Walnut and Grayson Creeks Levee Rehabilitation
At CCCSD Treatment Plant Project
Contra Costa County Flood Control and Water Conservation District
Benefits and Cost Analysis

Introduction

The primary benefit of the Walnut and Grayson Creeks Levee Rehabilitation at CCCSD Treatment Plant Project is flood damage reduction for said treatment plant. Because inundation associated with levee overtopping has significant and predictable effects to the treatment plant's electrical, mechanical and control systems (assets), and because CCCSD has tabulated and estimated the cost to replace these systems, the benefits of protecting the treatment plant from inundation can be easily quantified. Furthermore, because CCCSD will be the first to flood if the levees in this area overtopped and because the costs to replace the flood damaged treatment plant are so high ($146,380,000), damage that may occur to other property owners behind the levees is not nearly so significant and can be ignored for purposes of this analysis. Thus, the cost benefit analysis for this project is solely focused on preventing flood damage to the CCCSD treatment plant assets.

Section D1. Flood Damage Reduction Benefit Analysis

This benefit analysis for this project will only focus on avoided physical damage to the CCCSD treatment plant assets. As noted above, this analysis specifically looks at the replacement cost for the treatment plant's electrical, mechanical and control systems. However, in addition to avoiding impact to the treatment plant's systems, implementing the project would also avoid the following damages that could also occur during a low-frequency flood event:

- Damage to landscape and vehicles
- Loss of sewage service to CCCSD customers
- Loss of business function to other facilities in the area (County Costa County Public Works and County Costa County Animal Control)
- Emergency response and clean-up associated with the release of untreated sewage
- Public health and safety impacts associated with the release of untreated sewage and curtailment of sewage service.

These damages are mentioned here for the sake of completeness; however, they will not be entered in the Flood Damage Reduction Benefit Analysis.

Calculating the Expected Annual Damage

The expected annual damage (EAD) calculations, without and with project, are contained in Table 11 (following page). These calculations are based on the following assumptions:

- **Any** inundation of the CCCSD treatment plant will trigger a flood damage of $146,380,000. As noted previously, this damage will occur because these systems are at or below grade in tunnels and vaults. As previously noted, this is the only cost included in the analysis due to its high magnitude.
- The proposed project will raise the levees to a height greater than the 500-year hydrologic event with freeboard, but less than the 600-year hydrologic event with freeboard. CCCSD has requested that the District provide a 500-year level of flood protection with freeboard. Final levee height will be determined in proposed project Task 1.2, Risk and Uncertainty Analysis.

Table 11 – Calculation of Expected Annual Damage, Grayson and Walnut Creeks Levee Rehabilitation at CCCSD Treatment Plant Project											
Hydrologic Event	Event Exceedance Probability	Event Damage if Flood Structures Fail	Probability Structural Failure		Expected Event Damage		Interval Probability	Average Damage in Interval		Average Damage in Interval times Interval Probability	
			Without Project	With Project	Without Project	With Project		Without Project	With Project	Without Project	With Project
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(i)	(j)	(k)	(l)	(m)
					(c) x (d)	(c) x (e)	from (b)	from (f)	from (g)	(i) x (j)	(i) x (k)
25-year	0.0400	$146,380,000	0	0	$0	$0					
30-year	0.0333	$146,380,000	0	0	$0	$0	0.00667	$0	$0	$0	$0
50-year	0.0200	$146,380,000	1	0	$146,380,000	$0	0.01333	$73,190,000	$0	$975,867	$0
100-year	0.0100	$146,380,000	1	0	$146,380,000	$0	0.01000	$146,380,000	$0	$1,463,800	$0
200-year	0.0050	$146,380,000	1	0	$146,380,000	$0	0.00500	$146,380,000	$0	$731,900	$0
500-year	0.0020	$146,380,000	1	0	$146,380,000	$0	0.00300	$146,380,000	$0	$439,140	$0
600-year	0.0017	$146,380,000	1	1	$146,380,000	$146,380,000	0.00033	$146,380,000	$73,190,000	$48,793	$24,397
Expected Annual Damages, Without and With Project										$3,659,500	$24,397

- Implementation of the proposed project will greatly reduce the risk of structural failure of the levees and the subsequent inundation of the CCCSD treatment plant below a 500-year hydrologic event (represented by a "0" in column (e) of Table 11).

As reported in Table 11, the EAD without the project = $3,659,500, and the EAD with the project is $24,397.

Total Present Value of Expected Annual Damage Reduction Benefits
The present value of EAD benefits is presented in Table 12, below.

Table 12 – Present Value of Expect Annual Damage Benefits Project: Walnut and Grayson Creeks Levee Rehabilitation at CCCSD Treatment Plant			
(a)	Expected Annual Damage Without Project		**$3,659,500**
(b)	Expected Annual Damage With Project (1)		**$24,397**
(c)	Expected Annual Benefit	(a) – (b)	**$3,635,103**
(d)	Present Value Coefficient (2)		**15.76**
(e)	**Present Value of Future Benefits Transfer to Table 17, column (d)**		**$57,289,223**

(1) *This program assumes no land use changes in the floodplain. So, EAD will be constant over the analysis period.*
(2) *6% discount rate; 50 –year analysis period.*

Section D2. Non-Monetized Benefit Analysis
Non-monetized benefits for this project include:

- Community/social benefit of increased public health and safety
- Environmental stewardship benefit of prevention of water quality degradation
- Sustainability benefit of improved wastewater treatment reliability
- Sustainability benefit of increasing overall system resilience/more robust infrastructure

Non-monetized benefits are further delineated in the following Table 13:

Table 13 – Non-monetized Benefits Checklist		
Walnut and Grayson Creeks Levee Rehabilitation at CCCSD Treatment Plant Project		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits	
	Will the proposal:	
1	**Provide education or technology benefits?**	**No**
2	**Provide social recreation or access benefits?**	**No**
3	**Help avoid, reduce, or resolve various public water resources conflicts?**	**Yes**
	This project will help meet an existing state mandate to provide flood protection for central Contra Costa County. This project will help meet the state mandate to improve water quality in the San Francisco Bay.	
4	**Promote social health and safety?**	**Yes**
	This project will reduce the risk of exposure to water-related hazards (disease and chemical contamination) associated with the release of untreated sewage.	
5	**Have other social benefits?**	**No**
	Environmental Stewardship Benefits:	
	Will the proposal	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**No**
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**Yes**
	This project will prevent water quality degradation by reducing the risk of an untreated sewage discharge in the event of a low-frequency storm.	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	**No**
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	**No**
	Sustainability Benefits:	
	Will the proposal:	
10	**Improve the overall, long-term management of California groundwater resources?**	**No**
11	**Reduce demand for net diversions for the regions from the Delta?**	**No**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	Raising the levees that protect the treatment plant provides a long-term and cost-effective solution to potential plant inundation.	
13	**Reduce water consumption on a permanent basis?**	**No**

Table 13 – Non-monetized Benefits Checklist (continued)		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
14	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	**No**
15	**Improve water supply reliability in ways not quantified in Attachment 7?**	**Yes**
	This project will reduce the risk of a catastrophic shut down of the treatment plant.	
	This project will increase operational certainty in the face of infrequent storm events	
	This project will increase overall treatment system reliance and create more robust infrastructure.	
	This project will prevent the discharge of untreated sewage to the San Francisco Bay	
16	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	**Yes**
	This project will increase the operational viability of the recycled water system, and thus reduce dependence on potable water.	

Section D3. Monetized Benefit Analysis
While this project may provide other benefits that can be monetized, their contribution is small when compared to the value of providing flood protection to the CCCSD treatment plant. For purposes of this proposal, this project only has flood damage reduction benefits that can be monetized.

Section D4. Project Benefits and Cost Summary
Tables 16 and 17 are included on the following pages.

Project Costs
The life of the proposed project is 50 years. The project will be constructed in 2016, thus the life of the project terminates in 2066, as shown on Table 16.

Proposal Benefits and Costs Summary
Table 16, Annual Costs of Project, shows the annual costs of the project over its 50-year lifetime. Project costs are distributed over late 2013 through 2016 as projected in the project schedule. Table 17, Proposed Benefits and Costs Summary, show the overall project costs summarized.

Table 16 – Annual Costs of Project
(All costs should be in 2012 Dollars)

Project: Walnut and Grayson Creek Levee Rehabilitation at CCCSD Treatment Plant Project

	Initial Costs Grand Total Cost from Table 6 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012				$ 5,000	$ 7,000	$ -	$ -	$ 12,000	1.000	$ 12,000
2013	$ 72,314				$ 7,500	$ -	$ -	$ 79,814	0.943	$ 75,265
2014	$ 217,160				$ 7,500	$ -	$ -	$ 224,660	0.890	$ 199,947
2015	$ 217,160				$ 8,000	$ -	$ -	$ 225,160	0.840	$ 189,134
2016	$ 1,688,008				$ 8,000	$ -	$ -	$ 1,696,008	0.792	$ 1,343,238
2017					$ 8,500	$ -	$ -	$ 8,500	0.747	$ 6,350
2018					$ 8,500	$ -	$ -	$ 8,500	0.705	$ 5,993
2019					$ 8,500	$ -	$ -	$ 8,500	0.665	$ 5,653
2020					$ 8,500	$ -	$ -	$ 8,500	0.627	$ 5,330
2021					$ 8,600	$ -	$ -	$ 8,600	0.592	$ 5,091
2022					$ 8,600	$ -	$ -	$ 8,600	0.558	$ 4,799
2023					$ 8,600	$ -	$ -	$ 8,600	0.527	$ 4,532
2024					$ 8,600	$ -	$ -	$ 8,600	0.497	$ 4,274
2025					$ 8,700	$ -	$ -	$ 8,700	0.469	$ 4,080
2026					$ 8,700	$ -	$ -	$ 8,700	0.442	$ 3,845
2027					$ 8,700	$ -	$ -	$ 8,700	0.417	$ 3,628
2028					$ 8,700	$ -	$ -	$ 8,700	0.394	$ 3,428
2029					$ 8,700	$ -	$ -	$ 8,700	0.371	$ 3,228
2030					$ 8,800	$ -	$ -	$ 8,800	0.350	$ 3,080
2031					$ 8,800	$ -	$ -	$ 8,800	0.331	$ 2,913
2032					$ 8,800	$ -	$ -	$ 8,800	0.312	$ 2,746
2033					$ 8,800	$ -	$ -	$ 8,800	0.294	$ 2,587
2034					$ 8,800	$ -	$ -	$ 8,800	0.278	$ 2,446
2035					$ 8,800	$ -	$ -	$ 8,800	0.262	$ 2,306
2036					$ 8,800	$ -	$ -	$ 8,800	0.247	$ 2,174
2037					$ 8,800	$ -	$ -	$ 8,800	0.233	$ 2,050
2038					$ 8,800	$ -	$ -	$ 8,800	0.220	$ 1,936
2039					$ 8,900	$ -	$ -	$ 8,900	0.207	$ 1,842
2040					$ 8,900	$ -	$ -	$ 8,900	0.196	$ 1,744
2041					$ 8,900	$ -	$ -	$ 8,900	0.185	$ 1,647
2042					$ 8,900	$ -	$ -	$ 8,900	0.174	$ 1,549
2043					$ 8,900	$ -	$ -	$ 8,900	0.164	$ 1,460
2044					$ 8,900	$ -	$ -	$ 8,900	0.155	$ 1,380
2045					$ 8,900	$ -	$ -	$ 8,900	0.146	$ 1,299
2046					$ 8,900	$ -	$ -	$ 8,900	0.138	$ 1,228
2047					$ 9,000	$ -	$ -	$ 9,000	0.130	$ 1,170
2048					$ 9,000	$ -	$ -	$ 9,000	0.123	$ 1,107
2049					$ 9,000	$ -	$ -	$ 9,000	0.116	$ 1,044
2050					$ 9,000	$ -	$ -	$ 9,000	0.109	$ 981
2051					$ 9,000	$ -	$ -	$ 9,000	0.103	$ 927
2052					$ 9,000	$ -	$ -	$ 9,000	0.097	$ 873
2053					$ 9,000	$ -	$ -	$ 9,000	0.092	$ 828
2054					$ 9,000	$ -	$ -	$ 9,000	0.087	$ 783
2055					$ 9,000	$ -	$ -	$ 9,000	0.082	$ 738
2056					$ 9,000	$ -	$ -	$ 9,000	0.077	$ 693
2057					$ 9,000	$ -	$ -	$ 9,000	0.073	$ 657
2058					$ 9,000	$ -	$ -	$ 9,000	0.069	$ 621
2059					$ 9,000	$ -	$ -	$ 9,000	0.065	$ 585
2060					$ 9,000	$ -	$ -	$ 9,000	0.061	$ 549
2061					$ 9,100	$ -	$ -	$ 9,100	0.058	$ 528
2062					$ 9,100	$ -	$ -	$ 9,100	0.055	$ 501
2063					$ 9,100	$ -	$ -	$ 9,100	0.052	$ 473
2064					$ 9,100	$ -	$ -	$ 9,100	0.049	$ 446
2065					$ 9,100	$ -	$ -	$ 9,100	0.046	$ 419
2066					$ 9,100	$ -	$ -	$ 9,100	0.043	$ 391
									Total Present Value of Discounted Costs (Sum of Column (j))	$ 1,928,514
									Transfer to Table 17, column (c), Proposal Benefits and Costs Summaries	

Comments: The life of the proposed project is 50 years. The project will be constructed in 2016, thus the life of the project terminates in 2066. The District currently maintains the levees in this area as part of an overall watershed-wide maintenance program. No additional administrative or operation costs are anticipated with this project. With the increased levee footprint, some nominal maintenance costs are expected, and reflected in this table.

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

Contra Costa County Flood Control & Water Conservation District

Table 17 – Proposed Benefits and Costs Summary
Proposal: Walnut and Grayson Creeks Levee Rehabilitation at CCCSD Treatment Plant Project
Agency: Contra Costa County Flood Control and Water Conservation District

Project	Project Proponent	Total Present Value Project Costs	Total Present Value Project Benefits			From Section D2 – Briefly describe the main Non-monetized benefits
			From Section D2 – Flood Damage Reduction(2)	From Section D3 – Monetized(3)	Total	
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)
Walnut and Grayson Creeks Levee Rehabilitation at CCCSD Treatment Plant Project	**Contra Costa County Flood Control and Water Conservation District**	**$1,928,514**	**$57,289,223**	**$0**	**$57,289,223**	- Meets state mandates to provide flood protection and improve water quality in the San Francisco Bay. - Reduce the risk of exposure to water-related hazards associated with the release of untreated sewage. - Prevents water quality degradation by reducing the risk of an untreated sewage discharge in the event of a low-frequency storm. - Provides a long-term and cost-effective solution to potential plant inundation. - Reduce the risk of a catastrophic shut down of the treatment plant. - Increase operational certainty in the face of infrequent storm events. - Increases overall treatment system reliance and creates more robust infrastructure. - Prevent the discharge of untreated sewage into the San Francisco Bay. - Increase the operational viability of the recycled water system, and thus reduce dependence on potable water.

(1) From Table 16
(2) From Table 12
(3) For purposes of this project proposal, only flood damage reduction benefits are be monetized. "Other benefits that can be monetized" are not tabulated and equal $0.

Contra Costa County Flood Control & Water Conservation District