This Corrective Action Plan is the official response of the Contra Costa County Flood Control and Water Conservation District (District) to the March 30, 2007 notification by the US Army Corps of Engineers (Corps) that deficiencies in the Lower Walnut Creek Channel need to be addressed to the Corps' satisfaction. This plan, including the attached appendices, details the various corrective measures considered and their analysis, combination, and ranking as viable alternatives. Finally, the plan sets forth the District's preferred corrective action alternative (Alternative 2d) and provides the technical information supporting this preferred alternative, including the implementation schedule and a phasing plan. Also included are discussions on residual risk, potential changes to the original 1965 Operations and Maintenance Manual, the District's outreach efforts, and an evacuation plan.

The District is currently working with the Sacramento District of the Corps on a General Reevaluation Study on this reach of Walnut Creek, with the ultimate goal of implementing a more sustainable channel that needs less frequent dredging. Early work on the General Reevaluation Study has confirmed the presence of significant habitat for four State and / or Federal listed species in the most downstream reach of the channel, from the mouth to the Burlington Northern Santa Fe (BNSF) Railroad.

When the regulatory agencies were presented with the concept of dredging the channel back to the as-constructed condition, their informal feedback made it clear that the area downstream of the BNSF Railroad was very important habitat and getting permits would be very difficult if not impossible. It was also clear that, given the habitat complexities in this portion of the channel, it would be impossible to issue permits in time for the 2007 construction season. This forced the District into a two phased approach to implementing this Corrective Action Plan.

Phase I, focuses on the reach of Lower Walnut Creek between the BNSF Railroad and the Clayton Valley Drain, and the lowest reaches of Grayson Creek and the Clayton Valley Drain, a total distance of approximately 13,000 feet or 2.5 miles. For Phase I work, the District proposes to:

1. Remove approximately 200,000 cubic yards of sediment to restore hydraulic conveyance.
2. Raise the height of approximately 12,000 linear feet of levees by approximately 0.5 to 1.5 feet to restore the original design levee elevation.
3. Revegetate the disturbed areas with appropriate wetland and upland species.
4. Implement appropriate best management practices (BMPs) to minimize impacts to the creek environment outside the work area.

The District is currently securing the needed regulatory permits as well as completing design documents covering this work in order to implement Phase I of this Corrective Action Plan by November 2007. The estimated cost of Phase I work is $8,300,000.

Phase II work includes items identified in the Corps' March 30, 2007 letter that must be deferred to the following construction season due to constructability and permitting timelines. Phase II work includes:

1. Removing encroachments and restoring approximately 2,300 linear feet of levee on the right bank of Grayson Creek between State Highway 4 and Interstate 680. The process of removing encroachments cannot be completed in time for the 2007 construction season. The Grayson Creek levee work is scheduled to be complete by fall 2008 and is estimated to cost approximately $250,000.

2. Dredging and raising levees on the lowest reach of Walnut Creek from the mouth up to the BNSF Railroad. The schedule for completing work downstream of the BNSF Railroad is dependant on resolving the permitting issues with the State and /or Federal listed species in this reach. The estimated cost for this work is in excess of $40,000,000.

The Lower Walnut Creek Channel has a history of excessive sedimentation dating back to when the facility was constructed in 1965 and needed extensive dredging only eight years later. This Corrective Action Plan contains a discussion of the sediment location and accumulation rates, and Appendix B contains the Corps 1973 report on the amount of sediment.

Five main alternatives were analyzed and ranked in this Corrective Action Plan. The alternatives included both work downstream and upstream of the BNSF Railroad. Each alternative was analyzed and scored quantitatively for hydraulic performance, constructability, cost, environmental impact, and effect on minimizing residual risk. The analysis is based on a 10-year lifespan, which is when the District expects the General Reevaluation project to be implemented.

Alternative 2d ranked highest, became the preferred alternative, and is proposed to be implemented as the Phase I project described above.

Alternatives 1 and 4 ranked much lower. Alternative 1 – restoring the entire leveed system to 1965 conditions – was by far the most expensive and least sustainable alternative and had the largest environmental impact. It also ranked low for constructability because it would be impossible to construct it within the Corps 1-year rehabilitation timeline and because of its incompatibility with the ultimate General Reevaluation project. Alternative 4 – a reduction in the scope of Alternative 1 – also ranked poorly for the same reasons.

The District remains concerned about fundamental incompatibilities between the General Reevaluation Study (a long-term, sustainable solution) and the Corps-mandated dredge downstream of the BNSF Railroad (a costly and short-term solution, at best). The District understands the work downstream of the BNSF Railroad is mandated by the Corps to retain the active status of this portion of the facility, although getting permits to do the dredge work may not be feasible. The District believes that implementing the recommended plan from the General Reevaluation Study will result in a sustainable channel – balancing flood damage reduction and ecosystem restoration – and represents the ultimate solution to this dilemma of conflicting requirements. This is the District's long-range vision, a vision we believe we share with the Corps.

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SITE LOCATION AND DESCRIPTION

The Lower Walnut Creek Channel is located in the north, central portion of Contra Costa County and drains a watershed of over 146 square miles. Tributary to the Lower Walnut Creek Channel are many creeks in Central Contra Costa County that drain the communities of Concord, Walnut Creek, Pleasant Hill, Lafayette, Alamo, Danville, and portions of Martinez, Moraga, and San Ramon. The lowest 3.7 miles of Lower Walnut Creek Channel are tidally influenced. The photo on the cover of this Corrective Action Plan is of the Lower Walnut Creek Channel looking downstream at Imhoff Drive and is typical of the channel in this reach.

Figure 1 is an overview map of the Lower Walnut Creek Channel area showing surrounding land uses, railroads, and highways. The Tesoro Oil Refinery is located to the east of the channel, and to the west of the channel are the Pacheco Marsh, the ACME Landfill, the closed IT Baker hazardous waste disposal site, the Central Contra Costa Sanitary District (CCCSD) treatment plant and the Buchanan Field Airport.

DESILTING HISTORY

The Lower Walnut Creek Channel was constructed in 1965 as a wide, earth-lined channel designed to safely pass the 1%-chance storm event. The lowest 3.6 miles were designed with a flat bottom and no low-flow channel. In the 7-year period immediately following the channel construction, the channel filled with sediment at a rate much greater than was planned in the original design. In 1972, The Corps of Engineers (Corps) issued "Letter Supplement #3 to Design Memorandum #1" addressing the increased sediment rate. A copy of the Letter Supplement is included in Appendix B. The conclusions of the Letter Supplement report were:

a. Since Completion of the original dredging in 1965, sedimentation in the project channel from Suisun Bay to the AT&SF RR has been above normal, when compared with pre-project estimates;

b. Shoaling of the lower reaches of Walnut Creek has progressed to where the hydraulic capacity of the flood-control channels has been impaired and restoration to the design configuration is required;

c. The extraordinary nature of the sedimentation quantities requires an equitable cost sharing arrangement with the Federal Government participating in the cost of restoration of the channels.

In 1973, the Corps' contractor dredged the channel from the mouth to the AT&SF (now the BNSF) Railroad Bridge. Approximately 850,000 cubic yards (cy) of material was removed and placed on the adjacent Pacheco Marsh parcel at the mouth of Walnut Creek.

Between 1986 and 1989, the District removed approximately 276,000 cy of sediment from the non-tidally influenced portions of the channel between Clayton Valley Drain and Drop Structure #1. This helped restore hydraulic capacity in this reach. In the early 1990s, the District estimated that 650,000 cy of sediment had accumulated in the area dredged by the Corps in 1973, and began plans to remove that material again. After significant effort and expenditure of resources to secure the

Overview Map For Lower Walnut Creek

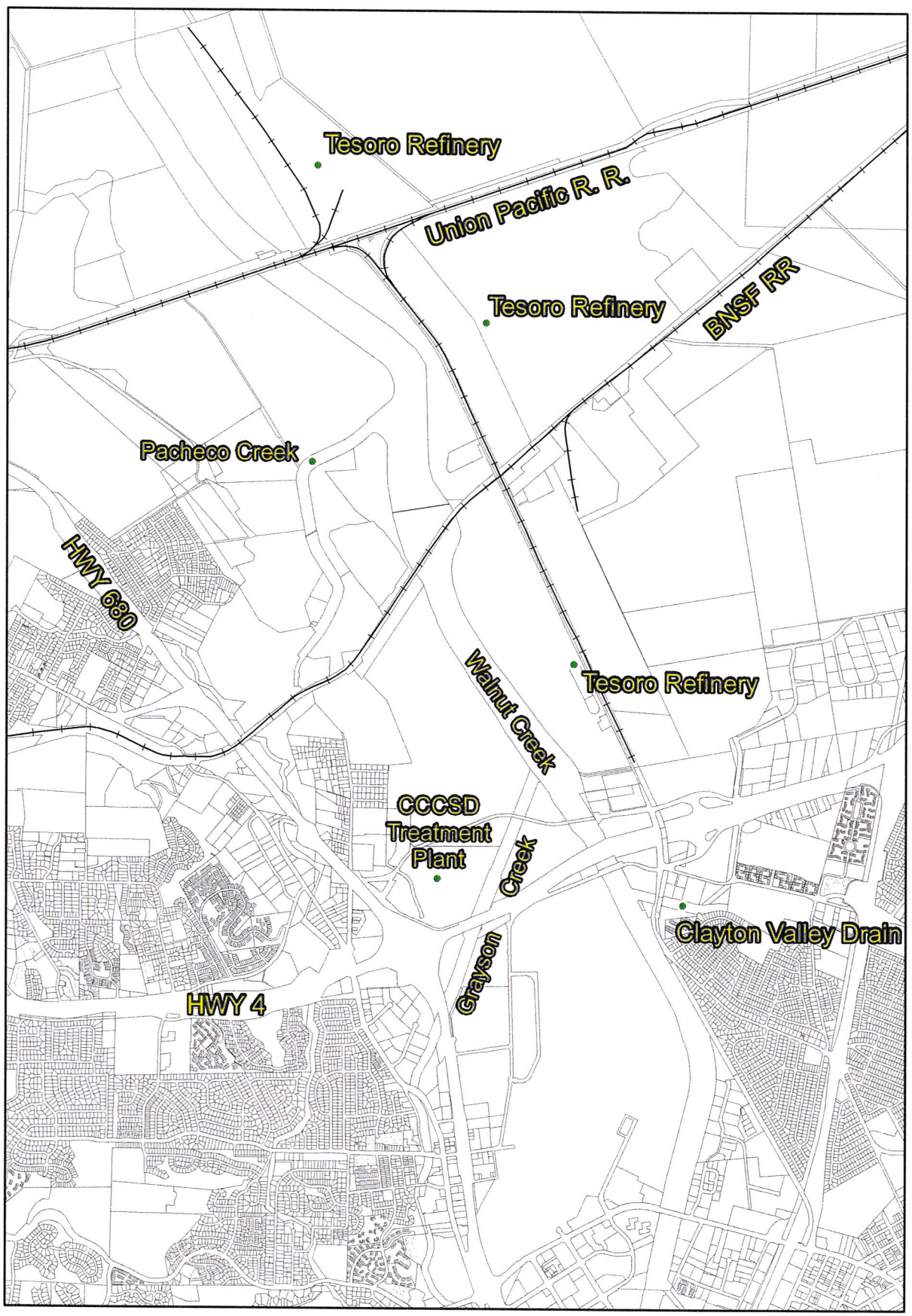

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Figure 1

Produced by S. Yu, FWD 6/4/2007
Using Contra Costa County GA Data &
U.S. Army Corp of Engineers Flood Elevation Data

needed regulatory permits, the District determined that the dredging work was unlikely to be permitted due to significant environmental impacts, with costly mitigation that far exceeded the District's financial resources. Therefore, the District's focus shifted again to sediment removal farther up in the watershed, where habitat and species impacts were much less. In 1993 and 1995, over 76,000 cy of sediment was removed from Walnut Creek between Pine Creek and Drop Structure #1. And in the summer of 2006, an additional 25,500 cy of sediment was removed from Walnut Creek in selected upland areas between Concord Avenue and Drop Structure #1.

COLLABORATIVE PROJECT WITH THE US ARMY CORPS OF ENGINEERS

Once it became clear to the District that the maintenance practices outlined in the project's Operation and Maintenance Manual were not practical due to regulatory requirements, the District turned to the Corps for assistance. The Corps agreed that a review of the original design concept was needed. With congressional authorization, the Corps completed a reconnaissance study that determined that there was Federal interest in proceeding with the planning process. In 2003, the District and the Corps developed a Project Management Plan and signed a Federal Cost Share Agreement for the Lower Walnut Creek General Reevaluation. This project, also known locally as the Lower Walnut Creek Restoration Project, includes the following as the study objectives:

> *[The] Project will reevaluate the traditional methods of operating and maintaining a flood control facility for the purposes of incorporating ecosystem restoration objectives. The existing floodway is a classic trapezoidal earth channel that has historically been desilted in order to maintain the original design capacity. This General Reevaluation will study alternative methods to this practice including but not limited to the setback of levees along the lower reaches of the creek to recreate a larger floodplain. These alternatives will focus on providing the capacity necessary for flooding while creating additional wetlands riparian habitat and the potential for revegetation throughout the floodplain.*

To date, the Corps/District partnership has produced a number of very useful products, including current photogrammetric and bathymetric surveys of the channel and deposited sediment, an unsteady flow hydraulic model of the existing conditions, habitat and wildlife surveys of the creek corridor, a vacant lands study, a salmonid viability study, and other baseline studies.

Progress on the General Reevaluation Report (GRR) has been much slower than planned, however, because of a shortage in federal funding. While remaining optimistic, the District realistically expects an ultimate solution can be implemented no sooner than seven to ten years from now.

LOCATION AND VOLUMES OF SEDIMENT — ACCUMULATION RATES

One of the most anticipated products of the GRR is the watershed-wide sedimentation study. It is expected to update the 1963 and 1972 estimates of sediment production from the watershed and determine accumulation rates in the various reaches of the channel. However, until this analysis is completed, the District has had to refer to estimates of sediment accumulation based on historic removal volumes and recent sediment surveys.

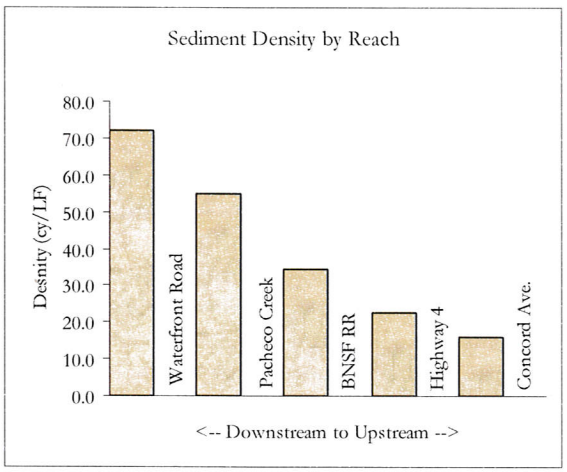
The recent photogrammetric, bathymetric and field surveys have produced a detailed picture of both the volume and location of deposited sediment. The results, summarized in Table 1 below, show that nearly half of the sediment volume in the entire system is located in the most downstream reach of the channel from the mouth to Waterfront Road. It is interesting to note that the reach where 850,000 cy was dredged by the Corps in 1973 (Mouth to BNSF RR) now contains over 810,000 cy of deposited sediment. Less detailed survey data from the early 1990s indicates that a majority of this sediment had been deposited before that time. This indicates that after a change in

Reach	Sediment Volume for reach cy	Sediment Volume Cummulative cy	Accumulation from	Accumulation to	Accumulation Rate cy/yr	Reach Length LF	Sediment Density cy/LF
Mouth to Waterfront Road	481,600	481,600	1974	2004	16,030	6,700	71.9
Waterfront Road to Pacheco Creek	219,700	701,300	1974	2004	1,320	4,000	54.9
Pacheco Creek to BNSF RR	109,500	810,800	1974	2004	3,650	3,200	34.2
BNSF RR to Highway 4	153,700	964,500	1965	2004	3,940	6,800	22.6
Highway 4 to Concord Ave.	122,200	1,086,700				7,700	15.9

Table 1—Sediment Volume and Density

the channel condition (such as the initial channelization or subsequent dredge), the rate of sediment accumulation is high and decreases as the channel reaches a stable, steadier geometry. This lowest reach of the channel appears to have reached this relatively stable state. As such, a full dredge in this lowest reach is only expected to be effective for a very limited period of time before dredging is needed again. As part of the GRR project, the District desires to develop a more sustainable solution.

It is also interesting to note how the density of sediment varies by reach of the channel. The most downstream reaches have a much higher density of sediment than those located farther upstream. A utility crossing near Highway 4 acts as the upper limit of tidal influence. The trend of decreasing density is clear downstream of this location, indicating that the deposition of sediment may be governed more by channel slope and geometry than tidal influence. The more detailed sediment study in the GRR is expected to bring additional clarity to these matters.



A map and table showing the location of density of sediment is included in Appendix C.

EXISTING CONDITION HYDRAULICS

The task was to compare the hydraulic performance of the channel in its existing condition to its performance upon its construction in 1965. To be a valid comparison, as many design parameters as possible needed to be held as constant. With the exception of the changed topography, all the original design parameters were validated and retained in the existing condition hydraulic analysis.

THE DESIGN PARAMETERS

The basis for the original design is detailed in the Corps' Design Memorandum #1 from January 1963. The design "n-value," or roughness, was 0.030, reflecting the presence of short grasses and shrubs with no woody vegetation. Field inspection of the channel verified that this design n-value accurately reflects the currently maintained condition.

The original design 1%-chance flowrates on Walnut Creek are shown in the adjacent table. Leveed sections, located in much of the channel downstream of Concord Avenue, were designed to contain the water surface with 3-feet of freeboard. Non-leveed sections, such as the channel upstream of Concord Avenue, were designed to have 1-foot of freeboard above the 1%-chance storm water surface.

Reach		Flowrate
From	To	cfs
Mouth	Grayson Creek	25,000
Grayson Creek	Pine Creek	22,500
Pine Creek	City of Walnut Creek	18,000

In 1963, the project was designed using the NGVD 1929 datum. The recent aerial photogrammetry was prepared using the NAVD 1988 datum. All work as part of this corrective action plan used the NAVD 1988 datum. At the project site, the datum equation used was NGVD 1929 elevations + 2.6 feet = NAVD 1988 elevations. The original design used a tailwater of a 4.0 MHHW tide (NGVD). The recent calculations used the same MHHW tide tailwater, but converted to 6.6 feet (NAVD).

With anticipated future climate change, both the design hydrology and tailwater are expected to increase. However, these changes were not incorporated in this analysis because the purpose of this study was to compare the existing performance to the original design. It is anticipated that the future GRR hydraulic analysis will revisit these design parameters and update them as needed to reflect a long-term sustainable solution.

Modeling technology has progressed steadily since the original design effort in the early 1960s. Despite the vast improvements in display and data input technology, the latest versions of the Corps' standard HEC-RAS model still uses the same one-dimensional energy balance equations that were used in the original calculations. Using the same modeling method helped to ensure a valid comparison between the original design calculations and the current hydraulic performance.

The levee freeboard calculations were made simply by subtracting the calculated water surface elevation from the design levee grade, as was done in the original design. To ensure the most direct comparison between the design and current conditions, this method was chosen over the more current "risk and uncertainty" methodology.

It is important to note that the certain section of the levees have settled by as much as 2 feet since their original construction. The levee settlement is most prevalent in the most downstream reach of the channel, where the levees are underlain by a deep layer of Bay Mud. As a past maintenance activity, the District has raised portions of these levees back to the design grade.

HYDRAULIC MODEL DESCRIPTION

The hydraulic performance of the existing channel condition, the contemplated measures, and the various alternatives were determined using the unsteady flow simulation in version 3.13 of the Corps' Hydrologic Engineering Center River Analysis System (HEC-RAS). The topography of the existing channel condition came from the July 2004 aerial photogrammetry with supplemental ground-truthing and bathymetric surveys. The topography was processed in In-Roads design

software (Bentley, 2006) and cross sections were cut perpendicular to the original channel centerline alignment and exported to the HEC-RAS model.

The hydrology used in this design study was based on a combination of new and old work. A draft hydrology report was issued for peer review by the Corps as part of the current GRR work. This new study contains design hydrographs for Lower Walnut Creek and its various tributaries. However, as the scope of this Corrective Action Plan is limited to analyzing the flowrates used in the original design, the newly calculated hydrographs were reduced proportionally so that the peak flow matched the original design value. Coincident flowrates were assumed for the tributaries to Walnut Creek within the project area (Pacheco Creek, Grayson Creek, and Clayton Valley Drain).

The HEC-RAS geometry file was developed with a series of side flow weirs serving offline storage areas. These weir profiles were extracted from the existing channel levee elevations (for cases of storage areas adjacent to the channels) and from the existing ground elevations (for cases of weirs between off-channel storage areas). The result was model geometry that included 31 storage areas that are used to determine the location, volume, and duration of flooding when the design hydrograph exceeded the channel capacity.

Scott Stonestreet of the Corps Hydraulic Design Section was instrumental in developing the HEC-RAS model up to this point. The District looks forward to continued collaboration with the Corps on model development as part of the GRR process.

The unsteady flow simulation of the 1%-chance storm provided both tabular data by cross section and GIS data of the extent and depth of the floodplain. This data is included in Appendix D. The GIS data for the 1%-chance storm, shown in Figure 2, indicates shallow flooding along Waterfront Road, through Pacheco Marsh and to a section of marsh to the northwest. An analysis of the elevations of these areas shows that the area is inundated by the 6.6-foot MHHW used as the tailwater for the model. Other inundated areas include the marsh area surrounding the ACME fill site, the Martinez Gun Club (when the high tailwater from Walnut Creek backs up Pacheco Creek and overtops the low portion of the Pacheco Creek levee on the gun club's frontage), the north portion of the capped IT Baker site, portions of the Conco Concrete facility, a buffer area at the northeast corner of the CCCSD treatment plant, a small area near Highway 242 where the levee has been lowered, and a small area at Buchanan Field Airport.

It is important to note that the sewage overflow ponds in the CCCSD treatment plant were included as storage areas to accurately model the extent of any floodplains in this area. Storage areas for CCCSD "Basin A North" and "Basin A South" include a starting volume assuming some sewage overflow coincident to the 1%-chance storm. But because the levees surrounding the plant are higher than the calculated 1%-chance water surface elevation, the levees do not overtop and the CCCSD storage areas were not used for stormwater storage. The inundation of these areas shown on the plans is the result of the starting wastewater surface assumption, not of stormwater passing over the levees. The one location where the levees overtopped at the CCCSD property is the buffer area at the extreme northeast corner of the plant where a low point in the levee allowed stormwater to pass through the CCCSD fence onto a 4 acre buffer area adjacent to the CCCSD railroad spur.

Lower Walnut Creek 1% Chance Floodplain

6/21/07 PRD

Legend

Assessor's Parcels

Exist Cond Floodplains

Value

High : 21

Low : 0.000002

N

0 0.05 0.1 0.2 0.3 0.4 Miles

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Figure 2

The 1%-chance water surface elevation was then compared to the surveyed levee elevation at each cross section location to determine the actual freeboard. This freeboard data was ranked into the following four categories:

- Negative Freeboard (channel overtops) — shaded red
- Freeboard between 0 and 1 foot, shaded blue
- Freeboard between 1 and 3 feet, shaded green
- Freeboard greater than 3 feet, unshaded

This data was then graphically displayed on a map of the channel and surrounding properties. A copy of this map is included as Figure 3, and a larger version of the map is included in Appendix D.

With a good understanding of the performance with the 1%-chance (100-year) storm, the focus shifted to determining the actual hydraulic capacity in areas that could not contain the 100-year storm. To do this, the frequency — flow curves in the Corps' project Design Memorandum were consulted to determine the flowrates of a 10, 20, 30, 40, 50, 60, 70, 80 and 90 year storms. These flowrates, noted in Appendix D, were included in a steady-flow version of the HEC-RAS model to determine when the water surface elevation corresponding to a given flowrate exceeded the levee elevation at a given station. This data was then noted as the channel capacity of that cross section. With the exception of the low, unleveed areas on the Tesoro Refinery near the Waterfront Road crossing of the channel, portions of the channel had a capacity of between a 40 and 50-year storm from between the mouth and BNSF Railroad. A majority of the expected inundation was characterized by shallow flooding at the Waterfront Road marsh area, the IT Baker site, the buffer area of the ACME Landfill, and the Martinez Gun Club.

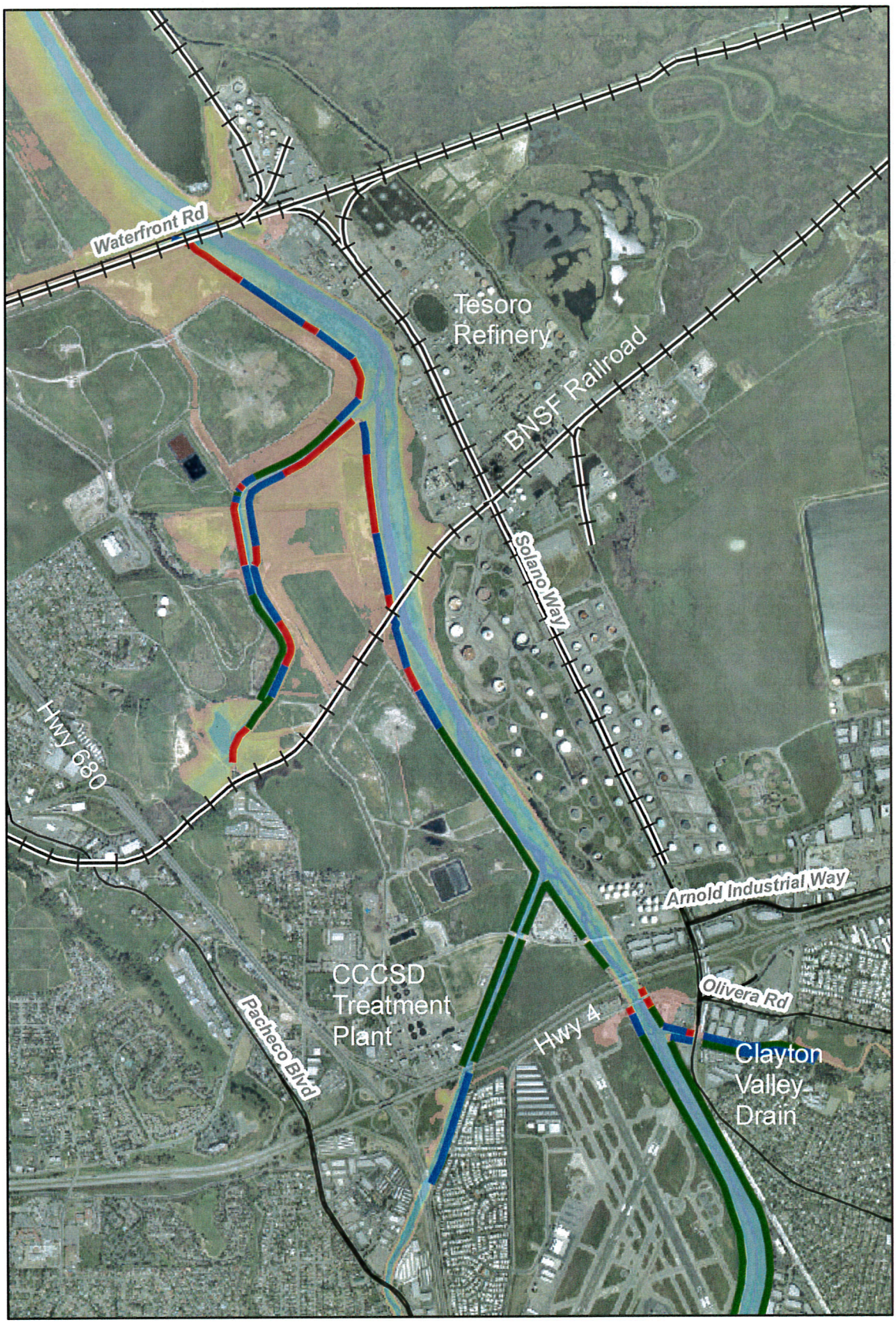
The numerical box showing the channel capacity at sections with negative freeboard was added to the display drawing showing the four freeboard categories.

A larger version of this display drawing was used in the District's outreach efforts to the various watershed stakeholders. Details of these stakeholder meetings are included later in this Corrective Action Plan.

COMPARISON BETWEEN CALCULATED AND FEMA FLOODPLAINS

Now that the capacity of the channel was well understood, the next logical step was to compare this newly calculated, detailed data to that shown on the latest FEMA Flood Insurance Rate Map (FIRM). The FIRM for this area is a combination of a detailed study of the portion of Walnut Creek Channel from Waterfront Road to Grayson Creek that included base flood elevations and a less detailed study supporting an "unnumbered A-zone" floodplain. The FIRM panels for this area date from 1987 and 2001. Figure 4 shows the FEMA FIRM data superimposed onto the newly calculated floodplains. A larger version of this figure is included in Appendix E.

Comparison of the two datasets shows that the FIRM data significantly underestimates the current capacity of the channel. Locations within the FIRM A-zone but outside the District's calculated floodplain include the Central Contra Costa Sanitary District treatment facility and the commercial/light industrial area near Marsh Drive along the Clayton Valley Drain. This figure showing the two floodplains was shared with FEMA representatives at their Provisional Levee Accreditation meeting on April 25, 2007.



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Existing Hydraulic Performance Of Army Corps of Engineers Levees
Figure 3

N

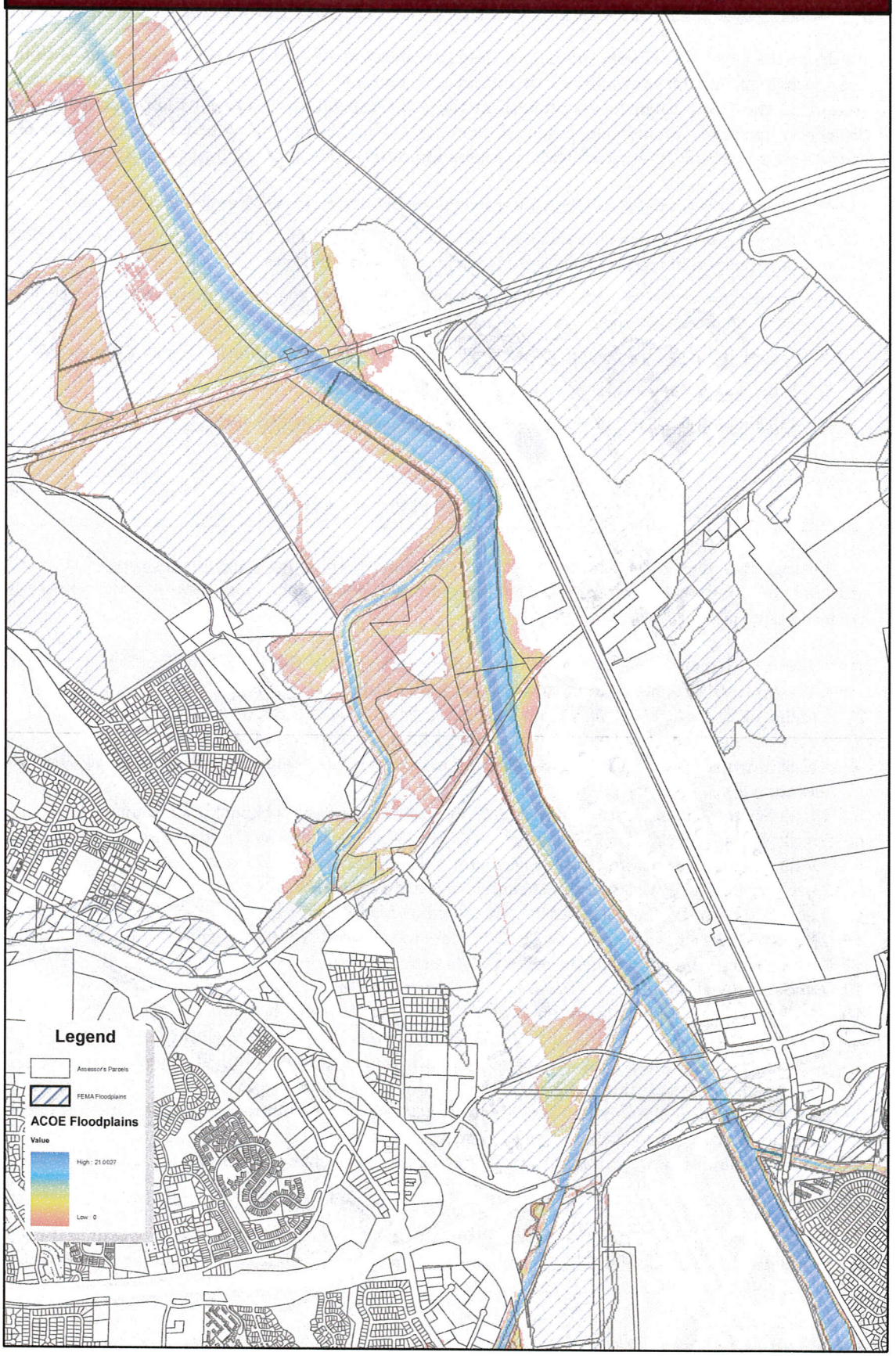
0 500 1,000 Feet

Levee Flood Capacity

- <= 100 Year Protection (Overtop)
- <= 1' Freeboard
- 1-3' Freeboard

Produced by Valley Osborn/S. Yu, PWD 6/27/2007
Using Contra Costa County CA Data &
U.S. Army Corp of Engineers Flood Elevation Data

FEMA vs. Computed 1% Floodplains



0 0.05 0.1 0.2 0.3 0.4 Miles

5/7/07 PRD

Contra Costa County Flood Control & Water Conservation District

Figure 4

NEED FOR INTERIM PROTECTION MEASURES

In response to the Corps' March 30, 2007, notification of deficiencies in the Lower Walnut Creek Channel, the District's Board of Supervisors declared the existence of an emergency and authorized the Chief Engineer to proceed in the most expeditious manner to implement interim protection measures to mitigate potential flooding. The District developed Interim Protection Measures for Lower Walnut Creek with consideration of the following six Project Objectives:

1. Interim project to meet a 10-year life span until the ultimate Corps GRR project is constructed.
2. Interim project to provide a minimum of 1-foot of freeboard for a 100 year water surface elevation projected out 10-years assuming historic sediment accumulation rates.
3. Interim project to provide 100-year protection based on 1965 Corps design criteria, excluding minimum freeboard requirement.
4. Interim project will not negatively affect the benefit cost ratio of the ultimate Corps GRR project.
5. Interim improvements will be compatible with ultimate project.
6. Interim project will maximize channel stretches eligible for Corps PL 84-99 emergency funds.

INTERIM PROTECTION MEASURES

District staff developed and analyzed the following 18 Interim Protection Measures that were analyzed for both the hydraulic benefit on channel conveyance and also for the expected environmental impacts:

1. Raise all existing levees to 1965 Corps design elevations for Lower Walnut Creek, Lower Grayson Creek, Pacheco Creek, and Clayton Valley Drain.
2. Dredge or desilt Walnut Creek from Waterfront Road to BNSF RR (to elevation 2').
3. Levee raising along west bank of Walnut Creek along ACME and IT properties.
4. Desilt downstream of BNSF RR adjacent to Tesoro (east bank, access through Tesoro) (to elevation 2').
5. Desilt Walnut Creek from BNSF RR to Grayson Creek (original channel bottom minus 1').
6. Desilt Walnut Creek from Grayson Creek to Hwy 4 (original channel bottom minus 1').
7. Desilt Walnut Creek from Hwy 4 to Clayton Valley Drain (original channel bottom).
8. Levee raising along west bank of Walnut Creek from BNSF RR to Grayson Confluence.
9. Levee raising of Walnut Creek east & west bank at Marsh Drive Bridge.
10. Desilt Walnut Creek from Clayton Valley Drain to Concord Avenue (original channel bottom).
11. Levee raising along east bank near Hwy 242 northbound bridge.
12. Levee raising along Pacheco Creek.
13. Desilt Grayson Creek from confluence to I680 (original channel bottom).
14. Levee raising along west bank of Grayson Creek from confluence to Highway 4.
15. Levee raising along east bank of Grayson Creek from Highway 4 to Interstate 680.
16. Flood wall along west side of Grayson Creek along CCCSD frontage.
17. Complete desilt to 1965 grades for Walnut Creek between mouth to Highway 4, Grayson Creek between confluence to I680, and all of Pacheco Creek.
18. Dredge Walnut Creek from mouth to Waterfront (original channel bottom).

For the purposes of this Corrective Action Plan, "dredging" is assumed to be a ***wet*** operation using a barge-mounted suction dredge where spoils are transmitted by pipeline or barge and need to be dried

prior to disposal or reuse. "Desilting" is assumed to be a ***dry*** operation using conventional construction equipment such as excavators, dozers, front-end loaders, and trucks to remove the material for disposal or reuse.

The District also considered and investigated alternative methods for raising the levees such as placing temporary concrete "k-rails" wrapped in an impervious membrane, constructing timber freeboard walls, or driving sheet piles along the landside crest of the levee. Because the magnitude of needed levee raising averages slightly over 1 foot, the alternative levee construction methods were determined to be less feasible and more costly than adding a small amount of impervious material to the top of the existing stable levee prism. A complete discussion of the proposed, more traditional levee construction methods can be found in the section titled "Preferred Alternative 2d" later in this document.

ANALYSIS OF INTERIM PROTECTION MEASURES

Each of these eighteen Interim Protection Measures was first analyzed hydraulically to determine the effect on system performance. This effect was measured by the change in volume of each off-channel storage area and also by the change in freeboard at each cross section.

One initial concern was that eliminating the flooding in the most downstream reach would also eliminate stormwater storage, thus keeping more stormwater in the channel and causing a higher water surface and reduced freeboard in the next upstream reach. The hydraulic model showed that this reduction in off-channel storage, while quantifiable, had a negligible effect on the upstream hydraulics.

The measures fell into two general categories: levee raising and channel desilting (or dredging). Analysis of the levee raising was straight forward. A 1-foot increase in the height of the levee corresponded to a 1-foot increase in the amount of freeboard. Quantifying the effect of the in-channel work, however, was more challenging.

As expected, removing sediment from the channel reduced the water surface and increased freeboard. But despite the flat channel slope, the hydraulic benefit of each desilting measure extended only a short distance upstream of the upper limit of the channel excavation. For example, implementing Measure 2 (Desilting from Waterfront Road to BNSF Railroad) lowered the water surface elevation at the BNSF Railroad by 0.52 feet. But this water surface reduction diminished to less than 0.1 feet within 1,200 feet upstream of the railroad.

One clear conclusion from the analysis of the measures was that the 100-year hydraulic performance of the tributary creeks (Pacheco Creek, Grayson Creek and Clayton Valley Drain) is not dependant on each creek's capacity, but rather on the tailwater at its confluence with Walnut Creek. A one foot rise (or drop) in the water surface in Walnut Creek means a one foot rise (or drop) in the water surface for the leveed portions of Pacheco Creek, Grayson Creek, and the Clayton Valley Drain. This was acknowledged in the original design when the levees on the tributary creeks were designed to a constant elevation, rather than following the channel slope, as they do on Walnut Creek. For example, implementing Measure 13 (desilt Grayson Creek) provided a negligible 0.03-foot reduction in water surface at Grayson Creek station 32+51 (adjacent to the CCCSD treatment plant). But implementing Measure 5 (desilt Walnut Creek from BNSF Railroad to Grayson Creek) and *not* desilting Grayson Creek, provided a 1.02-foot reduction at the same location. The results showed that providing a lower tailwater in Walnut Creek at the confluence of its tributaries carried these benefits up the tributaries, while minimizing the footprint of work and thus the environmental impact.

An additional concern was what effect raising the design water surface (by raising levees) would have on the velocities in the channel. The analysis showed that the change in velocity was minimal, and that velocities were still below that where bank protection would be required. This is also supported by the past performance of the Lower Walnut Creek channel showing significant deposition rather than scour after significant storm events.

Summary tables showing the hydraulic benefit for each measure are included in Appendix F.

In addition, the environmental impact of each measure was qualitatively assessed using habitat and species GIS shapefiles for the creek areas. These shapefiles were a result of some early in-kind work the District had performed in support of the GRR process, and proved to be very valuable in determining the location and extent of sensitive habitat. Critical habitat for four State and/or Federal listed species, such as salt marsh harvest mouse (Federal and State Endangered; State Fully Protected), soft bird's-beak (Federal Endangered), California clapper rail (Federal and State Endangered, State Fully Protected) and California black rail (State threatened; State Fully Protected). This critical habitat was located both in channel and on the landside of levees in Pacheco Creek and Walnut Creek downstream of the BNSF Railroad. Additionally, the amounts and locations of non-upland habitat, such as seasonal and perennial marsh, wetlands, and open water were identified. Maps showing the habitat areas are included in Appendix G.

Recognizing the short timeline for project implementation, and the guidance received from the District's initial outreach to the regulatory agencies, measures that avoided or minimized impacts to sensitive species and marsh and wetland habitat areas were considered to be more feasible to permit and construct than those that had greater environmental impacts. In fact, *no* form of take of individuals is authorized for these "fully protected species"— not even relocation. Therefore, large-scale habitat removal for these species would not be permitted by the California Department of Fish and Game.

A qualitative assessment of the hydraulic benefits, environmental impacts, and constructability showed that Measures 3, 5, 6, 7, 8, 9 and 11 ranked highest.

DEVELOPING ALTERNATIVES

Once the hydraulic and environmental impacts of the various measures were fully investigated, District staff combined the measures into various alternatives for further analysis and ranking. The five alternatives (and variations) considered were as follows:

***Alternative 1*: Restore entire leveed system to 1965 as-built condition.**

Complete desilt to 1965 grades for Walnut Creek between mouth to Concord Avenue, Grayson Creek between confluence and I-680, and all of Pacheco Creek. Raise all levees to 1965 design elevations for Lower Walnut Creek, Grayson Creek, Pacheco Creek, and improved portion of Clayton Valley Drain (2300 LF). (Measures 1 and 17).

This is the alternative required by the Corps in their March 30, 2007, deficiency letter.

Alternative 2: ***Selective work to maximize hydraulic benefit.***

Desilt Walnut Creek from BNSF RR to Highway 4 to 1-foot below 1965 design grades.
Desilt Walnut Creek from Highway 4 to Clayton Valley Drain to 1965 design grades (Measures 5, 6 and 7).
Raise west levees on Walnut Creek from BNSF to Grayson Creek (Measure 8).
Raise both Walnut Creek levees from Highway 4 to Clayton Valley Drain (Measure 9).
Raise west levee on Grayson Creek from confluence to Highway 4 (Measure 14).

This alternative, with variations below, includes the highest ranked measures.

Alternative 2a: Alternative 2 with the addition of Measure 11: Raise east levee on Walnut Creek by 2-feet for 200-feet upstream of State Route 242.

Alternative 2b: Alternative 2 with the addition of Grayson Creek desilting and east levee raising between Station 40~ and 58~. This is behind the Diablo Vista mobile home park. (Measure 15 and part of Measure 13).

Alternative 2c: Alternative 2 with the addition of levee raising on Pacheco Creek at the Gun Club frontage only.

Alternative 2d: Alternative 2 with the deletion of all excavation work below elevation 4.0 to improve constructability, especially in the lowest, tidally influenced areas of the project.

Alternative 2e: *minimization of environmental impacts*: Alternative 2 with the desilting limited to mapped upland areas only. Almost all areas identified as wetlands in the main channel of Walnut Creek are avoided.

Alternative 2e modified*: minimization of environmental impacts with additional upland excavation at west levee toe.* Alternative 2 with the desilting limited to mapped upland areas only. Almost all areas identified as wetlands in the main channel of Walnut Creek are avoided. Additional excavation at west side of channel (15-foot offset from levee toe) in the upland bench area.

Alternative 3: ***(Limit work to upstream of Highway 4 to use existing regulatory permits)***

Desilt Walnut Creek from Highway 4 to Concord Avenue to original 1965 design grades (Measures 7 and 10).
Desilt Clayton Valley Drain to original 1965 design grades.
Desilt Grayson Creek from Highway 4 to Highway 680 to original design grades.
Raise Walnut Creek Levees from Highway 4 to Concord Avenue (both sides).
Raise Clayton Valley Drain levees (both sides).
Raise east Grayson Creek levee from Highway 4 to Highway 680.

Alternative 4: ***(Selective work in tidally influenced areas downstream of BNSF RR)***

Desilt Walnut Creek from Waterfront Road to BNSF Railroad to elevation 2.0' (Measure 2).
Raise west levee on Walnut Creek from Waterfront Road to BNSF Railroad (Measure 3).
Raise both levees on Pacheco Creek (Measure 12).

Alternative 5: ***(Do no levee or channel work, but instead wait for ultimate Corps project)***

No levee raising. No channel desilting. Continue non-federal sponsor efforts to support the Corps GRR project.

ANALYSIS OF ALTERNATIVES

In order to fully explore the feasibility, risks and benefits of each alternative, the District gathered and analyzed supporting data from geotechnical, regulatory, economic, available lands/constructability, and risk perspectives. This data and findings are summarized below. Supporting data and reports are included in the various appendices as noted.

The District first investigated the **hydraulic performance** of each alternative. Generally, the hydraulic performance matched that of the measures that were included in each alternative. As expected, Alternative 1 provided the maximum hydraulic benefit as all the accumulated sediment was removed and all levees were restored to their as-built grades.

Alternative 2 (and variants) focused efforts on the stretch of Walnut Creek between the BNSF Railroad and Clayton Valley Drain and provided solid freeboard improvements in that reach and to a lesser degree the next upstream reach (Clayton Valley Drain to Concord Avenue). This alternative met the project objectives of 1-foot of levee freeboard for the reach from the BNSF Railroad up through Concord Avenue, and on Grayson Creek from the confluence up to Highway 680. Most areas, including the critical levees along the CCCSD treatment plan, experienced a freeboard increase of more than 1 foot with this alternative.

Alternative 3 focused efforts on the areas upstream of Highway 4. It increased freeboard in those areas upstream of Highway 4, as expected, but provided no improvement in the critical capacity areas near Marsh Drive and along the CCCSD treatment plant.

Alternative 4 focused on the tidally influenced areas of Walnut and Pacheco Creeks downstream of the BNSF Railroad. This alternative relied heavily on levee raising and only included sediment removal down to elevation 2.0 (for constructability reasons). As such, flows were contained in the channel within the limits of work, but hydraulic benefits for reaches upstream were minimal. Alternative 4 also suffered from the effects of preventing the shallow off-channel storage on the IT Baker and ACME marsh sites. Keeping these stormwaters contained in the channel caused an increase in water surface downstream of Pacheco Creek with this alternative.

Appendix H contains, for each alternative, comprehensive summary tables of the change in water surface and the change in freeboard at each cross section and the change in storage volume at each storage area.

The deposited sediment and levees were analyzed for **geotechnical issues**. The root issue was whether sediment could be successfully used to augment the levee height. The geotechnical report and soil borings (included in Appendix I) provided guidance that sediment with a clay classification would be acceptable for reuse as levee top material. The logistics of removing sediment and placing as levee fill was also considered in the constructability review.

The deposited sediment was also analyzed for a wide range of **contaminants**, such as CAM 17 metals, petroleum hydrocarbons, and TPH-motor oil, and was determined to be clean for disposal

and reuse. The favorable results (included in Appendix I) matched those from the 2006 test of sediment farther upstream in support of the previous desilting project.

Each alternative was also analyzed for **cost**. Unit prices were estimated from past projects as well as the logistics of accessing the site. As expected, Alternative 1 (full restoration to 1965 design) was the highest cost. More unexpected was that the $50M cost estimated by the District's hired consultant was almost double the $30M estimated by the District earlier this year. Either cost estimate far exceeds the District's resources, and Alternative #1 was ranked low for cost effectiveness.

Alt.	Description	Estimated Cost
1	Restore entire leveed system to 1965 as-built condition.	$49.9 M
2	Selective work to maximize hydraulic benefit	$9.2M
2a	Alt 2 + levee at Hwy 242	$9.2M
2b	Alt 2 + desilting and levee work on Grayson at mobile home park	$10.6 M
2c	Alt 2 + levee raising on Pacheco Creek at Martinez Gun Club	$9.5 M
2d	Alt 2 with depth of excavation reduced to improve constructability	$8.3 M
2e	Alt 2 avoiding wetlands impacts	$8.5 M
2e mod	Alt 2e with additional excavation at levee toe	$8.6 M
3	Work limited to upstream of Highway 4 -- maximize existing permits	$7.7 M
4	Desilting and levee raising downstream of BNSF RR	$10.6 M
5	"No nothing" alternative -- continue to wait for ACOE project.	$0.0

The full cost analysis is included in Appendix J, and the results are summarized here.

Each alternative was also analyzed for the relative **environmental impact**. District staff arranged for supplemental environmental baseline studies to verify the habitat areas previously identified and shown in Appendix G. The field work verified the presence of high value habitat for four State and/or Federal listed species: salt marsh harvest mouse (Federal and State Endangered; State Fully Protected), soft bird's-beak (Federal Endangered), California clapper rail (Federal and State Endangered; State Fully Protected) and California black rail (State threatened; State Fully Protected). No form of take of individuals is authorized for "fully protected species" — not even relocation. Therefore, large-scale habitat removal for these species would not be permitted by the California Department of Fish and Game. This habitat was verified to be present both in-channel and on the landside of certain levees in the lower watershed. These areas are predominantly located downstream of the BNSF Railroad in the areas covered by Alternatives 1 and 4.

District staff then met separately with management staff of the regulatory sections of the Corps, the Regional Water Quality Control Board, and the State Department of Fish and Game. The primary objective of these meetings was to present the expected environmental impacts of each alternative and seek informal feedback as to the likelihood of receiving regulatory permits covering the desired work for this summer/fall. The feedback was clear that the work in Alternatives 2 and 3 would be challenging to receive permits in time for summer 2007 construction, but because these alternatives avoided the most critical habitat, the work could possibly be permitted with appropriate mitigation. Feedback was also clear that securing permits for either Alternative 2 or Alternative 3 would be an equivalent effort, so the strategy of limiting work upstream of Highway 4 in Alternative 3 had no advantage from a permitting standpoint.

Informal feedback from the regulators made it clear that the impacts of doing work in the sensitive habitat areas downstream of the BNSF Railroad (Alternatives 1 and 3) made it unlikely that permits could ever be issued. It was also clear that given the habitat complexities in this portion of

the channel that it would be impossible to issue permits in time for summer 2007 construction. The environmental impacts for the alternatives were ranked accordingly.

Because of this pessimistic feedback for Alternatives 1 and 4, these alternatives were not further analyzed for mitigation amounts and ratios. But Alternative 2 and variations were analyzed for the amounts of the various habitat types that would be created and removed by the desilting operations. The analysis showed that the mitigation ratio of 2:1 (created:removed) was feasible with Alternative 2. A copy of this analysis is included in Appendix G. The environmental impacts of Alternative 2 (and variants) were ranked accordingly.

The District also looked closely at the logistics and **constructability** of the work in each of the alternatives. Part of this effort focused on securing nearby sites for borrowing material for levee rehabilitation and for permanently depositing sediment removed from the channel. In the 1973 dredge project of the lower channel, dredge spoils were decanted in the marshlands adjacent to the creek and were used to raise the grade of the marsh. In today's regulatory environment, disposal options are more focused on upland sites. The District has looked at a number of sites in the vicinity for both borrow and disposal, and negotiations are ongoing.

Another part of this effort focused on better understanding the moisture content and tidal elevations in the areas covered by each alternative. For Alternative 1, the area downstream of Waterfront Road could be dredged with a traditional low-draft barge mounted suction dredge. However, in the areas between Waterfront Road and the BNSF Railroad (included in Alternatives 1 and 4) the draft is too shallow and the bridges no longer open for barge traffic, so any dredge would have to be trucked in or be of a much smaller size. In addition, there is no access road on the east (right) bank between Waterfront Road and the BNSF Railroad, and the reach downstream of Waterfront Road lacks an access road on the west (left) bank as well. The constructability review showed that for alternatives 1 and 3, because of the volume of sediment (ref: Appendix C) and the poor access, the **work would simply not be feasible in one construction season**. As such, these alternatives were ranked very low for constructability.

Alternatives 2 and 3 generally ranked higher for constructability because their location higher in the watershed resulted in drier conditions. The variations on Alternative 2 were ranked slightly higher or lower for constructability depending on the specific requirements of each variation. For example, Alternative 2e (desilting while avoiding all wetlands impacts) was ranked slightly lower because of the need to selectively desilt and use special protective mats to cross the wetland areas with heavy equipment, which is expected to lower production.

Alternatives 2 and 3 are assumed to be *desilting* operations using traditional heavy construction equipment as opposed to a wet suction *dredge* operation. As such, a good understanding of the moisture content of the sediment and of the ability to successfully access the work area with traditional heavy construction equipment is critical for a successful project.

To better understand the effects of the tide on Alternative 2 (and variants), District staff placed witness stakes within the work area adjacent to the low flow channel immediately before known higher high tide events. The higher high tide marks left on the stakes were then surveyed for the exact elevation of the higher high tide at these locations. Comparing these elevations to reported data from known tide gauges showed that the project tides were 0.9 feet above the closest reported tide gauge elevation in the tables. Using this adjustment factor with the tide tables for July through October 2007, the exact tides anticipated at the project site were generated and plotted. The plots of tidal elevations and typical cross sections are included in Appendix L "Comparing Tide Elevations with Desilt Grades".

These anticipated tide elevations were then compared to the elevations of the desilting operations. Desilting to design grade in the lowest reaches covered by Alternative 2 (just upstream of the BNSF Railroad) were shown to be problematic because the design grade would be frequently inundated by the daily tides, and it would not be possible to complete the work as a dry desilting operation. A wet dredge operation would be needed in this area to excavate to design grade. Because a dredge operation had unmitigatable impacts and could not receive regulatory permits in the time allowed, the District explored ways to retain the "dry land" construction techniques in this area while maximizing the sediment to be removed and thus the hydraulic benefit. The compromise solution became our Preferred Alternative 2d, which limited the bottom elevation to 4.0 (NAVD 88 datum). This slightly shallower depth extends from the BNSF Railroad upstream until the 1965 invert exceeds that elevation.

As a result of this analysis, Alternative 2d (keeping desilt elevations to a minimum of 4.0-feet) was ranked with a higher constructability factor than the other variants of Alternative 2. It is important to note that the design elevation at Station 152 (just upstream of the BNSF Railroad) is 3.3. The proposed bottom of desilting is elevation 4.0. Alternative 2d holds this bottom elevation for approximately 1800 LF until the design bottom elevation rises above 4.0. Simply pit, with Alternative 2d, the District is maximizing the depth of excavation as conditions allow.

To confirm the validity of excavating down to elevation 4.0, the District has scheduled two test excavations adjacent to the low flow channel. These plots, each approximately 15 feet square, will be graded to the bottom elevation in Alterative 2d, and will be evaluated for how well the construction equipment is able to work in the tidally influenced area. If not feasible, mitigation could include further raising the bottom elevation, or increasing the size of the buffer left between the low flow channel and the work area.

Finally, District staff met with representatives from the Office of County Counsel, as well as the County's Risk Management Division, to gain a better understanding of **risk** issues surrounding the measures and alternatives contemplated in this plan.

RANKING OF ALTERNATIVES

Once all the constraints and opportunities were fully analyzed and understood, the District developed a numerical scoring methodology to quantitatively analyze and rank the various alternatives. Each alternative was considered for its hydraulic benefit, constructability (which included right of way and access constraints, construction methodology, assumed production rates, and the time allowed for implementing the corrective actions), cost, environmental impacts and effect on risk. This ranking matrix is shown below.

Each of the ranking criteria was assigned a multiplier. The hydraulic benefit and risk criteria were assigned a multiplier of 1.5. The environmental impact criteria was assigned a multiplier of 1.0, and the constructability, and cost impact criteria were assigned a multiplier of 0.8.

It is important to note that for the hydraulic benefit and constructability criteria, a high numerical score indicates high benefits or easier implementation. But for the cost, environmental impact and risk criteria, a *high* numerical score indicates a *low* cost, a *lower* environmental impact and a *reduced* risk.

Alt.	Description	Hydraulic Benefit	Multiplier	Constructability	Multiplier	Cost	Multiplier	Environmental Impact	Multiplier	Risk	Multiplier	Total Score
1	Restore entire leveed system to 1965 as-built condition.	5	1.5	1	0.8	1	0.8	1	1.0	8	1.5	**22.1**
2	Selective work to maximize hydraulic benefit	6	1.5	7	0.8	6	0.8	5	1.0	6	1.5	**33.4**
2a	Alt 2 + levee at Hwy 242	6	1.5	7	0.8	6	0.8	5	1.0	6	1.5	**33.4**
2b	Alt 2 + desilting and levee work on Grayson at mobile home park	6.5	1.5	4	0.8	5	0.8	5	1.0	7	1.5	**32.5**
2c	Alt 2 + levee raising on Pacheco Creek at Martinez Gun Club	6.5	1.5	5	0.8	6	0.8	4.5	1.0	6.5	1.5	**32.8**
2d	Alt 2 with depth of excavation reduced to improve constructability	5.5	1.5	8	0.8	6	0.8	5	1.0	6	1.5	**33.5**
2e	Alt 2 avoiding wetlands impacts	4.5	1.5	6.5	0.8	5	0.8	7	1.0	6	1.5	**32.0**
2e mod	Alt 2e with additional excavation at levee toe	5	1.5	6.5	0.8	5	0.8	7	1.0	6	1.5	**32.7**
3	Work limited to upstream of Highway 4 -- maximize exist permits	3	1.5	7	0.8	7	0.8	7	1.0	5	1.5	**30.2**
4	Desilting and levee raising downstream of BNSF RR	3	1.5	3	0.8	3	0.8	5	1.0	4	1.5	**20.3**
5	"No nothing" alternative -- continue to wait for ACOE project.	1	1.5	10	0.8	10	0.8	10	1.0	1	1.5	**29.0**

Notes:

Numerical rankings are on a scale of 1-10
Hydraulic Benefit of 1 = very small or no improvement in freeboard
Hydraulic Benefit of 10 = large improvement in freeboard
Constructability of 1 = extremely difficult to construct; tremendous impediments to completion in given timeframe
Constructability of 10 = easy to construct; few impediments to completion in given timeframe
Cost of 1 = extremely large cost to implement
Cost of 10 = very low cost to implement
Environmental Impact of 1 = extremely large environmental impact
Environmental Impact of 10 = very low environmental impact
Risk of 1 = risk and liability remain unchanged by implementing alternative
Risk of 10 = risk and liability are significantly reduced by implementing alternative

Based on these criteria, **Alternative 2d was ranked the highest**, followed by Alternatives 2, 2a, and Alternative 2b. The lowest ranked were Alternatives 1 and 4, primarily because of their very high cost, poor constructability, and unmitigatable environmental impacts.

Alternative 1 — restoring the entire leveed system to 1965 conditions — was by far the most expensive and least sustainable alternative and had the largest environmental impact. It ranked only moderately well for hydraulics because the newly dredged area is expected to be completely filled with sediment within the 10-year timeframe that the Corrective Action Plan is expected to be in place. Alternative 1 also ranked low because of its incompatibility with the ultimate GRR project. Informal feedback from the regulatory agencies indicated that a full dredge was unlikely to be permitted because of unmitigatable impacts to habitat of four State and/or Federal listed species, such as salt marsh harvest mouse (Federal and State Endangered; State Fully Protected), soft bird's-beak (Federal Endangered), California clapper rail (Federal and State Endangered; State Fully Protected) and California black rail (State threatened; State Fully Protected). No form of take of individuals is authorized for "fully protected species"— not even relocation. Therefore, large-scale habitat removal for these species would not be permitted by the California Department of Fish and Game. Even if the regulatory permits were obtainable, the magnitude of the project necessitates a phased approach over multiple years and would not meet the one year rehabilitation deadline.

It is important to note why Alternative 2b (Alt. 2 with levee raising at the Rancho Diablo Mobile Home Park) was ranked so low for constructability. This is because the construction feasibility investigation uncovered a retaining wall and other encroachments that appear to have been constructed by the mobile home park residents within the District's easement on the landside of the levee. A plan view of this portion of the Grayson Creek levee and photos of the encroachments are included in Appendix M. Restoring the levee here to its design elevation is straightforward, but identifying and abating the encroachments adds complexity that is not compatible with the aggressive schedule required by the Corps. Nonetheless, the District plans to survey the extent and location of the encroachments later this year and develop a more detailed plan for future levee restoration in this reach. The levee rehabilitation in this reach may include less-traditional methods, such as a timber, sheet pile, or concrete freeboard walls. See the section titled "Implementation Schedule and Phasing of Work" below for additional information.

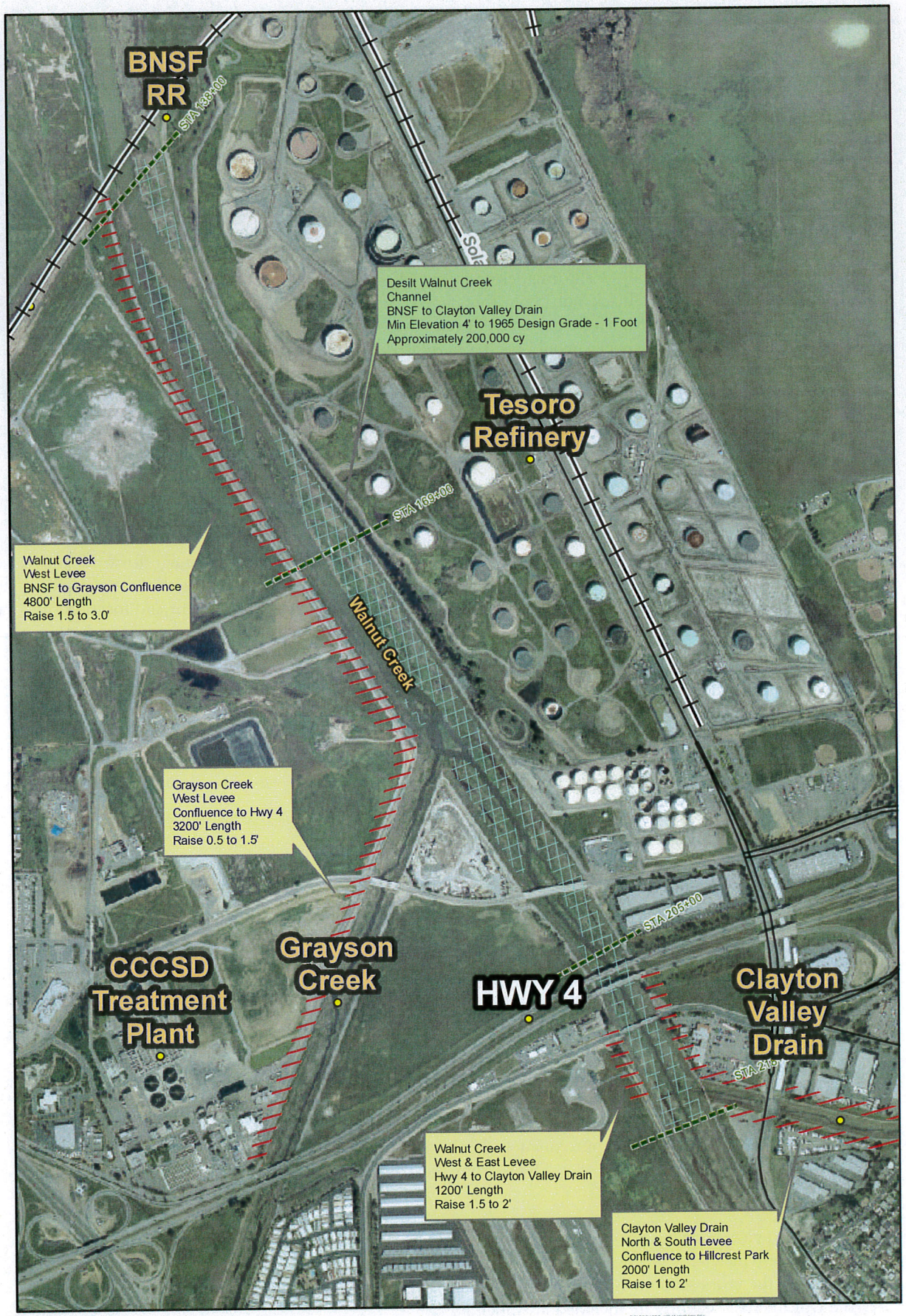
PREFERRED ALTERNATIVE 2D

The District's preferred alternative for implementation in this Corrective Action Plan is Alternative 2d. This alternative includes the following items of work:

- Removing approximately 200,000 cy of accumulated sediment from the Lower Walnut Creek Channel between the BNSF Railroad and the Clayton Valley Drain. Sediment will be removed to an elevation no lower than 4.0-feet and then will follow the original design grade where greater than elevation 4.0. Work will avoid the incised low flow channel, and will leave small berms of sediment along the low flow channel to provide a buffer between the work and the active stream and to keep the higher tides out of the work area.

- Raising the height of approximately 15,000 linear feet of levees by approximately 0.5 to 1.5 feet to restore the original design levee elevation. This levee work will include the west (left) side of Walnut Creek from the BNSF Railroad up to the confluence of Grayson Creek, the west (left) side of Grayson Creek from the confluence up to Highway 4, both sides of Walnut Creek from approximately Highway 4 to Clayton Valley Drain and at selected locations on Clayton Valley Drain from the confluence to the drop structure at Hillcrest Park.

A plan view showing the work included in Alternative 2d is shown in Figure 5. Following Figure 5 are three typical cross sections that cover the north, central and southern portion of the work, and following the cross sections is a two page hydraulic summary table. Larger versions of Figure 5 and the typical cross sections are included in Appendix N.

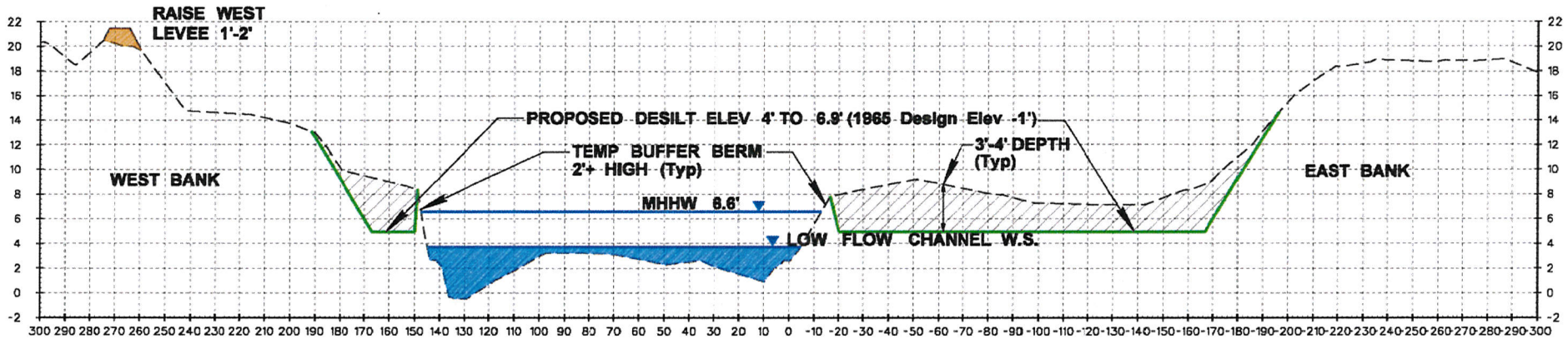


Contra Costa County
Flood Control
& Water Conservation District

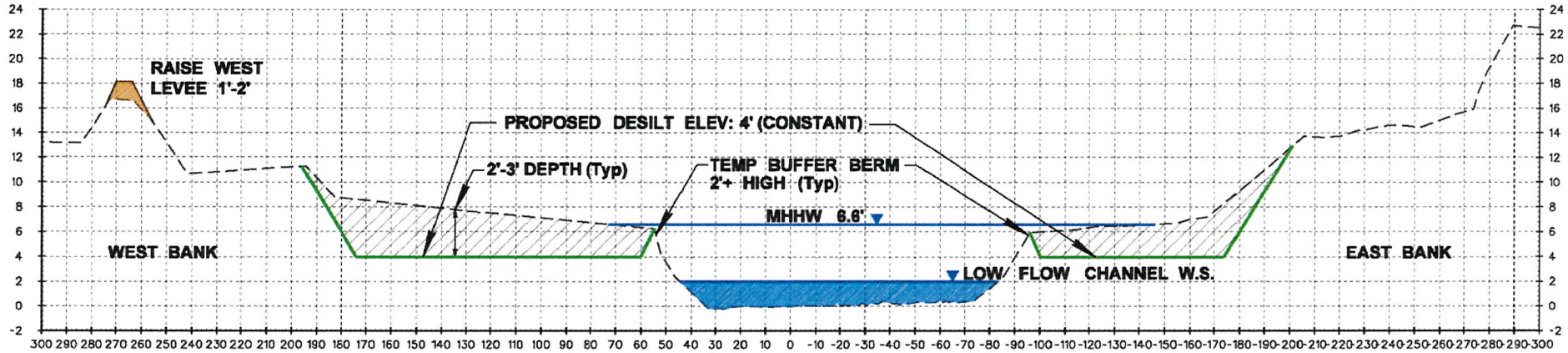
Proposed Improvements
Phase 1 Alternative 2D
Figure 5

Produced by Wiley Ciborn/S. Yu, PWD 6/5/2007
Using Contra Costa County CA Data &
U.S. Army Corp of Engineers Flood Elevation Data

MHHW - MEAN HIGHER HIGH WATER



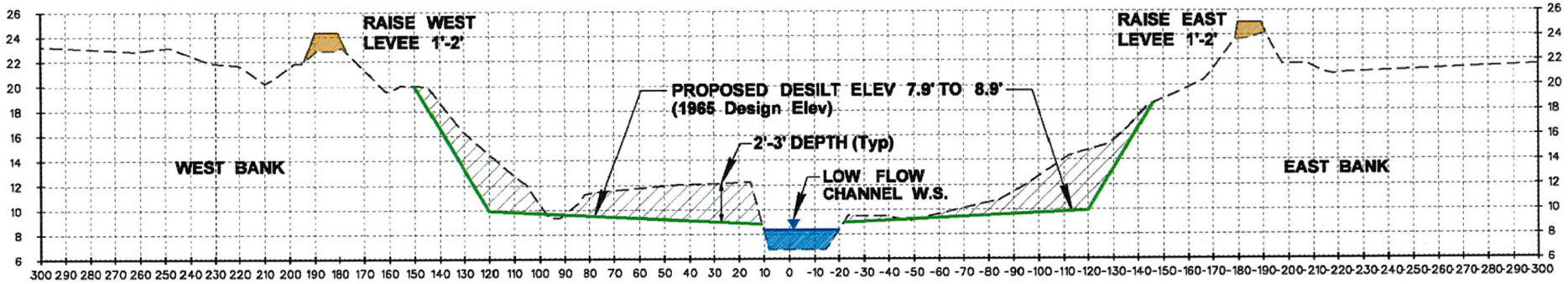
**TYPICAL SECTION 1800' D/S OF GRAYSON CONFLUENCE (Sta 169+00)
TO HWY 4 (Sta 205+00)**



**TYPICAL SECTION BNSF RR (Sta 138+00) TO
1800' D/S OF GRAYSON CONFLUENCE (Sta 169+00)**

**LOWER WALNUT CREEK
DESILT TYPICAL SECTIONS
ALTERNATIVE 2D**

SHEET 1 OF 2



TYPICAL SECTION HWY 4 (Sta 205+00)
TO CONFLUENCE OF CLAYTON VALLEY DRAIN (Sta 218+00)

LOWER WALNUT CREEK
DESILT TYPICAL SECTIONS
ALTERNATIVE 2D SHEET 2 OF 2

Hydraulic Effects of Alternative 2D along the creek channel (Freeboard & WS Elev)

100 year storm event

HEC-RAS Plan: OrgDes0412A1 Profile: Max WS

Overtopping | 0'-1' Freeboard | 1'-3' Freeboard

Bold & Italic Freeboard increase due to levee raising or Drop in WS Elev greater than 0.1'

Corrective Action Plan Project Limits

			Exist Levee/Embankment Elevation Data							Alternative 2D					
Creek	Location	River Sta	Exist WS Elev (ft)	Ex.Lt Levee Elev (ft)	Ex. Rt Levee Elev (ft)	Lt Freebrd (ft) exist	Rt Freebrd (ft) exist	1965 Levee Elev Lt (ft)	1965 Levee Elev Rt (ft)	Proposed WS Elev (ft)	WS Elev Diff (ft)	Freebrd Lt	Freebrd Rt	Frd Diff (lt)	Frd Diff (Rt)
Walnut		363+44	47.6	48.3	48.0	0.7	0.4		50.0	47.61	0.01	0.7	0.4	0.0	0.0
Walnut	SR 242 NB	362+98													
Walnut		362+44	47.36	48.4	48.0	1.0	0.6		50.0	47.36	0	1.0	0.6	0.0	0.0
Walnut		361+50	46.99	48.5	47.5	1.5	0.5		49.5	46.99	0	1.5	0.5	0.0	0.0
Walnut	SR 242 SB	360+97													
Walnut		358+85	44.24	48.7	48.0	4.5	3.8			44.24	0	4.5	3.8	0.0	0.0
Walnut	Drop Structure #1	356+69													
Walnut		356+31	37.17	47.1	44.0	9.9	6.8			37.17	0	9.9	6.8	0.0	0.0
Walnut		347+37	36.88	44.4	39.8	7.5	2.9			36.88	0	7.5	2.9	0.0	0.0
Walnut		338+40	35.69	42.0	39.0	6.3	3.3			35.69	0	6.3	3.3	0.0	0.0
Walnut	Willow Pass Road	334+90													
Walnut		330+61	33.64	38.0	36.0	4.4	2.4			33.64	0	4.4	2.4	0.0	0.0
Walnut		327+86	33.05	36.0	36.0	3.0	3.0			33.05	0	3.0	3.0	0.0	0.0
Walnut	Diamond Blvd	324+86													
Walnut		323+03	32.35	34.0	35.0	1.7	2.7			32.34	-0.01	1.7	2.7	0.0	0.0
Walnut		309+75	31.03	37.0	36.3	6.0	5.3			31.01	-0.02	6.0	5.3	0.0	0.0
Walnut	Pine Creek	299+56	29.73	33.0	34.0	3.3	4.3			29.7	-0.03	3.3	4.3	0.0	0.0
Walnut		294+00	28.47	30.0	31.1	1.5	2.6			28.4	-0.07	1.6	2.7	0.1	0.1
Walnut		284+29	27.83	30.0	30.0	2.2	2.2			27.73	-0.1	2.3	2.3	0.1	0.1
Walnut	Concord Ave	283+78													
Walnut		283+25	27.49	32.0	32.0	4.5	4.5	29.4	29.4	27.37	***-0.12***	4.6	4.6	0.1	0.1
Walnut		282+97	27.43	32.0	30.0	4.6	2.6	29.4	29.4	27.31	***-0.12***	4.7	2.7	0.1	0.1
Walnut	Concord Footbrid	282+88													
Walnut		281+31	27.38	30.0	29.5	2.6	2.1	29.3	29.3	27.25	***-0.13***	2.8	2.3	0.1	0.1
Walnut		276+46	26.94	29.3	28.9	2.4	2.0	29.0	29.0	26.78	***-0.16***	2.5	2.1	0.2	0.2
Walnut		264+21	26.14	28.0	28.3	1.9	2.2	28.2	28.2	25.91	***-0.23***	2.1	2.4	0.2	0.2
Walnut		259+04	25.83	27.9	27.4	2.1	1.6	27.9	27.9	25.57	***-0.26***	2.3	1.8	0.3	0.3
Walnut		249+73	25.27	27.7	27.9	2.4	2.6	27.3	27.3	24.93	***-0.34***	2.8	3.0	0.3	0.3
Walnut		245+93	24.99	27.5	27.7	2.5	2.7	27.0	27.0	24.61	***-0.38***	2.9	3.1	0.4	0.4
Walnut		239+17	24.13	26.9	26.6	2.8	2.5	26.2	26.2	23.59	***-0.54***	3.3	3.0	0.5	0.5
Walnut		235+38	23.8	26.2	25.8	2.4	2.0	25.7	25.7	23.18	***-0.62***	3.0	2.6	0.6	0.6
Walnut		228+59	23.3	24.2	25.0	0.9	1.7	24.9	24.9	22.52	***-0.78***	1.7	2.5	0.8	0.8
Walnut		225+35	22.92	24.3	24.3	1.4	1.4	24.5	24.5	22.02	***-0.9***	2.3	2.3	0.9	0.9
Walnut	Clayton Vly Drain	218+60	22.39	23.5	24.4	1.1	2.0			21.16	***-1.23***	2.3	3.2	1.2	1.2
Walnut		214+44	22.23	22.3	22.7	0.1	0.5	23.3	23.3	21.03	***-1.2***	***2.2***	***2.2***	2.2	1.8
Walnut		213+21	22.17	23.0	24.0	0.8	1.8	23.0	23.0	20.96	***-1.21***	***2.0***	3.0	1.2	1.2
Walnut		211+38	22.01	21.8	22.0	-0.2	0.0	22.6	22.6	20.83	***-1.18***	***1.8***	***1.8***	2.0	1.8
Walnut	Marsh Drive	211+11													
Walnut		210+07	19.34	22.3	22.4	3.0	3.1	22.5		18.19	***-1.15***	***4.3***	4.2	1.3	1.2
Walnut		208+06	19.3	24.0	22.4	4.7	3.1	22.2		18.09	***-1.21***	5.9	4.3	1.2	1.2
Walnut	SR 4 EB	207+79													
Walnut		206+99	18.99	26.0	22.0	7.0	3.0	22.1		17.74	***-1.25***	8.3	4.3	1.3	1.3
Walnut	SR 4 WB	206+76													
Walnut		206+08	18.85	19.3	21.0	0.4	2.2	22.0		17.51	***-1.34***	1.8	3.5	1.3	1.3
Walnut		203+81	18.54	20.8	22.4	2.3	3.9	21.8		17.24	***-1.3***	3.6	5.2	1.3	1.3
Walnut		201+33	18.36	20.7	23.0	2.3	4.6	21.5		17.15	***-1.21***	3.6	5.9	1.2	1.2
Walnut		200+17	18.47	20.7	22.2	2.2	3.7	21.4		17.3	***-1.17***	3.4	4.9	1.2	1.2
Walnut	Imhoff Drive	199+78													
Walnut		199+39	18.49	20.8	22.4	2.3	3.9	21.3		17.3	***-1.19***	3.5	5.1	1.2	1.2
Walnut		198+21	18.36	20.4	22.3	2.0	3.9	21.3		17.2	***-1.16***	3.2	5.1	1.2	1.2
Walnut		194+18	18.01	20.3	22.4	2.3	4.4	21.0		17.04	***-0.97***	3.3	5.4	1.0	1.0
Walnut		190+32	17.74	20.0	19.8	2.3	2.1	20.8		16.82	***-0.92***	3.2	3.0	0.9	0.9
Walnut	Grayson Creek	188+92	17.61												
Walnut		184+18	17.59	20.5	18.7	2.9	1.1	19.9		16.83	***-0.76***	***3.1***	1.9	0.2	0.8
Walnut		177+39	17.16	19.7	16.2	2.5	-1.0	19.4		16.63	***-0.53***	3.1	-0.4	0.5	0.5
Walnut		172+56	16.96	18.4	16.7	1.4	-0.3	18.9		16.42	***-0.54***	***2.5***	0.3	1.1	0.5
Walnut		162+79	16.54	18.0	15.5	1.5	-1.0	18.1		16.01	***-0.53***	***2.1***	-0.5	0.6	0.5
Walnut		153+62	15.91	16.2	15.3	0.3	-0.6	17.3		15.6	***-0.31***	***1.7***	-0.3	1.4	0.3
Walnut		150+44	15.73	15.5	16.0	-0.2	0.3	17.0		15.49	***-0.24***	***1.5***	0.5	1.7	0.2
Walnut		147+60	15.52	16.0	22.0	0.5	6.5	16.8		15.35	***-0.17***	***1.4***	6.7	0.9	0.2
Walnut		142+34	15.2	16.0	20.0	0.8	4.8	16.3		15.11	-0.09	***1.2***	4.9	0.4	0.1
Walnut	BNSF RR	137+62													
Walnut		137+26	14.09	14.6	11.0	0.5	-3.1	16.0		14.1	0.01	0.5	-3.1	0.0	0.0
Walnut		134+21	13.99	14.5	16.5	0.5	2.5	15.8		14.01	0.02	0.5	2.5	0.0	0.0
Walnut		127+03	13.84	13.0	20.0	-0.8	6.2	15.5		13.86	0.02	-0.9	6.1	0.0	0.0
Walnut		124+60	13.71	12.6	20.0	-1.1	6.3	15.4		13.73	0.02	-1.1	6.3	0.0	0.0
Walnut		118+77	13.49	13.4	20.0	-0.1	6.5	15.2		13.51	0.02	-0.1	6.5	0.0	0.0
Walnut	Pacheco Creek	111+24	13.11	13.6	20.0	0.5	6.9	14.8		13.12	0.01	0.5	6.9	0.0	0.0
Walnut		104+28	13.05	12.1	24.5	-1.0	11.5	14.5		13.06	0.01	-1.0	11.4	0.0	0.0
Walnut		91+00	12.73	12.4	24.0	-0.3	11.3	13.9		12.74	0.01	-0.3	11.3	0.0	0.0
Walnut		83+52	12.46	13.0	30.0	0.5	17.5	13.6		12.48	0.02	0.5	17.5	0.0	0.0
Walnut		80+77	12.37	12.6	30.0	0.2	17.6	13.5		12.38	0.01	0.2	17.6	0.0	0.0
Walnut		77+89	12.27	11.5	12.0	-0.8	-0.3	13.3		12.28	0.01	-0.8	-0.3	0.0	0.0

Note: this table includes data on Corps and non-Corps levees

			Exist Levee/Embankment Elevation Data							Alternative 2D					
Creek	Location	River Sta	Exist WS Elev (ft)	Ex.Lt Levee Elev (ft)	Ex. Rt Levee Elev (ft)	Lt Freebrd (ft) exist	Rt Freebrd (ft) exist	1965 Levee Elev Lt (ft)	1965 Levee Elev Rt (ft)	Proposed WS Elev (ft)	WS Elev Diff (ft)	Freebrd Lt	Freebrd Rt	Frd Diff (lt)	Frd Diff (Rt)
Walnut		72+59	12.09	12.0	10.0	-0.1	-2.1	13.1		12.11	0.02	-0.1	-2.1	0.0	0.0
Walnut		70+76	12.03	11.8	7.5	-0.2	-4.5	13.0		12.04	0.01	-0.2	-4.5	0.0	0.0
Walnut		68+52	11.96	11.0	8.0	-1.0	-4.0	12.9		11.97	0.01	-1.0	-4.0	0.0	0.0
Walnut	UP RR	68+37													
Walnut		68+23	10.77	10.9	6.0	0.1	-4.8			10.78	0.01	0.1	-4.8	0.0	0.0
Walnut		67+65	10.75	11.0	6.0	0.3	-4.8			10.75	0	0.3	-4.8	0.0	0.0
Walnut		67+16	10.74	11.4	8.0	0.7	-2.7			10.75	0.01	0.7	-2.8	0.0	0.0
Walnut	Waterfront Road	66+89													
Walnut		66+65	10.56	11.9	8.0	1.3	-2.6			10.56	0	1.3	-2.6	0.0	0.0
Walnut		66+54	10.57	11.9	8.0	1.3	-2.6			10.57	0	1.3	-2.6	0.0	0.0
Walnut	Tosco Utility Bridge	66+42													
Walnut		66+31	10.55	11.9	8.0	1.4	-2.6			10.55	0	1.4	-2.6	0.0	0.0
Walnut		63+92	10.57	8.0	7.6	-2.6	-3.0			10.58	0.01	-2.6	-3.0	0.0	0.0
Walnut		61+72	10.52	7.0	13.8	-3.5	3.3			10.52	0	-3.5	3.3	0.0	0.0
Walnut		57+49	10.4	8.3	13.3	-2.1	2.9			10.4	0	-2.1	2.9	0.0	0.0
Walnut		49+10	10.02	10.4	12.5	0.4	2.5			10.02	0	0.4	2.5	0.0	0.0
Walnut		41+45	9.64	10.8	12.3	1.2	2.7			9.65	0.01	1.2	2.7	0.0	0.0
Walnut		33+84	9.28	11.3	13.8	2.0	4.5			9.28	0	2.0	4.5	0.0	0.0
Walnut		26+85	8.78	11.0	13.6	2.2	4.8			8.78	0	2.2	4.8	0.0	0.0
Walnut		19+18	7.75	11.5	14.0	3.8	6.3			7.76	0.01	3.7	6.2	0.0	0.0
Walnut		13+14	6.73	14.3	4.7	7.6	-2.0			6.73	0	7.6	-2.0	0.0	0.0
Walnut	Mouth @ Suisun Bay	10+28	6.61	6.0	4.7	-0.6	-1.9			6.61	0	-0.6	-1.9	0.0	0.0
Pacheco		60+04	13.09	14.4	13.5	1.3	0.4	14.8	14.8	13.1	0.01	1.3	0.4	0.0	0.0
Pacheco		55+74	13.09	14.5	13.6	1.4	0.5	14.8	14.8	13.1	0.01	1.4	0.5	0.0	0.0
Pacheco		49+29	13.08	14.5	13.0	1.4	-0.1	14.8	14.8	13.1	0.02	1.4	-0.1	0.0	0.0
Pacheco		45+49	13.08	14.4	13.8	1.3	0.7	14.8	14.8	13.09	0.01	1.3	0.7	0.0	0.0
Pacheco	Henry's Wood Farm	42+03	13.08	14.1	13.9	1.0	0.8	14.8	14.8	13.09	0.01	1.0	0.8	0.0	0.0
Pacheco		39+84	13.08	13.7	13.5	0.6	0.4	14.8	14.8	13.09	0.01	0.6	0.4	0.0	0.0
Pacheco		38+23	13.08	12.8	13.1	-0.3	0.0	14.8	14.8	13.09	0.01	-0.3	0.0	0.0	0.0
Pacheco		33+15	13.08	12.6	13.3	-0.5	0.2	14.8	14.8	13.09	0.01	-0.5	0.2	0.0	0.0
Pacheco		29+99	13.08	12.6	14.0	-0.5	0.9	14.8	14.8	13.09	0.01	-0.5	0.9	0.0	0.0
Pacheco	Martinez Gun Club	29+27	13.08	12.6	13.8	-0.5	0.7	14.8	14.8	13.09	0.01	-0.5	0.7	0.0	0.0
Pacheco		27+37	13.08	14.5	13.8	1.4	0.7	14.8	14.8	13.09	0.01	1.4	0.7	0.0	0.0
Pacheco		19+50	13.08	15.3	13.2	2.2	0.1	14.8	14.8	13.09	0.01	2.2	0.1	0.0	0.0
Pacheco		10+47	13.09	14.4	12.8	1.3	-0.3	14.8	14.8	13.1	0.01	1.3	-0.3	0.0	0.0
Pacheco	Confluence w/ WC	06+98	13.11	13.7	13.0	0.6	-0.1	14.8	14.8	13.12	0.01	0.6	-0.1	0.0	0.0
Grayson	I680 SB Main Deck	59+10													
Grayson		57+34	18.73	18.0	19.3	-0.7	0.6	20.1	20.1	18.18	***-0.55***	-0.2	1.1	0.6	0.6
Grayson		54+71	18.63	17.0	19.5	-1.6	0.9	20.1	20.1	18.05	***-0.58***	-1.1	1.5	0.6	0.6
Grayson		51+50	18.56	17.5	19.4	-1.1	0.8	20.1	20.1	17.96	***-0.6***	-0.5	1.4	0.6	0.6
Grayson		47+85	18.44	16.5	19.4	-1.9	1.0	20.1	20.1	17.8	***-0.64***	-1.3	1.6	0.6	0.6
Grayson		44+68	18.4	17.0	18.7	-1.4	0.3	20.1	20.1	17.74	***-0.66***	-0.7	1.0	0.7	0.7
Grayson		42+53	18.3	18.0	18.8	-0.3	0.5	20.1	20.1	17.62	***-0.68***	0.4	1.2	0.7	0.7
Grayson		40+77	18.26	20.0	18.8	1.7	0.5	20.1	20.1	17.57	***-0.69***	2.4	1.2	0.7	0.7
Grayson	SR 4 EB	40+38													
Grayson		39+95	18.23	20.0	20.0	1.8	1.8	20.1	20.1	17.54	***-0.69***	2.5	2.5	0.7	0.7
Grayson		39+77	18.23	20.0	20.0	1.8	1.8	20.1	20.1	17.53	***-0.7***	2.5	2.5	0.7	0.7
Grayson	SR 4 WB	39+43													
Grayson		38+18	18.16	19.6	20.0	1.4	1.8	20.1	20.1	17.46	***-0.7***	2.1	2.5	0.7	0.7
Grayson		35+27	18.08	19.5	19.5	1.4	1.4	20.1	20.1	17.36	***-0.72***	2.1	2.1	0.7	0.7
Grayson		33+84	18.04	20.3	19.3	2.3	1.3	20.1	20.1	17.32	***-0.72***	3.0	2.0	0.7	0.7
Grayson		29+39	17.95	20.4	19.9	2.5	2.0	20.1	20.1	17.21	***-0.74***	3.2	2.7	0.7	0.7
Grayson		27+36	17.92	20.1	20.2	2.2	2.3	20.1	20.1	17.18	***-0.74***	2.9	3.0	0.7	0.7
Grayson		24+20	17.86	20.6	19.5	2.7	1.6	20.1	20.1	17.1	***-0.76***	3.5	2.4	0.8	0.8
Grayson		22+84	17.85	20.3	19.7	2.5	1.9	20.1	20.1	17.08	***-0.77***	3.2	2.6	0.8	0.8
Grayson		19+77	17.8	20.2	19.7	2.4	1.9	20.1	20.1	17.02	***-0.78***	3.2	2.7	0.8	0.8
Grayson		18+64	17.78	21.0	20.0	3.2	2.2	20.1	20.1	17	***-0.78***	4.0	3.0	0.8	0.8
Grayson		17+91	17.76	21.0	22.0	3.2	4.2	20.1	20.1	16.97	***-0.79***	4.0	5.0	0.8	0.8
Grayson	Imhoff Drive	17+60													
Grayson		17+21	17.72	20.0	22.0	2.3	4.3	20.1	20.1	16.93	***-0.79***	3.1	5.1	0.8	0.8
Grayson		16+51	17.72	19.7	20.0	2.0	2.3	20.1	20.1	16.92	***-0.8***	2.8	3.1	0.8	0.8
Grayson		15+35	17.69	19.6	19.3	1.9	1.6	20.1	20.1	16.89	***-0.8***	2.7	2.4	0.8	0.8
Grayson		11+99	17.66	19.5	19.0	1.8	1.3	20.1	20.1	16.84	***-0.82***	2.7	2.2	0.8	0.8
Grayson		11+26	17.65	19.5	19.0	1.9	1.4	20.1	20.1	16.82	***-0.83***	2.7	2.2	0.8	0.8
Grayson		08+80	17.61	19.6	18.8	2.0	1.2	20.1	20.1	16.78	***-0.83***	2.8	2.0	0.8	0.8
Clayton		26+61	22.6	28.0	23.3	5.4	0.7	Proposed Levee		22.2	***-0.4***	5.8	1.1	0.4	0.4
Clayton	Hillcrest Park	25+24	22.57	24.5	23.6	1.9	1.0	Raising Elevation		21.65	***-0.92***	2.9	2.0	0.9	0.9
Clayton		23+88	22.55	24.8	24.2	2.3	1.7	24.3	24.3	21.38	***-1.17***	3.4	2.8	1.2	1.2
Clayton		20+83	22.54	23.9	24.8	1.4	2.3	24.3	24.3	21.34	***-1.2***	***3.0***	3.5	1.6	1.2
Clayton		15+77	22.53	24.1	22.9	1.6	0.4	24.3	24.3	21.32	***-1.21***	***3.0***	***3.0***	1.4	2.6
Clayton		12+24	22.53	23.4	23.3	0.9	0.8	24.3	24.3	21.32	***-1.21***	***3.0***	***3.0***	2.1	2.2
Clayton		09+40	22.53	23.9	23.4	1.4	0.9	24.3	24.3	21.32	***-1.21***	***3.0***	***3.0***	1.6	2.1
Clayton		08+42	22.53	23.6	23.2	1.1	0.7	24.3	24.3	21.32	***-1.21***	***3.0***	***3.0***	1.9	2.3
Clayton	Solano Avenue	07+55						24.3	24.3						
Clayton		06+63	22.39	23.2	23.0	0.8	0.6	24.3	24.3	21.16	***-1.23***	***3.1***	***3.1***	2.3	2.5
Clayton		05+70	22.39	23.2	22.4	0.8	0.0	24.3	24.3	21.16	***-1.23***	***3.1***	***3.1***	2.3	3.1
Clayton	Confluence w/ WC	03+33	22.39	24.4	24.1	2.0	1.7	24.3	24.3	21.16	***-1.23***	3.2	***3.1***	1.2	1.4

Note: this table includes data on Corps and non-Corps levees

Hydraulic Effects of Alternative 2D along the creek channel (Freeboard & WS Elev)

100 year storm event

HEC-RAS Plan: OrgDes0412A1 Profile: Max WS

Legend

Overtopping | 0'-1' Freeboard | 1'-3' Freeboard

Bold & Italic Freeboard increase due to levee raising or Drop in WS Elev greater than 0.1'

Corrective Action Plan Project Limits

			Original Design		Exist Levee/Embankment Elevation					Alternative 2D Comparison					
Creek	Location	River Sta	1965 Levee Elev Lt (ft)	1965 Levee Elev Rt (ft)	Exist WS Elev (ft)	Ex.Lt Levee Elev (ft)	Ex.Rt Levee Elev (ft)	Lt Freebrd (ft) exist	Rt Freebrd (ft) exist	Alt 2D WS Elev (ft)	WS Elev Diff Exist vs Alt 2D (ft)	Lt Freebrd (ft) Alt 2D	Rt Freebrd (ft) Alt 2D	Frd Diff (Lt) Exist vs Alt 2D	Frd Diff (Rt) Exist vs Alt 2D
Walnut	Concord Ave	283+78													
Walnut		283+25	29.4	29.4	27.49	32	32	4.5	4.5	27.37	***-0.12***	4.6	4.6	0.1	0.1
Walnut		282+97	29.4	29.4	27.43	32	30	4.6	2.6	27.31	***-0.12***	4.7	2.7	0.1	0.1
Walnut	Concord Footbrid	282+88													
Walnut		281+31	29.3	29.3	27.38	30	29.5	2.6	2.1	27.25	***-0.13***	2.8	2.3	0.1	0.1
Walnut		276+46	29.0	29.0	26.94	29.3	28.9	2.4	2.0	26.78	***-0.16***	2.5	2.1	0.2	0.2
Walnut		264+21	28.2	28.2	26.14	28	28.3	1.9	2.2	25.91	***-0.23***	2.1	2.4	0.2	0.2
Walnut		259+04	27.9	27.9	25.83	27.9	27.4	2.1	1.6	25.57	***-0.26***	2.3	1.8	0.3	0.3
Walnut		249+73	27.3	27.3	25.27	27.7	27.9	2.4	2.6	24.93	***-0.34***	2.8	3.0	0.3	0.3
Walnut		245+93	27.0	27.0	24.99	27.5	27.7	2.5	2.7	24.61	***-0.38***	2.9	3.1	0.4	0.4
Walnut		239+17	26.2	26.2	24.13	26.9	26.6	2.8	2.5	23.59	***-0.54***	3.3	3.0	0.5	0.5
Walnut		235+38	25.7	25.7	23.8	26.2	25.8	2.4	2.0	23.18	***-0.62***	3.0	2.6	0.6	0.6
Walnut		228+59	24.9	24.9	23.3	24.2	25	0.9	1.7	22.52	***-0.78***	1.7	2.5	0.8	0.8
Walnut		225+35	24.5	24.5	22.92	24.3	24.3	1.4	1.4	22.02	***-0.9***	2.3	2.3	0.9	0.9
Walnut	Clayton Vly Drain	218+60													
Walnut		214+44	23.3	23.3	22.23	22.3	22.7	0.1	0.5	21.03	***-1.2***	***2.2***	***2.2***	2.2	1.8
Walnut		213+21	23.0	23.0	22.17	23	24	0.8	1.8	20.96	***-1.21***	***2.0***	3.0	1.2	1.2
Walnut		211+38	22.6	22.6	22.01	21.8	22	-0.2	0.0	20.83	***-1.18***	***1.8***	***1.8***	2.0	1.8
Walnut	Marsh Drive	211+11													
Walnut		210+07	22.5		19.34	22.3	22.4	3.0	3.1	18.19	***-1.15***	***4.3***	4.2	1.3	1.2
Walnut		208+06	22.2		19.3	24	22.4	4.7	3.1	18.09	***-1.21***	5.9	4.3	1.2	1.2
Walnut	SR 4 EB	207+79													
Walnut		206+99	22.1		18.99	26	22			17.74	***-1.25***				
Walnut	SR 4 WB	206+76													
Walnut		206+08	22.0		18.85	22	21			17.51	***-1.34***				
Walnut		203+81	21.8		18.54	20.8	22.4	2.3	3.9	17.24	***-1.3***	3.6	5.2	1.3	1.3
Walnut		201+33	21.5		18.36	20.7	23	2.3	4.6	17.15	***-1.21***	3.6	5.9	1.2	1.2
Walnut		200+17	21.4		18.47	20.7	22.2	2.2	3.7	17.3	***-1.17***	3.4	4.9	1.2	1.2
Walnut	Imhoff Drive	199+78													
Walnut		199+39	21.3		18.49	20.8	22.4	2.3		17.3	***-1.19***	3.5		1.2	
Walnut		198+21	21.3		18.36	20.4	22.3	2.0		17.2	***-1.16***	3.2		1.2	
Walnut		194+18	21.0		18.01	20.3	22.4	2.3		17.04	***-0.97***	3.3		1.0	
Walnut		190+32	20.8		17.74	20	19.8	2.3		16.82	***-0.92***	3.2		0.9	
Walnut	Grayson Creek	188+92													
Walnut		184+18	19.9		17.59	20.5	18.7	2.9		16.83	***-0.76***	***3.1***		0.2	
Walnut		177+39	19.4		17.16	19.7	16.2	2.5		16.63	***-0.53***	3.1		0.5	
Walnut		172+56	18.9		16.96	18.4	16.7	1.4		16.42	***-0.54***	***2.5***		1.1	
Walnut		162+79	18.1		16.54	18	15.5	1.5		16.01	***-0.53***	***2.1***		0.6	
Walnut		153+62	17.3		15.91	16.2	15.3	0.3		15.6	***-0.31***	***1.7***		1.4	
Walnut		150+44	17.0		15.73	15.5	16	-0.2		15.49	***-0.24***	***1.5***		1.7	
Walnut		147+60	16.8		15.52	16	22	0.5		15.35	***-0.17***	***1.4***		0.9	
Walnut		142+34	16.3		15.2	16	20	0.8		15.11	-0.09	***1.2***		0.4	
Walnut	BNSF RR	137+62													
Walnut		137+26	16.0		14.09	14.6	11	0.5		14.1	0.01	0.5		0.0	
Walnut		134+21	15.8		13.99	14.5	16.5	0.5		14.01	0.02	0.5		0.0	
Walnut		127+03	15.5		13.84	13	20	-0.8		13.86	0.02	-0.9		0.0	
Walnut		124+60	15.4		13.71	12.6	20	-1.1		13.73	0.02	-1.1		0.0	
Walnut		118+77	15.2		13.49	13.4	20	-0.1		13.51	0.02	-0.1		0.0	
Walnut	Pacheco Creek	111+24	14.8		13.11	13.6	20	0.5		13.12	0.01	0.5		0.0	
Walnut		104+28	14.5		13.05	12.1	24.5	-1.0		13.06	0.01	-1.0		0.0	
Walnut		91+00	13.9		12.73	12.4	24	-0.3		12.74	0.01	-0.3		0.0	
Walnut		83+52	13.6		12.46	13	30	0.5		12.48	0.02	0.5		0.0	
Walnut		80+77	13.5		12.37	12.6	30	0.2		12.38	0.01	0.2		0.0	
Walnut		77+89	13.3		12.27	11.5	12	-0.8		12.28	0.01	-0.8		0.0	
Walnut		72+59	13.1		12.09	12	10	-0.1		12.11	0.02	-0.1		0.0	
Walnut		70+76	13.0		12.03	11.8	7.5	-0.2		12.04	0.01	-0.2		0.0	
Walnut		68+52	12.9		11.96	11	8	-1.0		11.97	0.01	-1.0		0.0	
Walnut	UP RR	68+37													
Walnut		68+23			10.77	10.9	6			10.78	0.01				
Walnut		67+65			10.75	11	6			10.75	0				
Walnut		67+16			10.74	11.4	8			10.75	0.01				
Walnut	Waterfront Road	66+89													
Walnut		66+65			10.56	11.9	8			10.56	0				
Walnut		66+54			10.57	11.9	8			10.57	0				
Walnut	Tosco Utility Bridge	66+42													
Walnut		66+31			10.55	11.9	8			10.55	0				
Walnut		63+92			10.57	8	7.6			10.58	0.01				
Walnut		61+72			10.52	7	13.8			10.52	0				
Walnut		57+49			10.4	8.3	13.3			10.4	0				
Walnut		49+10			10.02	10.4	12.5			10.02	0				
Walnut		41+45			9.64	10.8	12.3			9.65	0.01				
Walnut		33+84			9.28	11.3	13.8			9.28	0				
Walnut		26+85			8.78	11	13.6			8.78	0				
Walnut		19+18			7.75	11.5	14			7.76	0.01				
Walnut		13+14			6.73	14.3	4.7			6.73	0				
Walnut	Mouth @ Suisun Bay	10+28			6.61	6	4.7			6.61	0				

Hydraulic Effects of Alternative 2D along the creek channel (Freeboard & WS Elev)

100 year storm event

HEC-RAS Plan: OrgDes0412A1 Profile: Max WS

Legend

Overtopping | 0'-1' Freeboard | 1'-3' Freeboard

Bold & Italic Freeboard increase due to levee raising or Drop in WS Elev greater than 0.1'

Corrective Action Plan Project Limits

			Original Design		Exist Levee/Embankment Elevation					Alternative 2D Comparison					
Creek	Location	River Sta	1965 Levee Elev Lt (ft)	1965 Levee Elev Rt (ft)	Exist WS Elev (ft)	Ex.Lt Levee Elev (ft)	Ex.Rt Levee Elev (ft)	Lt Freebrd (ft) exist	Rt Freebrd (ft) exist	Alt 2D WS Elev (ft)	WS Elev Diff Exist vs Alt 2D (ft)	Lt Freebrd (ft) Alt 2D	Rt Freebrd (ft) Alt 2D	Frd Diff (Lt) Exist vs Alt 2D	Frd Diff (Rt) Exist vs Alt 2D
Pacheco		60+04	14.8	14.8	13.09	14.4	13.5	1.3	0.4	13.1	0.01	1.3	0.4	0.0	0.0
Pacheco		55+74	14.8	14.8	13.09	14.5	13.6	1.4	0.5	13.1	0.01	1.4	0.5	0.0	0.0
Pacheco		49+29	14.8	14.8	13.08	14.5	13	1.4	-0.1	13.1	0.02	1.4	-0.1	0.0	0.0
Pacheco		45+49	14.8	14.8	13.08	14.4	13.8	1.3	0.7	13.09	0.01	1.3	0.7	0.0	0.0
Pacheco	Henry's Wood Farm	42+03	14.8	14.8	13.08	14.1	13.9	1.0	0.8	13.09	0.01	1.0	0.8	0.0	0.0
Pacheco		39+84	14.8	14.8	13.08	13.7	13.5	0.6	0.4	13.09	0.01	0.6	0.4	0.0	0.0
Pacheco		38+23	14.8	14.8	13.08	12.8	13.1	-0.3	0.0	13.09	0.01	-0.3	0.0	0.0	0.0
Pacheco		33+15	14.8	14.8	13.08	12.6	13.3	-0.5	0.2	13.09	0.01	-0.5	0.2	0.0	0.0
Pacheco		29+99	14.8	14.8	13.08	12.6	14	-0.5	0.9	13.09	0.01	-0.5	0.9	0.0	0.0
Pacheco	Martinez Gun Club	29+27	14.8	14.8	13.08	12.6	13.8	-0.5	0.7	13.09	0.01	-0.5	0.7	0.0	0.0
Pacheco		27+37	14.8	14.8	13.08	14.5	13.8	1.4	0.7	13.09	0.01	1.4	0.7	0.0	0.0
Pacheco		19+50	14.8	14.8	13.08	15.3	13.2	2.2	0.1	13.09	0.01	2.2	0.1	0.0	0.0
Pacheco		10+47	14.8	14.8	13.09	14.4	12.8	1.3	-0.3	13.1	0.01	1.3	-0.3	0.0	0.0
Pacheco	Confluence w/ WC	06+98	14.8	14.8	13.11	13.7	13	0.6	-0.1	13.12	0.01	0.6	-0.1	0.0	0.0
Grayson	I680 SB Main Deck	59+10													
Grayson		57+34	20.1	20.1	18.73	18	19.3		0.6	18.18	***-0.55***		1.1		0.6
Grayson		54+71	20.1	20.1	18.63	17	19.5		0.9	18.05	***-0.58***		1.5		0.6
Grayson		51+50	20.1	20.1	18.56	17.5	19.4		0.8	17.96	***-0.6***		1.4		0.6
Grayson		47+85	20.1	20.1	18.44	16.5	19.4		1.0	17.8	***-0.64***		1.6		0.6
Grayson		44+68	20.1	20.1	18.4	17	18.7		0.3	17.74	***-0.66***		1.0		0.7
Grayson		42+53	20.1	20.1	18.3	18	18.8		0.5	17.62	***-0.68***		1.2		0.7
Grayson		40+77	20.1	20.1	18.26	20	18.8		0.5	17.57	***-0.69***		1.2		0.7
Grayson	SR 4 EB	40+38													
Grayson		39+95	20.1	20.1	18.23	20	20	1.8	1.8	17.54	***-0.69***	2.5	2.5	0.7	0.7
Grayson		39+77	20.1	20.1	18.23	20	20	1.8	1.8	17.53	***-0.7***	2.5	2.5	0.7	0.7
Grayson	SR 4 WB	39+43													
Grayson		38+18	20.1	20.1	18.16	19.6	20	1.4	1.8	17.46	***-0.7***	***2.6***	2.5	1.2	0.7
Grayson		35+27	20.1	20.1	18.08	19.5	19.5	1.4	1.4	17.36	***-0.72***	***2.7***	2.1	1.3	0.7
Grayson		33+84	20.1	20.1	18.04	20.3	19.3	2.3	1.3	17.32	***-0.72***	3.0	2.0	0.7	0.7
Grayson		29+39	20.1	20.1	17.95	20.4	19.9	2.5	2.0	17.21	***-0.74***	3.2	2.7	0.7	0.7
Grayson		27+36	20.1	20.1	17.92	20.1	20.2	2.2	2.3	17.18	***-0.74***	2.9	3.0	0.7	0.7
Grayson		24+20	20.1	20.1	17.86	20.6	19.5	2.7	1.6	17.1	***-0.76***	3.5	2.4	0.8	0.8
Grayson		22+84	20.1	20.1	17.85	20.3	19.7	2.5	1.9	17.08	***-0.77***	3.2	2.6	0.8	0.8
Grayson		19+77	20.1	20.1	17.8	20.2	19.7	2.4	1.9	17.02	***-0.78***	3.2	2.7	0.8	0.8
Grayson		18+64	20.1	20.1	17.78	21	20	3.2	2.2	17	***-0.78***	4.0	3.0	0.8	0.8
Grayson		17+91	20.1	20.1	17.76	21	22	3.2	4.2	16.97	***-0.79***	4.0	5.0	0.8	0.8
Grayson	Imhoff Drive	17+60													
Grayson		17+21	20.1	20.1	17.72	20	22	2.3	4.3	16.93	***-0.79***	***3.2***	5.1	0.9	0.8
Grayson		16+51	20.1	20.1	17.72	19.7	20	2.0	2.3	16.92	***-0.8***	***3.2***	3.1	1.2	0.8
Grayson		15+35	20.1	20.1	17.69	19.6	19.3	1.9	1.6	16.89	***-0.8***	***3.2***	2.4	1.3	0.8
Grayson		11+99	20.1	20.1	17.66	19.5	19	1.8	1.3	16.84	***-0.82***	***3.3***	2.2	1.4	0.8
Grayson		11+26	20.1	20.1	17.65	19.5	19	1.9	1.4	16.82	***-0.83***	***3.3***	2.2	1.4	0.8
Grayson		08+80	20.1	20.1	17.61	19.6	18.8	2.0	1.2	16.78	***-0.83***	***3.3***	2.0	1.3	0.8
Clayton		26+61			22.6	28	23.3	5.4	0.7	22.2	***-0.4***				
Clayton	Hillcrest Park	25+24			22.57	24.5	23.6	1.9	1.0	21.65	***-0.92***				
Clayton		23+88			22.55	24.8	24.2	2.3	1.7	21.38	***-1.17***				
Clayton		20+83	23.5	23.5	22.54	23.9	24.8	1.4	2.3	21.34	***-1.2***	***3.0***	3.5	1.6	1.2
Clayton		15+77	23.5	23.5	22.53	24.1	22.9	1.6	0.4	21.32	***-1.21***	***3.0***	***3.0***	1.4	2.6
Clayton		12+24	23.5	23.5	22.53	23.4	23.3	0.9	0.8	21.32	***-1.21***	***3.0***	***3.0***	2.1	2.2
Clayton		09+40	23.5	23.5	22.53	23.9	23.4	1.4	0.9	21.32	***-1.21***	***3.0***	***3.0***	1.6	2.1
Clayton		08+42	23.5	23.5	22.53	23.6	23.2	1.1	0.7	21.32	***-1.21***	***3.0***	***3.0***	1.9	2.3
Clayton	Solano Avenue	07+55													
Clayton		06+63	23.5	23.5	22.39	23.2	23	0.8	0.6	21.16	***-1.23***	***3.1***	***3.1***	2.3	2.5
Clayton		05+70	23.5	23.5	22.39	23.2	22.4	0.8	0.0	21.16	***-1.23***	***3.1***	***3.1***	2.3	3.1
Clayton	Confluence w/ WC	03+33	23.5	23.5	22.39	24.4	24.1	2.0	1.7	21.16	***-1.23***	3.2	***3.1***	1.2	1.4

The hydraulic summary tables use color shading to denote various conditions. The yellow bar represents the river stations where desilting and / or levee raising work will occur under Alternative 2d. Red shading is used where the levee top elevation is below the calculated 100-year water surface elevation. Blue shading is used for stations where the freeboard is less than 1-foot. Green shading is used for stations where freeboard is between one and three feet, and un-shaded levee stations have more than 3 feet of freeboard. This summary table includes freeboard data only at the locations of the Corps levees. The hydraulic performance of Alternative 2d is best understood by comparing the existing freeboard with the proposed freeboard at or upstream of the yellow-shaded river stations.

Alternative 2d provides a lower water surface elevation and improved freeboard within the limits of work, and those benefits extend upstream on Walnut Creek, Grayson Creek and the Clayton Valley Drain.

On Walnut Creek at the confluence with Grayson Creek, Alternative 2d lowers the water surface by 0.9 feet and at the confluence with Clayton Valley Drain, Alternative 2d lowers the water surface by 1.2 feet. This reduction in water surface extends over 6,500 LF upstream past Concord Avenue gradually decreasing in effect. The freeboard at the confluence with Grayson Creek increases from 2.3 to 3.2 feet, and at the Clayton Valley Drain, freeboard increases from effectively zero to 2.2 feet. Freeboard generally remains greater than 2 feet upstream past Concord Avenue.

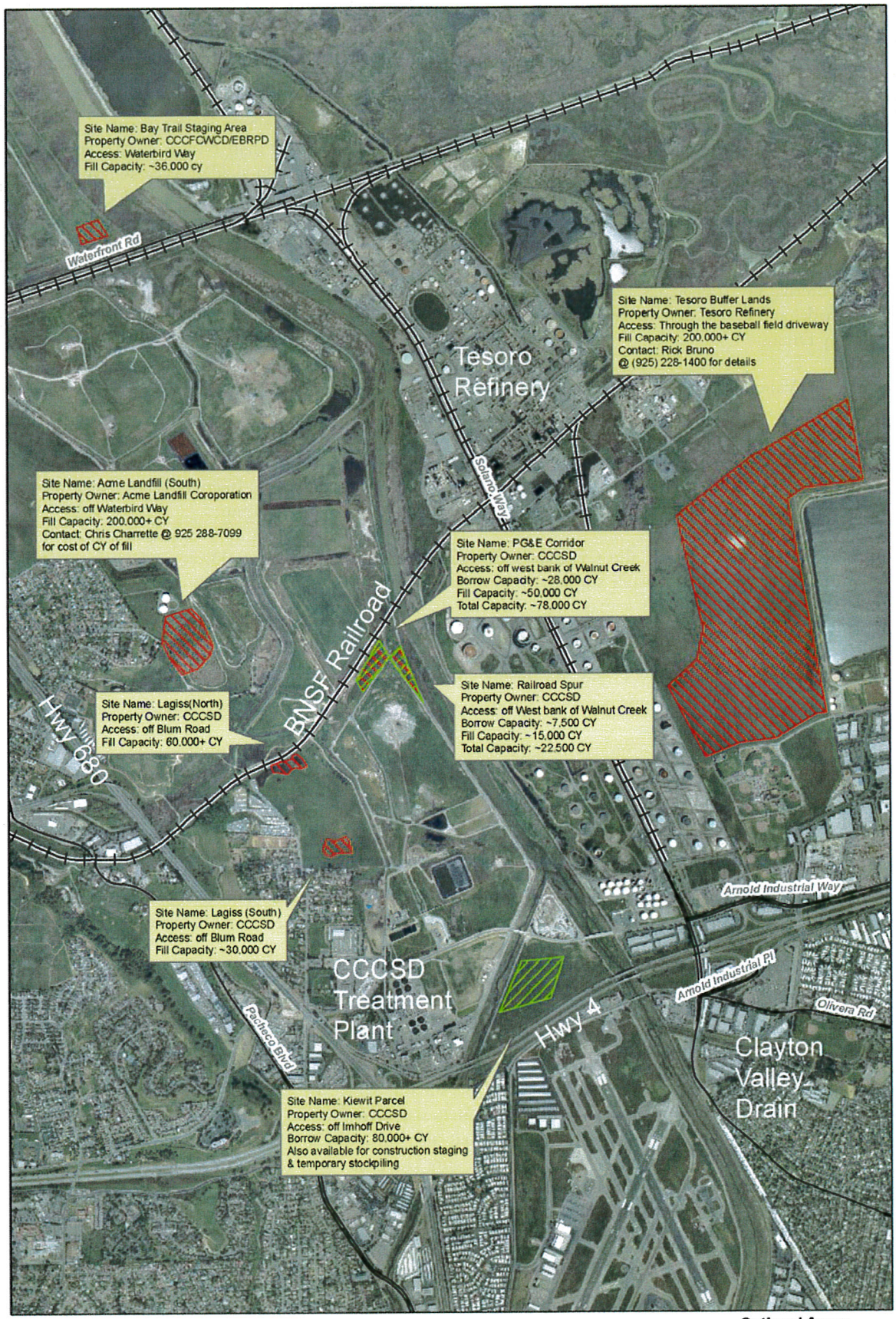
On Grayson Creek, at the CCCSD Treatment Plant (between Imhoff Drive and Highway 4), Alternative 2d lowers the water surface by approximately 0.7 feet and raises freeboard to in excess of 3 feet on the left levee for a majority of the reach. The minimum freeboard along the treatment plant is 2.5 feet just downstream of Highway 4.

On the Clayton Valley Drain, the water surface is decreased by approximately 1.2 feet, and freeboard increases from approximately 1 foot to consistently over 3 feet throughout.

The levee raising procedure is the same for all alternatives, and will follow the recommendations of the District's Geotechnical consultant, Hultgren-Tillis Engineers. Generally, the procedure includes removing the existing gravel surfacing, processing and recompacting the exposed materials, adding and compacting select material in small lifts, shaving the overbuilt side slopes, and finally restoring the all-weather gravel surfacing to the access roads. The select material for levee construction will be free of debris and organic matter, free of rocks or hard fragments greater than 4-inches in maximum dimension, and have a minimum plasticity of 18. The select material will be moisture conditioned to at least 3 percent over optimum and compacted to a minimum of 90% with a sheepsfoot compactor in maximum 8-inch lifts.

Specific details of the levee raising are contained in Hultgren-Tillis Engineers' letter report titled "Geotechnical Recommendation for Levee Raising" dated May 30, 2007 and included in Appendix I.

The geotechnical exploration indicates that a portion of the channel sediment material will meet the plasticity and gradation requirements and be suitable for levee construction. To provide the contractor sufficient options for sourcing levee material, other adjacent sites have been investigated, tested, and identified for borrow of material that also meet the geotechnical requirements. Two borrow sites adjacent to the left Walnut Creek channel levee just upstream of the BNSF railroad, and one site at the confluence of Grayson and Walnut Creeks contain material that meet the geotechnical requirements. The District is negotiating with the underlying property owner to make these sites available for borrow. The three borrow sites are identified as green hatched areas on the exhibit included in Appendix N, duplicated here as Figure 6. The analysis and raw data from these site specific investigations are contained in Hultgren-Tillis Engineers' letter report titled "Fill / Borrow Site Test Results" dated June 7, 2007 and included in Appendix I.



Contra Costa County Flood Control & Water Conservation District

Optional Borrow and Disposal Sites
Lower Walnut Creek Interim Protection Project

N

0 500 1,000 Feet

Optional Areas for Contractor Use

- Borrow Site Only
- Fill Site Only
- Borrow and Fill Site

In summary, this alternative eliminates the shallow flooding expected at the commercial area near Marsh Drive and at the northeast corner of the Buchanan Field Airport. It provides increased freeboard along the Grayson and Walnut Creek frontages of the CCCSD treatment plant, and provides improved freeboard up Walnut Creek, Grayson Creek, and the Clayton Valley Drain. However, this alternative does not provide improved freeboard along Pacheco Creek and along Walnut Creek downstream of the BNSF Railroad. This leaves both the ACME landfill and the IT Baker sites with their existing level of flood protection unchanged. Considering these sites' unoccupied nature and their inclusion in the current and past FEMA Flood Insurance Rate Maps, the impact of continued shallow flooding of these areas is considered minimal.

RESIDUAL RISK OF IMPLEMENTING ALTERNATIVE 2D

The residual risk for implementing Alternative 2d is very different for the land uses upstream and downstream of the BNSF Railroad. Typically, land uses upstream of the railroad are active industrial, municipal, or commercial uses. Downstream of the railroad, the land uses subject to flooding are typically closed industrial sites, or low-lying buffer lands to more active industrial areas. The residual risk for each area is described in more detail below.

RESIDUAL RISK UPSTREAM OF THE BNSF RAILROAD

Upstream of the BNSF Railroad, land uses are characterized by high-value industrial, municipal and commercial uses. Adjacent to the right bank of Walnut Creek is the Tesoro Refinery, but is located at an elevation significantly higher than the channel top of bank. Adjacent to the left bank of Walnut and Grayson Creeks is the Central Contra Costa Sanitary District's regional wastewater treatment plant. This plant has a capacity of 55 million gallons per day and serves 440,000 households and businesses. Much of the plant, including pumps, furnaces and control systems, is located approximately 20-feet below ground in a network of subterranean tunnels. These tunnels include multiple vents and access stairways, so even shallow flooding across their property would flood the tunnels and shut down the plant. The Sanitary District has estimated that such a flooding event would cause $40,000,000 in equipment damage and shut down the plant for a minimum of 30 days. During this time, the plant would bypass untreated sewage into Pacheco Creek and ultimately into the Lower Walnut Creek channel.

Other adjacent land uses upstream of the BNSF Railroad include the "County Quarry" concrete and aggregate recycling plant at the confluence with Grayson Creek, the Lithia Dodge / Jeep / Chrysler dealership and a complex of Light Industrial and Commercial Buildings near the confluence with the Clayton Valley Drain, and the Buchanan Field Airport.

Implementing Alternative 2d provides greatly increased flood protection for these parcels and leaves a greatly reduced residual risk.

RESIDUAL RISK DOWNSTREAM OF THE BNSF RAILROAD

Downstream of the BNSF Railroad, land uses are characterized by open marsh areas and generally unoccupied industrial uses. From north to south, adjacent west bank land uses include the Pacheco Marsh, the ACME Landfill, the closed IT-Baker hazardous material landfill, and buffer lands for both ACME and IT-Baker. Land uses along Pacheco Creek include the other frontages of ACME Landfill and the IT-Baker sites, and the Martinez Gun Club. All are described in more detail below.

The Pacheco Marsh is owned by the Flood Control District and was the disposal site used in the 1973 USACE dredge of the lower channel. The site is a combination of uplands and poor quality wetlands and is slated for future restoration. The site is unoccupied. The 1965 design included no levee on this parcel and anticipated periodic flooding of the site.

The ACME landfill is a 70-foot high mountain that currently accepts construction debris and green waste for disposal. The main landfill is surrounded by a 300-foot buffer zone. This buffer zone is high quality salt marsh and wetland habitat and supports a number of threatened and endangered species, such as the salt marsh harvest mouse. The buffer zone is also the area that is inundated in a 1%-chance storm event or would be inundated if the left bank levee were to fail. Feedback from the management of the landfill is that the buffer area is frequently inundated from interior drainage, and any flooding of this zone has no effect on their landfill operations. The long term desire of the District is to incorporate this buffer zone into a wider, more sustainable channel as part of the GRR project. There is no detriment to infrequent inundation of this area from levee overtopping (ref: Appendix S, Photos 2, 4, 5, 6 and 7).

The IT-Baker site is a closed and capped hazardous waste landfill located between Pacheco Creek and Lower Walnut Creek. (Photos 29, 33, 35 and 36). The closure and remediation of this site was approved by the Department of Toxic Substances Control. The Flood Control District was sensitive to the effect of potential inundation on the closed and capped hazardous waste landfill, and directed our environmental consultant, Ninyo and Moore, to investigate the effect of inundation on the facility. Ninyo and Moore investigated the landfill's approved and implemented closure plan and produced a summary report. The investigation found that the closure plan was implemented with the knowledge that the site was within the FEMA 1%-chance floodplain, and was designed to withstand periodic inundation without impact to the waste encapsulated below. The site was designed for a 24-hour PMP event in the Walnut Creek watershed, an event far exceeding the design of the Walnut Creek Channel. The full report, including the excerpts from the approved closure plan, is included in Appendix R.

Located between the IT-Baker site and the left Walnut Creek Levee is a 350-foot buffer zone that was used for borrow of levee materials and disposal of channel dredge spoils when the facility was originally constructed. This parcel, owned by the District, now supports various types of marsh and wetland habitats. The long term desire of the District is to incorporate this buffer zone into a wider, more sustainable channel as part of the GRR project. There is no detriment to infrequent inundation of this area from levee overtopping. (Photos 33, 35, and 36).

On Pacheco Creek, the adjacent land uses include the ACME Fill and IT-Baker sites described in detail above. Other land uses include the IT-Vine Hill Site and the Martinez Gun Club. The IT Vine Hill site is addressed in the same closure plan as the IT-Baker site, but it is located at a much higher elevation and is located outside and above the 1%-chance floodplain. (Photo 11).

The Martinez Gun Club includes a clubhouse and parking at an elevation above the floodplain, and a large, low marsh area over which the members practice their marksmanship. (Photo 9). This low marsh area is located within the calculated 1%-chance floodplain, and also becomes periodically

inundated by interior drainage independent from Pacheco Creek. This marsh area is considered high quality habitat for the salt-marsh harvest mouse, and efforts by the Gun Club to raise the elevation of this low area have been unsuccessful because of the presence of sensitive habitat.

Appendix S contains photos of the ACME Fill site, including the marsh and 300-foot buffer area, the Martinez Gun Club, the IT-Baker site and the buffer lands between the IT-Baker site and the left levee of the Walnut Creek channel. It also contains a key map showing the expected 1%-chance floodplain and the location and direction of each photo.

It is also important to note that the recently calculated 1%-chance floodplains covers a much smaller area than that shown on the FEMA FIRM dating back to 1987. The comparison of these floodplains is shown in Figure 4. The areas subject to residual risk are actually smaller than those in the official FEMA floodplain. Implementing Alternative 2d will not modify or worsen these official FEMA floodplains.

Comparing the reach of the Walnut Creek upstream of the BNSF Railroad with that downstream of the railroad shows that the upstream parcels are occupied, more actively used, and much more sensitive to the effects of inundation from failure of the Flood Control Channel. As such, alternatives that included work in this reach ranked higher when compared to alternatives that focused on the area downstream of the railroad. The residual risk of implementing Alternative 2d as a Phase I project is acceptable to the District, and the District looks forward to working with the Corps on addressing the sustainability issues of the channel downstream of the BNSF Railroad with the GRR project.

IMPLEMENTATION SCHEDULE & PHASING OF WORK

Once the District was made aware of the deficiencies in the existing channel and the Corps' deadline for correction, it adopted an extremely aggressive schedule to implement the corrective measures. This involved the compression of a typical two-year planning, permitting, and design effort into approximately four months. But after fully analyzing the environmental impacts of the Corps-mandated work downstream of the BNSF Railroad, it became clear that it was absolutely not possible to complete this work in the Corps-mandated 1-year window. This necessitated a two phase approach. **Phase I would include implementing all the items contained in Alternative 2d by November 2007**.

Major recent and upcoming Phase I milestones include:

- Public meeting on the preferred alternative and the planning process (June 19)
- Contractor outreach and constructability/bidability review (June 27 and 28)
- Complete plans/specifications/engineer's estimate (late July)
- Advertise contract (late July)
- Award contract (early August)
- Start of construction (Mid August)
- Completion of work (late October)

A copy of the detailed Microsoft Schedule for the Phase I project is included in Appendix O.

Phase II work contains the work identified in the Corps' March 30, 2007 deficiency letter that must be deferred to the following construction season due to constructability and permitting timelines. Phase II work includes:

- Removing encroachments and restoring approximately 2,300 linear feet of levee on the right bank of Grayson Creek between State Highway 4 and Interstate 680. This section of levee has encroachments installed by the Rancho Diablo Mobile Home Park (Appendix M). Surveying the right of way lines, determining the type of encroachments within our land rights, and the public outreach to the encroaching parties will take some time to achieve. The planning work is scheduled for Fall 2007 through Spring 2008, with implementation scheduled for Fall 2008.

- Dredging and raising levees on the lowest reach of Walnut Creek from the mouth up to the BNSF Railroad and along Pacheco Creek. These are the areas containing high quality habitat for four State and/or Federal listed species described elsewhere in this plan. Despite the inherent incompatibility with the ultimate GRR project, the District understands the implementation of this work is required by the Corps to retain the "active" status of the facility. As such, the District will begin the project development process by applying for regulatory permits for the dredge and levee work downstream of the BNSF Railroad. The indication we have received from the Regulatory Agencies is that permitting for this work will take a very long time and there is no assurance that a permit will ever be issued. The implementation of this portion of Phase II work is contingent on successfully securing the regulatory permits covering the work.

CHALLENGES AND CONSTRAINTS

In order for the District to successfully implement the preferred interim protection alternative, a number of technical, regulatory and financial issues will need to be resolved. The District is working on resolving — or at least reducing the risk of — the following challenges and constraints as the project is prepared for construction this summer:

- Uncertainty in securing levee raising materials and finding an appropriate and economical sediment disposal site.
- Need to ensure levee borrow material is free from contamination.
- Uncertainty whether construction bid amounts will be within project budget.
- Constructability — need to ensure production rate is sufficient, while avoiding paying for schedule compaction or an accelerated work effort.
- Need to ensure levee work and desilt work can occur simultaneously without affecting production rate of either task.
- Need to ensure regulatory permits are completed on time and with acceptable mitigation for project impacts.
- Uncertainty whether the Corps will fully embrace our interim protection measures project as an acceptable solution.
- Uncertainty whether the Corps will allow ultimate cost/benefit analysis to be based on existing levels of sediment. The project may need to be scaled back to meet the minimum objectives only and to maximize viability of the ultimate GRR project.

- Uncertainty of the effect that future hydrology and tide elevation changes will have on the hydraulic performance of the interim project.

MODIFICATIONS TO THE 1965 OPERATIONS AND MAINTENANCE MANUAL

While the proposed Phase I work does not restore the channel completely back to the 1965 condition, the District is not proposing to modify the adopted 1965 Operations and Maintenance (O&M) Manual. Instead, the District will prepare a set of as-constructed plans for the Phase I work and provide these to the Operations and Readiness Branch of the Sacramento District of the Corps for use in future maintenance inspections. These plans will be forwarded within 90 days of completion of the Phase I improvements. Additionally, the District will request a post-project inspection to assure the Corps that the Phase I work has been successfully completed.

Additionally, the District proposes to survey selected cross sections annually to monitor the rate of sedimentation. This data will not only help predict the lifespan of the Phase I work, but also is expected to be useful for calibrating the sediment model as part of the GRR.

The District anticipates that a new O&M Manual will be produced at a future date to reflect a new channel condition caused by the GRR project.

OUTREACH EFFORTS

The District has been especially proactive in reaching out to watershed stakeholders. Typical information shared in these meetings has been:

- The history of the channel and channel maintenance.
- The role of the Corps of Engineers.
- The role of FEMA and their provisional accreditation of levees.
- The deficiencies identified by the Corps.
- The District's plan for addressing these concerns.
- The benefits, costs and environmental effects of implementing the preferred alternative.
- The schedule for implementation.
- The challenges and uncertainties in implementing the preferred alternative.
- The consequences of not implementing an alternative acceptable to the Corps and FEMA.

A full list of meetings is noted below. Copies of agendas and staff reports for the meetings noted are included in Appendix K.

Date	Presentation to....	Agenda or Staff Report included in Appendix K?
February 12	Transportation Water and Infrastructure Committee (TWIC) of the Contra Costa County Board of Supervisors	Yes
February 12	County Supervisor Susan Bonilla	

February 20	Remy Goldsmith and Paul Kidwell of Congresswomen Tauscher's Staff	Yes
February 26	Kathy Hoffman of Congressman Miller's Office	
February 28	Central Contra Costa Sanitary District (CCCSD) General Manager and Director of Engineering.	
March 13	Contra Costa County Board of Supervisors (Board adopted TWIC recommendations and signed letter to Col. Light)	Yes
March 14	Contra Costa Watershed Forum, a coalition of watershed groups, friends of creeks groups, agency staff, regulators, and interested citizens. Presentation was followed by a presentation by Clark Frentzen, USACE SPD on the same topic.	
April 5	CCCSD Board Meeting	
April 12	Site tour with CCCSD and Congresswomen Tauscher's staff	
April 30	Technical presentation to CCCSD staff on existing hydraulic conditions and effect of flooding on their facility.	
April 30	Corps of Engineers, Regulatory Branch	
May 1	Regional Water Quality Control Board — Management Staff	
May 7	City of Concord — Public Works Director and Infrastructure Manager	
May 8	Tesoro Refinery — Facilities Manager	
May 9	Interagency Meeting — San Francisco. Attendees: USACE Regulatory, EPA, & Regional Water Quality Control Board	Yes
May 9	Contra Costa Watershed Forum in Town of Danville	
May 9	CCCSD — Director of Engineering and Capital Programs Manager	
May 10	Walnut Creek Watershed Council Exploratory Committee — a coalition of watershed groups, friends of creeks groups, and city staff	Yes
May 11	City — County Engineers Association	
May 14	Transportation Water and Infrastructure Committee of the Contra Costa County Board of Supervisors	Yes

May 17	City of Martinez — City Engineer	
May 17	State Department of Fish and Game — Management Staff	
May 20	Contra Costa Council — a group of business and government leaders	
May 21	City of Pleasant Hill — Public Works Director	
May 24	CCCSD Board	
May 30	Remy Goldsmith and Paul Kidwell, Congresswomen Tauscher's Staff (telephone briefing of project status)	
June 6	East Bay Regional Park District	
June 7	City of Walnut Creek — City Engineer	
June 13	Pacheco Municipal Advisory Council	
June 13	City of Concord – City Engineer	
June 13	East Bay Regional Park District	
June 13	ACME Fill Corporation	
June 19	Public Information Meeting on Project	Yes
June 25	Transportation Water and Infrastructure Committee of the Contra Costa County Board of Supervisors	Yes

The District's process for preparing and adopting a Mitigated Negative Declaration to satisfy the California Environmental Quality Act (CEQA) has also included public notification and outreach. The Mitigated Negative Declaration (a copy of which is included in Appendix P) includes full details of the proposed corrective actions. This document was posted at the County Clerk's office, legal notifications were published in the local newspaper, and the document is posted on the District's web page. Notification of posted document was emailed to individuals on the Contra Costa Watershed Forum email list, which includes over 330 watershed stakeholders.

Additionally, to ensure that the public is fully aware of the proposed corrective actions, the District held a public meeting on June 19, 2007. At this meeting, District staff presented the process used to develop this corrective action plan, as well as the content of the preferred alternative. Notice of this public meeting was featured on the District's website and invitations were sent to the Watershed Forum email list described above.

EMERGENCY EVACUATION PLAN FOR THE AFFECTED AREA

All emergency evacuations are coordinated though the Contra Costa County Office of Emergency Services (OES). They prepare emergency evacuation plans to cover specific perils. In response to the Corps' notification letter, OES has prepared an evacuation plan for flooding of the Lower Walnut Creek area. This evacuation plan covers the area within the official FEMA floodplain. It is important to note that this FEMA floodplain (from 1987) covers a much larger area than that shown in the recent HEC-RAS model, and that a majority of the area is shown on the FIRM as unnumbered A zone. A comparison of the FEMA and the recent HEC-RAS floodplains is included in Appendix E.

The emergency evacuation plan is included in Appendix Q.

SUMMARY

This Corrective Action Report covers in detail the work that can be done within the one year timeline specified in the Corps' March 30, 2007, letter. To avoid impacts to nesting birds as required by the Migratory Bird Treaty Act, and to meet State requirements for construction in the riparian zone of creeks, the available window of construction is August through October. Even though the Corps has provided a one year to correct deficiencies, all work must be done in this three month window.

The District carefully developed, analyzed, ranked and determined that the work contained in Alternative 2d has the best likelihood for successful completion within the Corps' one-year timeframe. The District has developed an extremely aggressive schedule and is on target for meeting that goal with Phase I. Phase I includes all the work in Alternative 2d.

The Phase I project focuses resources on the areas with the most hydraulic benefit and the greatest likelihood of securing regulatory permits. For Lower Walnut Creek, this reach is between the BNSF Railroad and the Clayton Valley Drain. Work in this reach avoids the most sensitive habitat, provides increased freeboard along high risk parcels, such as the CCCSD sewage treatment plant, and extends that benefit up both Grayson Creek and the Clayton Valley Drain.

As shown in the hydraulic summary tables following Figure 5 and repeated in Appendix N, the Phase I work provides greatly improved freeboard in Walnut Creek. At the confluence with Grayson Creek the freeboard increases from 2.3 to 3.2 feet and at the confluence with Clayton Valley Drain, freeboard increases from effectively zero to 2.2 feet. Freeboard generally remains greater than 2 feet upstream past Concord Avenue. On Grayson Creek, Phase I work raises the freeboard to in excess of 3 feet on the left levee for a majority of the reach along the CCCSD sewage treatment plant. The minimum freeboard along the treatment plant is 2.5 feet just downstream of Highway 4. On the Clayton Valley Drain the freeboard increases from approximately 1 foot to consistently over 3 feet throughout.

Both Pacheco Creek and the reach of Walnut Creek downstream of the BNSF Railroad contain high value habitat for four State and/or Federal listed species: salt marsh harvest mouse *(Federal and State Endangered; State Fully Protected)*, soft bird's-beak *(Federal Endangered)*, California clapper rail *(Federal and State Endangered; State Fully Protected)* and California black rail *(State threatened; State Fully Protected)*. No form of individual take is authorized for "fully protected species"— not even relocation. Therefore, large-

scale habitat removal for these species, as would result from channel dredging or levee reconstruction, would not be permitted by the California Department of Fish and Game. Even if the regulatory permits were obtainable, the magnitude of the project necessitates a phased approach over multiple years and would not meet the Corps' one year rehabilitation deadline.

The District understands the work downstream of the BNSF Railroad is required by the Corps to retain the active status of this facility, although getting permits to do this work may not be feasible. The District believes that the GRR project will result in a sustainable channel and represents the ultimate solution to this dilemma of conflicting requirements. This is the District's long-range vision, a vision we believe we share with the Corps.

The residual risk of deferring work downstream of the BNSF Railroad is low (Appendix S). There are no occupied structures in the floodplain, and the floodplain has been long-established on the FEMA Flood Insurance Rate Maps. The FEMA maps also significantly overestimate the magnitude of flooding compared to the District's more detailed recent modeling (Appendix E).

Nonetheless, the District intends to immediately follow the implementation of Phase I work with the regulatory permit applications for dredging downstream of the BNSF Railroad as Phase II work. Implementation of Phase II is dependant on receipt of the necessary regulatory permits. The District is not optimistic that Phase II work can be completed until the GRR process is implemented, and is concerned about the inherent incompatibility of a full dredge project with the ecosystem restoration goals of the GRR study.

The other major deficient section outlined in the Corps' 2006 inspection is the right levee of Grayson Creek between State Highway 4 and Interstate 680. The detailed design work for removing encroachments and restoring approximately 2,300 linear feet of levee is scheduled for Fall 2007 through Spring 2008, with implementation scheduled for Fall 2008. Because this work will not be completed within the 1-year timeframe, it has been included in Phase II of this Plan.

The remainder of items on the Corps' 2006 inspection are more minor in nature, and many have already been corrected. The District looks forward to the Corps' 2007 inspection, and requests that it be scheduled after the completion of Phase I of this Corrective Action Plan.

ACKNOWLEDGEMENTS

This effort would not have been possible without the extraordinary efforts of the Project Manager, Larry Theis, and the Environmental Planner, Cece Sellgren. Other critical assistance came from Wiley Osborne for GIS support, and Olivia Reynolds for Real Property outreach. Consultant assistance included Hultgren-Tillis Engineers for geotechnical engineering, LSA Associates for CEQA and regulatory permitting support, RBF Consulting for cost estimating support, and Ninyo and Moore for environmental assessment. The overall effort was performed under the direction of Paul R. Detjens, Senior Civil Engineer; Greg Connaughton, Assistant Chief Engineer; and Mitch Avalon, Deputy Chief Engineer of the District.

APPENDIX A:

THE US ARMY CORPS OF ENGINEERS

MARCH 30, 2007 DEFICIENCY CORRECTION LETTER

APPENDIX B:

THE US ARMY CORPS OF ENGINEERS

1972 LETTER SUPPLEMENT #3 TO DESIGN MEMORANDUM #1