Table 11 - 15

Low Growth Scenario
Alternative Summary
(1996 $1,000, 7.375 Percent)

	Remove Bridge Curfews	Bridge Only w/o curfew	900x90x22 with curfew	900x90x22 w/o curfew	900x110x22 with curfew	900x110x22 w/o curfew	900x110x36 with curfew	900x110x36 w/o curfew	1200x90x22 with curfew	1200x90x22 w/o curfew	1200x110x22 with curfew	1200x110x22 w/o curfew	1200x110x36 with curfew	1200x110x36 w/o curfew
Annual Construction Costs	0	3,764	43,347	43,347	44,954	44,954	52,101	52,101	48,516	48,516	51,857	51,857	55,449	55,449
Annual Mitigation Costs	0	1,701	3,939	3,939	3,939	3,939	4,150	4,150	4,150	4,150	4,150	4,150	4,150	4,150
Annual Nav Losses	0	0	152	152	152	152	152	152	152	152	152	152	152	152
Annual Permanent DD Loss	0	0	268	268	268	268	0	0	268	268	268	268	0	0
Annual O&M Costs	0	0	1,382	1,382	1,382	1,382	1,384	1,384	1,382	1,382	1,382	1,382	1,384	1,384
Induced Vehicular Losses	6,135	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Cost	6,135	5,465	49,088	49,088	50,695	50,695	57,787	57,787	54,469	54,469	57,809	57,809	61,135	61,135
Annual S.D. Benefits	6,967	18,016	48,381	49,591	49,964	50,065	51,312	51,754	51,914	51,949	52,389	52,436	52,421	52,427
Annual D.D. Benefits	0	0	0	0	0	0	539	539	0	0	0	0	539	539
Annual Vehicular Benefits	0	6,195	5,876	1,830	5,955	3,680	5,951	3,462	6,500	5,926	7,364	7179	7,347	7,160
Annual Savings to Fed Proj	0	0	4,017	4,017	4,017	4,017	4,194	4,194	4,194	4,194	4,194	4194	4,194	4,194
Annual Maint Closure - Nav Losses Prevented	0	0	10,471	10,471	10,471	10,471	11,243	11,243	11,243	11,243	11,243	11,243	11,243	11,243
Total Annual Benefits	6,967	24,211	68,745	65,909	70,407	68,233	73,239	71,192	73,851	73,312	75,190	75,052	75,744	75,563
Net Benefits	832	18,746	19,657	16,821	19,712	17,538	15,452	13,406	19,382	16,843	17,381	17,243	14,609	14,428
BCR	1.14	4.43	1.40	1.34	1.39	1.35	1.27	1.23	1.36	1.35	1.30	1.30	1.24	1.24
Base Year	1998	2006	2010	2010	2010	2010	2011	2011	2011	2011	2011	2011	2011	2011
Net Benefits Adj. to 2010	1,954	24,919	19,657	16,821	19,712	17,538	14,391	12,485	18,051	17,549	16,187	16,058	13,606	13,437

Table 11 - 16

High Growth Scenario
Alternative Summary
(1996 $1,000, 7.375 Percent)

	Remove Bridge Curfews	Bridge Only w/o curfew	900x90x22 with curfew	900x90x22 w/o curfew	900x110x22 with curfew	900x110x22 w/o curfew	900x110x36 with curfew	900x110x36 w/o curfew	1200x90x22 with curfew	1200x90x22 w/o curfew	1200x110x22 with curfew	1200x110x22 w/o curfew	1200x110x36 with curfew	1200x110x36 w/o curfew
Annual Construction Costs	0	3,764	43,347	43,347	44,954	44,954	52,101	52,101	48,516	48,516	51,857	51,857	55,449	55,449
Annual Mitigation Costs	0	1,701	3,939	3,939	3,939	3,939	4,150	4,150	4,150	4,150	4,150	4,150	4,150	4,150
Annual Nav Losses	0	0	284	284	284	284	292	292	292	292	292	292	292	292
Annual Permanent DD Losses	0	0	892	892	892	892	0	0	925	925	925	925	0	0
Annual O&M Costs	0	0	1,382	1,382	1,382	1,382	1,384	1,384	1,382	1,382	1,382	1,382	1,384	1,384
Induced Vehicular Losses	8,190	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Cost	8,190	5,465	49,844	49,844	51,451	51,451	57,928	57,928	55,266	55,266	58,607	58,607	61,276	61,276
Annual S.D. Benefits	14,444	13,164	73,263	80,896	89,625	90,283	88,222	90,072	91,110	92,082	96,923	97,444	95,725	96,931
Annual D.D. Benefits	0	0	0	0	0	0	1,862	1,862	0	0	0	0	1,862	1,862
Annual Vehicular Benefits	0	5,353	5,756	(1,379)	5,854	977	5,948	5,843	5,956	3,360	6,191	5,031	5,182	5,005
Annual Savings to Fed Pro	0	0	4,017	4,017	4,017	4,017	4,194	4,194	4,194	4,194	4,194	4,194	4,194	4,194
Annual Maint Closure - Nav Losses Prevented	0	0	10,471	10,471	10,471	10,471	11,243	11,243	11,243	11,243	11,243	11,243	11,243	11,243
Total Annual Benefits	14,444	18,517	93,507	94,005	109,967	105,748	111,469	113,214	112,503	110,879	118,551	117,912	120,206	119,235
Net Benefits	6,254	13,052	43,663	44,161	58,516	54,297	53,541	55,286	57,237	55,613	59,944	59,305	58,930	57,959
BCR	1.76	3.39	1.88	1.89	2.14	2.06	1.92	1.95	2.04	2.01	2.02	2.01	1.96	1.95
Base Year	1998	2006	2010	2010	2010	2010	2011	2011	2011	2011	2011	2011	2011	2011
Net Benefits Adj. to 2010	14,689	17,350	43,663	44,161	58,516	54,297	49,864	51,489	53306	51,793	55,827	55,232	54,883	53,978

Table 1 - 17

No Growth After 2010
Alternative Summary
(1996 $1,000 7.375 Percent)

	Remove Bridge Curfews	Bridge Only w/o curfew	900x90x22 with curfew	900x90x22 w/o curfew	900x110x22 with curfew	900x110x22 w/o curfew	900x110x36 with curfew	900x110x36 w/o curfew	1200x90x22 with curfew	1200x90x22 w/o curfew	1200x110x22 with curfew	1200x110x22 w/o curfew	1200x110x36 with curfew	1200x110x36 w/o curfew
Annual Constructon Costs	0	3,764	43,347	43,347	44,954	44,954	52,101	52,101	48,516	48,516	51,857	51,857	55,449	55,449
Annual Mitigation Costs	0	1,701	3,939	3,939	3,939	3,939	4,150	4,150	4,150	4,150	4,150	4,150	4,150	4,150
Annual Nav Losses	0	0	208	208	208	208	211	211	211	211	211	211	211	211
Annual Permanent DD Losses	0	0	375	375	375	375	0	0	375	375	375	375	0	0
Annual O&M Costs	0	0	1,382	1,382	1,382	1,382	1,384	1,384	1,382	1,382	1,382	1,382	1,384	1,384
Induced Vehicular Losses	8,479	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Cost	8,479	5,465	49,250	49,250	50,858	50,858	57,846	57,846	54,634	54,634	57,975	57,975	61,194	61,194
Annual S.D. Benefits	8,055	21,615	66,427	67,365	67,522	67,619	67,219	67,647	68,108	68,138	68,276	68,323	68,309	68,315
Annual D.D. Benefits	0	0	0	0	0	0	757	757	0	0	0	0	757	757
Annual Vehicular Benefits	0	5,573	5,811	1,478	5,892	3,387	5,883	3,230	6,124	5,690	7,130	6,963	7,111	6,944
Annual Savings to Fed Proj	0	0	4,017	4,017	4,017	4,017	4,194	4,194	4,194	4,194	4,194	4,194	4,194	4,194
Annual Maint Closure - Nav Losses Prevented	0	0	10,471	10,471	10,471	10,471	11,243	11,243	11,243	11,243	11,243	11,243	11,243	11,243
Total Annual Benefits	8,055	27,188	86,726	83,331	87,902	85,494	89,296	87,071	89,669	89,265	90,843	90,723	91,614	91,453
Net Benefits	(424)	21,723	37,476	34,081	37,044	34,636	31,450	29,225	35,035	34,631	32,868	32,748	30,420	30,259
BCR	0.95	4.98	1.76	1.69	1.73	1.68	1.54	1.51	1.64	1.63	1.57	1.56	1.50	1.49
Base Year	1,998	2006	2010	2010	2010	2010	2011	2011	2011	2011	2011	2011	2011	2011
Net Benefits Adj. to 2010	(996)	28,876	37,476	34,081	37,044	34,636	29,290	27,218	32,629	32,252	30,610	30,499	28,330	28,180

increases in shallow-draft navigation benefits (shown in table 7 - 10). However, because the increased processing capability represented by bridge replacement is modest, delays per tow would once again become serious after traffic grows to a certain level. The question then arises as to the economic implications of replacing the existing St. Claude Avenue Bridge with a mid-rise structure in the near-term, producing short term improvements, and then replacing the existing lock at a future point when delays at the lock warrant the investment in additional capacity. Because the significant costs associated with lock replacement would be delayed until some future year, the economic efficiency, measured in terms of average annual net benefits over the project life, of a phased bridge/lock construction alternative could prove to be superior to the non-phased construction approach. There are two primary questions that must be addressed: 1.) would the overall average annual net benefits associated with a phased bridge/lock approach be greater than the NED North of Claiborne Avenue plan, and 2.) would a lock different than the NED lock size of 900 x 110 x 22 ft be optimal in a phased construction approach and at what point in time. In order to address the first question, the second question must be answered first.

In order to determine both the optimal lock size and the optimal time when a new lock should be operational, both the project costs and the stream of future benefits associated with various lock plans have to be considered. In this analysis, costs were developed only for the shallow-draft lock alternatives because of the limited prospect of the deep-draft plans becoming optimal in the phased approach. Therefore, construction, operations and maintenance, and mitigation costs for a phased bridge/lock plan were considered (over a 50 year period using a 7.375 percent discount rate) for each of the shallow-draft lock alternatives. On the benefit side, since only shallow-draft lock alternatives were analyzed, the focus was limited to shallow-draft navigation benefits. Vehicle benefits were not applicable, since in the phased approach, the mid-rise replacement of the St. Claude Avenue Bridge is assumed to be already in place. In a similar manner, benefits associated with avoiding the losses associated with rehabilitation closures are also not relevant because the rehabilitation work will be required as scheduled due to the delay and the uncertainty associated with replacing the existing structure.

Future streams of net transportation cost savings were developed representing the difference in transportation cost savings between the "Bridge Only" alternative and each of the shallow-draft lock alternatives. This difference

represents the appropriate measure of shallow-draft savings that would result from the construction of a new lock in the future given that the St. Claude Avenue Bridge has already been improved. The year in which the net transportation cost savings of a particular lock plan exceeded the average annual cost of the plan determined the optimal time when the new lock should be operational. The net transportation cost savings from this year forward were then annualized over a 50 year period for each of the lock plans and then subtracted from the respective average annual cost to produce an average annual net benefit estimate. These results are shown in table 11 - 18. After adjusting the average annual net benefits for each of the lock plans to a common base year, the optimal lock size was determined by selecting that plan which produced the highest average annual net benefits.

As table 11 - 18 shows, the optimal lock size was determined to be a 900 x 110 x 22 ft lock, operational by the year 2011 (only 1 year later than the NED North of Claiborne Avenue plan) assuming the mid growth scenario in traffic projections. Using the same method as discussed above, table 11 - 19 shows that a 900 x 110 x 22 ft lock was also determined to be the optimal lock size assuming the low growth scenario, but because delays at the existing lock never become serious until many years later due to the lower growth in traffic, the replacement lock need not be in place until the year 2032. The high growth scenario was also evaluated. The results in terms of lock size and time were the same as the NED North of Claiborne Avenue plan in that a 900 x 110 x 22 ft replacement lock should be constructed as soon as possible.

Having determined the optimal lock size and when it should be operational, the next task in this analysis was to determine the average annual net benefits for the overall phased bridge/lock plan. To do so required the estimation of all average annual benefits and costs for the phased approach. In the phased approach, the mid-rise replacement for the existing low-rise St. Claude Avenue Bridge is scheduled to be in place and fully operational by the year 2007, hence this becomes the base year and assuming a 50 year project life, benefits were analyzed over the period 2007 - 2056. As determined above, assuming a mid growth in traffic, the optimal time for a 900 x 110 x 22 ft North of Claiborne Avenue lock to be operational is in the year 2011. Consequently, shallow-draft navigation benefits from 2007 to 2010 represent the difference in total cost savings between future without-project conditions and those resulting from a mid-rise replacement of the St. Claude Avenue Bridge while keeping the existing lock in place. From 2011 to 2056, with the new lock in place, shallow-

Table 11 - 18

Phased Bridge/Lock Plan
Optimal Lock Size and Timing

Mid Growth - Average Annual Net Benefits
(1996, $1,000, 7.375 Percent)

Lock Alternative	Average Annual Net Benefits	Base Year	Average Annual Net Benefits Adjusted to 2011
900 x 90 x 22	23,696	2011	23,696
900 x 110 x 22	27,278	2011	27,278
1200 x 90 x 22	27,429	2012	25,545
1200 x 110 x 22	26,608	2013	23,078

NOTE: Net benefits reflect shallow-draft benefits and lock construction costs only.

Table 11 - 19

Phased Bridge/Lock Plan
Optimal Lock Size and Timing

Low Growth - Average Annual Net Benefits
(1996, $1,000, 7.375 Percent)

Lock Alternative	Average Annual Net Benefits	Base Year	Average Annual Net Benefits Adjusted to 2032
900 x 90 x 22	27,608	2030	31,830
900 x 110 x 22	32,423	2032	32,423
1200 x 90 x 22	29,955	2032	29,955
1200 x 110 x 22	29,472	2033	27,448

NOTE: Net benefits reflect shallow-draft benefits and lock construction costs only.

draft navigation benefits are represented by the difference in cost savings between future without-project conditions and those resulting from the replacement of the existing lock with a North of Claiborne Avenue 900 x 110 x 22 ft lock.

In addition to shallow-draft benefits, vehicle benefits, resulting from the mid-rise replacement of the existing low-rise St. Claude Avenue Bridge were calculated as well as the benefits from discontinuing O&M expenditures on the existing lock, once the replacement lock is operating. Vehicle benefits, representing the difference in total vehicle cost savings between future without-project conditions and a mid-rise St. Claude Avenue Bridge while keeping the existing lock in place were calculated over the full 50 year period from 2007 to 2056. Savings from avoiding existing O&M would not begin to accrue until the year 2011, when the new lock is in place, hence these benefits were assumed over the period from 2011 to 2056. These benefit streams along with the shallow-draft benefits were then discounted back to the base year (2007) and average annual benefit estimates for each of these categories were calculated using a discount rate of 7.375 percent and a 50 year project life. Summing these average annual benefit estimates provided the total average annual benefits associated with the overall phased approach.

The final step in this analysis was to calculate the average annual costs associated with the phased approach. Total costs are comprised of seven categories: the construction and mitigation costs associated with the new bridge and lock, the operation and maintenance costs for the new lock, the existing deep-draft benefits that are lost when the existing lock is taken out of service and the permanent deep-draft losses that begin to occur once the new shallow-draft lock is in place and operating.

The construction and mitigation costs for the new St. Claude Avenue Bridge were compounded forward to the base year of 2007, whereas the costs for the new lock were either compounded forward or discounted back to the base year since some of these expenditures would occur either before or after 2007. Once the new lock begins to operate in the year 2011, permanent deep-draft losses, representing the difference in deep-draft cost savings between existing conditions and a 900 x 110 x 22 ft North of Claiborne lock, also would begin to occur. These were calculated for the years 2011 to 2056 and discounted back to the base year. Along with these losses, during the same time period (2011 - 2056), operation and maintenance expenditures for the new lock were also discounted back to the base year. The final cost item, the existing deep-draft benefits that are lost

when the existing lock is taken out of service, is scheduled to occur during the last two years of constructing the replacement lock in the years 2009 and 2010. Like the previous estimates, these were also discounted back to the base year. Each of these cost categories were then annualized and summed to provide the average annual costs associated with the phased approach.

Table 11 - 20 compares the total first cost (comprised of construction and mitigation costs) and the composition of total average annual benefits and average annual costs of the phased approach to the NED North of Claiborne Avenue 900 x 100 x 22 ft lock plan assuming the mid growth traffic scenario. As is shown in the table, the phased approach is clearly inferior to the non-phased plan with total average annual net benefits of the phased approach (after adjusting to a common base year) representing only 77 percent of the total average annual net benefits of the NED North of Claiborne Avenue plan.

Table 11 - 20 highlights that the main reason for this result lies in the assumptions regarding the maintenance work associated with the existing lock. In the NED North of Claiborne Avenue plan, the existing lock in scheduled to be replaced as soon as possible. Under this situation, it was reasonable to assume that plans to make extraordinary maintenance expenditures for the existing lock would be canceled. As a result, these maintenance expenditures, and the high cost to navigation that would result from the lock being closed during the maintenance, would be avoided. As such, both were claimed as benefits in the non-phased replacement plan. However, in the phased approach, even though construction of the replacement lock is scheduled only one year later than the NED plan, the inherent uncertainty as to when the replacement lock will actually become economically feasible dictates that scheduled maintenance work be pursued as currently scheduled. Consequently, in the phased approach, benefits from the avoided effects of the maintenance work were not claimed. If the benefits from avoided maintenance work are claimed for the phased approach, the phased approach would generate a higher level of average annual net benefits than the non-phased approach. However, it is worth emphasizing that if the assumption that the maintenance work would proceed as scheduled with the phased approach was changed, the difference in optimal implementation of the new lock is only one year between the phased and non-phased approaches.

Table 11 - 21 displays similar information for the low growth traffic scenario. As is shown, with the additional delay in the need for lock replacement, the non-phased approach becomes inferior to the phased 900 x 110 x 22 ft

Table 11 - 20

Benefit - Cost Summary
Mid Growth Scenario
(1996, $1,000, 7.375%)

	900 x 110 x 22	Phased Approach *
Total First Cost	425,507	435,078
Annual Construction Costs	44,954	38,024
Annual Mitigation Costs	3,939	3,168
Annual Nav Losses	208	159
Annual Permanent DD Losses	477	359
Annual O&M Costs	1,382	1,067
Total Annual Costs	50,960	42,777
Annual S.D. Benefits	83,982	69,314
Annual D.D. Benefits	0	0
Annual Vehicular Benefits	5,909	5,590
Annual Savings to Fed Proj	4,017	1,207
Annual Maint Closure - Nav Losses Prevented	10,471	0
Total Annual Benefits	104,379	76,111
Net Benefits	53,419	33,334
BCR	2.05	1.78
Base Year	2010	2007
Net Benefits adj. to 2010	53,419	41,266

* Mid-rise 300-ft horizontal clearance twin tower St. Claude Bridge operational in 2007 and a 900 x 110 x 22 new chamber north of Claiborne Ave operational in 2011.

Table 11 - 21

Benefit - Cost Summary
Low Growth Scenario
(1996, $1,000, 7.375%)

	900 x 110 x 22	Phased Approach *
Total First Cost	425,507	435,078
Annual Construction Costs	44,954	11,680
Annual Mitigation Costs	3,939	2,084
Annual Nav Losses	152	26
Annual Permanent DD Losses	268	38
Annual O&M Costs	1,382	200
Total Annual Costs	50,695	14,028
Annual S.D. Benefits	49,964	28,841
Annual D.D. Benefits	0	0
Annual Vehicular Benefits	5,955	6,203
Annual Savings to Fed Proj	4,017	234
Annual Maint Closure - Nav Losses Prevented	10,471	0
Total Annual Benefits	70,407	35,278
Net Benefits	19,712	21,250
BCR	1.39	2.51
Base Year	2010	2007
Net Benefits adj. to 2010	19,712	26,307

* Mid-rise 300-ft horizontal clearance twin tower St. Claude Bridge operational in 2007 and a 900 x 110 x 22 new chamber north of Claiborne Ave operational in 2032.

lock plan with total average annual net benefits of the non-phased approach (after adjusting to a common base year) representing 75 percent of the total average annual net benefits resulting from the phased North of Claiborne Avenue plan.

DELAYED IMPLEMENTATION

In order to consider if project implementation has been optimally timed for the non-phased construction alternatives, an analysis of alternative base years (the point of an operational project) was conducted. Because the non-phased alternatives would result in an operational project at the earliest possible date, questions of enhanced timing need only consider delaying implementation. The potential for improvement from delaying implementation comes primarily from two effects. By delaying project implementation, the 50 years of project life are shifted outward. Because certain benefit categories increase over time, the 50-year stream starting from a more future point can reflect higher absolute numbers. Also, by delaying implementation, project expenditures would be delayed. While by no means a certainty, given the rate of growth in benefits, and the interest rate used to discount future costs and benefits, it is possible that by delaying implementation a superior position (defined by a higher present value of average annual net benefits) could be identified.

In order to investigate this possibility, the original base year for each of the alternative non-phased with-project plans was delayed by five years. Assuming the mid growth traffic projections, table 11 - 22 displays the total average annual net benefits (adjusted to a common base year of 2010) for each of the alternative plans at their original base year and a base year five years later. For the lock replacement plans only the with-curfew plans were analyzed.

As table 11 - 22 shows, increasing the original base year by five years had the effect of reducing the total average annual net benefits for each of the alternative plans. (The 900 x 110 x 22 ft replacement lock remained the NED plan). Additional delay in project implementation was also evaluated. The outcome (not displayed) of delaying project implementation by 10 years was to generate an even more inferior position than that of the five year delay.

INTEREST RATES

Table 11 - 22

Non - Phased
Optimal Timing of Alternative With Project Scenarios
(1996 prices, $1,000's, 7.375 Percent)

With-Project Alternative	Original Base Year	Average Annual Net Benefits	Average Annual Net Benefits (Adjusted to 2010)	Base Year Increased by 5 years	Average Annual Net Benefits	Average Annual Net Benefits (Adjusted to 2010)
Remove Bridge Curfews	1998	916	2,151	2003	(1,294)	(2,129)
Replace Bridge Only	2006	15,508	20,614	2011	12,249	11,408
900 x 90 x 22	2010	47,765	47,765	2015	55,240	38,702
900 x 110 x 22	2010	53,419	53,419	2015	64,533	44,691
900 x 110 x 36	2011	48,977	45,613	2016	59,730	38,974
1200 x 90 x 22	2011	53,620	49,937	2016	65,122	42,492
1200 x 110 x 22	2011	51,324	47,799	2016	62,856	41,014
1200 x 110 x 36	2011	49,233	45,851	2016	60,931	39,758

Throughout this study an interest rate of 7.375 percent was used in determining average annual costs and benefits. In order to explore the implications of alternative interest rates on NED plan selection, three additional values (2.625 percent, 3.75 percent and 10 percent) will be presented. Tables 11 - 23 to 11 - 25 summarize the results for each of the alternative with-project plans assuming mid growth in traffic for 2.625 percent, 3.75 percent, and 10 percent, respectively.

Table 11 - 23 shows that an interest rate of 2.625 percent caused significant impacts with regards to NED plan determination. Lowering the interest rate resulted in the current NED plan (900 x 110 x 22 ft lock) shifting more towards the larger scale alternatives. At an interest rate of 2.625 percent, total average annual net benefits (adjusted to a base year of 2010) are maximized at $77.4 million by replacing the existing lock with a 1200 x 110 x 36 ft North of Claiborne Avenue lock. An interest rate of 2.625 percent was selected for display in this sensitivity analysis because it represents the authorized project interest rate.

In an attempt to determine the point at which a change in the current NED plan occurs as a result of lowering the interest rate, several interest rates between the current 7.375 interest rate and 2.625 percent were evaluated. Working from 7.375 percent and moving downward, a rate of 3.75 percent was identified as the point where a shift occurs. Table 11 - 24 shows the results caused by a 3.75 percent interest rate. Unlike table 11 - 23, average annual net benefits are maximized with a 1200 x 90 x 22 ft lock replacement at $71.5 million.

Table 11 - 25 shows the plan formulation consequences of a 10 percent interest rate. Unlike the previous two tables, no changes in the current NED plan occurred. At $35.4 million, total average annual net benefits are maximized with a 900 x 110 x 22 ft replacement lock.

ALTERNATIVE FLOOR DEPTHS

The current NED plan involves a 900 x 110 x 22 ft North of Claiborne Avenue replacement lock. In order to verify that the 22- foot depth is optimal, two additional floor depths were investigated, one more shallow than the 22-foot depth, at 18 feet, and the other deeper than the 22-foot depth at 25 feet. Table 11 - 26 shows the economic comparison of these two floor depths along with the 22-foot lock floor.

Table 11 - 23

Interest Rate Sensitivity

Alternative Summary
(1998 $1,000, 2.63 Percent)

	Remove Bridge Curfews	Bridge Only w/o Curfews	900x90x22 with Curfews	900x90x22 w/o Curfews	900x110x22 with Curfews	900x110x22 w/o Curfews	900x110x36 with Curfews	900x110x36 w/o Curfews	1200x90x22 with Curfews	1200x90x22 w/o Curfews	1200x110x22 with Curfews	1200x110x22 w/o Curfews	1200x110x36 with Curfews	1200x110x36 w/o Curfews
Total Annual Cost	8,035	2,340	19,220	19,220	19,829	19,829	21,238	21,238	20,473	20,473	21,645	21,645	22,516	22,516
Total Annual Benefits	7,219	15,020	79,014	77,010	95,121	92,219	95,847	94,429	99,515	97,676	100,837	100,070	101,991	100,824
Net Benefits	(816)	12,680	59,794	57,790	75,292	72,390	74,609	73,191	79,042	77,203	79,192	78,425	79,475	78,308
BCR	0.90	6.42	4.11	4.01	4.80	4.65	4.51	4.45	4.86	4.77	4.66	4.62	4.53	4.48
Base Year	1998	2006	2010	2010	2010	2010	2011	2011	2011	2011	2011	2011	2011	2011
Net Benefits Adj. to 2010	(1,204)	14,065	59,794	57,790	75,292	72,390	72,701	71,319	77,020	75,228	77,166	76,419	77,442	76,305

Table 11 - 24

Interest Rate Sensitivity

Alternative Summary
(1996 $1,000, 3.75 Percent)

	Remove Bridge Curfews	Bridge Only w/o Curfews	900x90x22 with Curfews	900x90x22 w/o Curfews	900x110x22 with Curfews	900x110x22 w/o Curfews	900x110x36 with Curfews	900x110x36 w/o Curfews	1200x90x22 with Curfews	1200x90x22 w/o Curfews	1200x110x22 with Curfews	1200x110x22 w/o Curfews	1200x110x36 with Curfews	1200x110x36 w/o Curfews
Total Annual Cost	7,959	2,958	24,599	24,599	25,392	25,392	27,650	27,850	26,461	26,461	28,014	28,014	29,309	29,309
Total Annual Benefits	7,945	16,618	83,283	81,112	96,655	93,664	97,687	95,925	100,676	98,975	101,901	101,238	103,016	102,026
Net Benefits	(14)	13,660	58,684	56,513	71,263	68,272	70,037	68275	74,215	72,514	73,887	73,224	73,707	72,717
BCR	1.00	5.62	3.39	3.30	3.81	3.69	3.53	3.47	3.80	3.74	3.64	3.61	3.51	3.48
Base Year	1998	2006	2010	2010	2010	2010	2011	2011	2011	2011	2011	2011	2011	2011
Net Benefits Ad. to 2010	(22)	15,827	58,684	56,513	71,263	68,272	67,506	65,807	71,533	69,893	71,216	70,577	71,043	70,089

Table 11 - 25

Interest Rate Sensitivity

Alternative Summary
(1996 $1,000, 10 Percent)

	Rerrove Bridge Curfews	Bridge Only w/o Curfews	900x90x22 with Curfews	900x90x22 w/o Curfews	900x110x22 with Curfews	900x110x22 w/o. Curfews	900x110x36 with Curfews	900x110x36 w/o Curfews	1200x90x22 with Curfews	1200x90x22 w/o Curews	1200x110x22 with Curfews	1200x110x22 w/o Curfews	1200x110x36 with Curfews	1200x110x36 w/o Curfews
Total Annual Cost	7,592	7,700	75,242	75,242	77,662	77,662	90,344	90,344	85,263	85,263	90,531	90,531	95,393	95,393
Total Annual Benefits	10,306	23,272	108,217	105,150	113,092	110,001	117,156	114,521	118,173	117,013	119,178	113,861	120,152	119,719
Net Benefits	2,714	15,572	32,975	29,908	35,430	32,339	26,812	24,177	32,910	31,750	28,647	23,330	24,759	24,326
BCR	1.36	3.02	1.44	1.40	1.46	1.42	1.30	1.27	1.39	1.37	1.32	1.31	1.26	1.26
Base Year	1998	2008	2010	2010	2010	2010	2011	2011	2011	2011	2011	2011	2011	2011
Net Benefits Adj to 2010	8,518	22,799	32,975	29,908	35,430	32,339	24,375	21,979	29,918	28,864	26,043	25,755	22,508	22,115

The rational for the changes in costs that occur as the floor elevation changes is straightforward and relates to the changes in physical dimensions and the associated construction requirements. The changes in benefits occur because as the floor elevation becomes more shallow, fill and empty times must be slowed so as to not violate design safety parameters relative to turbulence within the chamber. A slower fill/empty time will produce a longer processing time which ultimately translates to a lower level of service. Importantly, the impact on the level of service is not linear as the floor elevation is raised. Across the range of head differentials, the expected value increase in processing time would be 0.8 minutes when moving from the 25-foot floor to the 22-foot floor. However, the move from 22 feet to 18 feet would result in a 4.1 minute increase in processing time. It is these longer processing times that are responsible for the reduction in benefits as the lock floor is raised.

Comparing the economics of the 22 and 25-foot floor depths shows that the total average annual net benefits for the 22-foot floor depth is slightly higher than the 25-foot floor depth. In addition, constructing the lock at a floor depth of 25 feet would cost approximately $3.1 million (in total first cost) more than the 22- foot floor depth. Consequently, from an economic standpoint, it would be more rational to build the replacement lock at a floor depth of 22 feet.

By constructing the lock to 18 feet, table 11 - 26 shows that even though it would cost (in total first cost) approximately $2.1 million less to build compared to 22 feet, total average annual net benefits would decline by approximately $1.9 million. Consequently, the move to an 18-foot depth is not supported by economic criteria.

Table 11 - 26

Benefit - Cost Comparison
18, 22, and 25 foot Floor Elevations

(1996 $1,000, 7.375 Percent)

	900 x 110 x 18	900 x 110 x 22	900 x 110 x 25
Total Annual Benefits	102,267	104,379	104,549
Total First Cost	423,408	425,508	428,608
Total Annual Costs	50,747	50,960	51,220
Net Benefits	51,520	53,419	53,329