Analysis of Future Investment Needs on the Upper Mississippi River and Illinois Waterway (Objective 2A)

Upper Mississippi River – Illinois Waterway Navigation Study

Final

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Summary

This analysis attempts to evaluate the future investment needs of the Upper Mississippi River and Illinois Waterway Navigation System necessary to maintain the system's existing level of performance. Investment takes the form of rehabilitation for those components so suited as well as repairs for components that have deteriorated to the point where such expenditures are necessary for continued operation of the system.

This analysis only accounts for roughly 19 of 70 components at most lock sites. As a result total system needs as discussed in the Feasibility Report and Engineering Appendix are anticipated to be considerably higher than amounts shown in this report.

Three different conditions were evaluated: base, enhanced maintenance condition, and the rehab condition. Under the base condition, components would be allowed to deteriorate in both physical condition and performance until failure occurs and repairs become necessary. This is the condition against which the enhanced maintenance and rehab conditions will be compared for feasibility. Under the enhanced maintenance condition, relevant components would be maintained in an enhanced manner to ensure optimum performance. This condition was considered to determine if enhanced maintenance is an economically viable option for future maintenance of any components. Under the rehab condition, components would be rehabilitated in the future when optimally feasible to do so from an economic standpoint.

Total life-cycle costs for the base condition amount to approximately $155 million in present value terms. Of this, repair costs account for $126.7 million and navigation delay costs account for $28.4 million. These costs have been projected by lock and dam out to the year 2050. In undiscounted terms, the cumulative repair costs for those components evaluated over the 50-year base condition total approximately $460 million.

Enhanced maintenance does not appear to be feasible for any component. This condition applies only to structural components. Enhanced maintenance generally does reduce a components life-cycle cost but not enough to offset the additional maintenance cost. Total present value life-cycle costs under this condition amount to $165.5 million. This is an increase of $10.5 million over the base condition.

Rehabilitation does not appear to be feasible for any component either. Benefits in the form of reduced life-cycle costs of a component are not sufficient to offset the cost to rehab that component. It seems that past maintenance has kept the navigation infrastructure in good enough physical condition that rehabilitation is not required of any components. However, though they may not require rehabilitation, the components evaluated will still require maintenance and repairs as they deteriorate over time. This is where the bulk of future investment in the lock and dam system will be directed (see Appendix for expected cumulative repair costs).

Analysis of Future Rehabilitation Needs on the Upper Mississippi River and Illinois Waterway (Objective 2A)

References:

1. Upper Mississippi River - Illinois Waterway Navigation Study, Baseline Initial Project Management Plan, May 1994.

2. Upper Mississippi River - Illinois Waterway Navigation Study, Engineering Objective 1 Report, Part 1, November 1995

3. Upper Mississippi River - Illinois Waterway Navigation Study, Geotechnical/Materials Reliability Models, Objective 2A, March 1997

Introduction

This report documents the results of the task, Estimate Reliability of System (described in paragraph 3.4.3.10.1 of Reference 1). It is but one of the efforts that the Economic Work Group has undertaken in support of the Engineering Work Group (see paragraph 3.4.3.10, Reference 1). The purpose of the reliability analysis is to assist the Engineering Work Group in completing their Objective 2A (see paragraph 3.3.2.2., Reference 1). The intent of Objective 2A is to identify the future rehabilitation needs of the Upper Mississippi River - Illinois Waterway Navigation System, just one element of the total without-project scenario.

The primary focus of this reliability analysis is a comparison of the life-cycle costs of lock and dam components under the base condition and under the rehabilitated condition. Rehabilitation of a component will be feasible if life-cycle costs under this condition are less than life-cycle costs under the base condition. Costs are incurred over the planning period as a result of unsatisfactory performance (or failure) of a component. They take the form of repair costs and foregone transportation cost savings benefits if component failure forces closure of the lock. Life-cycle costs are the present value equivalent of all costs expected to be incurred over the 50-year planning period.

General Procedure

The general procedure for estimating reliability of the navigation system began with an evaluation by the Engineering Work Group of the condition of all lock and dam structures on the Upper Mississippi River and Illinois Waterway. Significant individual components comprising the lock and dam structure were identified and their current physical condition assessed. The Engineering Work Group also projected each component's future rate of degradation. Results from the condition assessments were used to develop hazard functions for each component. These functions calculate the probability of unsatisfactory performance for a given year and serve as the foundation of the reliability analysis.

The Engineering Work Group also defined the potential consequences in the event of component failure. This included estimates of repair costs and, if relevant, the length of time the lock may be closed to complete repairs.

Using the hazard functions and the information on consequences of failure, the Economic Work Group then proceeds to calculate life-cycle costs. A Monte Carlo simulation technique is used to estimate costs expected to be incurred by component over the 50-year planning period. This is done for both base and rehab conditions to determine if and when rehabilitation of the component can be justified. If rehab of a component is economically feasible, it will be included as part of the future without-project condition.

The following major work items were accomplished in estimating the reliability of the system (from Reference 1).

- Obtain engineering data regarding component condition.
- Obtain current reliability coefficients (these are documented in Reference 3).
- Obtain reliability indices vs. time relationship for 50-year planning period for each component at each site.
- Establish point of unsatisfactory performance.
- Obtain consequence of unsatisfactory performance and the probable action to correct.
- Evaluate life-cycle costs of significant components for range of scenarios.
- Participate in refinement of probabilities of unsatisfactory performance related to reliability values.
- Determine feasibility and optimal timing of rehabilitation of each site according to the latest guidance (benefits are computed as a probability times a consequence).

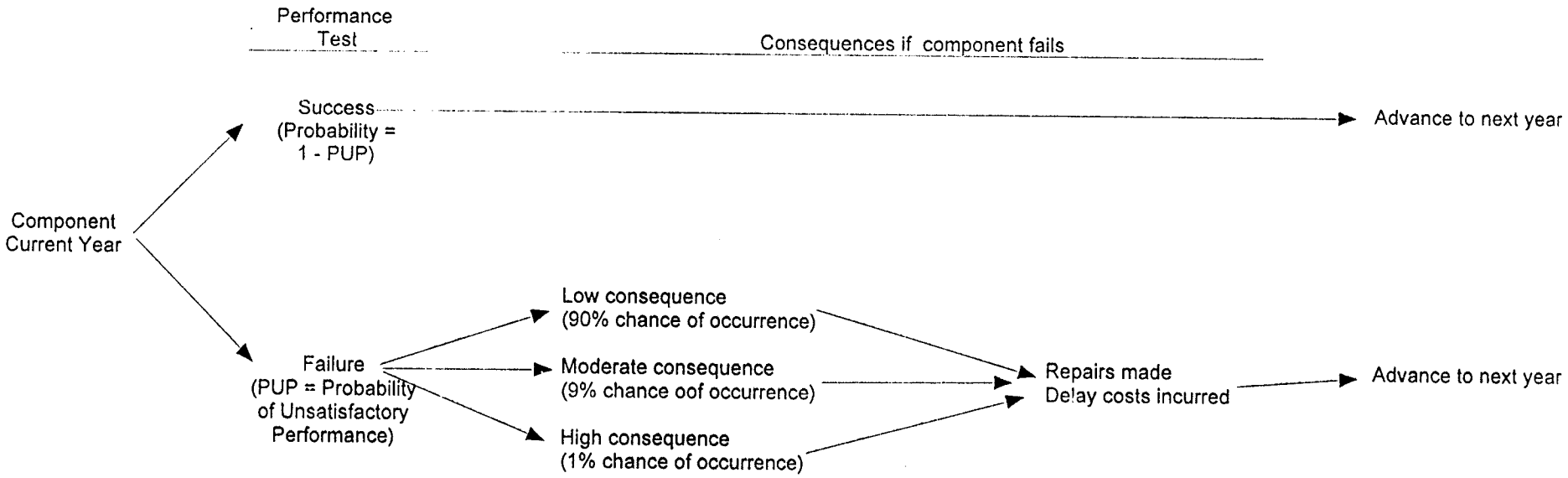
Figure 1 displays an event tree for a typical lock component and depicts the general procedure for analyzing the performance of the component.

Life-cycle Costs

The first step of the economic portion of the reliability analysis for determining rehabilitation needs is estimating life-cycle costs for the base condition. Life-cycle costs are costs related to a component's performance expected over the 50-year planning period. They include not only repair costs but also any lost transportation costs savings benefits due to lock down time caused by the component's failure. Costs are expressed in present value terms as a lump sum of expected future costs. An interest rate of 7-3/8 percent was used for discounting purposes.

Once the base condition is established, life-cycle costs expected under the rehab condition are then calculated. Costs under this scenario include the cost for rehabilitation itself and the typical costs associated with failure (i.e., repair and traffic delay costs) either before or after the component has been rehabilitated. The sum of the present value of these costs is compared to the base condition costs to determine whether or not rehabilitation is feasible. If rehabilitation of a component is feasible, it becomes part of the without-project planning scenario. If rehabilitation is not feasible, then presumably, from an economic standpoint at least, it would be acceptable for a component to fail and incur the associated repair costs and traffic delay costs.

Figure 1 - Event tree for typical lock component



Conditions Evaluated

Three different conditions were evaluated: base condition, enhanced maintenance condition, and the rehab condition. Under the base condition, components would be allowed to deteriorate in both physical condition and performance until failure occurs and repairs become necessary. This is the condition against which the enhanced maintenance and rehab conditions will be compared for feasibility.

Under the enhanced maintenance condition, those components so suited would be maintained in an enhanced manner to ensure optimum performance. Included under this condition are primarily the structural components such as a miter gate or a roller gate whose useful life may be prolonged by enhanced maintenance (i.e., more frequent painting). Geotechnical components such as non-overflow dikes or lockwall concrete are less suited for enhanced maintenance and thus are not included in this analysis. This condition was considered to determine if enhanced maintenance is an economically viable option for future maintenance of any components.

Under the rehab condition, components would be rehabilitated in the future when optimally feasible to do so from an economic standpoint. Components deemed feasible for rehabilitation would become part of the without-project planning scenario. Table 1 indicates which components were evaluated at each lock and for which conditions: base (B), enhanced maintenance (E), and rehabilitated (R). Where no letter appears, the component either does not exist at that lock and dam or the major rehab costs associated with this component will be included as a contingency cost factor in the overall economic analysis (see TABLE ENG-4 in Enginering Appendix)

Table 1 - Components Evaluated at Each Lock by Condition

Model	USAF	LSAF	L/D_1(Main)	L/D_1 (Aux)	L/D_2	L/D_3
Structural						
Miter gate						
Vertical						
Horizontal						
Anchorage						
Lift gate						
Roller gate						(4) B E R
Tainter gate						
Tainter valves						
Mech / Elec						
Control center	B	B	B	B	B	B
Control cables	B	B	B	B	B	B
Slide gate mach						
Miter gate mach			B	B	B	B
Lock valve mach			B	B	B	B
Channel (by pool)			B E R		B E R	B E R
Geotechnical						
Pile founded						
Lock wall (land)					B R	B R
Lock wall (interm.)					B R	B R
Lock monolith						
Guidewall (u.s.)					B R	B R
Guidewall (d.s.)					B R	B R
Dam piers					B R	B R
Rock founded (gravity)						
Lock wall (land)	B R					
Lock wall (unwatered)						
Lock wall (interm.)						
Guidewall (u.s.)	B R	B R				
Guidewall (d.s.)	B R					
Dam piers		B R				
Lock U-structure	B R	B R				
Non-overflow structure		B R				
Concrete						
Lock walls		B R			B R	B R
Dam piers		B R			B R	B R
Spillway			B R			
Underseepage						
Earth dikes		B R			B R	B R
Non-overflow dikes						
Overflow dike						
Storage yard						
Pool control dam		B R			B R	B R
Aux lock closure dam						
Sheet pile cells						
Regulating weir						
Navigable dam						
Lock unwatering						
Through seepage						
Earth dike		B R			B R	B R
Non-overflow dike						
Storage yard						
Aux lock closure dam						
Scour protection		B R	B R		B R	B R
Slope stability						B R
Earth dike	B R	B R			B R	B R
Overflow dike						
Non-overflow dike						
Storage yard					B R	B R
Aux lock closure dam						
Low water dam						

Scenarios: B = Base condition; E = Enhanced maintenance; R = Rehabilitation

Table 1 - Components Evaluated at Each Lock by Condition

Model	L/D 4			L/D 5			L/D 5A			L/D 6			L/D 7			L/D 8		
Structural																		
Miter gate																		
Vertical																		
Horizontal																		
Anchorage																		
Lift gate																		
Roller gate	(6)	B	E	R	(6)	B	E	R	(5)	B	E	R	(5)	B	E	R	(5)	B	E	R
Tainter gate	(22)	B	E	R	(28)	B	E	R	(5)	B	E	R	(10)	B	E	R	(11)	B	E	R	(10)	B	E	R
Tainter valves																		
Mech / Elec																		
Control center		B				B				B				B				B		
Control cables		B				B				B				B				B		
Slide gate mach																		
Miter gate mach		B				B				B				B				B		
Lock valve mach		B				B				B				B				B		
Channel (by pool)	B	E	R	B	E	R	B	E	R	B	E	R	B	E	R	B	E	R		
Geotechnical																		
Pile founded																		
Lock wall (land)	B		R	B		R	B		R	B		R	B		R	B		R		
Lock wall (interm.)	B		R				B		R	B		R	B		R	B		R		
Lock monolith																		
Guidewall (u.s.)	B		R	B		R	B		R	B		R	B		R	B		R		
Guidewall (d.s.)	B		R	B		R	B		R	B		R	B		R	B		R		
Dam piers	B		R	B		R	B		R	B		R	B		R	B		R		
Rock founded (gravity)																		
Lock wall (land)																		
Lock wall (unwatered)																		
Lock wall (interm.)																		
Guidewall (u.s.)																		
Guidewall (d.s.)																		
Dam piers																		
Lock U-structure																		
Non-overflow structure																		
Concrete																		
Lock walls	B		R	B		R	B		R	B		R	B		R	B		R		
Dam piers	B		R	B		R	B		R	B		R	B		R	B		R		
Spillway							B		R	B		R								
Underseepage																		
Earth dikes	B		R	B		R	B		R	B		R	B		R	B		R		
Non-overflow dikes																		
Overflow dike													B		R	B		R		
Storage yard																		
Pool control dam	B		R	B		R	B		R	B		R	B		R	B		R		
Aux lock closure dam																		
Sheet pile cells																		
Regulating weir																		
Navigable dam																		
Lock unwatering																		
Through seepage																		
Earth dike	B		R	B		R	B		R	B		R	B		R	B		R		
Non-overflow dike																		
Storage yard																		
Aux lock closure dam																		
Scour protection	B		R	B		R	B		R	B		R	B		R	B		R		
Slope stability							B		R											
Earth dike	B		R	B		R	B		R	B		R	B		R	B		R		
Overflow dike													B		R	B		R		
Non-overflow dike																				
Storage yard	B		R	B		R	B		R	B		R	B		R	B		R		
Aux lock closure dam																				
Low water dam																				

Table 1 - Components Evaluated at Each Lock by Condition

Model	L/D 9			L/D 10			L/D 11			L/D 12			L/D 13			L/D 14		
Structural																		
Miter gate																		
Vertical																		
Horizontal																		
Anchorage										B	E	R						
Lift gate																		
Roller gate	(5) B	E	R	(4) B	E	R	(3) B	E	R	(3) B	E	R	(3) B	E	R	(4) B	E	R
Tainter gate	(8) B	E	R															
Tainter valves																		
Mech / Elec																		
Control center		B			B			B			B			B			B	
Control cables		B			B			B			B			B			B	
Slide gate mach																		
Miter gate mach		B			B			B			B			B			B	
Lock valve mach		B			B			B			B			B			B	
Channel (by pool)	B	E	R	B	E	R	B	E	R	B	E	R	B	E	R	B	E	R
Geotechnical																		
Pile founded																		
Lock wall (land)	B		R	B		R	B		R				B		R			
Lock wall (interm.)	B		R	B		R	B		R				B		R			
Lock monolith																		
Guidewall (u.s.)	B		R	B		R	B		R				B		R			
Guidewall (d.s.)	B		R	B		R	B		R				B		R			
Dam piers	B		R	B		R	B		R				B		R			
Rock founded (gravity)																		
Lock wall (land)																B		R
Lock wall (unwatered)																		
Lock wall (interm.)																B		R
Guidewall (u.s.)																		
Guidewall (d.s.)																		
Dam piers																		
Lock U-structure																		
Non-overflow structure																		
Concrete																		
Lock walls	B		R	B		R	B		R	B		R	B		R	B		R
Dam piers	B		R	B		R	B		R	B		R	B		R	B		R
Spillway				B		R												
Underseepage																		
Earth dikes	B		R	B		R												
Non-overflow dikes							B		R	B		R	B		R			
Overflow dike	B		R															
Storage yard							B		R	B		R	B		R			
Pool control dam	B		R	B		R	B		R	B		R	B		R			
Aux lock closure dam																		
Sheet pile cells																		
Regulating weir																		
Navigable dam																		
Lock unwatering							B		R	B		R	B		R			
Through seepage																		
Earth dike	B		R	B		R												
Non-overflow dike							B		R	B		R	B		R			
Storage yard							B		R	B		R	B		R			
Aux lock closure dam																		
Scour protection	B		R	B		R	B		R	B		R	B		R	B		R
Slope stability																		
Earth dike	B		R	B		R												
Overflow dike	B		R							B		R	B		R			
Non-overflow dike							B		R	B		R	B		R	B		R
Storage yard	B		R	B		R	B		R	B		R	B		R	B		R
Aux lock closure dam																		
Low water dam																		

Table 1 - Components Evaluated at Each Lock by Condition

Model	L/D 15(Main)	L/D 15 (Aux)	L/D 16	L/D 17	L/D 18	L/D 19
Structural						
Miter gate						
Vertical						
Horizontal						
Anchorage				B E R	B E R	
Lift gate						B E R
Roller gate	(11) B E R		(4) B E R	(3) B E R	(3) B E R	
Tainter gate						
Tainter valves						
Mech / Elec						
Control center	B	B	B	B	B	B
Control cables	B	B	B	B	B	B
Slide gate mach						
Miter gate mach	B	B	B	B	B	B
Lock valve mach	B	B	B	B	B	B
Channel (by pool)	B E R		B E R	B E R	B E R	B E R
Geotechnical						
Pile founded						
Lock wall (land)			B R	B R	B R	
Lock wall (interm.)			B R	B R	B R	
Lock monolith						
Guidewall (u.s.)			B R	B R	B R	
Guidewall (d.s.)			B R	B R	B R	
Dam piers			B R	B R	B R	
Rock founded (gravity)						
Lock wall (land)	B R					B R
Lock wall (unwatered)						
Lock wall (interm.)	B R					B R
Guidewall (u.s.)						
Guidewall (d.s.)						
Dam piers						
Lock U-structure						
Non-overflow structure						
Concrete						
Lock walls	B R		B R	B R	B R	B R
Dam piers			B R	B R	B R	
Spillway			B R			
Underseepage						
Earth dikes						
Non-overflow dikes				B R	B R	
Overflow dike						
Storage yard			B R	B R	B R	
Pool control dam			B R	B R	B R	
Aux lock closure dam						
Sheet pile cells						
Regulating weir						
Navigable dam						
Lock unwatering			B R	B R	B R	
Through seepage						
Earth dike						
Non-overflow dike				B R	B R	
Storage yard			B R	B R		
Aux lock closure dam						
Scour protection	B R			B R	B R	B R
Slope stability						
Earth dike						
Overflow dike			B R	B R	B R	
Non-overflow dike				B R	B R	
Storage yard			B R	B R	B R	
Aux lock closure dam						
Low water dam						

Table 1 - Components Evaluated at Each Lock by Condition

Model	L/D 20	L/D 21	L/D 22	L/D 24	L/D 25	L/D 26 Main
Structural						
Miter gate						
Vertical				B E R		
Horizontal						
Anchorage	B E R	B E R	B E R			
Lift gate						B E R
Roller gate	(3) B E R	(3) B E R	(3) B E R		(3) B E R	
Tainter gate						
Tainter valves				B E R		
Mech / Elec						
Control center	B	B	B	B	B	B
Control cables	B	B	B	B	B	B
Slide gate mach						
Miter gate mach	B	B	B	B	B	
Lock valve mach	B	B	B	B	B	
Channel (by pool)	B E R	B E R	B E R	B E R	B E R	B E R
Geotechnical						
Pile founded						
Lock wall (land)		B R			B R	
Lock wall (interm.)		B R			B R	
Lock monolith						B R
Guidewall (u.s.)		B R			B R	B R
Guidewall (d.s.)		B R			B R	B R
Dam piers	B R	B R		B R	B R	B R
Rock founded (gravity)						
Lock wall (land)	B R		B R	B R		
Lock wall (unwatered)						
Lock wall (interm.)	B R		B R	B R		
Guidewall (u.s.)				B R		
Guidewall (d.s.)				B R		
Dam piers						
Lock U-structure						
Non-overflow structure						
Concrete						
Lock walls	B R	B R	B R	B R	B R	
Dam piers		B R	B R	B R	B R	
Spillway						
Underseepage						
Earth dikes				B R	B R	
Non-overflow dikes						
Overflow dike		B R		B R	B R	B R
Storage yard	B R	B R		B R	B R	
Pool control dam	B R	B R		B R	B R	B R
Aux lock closure dam					B R	
Sheet pile cells						B R
Regulating weir						
Navigable dam						
Lock unwatering		B R		B R	B R	B R
Through seepage						
Earth dike				B R	B R	B R
Non-overflow dike						
Storage yard	B R	B R		B R	B R	
Aux lock closure dam				B R	B R	
Scour protection	B R	B R	B R	B R	B R	B R
Slope stability						
Earth dike				B R	B R	B R
Overflow dike		B R	B R	B R	B R	B R
Non-overflow dike						
Storage yard	B R	B R	B R	B R	B R	
Aux lock closure dam				B R	B R	
Low water dam						

Table 1 - Components Evaluated at Each Lock by Condition

Model	L/D 26 Aux	L/D 27 Main	L/D 27 Aux	O'Brien	Lockport	Brandon Rd
Structural						
Miter gate						
Vertical						
Horizontal						B E R
Anchorage						
Lift gate		(2) B E R	B E R		B E R	
Roller gate						
Tainter gate						
Tainter valves						
Mech / Elec						
Control center	B	B	B	B	B	B
Control cables	B	B	B	B	B	B
Slide gate mach						
Miter gate mach		B	B		B	B
Lock valve mach		B	B		B	B
Channel (by pool)		B E R		B E R	B E R	B E R
Geotechnical						
Pile founded						
Lock wall (land)						
Lock wall (interm.)						
Lock monolith	B R					
Guidewall (u.s.)	B R	B R				
Guidewall (d.s.)	B R	B R				
Dam piers						
Rock founded (gravity)						
Lock wall (land)		B R	B R		B R	B R
Lock wall (unwatered)						
Lock wall (interm.)		B R			B R	B R
Guidewall (u.s.)						
Guidewall (d.s.)						
Dam piers						
Lock U-structure						
Non-overflow structure						
Concrete						
Lock walls					B R	B R
Dam piers						
Spillway						
Underseepage						
Earth dikes		B R	B R			
Non-overflow dikes						
Overflow dike						
Storage yard						
Pool control dam				B R		
Aux lock closure dam						
Sheet pile cells						
Regulating weir						
Navigable dam						
Lock unwatering	B R	B R	B R			
Through seepage						
Earth dike		B R	B R			
Non-overflow dike						
Storage yard						
Aux lock closure dam						
Scour protection		B R		B R		B R
Slope stability						
Earth dike		B R	B R		B R	
Overflow dike						
Non-overflow dike						B R
Storage yard						
Aux lock closure dam						
Low water dam		B R				

Table 1 - Components Evaluated at Each Lock by Condition

Model	Dresden	Marseilles	Starved Rock	Peoria	LaGrange
Structural					
Miter gate					
Vertical					
Horizontal					
Anchorage					
Lift gate					
Roller gate					
Tainter gate	(9) B E R		(10) B E R		
Tainter valves					
Mech / Elec					
Control center	B	B	B	B	B
Control cables	B	B	B	B	B
Slide gate mach					
Miter gate mach	B	B	B		
Lock valve mach	B	B	B		
Channel (by pool)	B E R	B E R	B E R	B E R	B E R
Geotechnical					
Pile founded					
Lock wall (land)				B R	B R
Lock wall (interm.)				B R	B R
Lock monolith					
Guidewall (u.s.)				B R	B R
Guidewall (d.s.)				B R	B R
Dam piers					B R
Rock founded (gravity)					
Lock wall (land)	B R	B R	B R		
Lock wall (unwatered)					
Lock wall (interm.)	B R	B R	B R		
Guidewall (u.s.)					
Guidewall (d.s.)					
Dam piers					
Lock U-structure					
Non-overflow structure					
Concrete					
Lock walls	B R	B R	B R	B R	B R
Dam piers					
Spillway	B R		B R		
Underseepage					
Earth dikes					
Non-overflow dikes					B R
Overflow dike					
Storage yard					
Pool control dam					
Aux lock closure dam					
Sheet pile cells					
Regulating weir				B R	B R
Navigable dam				B R	B R
Lock unwatering				B R	B R
Through seepage					
Earth dike					
Non-overflow dike					
Storage yard					
Aux lock closure dam					
Scour protection	B R	B R	B R	B R	B R
Slope stability					
Earth dike					
Overflow dike					
Non-overflow dike	B R				B R
Storage yard					
Aux lock closure dam					
Low water dam					

Hazard Function

Engineers provided hazard functions that were used to calculate probability of failure for a component in any year of the planning period. The hazard function is the probability of failure in any year, given that failure has not yet occurred. Hazard functions were provided for base condition, an after-repair condition, an enhanced maintenance condition, and a rehabilitated condition. The functions differ slightly depending on whether the component evaluated is a structural or geotechnical component. The hazard function for a structural component is presented as follows:

$$h(t) = (b/a)*(t/a)^{(b-1)} = \text{Probability of failure}$$

t = age, or number of years component has been in service
b = the shape parameter
a = the characteristic life of a component

The function for a geotechnical component is shown below. It includes an additional variable, v, defined as the minimum life of a component. Also, t is defined somewhat differently; it is the number of years since the component's condition was last evaluated with the year 1995 = 0.

$$h(t) = (b/a)*((t-v)/a)^{(b-1)} = \text{Probability of failure}$$

Consequences

The engineers also provided information regarding consequences of failure including repair costs and estimated downtime of a lock if component failure caused the lock to be shut down to barge traffic. A range of consequences was provided in recognition of the uncertainty associated with the potential degree of severity. For structural components, consequences were defined in terms of low, medium, and high probability of occurrence. Low consequences generally had a high probability of occurrence (85-90%); moderate consequences occur with a medium probability of occurrence (9-14%), and severe consequences occur with a low probability of occurrence (1%). Geotechnical components are assumed to have no significant consequences when a minor failure occurs. So, for these components consequences are expressed in terms of moderate and severe consequences with moderate consequences associated with 85 to 90 percent of failures and severe consequences associated with 10 to 15 percent of the failures. Table 2 presents the consequences of unsatisfactory performance by component by lock.

Table 2 - Consequences of Unsatisfactory Performance by Component

Lock = Upper St Anthony Falls	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	20 min	200	200,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	13,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	13,000
Lock U-structure						0.85	3			2,000	0.15	30	20 min	200	200,000
Scour protection (dam)						0.9	0			500	0.1	0	0		3,000
Slope stability															
Stone guard wall						0.9	0			0	0.1	1	0	0	480
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Lock = Lower St Anthony Falls	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Rock founded (gravity)															
Guidewall (u.s.)						0.75	5			1000	0.25	10	20 min	180	13000
Dam piers						0.95	1			2000	0.05	20			23000
Lock U-structure						0.85	3			2000	0.15	30	20 min	200	200000
Non-overflow structure						0.95	1			2000	0.05	20			24000
Concrete															
Lock walls						0.9	30			500	0.1	30			9000
Dam piers						0.9	0			500	0.1	0			10000
Underseepage															
Earth dikes (NSP dike)						0.9	1			0	0.1	20			0
Pool control dam						0.95	1			2000	0.05	20			100000
Through seepage															
Earth dikes (NSP dike)						0.9	1			0	0.1	20			0
Scour protection						0.9	0			500	0.1	0			3000
Slope stability															
Earth dikes (NSP dike)						0.9	0			500	0.1	0			0
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 1

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Concrete															
Overflow structures						0.9	0			500	0.1	0			8000
Scour protection						0.9	0			500	0.1	0			3000
Slope stability															
Crib wall						0.9	0			500	0.1	1	0	0	6000
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2640

L/D 2

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Overflow structures															
Underseepage															
Earth dikes						0.9	1			500	0.1	20			4,200
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			4,200
Scour protection						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	4,200
Storage yard						0.9	1			500	0.1	20	0	0	2,040
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 3

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			5,200
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			5,200
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	5,200
Storage yard						0.9	1			500	0.1	20	0	0	2,240
Protection dike						0.9	1			500	0.1	20	0	0	1,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 4

Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1,000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			6,500
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			6,500
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	6,500
Storage yard						0.9	1			500	0.1	20	0	0	2,160
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 5

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			16,400
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			16,400
Scour protection						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	16,400
Storage yard						0.9	1			500	0.1	20	0	0	2,080
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 5A

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Overflow structures						0.9	0			500	0.1	0			8,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			18,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			18,000
Scour protection						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	18,000
Overflow dike															
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Protection dike						0.9	1			500	0.1	20	0	0	1,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 6

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Overflow structures						0.9	0			500	0.1	0			8,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			5,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			5,000
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	5,000
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 7

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			7,100
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			7,100
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	7,100
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 6

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Overflow structures						0.9	0			500	0.1	0			8,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			5,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			5,000
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	5,000
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 7

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			7,100
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			7,100
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	7,100
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 8

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			14,000
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			14,000
Scour protection						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	14,000
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 9

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1,000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			8,200
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			8,200
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	8,200
Overflow dike						0.9	1			500	0.1	20	0	0	5,000
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 10

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1,000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Overflow structures						0.9	0			500	0.1	0			8,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			5,400
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			5,400
Scour protection (dam)						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	5,400
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 11

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Non-overflow dikes						0.9	1			500	0.1	20			4,720
Storage yard						0.9	1			500	0.1	20			2,160
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Non-overflow dike						0.9	1			500	0.1	20			4,740
Storage yard						0.9	1			500	0.1	20			2,160
Scour protection (dam)						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Non-overflow dike						0.9	1			500	0.1	20			4,720
Storage yard						0.9	1			500	0.1	20			2,160
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 12

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter gate anchorage	0.9	0			3	0.09	2			15	0.01	4			45
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Non-overflow dikes						0.9	1			500	0.1	20			6,640
Storage yard						0.9	1			500	0.1	20			2,160
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Non-overflow dike						0.9	1			500	0.1	20			6,640
Storage yard						0.9	1			500	0.1	20			2,160
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			3,152
Non-overflow dike						0.9	1			500	0.1	20			6,640
Storage yard						0.9	1			500	0.1	20			2,160
Lock unwatering															
Lock wall (Interm.)						0.9	1			500	0.1	20			2,640

L/D 13

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Non-overflow dikes						0.9	1			500	0.1	20			3,632
Storage yard						0.9	1			500	0.1	20			2,160
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Non-overflow dike						0.9	1			500	0.1	20			3,632
Storage yard						0.9	1			500	0.1	20			2,160
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			3,464
Non-overflow dike						0.9	1			500	0.1	20			3,632
Storage yard						0.9	1			500	0.1	20			2,160
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 14

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Overflow structures															
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Non-overflow dike						0.9	1			500	0.1	20			2,928
Storage yard						0.9	1			500	0.1	20			2,160

L/D 15

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 16

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Overflow structures						0.9				500	0.1				3,000
Underseepage															
Storage yard						0.9	1			500	0.1	20			2,332
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Storage yard						0.9	1			500	0.1	20			2,332
Scour protection (dam)						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			2,584
Storage yard						0.9	1			500	0.1	20			2,332
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 17

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter Gate Anchorage	0.9	0			3	0.09	2			15	0.01	4			45
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Non-overflow dikes						0.9	1			500	0.1	20			2,184
Storage yard						0.9	1			500	0.1	20			2,160
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Non-overflow dike						0.9	1			500	0.1	20			3,476
Storage yard						0.9	1			500	0.1	20			2,160
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			3,476
Non-overflow dike						0.9	1			500	0.1	20			2,184
Storage yard						0.9	1			500	0.1	20			2,160
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 18

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter Gate Anchorage	0.9	0			3	0.09	2			15	0.01	4			45
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Non-overflow dikes						0.9	1			500	0.1	20			3,760
Storage yard						0.9	1			500	0.1	20			2,156
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Non-overflow dike						0.9	1			500	0.1	20			3,760
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			3,760
Non-overflow dike						0.9	1			500	0.1	20			3,768
Storage yard						0.9	1			500	0.1	20			2,156
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 19

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Lift gate	0.84	7	0	0	100	0.15	7	20 min	7 days	500	0.01	21	20 min	180 days	5000
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 5

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			16,400
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			16,400
Scour protection						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	16,400
Storage yard						0.9	1			500	0.1	20	0	0	2,080
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

L/D 5A

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Tainter gate	0.9	0			150	0.09	2			250	0.01	7			700
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	30			500	0.1	30			9,000
Dam piers						0.9	0			500	0.1	0			10,000
Overflow structures						0.9	0			500	0.1	0			8,000
Underseepage															
Earth dikes						0.9	1			500	0.1	20			18,000
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dike						0.9	1			500	0.1	20			18,000
Scour protection						0.9	0			500	0.1	0			3,000
Slope stability															
Earth dike						0.9	1			500	0.1	20	0	0	18,000
Overflow dike															
Storage yard						0.9	1			500	0.1	20	0	0	2,120
Protection dike						0.9	1			500	0.1	20	0	0	1,120
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 20

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter Gate Anchorage	0.9	0			3	0.09	2			15	0.01	4			45
Roller gate	0.9	2			200	0.09	7			500	0.01	14			3000
Geotechnical															
Pile founded															
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Underseepage															
Storage yard						0.9	1			500	0.1	20			2,180
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Storage yard						0.9	1			500	0.1	20			2,180
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Storage yard						0.9	1			500	0.1	20			2,180

L/D 21

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter Gate Anchorage	0.9	0			3	0.09	2			15	0.01	4			45
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Overflow dike						0.9	1			500	0.1	20			3,632
Storage yard						0.9	1			500	0.1	20			2,160
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Storage yard						0.9	1			500	0.1	20			2,160
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			3,344
Storage yard						0.9	1			500	0.1	20			2,160
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 22

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter Gate Anchorage	0.9	0			3	0.09	2			15	0.01	4			45
Roller gate	0.9	0			50	0.09	2			200	0.01	7			1000
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Overflow structures															
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Overflow dike						0.9	1			500	0.1	20			3,488
Storage yard						0.9	1			500	0.1	20			2,160

L/D 24

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Miter gate	0.9	0			40 / Leaf	0.09	0			125 / Leaf	0.01	14			825 / Leaf
Tainter valves	0.9	0.167	?	6 days	175	0.09	1	?	20	200	0.01	2	?	45	250
Geotechnical															
Pile founded															
Dam piers						0.95	1			2,000	0.05	20			350,000
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	200,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	13,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	13,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Earth dikes (Sny Levee)						0.9	1			500	0.1	20			10,000
Overflow dike						0.9	1			500	0.1	20			10,000
Storage yard						0.9	1			500	0.1	20			4,720
Pool control dam						0.95	1			2,000	0.05	20			350,000
Through seepage															
Earth dikes (Sny Levee)						0.9	1			500	0.1	20			6,640
Storage yard						0.9	1			500	0.1	20			4,740
Aux lock closure dam						0.9	1			500	0.1	20			10,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Earth dikes (Sny Levee)						0.9	1			500	0.1	20			4,720
Overflow dike						0.9	1			500	0.1	20			4,720
Storage yard						0.9	1			500	0.1	20			4,720
Aux lock closure dam						0.9	1			500	0.1	20			10,000

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 25

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Roller gate	0.9	2			200	0.09	7			500	0.01	14			3000
Geotechnical															
Pile founded															
Lock wall ('and)						0.85	3			2,000	0.15	30	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Dam piers						0.9				500	0.1				10,000
Underseepage															
Earth dike (Sandy Slough)						0.9	1			500	0.1	20			5,800
Overflow dike						0.9	1			500	0.1	20			10,000
Storage yard						0.9	1			500	0.1	20			4,720
Pool control dam						0.95	1			2,000	0.05	20			350,000
Aux lock closure dam						0.9	1			500	0.1	20			10,000
Lock chamber unwtrd						0.85	3			500	0.15	30	15 min	200	10,000
Through seepage															
Earth dike (Sandy Slough)						0.9	1			500	0.1	20			5,800
Storage yard						0.9	1			500	0.1	20			4,740
Aux lock closure dam						0.9	1			500	0.1	20			10,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Earth dike (Sandy Slough)						0.9	1			500	0.1	20			4,720
Overflow dike						0.9	1			500	0.1	20			10,000
Storage yard						0.9	1			500	0.1	20			4,720
Aux lock closure dam						0.9	1			500	0.1	20			10,000

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 26 (Mel Price - Main)	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Lift gate (3 leaves)	0.84	2	0	0	15	0.15	7	0	0	53	0.01	180	0	0	360/leaf
Geotechnical															
Pile founded															
Lock wall (land)	Includes total lock structure					0.85	3			2,000	0.15	30	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Underseepage															
Overflow dike						0.9	1			500	0.1	20			3,600
Pool control dam						0.95	1			2,000	0.05	20			350,000
Sheet pile cells						0.9	1			500	0.1	20			2,250
Lock chamber unwtrd						0.9	1			500	0.1	20			2,640
Through seepage															
Esplanade						0.9	1			500	0.1	20			?
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Esplanade						0.9	1			500	0.1	20			?
Overflow dike						0.9	1			500	0.1	20			3,600

L/D 26 (Mel Price - Aux)	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Pile founded															
Lock wall (land)	Includes total lock structure					0.85	3			2,000	0.15	30 initial + 75 winter	15 min	200	250,000
Guidewall (u.s.)						0.75	3			1,000	0.25	30 initial + 75 winter	15 min	200	16,000
Guidewall (d.s.)						0.75	3			1,000	0.25	30 initial + 75 winter	15 min	200	16,000
Underseepage															
Lock chamber unwtrd						0.9	1			500	0.1	20			2,640

Table 2 - Consequences of Unsatisfactory Performance by Component

L/D 27(Main)	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Lift gate (2 leaves)	0.84	2	0	0	15	0.15	7	0	0	53	0.01	180	0	0	800/leaf
Geotechnical															
Pile founded															
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Rock founded (gravity)															
Lock wall (East)						0.85	3			2,000	0.15	30 initial + 75 winter	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30 initial + 75 winter	15 min	200	200,000
Underseepage															
Earth dike (east embkmt)						0.9	1			500	0.1	20			4,720
Through seepage															
Earth dike (east embkmt)						0.9	1			500	0.1	20			2,600
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Earth dike (east embkmt)						0.9	1			500	0.1	20			2,600
Low water dam						0.9	1			500	0.1	20			10,000
Lock unwatering															
Lock wall (interm.)															
Lock wall (land)															

L/D 27 (Aux)	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Lift gate (2 leaves)	0.84	2	0	0	15	0.15	7	0	0	53	0.01	180	0	0	800/leaf
Geotechnical															
Rock founded (gravity)															
Lock wall (West)						0.85	3			2,000	0.15	30 initial + 75 winter	15 min	200	200,000
Underseepage															
Earth dikes (West embkmt)						0.9	1			500	0.1	20			4,720
Through seepage															
Earth dikes (West embkmt)						0.9	1			500	0.1	20			2,600
Slope stability															
Earth dikes (West embkmt)						0.9	1			500	0.1	20			2,600

Table 2 - Consequences of Unsatisfactory Performance by Component

O'Brien

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Underseepage															
Pool control dam						0.95	1			2,000	0.05	20			350,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000

Lockport

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Lift gate	0.84	7	0	0	100	0.15	7	20 min	7 days	500	0.01	21	20 min	180 days	5000
Rock founded (gravity)															
Lock wall (land)						0.85	3			2000	0.15	30 + 75 winter	15 min	200	200000
Lock wall (interm.)						0.85	3			2000	0.15	30 + 75 winter	15 min	200	200000
Concrete															
Lock walls						0.9	75			500	0.1	75			9000
Scour protection						0.9	0			500	0.1	0	0	0	3000
Slope stability															
Right side dike						0.9	1			500	0.1	20			4400

Brandon Rd

Category of Component	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter gate	0.9	0			40 / Leaf	0.09	0			125 / Leaf	0.01	14			825 / Leaf
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Non-overflow dike						0.9	1			500	0.1	20			2,656

Table 2 - Consequences of Unsatisfactory Performance by Component

Dresden Island	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Tainter gate	0.9	0			300	0.09	2			500	0.01	7			1000
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Overflow structures						0.9				500	0.1				3,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Non-overflow dike						0.9	0			500	0.1	0	0	0	2,400

Marseilles	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000

Starved Rock	Low Level of Consequences					Medium Level of Consequences					High Level of Consequences				
Category of Component	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Tainter gate	0.9	0			250	0.09	2			300	0.01	7			500
Geotechnical															
Rock founded (gravity)															
Lock wall (land)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Lock wall (interm.)						0.85	3			2,000	0.15	30 + 75 winter	15 min	200	200,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Overflow structures						0.9				500	0.1				3,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000

Table 2 - Consequences of Unsatisfactory Performance by Component

Peoria

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Structural															
Miter gate	0.9	0			40 / Leaf	0.09	0			125 / Leaf	0.01	14			825 / Leaf
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2000	0.15	30 initial + 75 winter	15 min	200	250,000
Lock wall (interm.)						0.85	3			2000	0.15	30 initial + 75 winter	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1000	0.25	10	20 min	180	16,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Underseepage															
Regulating weir						0.95	1			2000	0.05	20			350,000
Navigable dam						0.95	1			2000	0.05	20			350,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

LaGrange

Category of Component	Low Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	Medium Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)	High Level of Consequences: Probability of failure	Closure Time (days)	Increased lockage time	Days of slowdown	Repair cost ($000)
Geotechnical															
Pile founded															
Lock wall (land)						0.85	3			2,000	0.15	30 initial + 75 winter	15 min	200	250,000
Lock wall (interm.)						0.85	3			2,000	0.15	30 initial + 75 winter	15 min	200	250,000
Guidewall (u.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Guidewall (d.s.)						0.75	5			1,000	0.25	10	20 min	180	16,000
Dam piers						0.95	1			2,000	0.05	20	0	0	350,000
Concrete															
Lock walls						0.9	75			500	0.1	75			9,000
Underseepage															
Non-overflow dikes						0.9	1			500	0.1	20			2,312
Regulating weir						0.95	1			2,000	0.05	20			350,000
Navigable dam						0.95	1			2,000	0.05	20			350,000
Scour protection						0.9	0			500	0.1	0	0	0	3,000
Slope stability															
Non-overflow dike						0.9	1			500	0.1	20			2,312
Storage yard															
Lock unwatering															
Lock wall (interm.)						0.9	1			500	0.1	20			2,640

Model Description

A model for calculating life-cycle costs was developed using Micro Saint simulation software, a product of Micro Analysis & Design, Inc. The model uses Monte Carlo simulation technique to simulate potential component failures and consequences over the 50-year planning life. A flow diagram of the model's logic appears as Figure 2. Model tasks are described below.

Start - Model starts running, variables are initiated

Create Parts - Components for this lock are created and component characteristics such as age, useful life, and consequences of failure are read into the model.

Increment Years - Components are in queue and ready to be run through the model. This task causes years to be added and simulation to advance through life cycle; at end of life cycle model branches to task **Done**. All components are evaluated before the model advances to the next year.

Failure - Given current year of life cycle, calculates probability of unsatisfactory performance (PUP) for the component evaluated and determines through "Monte Carlo" random number generation whether component has failed. If component performs successfully (i.e., if random number generated is between PUP and 1), simulation proceeds to the task **Increment Years** to advance to the next year. If component fails (i.e., if random number generated is between 0 and PUP), simulation proceeds to task **Calculate Consequences.**

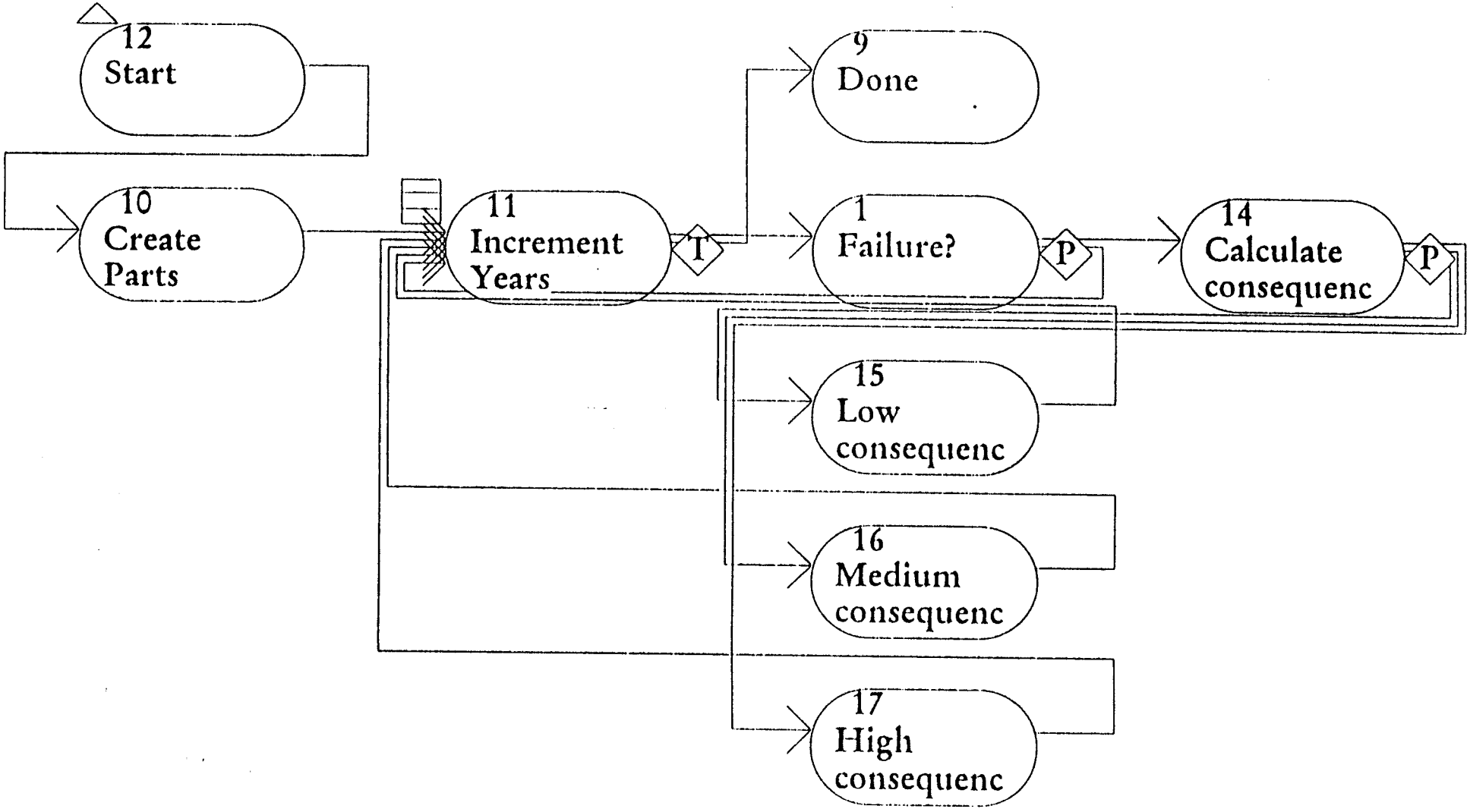
Calculate Consequences - If component fails, simulation advances to the calculation of consequences. Consequences incurred are of low, medium, or high severity and have a probability of occurrence inversely related to their degree of severity (example - low may have 90% chance of occurrence, medium may have 9% chance of occurrence, and high may have 1% chance of occurrence). Once consequences are calculated the model proceeds to the task **Increment Years** to advance to the next year of the life cycle. After a failure and subsequent repairs, the component is in the "after repair" mode and the probability of failure is modified to reflect this (i.e., the component's condition will be improved and the probability of unsatisfactory performance in subsequent years will be lower to reflect this).

Low Consequence - Simulation has been directed to this task based on probability of unsatisfactory performance causing low consequence (85 - 95 percent); low consequences are calculated and discounted to present worth.

Medium Consequence - Simulation has been directed to this task based on probability of a failure causing medium consequence (4 - 10 percent); medium consequences are calculated and discounted to present worth.

High Consequence - Simulation has been directed to this task based on probability of a failure causing high consequence (1- 5 percent); high consequences are calculated and discounted to present worth.

Figure 2 – Flow Diagram of Life-cycle Cost Model



Results

Base Condition – Table 3 displays the results of the life-cycle cost analysis by component for the base condition. This is the condition where current O&M practices prevail and would be anticipated in the future. The costs presented are the lump sum present value of expected repair costs and traffic delay costs associated with the component over the 50-year planning life of this study. These costs serve as the base against which comparison of the enhanced maintenance and rehab conditions will be made to determine if other maintenance/rehab options are feasible. Table 4 summarizes the results displayed in Table 3. For the components evaluated, total life-cycle costs for the base condition amount to $155.2 million, of which $126.7 million (82 percent) are repair costs and $28.4 million (18 percent) are traffic delay costs.

Another way of displaying costs is on a cumulative basis over the 50-year planning horizon. This was done for repair costs to show the magnitude of future investment required to maintain the base condition for those components evaluated. The Appendix presents in a tabular and graphical manner cumulative repair costs by lock expected over the 50-year period of analysis. The final tally for cumulative repair costs for components evaluated in this analysis amounts to approximately $460 million. Note that this figure does not include traffic delay costs.

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Upper St. Anthony Falls		Present Value of Life-cycle Costs		
Component #	Component Description	Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - rock foundation	$1	$468	$469
2	Lock U-structure - rock foundation	$1	$429	$430
3	Guidewall (u.s.) - rock foundation	$2	$119	$120
4	Guidewall (d.s.) - rock foundation	$1	$68	$68
9	Stone guard wall dike - slope stability	$0	$0	$0
Total		$4	$1,084	$1,088
Lower St. Anthony Falls				
1	Lock U-structure - rock foundation	$1	$821	$822
1.1	Lock walls - concrete	$15	$145	$160
3	Guidewall (u.s.) - rock foundation	$1	$101	$102
5	Dam piers - rock foundation	$0	$49	$50
5.1	Dam piers - concrete	$0	$194	$194
8	Non-overflow structure - rock foundation	$0	$23	$23
9	Earth dike - underseepage	$1	$0	$1
9.1	Earth dike - slope stability	$0	$6	$6
9.2	Earth dike - through seepage	$0	$0	$0
13	Pool control dam - underseepage	$0	$147	$147
14	Pool control dam - scour protection	$0	$146	$146
Total		$19	$1,632	$1,651
Lock and Dam 1				
6	Overflow structure - concrete	$0	$78	$78
14	Pool control dam - scour protection	$0	$193	$193
Total		$0	$271	$271
Lock and Dam 2				
1	Lock wall (land) - pile foundation	$22	$1,405	$1,427
1.1	Lock walls - concrete	$792	$224	$1,016
2	Lock wall (interm.) pile foundation	$35	$2,385	$2,419
3	Guidewall (u.s.) - pile foundation	$21	$120	$141
4	Guidewall (d.s.) - pile foundation	$19	$112	$132
5	Dam piers - pile foundation	$4	$737	$741
5.1	Dam piers - concrete	$0	$284	$284
9	Earth dikes - underseepage	$2	$14	$16
9.1	Earth dike - slope stability	$3	$13	$16
9.2	Earth dike - through seepage	$1	$4	$5
12	Storage yard - slope stability	$2	$7	$9
13	Pool control dam - underseepage	$1	$181	$182
14	Pool control dam - scour protection	$0	$144	$144
Total		$903	$5,630	$6,533

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 3 Component #	Component Description	Present Value of Life-cycle Costs Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$32	$2,133	$2,165
1.1	Lock walls - concrete	$816	$268	$1,084
2	Lock wall (interm.) pile foundation	$18	$1,013	$1,030
3	Guidewall (u.s.) - pile foundation	$37	$217	$255
4	Guidewall (d.s.) - pile foundation	$19	$107	$127
5	Dam piers - pile foundation	$4	$985	$989
5.1	Dam piers - concrete	$0	$256	$256
9	Earth dikes - underseepage	$3	$19	$23
9.1	Earth dike - slope stability	$5	$25	$31
9.2	Earth dike - through seepage	$1	$4	$4
10	Protection dike - slope stability	$2	$8	$10
12	Storage yard - slope stability	$1	$6	$7
13	Pool control dam - underseepage	$3	$691	$694
14	Pool control dam - scour protection	$0	$179	$179
21	Roller gate	$1	$7	$8
22	Roller gate	$2	$9	$11
23	Roller gate	$2	$7	$9
24	Roller gate	$1	$5	$6
Total		$948	$5,938	$6,887
Lock and Dam 4				
1	Lock wall (land) - pile foundation	$18	$1,113	$1,131
1.1	Lock walls - concrete	$788	$215	$1,003
2	Lock wall (interm.) pile foundation	$28	$1,753	$1,782
3	Guidewall (u.s.) - pile foundation	$18	$92	$110
4	Guidewall (d.s.) - pile foundation	$18	$97	$115
5	Dam piers - pile foundation	$3	$574	$578
5.1	Dam piers - concrete	$0	$208	$208
9	Earth dikes - underseepage	$4	$23	$27
9.1	Earth dike - slope stability	$1	$10	$11
9.2	Earth dike - through seepage	$0	$2	$2
12	Storage yard - slope stability	$2	$7	$9
13	Pool control dam - underseepage	$2	$278	$281
14	Pool control dam - scour protection	$0	$152	$152
21	Roller gate	$1	$6	$7
22	Roller gate	$1	$7	$8
23	Roller gate	$2	$6	$8
24	Roller gate	$3	$10	$12
25	Roller gate	$1	$6	$8
26	Roller gate	$2	$7	$8
27	Tainter gate	$0	$141	$141
Total		$892	$4,709	$5,601

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 5 Component #	Component Description	Present Value of Life-cycle Costs: Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$21	$1,381	$1,403
1.1	Lock walls - concrete	$808	$274	$1,082
3	Guidewall (u.s.) - pile foundation	$20	$481	$500
4	Guidewall (d.s.) - pile foundation	$24	$141	$166
5	Dam piers - pile foundation	$3	$369	$372
5.1	Dam piers - concrete	$0	$287	$287
9	Earth dikes - underseepage	$4	$46	$50
9.1	Earth dike - slope stability	$2	$22	$23
9.2	Earth dike - through seepage	$0	$6	$7
12	Storage yard - slope stability	$1	$7	$8
13	Pool control dam - underseepage	$2	$153	$155
14	Pool control dam - scour protection	$0	$178	$178
21	Roller gate	$1	$7	$8
22	Roller gate	$2	$8	$9
23	Roller gate	$1	$5	$6
24	Roller gate	$2	$7	$9
25	Roller gate	$1	$6	$7
26	Roller gate	$2	$7	$8
27	Tainter gate	$0	$186	$186
Total		$894	$3,571	$4,465

Lock and Dam 5A				
1	Lock wall (land) - pile foundation	$25	$1,539	$1,564
1.1	Lock walls - concrete	$750	$212	$962
2	Lock wall (interm.) - pile foundation	$29	$1,960	$1,990
3	Guidewall (u.s.) - pile foundation	$33	$193	$226
4	Guidewall (d.s.) - pile foundation	$25	$147	$172
5	Dam piers - pile foundation	$4	$862	$867
5.1	Dam piers - concrete	$0	$263	$263
6	Overflow structure - concrete	$0	$67	$67
8	Protection dike - slope stability	$3	$8	$11
9	Earth dikes - underseepage	$4	$51	$55
9.1	Earth dike - slope stability	$3	$34	$36
9.2	Earth dike - through seepage	$2	$22	$24
12	Storage yard - slope stability	$2	$8	$10
13	Pool control dam - underseepage	$1	$64	$65
14	Pool control dam - scour protection	$0	$170	$170
21	Roller gate	$1	$6	$7
22	Roller gate	$1	$7	$8
23	Roller gate	$1	$6	$8
24	Roller gate	$1	$6	$7
25	Roller gate	$2	$7	$9
26	Tainter gate	$0	$6	$6
Total		$888	$5,636	$6,524

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 6 Component #	Component Description	Present Value of Life-cycle Costs Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$14	$865	$880
1.1	Lock walls - concrete	$777	$237	$1,014
2	Lock wall (interm.) - pile foundation	$13	$717	$731
3	Guidewall (u.s.) - pile foundation	$40	$253	$293
4	Guidewall (d.s.) - pile foundation	$23	$133	$156
5	Dam piers - pile foundation	$4	$617	$620
5.1	Dam piers - concrete	$0	$197	$197
6	Overflow structure - concrete	$0	$106	$106
9	Earth dikes - underseepage	$6	$28	$34
9.1	Earth dike - slope stability	$2	$11	$13
9.2	Earth dike - through seepage	$1	$3	$4
12	Storage yard - slope stability	$4	$11	$15
13	Pool control dam - underseepage	$6	$1,295	$1,301
14	Pool control dam - scour protection	$0	$164	$164
21	Roller gate	$0	$4	$5
22	Roller gate	$0	$6	$6
23	Roller gate	$1	$7	$8
24	Roller gate	$1	$6	$7
25	Roller gate	$1	$5	$6
26	Tainter gate	$0	$11	$11
Total		$894	$4,677	$5,571
Lock and Dam 7				
1	Lock wall (land) - pile foundation	$22	$1,379	$1,401
1.1	Lock walls - concrete	$784	$247	$1,032
2	Lock wall (interm.) - pile foundation	$38	$2,490	$2,528
3	Guidewall (u.s.) - pile foundation	$12	$59	$71
4	Guidewall (d.s.) - pile foundation	$29	$160	$189
5	Dam piers - pile foundation	$3	$546	$550
5.1	Dam piers - concrete	$0	$183	$183
9	Earth dikes - underseepage	$6	$39	$45
9.1	Earth dike - slope stability	$4	$26	$30
9.2	Earth dike - through seepage	$1	$4	$5
10	Overflow dike - underseepage	$4	$22	$26
10.1	Overflow dike - slope stability	$2	$11	$13
12	Storage yard - slope stability	$2	$8	$9
13	Pool control dam - underseepage	$2	$270	$272
14	Pool control dam - scour protection	$0	$150	$150
21	Roller gate	$2	$8	$10
22	Roller gate	$2	$7	$9
23	Roller gate	$1	$6	$6
24	Roller gate	$1	$6	$7
25	Roller gate	$1	$7	$8
26	Tainter gate	$0	$10	$10
Total		$916	$5,638	$6,555

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 8

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$17	$950	$968
1.1	Lock walls - concrete	$777	$309	$1,086
2	Lock wall (interm.) - pile foundation	$20	$1,080	$1,099
3	Guidewall (u.s.) - pile foundation	$14	$67	$81
4	Guidewall (d.s.) - pile foundation	$22	$123	$145
5	Dam piers - pile foundation	$4	$866	$871
5.1	Dam piers - concrete	$0	$161	$161
9	Earth dikes - underseepage	$6	$61	$66
9.1	Earth dike - slope stability	$3	$29	$32
9.2	Earth dike - through seepage	$1	$11	$13
10	Overflow dikes - underseepage	$4	$21	$25
10.1	Overflow dike - slope stability	$1	$7	$9
12	Storage yard - slope stability	$2	$7	$9
13	Pool control dam - underseepage	$4	$875	$879
14	Pool control dam - scour protection	$0	$161	$161
21	Roller gate	$3	$9	$12
22	Roller gate	$2	$7	$10
23	Roller gate	$1	$6	$7
24	Roller gate	$0	$4	$5
25	Roller gate	$1	$5	$6
26	Tainter gate	$0	$8	$8
Total		$882	$4,771	$5,653

Lock and Dam 9

1	Lock wall (land) - pile foundation	$21	$1,315	$1,335
1.1	Lock walls - concrete	$770	$257	$1,027
2	Lock wall (interm.) - pile foundation	$24	$1,551	$1,575
3	Guidewall (u.s.) - pile foundation	$17	$86	$103
4	Guidewall (d.s.) - pile foundation	$8	$41	$49
5	Dam piers - pile foundation	$4	$596	$599
5.1	Dam piers - concrete	$0	$277	$277
9	Earth dikes - underseepage	$5	$38	$43
9.1	Earth dike - slope stability	$1	$10	$11
9.2	Earth dike - through seepage	$0	$2	$2
10	Overflow dikes - underseepage	$5	$28	$33
10.1	Overflow dike - slope stability	$1	$8	$9
12	Storage yard - slope stability	$1	$6	$8
13	Pool control dam - underseepage	$2	$54	$56
14	Pool control dam - scour protection	$0	$132	$132
21	Roller gate	$1	$7	$8
22	Roller gate	$1	$6	$8
23	Roller gate	$1	$5	$6
24	Roller gate	$3	$9	$12
25	Roller gate	$0	$4	$5
26	Tainter gate	$0	$8	$8
Total		$867	$4,440	$5,307

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 10

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$19	$1,110	$1,128
1.1	Lock walls - concrete	$828	$239	$1,068
2	Lock wall (interm.) - pile foundation	$15	$897	$912
3	Guidewall (u.s.) - pile foundation	$42	$251	$292
4	Guidewall (d.s.) - pile foundation	$15	$80	$95
5	Dam piers - pile foundation	$2	$240	$242
5.1	Dam piers - concrete	$0	$183	$183
7	Overflow structure - concrete	$0	$63	$63
9	Earth dikes - underseepage	$6	$30	$36
9.1	Earth dike - slope stability	$1	$4	$5
9.2	Earth dike - through seepage	$0	$2	$2
12	Storage yard - slope stability	$3	$11	$14
13	Pool control dam - underseepage	$1	$38	$39
14	Pool control dam - scour protection	$0	$125	$125
21	Roller gate	$1	$6	$7
22	Roller gate	$1	$6	$8
23	Roller gate	$1	$5	$6
24	Roller gate	$2	$7	$8
	Total	$935	$3,298	$4,233

Lock and Dam 11

1	Lock wall (land) - pile foundation	$27	$1,542	$1,569
1.1	Lock walls - concrete	$1,061	$257	$1,319
2	Lock wall (interm.) - pile foundation	$35	$1,901	$1,935
3	Guidewall (u.s.) - pile foundation	$25	$119	$144
4	Guidewall (d.s.) - pile foundation	$54	$286	$340
5	Dam piers - pile foundation	$4	$614	$618
5.1	Dam piers - concrete	$0	$198	$198
11	Non-overflow dike - underseepage	$6	$26	$32
11.1	Non-overflow dike - slope stability	$3	$12	$15
11.2	Non-overflow dike - through seepage	$0	$2	$2
12	Storage yard dike - underseepage	$4	$15	$19
12.1	Storage yard - slope stability	$2	$8	$10
12.2	Storage yard dike - through seepage	$1	$3	$4
13	Pool control dam - underseepage	$5	$57	$63
14	Pool control dam - scour protection	$0	$152	$152
21	Roller gate	$0	$1	$1
22	Roller gate	$0	$1	$1
23	Roller gate	$0	$1	$1
Total		$1,227	$5,194	$6,422

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 12 Component #	Component Description	Present Value of Life-cycle Costs Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$19	$1,016	$1,036
1.1	Lock walls - concrete	$1,078	$311	$1,389
2	Lock wall (interm.) - pile foundation	$37	$2,096	$2,133
3	Guidewall (u.s.) - pile foundation	$15	$63	$78
4	Guidewall (d.s.) - pile foundation	$29	$145	$174
5	Dam piers - pile foundation	$4	$699	$703
5.1	Dam piers - concrete	$0	$220	$220
10	Overflow dike - slope stability	$0	$3	$4
11	Non-overflow dike - underseepage	$10	$49	$59
11.1	Non-overflow dike - slope stability	$1	$7	$8
11.2	Non-overflow dike - through seepage	$0	$2	$2
12	Storage yard dike - underseepage	$4	$16	$20
12.1	Storage yard - slope stability	$3	$10	$13
12.2	Storage yard dike - through seepage	$1	$2	$3
13	Pool control dam - underseepage	$6	$1,197	$1,202
14	Pool control dam - scour protection	$0	$185	$185
19	Miter gate anchors	$1	$0	$1
21	Roller gate	$0	$1	$1
22	Roller gate	$0	$1	$1
23	Roller gate	$0	$1	$1
Total		$1,208	$6,022	$7,231
Lock and Dam 13				
1	Lock wall (land) - pile foundation	$34	$1,617	$1,651
1.1	Lock walls - concrete	$11	$2	$13
2	Lock wall (interm.) - pile foundation	$35	$1,698	$1,733
3	Guidewall (u.s.) - pile foundation	$37	$157	$194
4	Guidewall (d.s.) - pile foundation	$25	$101	$126
5	Dam piers - pile foundation	$4	$414	$418
5.1	Dam piers - concrete	$0	$289	$289
10	Overflow dike - slope stability	$4	$13	$17
11	Non-overflow dike - underseepage	$7	$25	$32
11.1	Non-overflow dike - slope stability	$4	$13	$17
11.2	Non-overflow dike - through seepage	$1	$4	$5
12	Storage yard dike - underseepage	$7	$20	$28
12.1	Storage yard - slope stability	$3	$8	$11
12.2	Storage yard dike - through seepage	$0	$2	$3
13	Pool control dam - underseepage	$3	$420	$423
14	Pool control dam - scour protection	$0	$170	$170
21	Roller gate	$0	$1	$1
22	Roller gate	$0	$1	$1
23	Roller gate	$0	$1	$1
Total		$176	$4,955	$5,131

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
Lock and Dam 14				
1	Lock wall (land) - rock foundation	$17	$653	$670
1.1	Lock walls - concrete	$1,162	$272	$1,434
2	Lock wall (interm.) - rock foundation	$19	$731	$750
5	Dam piers - concrete	$0	$268	$268
11	Non-overflow dike - slope stability	$1	$3	$4
12	Storage yard - slope stability	$0	$2	$2
13	Pool control dam - scour protection	$0	$149	$149
21	Roller gate	$0	$1	$1
22	Roller gate	$0	$1	$1
23	Roller gate	$0	$1	$1
24	Roller gate	$0	$1	$1
Total		$1,200	$2,080	$3,280
Lock and Dam 15				
1	Lock wall (land) - rock foundation	$4	$79	$83
1.1	Lock walls - concrete	$1,161	$275	$1,436
2	Lock wall (interm.) - rock foundation	$17	$645	$662
13	Pool control dam - scour protection	$0	$140	$140
21	Roller gate	$1	$2	$3
22	Roller gate	$1	$2	$3
23	Roller gate	$1	$2	$3
24	Roller gate	$1	$2	$3
25	Roller gate	$1	$3	$3
26	Roller gate	$1	$2	$3
27	Roller gate	$1	$2	$3
28	Roller gate	$1	$3	$3
29	Roller gate	$1	$2	$3
30	Roller gate	$0	$2	$2
31	Roller gate	$1	$2	$3
Total		$1,189	$1,163	$2,352

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 16 Component #	Component Description	Present Value of Life-cycle Costs: Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$19	$860	$880
1.1	Lock walls - concrete	$1,228	$242	$1,470
2	Lock wall (interm.) - pile foundation	$23	$962	$986
3	Guidewall (u.s.) - pile foundation	$29	$126	$155
4	Guidewall (d.s.) - pile foundation	$55	$254	$309
5	Dam piers - pile foundation	$5	$673	$678
5.1	Dam piers - concrete	$0	$200	$200
7	Overflow structure - concrete	$0	$72	$72
10	Overflow dike - slope stability	$2	$8	$10
12	Storage yard dike - underseepage	$8	$21	$29
12.1	Storage yard - slope stability	$2	$6	$8
12.2	Storage yard dike - through seepage	$1	$3	$5
13	Pool control dam - underseepage	$2	$200	$203
21	Roller gate	$1	$2	$3
22	Roller gate	$1	$2	$3
23	Roller gate	$0	$2	$2
24	Roller gate	$1	$2	$3
Total		$1,379	$3,636	$5,015
Lock and Dam 17				
1	Lock wall (land) - pile foundation	$30	$1,391	$1,421
1.1	Lock walls - concrete	$1,224	$260	$1,483
2	Lock wall (interm.) - pile foundation	$26	$1,242	$1,269
3	Guidewall (u.s.) - pile foundation	$25	$172	$197
4	Guidewall (d.s.) - pile foundation	$32	$144	$176
5	Dam piers - pile foundation	$3	$174	$177
5.1	Dam piers - concrete	$0	$148	$148
10	Overflow dike - slope stability	$3	$10	$13
11	Non-overflow dike - underseepage	$7	$21	$28
11.1	Non-overflow dike - slope stability	$2	$8	$10
11.2	Non-overflow dike - through seepage	$1	$4	$5
12	Storage yard dike - underseepage	$7	$21	$28
12.1	Storage yard - slope stability	$1	$6	$7
12.2	Storage yard dike - through seepage	$0	$2	$2
13	Pool control dam - underseepage	$5	$746	$751
14	Pool control dam - scour protection	$0	$171	$171
19	Miter gate anchors	$0	$0	$1
21	Roller gate	$0	$1	$1
22	Roller gate	$0	$1	$1
23	Roller gate	$0	$1	$1
Total		$1,367	$4,519	$5,886

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
Lock and Dam 18				
1	Lock wall (land) - pile foundation	$20	$833	$853
1.1	Lock walls - concrete	$1,099	$248	$1,347
2	Lock wall (interm.) - pile foundation	$15	$487	$502
3	Guidewall (u.s.) - pile foundation	$18	$63	$80
4	Guidewall (d.s.) - pile foundation	$40	$177	$217
5	Dam piers - pile foundation	$8	$1,357	$1,365
5.1	Dam piers - concrete	$0	$157	$157
10	Overflow dike - slope stability	$3	$11	$15
11	Non-overflow dike - underseepage	$5	$22	$27
11.1	Non-overflow dike - slope stability	$2	$8	$10
11.2	Non-overflow dike - through seepage	$1	$3	$4
12	Storage yard dike - underseepage	$11	$26	$38
12.1	Storage yard - slope stability	$3	$8	$11
13	Pool control dam - underseepage	$7	$1,276	$1,284
14	Pool control dam - scour protection	$0	$209	$209
19	Miter gate anchors	$1	$0	$2
21	Roller gate	$0	$1	$1
22	Roller gate	$0	$1	$1
23	Roller gate	$0	$1	$1
Total		$1,234	$4,888	$6,122
Lock and Dam 19				
1	Lock wall (land) - rock foundation	$16	$576	$592
1.1	Lock walls - concrete	$9	$3	$12
2	Lock wall (interm.) - rock foundation	$14	$526	$540
13	Pool control dam - scour protection	$0	$185	$185
20	Lift gate	$68	$26	$94
Total		$106	$1,316	$1,422

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
Lock and Dam 20				
1	Lock wall (land) - rock foundation	$9	$212	$221
1.1	Lock walls - concrete	$1,541	$327	$1,868
2	Lock wall (interm.) - rock foundation	$36	$1,347	$1,383
5	Dam piers - pile foundation	$4	$436	$440
12	Storage yard dike - underseepage	$5	$15	$19
12.1	Storage yard - slope stability	$3	$6	$9
12.2	Storage yard dike - through seepage	$2	$3	$5
13	Pool control dam - underseepage	$5	$425	$429
14	Pool control dam - scour protection	$0	$148	$148
19	Miter gate anchors	$2	$0	$2
21	Roller gate	$0	$0	$1
22	Roller gate	$2	$6	$8
23	Roller gate	$1	$3	$5
Total		$1,609	$2,930	$4,538
Lock and Dam 21				
1	Lock wall (land) - pile foundation	$26	$1,014	$1,040
1.1	Lock walls - concrete	$1,625	$310	$1,935
2	Lock wall (interm.) - pile foundation	$38	$1,468	$1,506
3	Guidewall (u.s.) - pile foundation	$66	$243	$310
4	Guidewall (d.s.) - pile foundation	$45	$151	$196
5	Dam piers - pile foundation	$7	$871	$878
5.1	Dam piers - concrete	$0	$257	$257
10	Overflow dike - underseepage	$6	$18	$23
10.1	Overflow dike - slope stability	$4	$11	$15
12	Storage yard dike - underseepage	$6	$15	$21
12.1	Storage yard - slope stability	$4	$9	$13
12.2	Storage yard dike - through seepage	$1	$2	$2
13	Pool control dam - underseepage	$3	$191	$194
14	Pool control dam - scour protection	$0	$176	$176
19	Miter gate anchors	$1	$0	$1
21	Roller gate	$0	$2	$2
22	Roller gate	$1	$2	$2
23	Roller gate	$1	$2	$2
Total		$1,834	$4,741	$6,575

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 22 Component #	Component Description	Present Value of Life-cycle Costs: Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - rock foundation	$23	$721	$744
1.1	Lock walls - concrete	$17	$4	$21
2	Lock wall (interm.) - rock foundation	$28	$837	$866
5	Dam piers - concrete	$0	$340	$340
10	Overflow dike - slope stability	$1.8	$6.3	$8.2
12	Storage yard - slope stability	$4.2	$8.2	$12.4
13	Pool control dam - scour protection	$0	$181	$181
19	Lift gate	$1	$0	$1
21	Roller gate	$1	$3	$3
22	Roller gate	$1	$2	$3
23	Roller gate	$1	$2	$3
Total		$78	$2,106	$2,183
Lock and Dam 24				
1	Lock wall (land) - pile foundation	$14	$391	$405
1.1	Lock walls - concrete	$1,709	$267	$1,976
2	Lock wall (interm.) - pile foundation	$15	$401	$416
3	Guidewall (u.s.) - pile foundation	$19	$67	$86
4	Guidewall (d.s.) - pile foundation	$35	$124	$160
5	Dam piers - pile foundation	$7	$913	$920
5.1	Dam piers - concrete	$0	$200	$200
9	Sny levee - underseepage	$3	$17	$20
9.1	Sny levee - slope stability	$3	$11	$15
9.2	Sny levee - through seepage	$1	$5	$6
10	Overflow dike - underseepage	$5	$25	$30
10.1	Overflow dike - slope stability	$2	$8	$9
12	Storage yard dike - underseepage	$3	$13	$15
12.1	Storage yard - slope stability	$3	$10	$13
12.2	Storage yard dike - through seepage	$0	$0	$0
13	Pool control dam - underseepage	$4	$383	$387
13.1	Pool control dam - scour protection	$0	$180	$180
17	Aux lock closure dam - slope stability	$0	$2	$2
17.1	Aux lock closure dam - through seepage	$1	$3	$3
19	Miter gate	$0	$0	$0
23	Tainter valves	$9	$13	$23
Total		$1,834	$3,032	$4,866

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 25 Component #	Component Description	Present Value of Life-cycle Costs Delay Cost	Repair Cost	Total Cost
1	Lock wall (land) - pile foundation	$28	$917	$945
1.1	Lock walls - concrete	$1,543	$238	$1,781
2	Lock wall (interm.) - pile foundation	$50	$1,921	$1,971
3	Guidewall (u.s.) - pile foundation	$48	$165	$213
4	Guidewall (d.s.) - pile foundation	$37	$122	$160
5	Dam piers - pile foundation	$12	$1,450	$1,461
5.1	Dam piers - concrete	$0	$27	$27
9	Sandy Slough dike - underseepage	$8	$34	$42
9.1	Sandy Slough dike - slope stability	$4	$12	$15
9.2	Sandy Slough dike - through seepage	$1	$3	$3
10	Overflow dike - underseepage	$7	$33	$39
10.1	Overflow dike - slope stability	$5	$14	$19
12	Storage yard dike - underseepage	$5	$19	$23
12.1	Storage yard - slope stability	$4	$13	$17
12.2	Storage yard dike - through seepage	$1	$3	$4
13	Pool control dam - underseepage	$2	$144	$146
13.1	Pool control dam - scour protection	$0	$174	$174
17	Aux lock closure dam - underseepage	$3	$16	$19
17.1	Aux lock closure dam - slope stability	$0	$1	$2
17.2	Aux lock closure dam - through seepage	$1	$3	$3
21	Roller gate	$71	$65	$136
22	Roller gate	$60	$57	$117
23	Roller gate	$70	$69	$139
Total		$1,888	$5,430	$7,318
Lock and Dam 26				
1	Lock wall (main) - pile foundation	$37	$1,356	$1,393
2	Lock wall (aux) - pile foundation	$29	$884	$913
3	Guidewall (main, u.s.) - pile foundation	$40	$134	$173
4	Guidewall (main, d.s.) - pile foundation	$72	$263	$336
5	Guidewall (aux, u.s.) - pile foundation	$34	$97	$132
6	Guidewall (aux, d.s.) - pile foundation	$32	$103	$135
7	Dam piers - pile foundation	$17	$2,444	$2,462
9	Esplanade - slope stability	$6	$17	$22
9.1	Esplanade - through seepage	$1	$3	$5
10	Overflow dike - underseepage	$15	$35	$49
10.1	Overflow dike - slope stability	$4	$13	$18
13	Pool control dam - underseepage	$4	$263	$267
13.1	Pool control dam - scour protection	$0	$0	$0
14	Sheet pile cells - underseepage	$6	$15	$21
20	Lift gate	$100	$5	$105
Total		$397	$5,633	$6,030

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Lock and Dam 27

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
1	East lock wall - rock foundation	$25	$788	$813
2	Lock wall (interm.) - rock foundation	$18	$633	$651
3	Guidewall (u.s.) - pile foundation	$19	$56	$75
4	Guidewall (d.s.) - pile foundation	$46	$150	$196
5	West lock wall - rock foundation	$12	$241	$253
9	East embankment - underseepage	$3	$13	$16
9.1	East embankment - slope stability	$5	$11	$16
9.2	East embankment - through seepage	$1	$2	$3
10	West embankment - underseepage	$6	$19	$25
10.1	West embankment - slope stability	$1	$6	$8
10.2	West embankment - through seepage	$1	$3	$4
13	Pool control dam - scour protection	$0	$269	$269
18	Low water dam - slope stability	$3	$15	$17
21	Lift gate (main, old)	$5	$0	$5
22	Lift gate (aux)	$0	$0	$0
Total		$144	$2,206	$2,350

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

O'Brien Lock and Dam Component #	Component Description	Present Value of Life-cycle Costs Delay Cost	Repair Cost	Total Cost
13	Pool control dam - underseepage	$2	$349	$351
14	Pool control dam - scour protection	$0	$199	$199
20	Sheet pile lock wall - interlock	$17	$12	$29
21	Sheet pile lock wall - buckling	$4	$1	$5
Total		$23	$561	$584
Lockport Lock and Dam				
1	Lock wall (land) - rock foundation	$14	$355	$369
1.1	Lock wall - concrete	$18	$4	$21
2	Lock wall (interm.) - rock foundation	$9	$267	$276
9	Right side dike - slope stability	$5	$14	$20
20	Lift gate	$195	$44	$239
Total		$241	$684	$924
Brandon Road Lock and Dam				
1	Lock wall (land) - rock foundation	$17	$493	$511
1.1	Lock wall - concrete	$17	$3	$20
2	Lock wall (interm.) - rock foundation	$20	$592	$612
11	Non-overflow dike - slope stability	$1	$2	$3
19	Miter gate	$0	$0	$1
Total		$55	$1,090	$1,146
Dresden Island Lock and Dam				
1	Lock wall (land) - rock foundation	$9	$203	$212
1.1	Lock wall - concrete	$15	$2	$17
2	Lock wall (interm.) - rock foundation	$15	$417	$433
6	Overflow structure - concrete	$0	$78	$78
11	Non-overflow dike - slope stability	$2	$7	$9
22	Tainter gate	$54	$675	$729
Total		$95	$1,383	$1,477
Marseilles Lock and Dam				
1	Lock wall (land) - rock foundation	$44	$1,439	$1,483
1.1	Lock wall - concrete	$12	$3	$15
2	Lock wall (interm.) - rock foundation	$12	$292	$304
Total		$68	$1,734	$1,802

Table 3 - Results of Life-cycle Cost Analysis - Base Condition ($000)

Component #	Component Description	Present Value of Life-cycle Costs		
		Delay Cost	Repair Cost	Total Cost
Starved Rock Lock and Dam				
1	Lock wall (land) - rock foundation	$12	$349	$361
1.1	Lock wall - concrete	$18	$5	$22
2	Lock wall (interm.) - rock foundation	$15	$325	$340
6	Overflow structure - concrete	$0	$85	$85
22	Tainter gate	$49	$561	$610
Total		$94	$1,325	$1,419
Peoria Lock and Dam				
1	Lock wall (land) - pile foundation	$35	$1,319	$1,354
1.1	Lock walls - concrete	$21	$4	$25
2	Lock wall (interm.) - pile foundation	$34	$1,311	$1,345
3	Guidewall (u.s.) - pile foundation	$36	$124	$160
4	Guidewall (d.s.) - pile foundation	$53	$176	$229
13	Pool control dam - scour protection	$0	$205	$205
15	Regulating weir - underseepage	$8	$1,026	$1,034
16	Navigable dam - underseepage	$6	$590	$595
Total		$193	$4,754	$4,947
LaGrange Lock and Dam				
1	Lock wall (land) - pile foundation	$21	$784	$805
1.1	Lock walls - concrete	$1,590	$371	$1,961
2	Lock wall (interm.) - pile foundation	$31	$1,157	$1,188
3	Guidewall (u.s.) - pile foundation	$54	$186	$240
4	Guidewall (d.s.) - pile foundation	$25	$74	$99
5	Dam piers - pile foundation	$5	$347	$352
11	Non-overflow dike - underseepage	$11	$19	$29
11.1	Non-overflow dike - slope stability	$6	$11	$17
13	Pool control dam - scour protection	$0	$184	$184
15	Regulating weir - underseepage	$2	$42	$44
16	Navigable dam - underseepage	$8	$891	$898
Total		$1,753	$4,065	$5,818

Table 4 - Summary of Life-cycle Costs by Lock ($000) - Base Condition

Lock	Delay	Repair	Total
USAF	$4	$1,084	$1,088
LSAF	$19	$1,632	$1,651
1	$0	$271	$271
2	$903	$5,630	$6,533
3	$948	$5,938	$6,886
4	$892	$4,709	$5,601
5	$894	$3,571	$4,465
5A	$888	$5,636	$6,524
6	$894	$4,677	$5,571
7	$916	$5,638	$6,554
8	$882	$4,771	$5,653
9	$867	$4,440	$5,307
10	$935	$3,298	$4,233
11	$1,227	$5,194	$6,421
12	$1,208	$6,022	$7,230
13	$176	$4,955	$5,131
14	$1,200	$2,080	$3,280
15	$1,189	$1,163	$2,352
16	$1,379	$3,636	$5,015
17	$1,367	$4,519	$5,886
18	$1,234	$4,888	$6,122
19	$106	$1,316	$1,422
20	$1,609	$2,930	$4,539
21	$1,834	$4,741	$6,575
22	$78	$2,106	$2,184
24	$1,834	$3,032	$4,866
25	$1,888	$5,430	$7,318
26	$397	$5,633	$6,030
27	$144	$2,206	$2,350
O'Brien	$23	$561	$584
Lockport	$241	$684	$925
Brandon Road	$55	$1,090	$1,145
Dresden Island	$95	$1,383	$1,478
Marseilles	$68	$1,734	$1,802
Starved Rock	$94	$1,325	$1,419
Peoria	$193	$4,754	$4,947
LaGrange	$1,753	$4,065	$5,818
Subtotal	$28,434	$126,742	$155,176

Enhanced Maintenance Condition - Under the enhanced maintenance condition, components are maintained on a regular schedule in order to prolong their useful life. For example, miter gates or roller gates may be painted every 10 or 15 years to minimize the deleterious effects of corrosion. Only structural components were considered for enhanced maintenance; geotechnical components were assumed to receive no appreciable benefit from enhanced maintenance.

Based on the condition assessment by the Engineering Work Group, structural components are generally of sufficiently sound condition and will continue to perform in a manner that results in only moderate life-cycle costs under the base condition. Consequently, little benefit is to be gained with scheduled enhanced maintenance of these components. This can be seen in Table 5 which compares the expected life-cycle costs by component for both base and enhanced maintenance condition. The difference is the benefit attributable to scheduled enhanced maintenance of that component. Compared, though, with the additional costs for implementing enhanced maintenance results it is evident that enhanced maintenance does not pay off in terms of reducing life-cycle costs. Table 6 summarizes the results displayed in Table 5. Life-cycle costs under the enhanced maintenance condition total up to $165.5 million compared to $155 million for the base condition. At no lock is it feasible to implement an enhanced maintenance program.

Table 5 - Comparison of Base vs. Enhanced Maintenance Conditions ($000)

Lock / Component	Present Value Life-cycle Cost: Base Condition	Enhanced Maint. Condition	Benefit of Enhanced Maint.	Enhanced Maint. Avg. Ann. Costs	PV Enhanced Maint. Costs
Lock 3					
Roller gate #1	$7.88	$0.12	$7.76	$8.25	$112.08
Roller gate #2	$10.89	$0.11	$10.78	$8.25	$112.08
Roller gate #3	$8.58	$0.12	$8.46	$8.25	$112.08
Roller gate #4	$6.11	$0.14	$5.97	$8.25	$112.08
Total for lock	$33.46	$0.49	$32.97	$33.00	$448.33
Lock 4					
Roller gate #1	$7.42	$0.12	$7.30	$8.33	$113.21
Roller gate #2	$8.21	$0.11	$8.10	$8.33	$113.21
Roller gate #3	$8.03	$0.12	$7.91	$8.33	$113.21
Roller gate #4	$12.49	$0.14	$12.35	$8.33	$113.21
Roller gate #5	$7.82	$0.07	$7.75	$8.33	$113.21
Roller gate #6	$8.40	$0.05	$8.35	$8.33	$113.21
Total for lock	$52.37	$0.61	$51.76	$50.00	$679.26
Lock 5					
Roller gate #1	$7.71	$0.05	$7.66	$8.33	$113.21
Roller gate #2	$9.45	$0.07	$9.38	$8.33	$113.21
Roller gate #3	$6.19	$0.05	$6.14	$8.33	$113.21
Roller gate #4	$8.75	$0.13	$8.62	$8.33	$113.21
Roller gate #5	$7.08	$0.06	$7.02	$8.33	$113.21
Roller gate #6	$8.10	$0.07	$8.03	$8.33	$113.21
Total for lock	$47.28	$0.43	$46.85	$50.00	$679.26
Lock 5A					
Roller gate #1	$7.15	$0.09	$7.06	$8.40	$114.12
Roller gate #2	$7.91	$0.11	$7.80	$8.40	$114.12
Roller gate #3	$7.58	$0.13	$7.45	$8.40	$114.12
Roller gate #4	$7.45	$0.02	$7.43	$8.40	$114.12
Roller gate #5	$8.54	$0.10	$8.44	$8.40	$114.12
Total for lock	$38.63	$0.45	$38.18	$42.00	$570.60
Lock 6					
Roller gate #1	$4.88	$0.09	$4.79	$8.40	$114.12
Roller gate #2	$6.16	$0.08	$6.08	$8.40	$114.12
Roller gate #3	$8.16	$0.07	$8.09	$8.40	$114.12
Roller gate #4	$6.87	$0.13	$6.74	$8.40	$114.12
Roller gate #5	$5.57	$0.14	$5.43	$8.40	$114.12
Total for lock	$31.64	$0.51	$31.13	$42.00	$570.60
Lock 7					
Roller gate #1	$10.45	$0.05	$10.40	$8.40	$114.12
Roller gate #2	$8.60	$0.09	$8.51	$8.40	$114.12
Roller gate #3	$6.25	$0.06	$6.19	$8.40	$114.12
Roller gate #4	$6.93	$0.03	$6.90	$8.40	$114.12
Roller gate #5	$8.00	$0.05	$7.95	$8.40	$114.12
Total for lock	$40.23	$0.28	$39.95	$42.00	$570.60

Table 5 - Comparison of Base vs. Enhanced Maintenance Conditions ($000)

Lock / Component	Present Value Life-cycle Cost: Base Condition	Enhanced Maint. Condition	Benefit of Enhanced Maint.	Enhanced Maint. Avg. Ann. Costs	PV Enhanced Maint. Costs
Lock 8					
Roller gate #1	$12.15	$0.06	$12.09	$8.40	$114.12
Roller gate #2	$9.61	$0.11	$9.50	$8.40	$114.12
Roller gate #3	$7.12	$0.12	$7.00	$8.40	$114.12
Roller gate #4	$4.72	$0.06	$4.66	$8.40	$114.12
Roller gate #5	$5.96	$0.04	$5.92	$8.40	$114.12
Total for lock	$39.56	$0.39	$39.17	$42.00	$570.60
Lock 9					
Roller gate #1	$8.07	$0.11	$7.96	$8.40	$114.12
Roller gate #2	$7.67	$0.12	$7.55	$8.40	$114.12
Roller gate #3	$6.03	$0.12	$5.91	$8.40	$114.12
Roller gate #4	$11.59	$0.10	$11.49	$8.40	$114.12
Roller gate #5	$4.72	$0.15	$4.57	$8.40	$114.12
Total for lock	$38.08	$0.61	$37.47	$42.00	$570.60
Lock 10					
Roller gate #1	$6.64	$0.15	$6.49	$8.25	$112.08
Roller gate #2	$7.64	$0.33	$7.31	$8.25	$112.08
Roller gate #3	$5.95	$0.20	$5.75	$8.25	$112.08
Roller gate #4	$8.10	$0.05	$8.05	$8.25	$112.08
Total for lock	$28.33	$0.72	$27.61	$33.00	$448.33
Lock 11					
Roller gate #1	$1.20	$0.15	$1.05	$8.33	$113.21
Roller gate #2	$0.85	$0.12	$0.73	$8.33	$113.21
Roller gate #3	$0.92	$0.04	$0.88	$8.33	$113.21
Total for lock	$2.97	$0.31	$2.66	$25.00	$339.63
Lock 12					
Roller gate #1	$0.92	$0.10	$0.82	$8.33	$113.21
Roller gate #2	$0.71	$0.16	$0.55	$8.33	$113.21
Roller gate #3	$0.67	$0.10	$0.57	$8.33	$113.21
Total for lock	$3.09	$1.50	$1.59	$25.00	$452.84
Lock 13					
Roller gate #1	$1.17	$0.12	$1.05	$8.33	$113.21
Roller gate #2	$0.76	$0.10	$0.66	$8.33	$113.21
Roller gate #3	$0.84	$0.17	$0.67	$8.33	$113.21
Total for lock	$2.77	$0.38	$2.39	$25.00	$339.63
Lock 14					
Roller gate #1	$0.82	$0.19	$0.63	$8.33	$113.21
Roller gate #2	$0.85	$0.09	$0.76	$8.33	$113.21
Roller gate #3	$0.82	$0.20	$0.62	$8.33	$113.21
Roller gate #4	$0.73	$0.08	$0.65	$8.33	$113.21
Total for lock	$3.22	$0.56	$2.66	$33.33	$452.84

Table 5 - Comparison of Base vs. Enhanced Maintenance Conditions ($000)

Lock / Component	Present Value Life-cycle Cost: Base Condition	Enhanced Maint. Condition	Benefit of Enhanced Maint.	Enhanced Maint. Avg. Ann. Costs	PV Enhanced Maint. Costs
Lock 15					
Roller gate #1	$2.60	$0.10	$2.50	$13.64	$185.25
Roller gate #2	$2.91	$0.12	$2.79	$13.64	$185.25
Roller gate #3	$3.20	$0.37	$2.83	$13.64	$185.25
Roller gate #4	$2.80	$0.07	$2.73	$13.64	$185.25
Roller gate #5	$3.31	$0.17	$3.14	$13.64	$185.25
Roller gate #6	$2.73	$0.07	$2.66	$13.64	$185.25
Roller gate #7	$2.74	$0.08	$2.66	$13.64	$185.25
Roller gate #8	$3.34	$0.11	$3.23	$13.64	$185.25
Roller gate #9	$2.79	$0.05	$2.74	$13.64	$185.25
Roller gate #10	$2.39	$0.08	$2.31	$13.64	$185.25
Roller gate #11	$2.90	$0.06	$2.84	$13.64	$185.25
Total for lock	$11.51	$0.67	$10.84	$150.00	$741.02
Lock 16					
Roller gate #1	$3.04	$0.19	$2.85	$8.33	$113.21
Roller gate #2	$2.82	$0.09	$2.73	$8.33	$113.21
Roller gate #3	$2.39	$0.20	$2.19	$8.33	$113.21
Roller gate #4	$2.77	$0.08	$2.69	$8.33	$113.21
Total for lock	$11.02	$0.56	$10.46	$33.33	$452.84
Lock 17					
Roller gate #1	$0.72	$0.31	$0.41	$8.33	$113.21
Roller gate #2	$0.84	$0.09	$0.75	$8.33	$113.21
Roller gate #3	$0.70	$0.08	$0.62	$8.33	$113.21
Total for lock	$2.84	$1.51	$1.33	$25.00	$339.63
Lock 18					
Roller gate #1	$0.72	$0.10	$0.62	$8.33	$113.21
Roller gate #2	$0.92	$0.12	$0.80	$8.33	$113.21
Roller gate #3	$0.97	$0.08	$0.89	$8.33	$113.21
Total for lock	$4.21	$1.20	$3.01	$25.00	$339.63
Lock 19					
Lift gate	$93.74	$95.62	($1.88)	$2.50	$33.96
Lock 20					
Roller gate #1	$4.58	$0.14	$4.44	$13.33	$181.14
Roller gate #2	$7.87	$0.12	$7.75	$13.33	$181.14
Roller gate #3	$4.54	$0.10	$4.44	$13.33	$181.14
Total for lock	$19.39	$2.16	$17.23	$40.00	$543.41
Lock 21					
Roller gate #1	$2.19	$0.07	$2.12	$8.33	$113.21
Roller gate #2	$2.46	$0.08	$2.38	$8.33	$113.21
Roller gate #3	$2.07	$0.27	$1.80	$8.33	$113.21
Total for lock	$7.70	$1.80	$5.90	$25.00	$339.63

Table 5 - Comparison of Base vs. Enhanced Maintenance Conditions ($000)

Lock / Component	Present Value Life-cycle Cost: Base Condition	Enhanced Maint. Condition	Benefit of Enhanced Maint.	Enhanced Maint. Avg. Ann. Costs	PV Enhanced Maint. Costs
Lock 22					
Roller gate #1	$3.47	$0.17	$3.30	$8.25	$112.08
Roller gate #2	$3.07	$0.09	$2.98	$8.25	$112.08
Roller gate #3	$2.89	$0.04	$2.85	$8.25	$112.08
Total for lock	$10.42	$1.50	$8.92	$24.75	$336.24
Lock 24					
Tainter valve	$22.55	$1.38	$21.17	$17.00	$230.98
Lock 25					
Roller gate #1	$135.50	$0.42	$135.08	$13.33	$181.14
Roller gate #2	$117.20	$0.65	$116.55	$13.33	$181.14
Roller gate #3	$138.97	$0.38	$138.59	$13.33	$181.14
Total for lock	$391.67	$1.45	$390.22	$40.00	$543.41
Lock 26					
Lift gate	$104.90	$0.01	$104.89	$8.75	$118.87
Lock 27					
Lift gate #1	$4.89	$2.85	$2.04	$12.50	$169.82
Lift gate #2	$0.41	$0.03	$0.38	$12.50	$169.82
Total for lock	$5.30	$2.88	$2.42	$25.00	$339.64
O'Brien Lock					
Sheetpile	$34.33	$5.18	$29.15	$35.96	$488.63
Lockport Lock					
Lift gate	$238.51	$258.45	($19.94)	$5.62	$76.32

Table - Summary Comparison of Base and Enhanced Maintenance Condition Life-cycle Costs ($000)

		Enhanced Maintenance Condition				
Lock	Base Condition	Enh maint	Delay	Repair	Total	Enh. Maint - Base
USAF	$1,088	$0	$4	$1,084	$1,088	$0
LSAF	$1,651	$0	$19	$1,632	$1,651	$0
1	$271	$0	$0	$271	$271	$0
2	$6,533	$0	$903	$5,630	$6,533	$0
3	$6,886	$448	$942	$5,911	$7,301	$415
4	$5,601	$679	$883	$4,666	$6,228	$627
5	$4,465	$679	$890	$3,528	$5,097	$632
5A	$6,524	$571	$881	$5,605	$7,057	$533
6	$5,571	$571	$890	$4,650	$6,111	$540
7	$6,554	$571	$909	$5,605	$7,085	$531
8	$5,653	$571	$875	$4,739	$6,185	$532
9	$5,307	$571	$860	$4,409	$5,840	$533
10	$4,233	$448	$931	$3,086	$4,465	$232
11	$6,421	$340	$1,227	$5,191	$6,758	$337
12	$7,230	$340	$1,207	$6,021	$7,568	$338
13	$5,131	$340	$175	$4,954	$5,469	$338
14	$3,280	$453	$1,200	$2,078	$3,731	$451
15	$2,352	$741	$1,183	$1,158	$3,082	$730
16	$5,015	$453	$1,376	$3,629	$5,458	$443
17	$5,886	$340	$1,367	$4,518	$6,225	$339
18	$6,122	$340	$1,233	$4,886	$6,459	$337
19	$1,422	$34	$106	$1,316	$1,456	$34
20	$4,539	$543	$1,605	$2,917	$5,065	$526
21	$6,575	$340	$1,832	$4,737	$6,909	$334
22	$2,184	$336	$75	$2,100	$2,511	$327
24	$4,866	$231	$1,826	$3,019	$5,076	$210
25	$7,318	$543	$1,758	$5,170	$7,471	$153
26	$6,030	$119	$297	$5,628	$6,044	$14
27	$2,350	$340	$142	$2,206	$2,687	$337
O'Brien	$584	$489	$5	$550	$1,044	$460
Lockport	$925	$76	$241	$684	$1,001	$76
Brandon Road	$1,145	$0	$55	$1,090	$1,145	$0
Dresden Island	$1,478	$0	$95	$1,383	$1,478	$0
Marseilles	$1,802	$0	$68	$1,734	$1,802	$0
Starved Rock	$1,419	$0	$94	$1,325	$1,419	$0
Peoria	$4,947	$0	$193	$4,754	$4,947	$0
LaGrange	$5,818	$0	$1,753	$4,065	$5,818	$0
Subtotal	$154,988	$11,504	$28,101	$125,928	$165,532	$10,356

Rehabilitation Condition – Table 7 presents information from the analysis of life-cycle costs for the rehabilitation condition. Life-cycle costs for a component under this scenario include the present value of the rehabilitation cost itself as well as the present value of expected repair costs and traffic delay costs for the segment of time before rehabilitation and for the segment of time after rehabilitation has occurred.

An attempt to optimize the timing of rehabilitation was made by evaluating costs if rehabilitation was performed in Years 10, 20, 30, or 40 of the planning period. Again, costs were compared with base condition costs to determine if, and when, rehabilitation of a particular component may be feasible. In most cases, the present value of the rehabilitation cost (and excluding the repair and traffic delay costs for the rehabilitation condition) exceeded the base condition life-cycle costs for the component evaluated, thus excluding it from further consideration as a rehabilitation candidate. When the additional life-cycle costs were considered (repair and traffic delay costs) for the rehabilitation scenario, the remaining components dropped out from consideration for potential rehabilitation. Table 7 displays results of this analysis.

The results indicate that in all instances life-cycle costs for a component in the rehab scenario will be greater than its costs in the baseline scenario. **As a result, no components are feasible for rehabilitation.**

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = USAF

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$469	$5,800	$2,847	$1,398	$686	$337	$954.8	$485.5
2	Lock U-structure - rock foundation	$430	$5,800	$2,847	$1,398	$686	$337	$948.2	$518.2
3	Guidewall (u.s.) - rock foundation	$120	$5,800	$2,847	$1,398	$686	$337		
4	Guidewall (d.s.) - rock foundation	$68	$5,800	$2,847	$1,398	$686	$337		
9	Stone guard wall dike - slope stability	$0	$480	$236	$116	$57	$28		
Total		$1,088							

Lock # = LSAF

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock U-structure - rock foundation	$822	$5,800	$2,847	$1,398	$686	$337	$903.6	$81.4	$1,117.9	$295.7
1.1	Lock walls - concrete	$160	$2,700	$1,325	$651	$319	$157				
3	Guidewall (u.s.) - rock foundation	$102	$5,800	$2,847	$1,398	$686	$337				
5	Dam piers - rock foundation	$49	$1,900	$933	$458	$225	$110				
5.1	Dam piers - concrete	$194	$3,400	$1,669	$819	$402	$197				
8	Non-overflow structure - rock foundation	$23	$2,000	$982	$482	$237	$116				
9	Earth dike - underseepage	$1	$2,200	$0	$0	$0	$0				
9.1	Earth dike - slope stability	$6	$480	$236	$116	$57	$28				
9.2	Earth dike - through seepage	$0	$2,200	$0	$0	$0	$0				
13	Pool control dam - underseepage	$147	$4,000	$1,963	$964	$473	$232				
14	Pool control dam - scour protection	$146	$2,500	$1,227	$602	$296	$145				
Total		$1,650									

Lock # = 1

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
6	Overflow structure - concrete	$78	$2,000	$982	$482	$237	$116		
14	Pool control dam - scour protection	$193	$2,500	$1,227	$602	$296	$145	$290.3	$97.6
Total		$271							

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 2

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,427	$3,000	$1,473	$723	$355	$174			$1,583.8	$156.7	$1,539.5	$112.4	$1,626.8	$199.6
1.1	Lock walls - concrete	$1,016	$2,700	$1,325	$651	$319	$157			$1,457.4	$441.2	$1,282.6	$266.4	$1,175.9	$159.6
2	Lock wall (interm.) pile foundation	$2,419	$3,000	$1,473	$723	$355	$174	$2,684.0	$264.7	$2,780.0	$360.7	$2,663.0	$243.7	$2,574.0	$154.7
3	Guidewall (u.s.) - pile foundation	$141	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$132	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$741	$12,000	$5,890	$2,891	$1,419	$697							$1,444.7	$703.7
5.1	Dam piers - concrete	$284	$3,400	$1,669	$819	$402	$197							$388.5	$104.1
9	Earth dikes - underseepage	$16	$2,200	$1,080	$530	$260	$128								
9.1	Earth dike - slope stability	$16	$2,200	$1,080	$530	$260	$128								
9.2	Earth dike - through seepage	$5	$2,200	$1,080	$530	$260	$128								
12	Storage yard - slope stability	$9	$40	$20	$10	$5	$2								
13	Pool control dam - underseepage	$182	$12,000	$5,890	$2,891	$1,419	$697					$14.5	$5.4	$13.0	$3.9
14	Pool control dam - scour protection	$144	$2,500	$1,227	$602	$296	$145								
Total		$6,533													

Lock # = 3

Part #	Component	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$2,165	3000	$1,473	$723	$355	$174	$2,751.6	$586.9	$2,637.0	$472.3	$2,469.0	$304.3	$2,303.0	$138.3
1.1	Lock walls - concrete	$1,084	2700	$1,325	$651	$319	$157			$1,437.6	$354.1	$1,230.4	$146.8	$1,215.3	$131.7
2	Lock wall (interm.) pile foundation	$1,030	$3,000	$1,473	$723	$355	$174			$1,303.8	$273.4	$1,338.7	$308.3	$2,241.2	$1,210.8
3	Guidewall (u.s.) - pile foundation	$255	$3,500	$1,718	$843	$414	$203							$388.5	$133.7
4	Guidewall (d.s.) - pile foundation	$127	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$989	$12,000	$5,890	$2,891	$1,419	$697							$1,335.2	$346.1
5.1	Dam piers - concrete	$256	$3,400	$1,669	$819	$402	$197							$386.7	$130.9
9	Earth dikes - underseepage	$23	$3,200	$1,571	$771	$378	$186								
9.1	Earth dike - slope stability	$31	$3,200	$1,571	$771	$378	$186								
9.2	Earth dike - through seepage	$4	$3,200	$1,571	$771	$378	$186								
10	Protection dike - slope stability	$10	$1,120	$550	$270	$132	$65								
12	Storage yard - slope stability	$7	$240	$118	$58	$28	$14								
13	Pool control dam - underseepage	$694	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$179	$2,500	$1,227	$602	$296	$145							$314.0	$135.5
21	Roller gate	$8	$150	$74	$36	$18	$9								
22	Roller gate	$11	$150	$74	$36	$18	$9								
23	Roller gate	$9	$150	$74	$36	$18	$9								
24	Roller gate	$8	$150	$74	$36	$18	$9								
Total		$6,867													

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 4

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,131	3000	$1,473	$723	$355	$174			$1,767.4	$636.2	$1,202.7	$71.6	$1,676.8	$545.7
1.1	Lock walls - concrete	$1,003	2700	$1,325	$651	$319	$157			$1,433.9	$431.1	$1,177.6	$174.7	$1,154.8	$151.9
2	Lock wall (interm.) pile foundation	$1,782	$3,000	$1,473	$723	$355	$174	$2,191.6	$410.0	$1,946.4	$164.8	$2,057.8	$276.2	$1,931.4	$149.8
3	Guidewall (u.s.) - pile foundation	$110	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$115	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$578	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$208	$3,400	$1,669	$819	$402	$197								
9	Earth dikes - underseepage	$27	$4,500	$2,209	$1,084	$532	$261								
9.1	Earth dike - slope stability	$11	$4,500	$2,209	$1,084	$532	$261								
9.2	Earth dike - through seepage	$2	$4,500	$2,209	$1,084	$532	$261								
12	Storage yard - slope stability	$9	$160	$79	$39	$19	$9								
13	Pool control dam - underseepage	$281	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$152	$2,500	$1,227	$602	$296	$145								
21	Roller gate	$7	$100	$49	$24	$12	$6								
22	Roller gate	$8	$100	$49	$24	$12	$6								
23	Roller gate	$8	$100	$49	$24	$12	$6								
24	Roller gate	$12	$100	$49	$24	$12	$6								
25	Roller gate	$8	$100	$49	$24	$12	$6								
26	Roller gate	$8	$100	$49	$24	$12	$6								
27	Tainter gate	$141	$12,000	$5,890	$2,891	$1,419	$697								
Total		$5,601													

Lock # = 5

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,403	3000	$1,473	$723	$355	$174	$1,639.1	$236.4	$1,641.5	$238.8	$1,498.4	$95.8
1.1	Lock walls - concrete	$1,082	2700	$1,325	$651	$319	$157	$1,379.2	$297.1	$1,185.6	$103.5	$1,266.7	$184.6
3	Guidewall (u.s.) - pile foundation	$500	$3,500	$1,718	$843	$414	$203			$687.7	$187.3	$1,132.7	$632.3
4	Guidewall (d.s.) - pile foundation	$166	$3,500	$1,718	$843	$414	$203						
5	Dam piers - pile foundation	$372	$12,000	$5,890	$2,891	$1,419	$697						
5.1	Dam piers - concrete	$287	$3,400	$1,669	$819	$402	$197						
9	Earth dikes - underseepage	$50	$14,400	$7,069	$3,470	$1,703	$836					$392.7	$105.8
9.1	Earth dike - slope stability	$23	$14,400	$7,069	$3,470	$1,703	$836						
9.2	Earth dike - through seepage	$7	$14,400	$7,069	$3,470	$1,703	$836						
12	Storage yard - slope stability	$8	$80	$39	$19	$9	$5						
13	Pool control dam - underseepage	$155	$12,000	$5,890	$2,891	$1,419	$697						
14	Pool control dam - scour protection	$178	$2,500	$1,227	$602	$296	$145						
21	Roller gate	$8	$100	$49	$24	$12	$6					$285.2	$107.4
22	Roller gate	$9	$100	$49	$24	$12	$6						
23	Roller gate	$8	$100	$49	$24	$12	$6						
24	Roller gate	$9	$100	$49	$24	$12	$6						
25	Roller gate	$7	$100	$49	$24	$12	$6						
26	Roller gate	$8	$100	$49	$24	$12	$6						
27	Tainter gate	$186	$1,500	$736	$361	$177	$87						
Total		$4,465								$340.7	$154.8	$266.8	$80.9

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 5A

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,564	3000	$1,473	$723	$355	$174	$2,294.1	$730.0	$1,683.6	$119.4	$1,637.6	$73.5	$1,769.3	$205.2
1.1	Lock walls - concrete	$982	2700	$1,325	$651	$319	$157			$1,381.0	$418.5	$1,213.0	$250.6	$1,165.5	$203.1
2	Lock wall (interm.) - pile foundation	$1,990	$3,000	$1,473	$723	$355	$174	$2,589.9	$600.4	$2,151.7	$162.1	$2,159.9	$170.3	$2,127.1	$137.5
3	Guidewall (u.s.) - pile foundation	$226	$3,500	$1,718	$843	$414	$203							$342.3	$116.6
4	Guidewall (d.s.) - pile foundation	$172	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$867	$12,000	$5,890	$2,891	$1,419	$697							$1,113.4	$246.9
5.1	Dam piers - concrete	$263	$3,400	$1,669	$819	$402	$197							$403.1	$140.5
6	Overflow structure - concrete	$67	$2,000	$982	$482	$237	$116								
8	Protection dike - slope stability	$11	$1,120	$550	$270	$132	$65								
9	Earth dikes - underseepage	$55	$16,000	$7,854	$3,855	$1,892	$929								
9.1	Earth dike - slope stability	$36	$16,000	$7,854	$3,855	$1,892	$929								
9.2	Earth dike - through seepage	$24	$16,000	$7,854	$3,855	$1,892	$929								
12	Storage yard - slope stability	$10	$120	$59	$29	$14	$7							$14.7	$5.0
13	Pool control dam - underseepage	$65	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$170	$2,500	$1,227	$602	$296	$145							$275.9	$106.0
21	Roller gate	$7	$120	$59	$29	$14	$7								
22	Roller gate	$8	$120	$59	$29	$14	$7								
23	Roller gate	$8	$120	$59	$29	$14	$7								
24	Roller gate	$7	$120	$59	$29	$14	$7								
25	Roller gate	$9	$120	$59	$29	$14	$7								
26	Tainter gate	$6	$350	$172	$84	$41	$20								
Total		$6,524													

Lock # = 6

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$860	3000	$1,473	$723	$355	$174	$1,704.2	$824.3	$1,304.1	$424.2	$962.8	$82.9
1.1	Lock walls - concrete	$1,014	2700	$1,325	$651	$319	$157	$1,413.7	$399.7	$1,190.1	$176.1	$1,043.4	$29.4
2	Lock wall (interm.) - pile foundation	$731	$3,000	$1,473	$723	$355	$174	$1,425.9	$695.2	$1,254.3	$523.5	$1,007.4	$276.6
3	Guidewall (u.s.) - pile foundation	$293	$3,500	$1,718	$843	$414	$203					$375.3	$82.1
4	Guidewall (d.s.) - pile foundation	$156	$3,500	$1,718	$843	$414	$203						
5	Dam piers - pile foundation	$620	$12,000	$5,890	$2,891	$1,419	$697						
5.1	Dam piers - concrete	$197	$3,400	$1,669	$819	$402	$197						
6	Overflow structure - concrete	$106	$2,000	$982	$482	$237	$116						
9	Earth dikes - underseepage	$34	$3,000	$1,473	$723	$355	$174						
9.1	Earth dike - slope stability	$13	$3,000	$1,473	$723	$355	$174						
9.2	Earth dike - through seepage	$4	$3,000	$1,473	$723	$355	$174						
12	Storage yard - slope stability	$15	$120	$59	$29	$14	$7					$15.5	$0.0
13	Pool control dam - underseepage	$1,301	$12,000	$5,890	$2,891	$1,419	$697					$1,948.9	$648.1
14	Pool control dam - scour protection	$164	$2,500	$1,227	$602	$296	$145					$305.0	$141.1
21	Roller gate	$5	$100	$49	$24	$12	$6						
22	Roller gate	$6	$100	$49	$24	$12	$6						
23	Roller gate	$6	$100	$49	$24	$12	$6						
24	Roller gate	$7	$100	$49	$24	$12	$6						
25	Roller gate	$6	$100	$49	$24	$12	$6						
26	Tainter gate	$11	$600	$295	$145	$71	$35						
Total		$5,571											

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 7

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,401	3000	$1,473	$723	$355	$174			$1,716.0	$314.9	$1,474.9	$73.8	$1,555.8	$154.7
1.1	Lock walls - concrete	$1,032	2700	$1,325	$651	$319	$157			$1,447.7	$415.9	$1,235.4	$203.7	$1,168.8	$137.0
2	Lock wall (interm.) - pile foundation	$2,528	$3,000	$1,473	$723	$355	$174	$2,962.1	$433.6	$3,137.5	$609.0	$2,736.9	$208.4	$2,666.9	$138.4
3	Guidewall (u.s.) - pile foundation	$71	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$189	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$550	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$183	$3,400	$1,669	$819	$402	$197								
9	Earth dikes - underseepage	$45	$5,100	$2,503	$1,229	$603	$296								
9.1	Earth dike - slope stability	$30	$5,100	$2,503	$1,229	$603	$296								
9.2	Earth dike - through seepage	$5	$5,100	$2,503	$1,229	$603	$296								
10	Overflow dike - underseepage	$28	$3,000	$1,473	$723	$355	$174								
10.1	Overflow dike - slope stability	$13	$3,000	$1,473	$723	$355	$174								
12	Storage yard - slope stability	$9	$120	$59	$29	$14	$7								
13	Pool control dam - underseepage	$272	$12,000	$5,890	$2,891	$1,419	$697							$16.1	$6.9
14	Pool control dam - scour protection	$150	$2,500	$1,227	$602	$296	$145							$300.6	$150.2
21	Roller gate	$10	$100	$49	$24	$12	$6								
22	Roller gate	$9	$100	$49	$24	$12	$6								
23	Roller gate	$6	$100	$49	$24	$12	$6								
24	Roller gate	$7	$100	$49	$24	$12	$6								
25	Roller gate	$8	$100	$49	$24	$12	$6								
26	Tainter gate	$10	$650	$319	$157	$77	$38								
Total		$6,555													

Lock # = 8

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$968	3000	$1,473	$723	$355	$174	$1,930.3	$971.8	$1,869.0	$901.4	$1,457.7	$490.1
1.1	Lock walls - concrete	$1,086	2700	$1,325	$651	$319	$157	$1,510.7	$424.5	$1,280.3	$194.0	$1,130.5	$44.2
2	Lock wall (interm.) - pile foundation	$1,099	$3,000	$1,473	$723	$355	$174	$1,857.0	$757.8	$1,904.4	$805.2	$1,346.2	$247.0
3	Guidewall (u.s.) - pile foundation	$81	$3,500	$1,718	$843	$414	$203						
4	Guidewall (d.s.) - pile foundation	$145	$3,500	$1,718	$843	$414	$203						
5	Dam piers - pile foundation	$871	$12,000	$5,890	$2,891	$1,419	$697						
5.1	Dam piers - concrete	$161	$3,400	$1,669	$819	$402	$197					$1,552.9	$682.4
9	Earth dikes - underseepage	$66	$12,000	$5,890	$2,891	$1,419	$697						
9.1	Earth dike - slope stability	$32	$12,000	$5,890	$2,891	$1,419	$697						
9.2	Earth dike - through seepage	$13	$12,000	$5,890	$2,891	$1,419	$697						
10	Overflow dikes - underseepage	$25	$3,000	$1,473	$723	$355	$174						
10.1	Overflow dike - slope stability	$9	$3,000	$1,473	$723	$355	$174						
12	Storage yard - slope stability	$9	$120	$59	$29	$14	$7						
13	Pool control dam - underseepage	$879	$12,000	$5,890	$2,891	$1,419	$697						
14	Pool control dam - scour protection	$161	$2,500	$1,227	$602	$296	$145					$936.0	$56.6
21	Roller gate	$12	$100	$49	$24	$12	$6					$294.1	$133.2
22	Roller gate	$10	$100	$49	$24	$12	$6					$12.0	($0.1)
23	Roller gate	$7	$100	$49	$24	$12	$6					$13.0	$3.4
24	Roller gate	$5	$100	$49	$24	$12	$6						
25	Roller gate	$6	$100	$49	$24	$12	$6						
26	Tainter gate	$8	$600	$295	$145	$71	$35						
Total		$5,653											

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 9

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,335	$3,000	$1,473	$723	$355	$174			$1,954.1	$618.8	$1,636.4	$301.1	$1,509.9	$174.6
1.1	Lock walls - concrete	$1,027	$2,700	$1,325	$651	$319	$157			$1,404.1	$376.7	$1,180.9	$153.4	$1,140.1	$112.6
2	Lock wall (interm.) - pile foundation	$1,575	$3,000	$1,473	$723	$355	$174	$1,624.0	$48.6	$2,415.2	$839.8	$1,895.8	$320.4	$1,734.3	$158.9
3	Guidewall (u.s.) - pile foundation	$103	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$49	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$599	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$277	$3,400	$1,669	$819	$402	$197							$363.0	$85.9
9	Earth dikes - underseepage	$43	$6,200	$3,043	$1,494	$733	$360								
9.1	Earth dike - slope stability	$11	$6,200	$3,043	$1,494	$733	$360								
9.2	Earth dike - through seepage	$2	$6,200	$3,043	$1,494	$733	$360								
10	Overflow dikes - underseepage	$33	$3,000	$1,473	$723	$355	$174								
10.1	Overflow dike - slope stability	$9	$3,000	$1,473	$723	$355	$174								
12	Storage yard - slope stability	$8	$120	$59	$29	$14	$7								
13	Pool control dam - underseepage	$56	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$132	$2,500	$1,227	$602	$296	$145								
21	Roller gate	$8	$100	$49	$24	$12	$6								
22	Roller gate	$8	$100	$49	$24	$12	$6								
23	Roller gate	$6	$100	$49	$24	$12	$6								
24	Roller gate	$12	$100	$49	$24	$12	$6							$12.4	$0.9
25	Roller gate	$5	$100	$49	$24	$12	$6								
26	Tainter gate	$8	$500	$245	$120	$59	$29								
Total		$5,307													

Lock # = 10

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,128	$3,000	$1,473	$723	$355	$174	$1,544.4	$416.1	$1,511.1	$382.8	$1,277.4	$149.1
1.1	Lock walls - concrete	$1,068	$2,700	$1,325	$651	$319	$157	$1,428.7	$361.1	$1,213.9	$146.4	$1,093.3	$25.8
2	Lock wall (interm.) - pile foundation	$912	$3,000	$1,473	$723	$355	$174	$1,545.3	$633.3	$1,143.4	$231.3	$1,064.6	$152.5
3	Guidewall (u.s.) - pile foundation	$292	$3,500	$1,718	$843	$414	$203					$378.1	$85.9
4	Guidewall (d.s.) - pile foundation	$95	$3,500	$1,718	$843	$414	$203						
5	Dam piers - pile foundation	$242	$12,000	$5,890	$2,891	$1,419	$697						
5.1	Dam piers - concrete	$183	$3,400	$1,669	$819	$402	$197						
7	Overflow structure - concrete	$63	$2,000	$982	$482	$237	$116						
9	Earth dikes - underseepage	$36	$3,400	$1,669	$819	$402	$197						
9.1	Earth dike - slope stability	$5	$3,400	$1,669	$819	$402	$197						
9.2	Earth dike - through seepage	$2	$3,400	$1,669	$819	$402	$197						
12	Storage yard - slope stability	$14	$120	$59	$29	$14	$7						
13	Pool control dam - underseepage	$39	$12,000	$5,890	$2,891	$1,419	$697						
14	Pool control dam - scour protection	$125	$2,500	$1,227	$602	$296	$145						
21	Roller gate	$7	$100	$49	$24	$12	$6						
22	Roller gate	$8	$100	$49	$24	$12	$6						
23	Roller gate	$6	$100	$49	$24	$12	$6						
24	Roller gate	$8	$100	$49	$24	$12	$6						
Total		$4,233											

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 11

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Total of Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Total of Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Total of Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Total of Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,569	$3,000	$1,473	$723	$355	$174	$2,041.4	$472.3	$1,865.1	$296.0	$1,858.5	$289.4	$1,713.2	$144.1
1.1	Lock walls - concrete	$1,319	$2,700	$1,325	$651	$319	$157			$1,638.7	$319.9	$1,369.2	$50.5	$1,449.3	$130.6
2	Lock wall (interm.) - pile foundation	$1,935	$3,000	$1,473	$723	$355	$174	$2,207.0	$271.7	$2,882.1	$946.8	$2,372.1	$436.8	$2,100.8	$165.5
3	Guidewall (u.s.) - pile foundation	$144	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$340	$3,500	$1,718	$843	$414	$203							$359.4	$19.3
5	Dam piers - pile foundation	$618	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$198	$3,400	$1,669	$819	$402	$197								
11	Non-overflow dike - underseepage	$32	$2,720	$1,335	$655	$322	$158								
11.1	Non-overflow dike - slope stability	$15	$2,720	$1,335	$655	$322	$158								
11.2	Non-overflow dike - through seepage	$2	$2,740	$1,345	$660	$324	$159								
12	Storage yard dike - underseepage	$19	$160	$79	$39	$19	$9							$28.8	$10.2
12.1	Storage yard - slope stability	$10	$160	$79	$39	$19	$9								
12.2	Storage yard dike - through seepage	$4	$160	$79	$39	$19	$9								
13	Pool control dam - underseepage	$63	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$152	$2,500	$1,227	$602	$296	$145							$308.7	$156.9
21	Roller gate	$1	$120	$59	$29	$14	$7								
22	Roller gate	$1	$120	$59	$29	$14	$7								
23	Roller gate	$1	$120	$59	$29	$14	$7								
Total		$6,422													

Lock # = 12

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Total of Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Total of Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Total of Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Total of Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,036	$2,700	$1,325	$651	$319	$157			$2,291.5	$1,255.9	$2,780.9	$1,745.3	$1,850.9	$815.3
1.1	Lock walls - concrete	$1,389	$2,700	$1,325	$651	$319	$157	$1,972.0	$583.0	$1,657.3	$268.2	$1,476.5	$87.5	$1,424.0	$35.0
2	Lock wall (interm.) - pile foundation	$2,133	$3,000	$1,473	$723	$355	$174	$2,479.6	$347.1	$2,759.6	$627.0	$2,518.0	$385.4	$2,305.9	$173.3
3	Guidewall (u.s.) - pile foundation	$78	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$174	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$703	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$220	$3,400	$1,669	$819	$402	$197							$465.6	$246.0
10	Overflow dike - slope stability	$4	$2,152	$1,056	$519	$255	$125								
11	Non-overflow dike - underseepage	$59	$4,640	$2,278	$1,118	$549	$269								
11.1	Non-overflow dike - slope stability	$8	$4,640	$2,278	$1,118	$549	$269								
11.2	Non-overflow dike - through seepage	$2	$4,640	$2,278	$1,118	$549	$269								
12	Storage yard dike - underseepage	$20	$160	$79	$39	$19	$9							$31.7	$12.2
12.1	Storage yard - slope stability	$13	$160	$79	$39	$19	$9							$18.6	$5.4
12.2	Storage yard dike - through seepage	$3	$160	$79	$39	$19	$9								
13	Pool control dam - underseepage	$1,202	$2,500	$1,227	$602	$296	$145			$1,530.0	$327.7	$1,372.8	$170.5	$1,324.8	$122.5
14	Pool control dam - scour protection	$185	$2,500	$1,227	$602	$296	$145							$305.6	$121.0
19	Miter gate anchors	$1	$45	$22	$11	$5	$3								
21	Roller gate	$1	$120	$59	$29	$14	$7								
22	Roller gate	$1	$120	$59	$29	$14	$7								
23	Roller gate	$1	$120	$59	$29	$14	$7								
Total		$7,231													

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 13

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,651	$3,000	$1,473	$723	$355	$174	$2,505.5	$854.8	$2,299.9	$649.2	$1,871.6	$220.9	$1,798.1	$147.4
1.1	Lock walls - concrete	$13	$2,700	$1,325	$651	$319	$157								
2	Lock wall (interm.) - pile foundation	$1,733	$3,000	$1,473	$723	$355	$174	$1,814.1	$81.6	$2,168.8	$436.2	$1,989.6	$257.0	$1,878.8	$146.2
3	Guidewall (u.s.) - pile foundation	$194	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$126	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$418	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$289	$3,400	$1,669	$819	$402	$197								
10	Overflow dike - slope stability	$17	$1,464	$719	$353	$173	$85							$410.4	$121.1
11	Non-overflow dike - underseepage	$32	$1,632	$801	$393	$193	$95								
11.1	Non-overflow dike - slope stability	$17	$1,632	$801	$393	$193	$95								
11.2	Non-overflow dike - through seepage	$5	$1,632	$801	$393	$193	$95								
12	Storage yard dike - underseepage	$28	$160	$79	$39	$19	$9							$34.9	$7.3
12.1	Storage yard - slope stability	$11	$160	$79	$39	$19	$9							$21.7	$10.9
12.2	Storage yard dike - through seepage	$3	$160	$79	$39	$19	$9								
13	Pool control dam - underseepage	$423	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$170	$2,500	$1,227	$602	$296	$145							$293.9	$123.8
21	Roller gate	$1	$120	$59	$29	$14	$7								
22	Roller gate	$1	$120	$59	$29	$14	$7								
23	Roller gate	$1	$120	$59	$29	$14	$7								
Total		$5,131													

Lock # = 14

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$670	$5,800	$2,847	$1,398	$686	$337	$1,951.8	$518.0	$1,756.8	$323.0	$1,582.4	$148.6	$1,371.0	$700.9
1.1	Lock walls - concrete	$1,434	$2,700	$1,325	$651	$319	$157					$876.1	$126.3	$1,597.5	$163.8
2	Lock wall (interm.) - rock foundation	$750	$5,800	$2,847	$1,398	$686	$337							$941.7	$191.9
5	Dam piers - concrete	$268	$3,400	$1,669	$819	$402	$197							$415.9	$148.2
11	Non-overflow dike - slope stability	$4	$928	$456	$224	$110	$54								
12	Storage yard - slope stability	$2	$160	$79	$39	$19	$9								
13	Pool control dam - scour protection	$149	$2,500	$1,227	$602	$296	$145							$276.0	$127.0
21	Roller gate	$1	$90	$44	$22	$11	$5								
22	Roller gate	$1	$90	$44	$22	$11	$5								
23	Roller gate	$1	$90	$44	$22	$11	$5								
24	Roller gate	$1	$90	$44	$22	$11	$5								
Total		$3,280													

Note:Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 15

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$83	$5,800	$2,847	$1,398	$686	$337								
1.1	Lock walls - concrete	$1,436	$2,700	$1,325	$651	$319	$157	$2,071.8	$636.3	$1,843.5	$407.9	$1,599.3	$163.8	$1,492.0	$56.4
2	Lock wall (interm.) - rock foundation	$662	$5,800	$2,847	$1,398	$686	$337							$885.3	$223.7
13	Pool control dam - scour protection	$140	$2,500	$1,227	$602	$296	$145								
21	Roller gate	$3	$165	$81	$40	$20	$10								
22	Roller gate	$3	$165	$81	$40	$20	$10								
23	Roller gate	$3	$165	$81	$40	$20	$10								
24	Roller gate	$3	$165	$81	$40	$20	$10								
25	Roller gate	$3	$165	$81	$40	$20	$10								
26	Roller gate	$3	$165	$81	$40	$20	$10								
27	Roller gate	$3	$165	$81	$40	$20	$10								
28	Roller gate	$3	$165	$81	$40	$20	$10								
29	Roller gate	$3	$165	$81	$40	$20	$10								
30	Roller gate	$2	$165	$81	$40	$20	$10								
31	Roller gate	$3	$165	$81	$40	$20	$10								
Total		$2,353													

Lock # = 16

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$880	$3,000	$1,473	$723	$355	$174			$1,730.7	$851.1	$1,209.0	$329.4	$1,128.0	$248.4
1.1	Lock walls - concrete	$1,470	$2,700	$1,325	$651	$319	$157	$2,023.8	$553.9	$1,797.9	$327.9	$1,645.7	$175.8	$1,656.7	$186.8
2	Lock wall (interm.) - pile foundation	$986	$3,000	$1,473	$723	$355	$174			$2,402.0	$1,416.5	$1,193.6	$208.1	$1,182.3	$196.7
3	Guidewall (u.s.) - pile foundation	$155	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$309	$3,500	$1,718	$843	$414	$203					$539.5	$230.5	$460.2	$151.2
5	Dam piers - pile foundation	$678	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$200	$3,400	$1,569	$819	$402	$197							$426.0	$226.1
7	Overflow structure - concrete	$72	$2,000	$982	$482	$237	$116								
10	Overflow dike - slope stability	$10	$584	$287	$141	$69	$34								
12	Storage yard dike - underseepage	$29	$332	$163	$80	$39	$19							$41.8	$13.0
12.1	Storage yard - slope stability	$8	$332	$163	$80	$39	$19								
12.2	Storage yard dike - through seepage	$5	$332	$163	$80	$39	$19								
13	Pool control dam - underseepage	$203	$2,500	$1,227	$602	$296	$145							$661.7	$459.0
21	Roller gate	$3	$100	$49	$24	$12	$6								
22	Roller gate	$3	$100	$49	$24	$12	$6								
23	Roller gate	$2	$100	$49	$24	$12	$6								
24	Roller gate	$3	$100	$49	$24	$12	$6								
Total		$5,014													

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 17

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,421	$3,000	$1,473	$723	$355	$174			$1,469.5	$48.7	$1,449.7	$28.9	$1,521.9	$101.1
1.1	Lock walls - concrete	$1,483	$2,700	$1,325	$651	$319	$157	$2,017.9	$534.5	$1,762.3	$278.8	$1,690.2	$206.7	$1,499.4	$16.0
2	Lock wall (interm.) - pile foundation	$1,269	$3,000	$1,473	$723	$355	$174			$1,608.8	$339.9	$1,424.1	$155.2	$1,974.6	$705.6
3	Guidewall (u.s.) - pile foundation	$197	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$176	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$177	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$148	$3,400	$1,669	$819	$402	$197								
10	Overflow dike - slope stability	$13	$1,476	$725	$356	$175	$86								
11	Non-overflow dike - underseepage	$28	$184	$90	$44	$22	$11					$47.2	$19.3	$36.4	$8.5
11.1	Non-overflow dike - slope stability	$10	$184	$90	$44	$22	$11								
11.2	Non-overflow dike - through seepage	$5	$1,476	$725	$356	$175	$86								
12	Storage yard dike - underseepage	$28	$160	$79	$39	$19	$9					$49.9	$22.1	$42.0	$14.3
12.1	Storage yard - slope stability	$7	$160	$79	$39	$19	$9								
12.2	Storage yard dike - through seepage	$2	$160	$79	$39	$19	$9								
13	Pool control dam - underseepage	$751	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$171	$2,500	$1,227	$602	$296	$145								
19	Miter gate anchors	$1	$45	$22	$11	$5	$3							$295.7	$125.0
21	Roller gate	$1	$120	$59	$29	$14	$7								
22	Roller gate	$1	$120	$59	$29	$14	$7								
23	Roller gate	$1	$120	$59	$29	$14	$7								
Total		$5,886													

Lock # = 18

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$853	$3,000	$1,473	$723	$355	$174			$1,583.6	$730.6	$1,197.4	$344.4	$1,022.0	$169.0
1.1	Lock walls - concrete	$1,347	$2,700	$1,325	$651	$319	$157	$2,029.3	$682.3	$1,752.1	$405.1	$1,625.2	$278.1	$1,595.9	$248.8
2	Lock wall (interm.) - pile foundation	$502	$3,000	$1,473	$723	$355	$174					$2,049.4	$1,547.5	$1,556.3	$1,054.4
3	Guidewall (u.s.) - pile foundation	$80	$3,500	$1,718	$843	$414	$203								
4	Guidewall (d.s.) - pile foundation	$217	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$1,365	$12,000	$5,890	$2,891	$1,419	$697							$409.9	$192.6
5.1	Dam piers - concrete	$157	$3,400	$1,669	$819	$402	$197							$2,053.0	$688.2
10	Overflow dike - slope stability	$15	$1,760	$864	$424	$208	$102								
11	Non-overflow dike - underseepage	$27	$1,760	$864	$424	$208	$102								
11.1	Non-overflow dike - slope stability	$10	$1,768	$868	$426	$209	$103								
11.2	Non-overflow dike - through seepage	$4	$1,760	$864	$424	$208	$102								
12	Storage yard dike - underseepage	$38	$156	$77	$38	$18	$9								
12.1	Storage yard - slope stability	$11	$156	$77	$38	$18	$9					$41.9	$4.2	$49.9	$12.2
13	Pool control dam - underseepage	$1,284	$12,000	$5,890	$2,891	$1,419	$697							$19.2	$8.4
14	Pool control dam - scour protection	$209	$2,500	$1,227	$602	$296	$145							$1,931.6	$647.9
19	Miter gate anchors	$2	$45	$22	$11	$5	$3							$291.2	$82.6
21	Roller gate	$1	$120	$59	$29	$14	$7								
22	Roller gate	$1	$120	$59	$29	$14	$7								
23	Roller gate	$1	$120	$59	$29	$14	$7								
Total		$6,122													

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 19

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$592	$5,800	$2,847	$1,398	$686	$337	$906.9	$315.4
1.1	Lock walls - concrete	$12	$2,700	$1,325	$651	$319	$157		
2	Lock wall (interm.) - rock foundation	$540	$5,800	$2,847	$1,398	$686	$337	$667.9	$128.0
13	Pool control dam - scour protection	$185	$2,500	$1,227	$602	$296	$145	$289.9	$104.7
20	Lift gate	$94	$800	$393	$193	$95	$46	$126.3	$32.7
Total		$1,422							

Lock # = 20

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$221	$5,800	$2,847	$1,398	$686	$337								
1.1	Lock walls - concrete	$1,868	$2,700	$1,325	$651	$319	$157	$2,129.8	$261.5	$1,903.4	$35.1	$2,048.4	$180.2	$1,927.3	$59.1
2	Lock wall (interm.) - rock foundation	$1,383	$5,800	$2,847	$1,398	$686	$337					$2,040.0	$657.1	$1,668.1	$285.2
5	Dam piers - pile foundation	$440	$12,000	$5,890	$2,891	$1,419	$697								
12	Storage yard dike - underseepage	$19	$180	$88	$43	$21	$10							$26.1	$6.8
12.1	Storage yard - slope stability	$9	$180	$88	$43	$21	$10								
12.2	Storage yard dike - through seepage	$5	$180	$88	$43	$21	$10								
13	Pool control dam - underseepage	$429	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$148	$2,500	$1,227	$602	$296	$145							$288.2	$139.8
19	Miter gate anchors	$2	$45	$22	$11	$5	$3								
21	Roller gate	$1	$2,000	$982	$482	$237	$116								
22	Roller gate	$8	$2,000	$982	$482	$237	$116								
23	Roller gate	$5	$2,000	$982	$482	$237	$116								
Total		$4,538													

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 21

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,040	$3,000	$1,473	$723	$355	$174			$1,477.0	$436.6	$1,107.5	$67.1	$1,574.8	$534.4
1.1	Lock walls - concrete	$1,935	$2,700	$1,325	$651	$319	$157	$2,104.7	$169.6	$2,212.6	$277.5	$2,103.4	$168.3	$2,052.8	$117.7
2	Lock wall (interm.) - pile foundation	$1,506	$3,000	$1,473	$723	$355	$174	$1,927.2	$421.0	$2,620.4	$1,114.2	$2,267.1	$760.9	$2,091.7	$585.5
3	Guidewall (u.s.) - pile foundation	$310	$3,500	$1,718	$843	$414	$203							$439.7	$130.1
4	Guidewall (d.s.) - pile foundation	$196	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$878	$12,000	$5,890	$2,891	$1,419	$697							$1,537.1	$659.2
5.1	Dam piers - concrete	$257	$3,400	$1,669	$819	$402	$197							$396.7	$139.4
10	Overflow dike - underseepage	$23	$1,632	$801	$393	$193	$95								
10.1	Overflow dike - slope stability	$15	$1,344	$660	$324	$159	$78								
12	Storage yard dike - underseepage	$21	$160	$79	$39	$19	$9								
12.1	Storage yard - slope stability	$13	$160	$79	$39	$19	$9					$43.1	$21.8	$26.6	$5.3
12.2	Storage yard dike - through seepage	$2	$160	$79	$39	$19	$9							$22.3	$8.9
13	Pool control dam - underseepage	$194	$12,000	$5,890	$2,891	$1,419	$697								
14	Pool control dam - scour protection	$176	$2,500	$1,227	$602	$296	$145							$268.3	$92.6
19	Miter gate anchors	$1	$45	$22	$11	$5	$3								
21	Roller gate	$2	$120	$59	$29	$14	$7								
22	Roller gate	$2	$120	$59	$29	$14	$7								
23	Roller gate	$2	$120	$59	$29	$14	$7								
Total		$6,575													

Lock # = 22

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$744	$5,800	$2,847	$1,398	$686	$337	$974.5	$230.6	$893.9	$150.0
1.1	Lock walls - concrete	$21	$2,700	$1,325	$651	$319	$157				
2	Lock wall (interm.) - rock foundation	$866	$5,800	$2,847	$1,398	$686	$337	$1,177.5	$312.0	$1,016.5	$150.9
5	Dam piers - concrete	$340	$3,400	$1,669	$819	$402	$197			$432.6	$92.4
10	Overflow dike - slope stability	$8.2	$1,488	$730	$359	$176	$86				
12	Storage yard - slope stability	$12.4	$160	$79	$39	$19	$9			$22.0	$9.6
13	Pool control dam - scour protection	$181	$2,500	$1,227	$602	$296	$145			$293.2	$111.7
19	Lift gate	$1	$45	$22	$11	$5	$3				
21	Roller gate	$3	$130	$64	$31	$15	$8				
22	Roller gate	$3	$130	$64	$31	$15	$8				
23	Roller gate	$3	$130	$64	$31	$15	$8				
Total		$2,183									

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 24

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$405.2	$5,800	$2,847	$1,398	$686	$337							$602.5	$197.3
1.1	Lock walls - concrete	$1,976.0	$2,700	$1,325	$651	$319	$157	$2,334.6	$358.6	$2,053.8	$77.8	$2,014.1	$38.2	$2,146.6	$170.6
2	Lock wall (interm.) - rock foundation	$415.6	$5,800	$2,847	$1,398	$686	$337							$1,713.0	$1,297.4
3	Guidewall (u.s.) - rock foundation	$86.1	$5,800	$2,847	$1,398	$686	$337								
4	Guidewall (d.s.) - rock foundation	$159.6	$5,800	$2,847	$1,398	$686	$337								
5	Dam piers - pile foundation	$919.9	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$199.9	$3,400	$1,669	$819	$402	$197							$1,486.8	$566.9
9	Sny levee - underseepage	$20.5	$5,000	$2,454	$1,205	$591	$290							$372.0	$172.1
9.1	Sny levee - slope stability	$14.8	$2,720	$1,335	$655	$322	$158								
9.2	Sny levee - through seepage	$6.2	$4,640	$2,278	$1,118	$549	$269								
10	Overflow dike - underseepage	$29.8	$5,000	$2,454	$1,205	$591	$290								
10.1	Overflow dike - slope stability	$9.5	$2,720	$1,335	$655	$322	$158								
12	Storage yard dike - underseepage	$15.4	$2,740	$1,345	$660	$324	$159								
12.1	Storage yard - slope stability	$12.7	$2,720	$1,335	$655	$322	$158								
12.2	Storage yard dike - through seepage	$0.0	$2,740	$1,345	$660	$324	$159								
13	Pool control dam - underseepage	$387.2	$12,000	$5,890	$2,891	$1,419	$697								
13.1	Pool control dam - scour protection	$179.5	$2,500	$1,227	$602	$296	$145								
17	Aux lock closure dam - slope stability	$1.9	$5,000	$2,454	$1,205	$591	$290							$271.1	$91.6
17.1	Aux lock closure dam - through seepage	$3.4	$5,000	$2,454	$1,205	$591	$290								
19	Miter gate	$0.0	$600	$393	$193	$95	$46								
23	Tainter valves	$22.6	$400	$196	$96	$47	$23								
Total		$4,865.9													

Lock # = 25

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$945.2	$3,000	$1,473	$723	$355	$174			$2,255.8	$1,310.5	$1,675.9	$730.7	$1,091.1	$145.8
1.1	Lock walls - concrete	$1,781.0	$2,700	$1,325	$651	$319	$157	$2,154.3	$373.3	$1,906.1	$125.1	$1,962.4	$181.4	$1,937.8	$156.8
2	Lock wall (interm.) - pile foundation	$1,971.2	$3,000	$1,473	$723	$355	$174	$2,129.1	$158.0	$2,655.0	$683.8	$2,075.8	$104.6	$2,103.6	$132.4
3	Guidewall (u.s.) - pile foundation	$213.4	$3,500	$1,718	$843	$414	$203							$526.9	$313.5
4	Guidewall (d.s.) - pile foundation	$159.6	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$1,461.1	$12,000	$5,890	$2,891	$1,419	$697								
5.1	Dam piers - concrete	$26.6	$3,400	$1,669	$819	$402	$197					$2,072.7	$611.6	$2,102.3	$641.2
9	Sandy Slough dike - underseepage	$42.3	$4,640	$2,278	$1,118	$549	$269								
9.1	Sandy Slough dike - slope stability	$15.3	$2,720	$1,335	$655	$322	$158								
9.2	Sandy Slough dike - through seepage	$3.5	$3,800	$1,865	$916	$449	$221								
10	Overflow dike - underseepage	$39.4	$5,000	$2,454	$1,205	$591	$290								
10.1	Overflow dike - slope stability	$19.1	$2,720	$1,335	$655	$322	$158								
12	Storage yard dike - underseepage	$23.4	$2,720	$1,335	$655	$322	$158								
12.1	Storage yard - slope stability	$16.5	$2,720	$1,335	$655	$322	$158								
12.2	Storage yard dike - through seepage	$4.1	$2,740	$1,345	$660	$324	$159								
13	Pool control dam - underseepage	$146.4	$12,000	$5,890	$2,891	$1,419	$697								
13.1	Pool control dam - scour protection	$174.1	$2,500	$1,227	$602	$296	$145								
17	Aux lock closure dam - underseepage	$18.7	$5,000	$2,454	$1,205	$591	$290							$319.6	$145.5
17.1	Aux lock closure dam - slope stability	$1.8	$5,000	$2,454	$1,205	$591	$290								
17.2	Aux lock closure dam - through seepage	$3.0	$5,000	$2,454	$1,205	$591	$290								
21	Roller gate	$135.5	$2,000	$982	$482	$237	$116								
22	Roller gate	$117.2	$2,000	$982	$482	$237	$116							$246.0	$110.5
23	Roller gate	$139.0	$2,000	$982	$482	$237	$116							$226.9	$109.7
Total		$7,318.3												$224.1	$85.1

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = 26

Component #	Component Description	Life-cycle Costs (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of Phase 1 + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (main) - pile foundation	$1,393	$3,000	$1,473	$723	$355	$174	$1,861.8	$469.1	$1,418.1	$25.4	$1,804.1	$411.4
2	Lock wall (aux) - pile foundation	$913	$3,000	$1,473	$723	$355	$174	$1,791.9	$878.8	$2,317.3	$1,404.2	$1,081.0	$167.8
3	Guidewall (main, u.s.) - pile foundatio	$173	$3,500	$1,718	$843	$414	$203						
4	Guidewall (main, d.s.) - pile foundatio	$336	$3,500	$1,718	$843	$414	$203					$379.3	$43.8
5	Guidewall (aux, u.s.) - pile foundation	$132	$3,500	$1,718	$843	$414	$203						
6	Guidewall (aux, d.s.) - pile foundation	$135	$3,500	$1,718	$843	$414	$203						
7	Dam piers - pile foundation	$2,462	$12,000	$5,890	$2,891	$1,419	$697			$3,766.6	$1,304.9	$3,166.8	$705.1
9	Esplanade - slope stability	$22	$2,720	$1,335	$655	$322	$158						
9.1	Esplanade - through seepage	$5	$2,740	$1,345	$660	$324	$159						
10	Overflow dike - underseepage	$49	$1,600	$785	$386	$189	$93						
10.1	Overflow dike - slope stability	$18	$2,720	$1,335	$655	$322	$158						
13	Pool control dam - underseepage	$267	$12,000	$5,890	$2,891	$1,419	$697						
13.1	Pool control dam - scour protection	$0	$2,500	$1,227	$602	$296	$145						
14	Sheet pile cells - underseepage	$21	$250	$123	$60	$30	$15					$43.1	$22.0
20	Lift gate	$105	$360	$177	$87	$43	$21	$130.2	$25.3	$136.0	$31.1	$125.9	$21.0
Total		$6,030											

Lock # = 27

Component #	Component Description	Life-cycle Costs (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	East lock wall - rock foundation	$813	$5,800	$2,847	$1,398	$686	$337	$1,301.7	$489.0	$1,202.7	$390
2	Lock wall (interm.) - rock foundation	$651	$5,800	$2,847	$1,398	$686	$337			$819.5	$169
3	Guidewall (u.s.) - pile foundation	$75	$3,000	$1,473	$723	$355	$174				
4	Guidewall (d.s.) - pile foundation	$196	$3,000	$1,473	$723	$355	$174			$327.0	$131
5	West lock wall - rock foundation	$253	$5,800	$2,847	$1,398	$686	$337				
9	East embankment - underseepage	$16	$2,740	$1,345	$660	$324	$159				
9.1	East embankment - slope stability	$16	$600	$295	$145	$71	$35				
9.2	East embankment - through seepage	$3	$2,740	$1,345	$660	$324	$159				
10	West embankment - underseepage	$25	$2,740	$1,345	$660	$324	$159				
10.1	West embankment - slope stability	$8	$600	$295	$145	$71	$35				
10.2	West embankment - through seepage	$4	$2,740	$1,345	$660	$324	$159				
13	Pool control dam - scour protection	$269	$2,500	$1,227	$602	$296	$145				
18	Low water dam - slope stability	$17	$5,000	$2,454	$1,205	$591	$290			$296.9	$28
21	Lift gate (main, old)	$5	$800	$393	$193	$95	$46				
22	Lift gate (aux)	$0	$800	$393	$193	$95	$46				
Total		$2,350									

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = O'Brien

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
13	Pool control dam - underseepage	$351	12000	$5,890	$2,891	$1,419	$697		
14	Pool control dam - scour protection	$199	$2,500	$1,227	$602	$296	$145	$301.7	$103.0
20	Sheet pile lock wall - interlock	$29	$2,500	$1,227	$602	$296	$145		
21	Sheet pile lock wall - buckling	$5	$2,500	$1,227	$602	$296	$145		
Total		$584							

Lock # = Lockport

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$369	5800	$2,847	$1,398	$686	$337					$617.9	$249.4
1.1	Lock wall - concrete	$21	2700	$1,325	$651	$319	$157						
2	Lock wall (interm.) - rock foundation	$276	$5,800	$2,847	$1,398	$686	$337						
9	Right side dike - slope stability	$20	$2,400	$1,178	$578	$284	$139						
20	Lift gate	$239	$800	$393	$193	$95	$46	$375.9	$137.4	$336.5	$98.0	$291.8	$53.3
Total		$924											

Lock # = Brandon Road

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$511	$5,800	$2,847	$1,398	$686	$337	$822.5	$311.8
1.1	Lock wall - concrete	$20	2700	$1,325	$651	$319	$157		
2	Lock wall (interm.) - rock foundation	$612	$5,800	$2,847	$1,398	$686	$337	$918.4	$306.8
11	Non-overflow dike - slope stability	$3	$656	$322	$158	$78	$38		
19	Miter gate	$1	$800	$393	$193	$95	$46		
Total		$1,146							

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = Dresden Island

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$212	$5,800	$2,847	$1,398	$686	$337								
1.1	Lock wall - concrete	$17	$2,700	$1,325	$651	$319	$157								
2	Lock wall (interm.) - rock foundation	$433	$5,800	$2,847	$1,398	$686	$337							$506.7	$74.0
6	Overflow structure - concrete	$78	$656	$322	$158	$78	$38								
11	Non-overflow dike - slope stability	$9	$800	$393	$193	$95	$46								
22	Tainter gate	$729	$800	$393	$193	$95	$46	$996.4	$267.6	$830.1	$101.2	$808.0	$79.1	$765.1	$36.2
Total		$1,477													

Lock # = Marseilles

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$1,483	$5,800	$2,847	$1,398	$686	$337	$1,912.7	$429.7	$2,191.7	$708.7	$1,795.3	$312.3
1.1	Lock wall - concrete	$15	$2,700	$1,325	$651	$319	$157						
2	Lock wall (interm.) - rock foundation	$304	$5,800	$2,847	$1,398	$686	$337						
Total		$1,802											

Lock # = Starved Rock

Component #	Component Description	Life-cycle Cost (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - rock foundation	$361	$5,800	$2,847	$1,398	$686	$337						
1.1	Lock wall - concrete	$22	$2,700	$1,325	$651	$319	$157						
2	Lock wall (interm.) - rock foundation	$340	$5,800	$2,847	$1,398	$686	$337						
6	Overflow structure - concrete	$85	$2,000	$982	$482	$237	$116						
22	Tainter gate	$610	$2,340	$1,149	$564	$277	$136	$976.5	$366.1	$768.2	$157.8	$745.9	$135.5
Total		$1,419											

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Table 7 - Summary of Rehabilitation Feasibility Analysis

Lock # = Peoria

Component #	Component Description	Life-cycle Costs (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$1,354	$3,000	$1,473	$723	$355	$174	$1,907.3	$553.2	$1,727.2	$373.1	$1,496.8	$142.7
1.1	Lock walls - concrete	$25	$2,700	$1,325	$651	$319	$157						
2	Lock wall (interm.) - pile foundation	$1,345	$3,000	$1,473	$723	$355	$174	$2,318.2	$973.4	$1,947.4	$602.6	$1,912.6	$567.8
3	Guidewall (u.s.) - pile foundation	$160	$3,500	$1,718	$843	$414	$203						
4	Guidewall (d.s.) - pile foundation	$229	$3,500	$1,718	$843	$414	$203					$363.3	$134.2
13	Pool control dam - scour protection	$205	$2,500	$1,227	$602	$296	$145					$299.3	$94.5
15	Regulating weir - underseepage	$1,034	$12,000	$5,890	$2,891	$1,419	$697					$1,730.0	$696.0
16	Navigable dam - underseepage	$595	$12,000	$5,890	$2,891	$1,419	$697						
Total		$4,947											

Lock # = LaGrange

Component #	Component Description	Life-cycle Costs (Base)	Rehab Cost	Rehab in Yr 10 PV of Rehab Cost	Rehab in Yr 20 PV of Rehab Cost	Rehab in Yr 30 PV of Rehab Cost	Rehab in Yr 40 PV of Rehab Cost	Rehab in Year 10 Total of L-c costs + Rehab Costs	Rehab in Year 10 Rehab - Baseline	Rehab in Year 20 Total of L-c costs + Rehab Costs	Rehab in Year 20 Rehab - Baseline	Rehab in Year 30 Total of L-c costs + Rehab Costs	Rehab in Year 30 Rehab - Baseline	Rehab in Year 40 Total of L-c costs + Rehab Costs	Rehab in Year 40 Rehab - Baseline
1	Lock wall (land) - pile foundation	$805	$3,000	$1,473	$723	$355	$174			$1,832.3	$1,027.4	$2,179.6	$1,374.7	$1,036.1	$231.2
1.1	Lock walls - concrete	$1,961	$2,700	$1,325	$651	$319	$157	$2,238.4	$277.5	$2,225.6	$264.7	$2,151.4	$190.5	$2,076.8	$115.9
2	Lock wall (interm.) - pile foundation	$1,188	$3,000	$1,473	$723	$355	$174			$2,021.7	$833.7	$1,575.5	$387.5	$1,344.4	$156.3
3	Guidewall (u.s.) - pile foundation	$240	$3,500	$1,718	$843	$414	$203							$420.0	$179.8
4	Guidewall (d.s.) - pile foundation	$99	$3,500	$1,718	$843	$414	$203								
5	Dam piers - pile foundation	$352	$12,000	$5,890	$2,891	$1,419	$697								
11	Non-overflow dike - underseepage	$29	$312	$153	$75	$37	$18							$44.0	$14.7
11.1	Non-overflow dike - slope stability	$17	$312	$153	$75	$37	$18								
13	Pool control dam - scour protection	$184	$2,500	$1,227	$602	$296	$145							$312.4	$128.4
15	Regulating weir - underseepage	$44	$12,000	$5,890	$2,891	$1,419	$697								
16	Navigable dam - underseepage	$698	$12,000	$5,890	$2,891	$1,419	$697								
Total		$5,818												$1,322.2	$423.8

Note: Rehab evaluated 10, 20, 30, and 40 years beyond base year.

Appendix

Cumulative Repair Costs

Cumulative Repair Costs by Lock Over 50-Year Planning Period

Year	LSAF	USAF	1	2	3	4	5	5A	6	7	8
5	$188.4	$240.7	$81.7	$2,873.2	$2,229.2	$1,522.8	$813.4	$2,570.3	$886.8	$1,731.9	$2,329.0
10	1,437.6	598.7	150.0	4,136.7	4,614.4	3,769.2	1,897.1	4,679.2	3,029.2	3,500.1	3,853.4
15	1,704.7	1,076.7	246.7	6,847.9	8,263.0	4,944.6	3,531.0	8,524.4	3,755.3	8,351.1	5,345.8
20	2,540.3	1,865.3	366.7	9,030.3	9,451.0	6,184.9	4,221.0	9,072.4	6,207.6	9,508.0	6,669.4
25	3,647.6	2,632.3	551.7	10,319.0	10,897.0	10,143.5	5,726.0	10,525.9	12,415.7	10,803.3	7,794.2
30	4,391.6	2,855.3	706.7	13,302.2	12,169.9	12,050.0	9,039.5	12,635.3	14,613.7	14,600.5	10,232.7
35	5,278.0	3,223.6	933.3	14,135.6	13,052.1	13,449.7	11,416.1	14,262.8	16,016.8	15,785.6	11,268.7
40	6,013.3	3,978.9	1,085.0	17,238.4	14,355.4	15,029.6	12,223.4	14,749.1	16,855.2	16,463.0	14,334.3
45	6,660.9	4,099.6	1,198.3	19,054.1	16,467.3	15,477.3	13,528.6	16,852.5	18,987.0	19,146.7	15,794.0
50	6,921.6	4,464.3	1,318.3	19,904.5	17,307.5	17,962.5	14,504.6	17,246.0	20,877.2	20,045.5	16,055.1

Cumulative Repair Costs by Lock Over 50-Year Planning Period

Year	9	10	11	12	13	14	15	16	17	18	19
5	$2,058.9	$1,197.7	$2,110.6	$932.1	$2,515.3	$900.0	$463.4	$456.9	$1,546.7	$1,900.6	$485.4
10	3,700.0	2,177.2	5,970.3	4,059.4	3,798.2	1,402.2	804.1	1,477.4	2,899.3	3,741.8	1,114.8
15	6,591.1	3,440.9	6,666.7	6,495.3	6,036.0	2,467.2	1,344.7	5,349.6	5,397.4	5,428.8	1,519.0
20	7,443.2	4,729.2	8,503.1	8,973.2	7,480.1	3,268.6	1,712.7	6,711.1	7,396.5	6,004.9	1,596.4
25	8,190.3	5,582.7	9,490.5	11,047.7	8,871.5	4,109.0	2,177.5	7,460.1	8,709.8	9,663.5	2,508.3
30	8,680.0	7,531.2	10,749.2	12,963.6	11,460.6	4,799.3	2,332.6	9,539.1	9,857.9	12,319.2	3,293.3
35	9,968.3	8,636.7	11,617.1	14,453.6	12,843.7	5,206.5	2,840.3	11,057.1	11,460.3	14,312.0	4,026.5
40	11,640.5	10,104.2	13,139.4	17,289.7	14,312.7	5,920.2	3,525.4	11,973.3	12,987.9	14,643.8	4,314.4
45	12,017.3	11,333.7	14,041.4	18,224.9	15,368.0	7,012.8	4,386.5	14,876.7	15,008.9	17,360.9	4,805.9
50	12,362.8	12,255.3	15,377.9	20,125.8	16,137.0	7,712.4	5,782.6	15,820.9	17,574.3	18,025.4	5,315.1

Cumulative Repair Costs by Lock Over 50-Year Planning Period

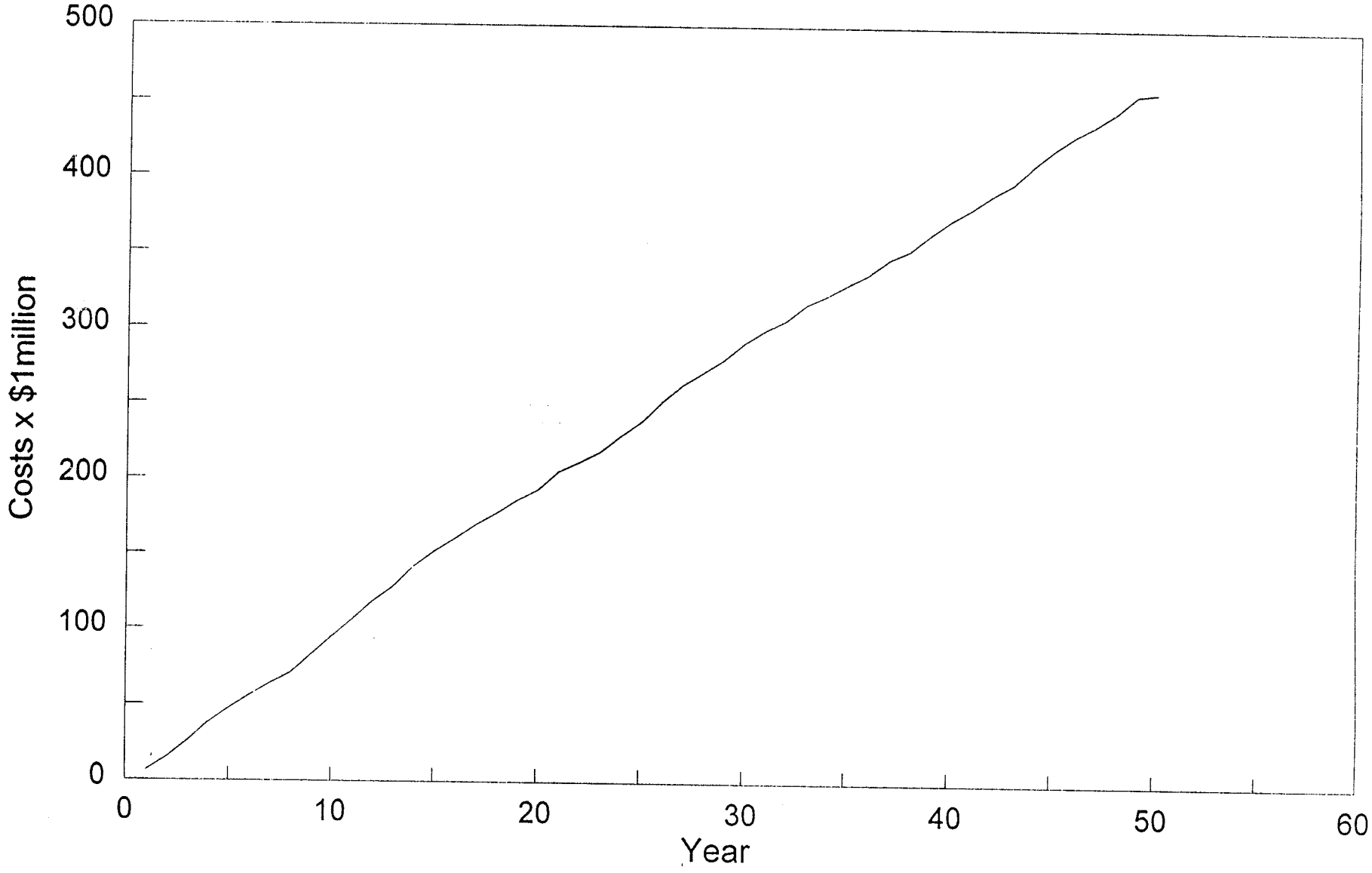
Year	20	21	22	24	25	26	27	O'Brien	Lockport	Brandon Rd
5	$1,308.8	$3,301.1	$1,363.6	$509.5	$2,122.9	$3,225.4	$158.9	$100.2	$195.8	$706.8
10	2,066.9	4,179.7	1,606.5	2,050.9	3,912.1	4,250.9	1,143.7	630.5	439.9	855.1
15	2,663.0	5,913.5	2,173.5	3,380.1	6,346.2	6,109.2	3,298.4	708.5	481.3	1,304.6
20	4,603.4	7,816.3	3,359.7	5,051.8	8,976.7	7,062.0	3,973.2	811.8	893.6	1,476.0
25	6,214.1	8,766.0	3,752.1	6,347.0	10,800.3	7,779.3	4,651.1	917.4	1,593.3	1,643.9
30	6,389.6	9,992.6	4,056.4	7,106.7	12,809.0	9,661.5	5,891.0	1,449.8	1,990.6	2,073.7
35	6,964.3	12,382.0	4,709.1	9,099.2	15,719.3	9,882.8	7,065.6	1,550.8	2,341.3	2,521.9
40	8,548.1	13,309.4	4,905.2	9,731.2	17,880.9	12,091.5	7,761.4	1,664.2	3,638.8	3,254.7
45	11,696.0	14,248.7	6,422.3	11,086.1	18,411.5	15,174.0	8,629.6	1,784.9	4,448.2	3,979.8
50	12,054.9	16,482.2	6,993.7	12,555.6	21,770.2	16,715.9	9,568.2	1,856.4	4,729.1	4,631.9

Cumulative Repair Costs by Lock Over 50-Year Planning Period

Year	Dresden Is	Marseilles	Starved Rk	Peoria	LaGrange	Total
5	$280.3	$414.2	$256.8	$2,258.7	$1,297.5	$47,535.6
10	975.2	1,638.5	532.9	3,598.6	4,052.7	$94,744.4
15	1,584.9	2,238.8	1,604.5	5,679.5	5,102.3	$151,916.1
20	1,891.0	2,824.9	1,853.7	7,682.5	6,647.4	$193,859.4
25	2,547.2	3,154.8	2,534.4	8,837.4	7,433.2	$240,238.4
30	3,412.6	4,037.2	3,621.4	10,220.8	8,499.3	$291,335.5
35	4,174.7	4,225.5	4,377.1	11,053.6	8,861.9	$330,173.7
40	4,867.1	4,411.1	4,689.0	13,215.3	10,825.5	$372,970.6
45	5,786.1	5,543.1	5,781.3	14,552.5	13,011.7	$422,258.8
50	6,785.9	5,652.3	6,612.7	15,751.3	13,345.2	$458,602.1

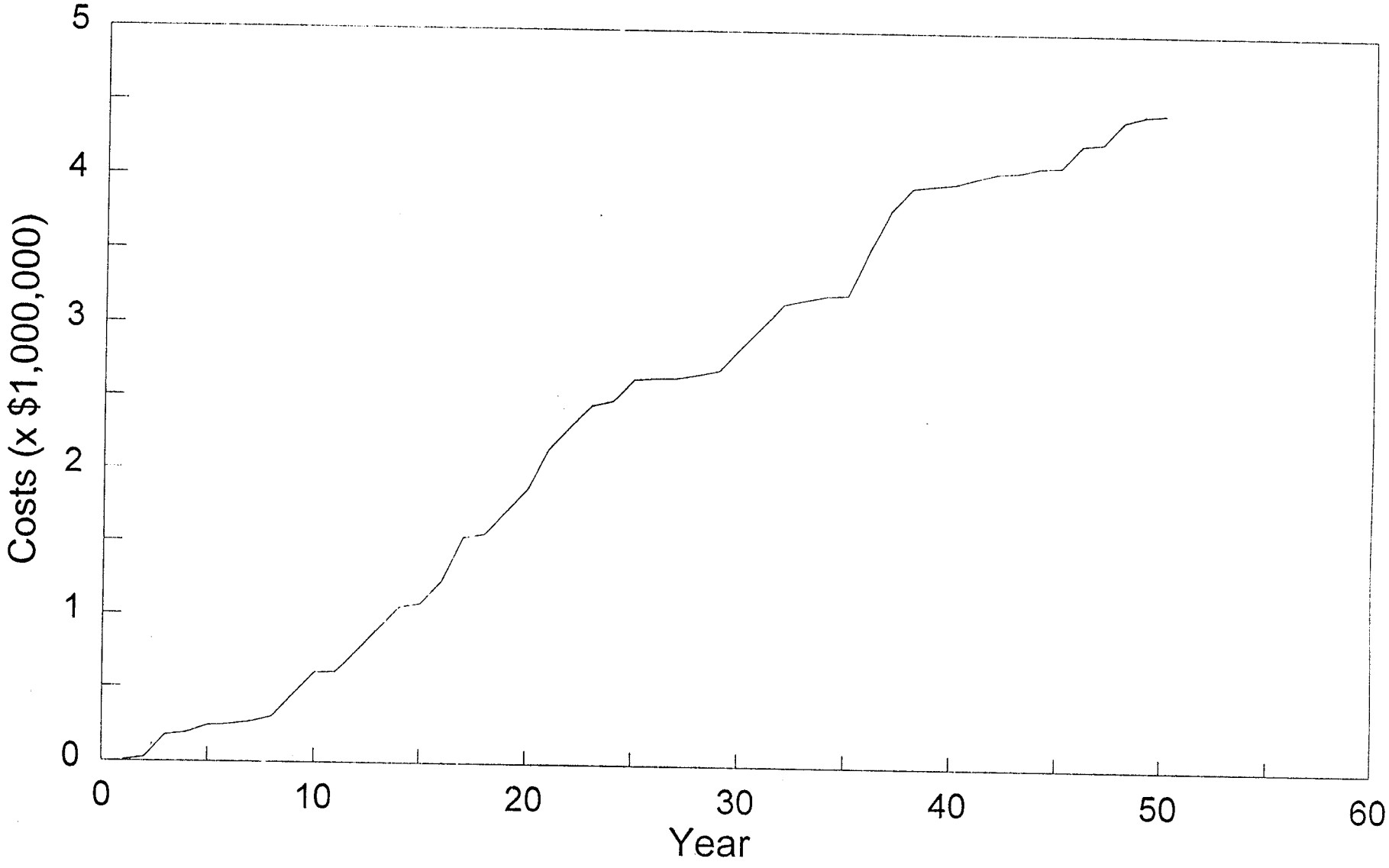
Total Cumulative Repair Costs

(UMR-IWW System - Base Condition)



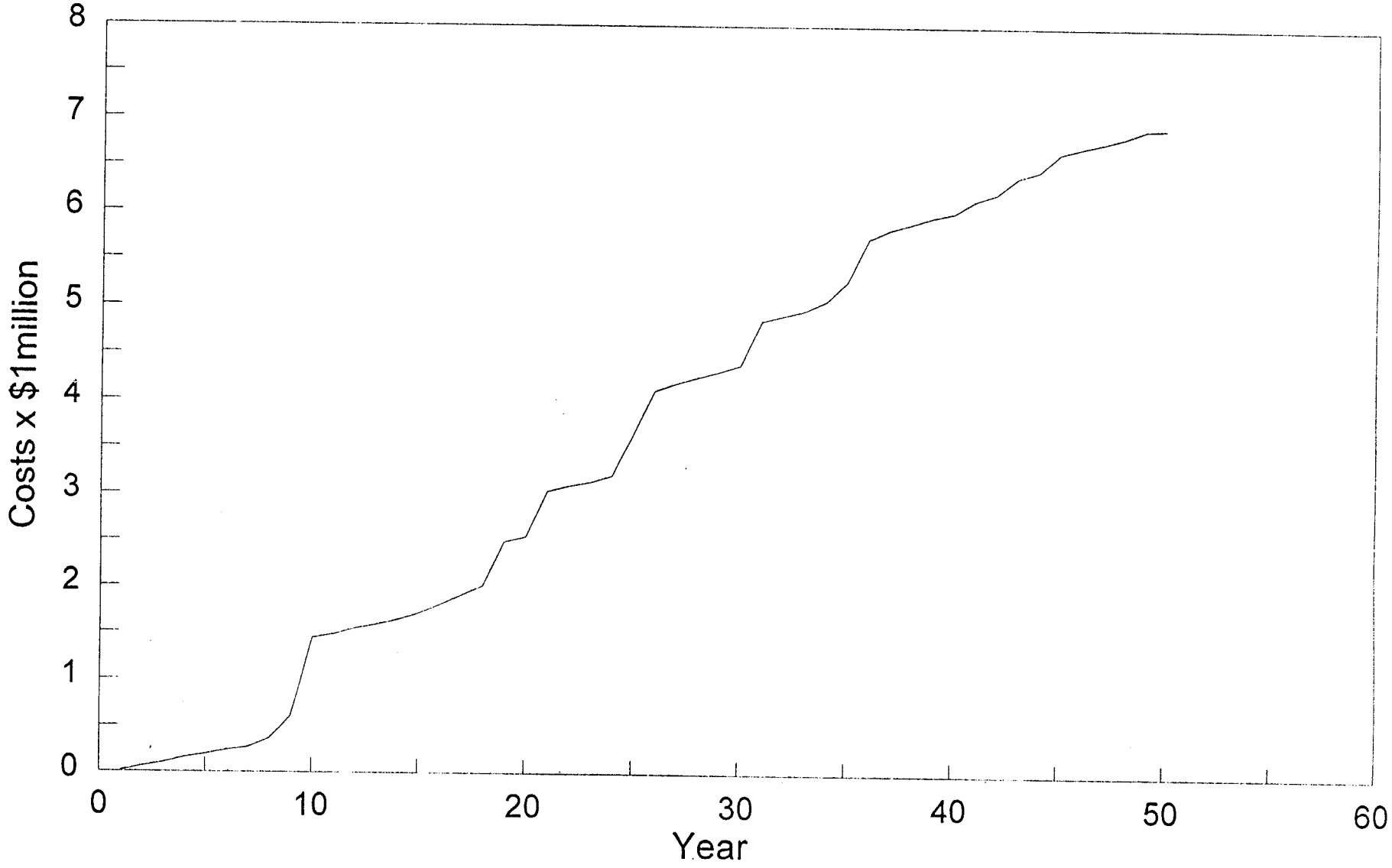
Cumulative Repair Costs (USAF Lock)

Base Condition



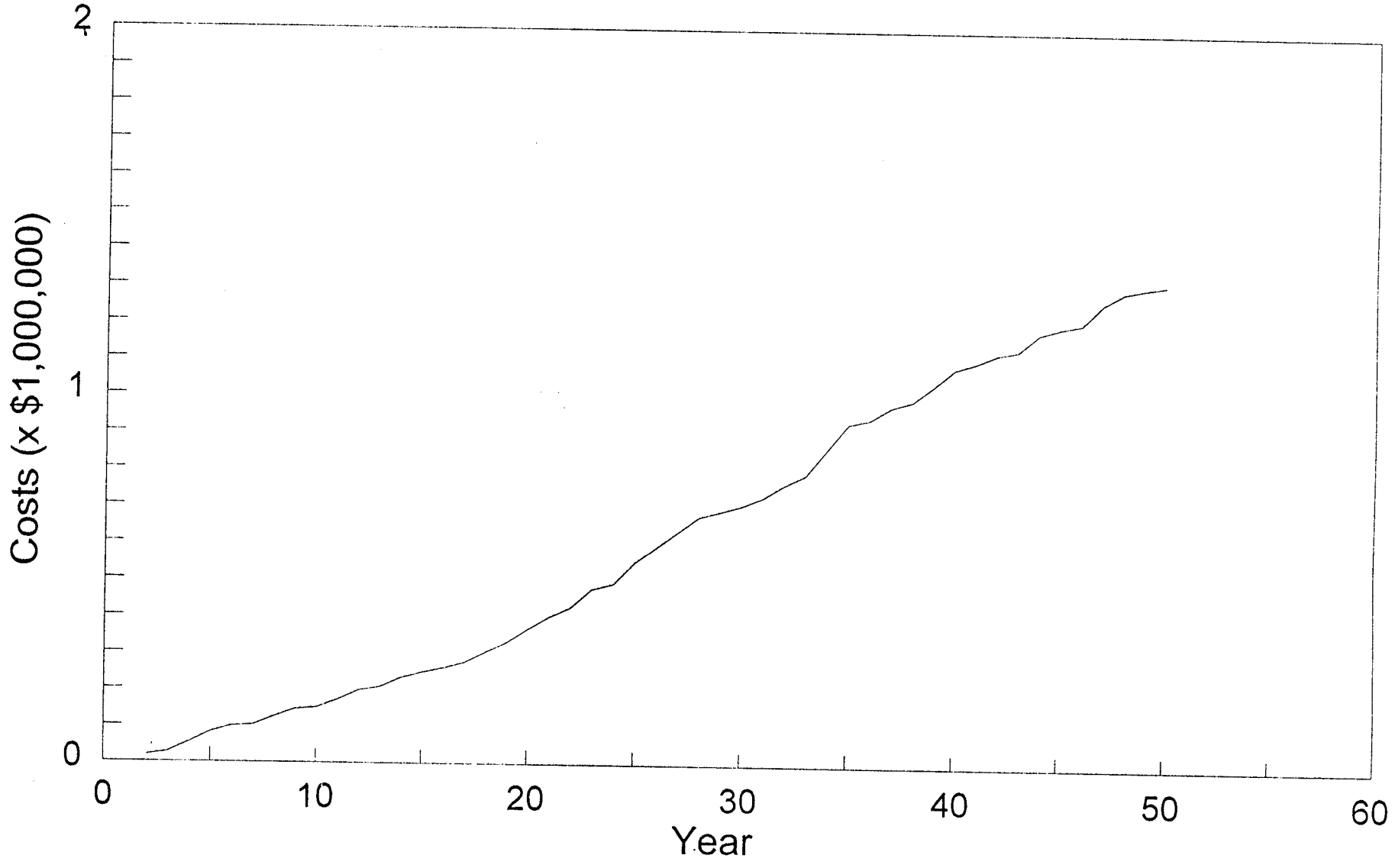
Cumulative Repair Costs (LSAF)

Base Condition



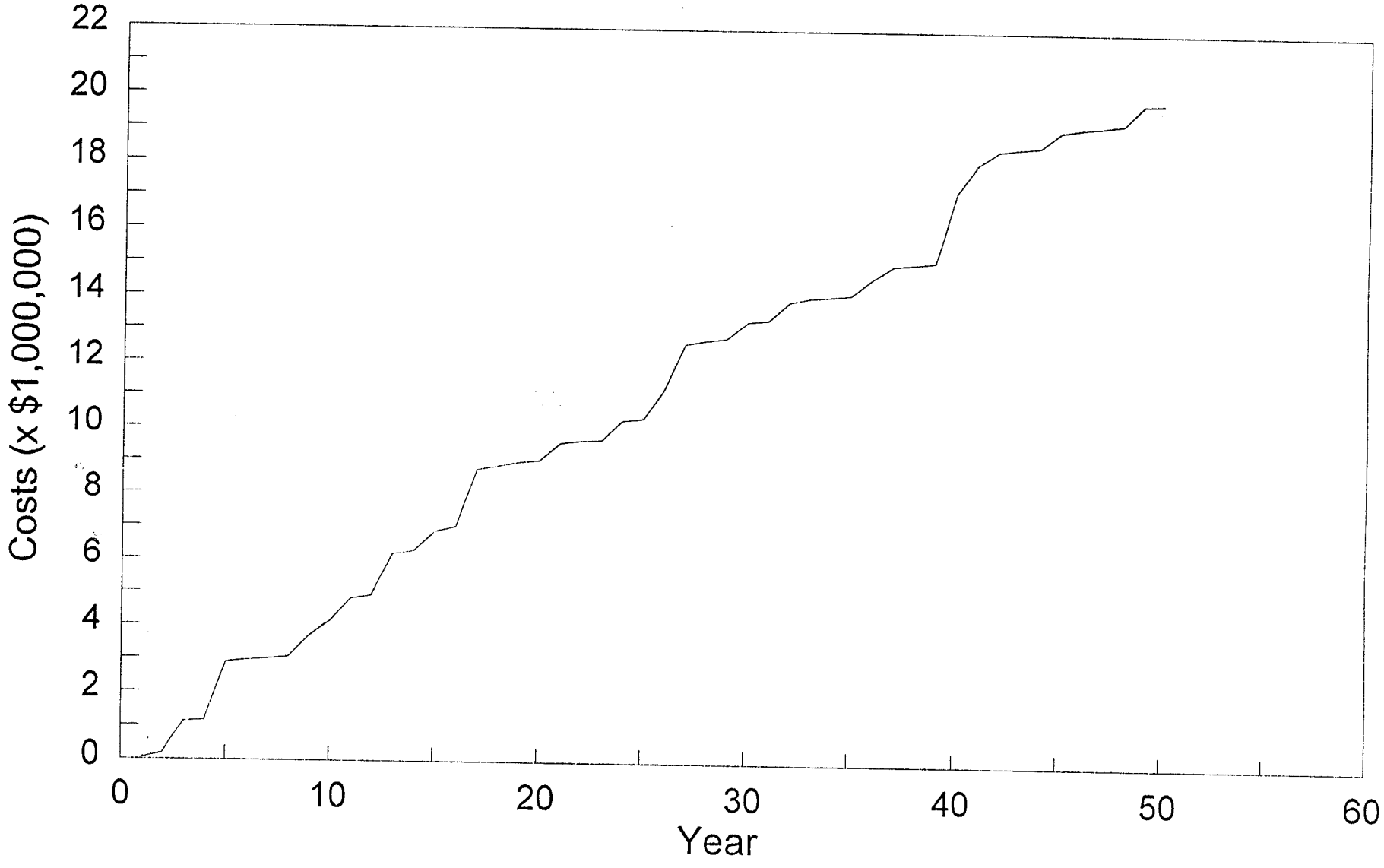
Cumulative Repair Costs (Lock 1)

Base Condition



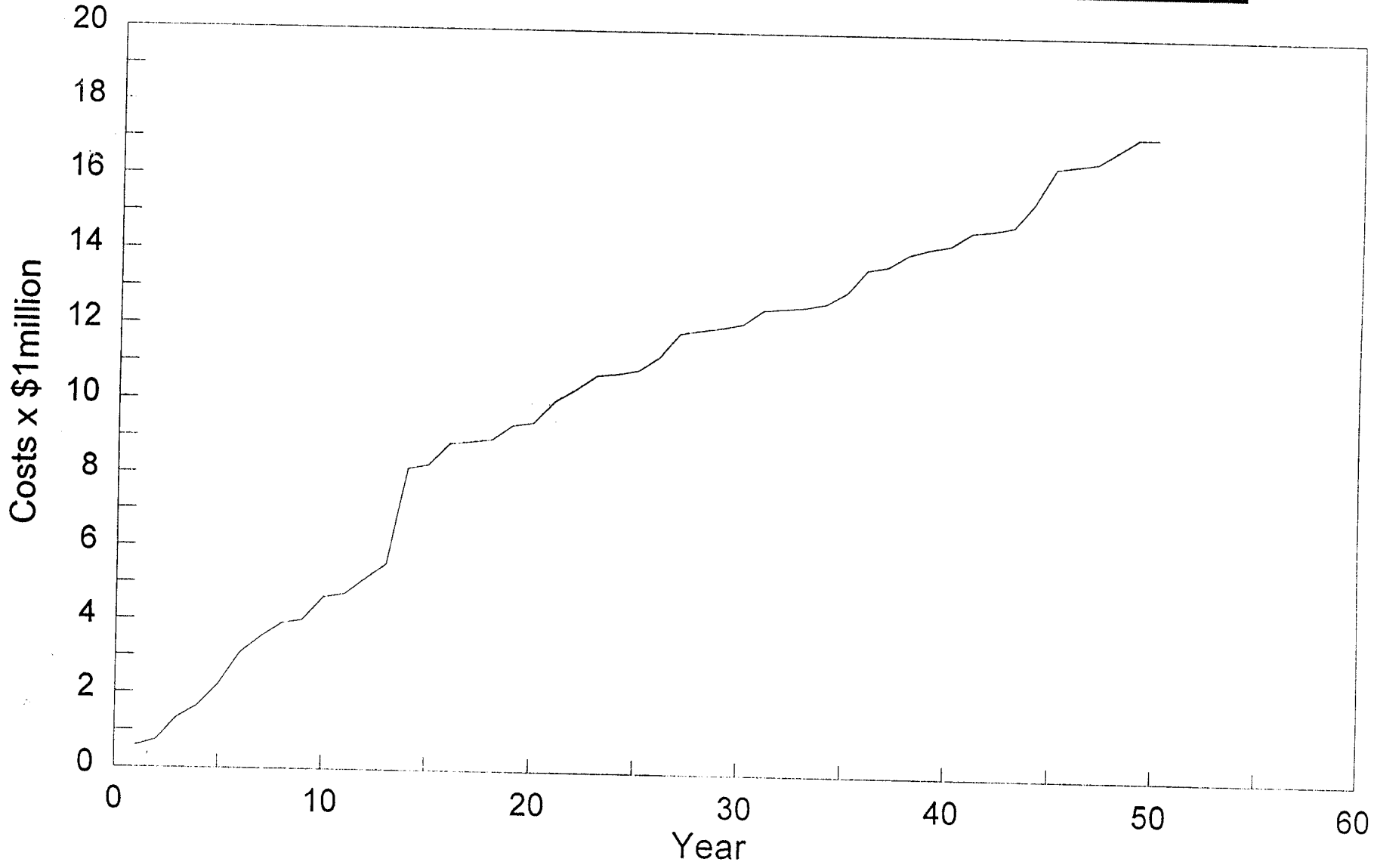
Cumulative Repair Costs (Lock 2)

Base Condition



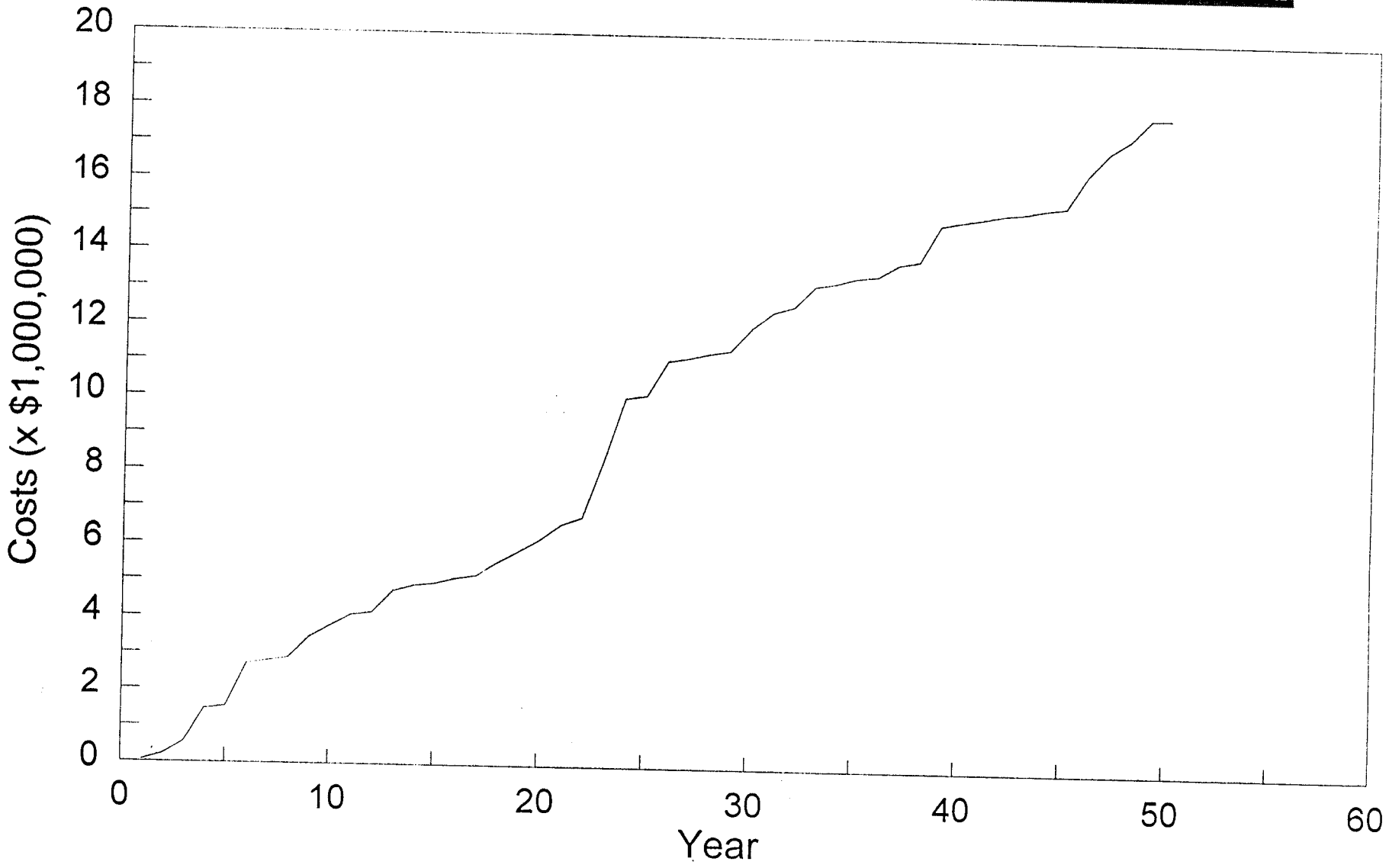
Cumulative Repair Costs (Lock 3)

Base Condition



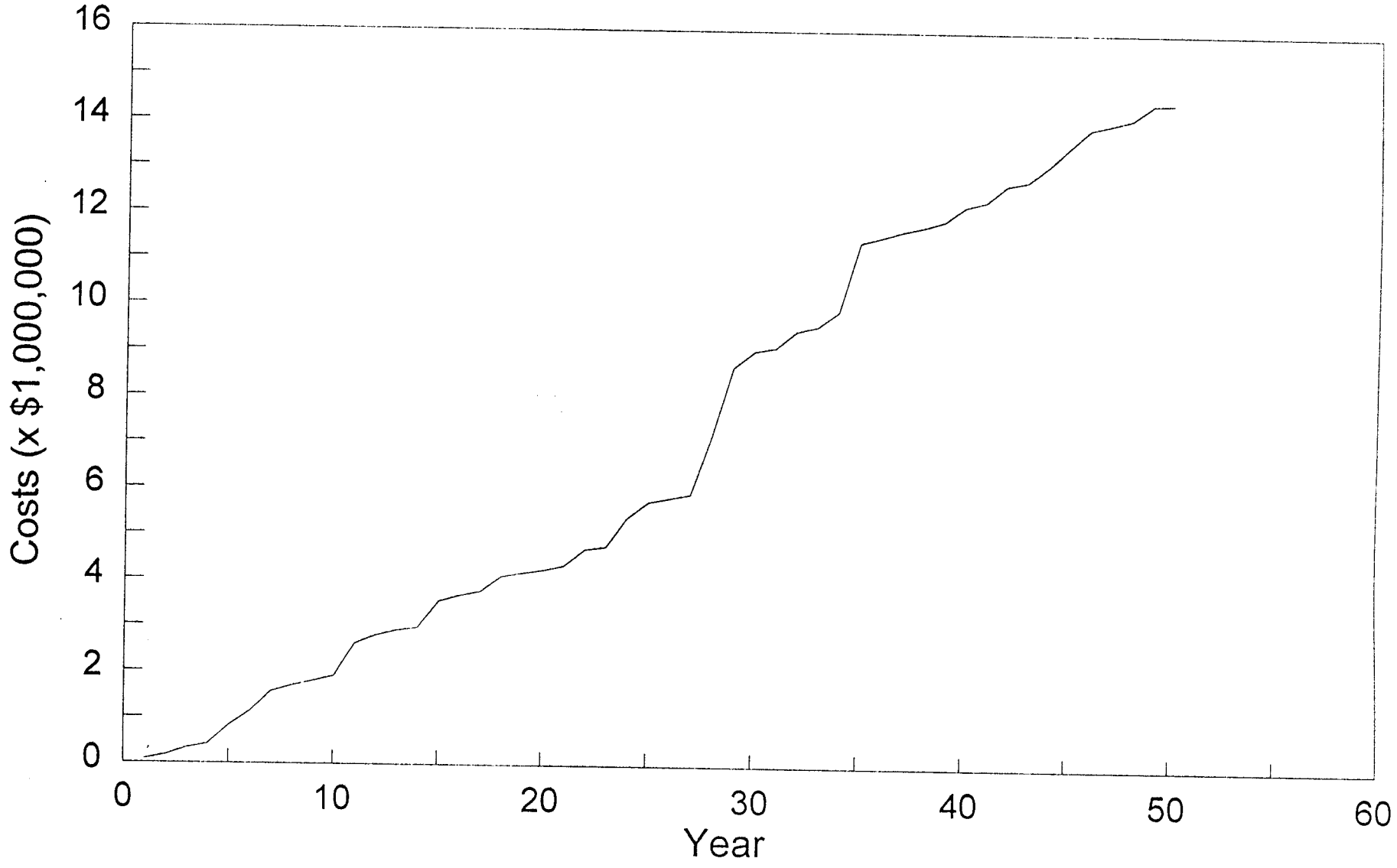
Cumulative Repair Costs (Lock 4)

Base Condition



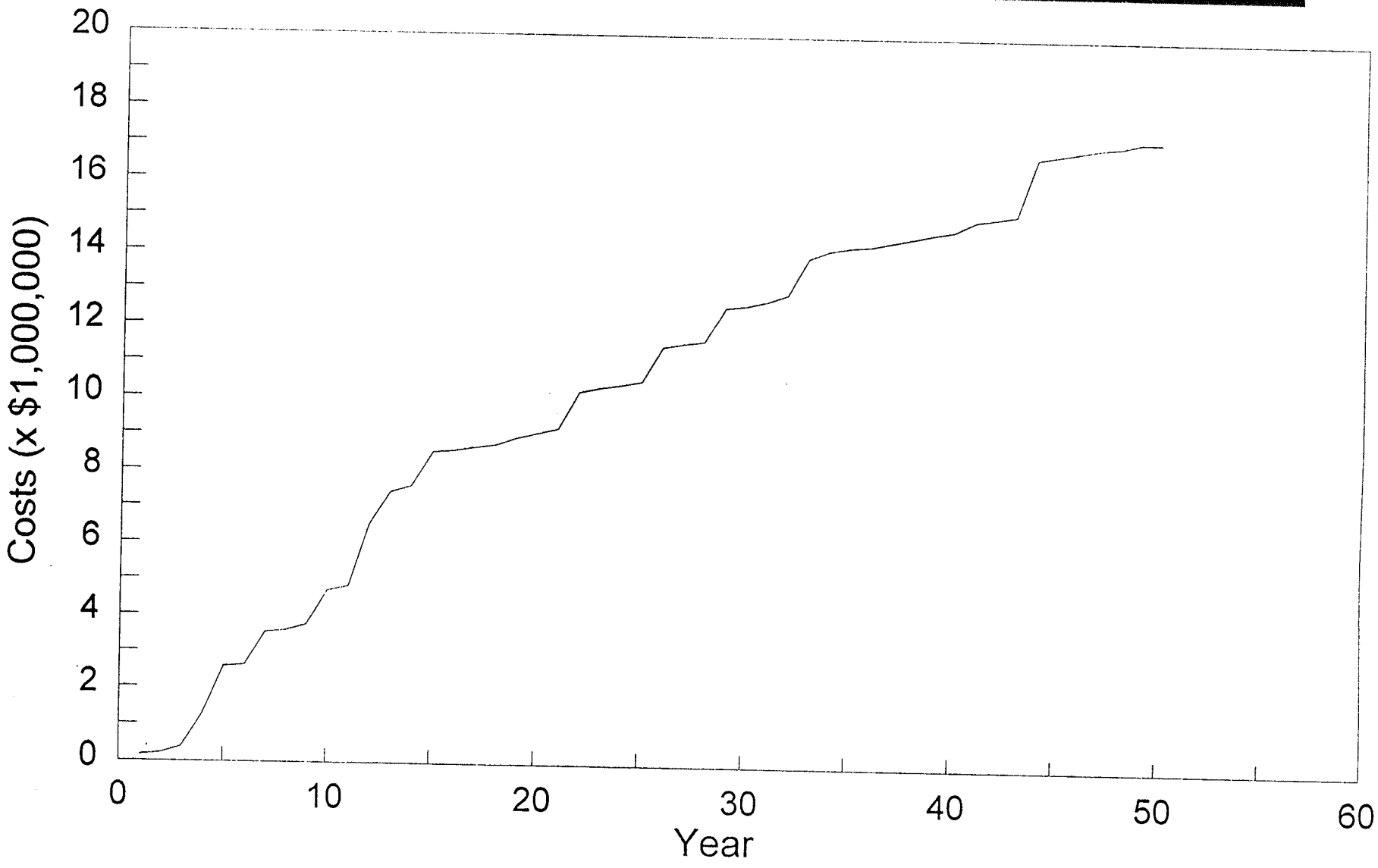
Cumulative Repair Costs (Lock 5)

Base Condition



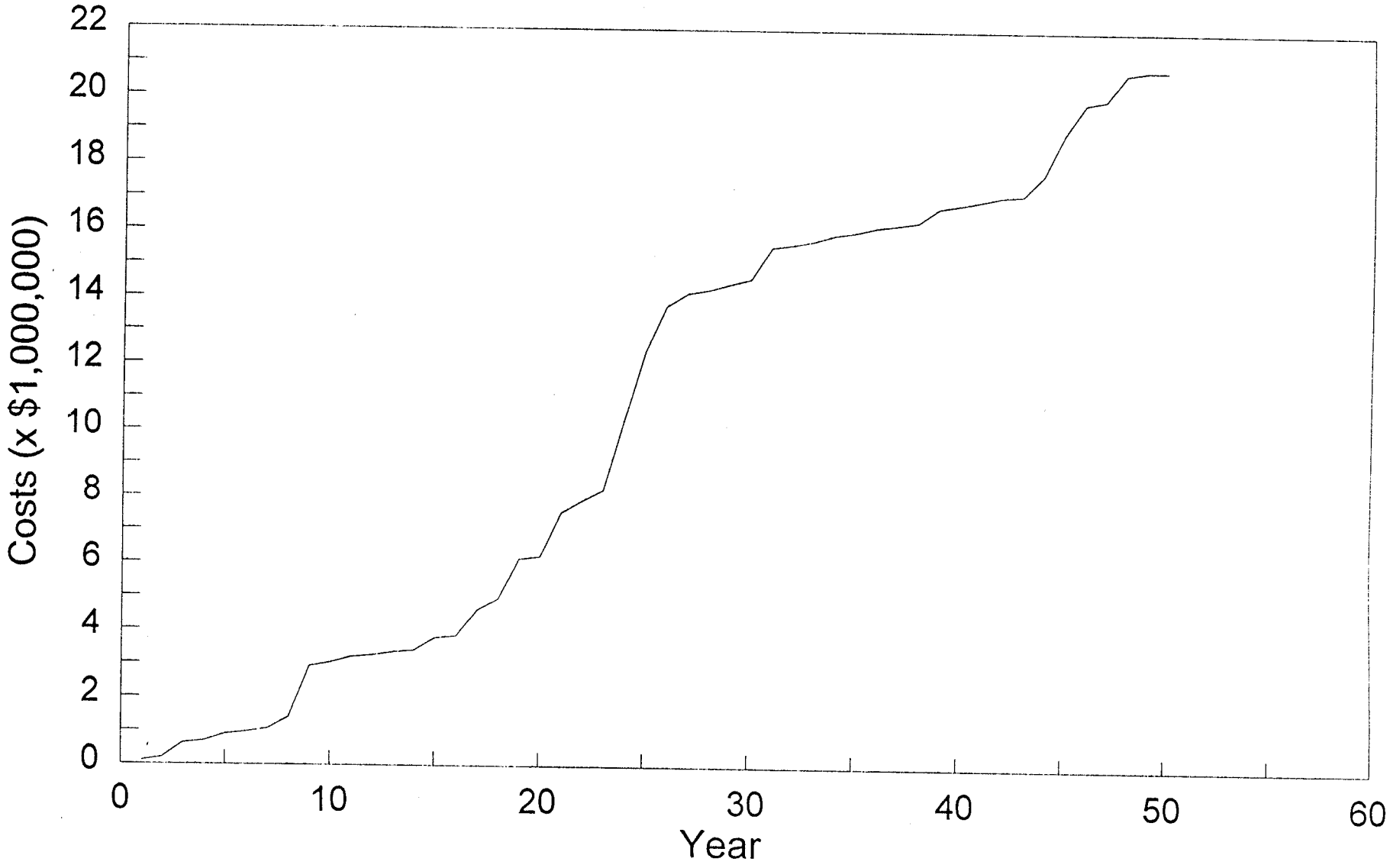
Cumulative Repair Costs (Lock 5A)

Base Condition



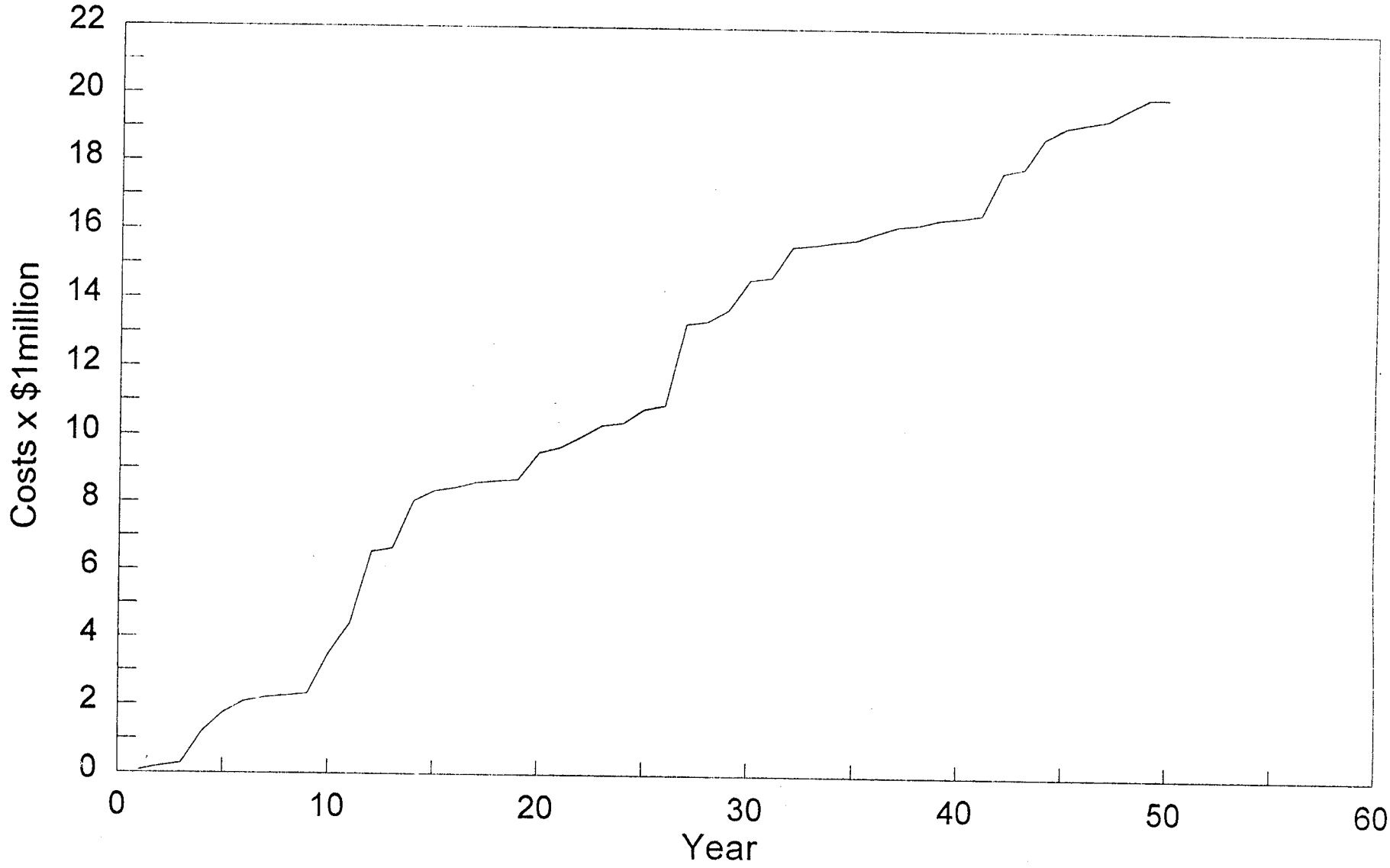
Cumulative Repair Costs (Lock 6)

Base Condition



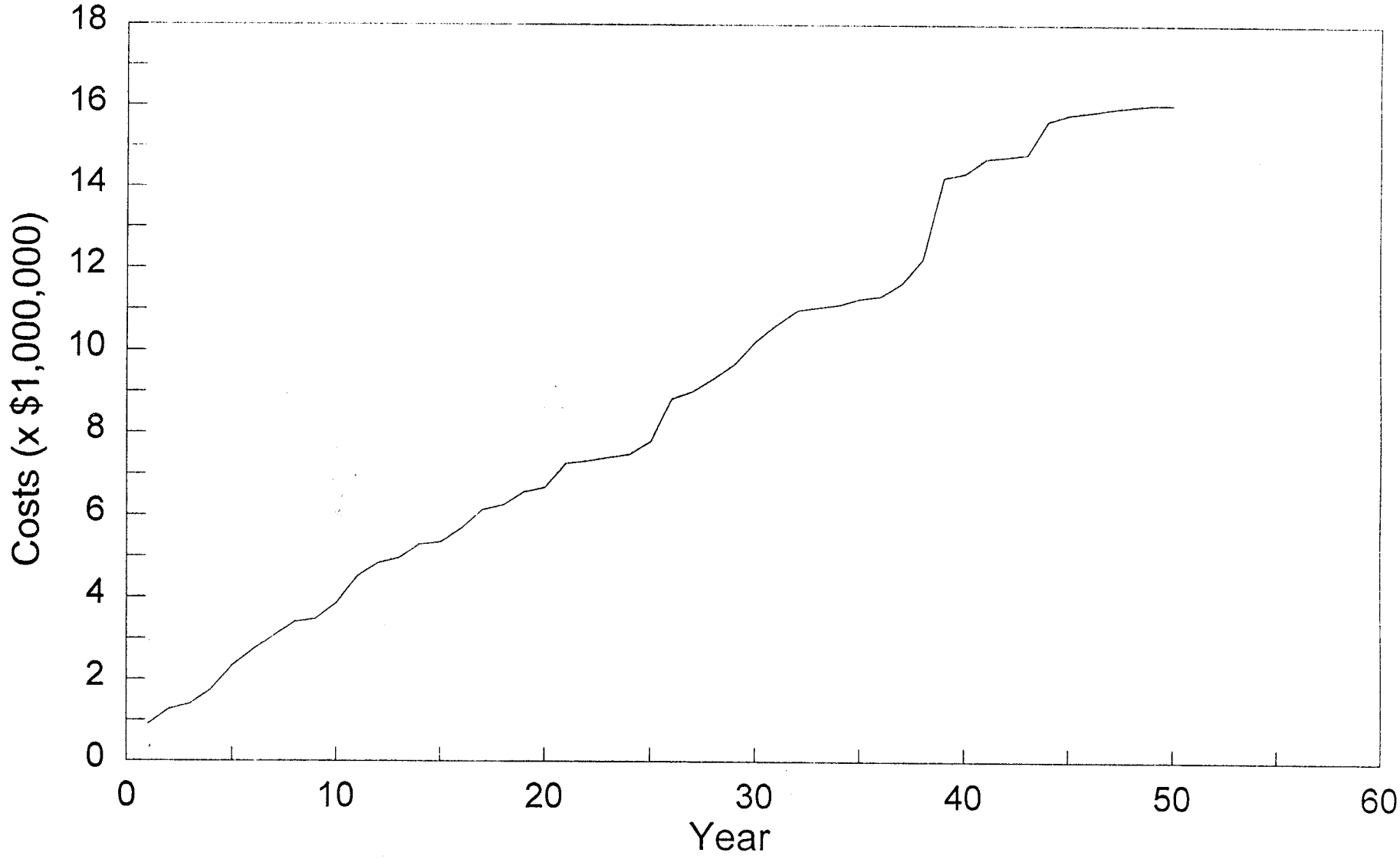
Cumulative Repair Costs (Lock 7)

Base Condition



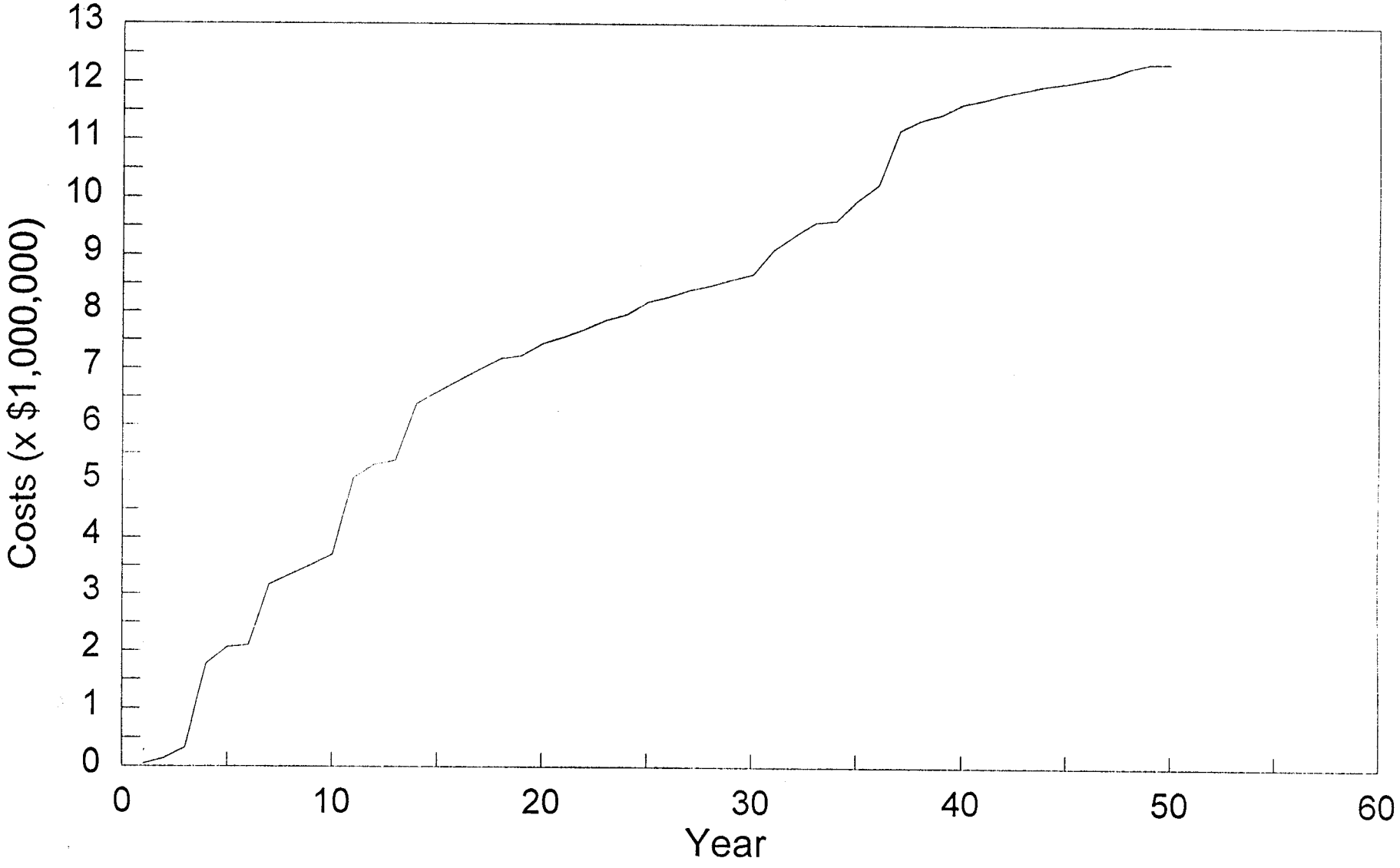
Cumulative Repair Costs (Lock 8)

Base Condition



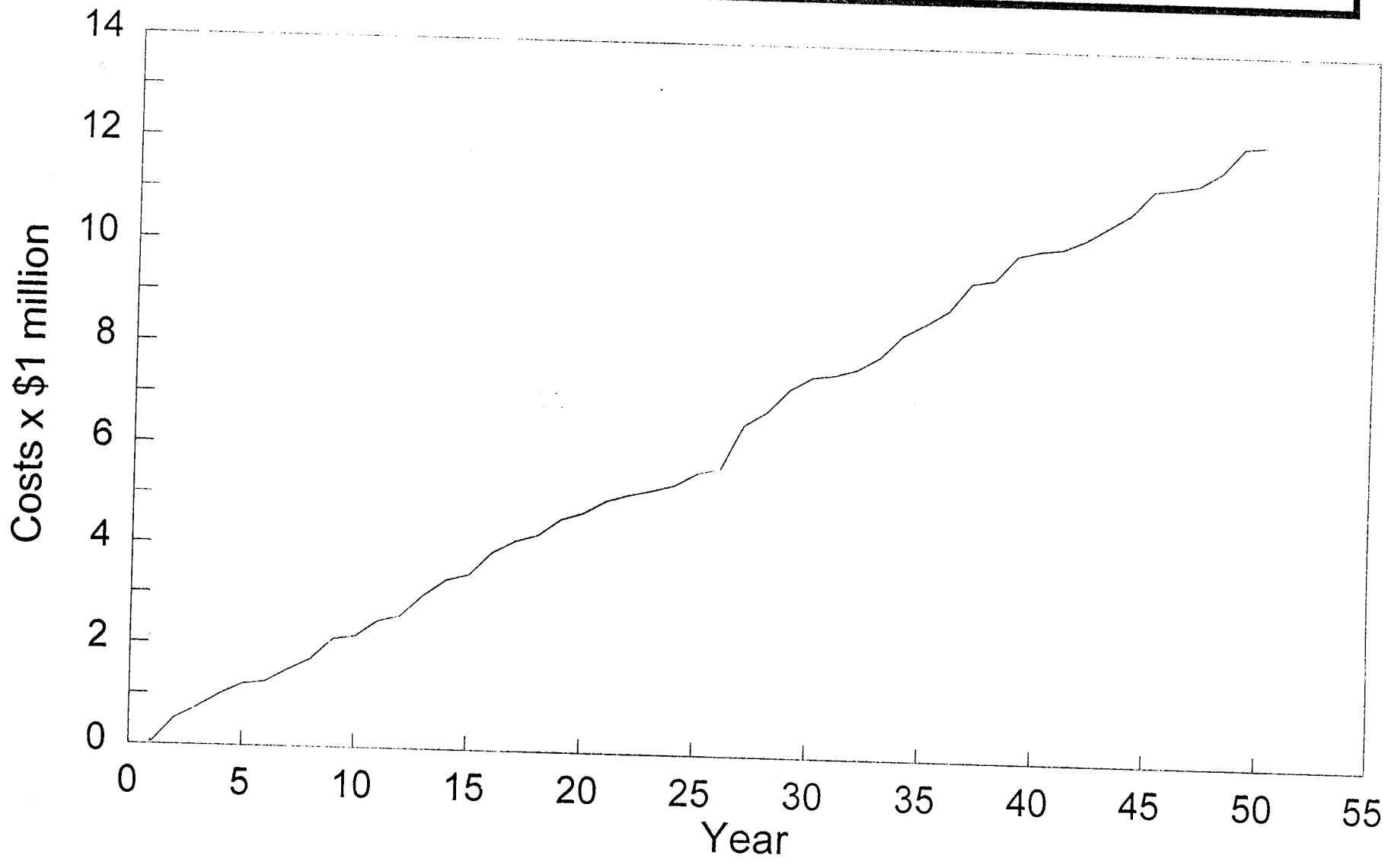
Cumulative Repair Costs (Lock 9)

Base Condition

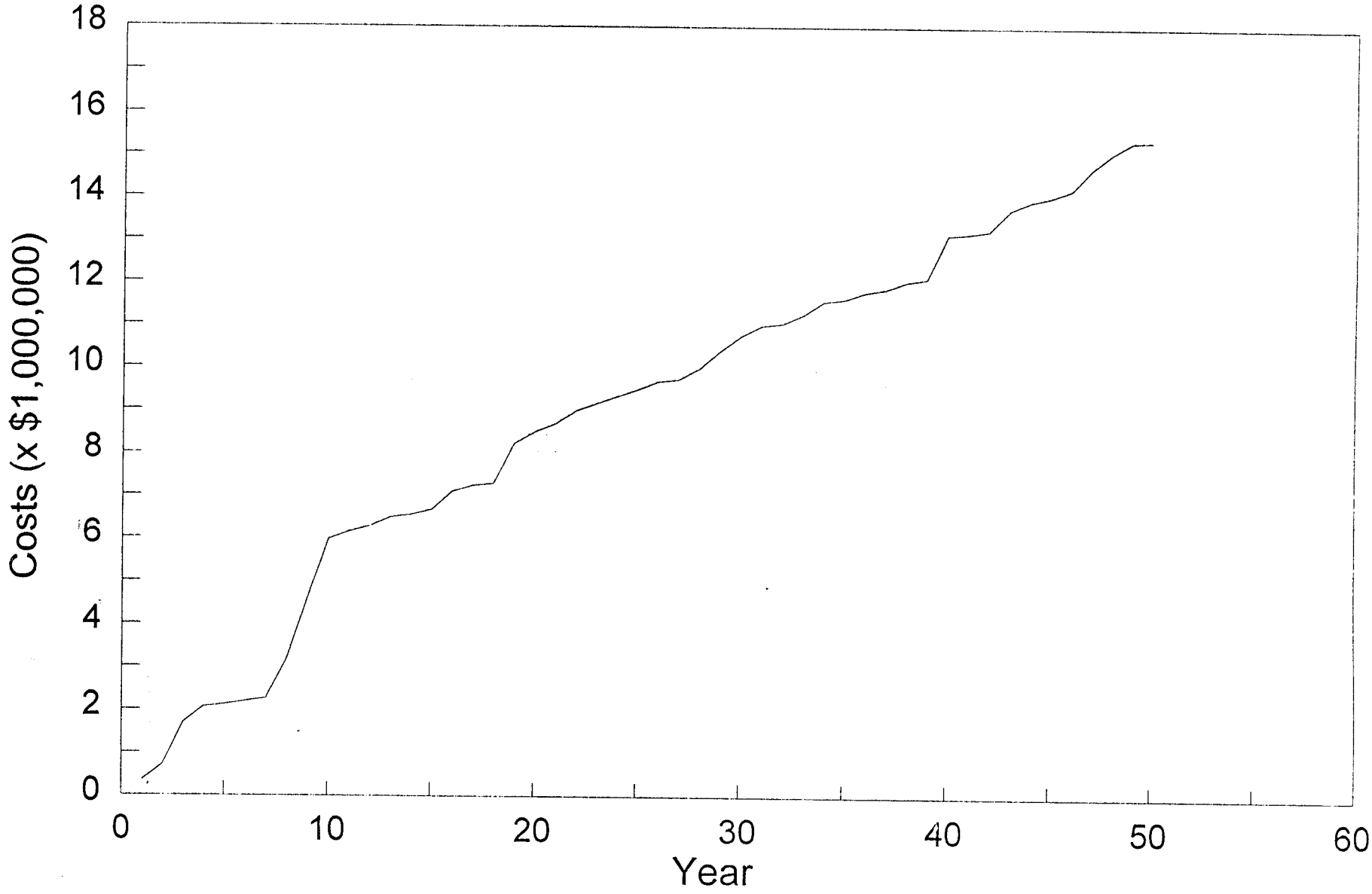


Cumulative Repair Costs (Lock 10)

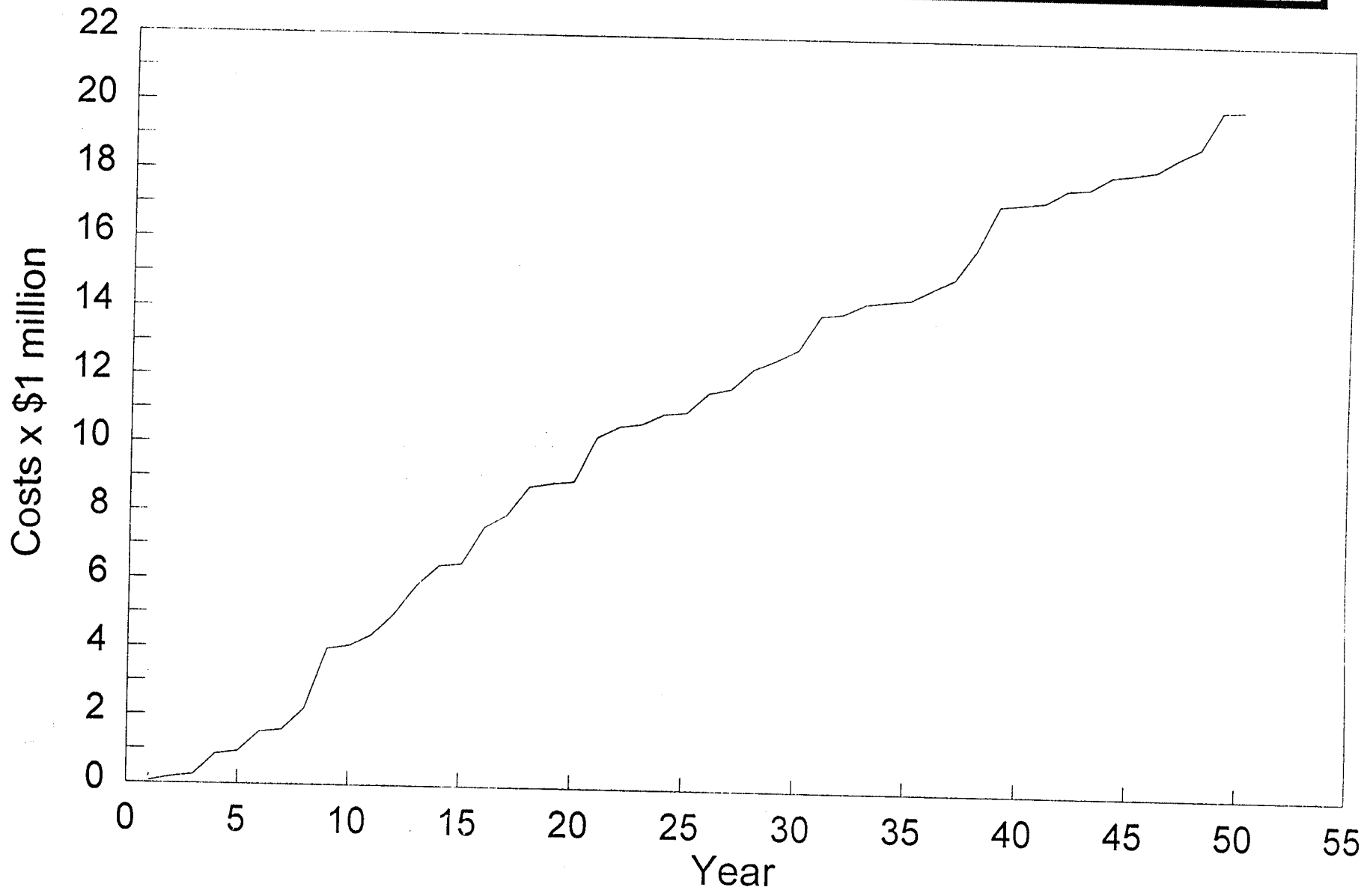
Base Condition



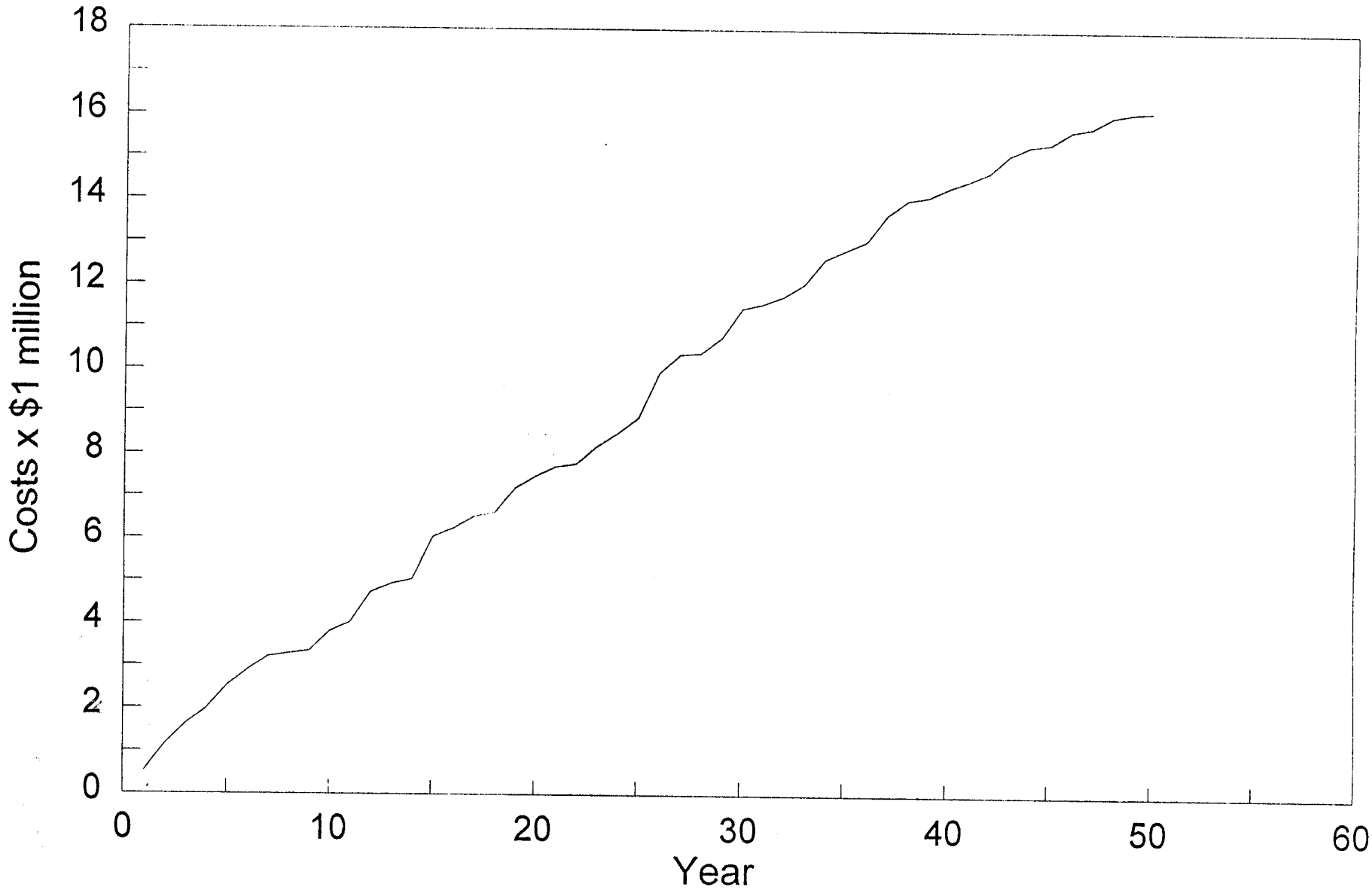
Cumulative Repair Costs (Lock 11)



Cumulative Repair Costs (Lock 12)

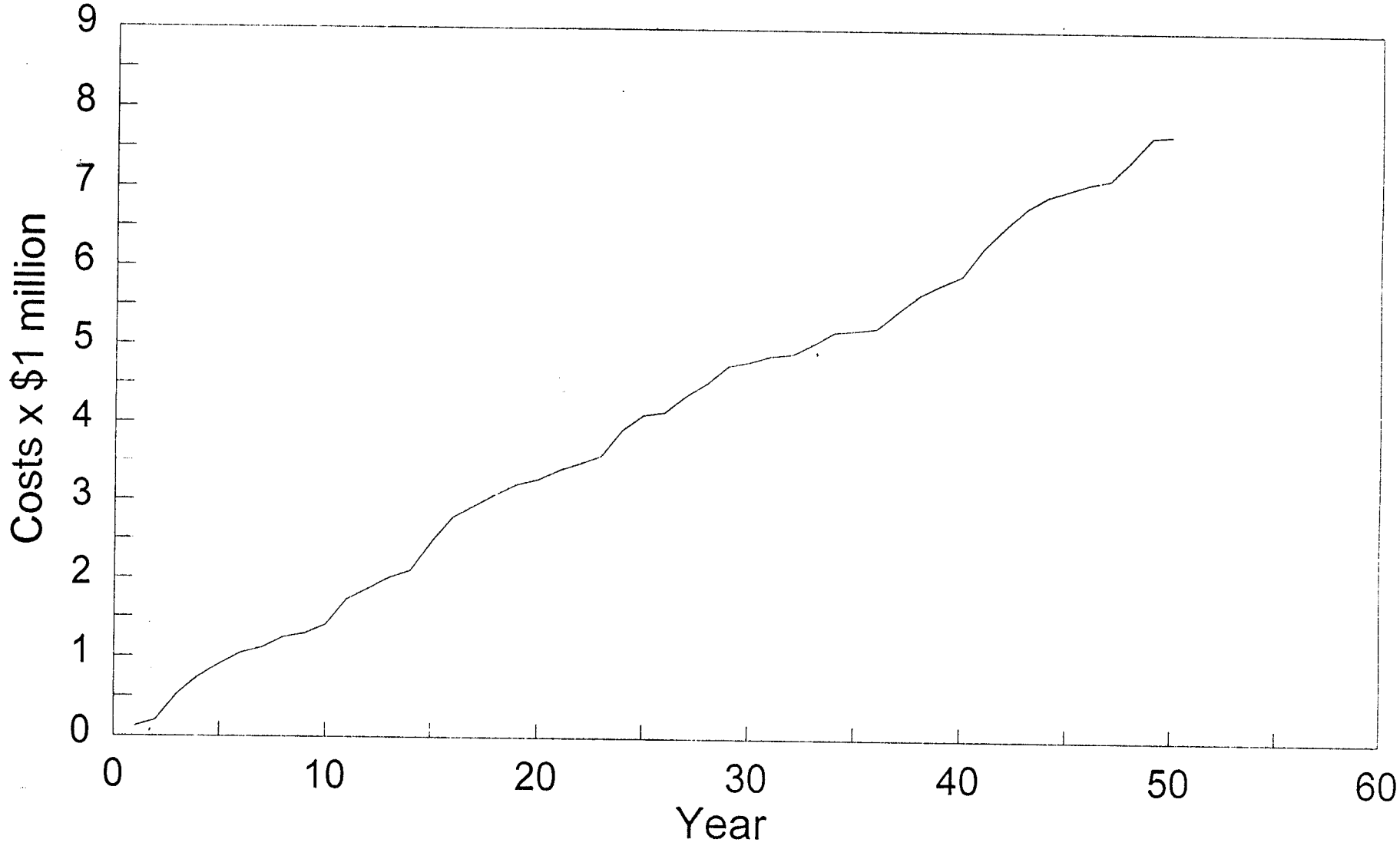


Cumulative Repair Costs (Lock 13)



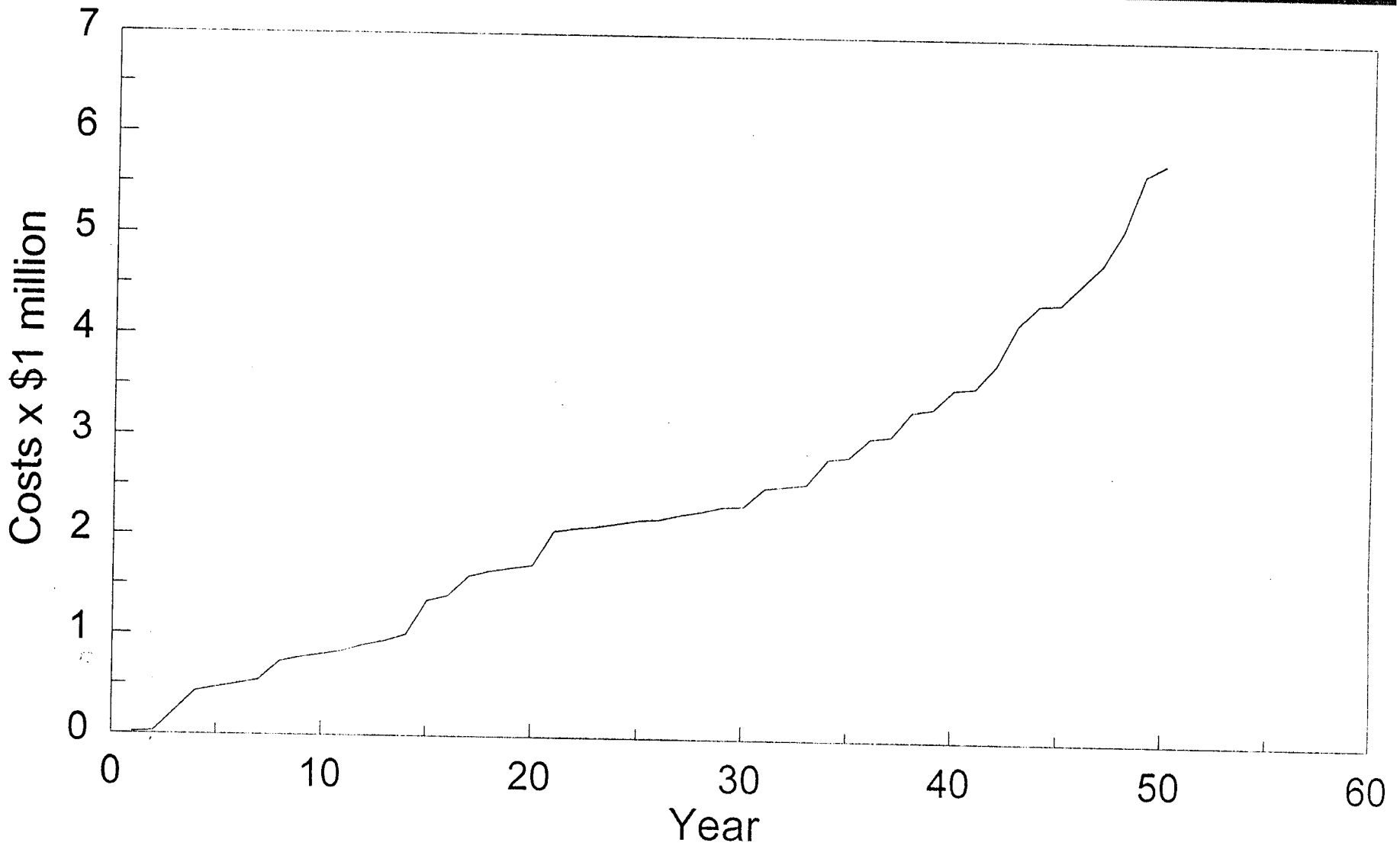
Cumulative Repair Costs (Lock 14)

Base Condition



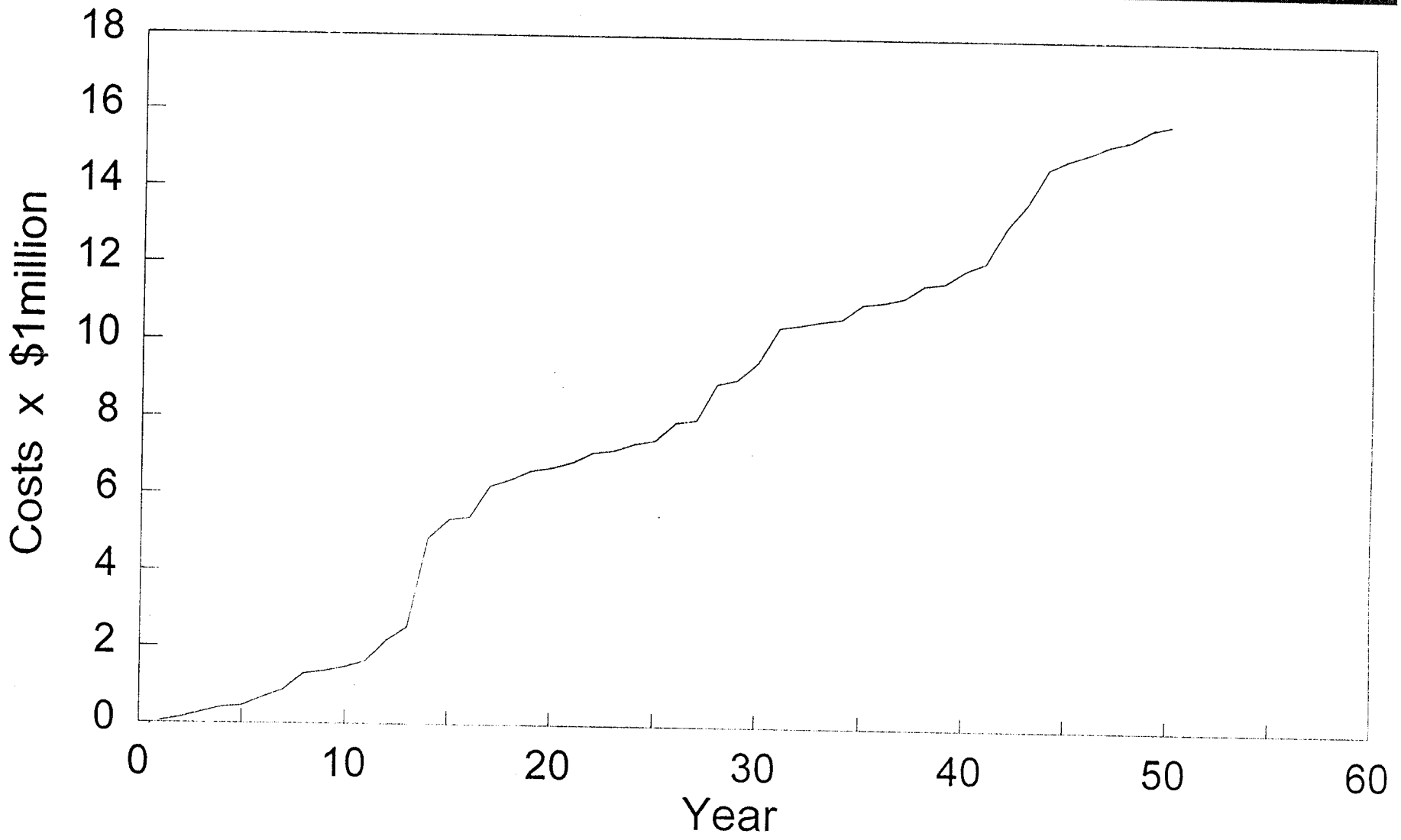
Cumulative Repair Costs (Lock 15)

Base Condition



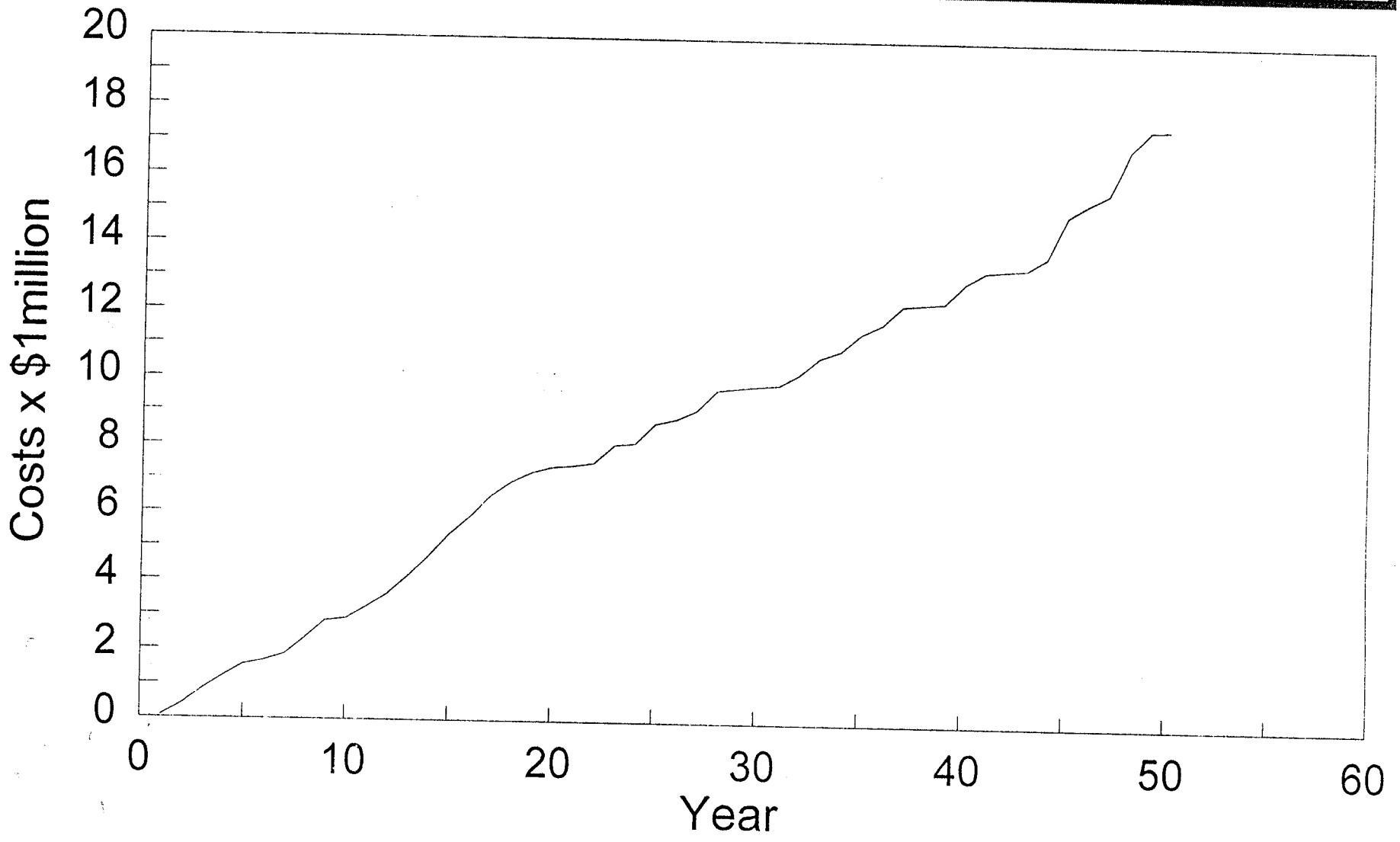
Cumulative Repair Costs (Lock 16)

Base Condition



Cumulative Repair Costs (Lock 17)

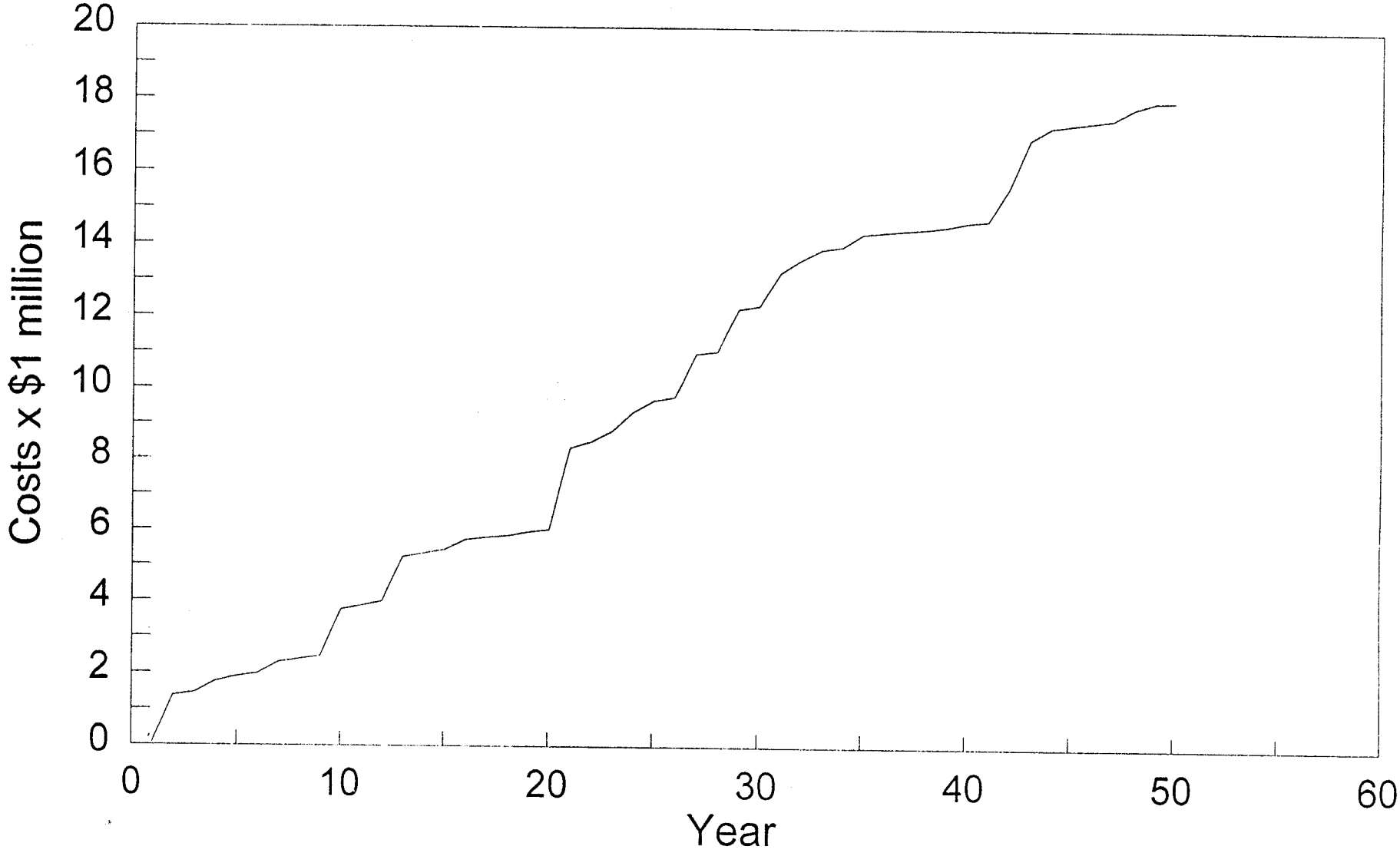
Base Condition



A-37

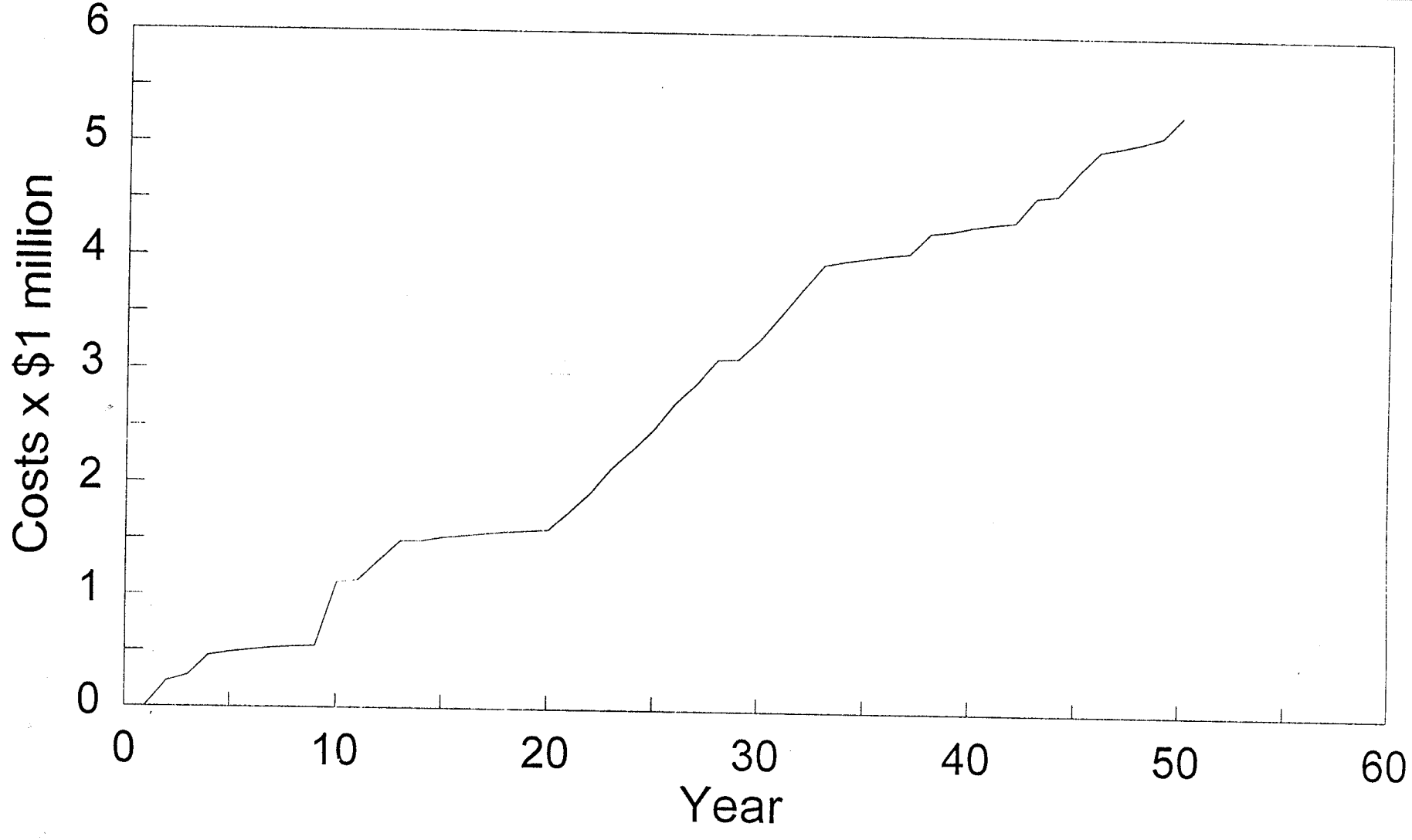
Cumulative Repair Costs (Lock 18)

Base Condition



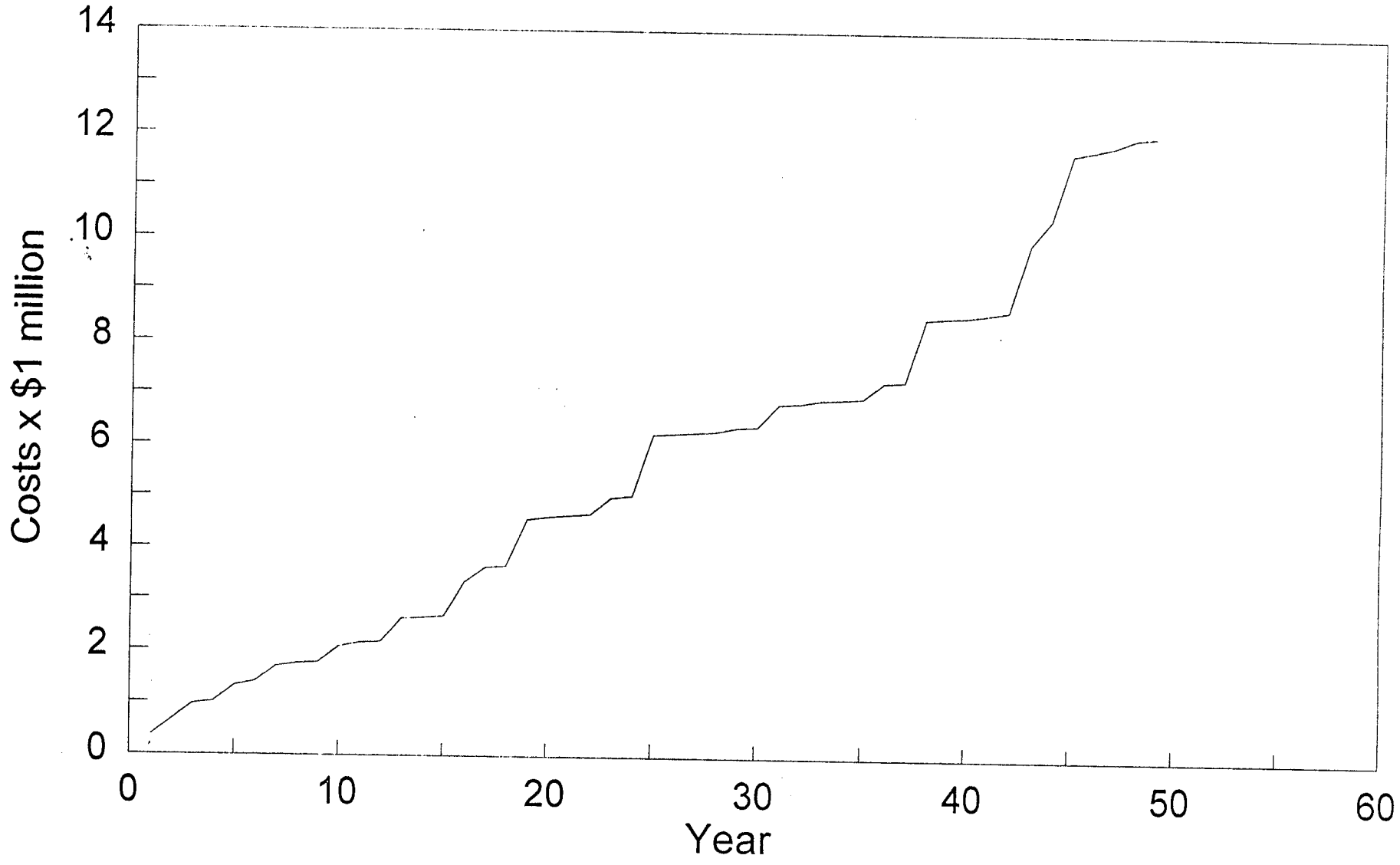
Cumulative Repair Costs (Lock 19)

Base Condition



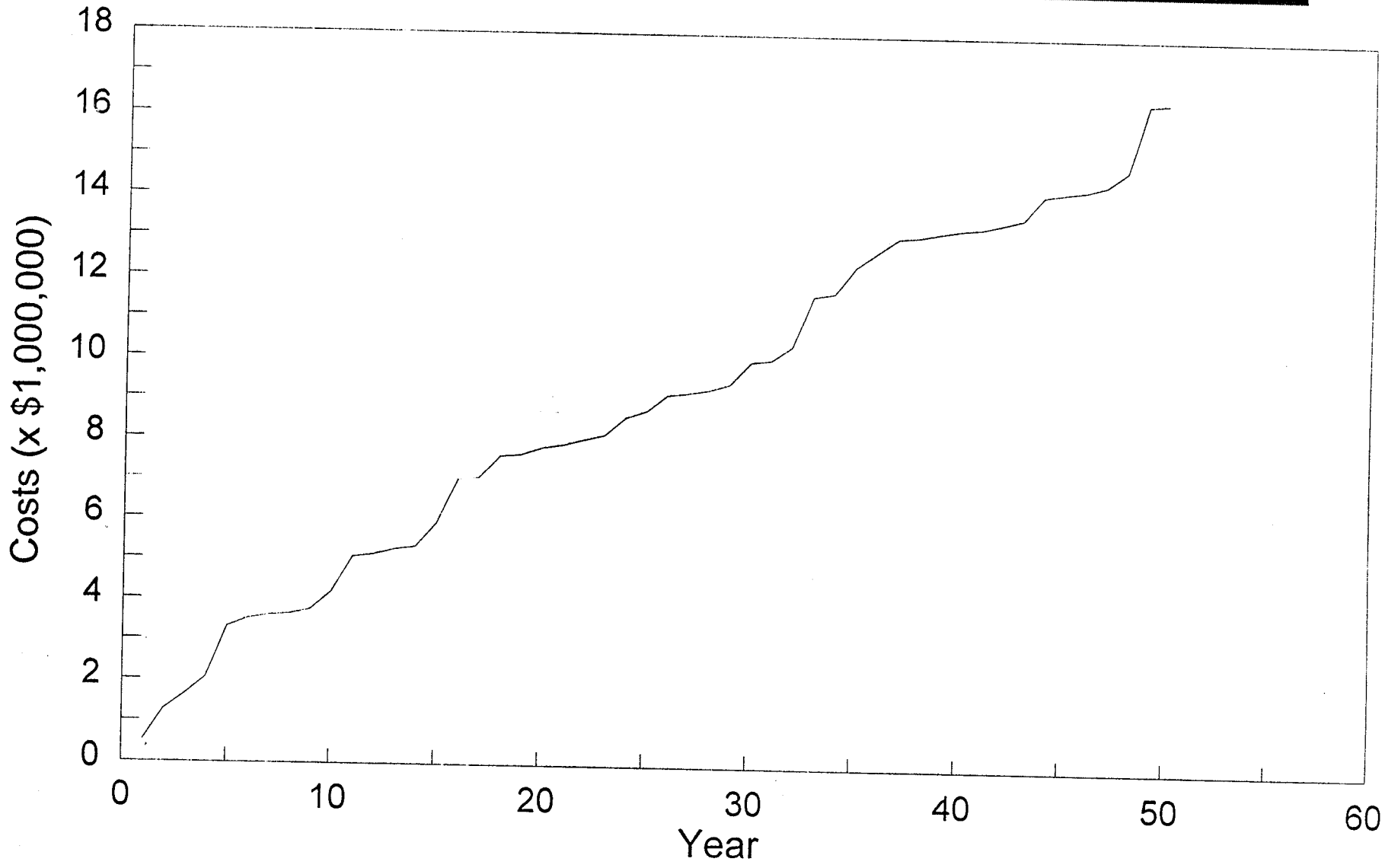
Cumulative Repair Costs (Lock 20)

Base Condition



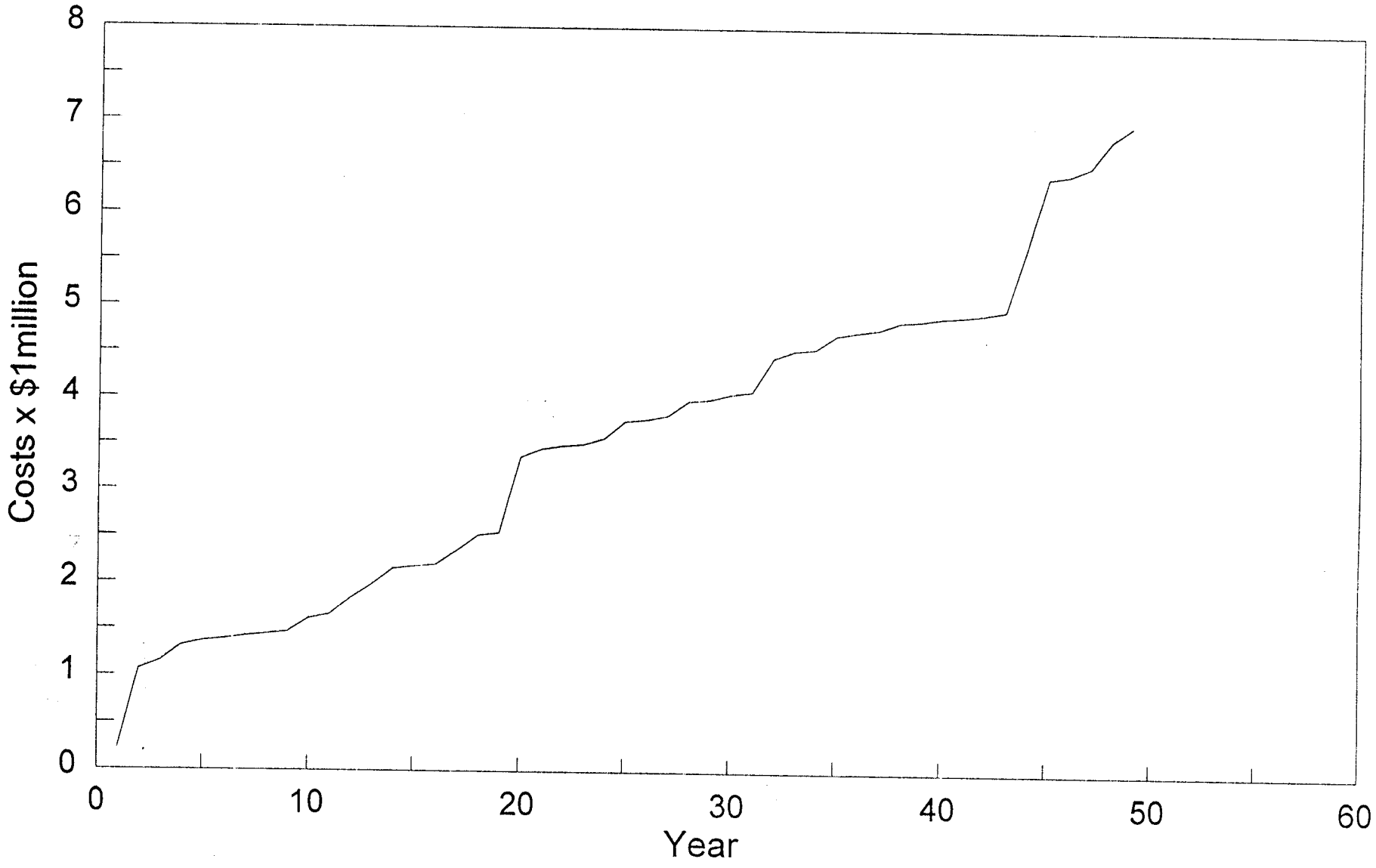
Cumulative Repair Costs (Lock 21)

Base Condition



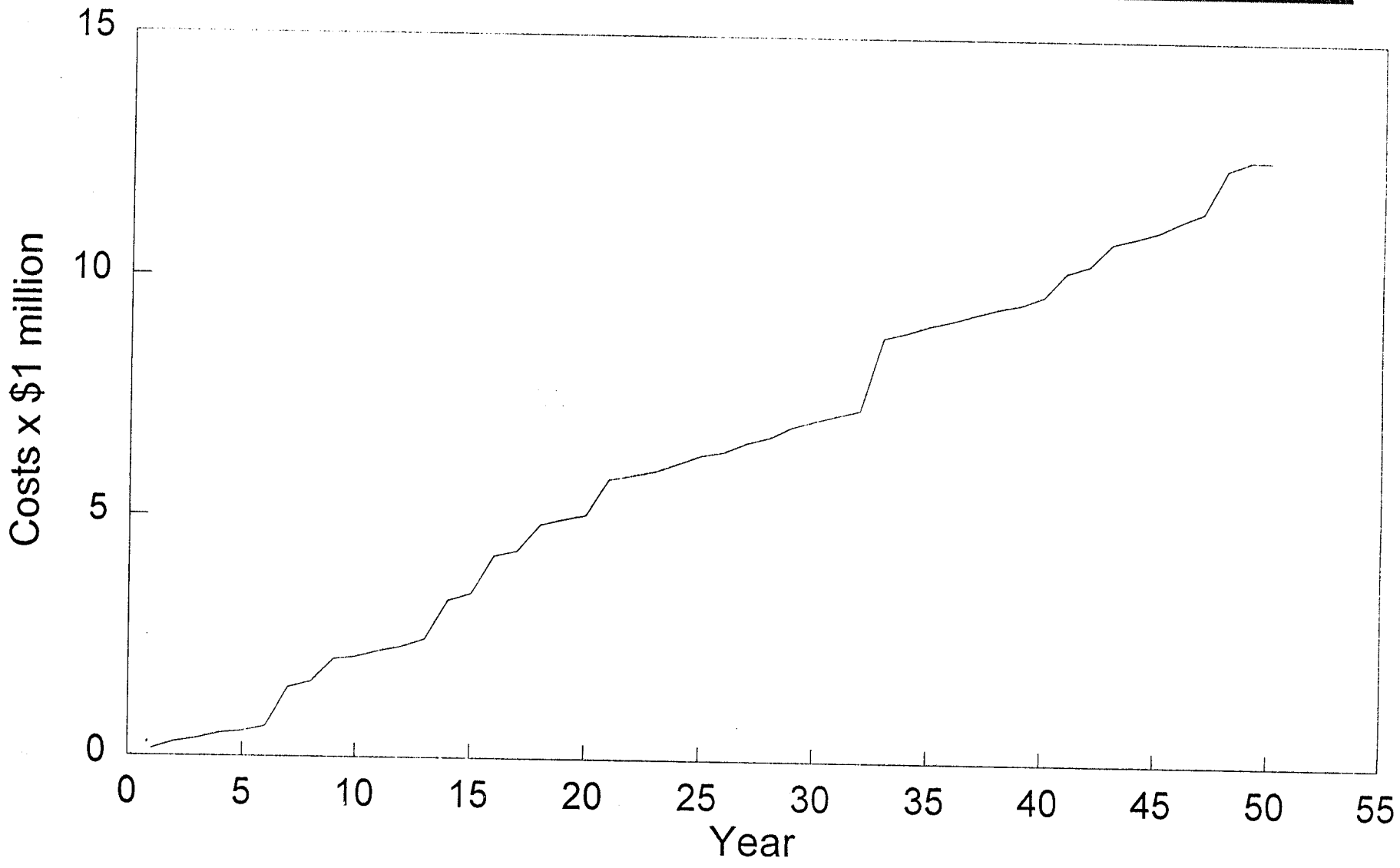
Cumulative Repair Costs (Lock 22)

Base Condition



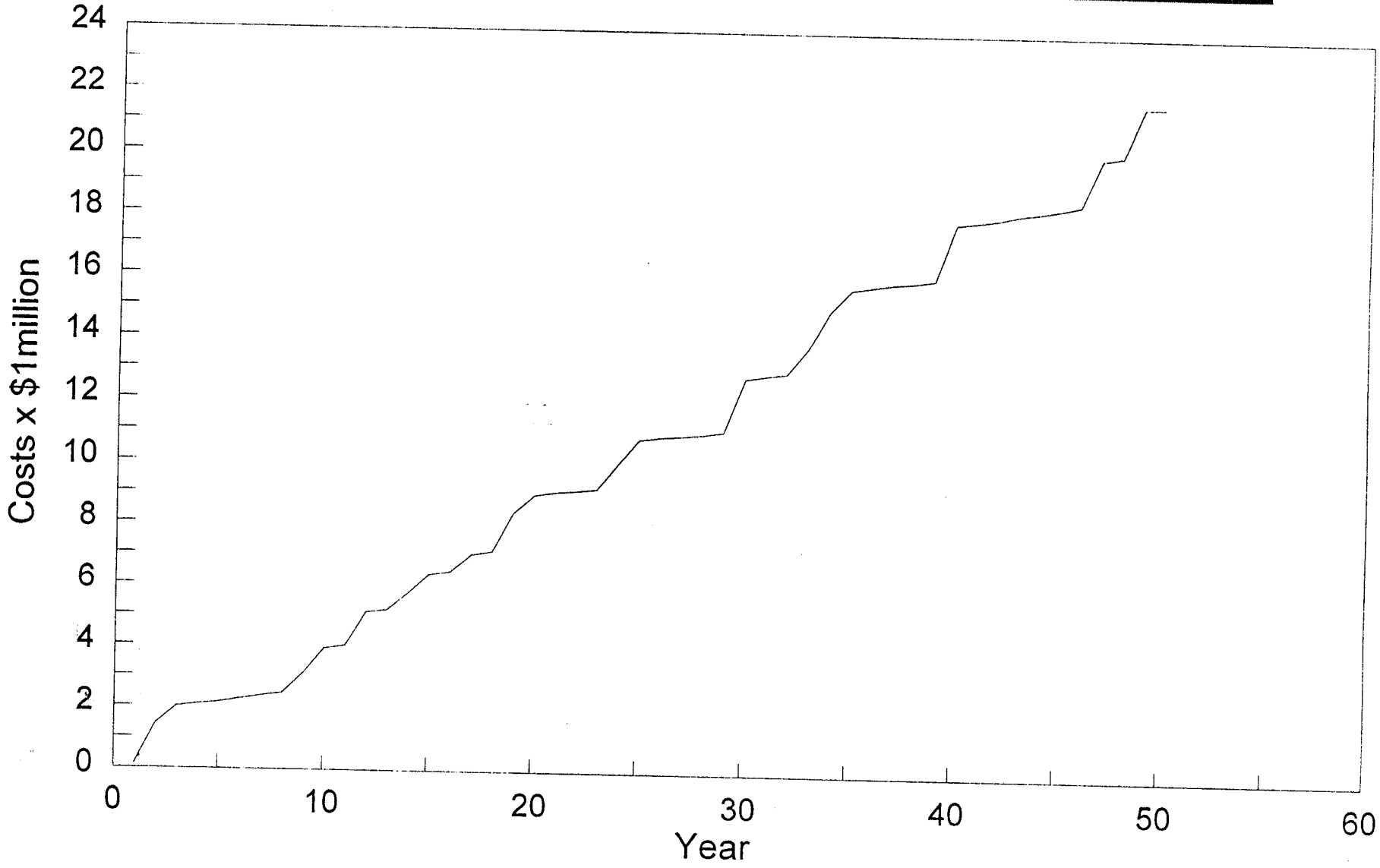
Cumulative Repair Costs (Lock 24)

Base Condition



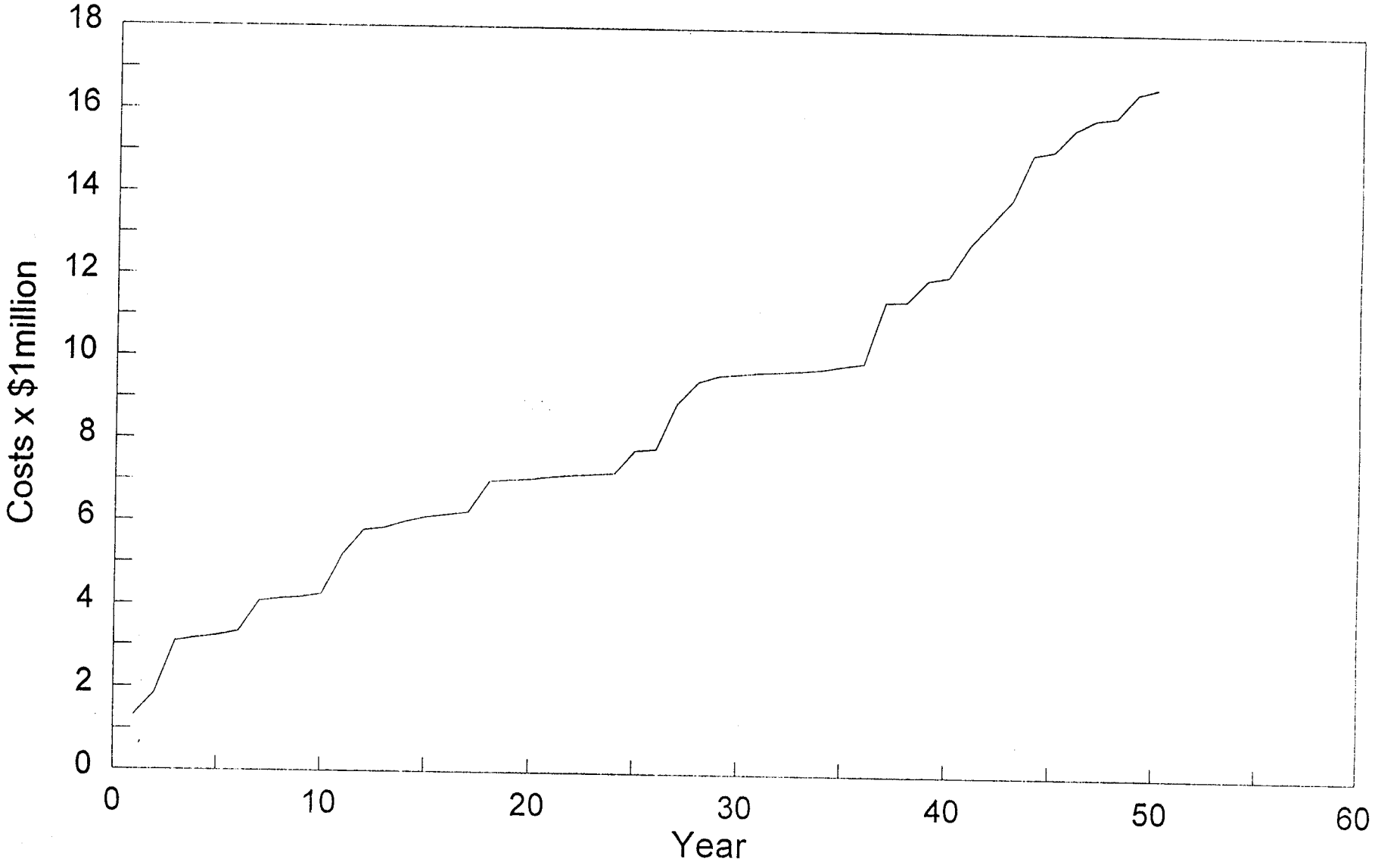
Cumulative Repair Costs (Lock 25)

Base Condition



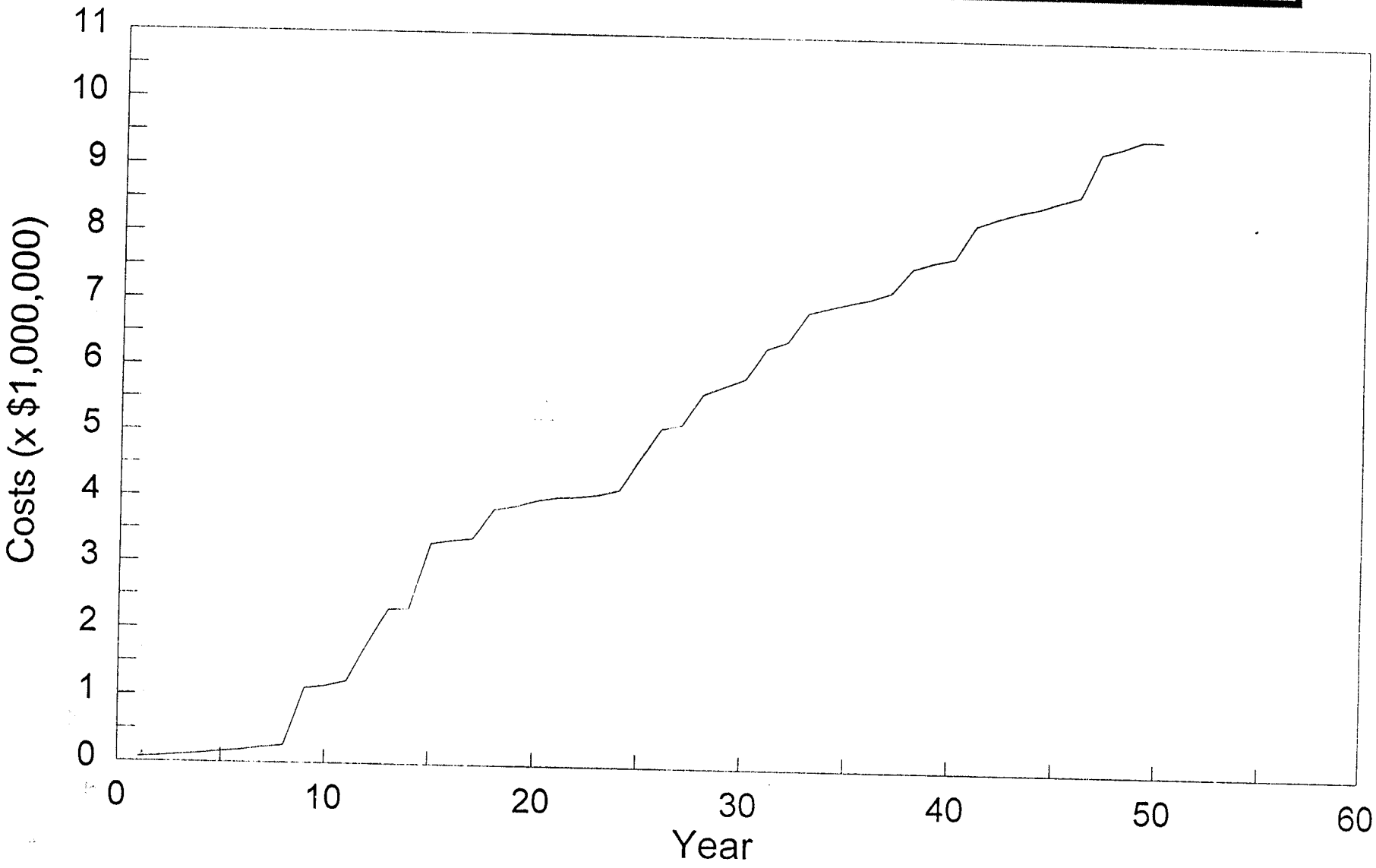
Cumulative Repair Costs (Mel Price Lock)

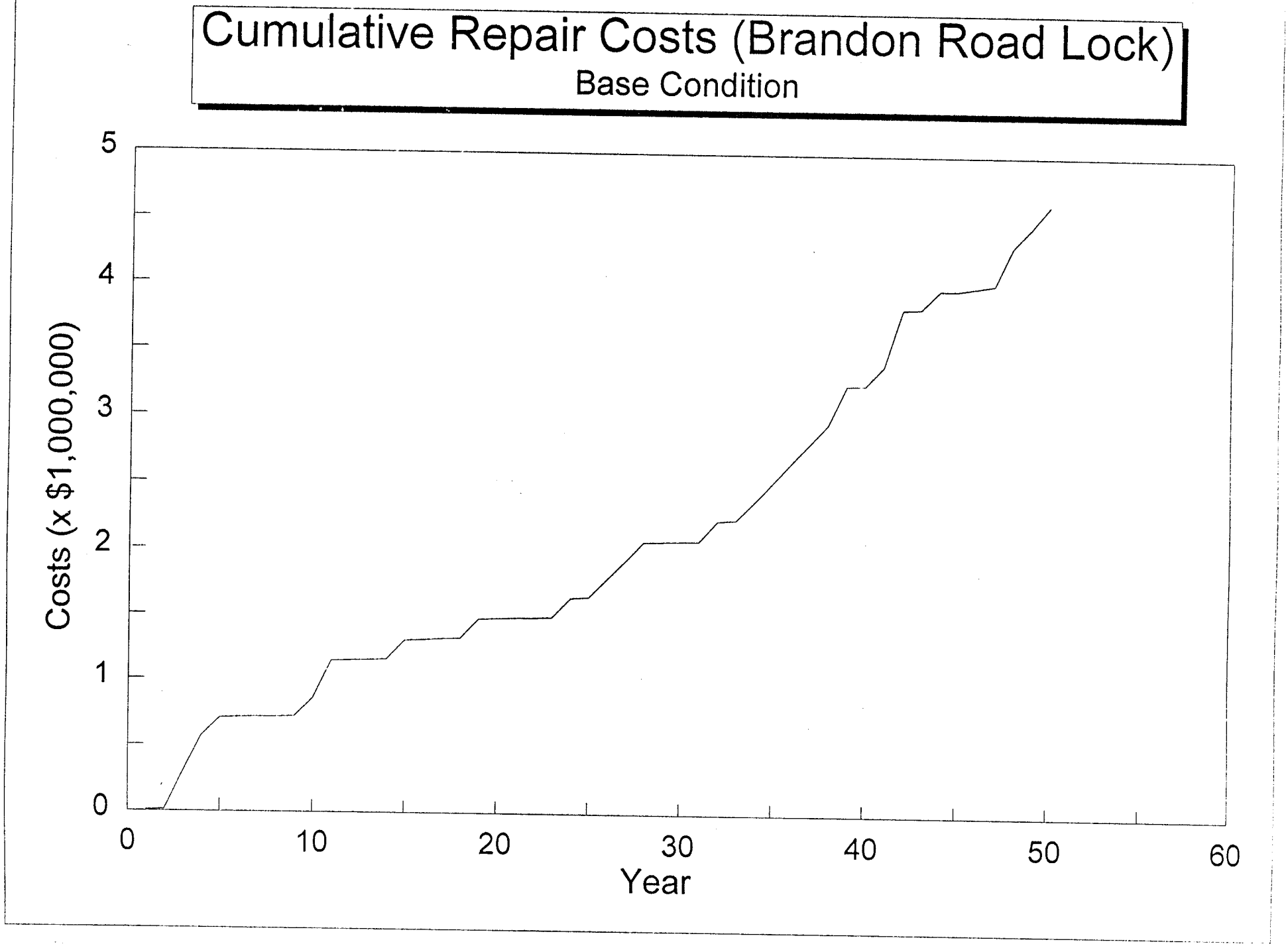
Base Condition



Cumulative Repair Costs (Lock 27)

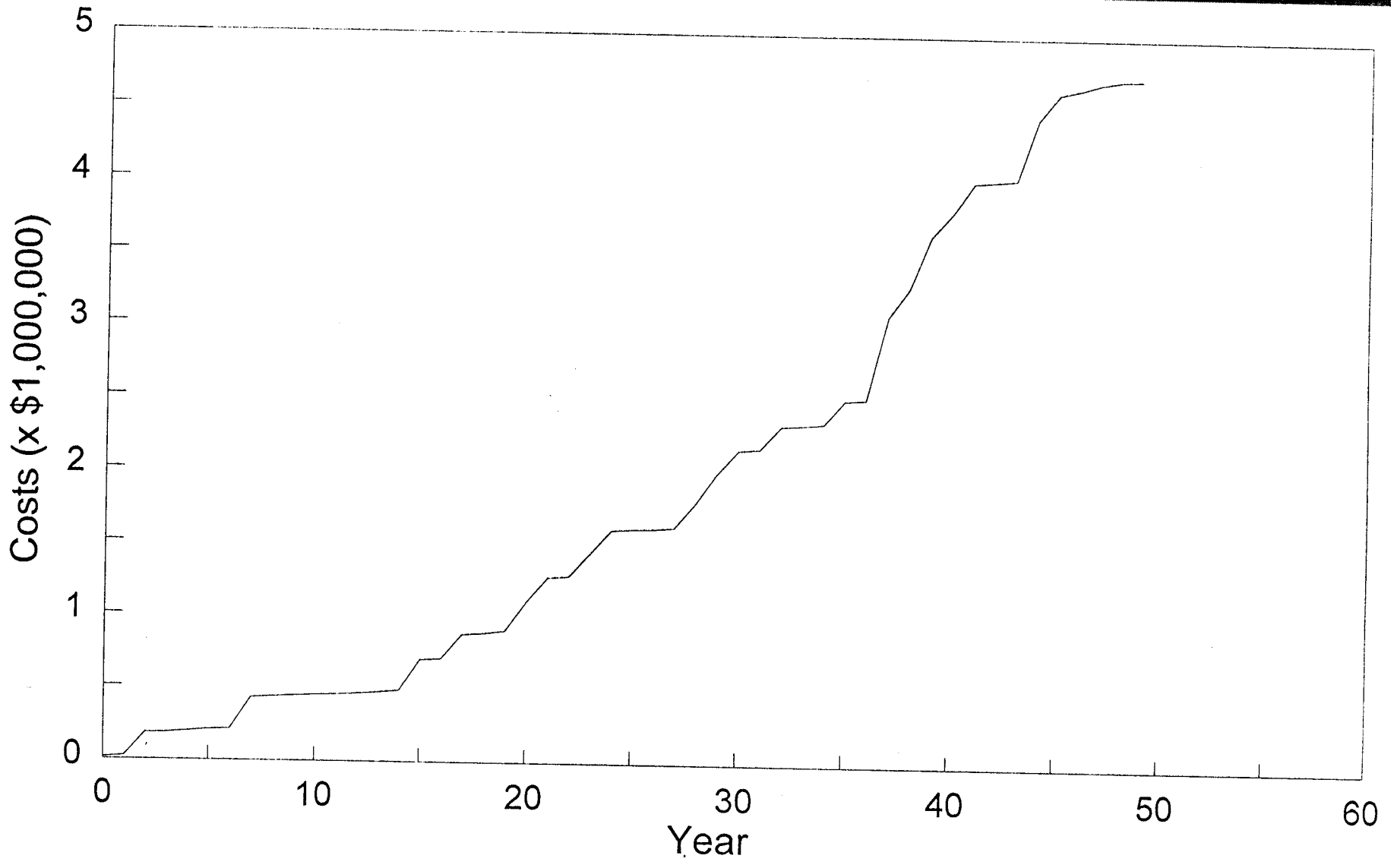
Base Condition




Cumulative Repair Costs (Brandon Road Lock)
Base Condition
Costs (x $1,000,000)
0
1
2
3
4
5
0
10
20
30
40
50
60
Year

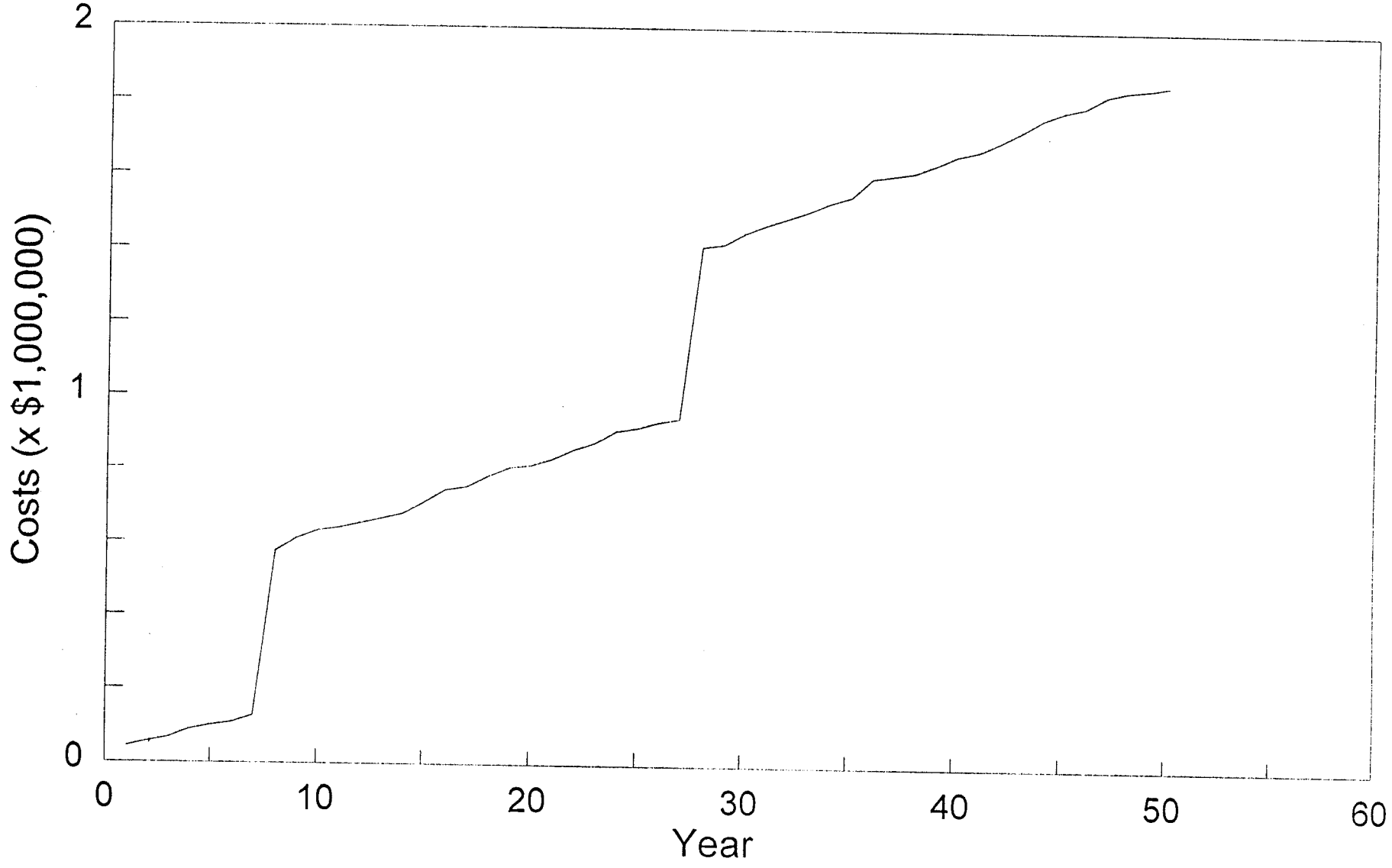
Cumulative Repair Costs (Lockport Lock)

Base Condition



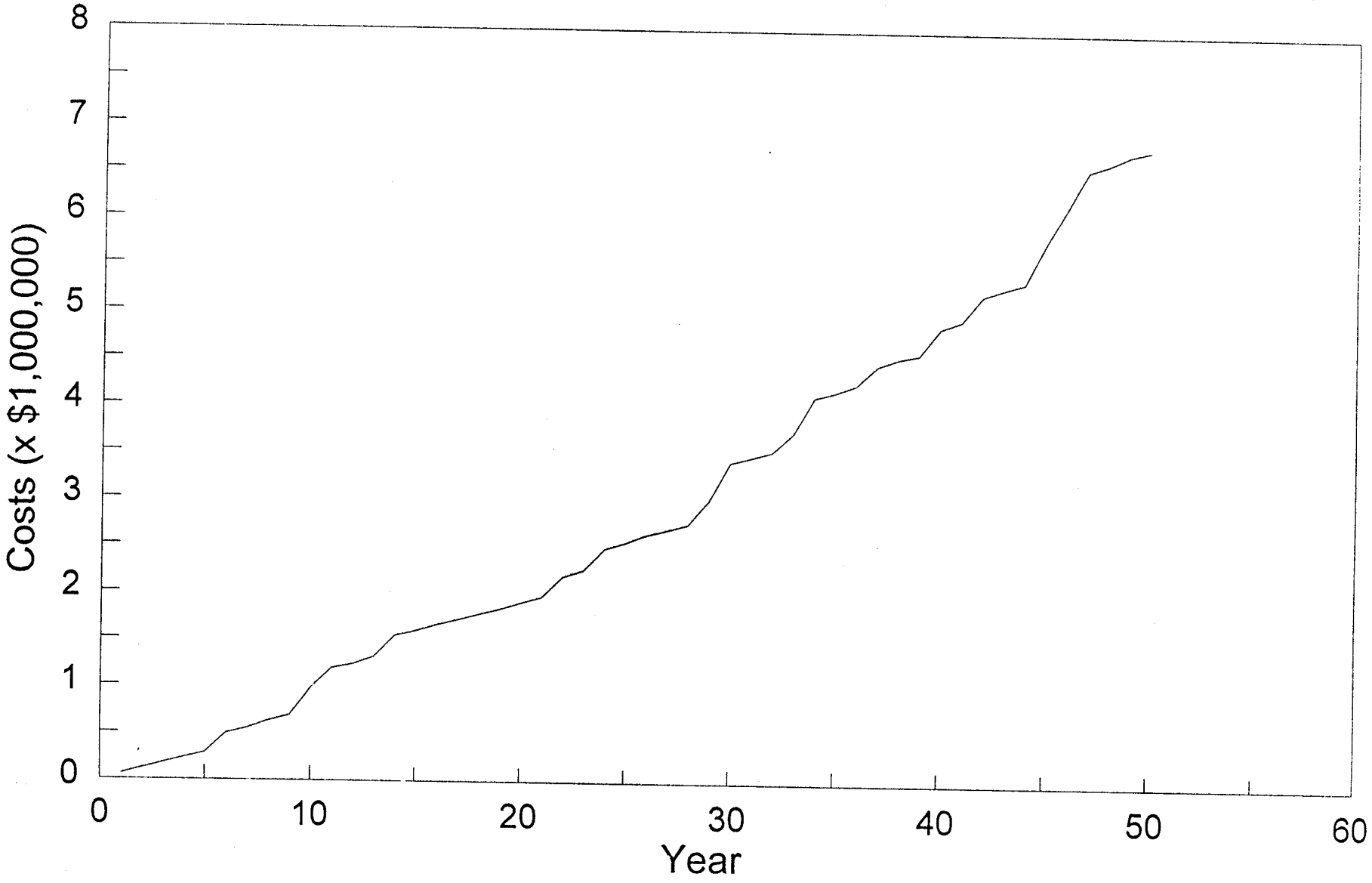
Cumulative Repair Costs (O'Brien Lock)

Base Condition



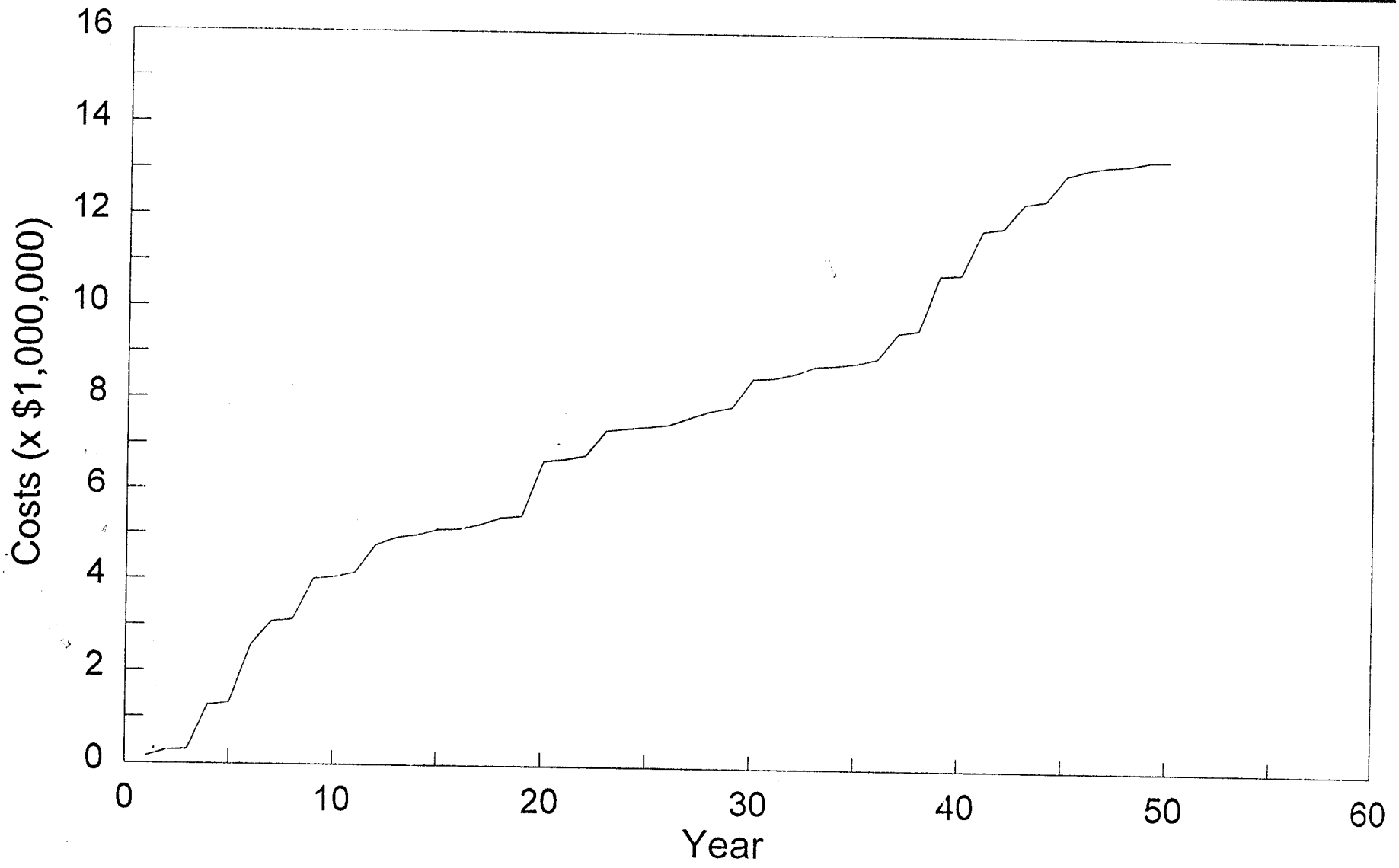
Cumulative Repair Costs (Dresden Island Lock)

Base Condition



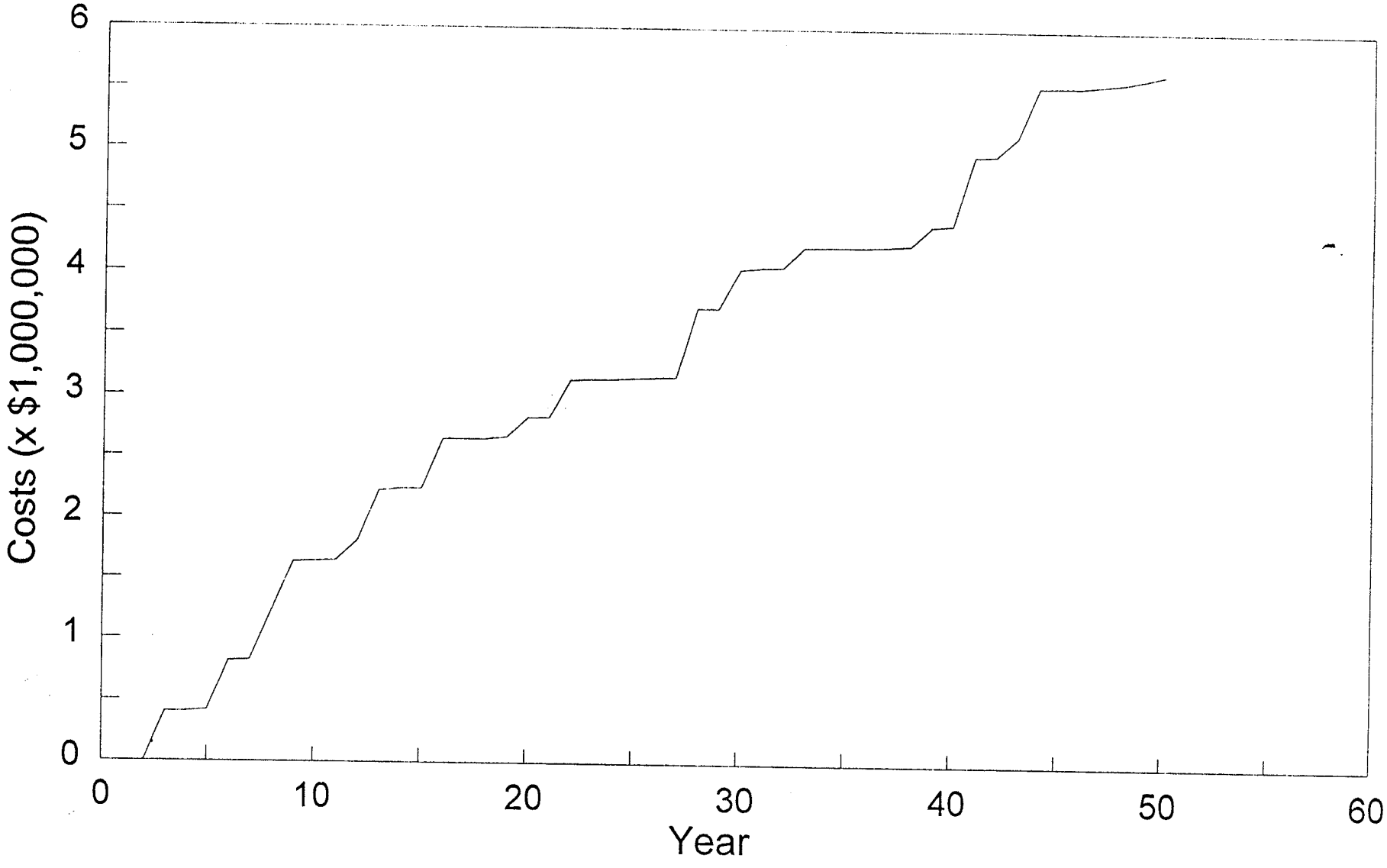
Cumulative Repair Costs (LaGrange Lock)

Base Condition



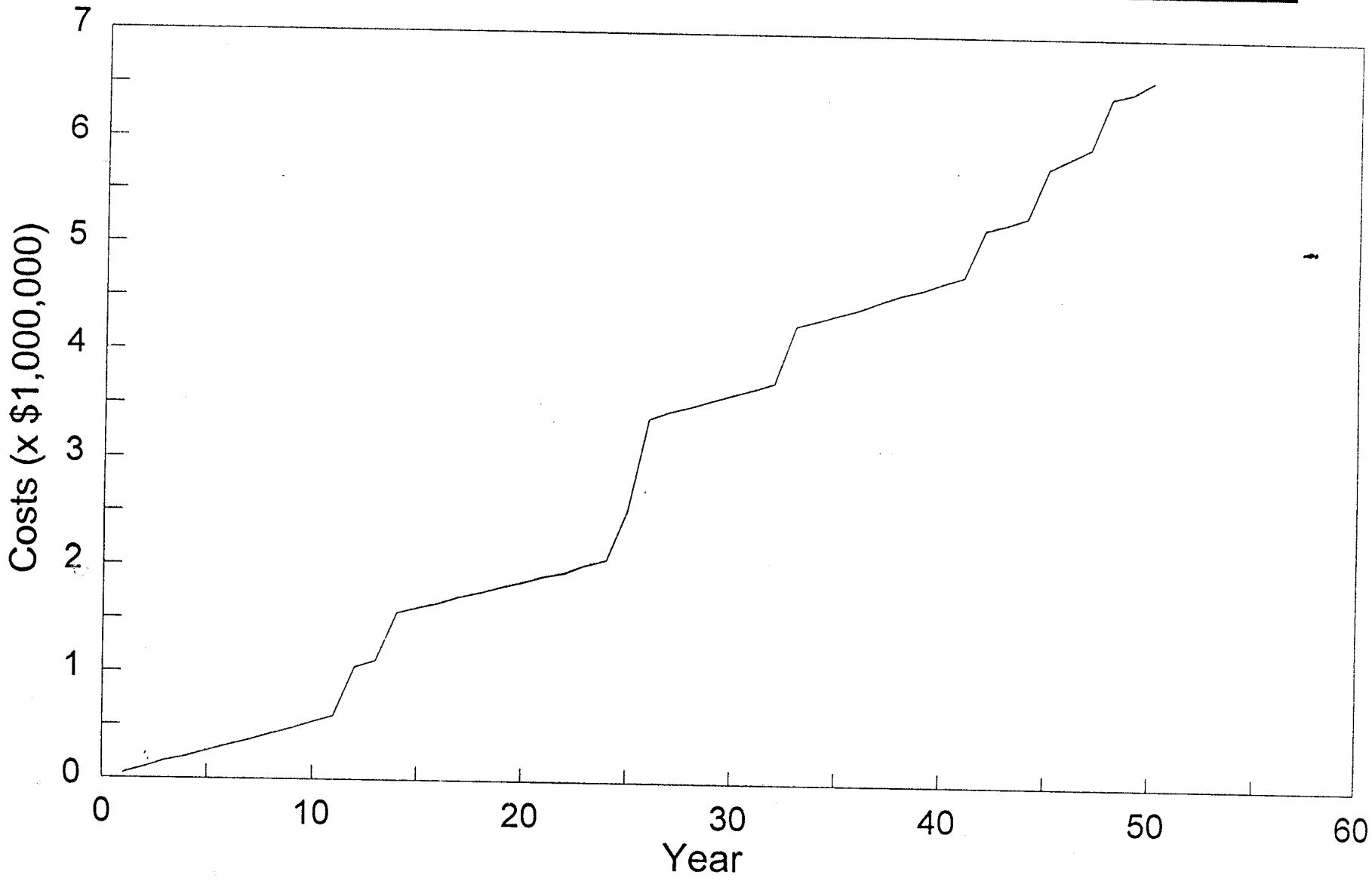
Cumulative Repair Costs (Marseilles Lock)

Base Condition



Cumulative Repair Costs (Starved Rock Lock)

Base Condition



Cumulative Repair Costs (Peoria Lock)

Base Condition