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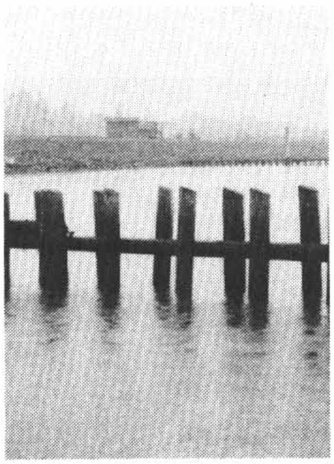

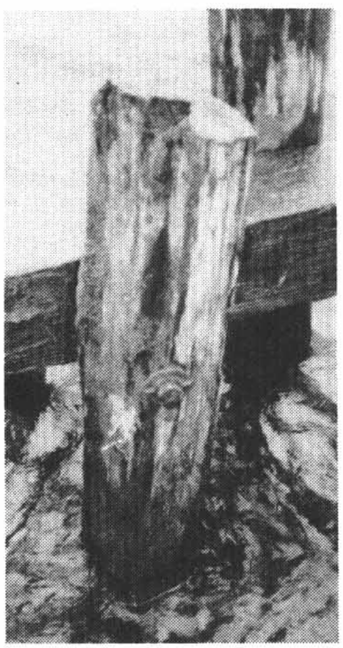

REMR
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REPAIR, EVALUATION, MAINTENANCE, AND REHABILITATION RESEARCH PROGRAM

TECHNICAL REPORT REMR-OM-5

TIMBER DIKE MANAGEMENT SYSTEM

by

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COVER PHOTOS:

TOP - Rotten pile.

BOTTOM - Timber dike on Columbia River, Oregon.

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The Timber Dike Management System is a computer-aided management system for optimizing allocation of funds available for maintenance and repair (M&R) of timber dikes. The system employs a condition index (CI) for consistent, objective rating of the dike condition, and provides easy access to information critical for M&R management. For timber dikes, while maintenance options are limited, savings in maintenance cost can be realized by optimizing the timing and scope of maintenance work.

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The Timber Dike Management System has three key features: a dike condition index (DCI) evaluation procedure, a data management system, and a consequence modeling procedure. A condition index is an objective indicator of the "health" of a structure. Consequence modeling is an optimizing procedure that allows objective comparison of available alternatives.

This report focuses on the CI evaluation procedure of the Timber Dike Management System. The simple timber dike inspection and evaluation procedures described in this report proved capable of consistently producing reliable results. The DCI can be used for budget planning and prioritization of maintenance work.

The data management system described in this report has been implemented and tested on an IBM-compatible personal computer as a program called TDIKE. Appendix A of this report describes the TDIKE program and the data manager. The consequence modeling procedure is currently under development.

PREFACE

This study was authorized by Headquarters, US Army Corps of Engineers (HQUSACE), as part of the Operations Management problem area of the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program. The work was performed under Work Unit 32337, "Implementation of the REMR Management System," for which Dr. Anthony M. Kao, US Army Construction Engineering Research Laboratory (USACERL), was Principal Investigator. Mr. James E. Crews (CECW-OM) is the REMR Technical Monitor for this work.

Mr. Jesse A. Pfeiffer, Jr. (CERD-C) was the REMR Coordinator at the Directorate of Research and Development, HQUSACE; Mr. James E. Crews (CECW-OM) and Dr. Tony C. Liu (CECW-ED) serve as the REMR Overview Committee; Mr. William F. McCleese (CEWES-SC-A), US Army Engineer Waterways Experiment Station (WES), is the REMR Program Manager. Dr. Kao was also the Problem Area Leader for the Operations Management problem area.

This study was performed under Contract/Purchase Order No. DACA88-86-D-0013 with Massachusetts Institute of Technology (MIT), Cambridge, Mass., and was conducted by Mr. Michael J. Markow (Principal Investigator), under the direct guidance of Dr. Kao. General supervision was provided by Dr. R. Quattrone, Chief of USACERL's Engineering and Materials Division (EM). Preparation of the draft was supervised by Mrs. Irene Miller of MIT. The Technical Editor was Gloria J. Wienke, USACERL Information Management Office.

COL Carl O. Magnell was Commander and Director of USACERL during this research, and Dr. L. R. Schaffer was the Technical Director.

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UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
foot	0.305	metres
miles	1.609	kilometers

TIMBER DIKE MANAGEMENT SYSTEM

PART I: INTRODUCTION

Background

1. The US Army Corps of Engineers' Civil Works program involves the entire spectrum of water resources development for a variety of purposes including inland navigation, flood control, hydropower generation, water supply, beach erosion control, and wildlife preservation. The Corps received its first appropriation for improving navigability of rivers in 1824. Since then, the Corps has constructed, and is currently maintaining, over 600 projects classified as Locks and Dams (many of which are multi-purpose), and numerous structures in other categories. The Corps is responsible for designing, constructing, operating, and maintaining these Civil Works projects.

2. In the early days of involvement with Civil Works structures, the Corps was occupied primarily with designing and constructing new structures; however, as a growing number of the structures are reaching their design life, and fewer new construction starts are authorized, the Corps' primary role in the Civil Works program has shifted to maintaining existing structures in a safe and efficient working condition. Approximately half the Corps' inventory of Civil Works structures will reach their 50-year design life within the next 20 years (Scanlon 1983). Because of prohibitive replacement costs, many of these structures must be kept in operation well beyond their original design life to provide the necessary services. In the future, the task of maintaining the aging structures in good working order is expected to be the Corps' primary role in the Civil Works program.

3. To address the problems associated with repair, evaluation, maintenance, and rehabilitation (REMR) of aging structures, the REMR Research Program was established. The program consists of research, development,

implementation, and transfer of the technologies relevant to the REMR problems in seven areas:

a. Concrete and Steel.

b. Geotechnical.

c. Hydraulics.

d. Coastal.

e. Electrical and Mechanical.

f. Environmental.

g. Operations Management.

The work described in this report falls under the Operations Management (OM) problem area of the REMR Research Program.

4. The research in the OM problem area is centered around the development of the REMR Management System, a computer-aided system for maintenance management of Civil Works structures. The details of the REMR Management System are described in the Technical Report REMR-OM-2 (Yu and Kao 1988). The concept central to the REMR Management System is that of a Condition Index (CI), which is an objective indicator of the "health" of a structure. The CI is used for prioritizing REMR activities and for consequence modeling in the REMR Management System. The ultimate goal of employing an engineered system for maintenance management is to promote savings in maintenance costs and maintain structures in the best possible condition for a given level of funding.

5. The REMR Management System is actually a conglomerate of many management systems. The term "Civil Works structure" is a broad description for many different types of structures. In most cases, even a single type of Civil Works structure may be so complex that a meaningful CI cannot be derived without further dividing the structure into component types. A CI evaluation procedure is very specific to the structure type; thus, the CI evaluation procedure must be developed individually for selected structure types. This report describes the maintenance management system (which includes the CI evaluation procedure) developed for timber dikes.

Objective

6. The objective of this research was to develop a computer-aided system for maintenance management of timber dike structures.

Approach

7. The Timber Dike Management System described in this report contains three key features:

- a. Dike Condition Index (DCI) evaluation procedure -- ensures objective rating and comparison of the condition of all structures.
- b. Data management system -- provides easy access to information critical for maintenance management.
- c. Consequence modeling procedure -- allows objective comparison of various maintenance options.

The parts of the system were developed in the order listed above. First, based on technical information gathered from the Corps districts that maintain timber dikes, the DCI evaluation procedure was developed. A computer-based system that performs data management and automates the DCI evaluation was then developed and tested. The consequence modeling procedure is currently under development.

8. In developing the Timber Dike Management System, a major emphasis was placed on maintaining compatibility with current practice. Information on the current practices in inspection, maintenance, and repair of the timber dikes was obtained from the district offices and incorporated into the system. The dike inspection procedure specified in the system is simply a formalized (thus, standardized) version of the current procedure. The DCI is evaluated from essentially the same type of data currently collected during inspections.

9. Of the three key features of the Timber Dike Management System (DCI evaluation procedure, data management system, and consequence modeling procedure), only the work on the consequence modeling has not been completed. The CI evaluation procedure and data management system have been completed and implemented on an IBM-compatible, personal computer system. The computer program, called TDIKE, performs data management functions, report generation, and CI evaluation. TDIKE is a fully self-contained system that is ready for

implementation. The details on data management functions, as well as TDIKE usage are provided in Appendix A.

10. Consequence modeling is a procedure for optimizing resource allocation. The costs of various maintenance options are weighed against the benefits to arrive at the best solution. For timber dikes, maintenance options are rather limited (defective components are simply replaced); however, cost savings can be realized by optimizing the timing of repair and scope of work by using a procedure to predict the dike's future condition. This work is currently under development and will be reported separately.

Scope

11. For the prototype Timber Dike Management System, only one specific type of timber dike was considered; one that consists of two rows of timber piling alternately placed on each side of horizontal spreader timber. This is the typical type of dike found on the Columbia River (only the dikes located on the lower 19 miles* of the river, the estuarine dikes, are of a different design) and represents the majority of the Corps' inventory of all-timber dikes.

*A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 4.

PART II: TIMBER DIKES

Function of Timber Dikes

12. The function of timber dikes is to control the flow in the river so that a favorable channel can be formed in reaches where the channel previously had been inadequate for navigation (Dodge 1971). The dikes reduce velocities along their lengths, and increase velocities channelward of the dikes without creating excessive turbulence. Properly placed dikes improve alignment and reduce the cross-sectional area of the river. These structures generally consist of two types, training dikes and spur dikes (or groins), which are distinguished by their orientation with respect to the flow of the river.

13. Training dikes are constructed parallel to the channel to improve the alignment of the river. The slack water behind the dikes tends to fill with sediment as suspended particles settle out. This area is also used as a dump site for dredge material. Training dikes prevent migration of the channel to an unfavorable position in the river.

14. Spur dikes are constructed perpendicular to the channel to reduce the cross-sectional area of the river and increase velocities in the navigation channel. The shore end of spur dikes is also used as a dump site for dredge material. Spur dikes prevent erosion of the river bank and cause localized scour in the navigation channel so that adequate depth is maintained without dredging.

15. A well designed dike system can shape the river system into one channel along a permanent alignment consisting of a series of bends and crossovers. The ultimate aim of a dike system is to develop a hydraulically efficient bank alignment and river cross section that will maintain the desired navigation channel dimensions and location.

Description

16. The timber dikes on the Columbia River between river miles 20 and 136 were considered in this study. These dikes are permeable structures consisting of untreated timber piles driven on 2 or 2-1/2 ft centers alternately placed on each side of horizontal spreader timbers. The spreader connects the dike piles together near the top and forces the piles to act as a group so that individual piles are not pulled out by the dynamic forces from local current and wave action. The spreader also protects the piles against floating debris by distributing impact forces. In some locations, brace piles are also provided for additional lateral support.

17. In certain reaches of the Columbia River, the moment capacity of vertical dike piles alone are inadequate to resist the applied lateral forces. At these locations, the dikes are provided with brace piles spaced about 10 to 12 ft apart, with a batter of about 6 on 1, along the length of the dike for additional lateral support. The brace piles are bolted to the spreader and adjacent vertical pile to form a relatively rigid frame.

18. The river end of the dikes are anchored by a dike-end cluster (outer dolphin) consisting of 10 or more piles tied together. The outer dolphin also serve as a navigational aid during high flows that cover the dike piles. In the reaches where the entire dike submerges seasonally, or with the tide, marking dolphins are also provided at regular intervals along the dike to indicate the presence of the dike. At the bottom, around the dike-end cluster, and along the length of the dike, crushed stone is placed to protect against scour and to aid in the creation and protection of sediment deposits.

19. A typical plan for the dikes on the Columbia River is shown in Figure 1. In addition to the components that contribute to the structural and hydraulic capability of the dike, components that are used to indicate the presence of the dike, are also shown in the figure. Figure 2 shows timber spur dikes located on the Columbia River. The Portland District currently maintains 112 timber dikes on the Columbia River.

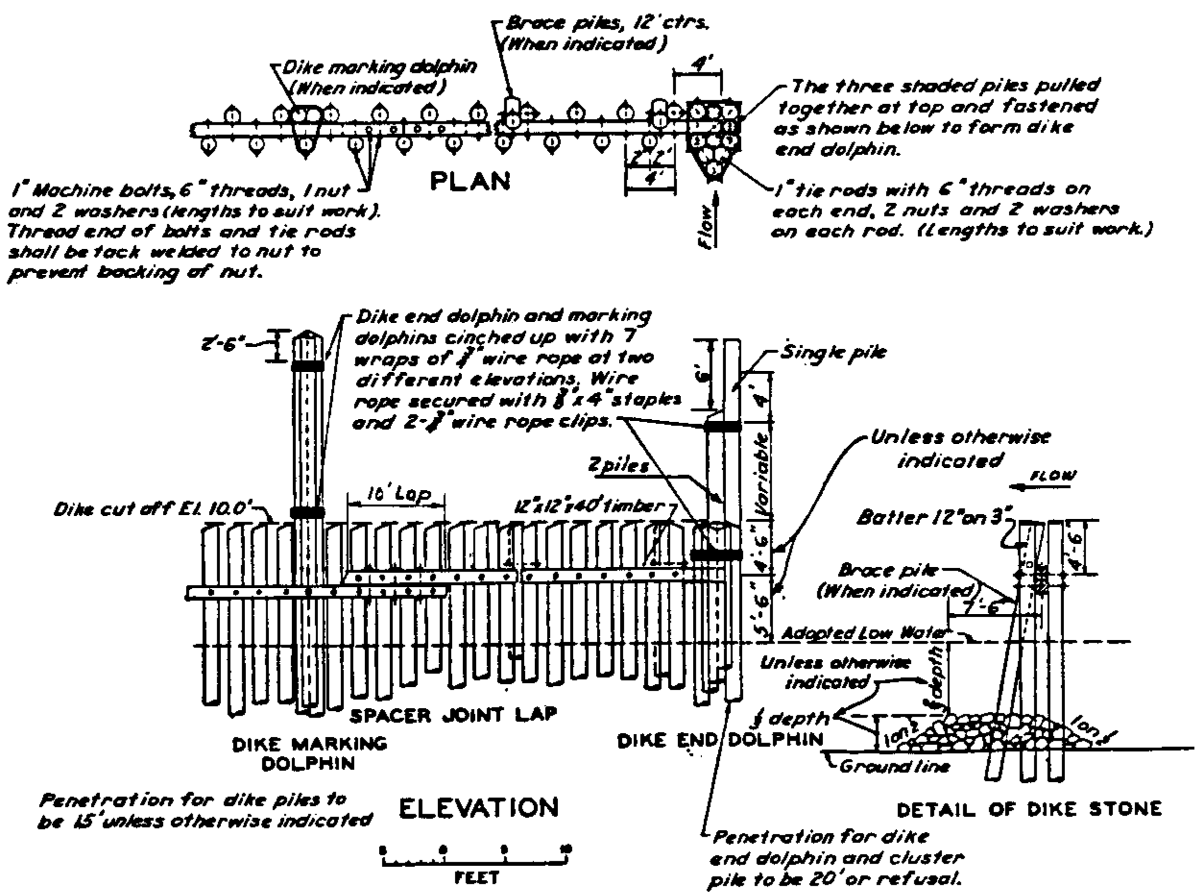

Figure 1. Timber dike plan

Figure 2a. A timber dike

Figure 2b. A timber dike in high water

Factors Affecting Design

20. Besides economic and environmental factors, the following factors affect design of timber dikes:

- a. The physical factors that directly affect the design of the dike, such as wave forces, velocity forces, foundation characteristics, and cutoff elevation.
- b. The hydraulic factors that lead to determination of the length, number, and positioning of dikes.

The forces acting on the dikes are determined analytically using simplifying assumptions and the dikes are designed to resist the analytically determined forces. Somewhat more subjective methods are used to determine the number and positioning of the dikes. Other than model studies, the positioning of the dikes is determined subjectively by hydraulic experts. A model of the lower 52 miles of the Columbia River has been constructed at the US Army Waterways Experiment Station (WES) in Vicksburg, Mississippi (Dodge 1971).

21. One of the design factors, the cutoff elevation, also affects the deterioration characteristics of the dike. Experience at the Portland District has shown that the portion of the dike that is submerged daily remained solid. On dikes that were constructed too high, rotting started at the top of the pile and extended downward, resulting in premature loosening of the pile from the spreader.

Timber Dike Deterioration

22. The primary cause of component failure in the timber dikes studied is rotten timber. The rotting is caused by wood-destroying fungi. According to the ASCE report on wood structures:

> These fungi must have food, moisture, air, and favorable temperature conditions to develop.... Untreated wood having a moisture content of over 20 percent exposed to temperatures in the 40° to 105° F range, with even a small amount of air present is subject to decay.

Elimination of any of the four requirements prevents the rotting of timber; thus, for timber piles, the rotting occurs only on the portion of the timber that is exposed to the air. In salt and brackish water environments, marine borers may also be present; however, the marine borer attack did not appear to be a problem in the dikes studied.

23. According to the data collected from the Portland District, newly placed piles and spreaders remain in like-new condition for the majority of their service life (about 25 to 30 years for untreated timber piles) and then rapidly deteriorate to failure. Figure 3 illustrates the deterioration characteristic typical of timber piles and spreaders. Point A represents the condition when the signs of deterioration are easily detected during visual inspection. For piles, this is when the rotting of the timber around the connector that joins the pile to the spreader has progressed to a point where relative movement between the pile and the spreader is possible. From this point on, mechanical wear due to the relative movement contributes to the deterioration process and accelerated deterioration results.

24. Rapid deterioration takes place until either a break in the spreader occurs, or the pile completely detaches itself from the spreader (point B in Figure 3). In most cases, the pile breaks at the bore hole for the connector. The fate of the pile from this point depends on the local conditions. In deeper waters, the pile is most likely to be worked out (pulled out) by the dynamic forces, or break, if the pile depended on a bracing system for addition support. In shallow waters, with only the submerged portion of the pile remaining, no further deterioration takes place, and the pile may stay in the same condition indefinitely.

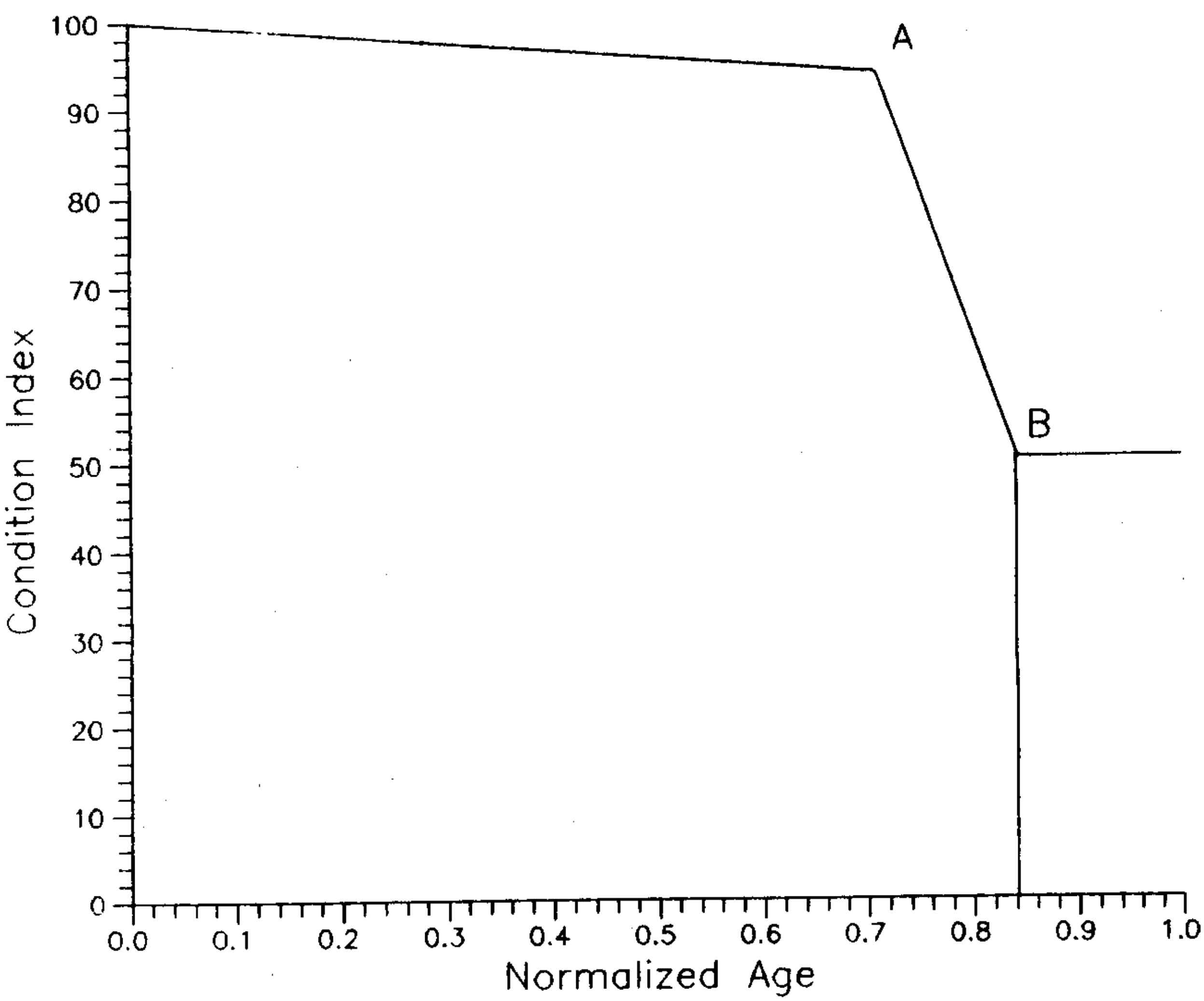

Figure 3. Typical timber deterioration characteristic

PART III: DEVELOPMENT OF TIMBER DIKE CONDITION INDEX

REMR Condition Index

25. The REMR Condition Index (CI) is an indicator that relates to the general "health" of the structures. The CI is an objective measure of the structure's ability to safely perform its intended function. The factors that relate to the structural integrity, serviceability, and safety of the structure are weighted when evaluating the CI.

26. Once the CI evaluation procedure is established for a particular type of structure, all structures of that type are inspected and evaluated the same way. The use of the CI allows objective comparison of the condition among many structures, and monitoring of changes in the condition of a particular structure over time. The natural application of this ability is the prioritization of maintenance work based on the current condition and a prediction of the future condition.

27. In the REMR program, a standardized REMR Condition Index Scale has been established so that objective comparison of the condition of different types of structures may be possible. Figure 4 describes the REMR Condition Index Scale. While the scale is continuous from 0 to 100, two CI numbers that are very close to each other (73 and 75, for example) do not necessarily represent different conditions. The condition descriptions were created to show that a range of numbers represent the same general condition. The REMR CI scale defines seven condition descriptions and three recommended action zones.

Approach

28. The CI for a timber dike should relate to both its structural integrity and hydraulic effectiveness. Structural integrity refers to the dike's physical condition, whereas the hydraulic effectiveness refers to the

Zone	Condition Index	Condition Description	Recommended Action
1	85 to 100	EXCELLENT - No noticeable defects. Some aging or wear may be visible.	Immediate action is not required.
	70 to 84	VERY GOOD - Only minor deterioration or defects are evident.	
2	55 to 69	GOOD - Some deterioration or defects are evident. Function is not impaired.	Economic analysis of repair alternatives is recommended to determine appropriate action.
	40 to 54	FAIR - Moderate deterioration. Function is not seriously impaired.	
3	25 to 39	POOR - Serious deterioration in at least some portions of structure. Function is seriously impaired.	Detailed evaluation is required to determine the need for repair, rehabilitation, or reconstruction. Safety evaluation is recommended.
	10 to 24	VERY POOR - Extensive deterioration. Barely functional.	
	0 to 9	FAILED - General failure or failure of a major component. No longer functional.	

Figure 4. REMR condition index scale.

dike's serviceability (the ability to perform its intended function). While both the structural integrity and hydraulic effectiveness are considered in the DCI evaluation, the DCI is primarily a structural integrity index; the hydraulic effectiveness was only indirectly considered.

29. The reason for indirect assessment of the hydraulic effectiveness is the complexity of the problem. Assessment of the hydraulic effectiveness not only involves determining the effects of missing piles on the hydraulic effectiveness of a single dike, but also involves determining the contribution of individual dikes on the hydraulic effectiveness of a system of dikes. This is an extremely complex problem that requires model studies.

30. For simplicity, this study assumes that if the structural integrity of the dike is maintained, the hydraulic effectiveness of the dike is also maintained. This is a reasonable assumption since the hydraulic capability of the dike is derived from the structural components (piles) being in place. The conditions that tend to reduce the hydraulic effectiveness are also the conditions that adversely affect the structural integrity of the dike.

31. For the DCI evaluation, the dike is divided into four components:

a. Pile.

b. Spreader.

c. Brace Pile.

d. Outer Dolphin.

The DCI is obtained by taking a weighted average of the CI evaluated for each component. The component CI is obtained by assigning a specific CI value to subcomponents (individual piles, or spreader segments) based on either age or distress type (damage), and then taking a weighted average. The weighting factors used to combine the component CI to obtain the DCI are determined based on the relative importance of each component to the overall structural integrity of the dike.

32. The DCI is evaluated based on historical data and visual inspection data. An approach where pile diameters are measured on random samples to assess the structural integrity of the waterfront structures supported on timber piles is described in a report prepared for the Naval Civil Engineering

Laboratory (Western Instrument Corp., 1986). This method was not used for the following reasons:

a. The failure of a timber dike poses minimal threat to life or property, thus a rigorous analysis to determine structural reliability is not warranted.

b. The method does not offer a particular advantage and is not directly applicable to the timber dike problem. The timber deterioration on a dike is highly localized to the area around the bolt that connects the piles to the spreader. The underwater portion that carries the majority of the loading on the pile remains solid. The dike piles are capable of resisting static force acting on them independently. While the diameter measurements relate directly to the strength of the dike components, the ability of the components to resist the dynamic forces (which can be assessed from visual inspection data) relates more directly to the structural integrity of a dike, rather than strength.

Distress Type Definition and Evaluation

33. For piles and brace piles, three easily distinguishable distress types are defined:

a. Loose -- Condition in which the rotting around the bolt that connects the pile to the spreader has progressed to a point where relative movement between the pile and spreader is possible. The pile is still attached to the spreader. Examples of Loose piles are shown in Figure 5.

b. Rotten -- Condition in which the pile is either completely detached from the spreader, or the portion of the pile above the connector is broken off, so that the pile is no longer braced by the spreader. Figure 6 shows the examples of Rotten piles.

c. Missing -- The pile is no longer in place.

34. Each distress type has a specific CI value associated with it. For piles, the CI value assigned to a given distress type depends on the depth of water where the pile is located. The reason for this is because the likelihood of the pile remaining in the same condition for a reasonable length of time (until the next inspection, for example) is significantly different depending on the local conditions. In shallow water, a pile that is

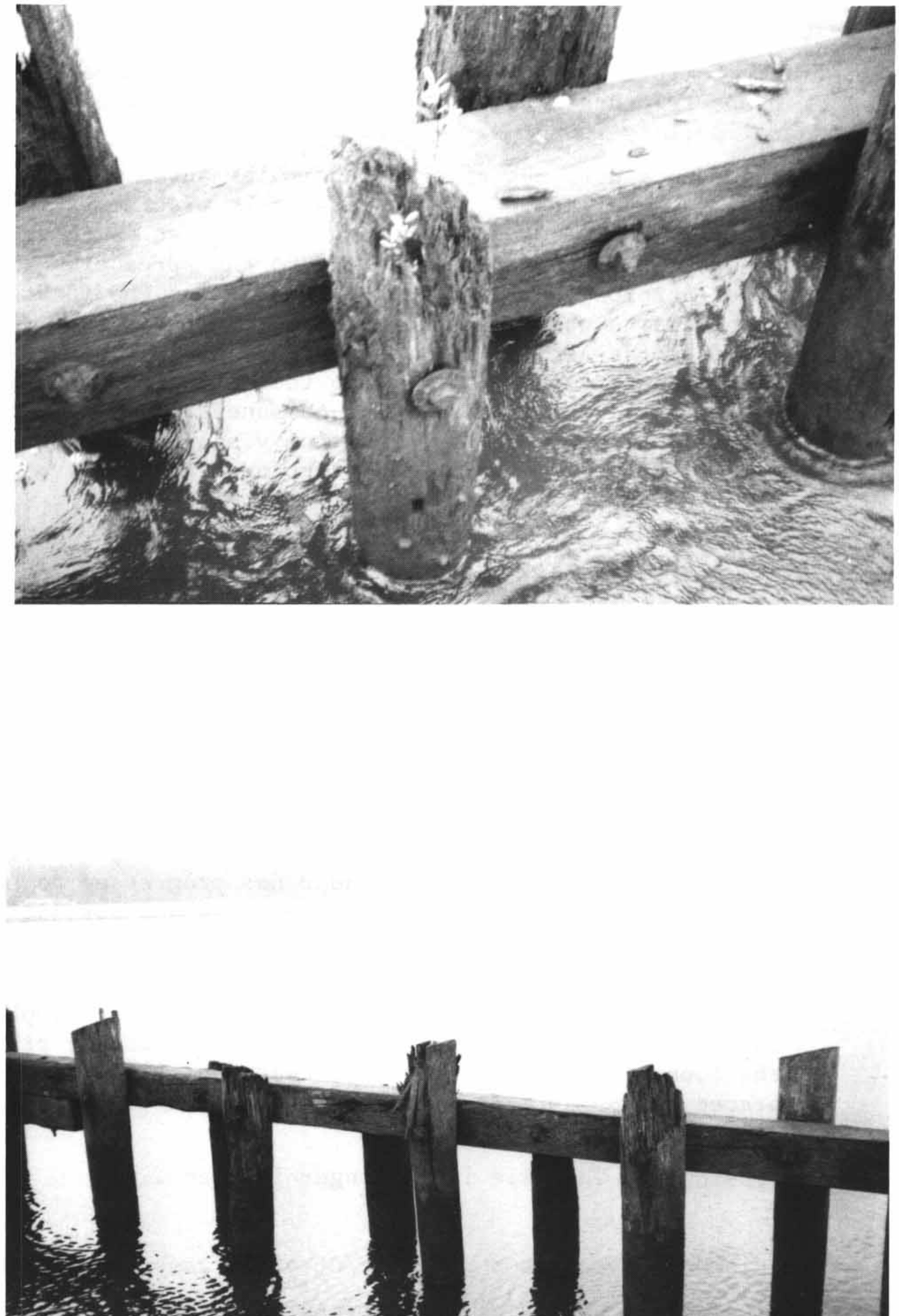

Figure 5. Loose piles

Figure 6. Rotten piles

completely detached from the spreader ca⌐ remain in the same condition indefinitely; in deep water, the pile is most likely to get pulled out or broken.

35. Deep water is defined as greater than 30 ft. This depth is conservative and accounts for the dynamic forces that can pull the piles out. The design guide recommends the use of brace piles in water more than 45 ft deep. At these locations, a loose pile is most likely to get broken off by the velocity and wave force acting on the pile. If the depth is less than 10 ft, the distress CI is not used unless the distress type is Missing; the component CI in these depths are evaluated based on age. Distress CI values for the piles are listed below.

Distress Type	10 ft or less	10 to 30 ft	Greater than 30 ft
Loose	N/A*	40	20
Rotten	N/A*	20	0
Missing	0	0	0

*Only the age CI is used.

36. Two distress types are defined for spreaders:

a. Rotten -- Condition in which the severity of the loss of a section on the spreader timber begins to affect the serviceability of the spreader. Figure 7 shows examples of a rotten spreader.

b. Missing/Broken -- Condition in which a section of the spreader timber is missing, or the continuity of the spreader is broken.

The CI values for spreader distress do not depend on the water depth. The CI value of 20 is assigned to Rotten spreader sections, and 0 is assigned to Missing/Broken spreader sections.

37. The distress types are defined for one other dike component--the wire rope wraps that are used to tie the piles in the outer dolphin (OD) together. Two distress types are defined for wire rope wraps:

a. Loose -- Condition in which the wire rope wrap is not tightly wrapped around the pile cluster so that the piles in the OD no longer function as a unit. An example of loose wire rope wrap is shown in Figure 8 above the newly placed wire rope wrap.

b. Missing -- The wire rope wrap is no longer in place.

Figure 7. Rotten spreaders

Figure 8. Loose wire rope wrap.

The CI of nondistressed wire rope wrap is 100. The CI value of 20 is assigned to Loose wire rope wrap, and 0 is assigned to Missing wire rope wrap.

Component Age Consideration

38. The deterioration of timber is time-dependent. Untreated timber exposed to the environment deteriorates over time and results in loss of a section. The typical deterioration characteristic of untreated timber is shown in Figure 3 (discussed earlier). A reasonable conclusion to draw from this figure is that as the component age increases, the reliability of the component decreases.

39. If the DCI is evaluated based on visual inspection data only, incorrect conclusions could be drawn about the condition of the dikes. Using the condition rating procedure, there is no difference between the condition of an old dike and a new one, given the same distress data. It is wrong to assume that more distresses will be observed on an older dike (thus lower DCI rating), since, as shown in Figure 3, dike components remain in like-new

condition for the majority of their service life. For serviceability considerations, it may be acceptable to assign the DCI based only on current physical condition. However, for planning purposes, this approach is hardly acceptable.

40. To ensure the reliability of the DCI, the components' ages must be considered. Consideration of an age CI for structures exhibiting such abrupt changes in deterioration rate is difficult. Two problems are encountered in dealing with such structures:

a. The CI evaluation is very sensitive to the time when signs of deterioration are easily detected during visual inspection (point A in Figure 3).

b. Since essentially the same condition is observed during the first phase of deterioration, it is difficult to find a rational basis for assigning an age CI.

41. The age CI was assigned based on the following assumption. The timber does not go from a like-new condition to a loose condition suddenly. Instead, the timber goes through continuous deterioration from the time it is placed until the signs of deterioration are readily visible. If the components are more closely inspected, the continuous change in the condition would be observed. Based on this assumption, and by examining historical data, a formula for the age CI was developed. It is a simple formula that uses the expected maximum age as a guide in determining the age CI of the dike components:

$$\text{age CI} = 100 * [1 - (\text{Normalized Age})^2] \geq 50 \qquad (1)$$

The Normalized Age is simply the actual age of the component divided by the maximum expected age for the component. The maximum expected age is specific to the component type, material, and location of the dike and is intended to be updated periodically.

42. Figure 9 shows a comparison of the age CI curve and the typical deterioration curve. The age CI is always taken to be greater than or equal to 50. The minimum age CI was established so that the old components that are

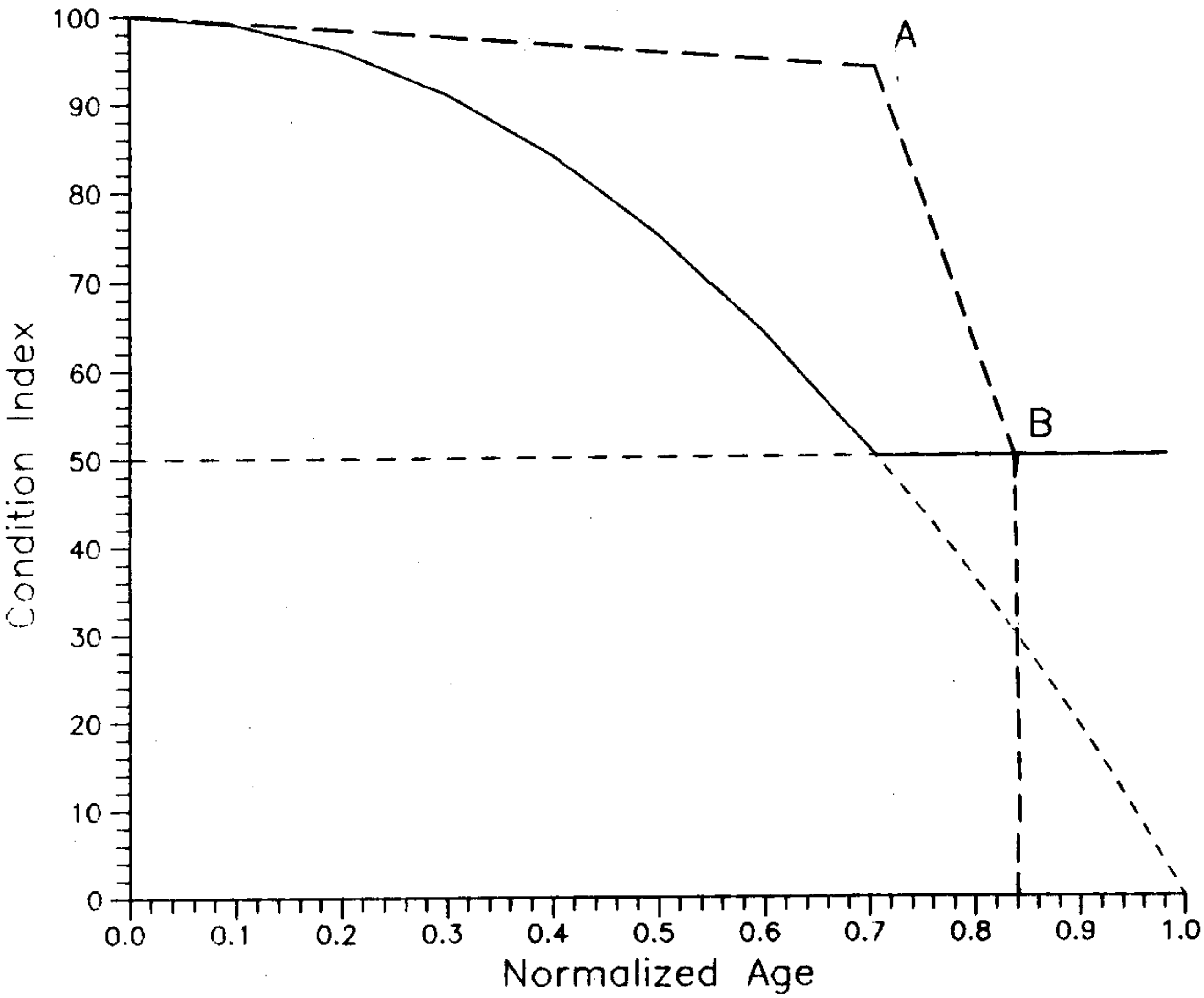

Figure 9. The age CI

still in good condition are not unduly discredited. In essence, old components not reported to be distressed are in Fair (REMR CI Scale) condition.

Component CI Evaluation

Pile, Spreader, and Brace Pile CIs

43. The individual component CIs for piles, spreaders, and brace piles are obtained by assigning a specific CI value to each subcomponent based on age or distress type, and then taking a weighted average. For piles and brace piles, the subcomponent is the individual pile. For spreaders, a 10-ft segment is used as the subcomponent. Initially, each subcomponent is assigned a CI value based on age. Then the CI for the subcomponents with reported distress are replaced with the value based on the distress. In combining subcomponent CIs, the subcomponents located on the outer portion of the dike are given greater weight than the ones located near the shore end because they contribute more to the hydraulic effectiveness of the dike and are exposed to harsher loading conditions.

44. To facilitate the component CI evaluation process, the dike is divided into four sections of equal length, and the weighting factors are applied to the section CI. The section CI for each component is a simple average of the individual subcomponent CIs for the spreader and brace piles:

$$CI_{section} = \sum_{i=1}^{n} CI_{subcomponent\ i}/n \qquad (2)$$

where: n = Number of subcomponents in the section.

For piles, the section CI is a modified average of the individual pile CIs. Because of the large number of piles in a section, distresses on a small number of piles (small compared to the number of piles in the section) are not well represented on the section CI; that is, distress data is averaged out, and the section CI is dominated by the age CI. The following procedure was adopted to offset the effect of averaging out the significant data:

a. The section is divided into three zones of equal lengths, and the CI for each zone (CI_{zi}) is obtained using the following expression.

$$CI_{zone} = \sum_{i=1}^{n} CI_{pile\ i}/n$$

where: n = total number of piles in the zone

The zones are defined as follows in terms of relative distances from the beginning of the section using the section length, L_s:

$$z1 = 0 \quad \text{to} \quad \frac{1}{2} L_s$$

$$z2 = \frac{1}{4} Ls \quad \text{to} \quad \frac{3}{4} L_s$$

$$z3 = \frac{1}{2} ls \quad \text{to} \quad L_s$$

b. The section CI for the pile is the average of the base CI and the lowest zone CI:

$$CI_{Pile\ Section} = (CI_{base} + Min\ [CI_{zi}]) \ / \ 2.0 \qquad (3)$$

where: $$CI_{base} = \sum_{i=1}^{3} CI_{zi} \ / \ 3.0$$

45. Once the section CIs are obtained using Equations 2 or 3 (depending on the component type) the component CI can be computed. The component CI is evaluated using the following expression:

$$CI_{Component} = \sum_{i-1}^{4} CI_{si} * W_i / \sum_{i=1}^{4} W_1 \qquad (4)$$

where: Component = Pile, Spreader, or Brace Pile.

CI_{si} = CI for section i.

W_i = Weighting factor for section i.

The weighting factors used for component CI evaluation are shown below.

Section No.	Location*	Weight
S1	0 to 1/4	2.0
S2	1/4 to 1/2	1.0
S3	1/2 to 3/4	1.0
S4	3/4 to 1	0.5

*Location is expressed in terms of distances from outer dolphin, where 1 = dike length.

Outer Dolphin CI

46. Two subcomponents are considered in determining the outer dolphin (OD) CI: the piles and the wire rope wraps. The CI is evaluated for each subcomponent and then combined to produce CI_{OD}. The pile CI is an average of the individual CIs for the 10 piles in the OD. The wire rope wrap CI is obtained by assigning CI values to both the upper and lower wire rope wraps and then taking a weighted average. The lower wire rope wrap ties together all the piles in the OD, whereas the upper wire rope wrap ties only the two dolphins and the king pile together. The wire rope wrap CI is calculated as follows:

$$CI_{Wire\ Rope\ Wrap} = 0.7 * CI_{Lower\ WRW} + 0.3 * CI_{Upper\ WRW} \quad (5)$$

The OD CI is obtained by taking a weighted average of CI for piles in the OD, and wire rope wraps:

$$CI_{OD} = 0.6 * CI_{Pile} + 0.4 * CI_{Wire\ Rope\ Wrap} \quad (6)$$

DCI Evaluation

47. If the lowest component CI is less than 40, the lowest CI is taken as the DCI (according to the REMR CI Scale, if the CI of a structure is less

than 40, immediate remedial action is recommended). Otherwise, the DCI is obtained by taking a weighted average of the component CIs:

$$DCI = 0.85 * ([CI_{Piles} + CI_{Brace}] / 2) + 0.15 * CI_{OD} \quad (7)$$

where: If $CI_{Spreader} > CI_{Brace\ Pile}$

Then $CI_{Brace} = (CI_{Spreader} + CI_{Brace\ Pile}) / 2$

If $CI_{Spreader} \leq CI_{Brace\ Pile}$

Then $CI_{Brace} = CI_{Spreader}$

The brace piles and spreaders are considered together for the DCI evaluation because both of these components serve to provide additional support for the vertical piles. The lateral support provided by the brace piles is transmitted to the piles through the spreaders; therefore, the spreaders must be in good condition for the brace piles to effectively provide the support. Since the condition of the spreader is more critical to the effectiveness of the bracing system, $CI_{Brace\ Pile}$ is considered only if it is less than that of $CI_{Spreader}$.

48. One other special modification to the DCI is made to deal with the concentrated damage to the dike. The occurrence of concentrated damage is defined by the following criteria:

a. More than four consecutive missing vertical piles.

b. More than six consecutive unsupported vertical piles (due to missing spreader) in locations where the depth is greater than 30 ft.

c. More than one missing brace pile in locations where the depth is greater than 30 ft.

If the dike suffers concentrated damage, both the structural integrity and hydraulic effectiveness are greatly compromised; however, the CI for the component would not necessarily show the seriousness of the damage, since only a few subcomponents may be in distress.

49. The following procedure describes how the concentrated damage relates to the DCI evaluation procedure:

a. DCI is evaluated normally.

b. The inspection data is examined for concentrated damage according to the criteria described above.

c. If concentrated damage exists, the DCI obtained by the normal procedure is divided by 10.

This action presents two very useful properties:

a. It guarantees that the DCI for the dike suffering concentrated damage is in the "immediate action" zone (zone 3 in the REMR CI Scale).

b. It indicates what the DCI of the dike would be if the concentrated damage were not present. The DCI of the dike without the concentrated damage would simply be 10 times the displayed value.

50. The DCI evaluation procedure described in this report represents the general condition level of the dike only if special conditions do not exist. The special conditions considered are:

a. A component CI less than 40.

b. Concentrated damage to one or more components.

These conditions are singled out by the DCI evaluation procedure because they may require immediate remedial action. A sample evaluation of the DCI is provided in Appendix B.

Inspection Procedure

51. The inspection procedure adopted for the Timber Dike Management System is a simple visual inspection consistent with current practice. The visible component distresses are recorded on dike inspection forms (Figure 10). The form lists the items in the OD that must be checked during inspections. The following summarizes the inspection procedure:

a. Record bookkeeping information -- dike number, inspection date, and gage measurements. Three data fields are associated with the gage measurement: "Gage," "Time," and "Location." The "Time" and "Location" data are used to correct the field measurement of "Gage" to establish mean water level at the dike location.

b. Inspect OD piles and wire rope wraps, and record any observed defects in the "OUTER DOLPHIN" section of the inspection form. For the wire rope wraps, record "Upper" or "Lower" to indicate which one is in distress; for piles, record the number of piles in distress under appropriate column.

c. Record distress data for piles, brace piles, and spreader. The following fields are provided on the inspection form for the distress data:

   i. Component Type.

   ii. Distance from OD.

   iii. Length/Number of Damage.

   iv. Distress Type.

   v. Sounding.

d. Enter the inspection data in the TDIKE program for DCI evaluation.

TIMBER DIKE INSPECTION FORM

Dike Number: ______________ Inspection Date: ______________

Location: ________________________________

Gage: __________ ft Time: __________ Location: __________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: __________ ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

____

____

____

____

____

Figure 10. Dike Inspection Form

PART IV: IMPLEMENTATION AND VALIDATION

52. The work described in this report has been implemented on an IBM-compatible, personal computer system as the program called TDIKE. TDIKE performs data management functions, report generation, DCI evaluation, and repair quantity estimation. Appendix A describes TDIKE.

53. To validate the DCI evaluation procedure, 16 dikes on the Columbia River were inspected using the procedure described in this report, and were subjectively rated by an expert. Mr. Dave Illias from the Portland District was asked to rate the dikes using either (a) excellent, (b) good, (c) fair, or (d) poor ratings. (The REMR condition description [excellent, very good, good, fair, poor, very poor, and failed] was not used for the field testing because the REMR CI Scale had not been formally established at the time.)

54. The validation results are summarized in Table 1 and the data from the inspection is provided in Appendix C. Table 1 shows generally very good correlation between the subjective rating and the rating by CI. Except for dikes 69.79, 71.87, 75.63, and 76.16, examination of the CI numbers shows that minor differences in the ratings are due to differences in the number of condition categories used for the rating. The following provides explanations for the discrepancies in the rating of the four dikes.

a. Dikes 69.79 and 76.16. A comment on the inspection forms for these dikes indicated that many of the piles were in poor condition; however, only a few of the piles were reported to be in distress.

b. Dike 71.87. The DCI for this dike was raised by a high outer dolphin CI. The pile and spreader CIs show ratings more consistent with that of the subjective rating.

c. Dike 75.63. The component CI for the spreader is less than 40; therefore the spreader CI was taken as the CI for the dike. If normal weighted averaging is used the DCI for the dike number 75.63 is:

$$DCI = 0.85 * (40 + 25) / 2 + 0.15 * 69 = 38$$

The rating for DCI of 38 is still Poor; however, this number is very close to the cutoff value for the Fair condition (40).

Table 1

DCI Validation

Dike No.	Component CI				DCI	Evaluation	
	OD	P	SP	BP		CI Std	Field
68.79	98	47	41	NA	52	Fair	Fair
69.01	83	57	57	59	61	Good	Good
69.25	80	49	49	NA	54	Fair	Fair
69.51	77	62	57	59	62	Good	G/F
69.79	96	49	44	NA	54	Fair	Fair
70.07	96	66	75	NA	74	VGood	Good
70.35	78	47	50	NA	53	Fair	G/F
71.17	69	51	43	NA	50	Fair	Fair
71.87	86	54	50	NA	57	Good	F/P
75.17	77	63	57	NA	63	Good	Good
75.35	77	59	57	NA	61	Good	G/F
75.45	77	57	57	60	60	Good	Good
75.63	69	40	25	NA	25	Poor	Fair
76.16	75	45	50	NA	52	Fair	Poor
76.58	69	50	50	NA	53	Fair	G/F
76.86	69	50	50	NA	53	Fair	Good

55. While generally good correlation was observed between subjective rating and DCI, further evaluation may be required to assure validity of DCI on dikes exposed to different environmental conditions. The rate of timber deterioration is influenced by the frequency of wet-dry cycles the dike is exposed to. TDIKE accounts for the effects of different exposure conditions on age-deterioration by classifying the exposure condition as either constant, seasonal, or infrequent. More dikes from different exposure conditions should be tested to assure the validity of DCI.

PART V: SUMMARY

56. This report describes the CI evaluation procedure of the Timber Dike Management System. The procedure has been implemented on an IBM-compatible PC and tested. The dike inspection and evaluation procedure, while simple, appears capable of consistently producing reliable results. Results of CI evaluation can be used for budget planning and prioritization of maintenance work.

57. The work on consequence modeling is currently under development. The consequence modeling is an optimizing procedure that allows objective comparison of available alternatives. Although maintenance options for timber dikes are limited, savings in maintenance costs could be realized by optimizing the timing and scope of maintenance work.

58. To be able to weigh the relative merits of various options, two utilities must be available:

a. A procedure for future condition prediction, and

b. Economic analysis procedure.

The condition prediction procedure currently under development considers the probability of component failure given the age. The probability numbers are obtained by analyzing the historical data collected automatically by TDIKE. For economic analysis, a utility that estimates the cost of repair given the inspection data is also needed; the utility for repair quantity estimate has already been developed, and implemented in TDIKE. A description of the consequence modeling procedure, as well as a list of available repair alternatives will be reported separately.

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APPENDIX A: TDIKE USER'S GUIDE

Contents

1 INTRODUCTION

About TDIKE

TDIKE is the computer implementation of a system for maintenance management of timber dikes, the Timber Dike Management System. The system was developed at the U.S. Army Construction Engineering Research Laboratory (USACERL) under the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program. TDIKE aids in management of timber dike maintenance by providing easy access to the information critical for decision making.

TDIKE performs three functions:

1. data management

2. analysis (condition and quantity)

3. report generation.

The TDIKE data manager allows the user to store and manipulate inventory data, inspection data, material quantity estimate data, and maintenance records. Based on the inventory and inspection data, TDIKE can evaluate the Condition Index (CI) and estimate the quantity of material needed to repair observed defects. The report facility allows the user to print the results of the analysis and other information in the data base.

Figure A1 shows an overview of how TDIKE is intended to be used. The items listed inside the brackets in the figure are references to the menu selections (discussed later in Chapter 3).

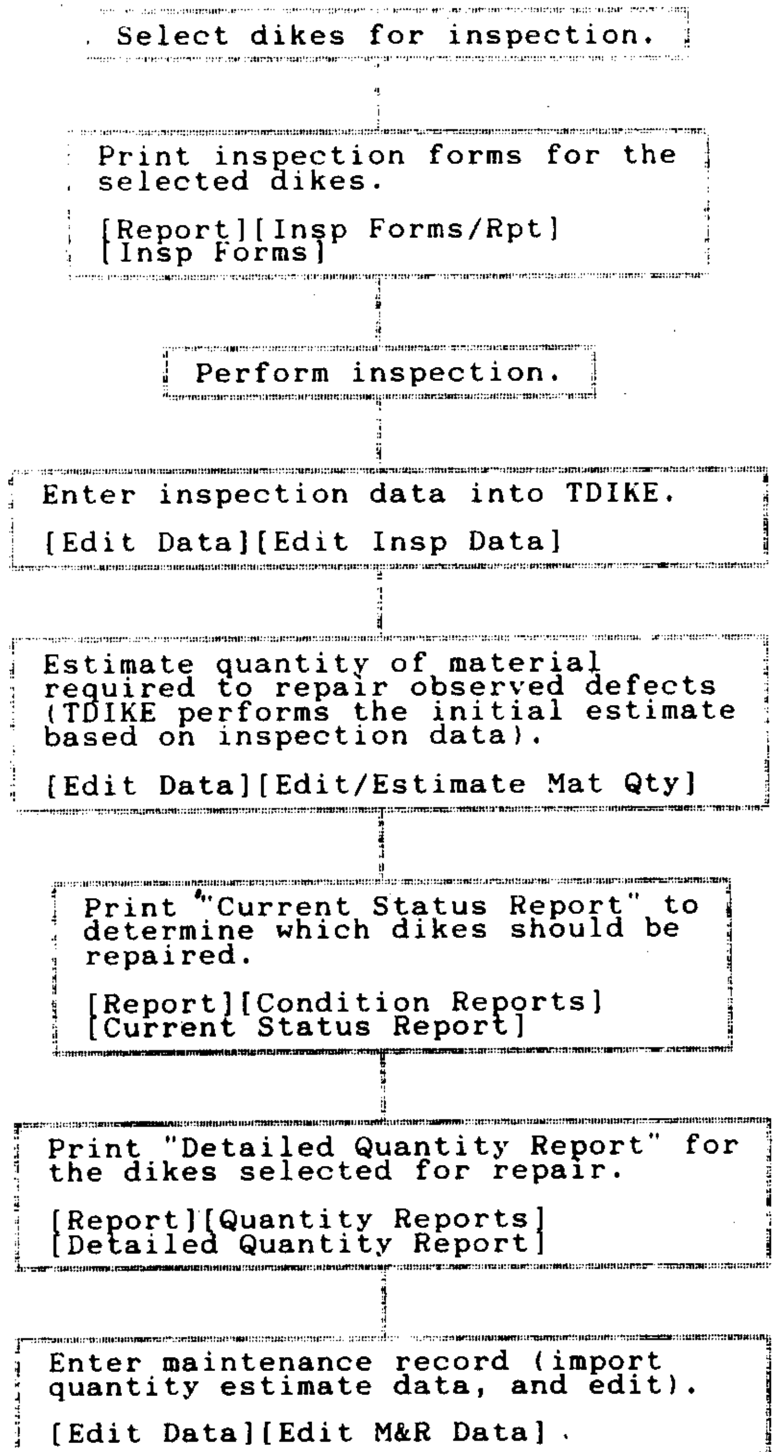

Figure A1. Overview of TDIKE

What You Need

To run TDIKE, you need:

1. an IBM-compatible personal computer,
2. at least 512 kilobytes (Kb) of random access memory (RAM), and
3. a hard disk.

The amount of disk space that should be reserved for TDIKE depends on the number of dikes you have. TDIKE uses about 4Kb of disk space per dike for storage of inventory and component age information. In addition, about 0.5Kb is required for each maintenance record entry, which amounts to about 10Kb per dike over long term. Thus, if you have 200 timber dikes to manage, you need to reserve one megabyte (Mb) of disk space for TDIKE initially, but eventually you will need 3Mb.

About This Guide

The following list outlines the chapters in this guide and their contents.

- Chapter 1, Introduction, explains what TDIKE does, what you need to run TDIKE, the notational conventions used in this guide, as well as providing a brief outline of this guide.
- Chapter 2, Getting Started, explains the TDIKE installation and startup procedures.
- Chapter 3, Techniques, describes the basic techniques you will use in working with TDIKE.
- Chapter 4, Entering and Editing Data, provides a step-by-step instruction on how to move through various data entry screens, and how to enter/edit data items.
- Chapter 5, Printing Reports, describes available reports and printing instructions.
- Chapter 6, Backing Up Your Data, describes how to backup your data files.

Notational Conventions

Typeface Conventions

The following notational conventions are used throughout this guide:

- **BOLD CAPITAL LETTERS** -- File names, directory names, and DOS commands are printed in bold capital letters.

- *Italics* -- Anything that you should type verbatim is printed in italics. In this guide, the examples of your responses are printed in lower case letters, but you can use either upper or lower case letters.

- **Bold upper and lower case letters** -- Bold lower case letters are used in two situations.

  1. special key names -- special key names are printed exactly as they appear on the keyboard and in bold letters.

  2. screen instructions -- the screen instructions or prompts are printed exactly as they appear on the screen and in bold letters.

- Underlines -- Underlines are used where special emphasis is needed.

Bullets vs Numbers

Bullets are used to head all lists in this guide with the following exceptions:

1. Numbers are used in the description of procedures where the instructions must be followed in a specific order.

2. Numbers are also used where the emphasis on the finite number of possibilities (or requirements) is important.

2 GETTING STARTED

This chapter describes the installation and startup procedure for TDIKE. You will find information on how to configure your computer system for TDIKE, install TDIKE on your system, initialize TDIKE data files, and start TDIKE.

Customizing MS-DOS for TDIKE

To run TDIKE on your system, some of the MS-DOS operating system defaults must be extended. In general, this modification will improve performance of other programs on your system as well. Operating system defaults are changed by modifying the **CONFIG.SYS** file in the root directory of your system.

Include the following statements to your **CONFIG.SYS**:

FILES=20
BUFFERS=16
DEVICE=*path***\ANSI.SYS**

Where
path = file path to **ANSI.SYS** (**ANSI.SYS** is one of the files included in **MS-DOS**)

The numbers following the parameters FILES and BUFFERS are minimums; that is, if you already have **CONFIG.SYS** and the parameters are set to higher numbers, they do not need to be changed. If you do not already have the **CONFIG.SYS** on the root directory of your system, you can create one using any text editor that produces a standard DOS text file (**ASCII** file). You can use **EDLINE**, for example, which comes with the DOS, to create the file. Be sure to place the **CONFIG.SYS** in the root directory of the C: drive (normally, the default startup drive).

If you have created or modified the **CONFIG.SYS**, you must restart the system (by turning the system off and then back on, or by keying the **Ctrl-Alt-Del** sequence) for the changes to take effect.

Installing TDIKE on Your System

The **TINSTALL.BAT** on the distribution disk automatically installs TDIKE onto the C: drive of your system. To install TDIKE:

1. See that your computer is on and you have the DOS prompt.

2. Place the TDIKE distribution disk in drive A:.

3. Type *a:tinstall* and press **Enter.**

The **TINSTALL.BAT** executes the following DOS commands to create a directory named **TD** on the root directory of the C: drive and to install TDIKE:

COMMAND	Function
C:	go to C: drive
MD \TD	create a directory called TD
CD \TD	change directory to \TD
COPY A:TDIKE.EXE	copy TDIKE.EXE to TD directory

If you would like to install TDIKE on a drive other than C:, or use another name for the TDIKE directory, you must either modify **TINSTALL.BAT**, or install TDIKE manually.

In this guide, we will assume that you have used the unmodified **TINSTALL.BAT** to install TDIKE, and use **TD** to refer to the TDIKE directory.

Starting TDIKE

The procedure for starting TDIKE is slightly different depending on whether you are using existing data files or creating new ones. To start TDIKE using the existing data files:

1. Make sure you have the system prompt and are in the **TD** directory.

2. Type *tdike* and press **Enter.**

To start TDIKE with new data files:

1. Make sure you have the system prompt and are in the **TD** directory.

2. Type *tdike timber* and press Enter.

3. TDIKE will ask **Create new data base? (N).** Confirm by pressing y (for yes), the default is "No."

The code word "timber" should be used with caution. When TDIKE is started with the code word "timber", the data subdirectory named **DATA** is created under **TD** (if it does not already exist), and the data files are created under the **DATA** directory. The old data files in the **DATA** directory are destroyed as the new files are created.

Once you are in TDIKE, you will be asked to verify the date and district code. TDIKE will print

Are these OK? (y)

after displaying the current value for the date and district code. If the information is incorrect type n and make the necessary corrections. TDIKE will display the format for the date next to where the date is to be entered. Use the **Backspace** key to erase the current value, if needed. When you press **Enter** after correcting the district code, TDIKE will prompt you with **Are these OK? (y)** again; type y to go on to the main menu.

Now you are ready to enter data, run an analysis, or print reports. But if you are new to TDIKE, it is helpful to become familiar with some of the basic techniques you will use in working with TDIKE. Chapter 3 describes the basic techniques.

3 TECHNIQUES

This chapter describes basic techniques for working with TDIKE. Most of the techniques for data entry/edit and navigation through TDIKE are described here.

Simple Responses

Any Key Response

The **Shift, Alt, Ctrl, Caps Lock,** and **Num Lock Keys** are excluded from "any key". Pressing these keys has no effect when you are given the instruction.

Press any key ...

You may press any key other than the ones noted above.

Default Response

Most of the questions requiring a simple yes or no response have (y) or (n) at the end of the question. The y or n in the parenthesis at the end of a question is the default response.

Example:

If you were given the following prompt

Create new data base? (n)

pressing any key, other than the Y key, has the same effect as pressing the **N** key; that is, TDIKE will create a new data base only if you press y.

Menus

The menus are used extensively in TDIKE to facilitate data entry. The TDIKE menus are two basic types: the program option menus and the value selection menus.

Program Option Menu

The program option menus list what operations are available and allow you to select the desired operation. The program option menus list the option number followed by the description of the operation.

Example:

```
Main Menu
---------
(1) Edit Data
(2) Report
(3) Edit Material
(4) Quit
```

The program option menus always have one of the option numbers highlighted. The highlighting will move up or down as you press the up-arrow, or the down-arrow key. To select the desired option:

- Move the highlighting to the desired option using the up or down arrow key, and then press **Enter.**

- The shortcut procedure for selecting an option is to enter the option number directly. For example, to select the "Report" operation from the main menu, simply type 2, the option number for the operation "Report".

Figure A2 shows the arrangement of the TDIKE program options menus. Where needed, several levels of menus are used to separate the logically unrelated operations so that the menus are not cluttered. The program option menus contain the options for moving from one level of menu to another. The **Esc** key is also available for moving to the next higher level menu; that is, pressing **Esc** from any menu will take you to the next higher level menu.

Examples:

- To go to the "Edit Data" menu, select the "Edit Data" option from the main menu.

- To go back to the "Main Menu," select "Return to Main Menu" option, or press the **Esc** key.

Value Selection Menus

The value selection menus list this possible choices of values for a data field and allow you to select the desired value. The following is an example of a value selection menu:

```
Select:  1
1.  Pile
2.  Spreader
3.  Brace Pile
```

The value selection menus are placed in a window. The possible value for the data field are listed with the selection numbers which are used to identify the data

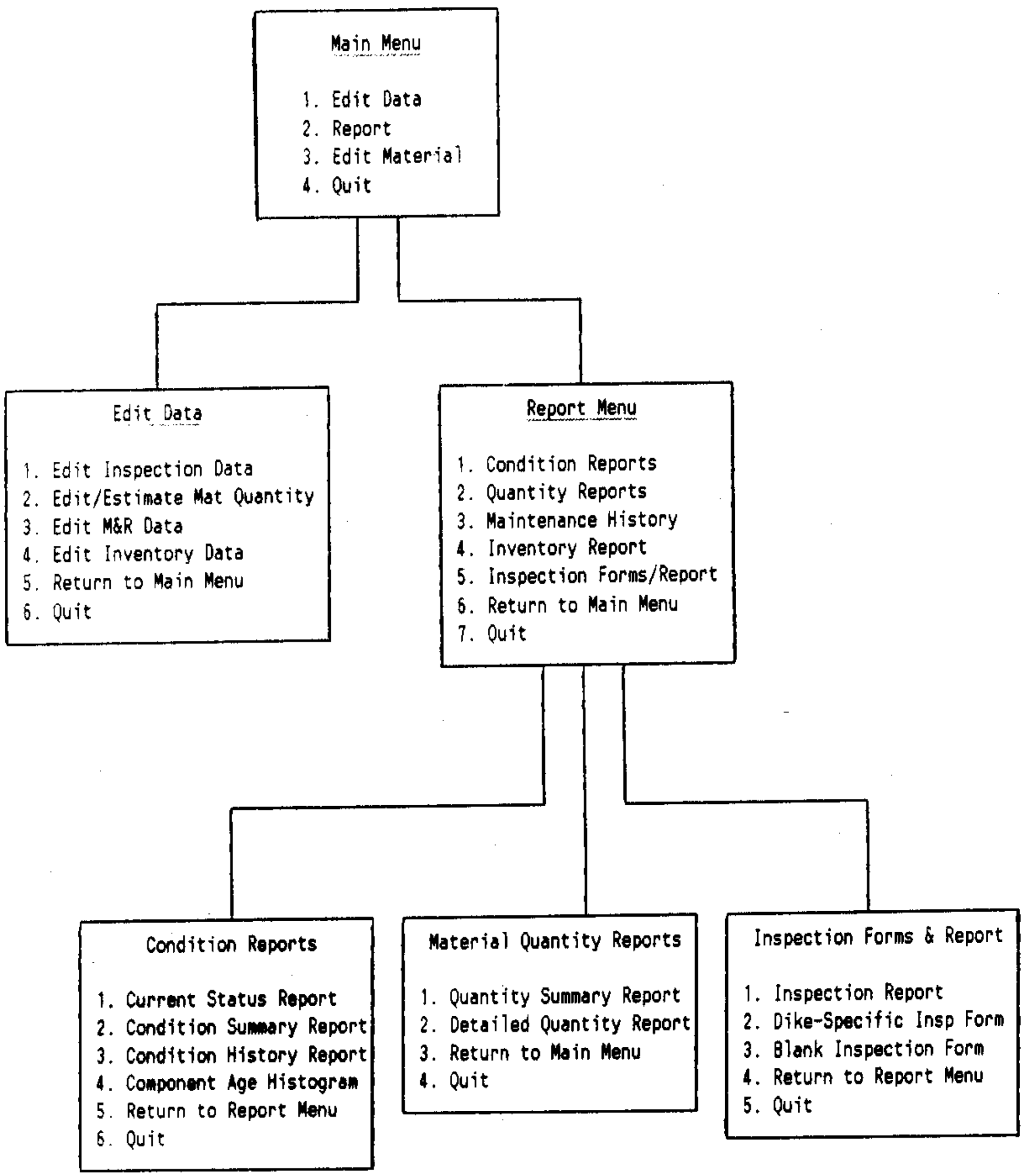

Figure A2. Organization of TDIKE menus

values. The current value of the data field is highlighted and the selection umber for the current value is listed next to the "Select:" prompt.

To select a new value for the data field, enter the selection number for the desired data value.

Example:

> To select the component type "Spreader" from the above selection menu, type 2.

When you enter a valid selection number (an allowable value among the selection numbers displayed in the menu -- not all values displayed in the menu are valid for all data fields) the menu window will be "lifted" and TDIKE will take you to the next data field. The selected value is usually displayed in the designated space on the screen.

When a selection menu is used, the value of the data field is changed only if a valid entry is made. Pressing any other key directs TDIKE to take the following actions:

- **Enter** key -- move to the next data field.
- **Esc, Insert, Delete, Home, End, Page Up, Page Down**, and function keys (F1-F12) -- change to "Move" mode (the data entry modes are discussed in the last section of this chapter, "Moving About").
- Other keys -- no effect.

Data Entry

TDIKE provides a standard data entry utility for setting the value of the data items for which the use of a value selection menu is not practical. The data items that require numeric or text input have infinite possibilities for their values. For such data items, TDIKE expects you to manually enter the data value. The rules described in this section apply to <u>all</u> data fields that require manual data entry.

Changing Data
Entry Mode

TDIKE supports two different modes for data entry: the "Insert" and "Overwrite" modes. In the "Insert" mode, the characters you type are inserted at the current cursor location; whereas, in the "Overwrite" mode, the character at the current cursor position is replaced with your entry. In either mode, the cursor advances by one position after each character entry.

Press **Insert** key to toggle between the "Insert" and "Overwrite" modes. The current data entry mode is indicated by the cursor. The cursor for the "Insert" mode is a small flashing square, whereas the cursor for the "Overwrite" mode is a flashing underscore character. The default mode is the "Overwrite" mode.

Cursor Control

Several commands are available for moving within the data entry line for editing:

- Use the right or left arrow keys to move right or left by one character.
- Use **Ctrl**-right arrow or **Ctrl**-left arrow keys to move a word right or left.
- Press **Home** key to go to the beginning of the line.
- Press **End** key to go to the end of the line.

Deleting

You can selectively delete any part of the data entry line (or the whole line) with one of the following commands:

- Press **Backspace** key to delete a character to the left of the cursor.
- Press **Del** key to delete a character at the current cursor position.
- Use **Ctrl-T** to delete a word to the right of the cursor.
- Use **Ctrl-Y** to delete from current cursor position to the end of line.
- Use **Ctrl-D** to delete the entire line.

Leaving Current Data Field

- Press **Enter** key to go to the next data item.
- You can leave the current data field and move to any other data field by switching to the "Move" mode (see the next section, "Moving About"). Press the **Esc** key to switch to the "Move" mode.
- You may exit from the current data line by pressing one of the active function keys.

Error Checking

TDIKE performs an error check on these data items at the data entry-time:

- Only allowable characters are accepted; illegal characters are rejected with a "beep."

- A Range check is performed on the numeric data at the completion of the entry. If the number entered is out of range, TDIKE will prompt you to edit. You must provide valid data or delete the entry in order to move on to the next data item.

- Range checks on date fields are performed upon completion of the entry. You must provide a valid date to move on to the next data item.

Moving About

TDIKE supports what is known as full-screen editing on all of its data entry screens. Full-screen editing simply means that you can freely move from one data field to any other data field on the screen. TDIKE uses two different modes to support the full-screen editing feature: the "Edit" mode, and the "Move" mode. The **Esc** key is used to toggle between the two modes.

Edit Mode

The "Edit" mode is the mode in which you can enter or edit the value of a data field. When you are in the "Edit" mode, you will be prompted to set the value of the current data field, either by a value selection menu or a prompt line. The movement of the "current" data field is sequential in this mode; that is, when you are finished with one data field, TDIKE will take you to the next logical data field.

Move Mode

You can recognize the "Move" mode by the inverse video display of the current data field. When you are in the "Move" mode, you can move freely from one data field to another. The arrow keys are used in the "Move" mode to move in the indicated direction. The screen wrapping occurs when further movement in the same direction is not possible (for example, pressing left arrow when you are in the left-most data field will take you to the right-most data field on the same line). The following is a summary of the "Move" mode commands:

- Arrow keys -- take you to the next data field in the corresponding direction from the current data field. Screen wrapping occurs when moving in the indicated direction is not possible.

- **Home** -- move to the data field in the top-most line of the screen at the same approximate horizontal position.

- **End** -- move to the data field in the bottom-most line of the screen at the same approximate horizontal position.

- **Esc** -- toggle between "Edit" and "Move" mode.

- **E** (for Edit) -- from the "Move" mode, the E key will take you to the "Edit" mode.

The "Move" mode commands for some data entry screens may deviate somewhat from the above description. The individual data entry screens are discussed in detail in the following chapter.

Function Keys

Wherever function keys are in use, TDIKE lists the currently active function keys with a short description about the keys at the bottom line of the screen in inverse video. Any key listed at the bottom of the screen is active at all times; that is, regardless of what mode you are in, pressing the function keys will have the described effect.

The definition of function keys is consistent throughout TDIKE. The function keys F1 through F5 are used in TDIKE. While not every data entry/edit screen uses all five function keys, the definition of the keys is the same on all screens:

- **F1-Help** -- Display help message.

- **F2-List** -- Show list of available records.

- **F3-Copy** -- Copy the value from the corresponding data field of the reference record (defined only in "Edit Inventory").

- **F4-NextRec** -- Update current record to the file, and clear the form for entry of another record.

- **F5-Quit** -- Abort data entry/editing and return to main menu.

4 ENTERING AND EDITING DATA

This chapter describes the TDIKE data entry/edit procedure in detail. The five sections in this chapter each describe a particular data entry/edit screen of TDIKE. The sections in this chapter are arranged in the order that you need to enter the data when you are starting a new data base. The screens are listed in a different order in the TDIKE menus; they are listed in the order of most frequent use.

Material Description Data

The material description data consists of material description, material type (treated timber, untreated timber, or other), unit of measure, and cost information. TDIKE uses this information for data entry on material type data fields of other data forms, and for analyses. The material types are specified using a value selection menu on all data entry screens (forms). The value selection menu for material type specification is unique in that the options listed in the menu can be edited interactively. You can add, delete, or edit up to eight different material types from the "Edit Material" screen.

"Edit Material" Screen

The material data editor is selected from the main menu (option number 3). The "Edit Material" screen (Figure A3) has eight lines at the top where you can enter the material description data (one material per line), and three lines below where you define the default material types for pile, spreader, and hardware. On this screen, in addition to the "Move" and "Edit" modes, the "Add" mode, which is used for adding new material description to the material list, is also defined.

Status Line

The bottom line of the "Edit Material" screen is used as the status line. It displays the current mode of operation and available commands. The current mode of operation is indicated in a box at the left end of the line. The box to the right of the "current mode" box shows the list of available commands. The commands for all three modes are displayed in this box; accordingly, not all of the commands that you see in the box are active at all times. The active commands are highlighted in inverse video.

6/15/198 Edit Material NPP

ID	Material Description	Type	Unit	Unit Price
1.	12x12 Untreated Timber Pile, Douglas Fir	1	L.F.	$7.50
2.	12x12 Untreated Timber Spreader, Douglas Fir	1	L.F.	$15.00
3.	Hardware	3	LBS.	$4.50
4.				
5.				
6.				
7.				
8.				

Default Pile: 12x12 Untreated Timber Pile, Douglas Fir

Default Spreader: 12x12 Untreated Timber Spreader, Douglas Fir

Default Hardware: Hardware

Move | Esc ↑↓ ←→ PgUp PgDn A)dd D)elete E)dit Q)uit

Figure A3. Edit Material screen

"Add" Mode

On the "Edit Material" screen, new material data can only be added in the "Add" mode. You can enter the "Add" mode while the material list is not full (eight is the maximum number of materials that you can define), by pressing *a* (for "Add") from the "Move" mode. The location where the new material data is placed on the screen depends on where you are on the screen when you press *a* to enter the "Add" mode:

- If you are on one of the eight lines where the material description data is placed, the new entry is placed on the current line; the existing data below the current line is scrolled down.

- If you are in the lower part of the screen where the default materials are specified, the new entry is placed at the end of the list.

The location of the data in the edit screen is of some significance, because the order in which the material data is listed on the "Edit Material" screen is the exact order that TDIKE will list them whenever material types are listed (on value selection menus or reports).

The changes in the location of the material data on the screen (possibly due to the insertion of new material data), however, have no effect on other records on file which have the material type specification fields, as long as none of the materials referenced by the record have been deleted from the list. TDIKE uses an indirect, internal data reference number to refer to the material type data which is independent of the location of the data on the screen. Thus, although the line number (of the option) is used to specify your selection on value selection menus, TDIKE correctly interprets the option number for the specified material from an old record, even if new materials have been added to the material list.

- When you are ready to enter maintenance records, you can try this example:

    1. Enter a maintenance record.

    2. Go to "Edit Material" and add a new material at the top of the material list.

    3. Go back and edit the same maintenance record.

When you perform this example, you will see that TDIKE makes correct references to the material data, although a new material has been added, and the line numbers of the existing materials have been changed.

Entering Material Description Data

To enter material description data:

1. Select "Edit Material" from the main menu (option number 3).

2. Press *a* to get in to the "Add" mode.

3. Enter the material description, abbreviated description (7 characters), material type, unit of measure, and unit cost as prompted.

4. Press the **Esc** key to get into the "Move" mode, and press the **Enter** or the down arrow key to move to the "Default Pile" field.

5. Change to the "Edit" mode and select the default materials for pile, spreader, and hardware by typing the line number, as displayed on the material list, of the desired materials.

To make changes to the previously entered data fields, switch to "Move" mode to get to the field, and switch back (to the "Edit" mode) for edit.

When you press **Enter** after selecting the default material for hardware, or if you press *q* from the "Move" mode, TDIKE will ask

Save changes to the file? (y)

As discussed in chapter 3 (in the "Default Responses" section), the default is to save the changes. Unless you type *n*, TDIKE will save the changes to the file and exit "Edit Material" screen. If you do type *n*, you will be asked

Exit without saving changes? (n)

Type *y* to discard the changes and exit, or any other key to edit. If you elect to edit, TDIKE will take you to the very first data field and place you in the "Move" mode. Make the changes as necessary, and press *q* from the "Move" mode to exit.

Inventory Data

Before TDIKE can perform any analysis, it must know the physical characteristics (such as the length, pile spacing, and the construction material) of the dikes it will be working with. The physical description of the dikes and the information that serves to identify and locate individual dikes are stored in the inventory data base.

Selecting "Edit Inventory"

Figure A4 shows the "Edit Inventory" screen. This is the inventory data "form" that you must complete for each dike that you want to manage using TDIKE. To get to the "Edit Inventory" screen:

1. From the main menu select "Edit Data," option number 1 (see "Getting Started" for instructions on starting TDIKE). TDIKE will display the "Data Edit" menu.

2. Select "Edit Inventory Data" (option number 4).

When you first get to the "Edit Dike Inventory" screen, TDIKE will be in the "Edit" mode, ready to accept data.

```
6/12/198                         Edit Dike Inventory                          NPP


Dike Number: ________                               Project:

   Location:                           State:         River:

Constructed:             Construction Cost: $

Wetting Freq:                Cutoff Elv:              King Pile Cutoff:

                     Pile Spacing      Length         Pile Type     Spreader Type
                     ------------    -----------      ---------     -------------
Main Section:
 Brace  Pile:
Aux  Section:
Outer Dolphin Type:

Remarks:


 F1-Help   F2-List   F3-Copy   F4-NextRec   F5-Quit
```

Figure A4. Edit Inventory screen

Entering Inventory Data

The process of entering the inventory data, for the most part, is straightforward. TDIKE will lead you through the data form. Enter data as prompted by TDIKE. For guidance on data entry techniques, see Chapter 3 ("Techniques"). A few special comments about the inventory screen are listed here:

- The "Dike Number" can be any combination of alphanumeric characters up to 8 characters in length, but it must be unique. TDIKE will not accept a duplicate "Dike Number."

- All numeric entries may be punctuated with commas and a decimal point at the data entry time. TDIKE reformats all numeric input; therefore, as long as you place the decimal point correctly, you are free to enter the data in any format you wish.

- Some data fields have a default value assigned to them:

Examples:

  - The default "Pile Spacing" for the main section is 2.5 ft.

  - The default material type for all dike components is Untreated timber.

If the values for these data fields have not been set, TDIKE will assign the default values and display them as you get to these data fields. You can either accept the default value by pressing **Enter**, or edit them.

Making Corrections

If at any time you need to make corrections on previously entered data fields

1. Press **Esc** to get into the "Move" mode.

2. Use the arrow keys (and/or **Home**, or **End** keys) to get to the data field which requires correction.

3. Press **Esc** or **E** to get into the "Edit" mode, and make the correction.

4. Get back to where you left off via "Move" mode, or by repeatedly pressing **Enter** (the **Enter** key takes you to the next data field without changing the value of the current data field).

Saving Inventory Record

When you press **Enter** after entering the last data item of the form, the "Remarks," TDIKE will reformat all of the data on the screen, display them, and then ask

OK to Update? (y)

The default response is "yes"; that is, unless you press *n* (for "no"), the current record will be added to the data base. After the record is added to the file, the data form is cleared in preparation for the next record. If you do press *n*, TDIKE will take you to the very first data field, and place you in the "Move" mode. Pressing the *F4* key has the same effect as pressing the **Enter** key (from "Edit" mode) on the last data field. You can update the inventory record at any point by pressing the *F4* key, as long as the values for the following data fields have been set:

1. Dike Number

2. Year of Construction

3. Pile Spacing of the main section

4. Length of the main section

If any of these data fields are missing in value, TDIKE will not update the record to the file.

F3-Copy

Figure A5 shows an example of the "Edit Inventory" screen, after the first inventory record has been updated to the file. Note the first five data fields of the last record displayed at the top part of the screen. The first five data fields of the inventory record contain the dike identification information. Of the five data fields, only the "Dike Number" field contains a unique value for each dike. The values for the remaining four data fields are repeated on many records.

The values of the first five data fields may be copied from the corresponding data fields of the last record by pressing **F3**, while you are in the "Edit" mode. The **F3** key normally takes you to the next data field after setting the value of the current data field, except when you are on the "Dike Number" field. As mentioned above, the value of the "Dike Number" field must be unique; therefore, the automatic advance feature is disabled for the "Dike Number" field to allow you to edit this data before moving on to the next data field. The **F3** key is active only for the first five data fields.

F2-List

The **F2** key brings up a list of all the dikes that have been added. The list is displayed in a window on the right side of the screen, and contains the dike numbers. You can page through the list by pressing **Page Up** or **Page Down** keys. The listing of dikes serves three purposes; it allows you to:

1. see which dike records have been added.

2. select the dike records for editing.

3. delete dike records.

```
6/15/198                    Edit Dike Inventory                              NPP

Dike Number: 68.79                                     Project: C&LW
   Location: Dobelbower Bar            State: OR         River: Columbia River


Dike Number: ________                                  Project:

   Location:                           State:            River:

Constructed:             Construction Cost: $

Wetting Freq:                Cutoff Elv:               King Pile Cutoff:

                      Pile Spacing       Length        Pile Type     Spreader Type
                      ------------     -----------     ---------     -------------

Main Section:
 Brace  Pile:
Aux  Section:
Outer Dolphin Type:

Remarks:

 F1-Help    F2-List    F3-Copy    F4-NextRec    F5-Quit
```

Figure A5. Edit Inventory screen after an update

When you select a dike from the list, the following window will appear

Dike Number: 68.79 Project: C&LW
Location: Dobelbower Bar, OR
E)dit, D)elete, R)eference, Esc, or Q)uit

The window displays the ID information for the dike that you have selected and the available options. The available options are:

1. **E)dit** -- retrieve inventory record for the selected dike for editing.

2. **D)elete** -- delete all information related to the selected dike from the files.

3. **R)eference** -- show first five data fields of the inventory data for the selected dike at the top of the "Edit Inventory" screen so that these fields may be copied using the F3 key.

4. **Esc** -- select another dike.

5. **Q)uit** -- return to the "Edit Inventory" screen without taking any action. This is the default option.

You can select an option by pressing the key corresponding to the first letter of the option description (except for the <Esc> option).

Quit Procedure

You can quit editing at any time by pressing the F5 key. If the data on the current screen has not been saved, TDIKE will ask

Discard current record? (y)

Normally, you would quit after the current record has been updated to the file. It is important to note that discarding is not the same as deleting. In TDIKE, the term "delete" refers to the process of eliminating the record from the files permanently; whereas, the term "discard" means not saving the changes. Your files are not affected by discarding a record.

Inspection Data

The inspection data is used to evaluate the Condition Index (CI) of the dike, and for estimating the material quantity needed to repair the observed defects.

Selecting "Edit Inspection"

To get to the "Edit Inspection" screen:

1. From the main menu select "Edit Data" (option number 1).

2. From the "Edit Data" menu, select "Edit Inspection Data" (option number 4).

Selecting Dike Listing Method

TDIKE provides two different methods of selecting dikes for data entry: sequential and random. The sequential method, as the term implies, allows you to select the dikes in the increasing order of dike number, whereas the random method allows you select dikes without regard to the order of dike numbers. TDIKE will prompt you to select the listing method when you first get to the "Edit Inspection" screen. Type either *s* or *r* to select. The default method is sequential.

Dike Selection

If the sequential method is selected, TDIKE will display a window at the right side of the screen that lists the dikes. You may select any dike listed in the window by typing the option letter (a letter is assigned to each entry in the list for easy reference) of the dike or by using the arrow keys to get to the desired dike and pressing **Enter** (the option letter for one of the dikes will be displayed in inverse video to indicate the current selection). When you come back to this list to select the next dike (after you have entered data for the previously selected dike), TDIKE will automatically highlight the next dike in sequence, so that the next dike in sequence may be selected by simply pressing **Enter**. You may also go to the next page by pressing the **Page Down** key; however, you cannot get back to the previous page in this listing method.

The random selection method allows you to first type in the dike number, so you do not have to page through the dike list to select one. If the dike number you have entered is not found in the inventory data base, TDIKE will display a dike list, similar to the one used in the sequential method, for you to select from. You can page forward or backward on this list, but this list will not automatically take you to the next dike in sequence upon return.

When you select a dike, the following window will appear

Dike Number: 68.79 Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
E)dit, C)lear Form, Esc, or Q)uit

The available options are listed at the bottom of the window with the default option in inverse video. You have the option to:

1. **Edit** -- Modify previously entered inspection data. This option should only be used to correct the errors or to complete data entry from a previous inspection.

2. **Clear Form** -- Clear inspection form in preparation for new data. This is the default option. This option should be used when you have new inspection data to enter.

3. **Esc** -- Select another dike.

4. **Quit** -- Quit and return to the main menu.

Select **Edit** to edit data from previous inspection, or **Clear Form** to enter new inspection data.

"Edit Inspection" Screen

The "Edit Inspection" screen is divided into two pages. The first page contains the data fields for bookkeeping information (dike number and inspection date), outer dolphin (OD) data, and comments. The distress data for the dike components (other than OD) is entered in page two of the inspection form. Figure A6 shows the first page of the "Edit Inspection" screen. When you get to the data field labeled "Piles, Spreaders, & Brace Piles" in the "Edit" mode, the second page will be displayed in a window. Figure A7 shows the "Edit Inspection" screen with the second page window overlaid.

Entering Page One Data

The data entry on the first page of the inspection form is straightforward. The only comment for the first page is that the value for the "Gage" field must be a corrected value:

- TDIKE does not have a built-in utility for correcting the gage values for time and location of measurement; therefore, you must provide the corrected value.

Enter the data as prompted. If you must change any of the data fields on the screen:

1. Press **Esc** to get in to the "Move" mode.
2. Go to the data field that requires editing using the arrow keys.
3. Press **Esc** or **e** to switch back to the "Edit" mode and make corrections.

Switching Between the Pages

To enter/edit distress data for dike components, you must first get to page two of the "Edit Inspection" screen.

- If you are in the "Edit" mode, TDIKE will automatically take you to page two when you press Enter after entering the OD sounding.
- If you are in the "Move" mode:

1. Go to the field labeled "Piles, Spreaders, & Brace files."

```
6/16/198                         Edit Inspection Data                         NPP

Dike Number: 68.79              Gage: 4.0__ ft          Inspection Date: 10/29/1986

Outer Dolphin:                   Distress     Number
                                 --------     ------
     Upper Wire Rope Wrap: Ok
     Lower Wire Rope Wrap: Ok
               King Pile: Ok
            Dolphin Pile: Ok
                          Ok
            Cluster Pile: Ok
                          Ok

      OD Sounding:  29.0 ft

Piles, Spreaders, & Brace Piles:

Comments:



F1-Help    F4-NextRec    F5-Quit
```

Figure A6. Edit Inspection screen.

```
6/15/198                         Edit Inspection Data                          NPP

Dike Number: 68.79              Gage:    4.0 ft         Inspection Date: 10/29/1986

Out
         Component       Dist From     Length/Number    Distress    Sounding
           Type           OD (ft)      Damaged(#/ft)      Type        (ft)
        ----------      -----------    -------------    --------    --------
    1.  Pile                  2.5              1        Missing     29.0 ft
    2.  Pile                 10.0              1        Missing     29.0 ft
    3.  Spreader              0.0          90.0 ft      Rotten
    4.
    5.
    6.
    7.
    8.
Pil 9.
   10.
Com
 Move | Esc  ↑↓ ←→ PgUp PgDn ^PgUp ^PgDn   A)dd   D)elete   E)dit   Q)uit


F1-Help    F4-NextRec    F5-Quit
```

Figure A7. Edit Inspection screen with page two overlay

2. Press **Esc**, or *e* to go to page two.

To get back to page one:

- Press *q* from the "Move" mode to return to page one.

Entering Page Two Data

The status box at the bottom left of page two window indicates the current mode of operation. Three modes of operation are defined on this screen: the "Add," "Edit," and "Move" modes. The list of available commands are displayed in the box at the right of the status box with the active commands highlighted in inverse video.

Page two of the "Edit Inspection" screen has practically unlimited space for distress data. Each line on this page represents one distress entry. The window displays up to ten lines of data at a time. When you get to the bottom of the window, the entries in the window will scroll up to allow new entries to be added at the bottom. You can use the **Page Up, Page Down, Ctrl-Page Up, Ctrl-Page Down,** or the arrow keys to inspect the data. The **Ctrl-Page Up** takes you to the beginning of the data, and **Ctrl-Page Down** takes you to the end. These combinations are listed as ***PgUp** and ***PgDn** on the status line of the window.

To add new distress data entries, you must be in the "Add" mode:

- Press *a* from the "Move" mode to get into the "Add" mode.

- The "Edit" mode will automatically switch to the "Add" mode, when you get to the end of previous entries.

You should be aware of the following when you are entering new distress data:

- If the values that you enter for the "Dist From OD" and "Length/Number Damaged" fields are out of range, TDIKE will display the following and adjust the values so that they are within the allowable range:

  Specified dist + length is greater than the dike length. The numbers will be adjusted to max allowable value.

- For the component types "Pile" and "Brace Pile," the "Length/Number Damaged" field may be entered as either the number of piles in distress, or the length (in feet) of the dike occupied by the damaged piles. If you include *f* or *ft* at the end of your entry, TDIKE will interpret the value as the length. For the spreaders, this field is always entered as the length of damage.

- The distress type "Loose" is not defined for the component type "Spreader." Although "Loose" is displayed in the value selection menu, you will not be allowed to select "Loose" as the distress type for spreaders.

- If you do not specify the distress type, TDIKE will delete the entry and switch to "Move" mode.

- You should provide the sounding data for the component types "Pile" and "Brace Pile." If the sounding data is omitted, TDIKE will display

  Missing sounding data will lead to inaccurate estimate of pile length.

  The sounding data is used in estimating material quantity of distressed piles and brace piles.

Editing and Deleting Page Two Data Entries

To edit or delete a data entry on page two:

1. Get to the data field that you want to edit or delete via "Move" mode.

2. Switch to "Edit" mode, or press *d* while you are in the "Move" mode to delete.

Page two data entries are deleted by line; that is, when you press *d* the entire line (which is one complete entry) is deleted.

Saving Inspection Record

When you return to the first page, you will be prompted to enter or edit comments. If you press **Enter** on a blank comment line, or if you press **F4**, TDIKE will ask

OK to Update? (y)

The default response is "yes." If you type *n* (for "no") TDIKE will take you to the "Gage" field (the very first data field that you edit on the screen) and place you in the "Move" mode.

Condition Index Evaluation

Whenever the inspection data is updated, TDIKE automatically performs Condition Index (CI) evaluation, and displays the results in a window (Figure A8). Two different sets of numbers are displayed in the window: the set labeled "After Repair" which shows the CI of the dike if all components with reported defects have been replaced with new components, and the set labeled "Current CI" which shows the result of the CI evaluation based on the inspection data. Each set shows the CI for the four dike components (OD, pile, spreader, and brace pile), and the overall dike CI which is a weighted average of component CIs.

The overall dike CI (or DCI) is not always a straight weighted average of the component CIs. If the lowest of the component CI is less than 40, this number is taken as the DCI. The component CI that prompted this action will be displayed in inverse video.

```
 6/12/198                      Edit Inspection Data                          NPP

Dike Number: 68.79             Gage:   4.0 ft          Inspection Date: 10/29/1986

Outer Dolphin:                 Distress    Number
                               --------    ------
     Upper Wire  ___________CONDITION EVALUATION SUMMARY___________
     Lower Wire |                                                  |
                |                            After    Current      |
            Dol |     COMPONENT              Repair     CI         |
                |  ----------------------------------------------  |
            Clu |  Outer Dolphin .......       98        98        |
                |  Pile ................       50        47        |
                |  Spreader ............       95        20        |
      OD Soundin|  Brace Pile ..........      N/A       N/A        |
                |  ----------------------------------------------  |
Piles, Spreaders|  OVERALL DIKE CI               76        20        |
                |  %Sound Components           74%       76%       |
Comments:       |  ----------------------------------------------  |
                |        Press any key to continue:                |
                |__________________________________________________|


 F1-Help    F4-NextRec    F5-Quit
```

Figure A8. Condition evaluation results

If concentrated damage (defined in terms of number of consecutively missing piles or spreader sections) is observed, the DCI is taken as 1/10th of the value obtained from normal weighted averaging. The entire line that contains the component that prompted this action will be highlighted in inverse video, and the message:

"Low DCI is due to concentrated damage to the highlighted component." will be displayed. The purpose of dividing the DCI by 10 is to:

1. capture your attention when concentrated damage is observed, and

2. show what the CI of the dike would be if the concentrated damage did not exist; the DCI without the concentrated damage is roughly 10 times the reported DCI.

One other piece of information is displayed in this window: The "% Sound Components." The "% Sound Components" measures the percentage of piles and spreaders with the age less than 70 percent of expected maximum. The general condition of the dike may be estimated from this value. This information is included to augment the DCI in describing the dike condition.

Quit Procedure

You may discard the current record at any time and return to the main menu by pressing F5 while you are on page one. When you press F5 TDIKE will ask

Discard current record? (y)

The default is to discard the current record. Remember that as long as you do not update a record by pressing **F4**, the file records are unaffected. Even if you have cleared the inspection form to enter new data if you abort editing by pressing **F5**, the previous inspection data will not be erased.

Quantity Estimate Data

One of the analysis functions performed by TDIKE is the material quantity estimate for repair of observed defects. TDIKE estimates the required material quantity based on the inspection data, then allows you to edit the estimate. If the inspection data does not exist, you must prepare the quantity estimate manually.

Selecting "Edit/ Estimate Material Quantity"

The "Edit/Estimate Material Quality" screen is selected from the "Edit Data" menu:

1. Select "Edit Data" from the main menu (option #1).

2. Select "Edit/Estimate Material Quantity" (option #2).

The quantity estimation is one of the operations that requires the material description data. If the material description data base is empty when you select this operation, TDIKE will display the following message and take you back to the main menu:

MATERIAL DESCRIPTION data has not been entered.

Please select "Edit Material" from the Main Menu and enter this information before attempting to edit the quantity estimate or M&R data.

File Options

Before you can start editing quantity data, you must tell TDIKE whether or not the quantity estimate file should be cleared and how you want to select the dikes. The quantity estimate file is intended to hold only the current year's records. In producing the total quantity estimate report for the entire district for the current year, all of the records in the quantity estimate file are combined; therefore, the previous year's records must be cleared before the current year's data is stored. You have the option to clear the quantity estimate file and to select the dike selection method before you start editing any quantity estimate records.

When you select the "Edit/Estimate Material Quantity" screen from the "Edit Data" menu, the following window will appear:

```
                Options

    1. Quantity Estimate File:
       Use Existing File           [x]
       Delete Existing File        [ ]

    2. Dike Selection:
       Sequential Selection        [x]
       Random Selection            [ ]

           Are these ok? (y)
```

The "x" in the brackets mark the current selections. The defaults are "Use Existing File", and "Sequential Dike Selection" (see "Selecting Dike Listing Method" in the "Inspection Data" section for details on dike selection). Press any key to accept the defaults, or *n* to change.

If you press *n* to change current selections the following instructions will be displayed at the bottom of the window:

> **"Press Enter for next option, or**
> **space bar to change selection."**

The first option will be highlighted, and the "x" in the bracket for the first option will move to the other selection each time you press the space bar. When you are done with the first option, press **Enter** to go to the next option. You will be asked to confirm the current selections again when you press **Enter** after setting the second option.

If you have selected to use the existing file the following message will be displayed:

> **Existing Data File will be used.**
> **Press any key to continue...**

If you have selected to delete the existing file you will be asked to confirm your selection with the following prompt:

> **"Delete Existing Quantity Estimate File"**
> **has been selected.**
>
> **Confirm 'delete' by typing 'd'.**

If you do not confirm by typing *d*, the existing file is used.

"Edit/Estimate Material Quantity" Screen

The "Edit/Estimate Material Quantity" screen is in two pages. Page one is used for entry of hardware quantity and other miscellaneous items. Page two is used for entry of piles and spreader quantity. The total estimate for each material type, and the total cost of repair for the dike are displayed at the bottom of the screen (the totals are visible from both pages). Figure A9 shows page one of the screen with the dike listing window at the right end. The "Add" mode and "Delete" command are defined on both pages

```
6/12/198             Edit/Estimate Material Quantity                          NPP

Dike Number:                                            Inspection Date  Dike List

Pile, Spreader, & Brace Pile Quantity:                                  #A. 68.79
                                                                        #B. 69.01
Miscellaneous Items:                                                     C. 69.25
      Mat Type                  Description                              D. 69.51
      --------   ---------------------------------------------    ---    E. 69.79
   1.                                                                    F. 70.07
   2.                                                                    G. 70.35
   3.                                                                    H. 71.17
   4.                                                                    I. 71.87
   5.                                                                    J. 75.17
   6.                                                                    K. 75.35
   7.                                                                    L. 75.45
   8.                                                                    M. 75.63
   9.                                                                    N. 76.16
  10.                                                                    O. 76.58
                                                                         P. 76.86
Total Quantity:
 TP U       TSP U      HDware                                          Select, PgDn,
                                                                          or Esc
Total Cost of Repair:
 F1-Help    F4-NextRec    F5-Quit
```

Figure A9. Edit/Estimate Material Quantity screen

of the screen. A pound sign (#) indicates a material estimate has already been performed. After making a selection, the list of available commands and the current mode of operation are displayed at the bottom right of the screen.

Figure A10 shows the edit material quantity screen with the page two window overlay. The "Length/Numb to Replace" field on page two measures the quantity on the dike (such as the number of piles, and feet of spreader to replace); whereas, the "Material Quantity" field measures the actual quantity of material required to replace the components (actual pile lengths and the length of spreaders including the overlap). The "Distress Type" field is also included on page two, but is only visible at the data entry/edit time. The "Distress Type" field is included for reference only, and has no effect on the quantity estimation.

When you select a dike for quantity estimate, you will be asked to enter the default spreader length:

Default spreader length: ____ ft

The default spreader length is used for determining the number of overlaps.

6/15/198 Edit/Estimate Material Quantity NPP

Dike Number: 68.79 Inspection Date: 10/29/1986

	Component Type	Dist From OD (ft)	Length/Numb to Replace	Depth (ft)	Material Type	Material Quantity	Unit
1.	Pile	2.5	1	29.0	TP U	53.0	L.F.
2.	Pile	10.0	1	29.0	TP U	53.0	L.F.
3.	Spreader	0.0	120.0 ft		TSP U	150.0	L.F.
4.							
5.							
6.							
7.							
8.							
9.							
10.							

Move | Esc ↑↓ ←→ PgUp PgDn ^PgUp ^PgDn A)dd D)elete E)dit Q)uit

Total Quantity:

TP U	TSP U	HDware
106	150	600

Total Cost of Repair: $5,745.00

F1-Help F4-NextRec F5-Quit EDIT

Figure A10. Edit/Estimate Material Quantity screen with page two overlay

If the inspection data is available, the quantity estimate is automatically performed by TDIKE, unless an estimate has already been performed on the inspection data. If the previous estimate is available, you will see the following prompt:

Previous estimate available. E)dit existing data, or start N)ew? (E)

The default is to edit the previous estimate.
If the inspection data is not available the following message will be displayed:

Inspection data not available.
Quantity Estimate is not performed.

If the inspection data is not available, the quantity estimate must be prepared manually.

Entering/Editing Quantity Estimate Data

The data entry/edit procedure for the quantity estimate data is similar to that for the inspection data:

- The new entries are added to the list in the "Add" mode. Press *a* from the "Move" mode to get into the "Add" mode.
- Press *d*, while in the "Move" mode, to delete the entry on the current line.
- Press *e* or **Esc** from the "Pile, Spreader, & Brace Pile" field on page one to go to page two.
- To return to page one from page two, press *q* from the "Move" mode.

On page two of the quantity estimate screen, the values for the "Distress Type" and "Depth" fields are not required; however, if you do provide the value for the "Depth" field, TDIKE will calculate the required material quantity and display it in the "Material Quantity" field for the component types "Pile" and "Brace Pile."

When you return to page one after editing the page two data, the number of bolts needed to install the material specified in page two is automatically estimated and is added (or updated, if the bolt entry already exists) as an entry on the first page. This generated entry is marked internally so that it can be identified and updated. If additional bolts must be included in the estimate, add the number as a separate entry. The bolt entry generated by TDIKE is updated each time you exit page two; thus, if you go back to edit page two, the changes that you have made to the bolt entry will be lost upon return to page one.

If any of the entries manually added in page two specify outer dolphin piles as the component type, the hardware entries on page one should be checked to ensure that the wire rope wraps are included. The original estimate generated by TDIKE will include the wire rope wraps; however, TDIKE does not automatically update the wire rope wrap entries when the OD piles are added manually.

Update and Quit Procedures

Press **F4** key to save the quantity record. If you have saved another estimate for the same dike previously, that record will be overwritten. Press **F5** to leave the "Edit/Estimate Material Quantity" screen.

Maintenance Record

The maintenance records accumulated over the years provide important data for establishing the behavioral model for the dike components. The maintenance record is very similar to the quantity estimate record in content. The maintenance record has comment fields in addition to the data fields contained in the quantity estimate record. The major difference is that while the quantity estimate data tells you what needs to be done to the dike, the maintenance record tells you what has been done to the dike.

Entering/Editing M&R Data

When the maintenance work performed is exactly the work specified in the quantity estimate, the maintenance record describing the work would be identical to the quantity estimate record. Since the material quantity estimate is usually prepared before performing the maintenance work, a utility for importing data from the quantity estimate record is provided. You will see the following prompt when you select a dike to enter a maintenance record, if the quantity estimate record for the dike is available:

> **Quantity estimate data available.**
> **Import this data? (y)**

The default is to import.

When you enter the date when the maintenance work took place, TDIKE will search the file for a maintenance record with the same date and the dike number. If the record is found, you will see the following prompt:

> **There is an existing M&R record with same dike number and date. Do you want to discard current record and edit the existing record? (y)**

The procedure for entering/editing the material quantity data (the data that shows how much of what is placed where) on the maintenance record is identical to the procedure for the quantity estimate record (see the "Quantity Estimate Data" section).

The comments on the maintenance work are entered from a window. To enter comments:

1. Press *e* or **Esc** from the "Comments" field to go to the "Notes" window.

2. Press *e* or **Esc** to get into the "Edit" mode.

3. Enter comments.

4. Press **Esc** to switch back to the "Move" mode.

5. Press *q* to exit "Notes" window.

Editing Old Records

To edit an old maintenance record, you must first select the record that you want to edit. Over the years, a dike will have many maintenance records:

1. Press **Esc** from the dike selection menu (if you are using the "random" selection method, press Enter on the "Dike Number" field to go to the dike selection menu). The following prompt will appear:

   E)dit old data or Q)uit? (Q)

2. Press *e* for edit. You will be asked to enter the search parameters:

   Enter Search Parameter

   Dike Number: ________
   Year: ________

You will be asked to verify the parameters when you enter a value for both parameters. TDIKE will provide a list of all maintenance records matching the parameters that you provide. The list will show the dike number and the maintenance/repair date. Your options are:

a. Press **Esc** to abort.

b. Leave both parameters blank to list all.

c. Enter only the "Dike Number" to list all maintenance records for a particular dike.

d. Enter only the "Year" to list all maintenance records for a given year.

e. Enter both parameters to list only the maintenance records for a particular dike for a given year.

3. When you select a record, the following window will appear:

Dike Number: 68.79 Date: 10/16/1988

Esc, E)dit, D)elete, or Q)uit? (Q)

Press **Esc** to select another record, *e* to edit, *d* to delete, or *q* to quit. The default is to quit.

5 PRINTING REPORTS

The primary function of TDIKE is to provide the information helpful for maintenance management of timber dikes. The data that you have entered and the results of analyses performed by TDIKE are organized and presented in a useful form by the report utility.

Selecting Output Device

The reports can be directed either to the printer or a file. When you select the "Report" option from the main menu the following prompt will appear:

Send output to printer? (y)

The default is to send the output to the printer. If you type *n* you will be asked to enter the name of the file where the reports are to be sent. TDIKE will check to see if there is an existing file with the same name. If the match is found, you will be prompted as follows:

File already exists. Do you want to A)ppend, or O)verwrite? (A)

If you accept the default option (append) the new reports will be added to the end of the file. Otherwise, the old file will be overwritten.

Specifying Reports

To describe what you want reported to TDIKE, you must specify some or all of the following:

1. Report Type

2. Dike

3. Reporting Period

What you need to specify depends on the type of report.

Report Type Selection

To select the report type:

1. Select the "Report" option from the main menu (option #2). The report menu will be displayed.

2. From the report menu, select the general report category. The five different report categories are:

   a. Condition Reports
   b. Quantity Reports
   c. Maintenance History
   d. Inventory Report
   e. Inspection Forms/Report

3. Two of the five report categories (Maintenance History and Inventory Report) contain only a single report. The other categories contain multiple report types and the next level of menus will be displayed if you select one of these categories:

   a. Condition Reports consists of four report types.

      1) Current Status Report
      2) Condition Summary Report
      3) Condition History Report
      4) Component Age Histogram

   b. Quantity Reports consists of two report types.

      1) Quantity Summary Report
      2) Detailed Quantity Report

   c. Inspection Forms/Report consists of three report types.

      1) Inspection Report
      2) Dike-Specific Inspection Form
      3) Generic Inspection Form

Select the desired report type from the respective menu. Descriptions and examples of the individual report types are provided in the next section.

Dike Selection Options

TDIKE provides four different methods for selecting dikes for reports. If you select a type of report that requires the dikes to be specified, the following menu will appear:

Dike Selection Option:

1. Select All
2. Select Several
3. Select One (Sequential)
4. Select one (Random)
5. Abort

The sequential and random selection methods (option #3 and #4) are the same as the methods discussed in "Selecting Dike Listing Method" of the "Inspection Data" section (Chapter 4). If you select the "Select All" option (option #1), TDIKE will generate the specified report for all of the dikes in the inventory and return to the report menu.

The "Select Several" option is for selecting multiple dikes for batch processing, so that you do not need to wait for the printer to select the next dike. The procedure for selecting individual dikes in this method is the same as the selection procedure in the sequential or the random selection method. The difference is that you continue to make your selection until all of the dikes that you want to include have been selected. The dikes that you have selected are marked with an asterisk (*). You can "unselect" a dike by selecting the same dike again. You may page forward to select from the next page of listing, but you cannot page backwards. Press **Esc** to end the selections or **F5** to abort.

Specifying Reporting Period

If the selected report type requires you to specify the reporting period, TDIKE will prompt you to enter the starting and ending dates for the report:

Enter range of years,
or Esc to abort:

START YEAR: ____
END YEAR: ____

The default is to include the entire range (include all the records). Press **Enter** without entering a value for either parameter to accept the default value. The "START YEAR" will be set to 0 and the "END YEAR" will be set to the current year. If the "START YEAR" is set greater than the "END YEAR," TDIKE will set the "START YEAR" equal to the "END YEAR." When you press **Enter** after entering the "END YEAR," you will be asked to verify the values with the following prompt:

Are these ok? (y)

Press any key to accept the values, or *n* to make corrections. You can press **Esc** at any time to abort.

Condition Reports

The condition reports include four different types of reports that describe the dike condition in terms of the CI and the component age.

Current Status Report

A summary of all the information that TDIKE can offer is contained in the "Current Status Report" (Figure A11). The report includes the results of CI evaluation and the estimate of repair cost for all dikes for which the material quantity estimate has been performed (only the dikes with the quantity estimates are included in this report). This report shows the relative need for maintenance among the dikes with reported defects. To print the "Current Status Report" only the report type need to be specified.

Condition Summary Report

The "Condition Summary Report" (Figure A12) shows the results of CI evaluation from the latest inspection data for all the dikes in the inventory. This report is very similar to the "Current Status Report." The difference is that the "Condition Summary Report" includes all the dikes in the inventory, but does not include the repair cost estimate. The existing condition of the dikes could be estimated from the information included in this report. Only the report type need be specified to print this report.

Condition History Report

The "Condition History Report" (Figure A13) shows changes in dike condition over time. The results of CI evaluation compiled over the specified period of time are included in this report. The report lists:

1. Inspection Date,

2. Component CI (the OD, Pile, Spreader, and Brace Pile CI),

3. % Sound Components, and

4. DCI.

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CURRENT STATUS REPORT

Dike No.	Insp Date	Component CI OD	P	SP	BP	% Sound CUR	ARp	DCI CUR	ARp	Repair Cost
68.79	10/29/86	97	47	41	NA	24	26	52	76	$5,745.00
69.01	10/29/86	78	49	53	50	100	100	54	58	$3,112.50
69.25	10/29/86	80	49	49	NA	11	17	54	67	$5,422.50
69.51	10/29/86	71	54	53	50	100	100	55	58	$2,040.00
69.79	10/29/86	96	49	44	NA	12	19	54	67	$5,280.00
70.07	10/29/86	96	58	73	NA	100	100	70	72	$802.50
70.35	10/29/86	78	47	50	NA	6	11	53	55	$1,860.00
71.17	10/29/86	69	51	43	NA	4	10	50	58	$2,685.00
71.87	10/29/86	86	54	50	NA	19	20	57	58	$660.00
75.35	10/29/86	71	49	53	NA	100	100	54	56	$1,117.50
75.45	10/29/86	71	48	53	51	100	100	53	57	$3,127.50
75.63	10/29/86	69	40	25	NA	0	66	25	87	$23,782.50
76.16	10/29/86	75	45	50	NA	3	9	52	55	$8,700.00
76.58	10/29/86	69	50	50	NA	8	8	53	54	$2,085.00
							T O T A L			$66,420.00

Figure A11. Current Status Report

US Army Engineer District, NPP 8/08/88

CONDITION SUMMARY REPORT

Dike No.	Last Insp Date	Component CI OD	P	SP	BP	% Sound CUR	ARp	D C I Current	Aft Repair
68.79	10/29/86	97	47	41	NA	24	26	52	76
69.01	10/29/86	78	49	53	50	100	100	54	58
69.25	10/29/86	80	49	49	NA	11	17	54	67
69.51	10/29/86	71	54	53	50	100	100	55	58
69.79	10/29/86	96	49	44	NA	12	19	54	67
70.07	10/29/86	96	58	73	NA	100	100	70	72
70.35	10/29/86	78	47	50	NA	6	11	53	55
71.17	10/29/86	69	51	43	NA	4	10	50	58
71.87	10/29/86	86	54	50	NA	19	20	57	58
75.17	10/29/86	71	53	53	NA	100	100	56	56
75.35	10/29/86	71	49	53	NA	100	100	54	56
75.45	10/29/86	71	48	53	51	100	100	53	57
75.63	10/29/86	69	40	25	NA	0	66	25	87
76.16	10/29/86	75	45	50	NA	3	9	52	55
76.58	10/29/86	69	50	50	NA	8	8	53	54
76.86	10/29/86	69	50	50	NA	0	0	53	53
EXAMPLE	10/01/87	83	85	77	87	100	100	81	90

Figure A12. Condition Summary Report

US Army Engineer District, NPP 8/08/88

CONDITION HISTORY REPORT

Dike No: 68.79

Location: Dobelbower Bar, OR

Inspection Date	Component CI OD	P	SP	BP	% Sound	Dike Condition Index (DCI)
10/29/86	97	47	41	NA	24	52
10/12/84	99	50	20	NA	10	20
8/25/82	28	50	50	NA	13	28
8/15/66	28	54	50	NA	6	28
8/15/65	63	48	50	NA	0	51

Figure A13. Condition History Report

The "Condition History Report" may show a trend in the dike component behavior, which could be used to estimate the future condition of the dike.

To print this report:

1. Select the report type.

2. Specify reporting period.

3. Choose the dike selection method.

4. Select the dikes.

Quantity Reports

Two reports are included in the "Quantity Reports":

1. Material Quantity Summary Report, and

2. Detailed Quantity Report.

Quantity Summary Report

The "Quantity Summary Report" shows the required quantity of each of the material types defined in the "Material Description" data base for repair of the reported defect. You have the option to print only the total for each material type (Figure A14), or breakdown the required quantity by individual dike (Figure A15). Only the report type need be specified to print this report.

Detailed Quantity Report

An itemized listing of the component type, location within the dike (distance from OD), and the quantity of material to be placed are included in the "Detailed Quantity Report" (Figure A16). This report could be used as part of the specification for the repair work. Only the report type need be specified to print this report.

Maintenance History Report

The "Maintenance History Report" (Figure A17) shows a summary of the work performed on a dike over the specified time period. The report shows the amount of each material type placed in the dike and the cost by year. The cost shown in the report is the current cost; the cost is calculated using the current cost for each material type and the quantity information from the historical data.

To print the "Maintenance History Report":

1. Select the report type.

2. Specify reporting period.

3. Choose the dike selection method.

4. Select the dikes.

Inventory Report

The "Inventory Report" (Figure A18) lists all the dikes in the inventory data base. The location, physical description, construction cost, and construction date of the dikes are included in this report. Only the report type need be specified to print this report.

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MATERIAL QUANTITY SUMMARY REPORT

1. 12x12 Untreated Timber Pile, Douglas Fir

   [TP U] --- 5,752 L.F. x $7.50/L.F. = $43,140.00

2. 12x12 Untreated Timber Spreader, Douglas Fir

   [TSP U] --- 610 L.F. x $15.00/L.F. = $9,150.00

3. Hardware

   [HDware] --- 3,140 LBS. x $4.50/LBS. = $14,130.00

TOTAL $66,420.00

Figure A14. Material Quantity Summary Report, by totals

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MATERIAL QUANTITY SUMMARY REPORT

Dike No.	TP U	TSP U	HDware	Cost ($)
68.79	106	150	600	5,745.00
69.01	373	0	70	3,112.50
69.25	253	100	450	5,422.50
69.51	242	0	50	2,040.00
69.79	140	120	540	5,280.00
70.07	95	0	20	802.50
70.35	212	0	60	1,860.00
71.17	0	80	330	2,685.00
71.87	76	0	20	660.00
75.35	131	0	30	1,117.50
75.45	369	0	80	3,127.50
75.63	2,467	160	640	23,782.50
76.16	1,040	0	200	8,700.00
76.58	248	0	50	2,085.00
TOTAL	5,752	610	3,140	$66,420.00

Figure A15. Material Quantity Summary Report, by dike number

DETAILED QUANTITY REPORT

Dike Number: 68.79 Inspection Date: 10/29/86

Miscellenous Items:

Material	Description	Quantity
HDware	60 Bolts	600.0 LBS.

Dike Component Report:

COMPONENT TYPE	Dist From OD (ft)	Number or Length (ft)	Material	Quantity
Pile	2.5	1	TP U	53.0 L.F.
Pile	10.0	1	TP U	53.0 L.F.
Spreader	0.0	120.0 ft	TSP U	150.0 L.F.

Dike Number: 69.01 Inspection Date: 10/29/86

Miscellenous Items:

Material	Description	Quantity
HDware	7 Bolts	70.0 LBS.

Dike Component Report:

COMPONENT TYPE	Dist From OD (ft)	Number or Length (ft)	Material	Quantity
Pile	40.0	1	TP U	57.0 L.F.
Pile	55.0	1	TP U	57.0 L.F.
Pile	90.0	1	TP U	54.0 L.F.
Pile	100.0	1	TP U	51.0 L.F.
Pile	110.0	1	TP U	49.0 L.F.
Pile	120.0	1	TP U	48.0 L.F.
Brace Pile	40.0	1	TP U	57.0 L.F.

Figure A16. Detailed Quantity Report

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MAINTENANCE HISTORY REPORT

Dike No: 68.79

Location: Dobelbower Bar, OR

Length: 200

Year	TP U	TSP U	HDware	Cost ($)
1984	0	200	800	6,600.00
1982	578	0	235	5,392.50
1966	488	0	235	4,717.50
1963	292	0	275	3,427.50
	T O T A L			$20,137.50

* Ave maintenance cost (1963-1988) = $775/yr or $3.87/yr/ft of dike.

Figure A17. Maintenance History Report

US Army Engineer District, NPP [illegible]

TIMBER DIKE INVENTORY REPORT

Dike #	Project	Location	Cutoff	Ring C.	PS	EPS	APS	AS Length	Total Len	Const Cost	Yr Const
68.79	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	200 ft	$11,746.00	[illegible]
69.0[illegible]	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	10.0	0.0	0 ft	[illegible] ft	$4[illegible].00	[illegible]
69.[illegible]	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	30[illegible] ft	$[illegible].00	1924
69.5[illegible]	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	10.0	0.0	0 ft	2[illegible] ft	$45,[illegible]	[illegible]
69.7[illegible]	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	[illegible] ft	$14,[illegible].00	1924
70.07	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	200 ft	$41,5[illegible].00	1965
70.35	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	250 ft	$1[illegible],55[illegible].00	[illegible]
71.17	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	150 ft	$6,27[illegible].00	[illegible]
71.87	CALW	Dobelbower Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	150 ft	$11,6[illegible]9.00	[illegible]
75.17	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	300 ft	$33,030.00	1969
75.35	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	160 ft	$31,072.00	1969
75.45	CALW	Kalama Bar, OR	8.0	28.0	2.5	10.0	0.0	0 ft	100 ft	$23,376.00	1969
75.63	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	150 ft	$20,396.00	196[illegible]
76.18	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	640 ft	$9,251.00	1931
76.58	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	400 ft	$12,971.00	1932
76.86	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	200 ft	$17,162.00	1923
77.06	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	150 ft	$19,942.00	1959
77.48	CALW	Kalama Bar, OR	8.0	28.0	2.5	0.0	0.0	0 ft	300 ft	$22,427.00	1963

Figure A18. Inventory Report

Inspection Forms/Report

TDIKE generates two different types of inspection forms for field inspection:

1. Dike-Specific Inspection Form (Figure A19), and

2. Generic Inspection Form (Figure A20).

The "Dike-Specific Inspection Form" is an individualized form that includes the inventory information (location and physical description) for the dike, whereas the generic form is a blank form. To print the dike-specific form, you must specify which dikes you need the inspection form for. The number of forms desired must be specified to print the generic form. The "Inspection Report" (Figure A21) shows the result of condition evaluation along with the inspection data.

TIMBER DIKE INSPECTION FORM

Dike Number: 68.79
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft   BP Spacing: N/A   APS: N/A

Inspection Date: ______________
YR Constructed: 1925
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: __________ ft   Time: __________   Location: __________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap	______	______	______
King Pile	______	______	______
Dolphin Pile	______	______	______
Cluster Pile	______	______	______

OD Sounding: __________ ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

____

____

____

____

____

Figure A19. Dike-Specific Inspection Form

TIMBER DIKE INSPECTION FORM

Dike Number: ______________ Inspection Date: ______________

Location: ________________________________

Gage: __________ ft Time: __________ Location: __________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: __________ ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Figure A20. Generic Inspection Form

US Army Engineer District, NPP

TIMBER DIKE INSPECTION REPORT

Dike Number: 68.79
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft BP Spacing: N/A

Inspection Date: 10/29/1986
YR Constructed: 1925
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
APS: N/A

OD Sounding: 29.0 ft

Gage: 0.0 ft

OUTER DOLPHIN: OK

Distress Data:

Component	Dist From OD	Numb/Len	Dist TP	Sounding
Pile	2.5 ft	1	Missing	29.0 ft
Pile	10.0 ft	1	Missing	29.0 ft
Spreader	0.0 ft	90.0 ft	Rotten	

Evaluation Summary:

Component	After Repair	Current CI
Outer Dolphin	98	97
Pile	50	47
Spreader	95	41
Brace Pile	N/A	N/A
OVERALL DIKE CI	76	52
% Sound Components	26	24

Figure A21. Inspection Report

6 BACKING UP YOUR DATA

Your data files should be backed up periodically to a secondary storage, such as floppy disks or a tape. The procedure for backing up your files to floppy disks is described in this chapter. For more information on the backup procedure, see the MS-DOS manual.

Backup Procedure

The **DOS BACKUP** command should be used to backup your files. To backup:

1. Check the total size of your files in the **DATA** directory and prepare enough formatted diskettes to hold the data.
2. Place one of the formatted floppy diskettes in drive A:
3. Type *backup data a*:
4. Switch diskettes as necessary, as instructed by DOS.

Restore Procedure

To restore files from floppies to the **DATA** directory:

1. Place the backup diskette in the drive A:
2. Type *restore a: data*.
3. Switch diskettes in the drive A: as necessary, as instructed by DOS.

APPENDIX B: SAMPLE DCI EVALUATION

1. For a sample evaluation of DCI, consider a timber dike with the following attributes:

Length:	300.0 ft
Pile Spacing:	2.5 ft
Braced Length:	300.0 ft
BP Spacing:	10.0 ft
Construction YR:	1979

The dike is constructed of untreated timber, and none of the components have been replaced since the construction (i.e., all components are at the same age). Assume that at the location of the dike, the maximum expected life of untreated timber pile and spreader are both 25 years.

2. The example evaluation is performed using the inspection data shown in Figure B1.

a. Determine the Age CI. Since all components have the same age and maximum expected life, the age CI for all components is the same.
Normalized age = (1987 - 1979) / 25 = 0.32
age CI = $100 * (1 - (0.32)^2) = 89$

b. Pile CI Evaluation.

(1) Determine section boundaries:
300 ft / 4 = 75 ft
75 ft / 2.5 ft = 30

Each section is 75 ft long, and contains 30 piles.

Section #	Distance From OD	Pile Number
1	2.5' to 75.0'	1 to 30
2	77.5' to 150.0'	31 to 60
3	152.5' to 225.0'	61 to 90
4	225.5' to 300.0'	91 to 120

(2) Determine the section CIs.

- Determine location of damage. Two piles missing, 10 ft from OD.

  10 ft / 2.5 ft = 4

  Piles 4 and 5 are missing.

TIMBER DIKE INSPECTION FORM

Dike Number: Example   Inspection Date: 10/1/87

Location: ______________________

Gage: ________ ft   Time: ________   Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap		Upper	
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 30 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	10	2	✓			30
2	SP	8	20 f			✓	
3	BP	100	1		✓		20
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Figure B1. Example Inspection Form

- Only section 1 contains damaged piles. The section CI for sections 2, 3, and 4 is simply the age CI.

  -- Assign the age CI for all subcomponents in the section (no distress).

  -- Calculate section CI for sections 2, 3, and 4.

$$CI_{Section} = \sum_{i=i}^{n} CI_{Subcomponent\ i} / n$$

$$= 89 * 30 / 30$$

$$CI_{Section} = 89 \text{ for sections 2, 3, and 4.}$$

- Determine the section CI for section 1.

  -- Determine zone boundaries for section 1.

  30 / 2 = 15 -- each zone contains 15 piles.

Zone #	Pile #
1	1 to 15
2	8 to 22
3	16 to 30

  -- Only zone 1 contains the damaged pile (piles 4 and 5). Thus, the zone CI for the zones 2 and 3 is 89.

  -- Since the subcomponent CI for missing pile is 0, the zone 1 CI is:

  89 * (15 - 2) / 15 = 77.13 = Min zone CI

  -- Determine base CI for section 1. The base CI is the average of subcomponent CIs.

$$CI_{base} = (CI_{z1} + CI_{z2} + CI_{z3}) / 3$$

$$= (77.13 + 89 + 89) / 3$$

  CIbase = 85.04

-- Thus:

$$CI_{Section\ 1} = (CI_{base} + Min[CI_{zi}]) / 2$$

$$= (85.04 + 77.13) / 2$$

$$CI_{Section\ 1} = 81.09$$

(3) Determine the CI_{Pile}.

$$CI_{Component} = \sum_{i=1}^{4} CI_{Si} * Wi / \sum_{i=1}^{4} Wi$$

$$CI_{Pile} = (2 * CI_{S1} + CI_{S2} + CI_{S3} + 0.5 * CI_{S4}) / 4.5$$

$$= (2 * 81.09 + 89 + 89 + 0.5 * 89) / 4.5$$

$$CI_{Pile} = 85$$

c. Spreader Evaluation

(1) Determine the section boundaries.

300 ft/10 ft = 30 (number of spreader segments)

30/4 = 7 + 2 remainder

If 7 spreader segments are assigned to each section, there will be 2 spreader segments leftover. Add 1 segment to the first two sections.

Section #	Segment #	Distance from OD
1	1 to 8	0' to 80'
2	9 to 16	80' to 160'
3	17 to 23	160' to 230'
4	24 to 30	230' to 300'

(2) Determine the spreader section CIs.

- Determine location of damage. Twenty ft of spreader rotten, 8 ft from OD.
  8 ft/10 ft = 1
  20 ft/10 ft + 1 = 3
  Spreader segments 1, 2, and 3 are rotten

- Determine the section CI for section 1.
  CI for Rotten spreader is 20
  $CI_{Section\ 1} = (3 * 20 + 5 * 89) / 8$
  $CI_{Section\ 1} = 63.13$

- Section CI for the sections 2, 3, and 4 is 89 (no distress)

(3) Determine the $CI_{Spreader}$.

$CI_{Spreader} = (2 * 63.13 + 89 + 89 + 0.5 * 89) / 4.5$

$CI_{Spreader} = 77$

d. Brace Pile Evaluation

(1) Section boundries for brace pile are the same as the spreader section boundaries.

(2) Evaluate section CI.

- Determine location of damage. One BP loose, 100 ft from OD.

  100 ft/10 ft = 10

  BP 10 is loose -- located in section 2.

- Determine section CI for section 2.

  CI for Loose pile is 40

  $CI_{Section\ 2} = (40 + 7 * 89) / 8$

  $CI_{Section\ 2} = 82.88$

- Section CI for the sections 1, 3, and 4 is 89 (no distress).

(3) Determine $CI_{Brace\ Pile}$.

$CI_{Brace\ Pile} = (2 * 89 + 82.88 + 89 + 0.5 * 89) / 4.5$

$CI_{Brace\ Pile} = 87$

e. OD Evaluation

(1) Wire rope wrap (WRW) evaluation.

Upper WRW is Loose (CI of 20)

CI_{WRW} = 0.7 * $CI_{Lower\ WRW}$ + 0.3 * $CI_{Upper\ WRW}$

= 0.7 * 100 + 0.3 * 20

CI_{WRW} = 76

(2) Evaluate cluster piles. Since no pile distress is observed, use the age CI as the average CI for the cluster piles.

CI_{Pile} = 89

(3) Determine CI_{OD}.

CI_{OD} = 0.6 * CI_{Pile} + 0.4 * CI_{WRW}

= 0.6 * 89 + 0.4 * 76

CI_{OD} = 83

f. DCI Evaluation

(1) Determine CI_{Brace}.

CI_{Brace} = $CI_{Spreader}$ (because $CI_{Spreader} < CI_{BP}$)

CI_{Brace} = 77

(2) Determine DCI.

DCI = 0.85 * ([CI_{Pile} + CI_{Brace}] / 2) + 0.15 * CI_{OD}

= 0.85 * ([85 + 77] / 2) + 0.15 * 83

DCI = 81

(3) Check for concentrated damage.

g. CI Evaluation Summary

CIOD 83
CIPile 85
CISpreader 77
CIBrace Pile 87

DCI 81

*The Evaluation summary from TDIKE is provided in Figure B2.

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION REPORT

Dike Number: EXAMPLE	Inspection Date: 10/01/1987
Project: tdk	YR Constructed: 1979
Location: ,	Wetting Freq: Seasonal
River:	Cutoff Elevation: 10.0 ft
Length: 300.0 ft	King Pile Cutoff: 20.0 ft
Pile Spacing: 2.5 ft BP Spacing: 10.0 ft	APS: N/A
OD Sounding: 30.0 ft	Gage: 0.0 ft

OUTER DOLPHIN:

Upper Wire Rope Wrap .... Loose

Distress Data:

Component	Dist From OD	Numb/Len	Dist TP	Sounding
Pile	10.0 ft	2	Missing	30.0 ft
Spreader	8.0 ft	20.0 ft	Rotten	
Brace Pile	100.0 ft	1	Loose	20.0 ft

Comments:

Example evaluation

Evaluation Summary:

Component	After Repair	Current CI
Outer Dolphin	93	83
Pile	89	85
Spreader	90	77
Brace Pile	89	87
OVERALL DIKE CI	90	81
% Sound Components	100	100

Figure B2. Example evaluation result

APPENDIX C: Inspection Data

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 68.79
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft BP Spacing: N/A

Inspection Date: 10/29/86
YR Constructed: 1925
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
APS: N/A

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 29.0 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	2.5	1	✓			29.0
2	P	10	1	✓			29.0
3	SP	0	90 f			✓	
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Fair

US Army Engineer District, NPP

TIMBER DIKE INSPECTION FORM

Dike Number: 69.01
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft BP Spacing: 10.0 ft APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1969
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 35 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	40	1			✓	33
2		55	1			✓	33
3		90	1			✓	30
4		100	1			✓	27
5		110	1			✓	25
6		120	1			✓	24
7							
8	BP	40	1		✓		33
9							
10							
11							
12							
13							
14							
15							

Comments:

Good

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 69.25
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 300.0 ft
Pile Spacing: 2.5 ft

Inspection Date: 10/29/86
YR Constructed: 1924
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
BP Spacing: N/A
APS: N/A

Gage: ______ ft   Time: ______   Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 33 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	110	2			✓	28
2	P	140	1	✓			26
3	P	145	1			✓	26
4	P	150	1			✓	25
5	SP	20	60.0 f			✓	
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Fair

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 69.51
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft BP Spacing: 10.0 ft APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1969
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 28 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	50	2			✓	26
2	P	200	1			✓	24
3	BP	55	1		✓		26
4	BP	85	1			✓	25
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Good / Fair

US Army Engineer District, NPP

TIMBER DIKE INSPECTION FORM

Dike Number: 69.79
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 300.0 ft
Pile Spacing: 2.5 ft BP Spacing: N/A APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1924
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 25 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	40	1			✓	24
2	P	45	1			✓	24
3	P	170	1	✓			20
4	SP	30	70 ft			✓	
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Starting 100' from OD piles are in poor condition.

Poor

US Army Engineer District, NPP

TIMBER DIKE INSPECTION FORM

Dike Number: 70.07
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft BP Spacing: N/A

Inspection Date: 10/29/86
YR Constructed: 1969
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
APS: N/A

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile ,			

OD Sounding: 24 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	40	1		✓		24
2	P	60	1			✓	23
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Good

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 70.35
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 250.0 ft
Pile Spacing: 2.5 ft

Inspection Date: 10/29/86
YR Constructed: 1924
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
BP Spacing: N/A
APS: N/A

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 16 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	20	1			✓	15
2	P	30	1			✓	15
3	P	90	2			✓	12
4	P	100	2			✓	10
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Good / Fair

US Army Engineer District, NPP

===

TIMBER DIKE INSPECTION FORM

Dike Number: 71.17
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 150.0 ft
Pile Spacing: 2.5 ft

Inspection Date: 10/29/86
YR Constructed: 1931
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

BP Spacing: N/A APS: N/A

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 23 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	SP	100	50 f			✓	
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Outer End piles are in good condition

Fair

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 71.87
Project: C&LW
Location: Dobelbower Bar, OR
River: Columbia River
Length: 150.0 ft
Pile Spacing: 2.5 ft BP Spacing: N/A APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1931
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ________ ft Time: ________ Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 17 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	25	1		✓		15
2	P	30	1		✓		15
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Fair/Poor

US Army Engineer District, NPP

TIMBER DIKE INSPECTION FORM

Dike Number: 75.17
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 300.0 ft
Pile Spacing: 2.5 ft   BP Spacing: N/A   APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1969
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ________ ft   Time: ________   Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: ________ ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

No distress observed.

Good

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 75.35
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 160.0 ft
Pile Spacing: 2.5 ft   BP Spacing: N/A

Inspection Date: 10/29/86
YR Constructed: 1969
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
APS: N/A

Gage: ________ ft   Time: ________   Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 22 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	15	1			✓	22
2	P	25	1			✓	20
3	P	160	1			✓	10
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Good / Fair

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 75.45
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 100.0 ft
Pile Spacing: 2.5 ft
BP Spacing: 10.0 ft
APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1969
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ______ ft   Time: ______   Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 24 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	Distress Type L	Distress Type R	Sounding (ft)
1	P	40	1			✓	23
2	P	55	1			✓	23
3	P	80	3			✓	22
4	P	100	1			✓	10
5	BP	50	1		✓		23
6	BP	100	1		✓		10
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Good

US Army Engineer District, NPP

==

TIMBER DIKE INSPECTION FORM

Dike Number: 75.63
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 150.0 ft
Pile Spacing: 2.5 ft

Inspection Date: 10/29/86
YR Constructed: 1960
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

BP Spacing: N/A APS: N/A

Gage: ______ ft Time: ______ Location: ______ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 25 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	SP	0	100 f			✓	
2	P	2.5	100 f		✓		24
3	P	100	3		✓		22
4	P	105	1			✓	20
5	P	110	1		✓		19
6	P	115	1		✓		18
7	P	120	1		✓		16
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Fair

US Army Engineer District, NPP

TIMBER DIKE INSPECTION FORM

Dike Number: 76.16
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 640.0 ft
Pile Spacing: 2.5 ft
BP Spacing: N/A
APS: N/A

Inspection Date: 10/29/86
YR Constructed: 1931
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft

Gage: ________ ft Time: ________ Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 25 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	30	20			✓	24
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

From 140' in, dike is in poor shape – many piles are rotten.

Poor

US Army Engineer District, NPP

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TIMBER DIKE INSPECTION FORM

Dike Number: 76.58
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 400.0 ft
Pile Spacing: 2.5 ft

Inspection Date: 10/29/86
YR Constructed: 1932
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
BP Spacing: N/A
APS: N/A

Gage: ________ ft   Time: ________   Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: 22 ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1	P	5	1			✓	22
2	P	25	1			✓	22
3	P	30	1			✓	22
4	P	35	1			✓	22
5	P	170	1	✓			20
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

Good / Fair

US Army Engineer District, NPP

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TIMBER DIKE INSPECTION FORM

Dike Number: 76.86
Project: C&LW
Location: Kalama Bar, OR
River: Columbia River
Length: 200.0 ft
Pile Spacing: 2.5 ft

Inspection Date: 10/29/86
YR Constructed: 1923
Wetting Freq: Seasonal
Cutoff Elevation: 8.0 ft
King Pile Cutoff: 28.0 ft
BP Spacing: N/A APS: N/A

Gage: ________ ft Time: ________ Location: ________ ft

OUTER DOLPHIN:

	Missing	Loose	Rotten
Wire Rope Wrap			
King Pile			
Dolphin Pile			
Cluster Pile			

OD Sounding: ________ ft

	DIKE COMPONENT	Dist From OD (ft)	Number or Length (ft)	Distress Type M	L	R	Sounding (ft)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Comments:

No distress observed

Good.