

# **Dallas Floodway Extension Project Information Paper Dallas Floodway System Phasing**

## **GENERAL**

This Information Paper documents the economic impacts and findings of a possible option to reduce potential flood damages to the Dallas Central Business District (CBD). The improvement evaluated consists of raising the existing Dallas Floodway East Levee and the required tieback floodwall by approximately 2.5 feet – the maximum practical limit for raising the existing levees due to elevations of existing bridges and infrastructure.

A system analysis also was undertaken which documents the interaction between the East Levee upgrade option and the flood damage reduction features of the authorized Dallas Floodway Extension Project (DFE). This analysis shows that the authorized DFE project is still economically justified as a last added increment and, in combination with the proposed East Levee Upgrade, provides for a combination plan with higher net annual benefits than either individual project. Further, the analysis shows that by sequencing the construction so that the downstream project is constructed first, the need for the tieback floodwall portion of the upstream levee raise is eliminated. By following this construction sequence, this combination plan not only results in a lower overall system cost for the two projects, but also maximizes net NED benefits.

## **BACKGROUND**

A meeting was held on 25 July 2001 in the office of Mr. Marcus Peacock, Office of Management and Budget (OMB). Attendees included representatives from the U.S. Army Corps of Engineers, the Office of the Assistant Secretary of the Army for Civil Works, and OMB.

Mr. Peacock requested additional information regarding the costs and benefits for the option of first raising the existing Dallas Floodway levees followed by construction of the authorized DFE Project. Mr. Peacock was concerned that once the existing floodway levee was raised, there would not be sufficient residual damages in the Dallas CBD to also justify the authorized DFE project. This paper has been prepared to address Mr. Peacock's concern.

## **ANALYSIS**

### **Dallas Floodway Extension Project**

Previous formulation of the DFE project is documented in the 1999 General Reevaluation Report and Environmental Impact Statement (GRR). All first costs and benefits for the DFE project were extracted from the GRR, and the April 1998 price level was used for this comparison. The investment and annualized costs were calculated at the current Fiscal Year 2001 interest rate of 6.375%.

Table 1 presents the costs and benefits for the flood damage reduction features of the authorized DFE project when considered as a first added element to the existing Dallas Floodway system. As shown, annual net benefits for the plan is \$5,156,700. Although the authorized DFE project also includes ecosystem restoration and recreation features, the costs and benefits associated with these features have been excluded from the analysis shown in this paper.

**Table 1**  
**Cost and Benefits for the**  
**Dallas Floodway Extension Configurations**  
**(Flood Control Features Only)**

<i>Description</i>	<i>Authorized DFE Project*</i>
<b>INVESTMENT</b>	
Estimated First Cost	\$106,279,400
Annual Percentage Rate	0.06375
Project Life (years)	50
Construction Period (mo)	36
Capital Recovery Factor	0.0667890
Interest During Construction	\$4,026,100
Investment Cost	\$110,305,500
<b>ANNUAL CHARGES</b>	
Interest	\$7,032,000
Amortization	\$335,200
O&M	\$527,000
<b>Total Annual Charges</b>	<b>\$7,894,200</b>
<b>ANNUAL BENEFITS</b>	<b>\$13,050,900</b>
<b>Net Annual Benefits</b>	<b>\$5,156,700</b>
<b>Benefit-Cost Ratio</b>	<b>1.65</b>

\* The authorized DFE alternative includes a levee which affords SPF level of protection to the Cadillac Heights area based on (1) the optimal Cadillac Heights levee did not meet Federal Emergency Management Agency (FEMA) standards for protecting the area from a 100-year flood, (2) Congress had previously authorized a similar project at the SPF level of protection, (3) for purposes of environmental justice (upstream improvements contributed to downstream flood problems).

### **Existing Levee Upgrades**

The existing Dallas Floodway levees no longer provides the original 800-year (Standard Project Flood) level of protection due to changed conditions both upstream and downstream of the project. The West Levee currently provides approximately a 700-year level of protection while the East Levee provides approximately a 300-year level of protection for the Dallas CBD.

In 1996, the Corps and the City of Dallas initiated the Upper Trinity River cost shared feasibility study (separate from the DFE reevaluation study) because of the significant residual flood damages associated with the existing Dallas Floodway, particularly behind the East Levee. This feasibility study proceeded under the assumption that for the without project condition, the authorized downstream DFE project was in place. The preliminary screening of possible alternatives as part of this study identified

levee raises as a cost effective measure to reduce residual flood damages. It also was determined that any levee raises would be limited to a maximum of approximately 2.5 feet. The upgrade limits are due to substantial costs associated with the relocation and/or modification of the eleven bridge crossings within the Floodway. Further, several of the bridges have historical significance and cannot easily be altered or removed. The maximum practical levee upgrade project would parallel the river for a distance of 10.3 miles, and would include approximately 1.4 million cubic yards of impervious fill.

Without the authorized DFE project in place, the East Levee upgrade would require a floodwall tieback to be constructed to high ground to keep floodwater from passing into the Dallas CBD at the lower end of the levee. Thus, in response to OMB's concerns regarding a stand-alone option for raising the existing Dallas Floodway Levees, a second segment of the levee upgrade design was developed for the required tieback levee/floodwall. The floodwall would need to be constructed to an elevation of 426.5, which is 3.5 feet higher than the existing floodwall.

Table 2 shows the preliminary costs and benefits associated with two levee upgrade alternatives for the existing Dallas Floodway levees. The first alternative is to upgrade only the East Levee. The second is to upgrade both the East and West Levees equally. From an economic perspective, only the East Levee is incrementally justified, and thus is the only levee upgrade option that will be carried forward for further evaluation in this paper. The annual net benefits for the East Levee upgrade are estimated to be approximately \$5,292,500, with a benefit-to-cost ratio of 4.41. This analysis does not estimate the damages that the levee upgrades would induce downstream or across the river, or any costs for mitigation of induced damages because it was beyond the scope of this analysis. Including the induced damages or mitigation costs would increase costs, thereby decreasing the net benefits for either the East Levee upgrade or the upgrade of both levees, and improve incremental justification of the authorized DFE Project. The levee upgrades do not provide any flood relief for residents located downstream of the existing Dallas Floodway, which was the objective of the authorized Dallas Floodway Extension project.

**Table 2**  
**Cost and Benefits for the**  
**Upstream Levee Upgrade Options**

<i>Description</i>	<i>Upgrade East Levee</i>	<i>Upgrade Both Levees</i>
<b>INVESTMENT</b>		
Segment 1 – Paralleling River	\$17,736,000	\$34,347,000
Segment 2 – Tieback	\$3,323,000	\$3,323,000
<b>Total First Cost</b>	<b>\$21,059,000</b>	<b>\$37,670,000</b>
Annual Percentage Rate	0.06375	0.06375
Project Life (years)	50	50
Construction Period (mo)	12	24
Capital Recovery Factor	0.0667890	0.0667890
Interest During Const.	\$664,300	\$2,426,900
Investment Cost	\$21,723,300	\$40,096,900
<b>ANNUAL CHARGES</b>		
Interest	\$1,384,900	\$2,556,200
Amortization	\$66,000	\$121,800
O&M	\$100,000	\$200,000
<b>Total Annual Charges</b>	<b>\$1,550,900</b>	<b>\$2,878,000</b>
<b>ANNUAL BENEFITS</b>	<b>\$6,843,400</b>	<b>\$7,202,400</b>
<b>Net Annual Benefits</b>	<b>\$5,292,500</b>	<b>\$4,324,400</b>
<b>Benefit-Cost Ratio</b>	<b>4.41</b>	<b>2.50</b>

**Combination Plan – East Levee Upgrade, followed by Authorized DFE Plan**

While the DFE project and the East Levee Upgrade both provide flood damage reduction benefits to the Dallas CBD, they may also be constructed in combination to derive higher levels of protection than either could have done individually. Key to this analysis was demonstrating that sufficient residual damages exist to justify each as a last added element.

Table 3 presents the costs and benefits for the combination plan of first constructing the East Levee upgrade, followed by the authorized DFE plan as a last added increment. This combination plan would realize annual net benefits of \$6,409,100. Incremental justification of the DFE Project as a last added increment is shown.

**Table 3  
Costs and Benefits for the  
East Levee Upgrade, followed by Authorized DFE Project**

<i>Description</i>	<i>East Levee Only</i>	<i>East Levee Followed by DFE</i>	<i>Incremental Authorized DFE Project</i>
<b>INVESTMENT</b>			
Estimated First Cost	\$21,059,000	\$127,338,400	\$106,279,400
Annual Percentage Rate	0.06375	0.06375	
Project Life (years)	50	50	
Construction Period (mo)	12	36	
Capital Recovery Factor	0.0667890	0.0667890	
Interest During Const.	\$664,300	\$4,690,400	\$4,026,100
Investment Cost	\$21,723,300	\$132,028,800	\$110,305,500
<b>ANNUAL CHARGES</b>			
Interest	\$1,384,900	\$8,416,900	\$7,032,000
Amortization	\$66,000	\$401,200	\$335,200
O&M	\$100,000	\$627,000	\$527,000
<b>Total Annual Charges</b>	\$1,550,900	\$9,445,100	\$7,894,200
<b>ANNUAL BENEFITS</b>	\$6,843,400	\$15,854,300	\$9,010,900
<b>Net Annual Benefits</b>	\$5,292,500	\$6,409,200	\$1,116,700
<b>Benefit-Cost Ratio</b>	4.41	1.68	1.14

**Combination Plan – DFE Authorized Project, followed by East Levee Upgrade**

This combination plan would result in the same physical configuration as the plan shown above. However, if the DFE Project were constructed first, there is no need to construct the tieback portion of the East Levee upgrade. Savings of \$3,323,000 in first costs would be realized by avoiding construction of this feature. Costs for mitigating any induced damages in the extension area are also eliminated.

Table 4 shows the costs and benefits of the DFE Project proposed for construction in combination with the East Levee Upgrade. Incremental justification of the East Levee Upgrade as last added increment is shown:

**Table 4  
Costs and Benefits for the  
Authorized DFE Project, followed by East Levee Upgrade**

<i>Description</i>	<i>Authorized DFE Project</i>	<i>DFE Project followed by East Levee</i>	<i>Incremental East Levee</i>
<b>INVESTMENT</b>			
Estimated First Cost	\$106,279,400	\$124,015,400	\$17,736,000
Annual Percentage Rate	0.06375	0.06375	
Project Life (years)	50	50	
Construction Period (mo)	36	36	
Capital Recovery Factor	0.0667890	0.0667888	
Interest During Construction	\$4,026,100	\$4,585,577	\$559,477
Investment Cost	\$110,305,500	\$128,600,977	\$18,295,477
<b>ANNUAL CHARGES</b>			
Interest	\$7,032,000	\$8,198,300	\$1,166,300
Amortization	\$335,200	\$390,800	\$55,600
O&M	\$527,000	\$600,000	\$73,000
<b>Total Annual Charges</b>	\$7,894,200	\$9,189,100	\$1,294,900
<b>ANNUAL BENEFITS</b>	\$13,050,900	15,854,300	\$2,803,400
<b>Net Annual Benefits</b>	\$5,156,700	\$6,665,200	\$1,508,500
<b>Benefit-Cost Ratio</b>	1.65	1.73	2.16

## **SUMMARY AND CONCLUSION**

The analysis presented in this information paper has compared the costs and flood damage reduction benefits associated with the authorized Dallas Floodway Extension Project and an upgrade of the Dallas Floodway East Levee. In addition, two combination plans, including measures to reduce flood damages to both the Dallas Central Business District and the immediate study area of the Dallas Floodway Extension area, have been evaluated. As shown in the chart below, the highest net benefits are achieved by first constructing the authorized DFE Project, and then completing the system with an upgrade of the East Levee. The authorized DFE Project, together with the East Levee upgrade as a last added increment, produce 26% higher net annual benefits than the East Levee upgrade alone. This conclusion supports initiating construction of the authorized Dallas Floodway Extension, as currently proposed, and continuing studies of raising the existing floodway levees under the ongoing Upper Trinity Feasibility study which will develop the decision document for seeking Congressional authorization of this element.

**Comparison of Net Benefits for  
Authorized Dallas Floodway Extension Project and  
Existing Dallas Floodway Levee Options  
(Flood Control Features Only)**

