Exponent™

Ward Cove Sediment Remediation Project

Design Analysis Report for the Marine Operable Unit of the Ketchikan Pulp Company Site

Prepared for

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Acronyms and Abbreviations

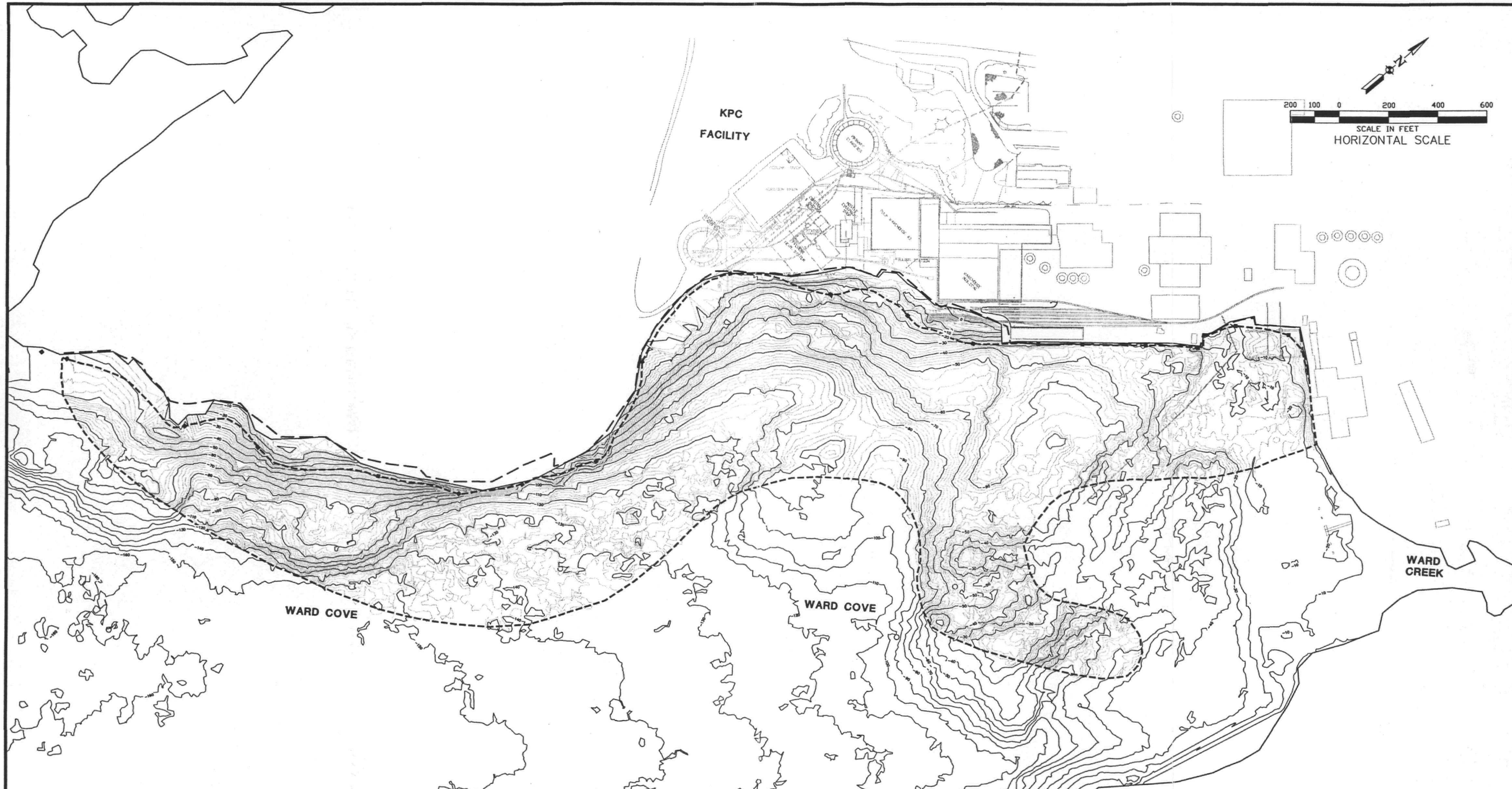
ADDAMS	Automated Dredging and Disposal Alternatives Management System
ADEC	Alaska Department of Environmental Conservation
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
Corps	U.S. Army Corps of Engineers
cy	cubic yards
DTSR	detailed technical studies report
EPA	U.S. Environmental Protection Agency
fps	feet per second
GFP	Gateway Forest Products
KPC	Ketchikan Pulp Company
MLLW	mean lower low water
NMFS	National Marine Fisheries Service
PAH	polycyclic aromatic hydrocarbon
pcf	pounds per cubic foot
psf	pounds per square foot
PSVP	performance standard verification plan
RAO	remedial action objective
ROD	record of decision
STFATE	Short-Term Fate of Dredged Material Disposal in Open Water
USFWS	U.S. Fish and Wildlife Service
WES	Waterways Experiment Station

1. Introduction

This design analysis report has been prepared as part of the remedial design phase for implementation of the remedial action set forth in the record of decision (ROD) for the Marine Operable Unit of the Ketchikan Pulp Company (KPC) site (U.S. EPA 2000), Ketchikan, AK. This report is one of the requirements for final design at the site. KPC will implement remedial design and remedial action at the Marine Operable Unit. The investigation of the Marine Operable Unit of the KPC site and the design and implementation of a cleanup alternative were initiated under a Clean Water Act consent decree between the U.S. Environmental Protection Agency (EPA) and KPC. However, it is anticipated that this work will be completed under a Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) Consent Decree between EPA, KPC, and Gateway Forest Products (GFP). GFP is the current owner of the former pulp mill assets and patented tidelands in Ward Cove.

In May 1999, KPC completed a detailed technical studies report (DTSR) (Exponent 1999) for identifying contaminated sediments in Ward Cove that warrant sediment remediation. The DTSR included a remedial investigation, which documented the nature and extent of sediment contamination, and a feasibility study, which evaluated remedial action alternatives. The DTSR identified an area of concern (AOC) that represents an area where, based on a human health assessment and ecological evaluation, remediation of contaminated sediments may be warranted.

After completion of the DTSR, additional remedial design sampling was conducted in Ward Cove in September and October 1999. The results of the design sampling are presented in the cruise and data report (Exponent and Hartman 2000a). Information from remedial design sampling was used to refine the boundaries of the AOC (Figure 1-1), as documented in Exponent and Hartman (2000b) (included as Appendix D). The data from



NOTE

ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED
ELEVATIONS IN FEET, MLLW

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

LEGEND

— — — — AOC SHOWN IN FEASIBILTY STUDY (87 ACRES)

- - - - - - - - AREA OF CONCERN (AOC) (80 ACRES)

SHORELINE

FOSTER WHEELER AND HARTMAN CONSULTING CORPORATION	
DATE: 3/6/2000 SCALE: AS NOTED DRAWN: MCG	**FIGURE 1-1** **KETCHIKAN PULP COMPANY** **AREA OF CONCERN**

this sampling and the data in the DTSR were used in performing design calculations and computer modeling for this report.

Remedial design is generally defined as those activities to be undertaken to develop the final plans and specifications, general provisions, special requirements, and all other technical and procurement documentation necessary to fully implement the remedial action. The purposes of this report are to:

- Describe the methods and present results of design calculations and computer modeling for design of the remedial action
- Present the rationale for specific remedial actions at the site in more detail than presented in the DTSR or ROD
- Describe the design requirements for implementing remedial actions that will form the basis for the final design drawings, specifications, and work plans.

The next step in the design process will be to prepare the balance of the documents for the remedial design. These documents are as follows:

- Contract drawings and technical specifications for the contract between the prior owner and the construction team
- Construction schedule and construction cost estimate
- Performance standard verification plan (PSVP)
- Construction quality assurance plan
- Water quality monitoring plan.

A remedial action work plan will be prepared after the design.

It is recognized that a number of conditions that influence the remedy design (e.g., bearing capacity, thickness of organic layer) are heterogeneous throughout the site. It is anticipated that refinements to the design will be made in the field. The decision framework to support these refinements is provided in the PSVP.

1.1 Overview of Remedy

In the Superfund ROD (U.S. EPA 2000), EPA documented its decision for remediation of contaminated surface sediments in the 80-acre AOC. The contaminated sediments that will be cleaned up were impacted by historical releases from the KPC site and they are toxic to benthic organisms. The objective of the cleanup is to reduce toxicity of surface sediments (i.e., the top 10 cm) to the benthic organisms and to enhance recolonization of the bottom sediments to support a healthy community of marine animals. EPA has determined that the contaminated sediments are not toxic to human health or to birds and mammals living in Ward Cove.

The selected remedy will achieve remedial action objectives (RAOs) (i.e., reduce toxicity in surface sediments and enhance recolonization of sediments to support a healthy benthic community) through a combination of thin-layer capping, mounding, navigational dredging, and natural recovery. The selected remedy for the Marine Operable Unit of the KPC site includes the following elements:

- **Thin-Layer Capping—**A thin-layer cap (approximately 6 to 9 in.) of clean, sandy material will be placed over problem sediments where practicable within the AOC. Thin-layer capping is preferable to mounding. Thin-layer capping is estimated to be practicable for approximately 27 acres, which includes approximately 2 acres that are predicted to be capped after dredging, 7 acres that may be either thin capped or mounded, and approximately 4 acres that are considered transition areas between the different remedial options.

- **Mounding**—Mounds of clean material will be placed in problem sediments where thin-layer capping is not practicable, and where mounding is practicable. Mounding will generally be considered practicable in those areas where the organic-rich sediments are less than 5 ft thick and the sediments do not have the bearing capacity to support a thin-layer sediment cap (i.e., the bearing strength is less than 6 pounds per square foot [psf]). Mounding will be used over at least 1 acre and up to a maximum of 20 acres, if thin capping is not effective. The total area considered viable for mounding is limited by the thickness of soft organic material because mounding material is expected to sink below the surface of *in situ* sediments. Mounding may be attempted if thin capping is monitored and determined to be unsuccessful in placing clean, sandy sediment on the surface.

- **Dredging and Upland Disposal**—Navigational dredging of approximately 17,000 cubic yards (cy) of contaminated sediments will be performed in an approximate 3-acre area in the deep draft berth area in front of the main dock facility. To allow reasonable access to vessels, it is estimated that this deep draft berth area will be dredged to approximately –40 ft mean lower low water (MLLW) at the bow end of the vessel and to –44 ft MLLW at the stern end of the vessel. In addition, dredging of approximately 3,500 cy of contaminated sediments will be performed in an approximate 1-acre area near the planned shallow draft berth area in the northeast corner of Ward Cove. It is estimated that this shallow draft berth area will be dredged to –14 ft MLLW, provided that bedrock does not extend above this elevation. In both areas, the areal extent of dredging and the dredge depths have been determined to be necessary to maintain current and accommodate reasonably anticipated future navigational needs and because a cap could not be placed in these areas without constraining current and potential future navigational needs.

Dredged sediments will be disposed at an upland landfill authorized to accept the material. After dredging, a thin-layer cap of clean, sandy material will be placed in dredged areas unless native sediments or bedrock is reached during dredging. Potential propeller scouring will be considered in designing the capping remedy for these areas.

- **Log Removal from Selected Locations**—Prior to dredging, sunken logs in the area to be dredged will be removed. Logs removed from the dredged areas will be disposed in an authorized landfill unless they can be otherwise used in a manner (e.g., hog fuel) that is acceptable to the regulatory agencies.

- **Natural Recovery**—Natural recovery is the selected remedy in areas where neither capping nor mounding is practicable. Natural recovery is estimated to be the remedy for approximately 50 acres of the 80-acre AOC, as follows:

  1. An 8-acre area in the center of Ward Cove and a 2-acre area near Boring Station 8 that have a very high density of sunken logs (>500 logs/10,000 m^2)

  2. A 13.5-acre area where water depth to the bottom of the cove is deeper than −120 ft MLLW and the depth of the sediment is currently considered to be too great to cap

  3. A 14.5-acre area where slopes are estimated to be greater than 40 percent and are currently considered to be too steep for capping or mounding material to remain in place

  4. An 11-acre area where the organic-rich sediments do not have the bearing capacity (i.e., strength is less than 6 psf) to support a sediment cap and are too thick (i.e., thickness is greater than 5 ft) to practicably allow for placement of sediment mounds

5. A 0.2-acre area near the sawmill log lift where maintenance dredging generally occurs on an annual basis.

- **Institutional Controls**—An institutional control has been developed for the site to ensure that any future post-remediation activities within the AOC do not result in material damage to the thin-layer cap or mounds. As such, the following requirement is included in an "Environmental Protection Easement and Declaration of Restrictive Covenants" recorded on October 28, 1999:

  > Projects or activities that materially damage the cap or mounds applied to tidelands or submerged lands shall be required, at the direction of EPA, to redress such impacts, e.g., a dredging project that may erode or displace large portions of the cap will be required to repair or replace the cap.

  The term "cap" in this requirement is inclusive of any clean material (e.g., cap or mound) placed on the bottom of Ward Cove. As an example, when activities in the AOC, such as dredging projects, expose substantial area(s) of non-native organic-rich sediments and thus adversely affect the continued recovery of the benthic community in the sediments, the current owner of the patented tidelands will be required, at the direction of EPA, to include replacement of the cap in exposed areas.

- **Long-Term Monitoring**—Long-term monitoring of surface sediments in both capped/mounded areas and in natural recovery areas will be performed until RAOs are achieved, as determined by EPA. The long-term effectiveness of sediment remediation in the AOC in Ward Cove will be demonstrated by a reduction in sediment toxicity and the existence of a healthy benthic community in the sediments. EPA does not intend to require long-term monitoring of surface sediments within the maintenance dredging area and the very high-density areas of sunken logs.

- The condition of the benthic community will be analyzed using methods that will include, but will not necessarily be limited to, comparisons to relatively unimpacted areas of similar habitat (e.g., reference areas or areas of Ward Cove outside of the AOC that are of similar habitat), as well as spatial and temporal comparisons of community structure within the AOC. Benthic community indices will include taxa richness and abundance as well as other relevant indices. EPA will require monitoring of ammonia and 4-methylphenol in surface sediments to assist in interpretation of biological monitoring data.

- **Other Work**—As deemed appropriate by EPA, subtidal sediments associated with an intermittent sheen in a localized area near the east end of the main dock will be addressed through dredging and disposal of suspected polycyclic aromatic hydrocarbon (PAH)-contaminated sediments.

1.2 Design Approach

This section describes the design approach being used to implement the selected remedy described in the KPC ROD for the Marine Operable Unit (U.S. EPA 2000). As described in the ROD, the RAOs for surface sediment in the AOC are to:

- Reduce toxicity for surface sediments

- Enhance recolonization of surface sediment to support a healthy marine benthic infaunal community with multiple taxonomic groups.

A benefit of achieving these RAOs is that a healthy benthic infaunal community serves as a diverse food source to large invertebrates and fish.

The RAOs for Ward Cove can be considered the overall performance goal for the project. However, specific performance or method requirements (and associated verification methods and quality control checks) are needed during construction and throughout post-construction monitoring to optimize the potential for achieving RAOs as efficiently and effectively as possible over as much of the AOC as possible. Performance requirements identify the desired results and the method of obtaining them is left to the construction team. Method requirements give detailed directions on what to do and how to do it. The potentially responsible parties and property owners work with a design team to specify a mix of performance and method requirements that provide a realistic framework with built-in control checks that maximize the potential for success.

The remedial action for the KPC Marine Operable Unit has some complicating features relating to the concept of performance requirements and method requirements. First, achievement of RAOs cannot be measured immediately after remedial action. This will be measured as part of long-term monitoring at the site. Second, placing cap material in water depths of greater than 80 ft, on very soft organic material, is not routine work. These two complications result in uncertainty for the development of the final design, plans, and specifications to realize remediation. This uncertainty limits the value of performance-based requirements for the construction phase of the project and emphasizes the need to effectively integrate both method- and performance-based requirements.

Some examples of general method and performance requirements for major stages of the construction effort are described below.

- **Dredging of Deep Draft and Shallow Draft Berth Areas**
  - Method Requirements: Type of equipment, positioning techniques, production rates
  - Performance Requirements: Target dredge areas and dredge depths, removal volumes
- **Sediment Dewatering and Disposal**
  - Method Requirements: Specifications for dewatering area, dewatering method, rehandling methods, methods for transferring to landfill
  - Performance Requirements: Volume of dewatering required prior to transfer to disposal area, water quality requirements and related points of compliance
- **Log Removal and Disposal**
  - Method Requirements: Type of removal equipment, positioning techniques, transportation methods
  - Performance Requirements: Criteria for assurance of removal
- **Thin-Layer Capping**
  - Method Requirements: Type of placement equipment, placement control methods
  - Performance Requirements: Requirements for sand on or in surface sediment over a given fraction of the target area
    Combination Requirements: Requirement for a given volume of capping material per unit acre

- **Mounding**
  - Method Requirements: Type of placement equipment, placement control methods
  - Performance Requirements: Requirement for sand on or in the sediment surface over a given percentage of the area
  - Combination Requirements: Requirement for a given volume of mounding material per unit acre.

Given the need for flexibility during thin capping and mounding construction, an evaluation process or decision framework (described in the PSVP) will be applied during construction to optimize or refine placement methodology. Key decision points and performance measures will be used to optimize method performance. Examples of assessing and modifying method requirements to optimize method performance, or support the decision to shift from thin capping to mounding, include the following:

- Decision Point: Is the capping method being used actually covering surface sediment as evenly as possible?
  - Optimization Measurement: Surface samples
  - Potential Action: Adjust placement methods (e.g., release time, release location relative to bed)
- Decision Point: Is thin capping working? Should thin capping be transitioned to mounding methods?
  - Measurement: Surface samples
  - Potential Action: Adjust placement methods (e.g., release time, release location relative to bed), apply additional cap material, begin mounding

- Decision Point: Is mounding working? Should mounding be transitioned to natural recovery?
  - Measurement: Side-scan sonar, diver survey, remote video survey
  - Potential Action: Adjust placement method, terminate mounding if infeasible due to depth of soft organic matter.

The remedy design for the Ward Cove AOC is based on field and oversight contracting experience and on engineering calculations. In routine waterway design projects, the engineering calculations focus on analysis of the completed work and how the design will perform over the long term. The methods of construction and short-term impacts are usually not analyzed or specified, but are left up to the construction team. For example, traditional cap analytical design focuses on long-term integrity of the cap and effective chemical isolation. For the KPC project, engineering calculations are used to predict the likely outcome of alternative methods and likely failure points at the site (e.g., areas where sediment is too steep to cap, locations where the limited bearing capacity and thickness of the organic layer make mounding untenable).

Two of the tasks for the remedial design are to prepare a PSVP and a construction quality assurance plan. Because the RAOs are long-term objectives, more specific performance criteria are needed to evaluate the effectiveness of remedial action construction. In the case of the KPC RAOs, these post-construction criteria are temporary, but have a significant impact on how success of the construction phase is defined. A performance-based approach would require a minimum cap thickness over a minimum area of the remedial action sectors shown in this report. Alternatively, a combination of the performance requirement and the method requirement could require the owner to spread cap material in a specific way at the rate needed to provide an average application thickness of 6 in. per acre (about 800 cy). The process and criteria for assessing the success of capping and mounding will be provided in the PSVP. Remediation goals can be achieved for the KPC project with partial thin-cap cover and mixing of clean sediment in the upper surface of the organic-rich sediment.

1.3 Report Organization and Correlation with Statement of Work Elements

The remainder of this design analysis report consists of the following sections:

- Section 2—*Placement Methods for Capping and Mounding*
- Section 3—*Navigation Channel Design*
- Section 4—*Propeller Scour Analysis*
- Section 5—*Dredging and Related Activities*
- Section 6—*Technical Parameters and Design Calculations*
- Section 7—*Overview of Remedial Action*
- Section 8—*Compliance with Applicable or Relevant and Appropriate Requirements*
- Section 9—*References*

In addition, four appendices are provided with this report. Appendices A, B, and C present calculations for estimating foundation support and slope stability, short-term fate, and propeller scour, respectively. Appendix D contains a technical memorandum describing the basis for modifications to the AOC.

This design report addresses the topics required for the "Design Analysis" in the statement of work. Table 1-1 identifies the required elements and the corresponding major sections of this report.

Table 1-1. Correlation between statement of work elements and report sections

Design Analysis Element	Location in Design Report
1. Technical parameters and calculations	Section 6
2. Characteristics of cap material	Section 2
3. Source material criteria	Section 2
4. Propeller-driven erosion	Section 4
5. Cap and mound placement techniques	Section 2
6. Dredged sediment handling	Section 5
7. Dredge depth design	Section 3
8. Dredge material volumes	Section 3
9. Dredging techniques	Section 3
10. Upland landfill location	Section 5
11. Analyses for design	Section 6
12. Access and easements	Section 5

2. Placement Methods for Capping and Mounding

A number of material placement methods have been evaluated to accomplish the thin-layer capping and mounding within the Marine Operable Unit AOC. Five in-place methods were originally considered for completion of this aspect of the project, as described in the DTSR (Exponent 1999).

Capping or mounding material is generally brought to the site by barge and put in place using a variety of methods, depending upon the selected remedial action alternative. The issues generally associated with in-place capping are 1) obtaining an appropriate cap thickness over the entire problem sediment area, and 2) placing the capping material without displacing sediment. Mounding will be considered for an area only if capping is considered likely to fail or has been demonstrated to fail. The issues associated with placing mounds are 1) foundation stability, and 2) losses (or submergence) of mounding material in areas of thick organic deposits. Placement methods include the following:

- *Surface release from barges* is a technique where the clean sediment is slowly released from a split-hull barge as the barge is slowly towed over the problem sediment area.
- *Tremie tube* placement of capping material is a method to control the capping material as it passes through the water column for deep-water capping sites. A tremie tube is a large diameter tube, usually greater than 10 ft in diameter. The tube contains the material as it travels through the water column and allows for relatively accurate placement. The material can be pumped from the barge and discharged through the tremie tube or can be placed into a hopper and fed into the tubes.
- *Hydraulic washing* is a technique where the clean sediment is washed off of a barge with large water hoses. This technique has been

successfully used in shallow water (10–30 ft) at the Eagle Harbor project at Bainbridge Island, Washington, where bed material was predominantly sandy silt and silty sand. This method allows the clean sediment to rain down over problem sediment.

- *Pipeline with diffuser placement* of capping material uses a pump-out system to transport the capping material from the barge to the capping area. The material is pumped from the barge through a floating pipeline and into a submerged diffuser, which reduces the slurry velocity and allows the capping material to fall gradually over the problem sediment area.
- *Direct mechanical placement* of capping material uses a clamshell dredge to lower and release the capping material near the bed surface.

In the following sections, the necessary properties of cap and mound material and placement techniques are discussed.

2.1 Cap and Mound Material

The purpose of the remedial action is to reduce surface sediment toxicity and improve benthic habitat so a greater variety of infaunal organisms can live there. As described in Section 7, approximately 23,500 to 41,200 cy of material will be needed for the thin cap and mounds. Imported clean material with grain size ranging from sand to silt and natural levels of organic matter is considered acceptable as surface cap material for benthic habitat. The imported materials used for capping or mounding must be tested and proven to be absent of substances that may have acute, chronic, or bioaccumulative effects.

All cap and mound material will be tested, and reports submitted for the following:

- Specific gravity of uncompacted materials
- Weight per unit volume of uncompacted materials
- Grain size distribution (ASTM 422-63)
- Modified Proctor test (ASTM D 1557-78/D 698-78)
- Priority pollutant metals
- Volatile organic compounds (EPA SW 846 8240)
- Semivolatile organic compounds (EPA SW 846 8270)
- Polychlorinated biphenyls and pesticides (EPA SW 846 8080).

Analysis of capping and mounding material for dioxin is not expected to be needed if the material is collected below grade in an area that is not anthropogenically influenced. If the capping and mounding material is taken from urban or industrial areas, consists of material removed for navigational dredging in another area, or otherwise has a reasonable likelihood of being anthropogenically influenced, then dioxin analysis may be required. The EPA project manager will review information on the source of material and determine whether dioxin analysis must be conducted (by EPA SW-846 8290).

The contractor will submit documentation and location of materials source, along with representative sample(s) (10 gallons per sample).

The ability of the material to meet engineering requirements poses a more rigorous constraint on specifications. The general material requirements for both cap and mound are listed below:

- Organic content from less than 0.5 to 5 percent (i.e., natural levels of organic matter for surface sediments of southeast Alaska).
- Acceptable concentrations of organic chemicals and metals (i.e., below levels of concern for human health and the environment).
- Cap Material: Particle size large enough to settle onto the sediment within the cap areas and small enough to rest on top of very soft organic material.
- Mound Material (surface): Similar to cap material, but could consist of coarser sand because retention on the sediment surface is not a criterion.
- Mound Material (subsurface): Could range from gravel to fine sand, depending on availability. Habitat suitability is not a concern for the subsurface mound foundation.
- Particle size that will minimize turbidity in the water column.
- Relatively low cost per ton (a function of both unit cost and transportation costs).
- Bulk quantities of material that can be loaded onto barges for placement in Ward Cove.

Cap material can be delivered to Ketchikan using standard shipping methods for bulk cargo. It is expected that barge transport would be the most economical, unless an upland source near Ketchikan is used. In that case, the cap material could be delivered by standard highway trucks.

2.1.1 Cap Material

Natural fine-to-medium sand with non-plastic silt is recommended for the cap material. A slightly more coarse sediment will be required for capping in the barge approach channel and the –44 ft deep draft berth area. Medium sand is defined as soil with particle size of 0.43–2.0 mm and fine sand is soil with particle size of 0.08–0.43 mm. Non-plastic silt is soil with particle size between 0.005 and 0.08 mm and plasticity index of less than 4 (as determined by the Atterberg limit tests).

The theoretical settling velocities of individual soil particles through the water column are as follows:

- Small gravel—1.0 feet per second (fps)
- Coarse sand—0.5 fps
- Medium sand—0.1 fps
- Fine sand—0.02 fps
- Non-plastic silt—0.01 fps
- Clay—0.002 fps.

The gradation for imported cap material is shown in Table 2-1.

Table 2-1. Cap material gradation

Particle Size (mm)	Particle Size (U.S. sieve size)	Percent Passing (percent of particles finer than the given size)
4.0	No. 4	100
2.0	No. 10	80 to 100
0.43	No. 40	25 to 100
0.08	No. 200	0 to 25
0.005	NA	None

Atterberg limit tests should be performed on the portion of the soil finer than the No. 40 sieve and the plasticity index must be less than 4. The organic content of the material can range from less than 0.5 to 5 percent on a dry-weight basis. (Test methods for the Atterberg limit tests are described in the cruise and data report [Exponent and Hartman 2000a]).

Soil with a significant mass of clay particles (i.e., particle size less than 0.005 mm and plasticity index greater than 4) is not recommended because clay particles can be suspended in salt water for long periods, or tend to clump and form larger masses of sediment. Suspension of loose clay material results in loss of capping sediment along with elevated turbidity at the site. The clumping of clay particles increases the fall rate, which results in higher impact on the bed and submergence into the fine organic sediment. Soil with coarse sand and gravel is also not recommended for capping on the deeper organic sediment. The larger particles in this mix will also settle too fast in the water and bury upon impact into the very soft organic sediment at the site. Coarser sand with some small gravel may be used in areas that are dredged and in the approach channel. The dredged area in the deep berth will have subsurface sediment with increased sediment strength to support the cap. The shallow draft berth approach channel is in an area that has also been identified as having greater shear strength, and along with shallower depth, the channel should also be able to support a coarser grain cap.

Sources for capping material are located in southeast Alaska, British Columbia, and Puget Sound. Specific sources of imported material will not be identified in the design, but will be determined during construction. The design specifications will give the criteria for the imported material and will require sampling with physical and chemical testing.

The imported material could be obtained from upland sources or from sediment dredged at another site. The imported material could be a processed or artificial material. For example, excess material from other construction projects may be suitable as long as it meets the material test requirements and engineering properties. It is expected that the final selection of source material will be made based on sediment grain size, low concentrations of organic chemicals and metals, absence of bioaccumulative substances, and lowest total cost delivered to the site.

2.1.2 Mound Material

If mound placement replaces capping as the only viable alternative, the specifications for material can be altered to meet the unique requirements of mounding. The exposed surface of the mound (i.e., the upper 6–12 in.) will need to meet the habitat requirements for benthic infauna, described in Section 2.1.1. However, the base of the mound can be composed of foundation material (i.e., gravel or cobble). In the Ketchikan area, bedrock is present near the ground surface. As a result, gravel- and cobble-size material is readily available. (Gravel-size material has particles of 1/4 to 3 in. and cobble-size material has particles of 3 to 12 in.)

The foundation material should be well-graded with particle size from cobbles to fine sand. The maximum size should be 12 in. Material with uniform particle size should not be used because particles of the same size do not compact as closely together, leaving more void space between the particles. For example, if only 6- to 12-in. size cobbles were used, there would be void spaces of several inches in size. Additional volume of cap material for the surface layer would be required. Mound design will consider the possible use of large granular material for mound foundation.

2.2 Cap Placement Method Selection

Cap material goes through three phases of descent independent of the water depth at a site: convective descent, dynamic collapse, and passive dispersion (Bajek et al. 1987). During convective descent, the material falls through the water under the influence of gravity. As the water depth increases, the time the material spends in the water column increases, as does the water entrainment. Dynamic collapse starts when material impacts the bottom, where the vertical momentum is transferred to horizontal spreading. After dynamic collapse, material can be moved laterally by passive dispersion.

Cap material can be released from the water surface only by surface releases from barges and hydraulic washing. Cap material can be released from near the surface, or from variable depths below the surface using tremie tubes, pipeline with diffuser, or mechanical placement. Subsurface release of capping material provides more control over placement accuracy and fewer water quality turbidity impacts. Given the variable water depths and the wind and current conditions in Ward Cove, subsurface release methods have significant advantages over surface release methods. Therefore, only the subsurface release methods are evaluated in more detail below.

During the capping activity, the haul barge and equipment barge will be anchored, repositioned, and anchored again. The contractor will control the placement and movement of the anchors to limit or eliminate resuspension of bed sediments. Whenever possible, the anchor will be located outside the AOC or beyond areas where cap material has already been placed. No anchor dragging will be allowed.

2.2.1 Tremie Tube

For application of the tremie tube to the Ward Cove project, capping material would be stockpiled on a flat deck material barge. This material would be fed by conveyor, or by small front-end loader, to a material hopper attached atop the tremie tube, which would be fixed to the barge. The tremie delivery operation would involve the continuous supply of the capping material to the hopper onboard the barge, and discharge down the tremie tube. The barge and tremie tube would be moved by tugs or anchors and winches. By monitoring the rate of material introduction, and horizontal movement of the tremie, a desired amount of material can be placed over the coverage area. The conveyor can include an electronic meter to measure the amount of material being delivered to the tremie.

The Japanese have used mechanical tremie technology for subaqueous capping operations. This equipment consists of a tremie conduit attached to a barge equipped with a conveyor. The capping material is initially placed in the barge mechanically by a barge-mounted crane. The conveyor then mechanically feeds the material to the tremie conduit. Caps have been placed in water depths of up to 40 ft. They have used "telescoping" tubes, which can be adjusted to different lengths, depending on water depth. Anchor and winch systems are used to swing the barge from side to side and forward so that larger areas can be capped (Palermo et al. 1998).

The conduit provides the desired isolation of the discharge sediment from the upper water column during descent, and improves placement accuracy. However, because the conduit is a large-diameter straight vertical section, there is little reduction in momentum or impact energy over conventional surface discharge. The weight and rigid nature of the conduit require a sound structural design and consideration for forces due to currents and waves (Palermo et al. 1998). Because of the pressure at depth, the tremie tube would have slots to equilibrate the pressure inside and outside the tube. Structural requirements will be especially important if capping is conducted during the winter, when weather conditions are poor.

The accuracy of the placement operation with the tremie method is heavily dependent on currents, wave, and wind environment. With modern dredge positioning, pressure sensors, and transducers, the location of the top of the tremie tube and the depth of the tremie discharge can be monitored with some accuracy. However, the actual barge positioning and discharge control on the bed in deep water is difficult. Operation in the winter months at Ward Cove will be difficult with a tremie system. Strong winds and deep water with potentially poor anchoring due to the nature of Ward Cove sediment would further decrease the production rate and precision placement using a submerged tremie. With increasing depth, the discharge positioning control becomes increasingly worse.

2.2.2 Hydraulic Pipeline with Diffuser

With the hydraulic pipeline method, cap material would be slurried in the haul barge with make-up water (seawater). A centrifugal pumping system would pump slurry into a flexible discharge pipeline. A diffuser could also be used at the discharge end of the pipeline to redirect the slurry discharge away from the placement surface, allowing the capping material to settle out with low impact forces. On the Eagle Harbor Operable Unit B project (Bainbridge Island, Washington), a hydraulic capping system was developed that used a material hopper to feed material into the pump discharge line. The discharge pipeline was moved using a small derrick onboard the barge and/or separate derrick barge. Careful control of the discharge pressure was required to prevent erosion of the bottom sediments.

The hydraulic pipeline system offers positioning accuracy comparable to the clamshell bucket. The accuracy of the placement operation is dependent on site conditions such as currents, wind, and wave environment. With positioning and pressure sensors and transducers, the location of the top of the discharge pipe and the depth of the discharge can be monitored. Again, the control of precision cap placement is more difficult to maintain with greater depth. This method would best provide successful thin capping results in shallow water, where the discharge position can be controlled with a reasonable level of accuracy.

2.2.3 Mechanical Bucket

Placing capping material by mechanical bucket offers the most direct and controllable means of conveying material from the material barge to the bottom. The mechanical bucket capping method is essentially the reverse of mechanical dredging. A derrick barge equipped with a mechanical clamshell bucket would be moved alongside a material barge loaded with the capping material. The crane derrick would swing over the material stockpile, grab a bucket load, swing over the target capping area, lower the bucket to within about 10 to 20 ft of the bottom surface elevation, and open the bucket to release the capping material. A sealed, flat-edge bucket would be the best tool to minimize the losses of capping material as it is lowered through the water. The derrick barge would be held in position using anchor and wire systems. The derrick barge could cover a significant area of capping by extension of the derrick boom, such that continuous movement of the equipment would not be required as it is with hydraulic discharge or tremie tube placement. A tug would be used to move the derrick barge and material barge over the capping area.

Operation of the derrick barge with clamshell would still be difficult during the winter months. However, when compared to the other proposed methods of placement, the operation of this equipment would require fewer personnel, reduced time on deck for labor, and less movement of the anchoring system.

2.2.4 Summary

Where water depths are less than approximately 20 to 40 ft, all three of the methods identified for cap placement could be effectively used depending on the contractor experience. These methods would offer similar levels of control in the horizontal and vertical axes. As depth increases, the inherent positioning and control difficulties for each method would be susceptible to impacts from sea state, tidal currents, and surface weather (temperature, precipitation).

The selection of one method of placement in this analysis of design is intentionally not specified to allow contractors with varied experience to bid using their individual expertise and equipment capabilities. The contractor will be required to accomplish a performance specification for capping and may elect to use one, two, or all three methods of cap placement. An alternative method may be proposed that is not included in this report. The contractor proposals will be evaluated and then rated based on the contractor's experience and proposed methodology to ensure the best opportunity for success of this remedial action.

It is reasonable to assume that the contractor bidding the project will take into consideration the weather conditions, the depth of dredging and cap placement, as well as their equipment capabilities. The tremie and the hydraulic pipeline system incorporate more labor and equipment requirements than does the clamshell operation. During winter storm conditions, personnel will be working in the open to adjust pipeline, move equipment, and feed the discharge line of a tremie hopper or hydraulic pump. These more complicated methods will be more severely impacted by winter storms, low temperatures, and short daylight hours. Because of these difficult operating conditions, special attention must be given to safety of operation for these methods and any other activities on the water.

A number of marine contractors located in southeast Alaska, British Columbia, and Puget Sound regions could accomplish the capping by mechanical bucket. Capping by either tremie or hydraulic pipeline methods could be accomplished only by a limited selection of Puget Sound-based contractors who have experience with these techniques.

2.3 Mounding Placement

Mounding is considered to be an option only when thin capping is not practicable. The mounding technique builds an island of sediment in the organic bed material, with the top of the island, or mound, above the existing bed surface of organic material and the bottom of the mound resting on anything with sufficient strength to support it (i.e., organic matter with sufficient shear strength, native sediment, bedrock).

2.3.1 Concept of Mounding

The DTSR presented field data that identified the presence of very soft, organic sediment. This finding prompted the early concern that the Ward Cove sediment could not support a cap of clean material, regardless of cap thickness. An alternative method of creating mounds of clean sediment within the organic sediment was proposed.

The proposed method of mounding is to place clean sediment and create islands or ridges of clean material that have a top elevation above the organic-rich surface. The bottom of these mounds will be supported by stronger subsurface sediment that would include native sediment or rock. The top of the mound will be above the organic sediment and become clean surface sediment that provides the thin-cap concept of improving ecosystem conditions in the AOC.

2.3.2 Mound Configuration

The mounding design is based on the natural angle of repose for the sediment used in the creation of underwater islands of clean surface sediment. Mounds can be built as a deposit of sand material. Alternatively, they can be two-layer mounds, with a bottom core of granular gravel, cobble, or rock material that is covered with sandy sediment to create islands or ridges of clean surface sediment.

The mound requires significantly more sediment for creation of a clean, granular surface layer than does the thin-cap alternative. The mound composition will therefore be dependent on the availability of a foundation material that is coarser than the sand cap sediment and more readily obtained. If inexpensive, clean, coarser core fill is not available, the mound will be constructed using the sand cap material. The mound design for this design analysis report is based on the use of the sand cap material. If coarser foundation material is available, it will require the same testing requirements as sand prior to application on the KPC project.

Material mound geometry will be a function of the thickness and shear strength of the soft surface layer, mounding pattern, and placement method used. With an understanding of the geotechnical characteristics of the *in situ* surface layer sediments, it is believed that the weight of the mound material would sink into the organic surface material. This would result in lateral and upwards displacement of the existing organic surface material. The mound surface would be rectangular shaped. This configuration would provide extended lengths or ridges of continuous sand surface, which would provide better habitat than discrete "islands" of sand surrounded by the existing organic material. Conceptual renderings of the mounding cross-section and plan views are provided in Figures 2-1 and 2-2, respectively.

Because mounds will be constructed in those areas where the existing sediment does not have sufficient bearing capacity to support a thin cap, the mound material will cause bearing capacity failure. A bearing capacity failure means that the existing sediment will be displaced laterally and upwards away from the mounds in what is called a "mud wave." When a mud wave occurs, the existing sediment is compressed somewhat, but the volume change is insignificant. Therefore, the mass of existing sediment displaced is unchanged and the volume is approximately the same. As the spacing between the mound decreases, there is less room for displaced existing sediment between the rows of mounds. If the mounds are too close, the existing sediment will be forced up over adjacent mounds. This occurrence will limit the spacing of mounds and create a practical limit of the percentage of bottom surface that will be exposed sand. Estimated volumes of imported material required to construct mounds and maximum practical cover percentages are described in Section 6.4.

Sand material would replace the very soft organic surface material over the majority of the mound footprint. To provide initial displacement and foundation support for a

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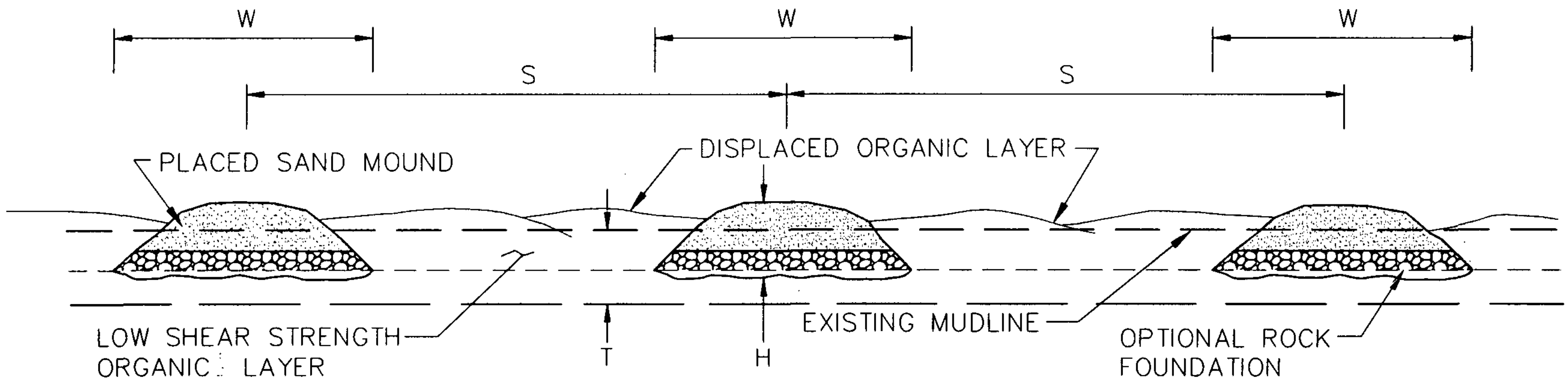
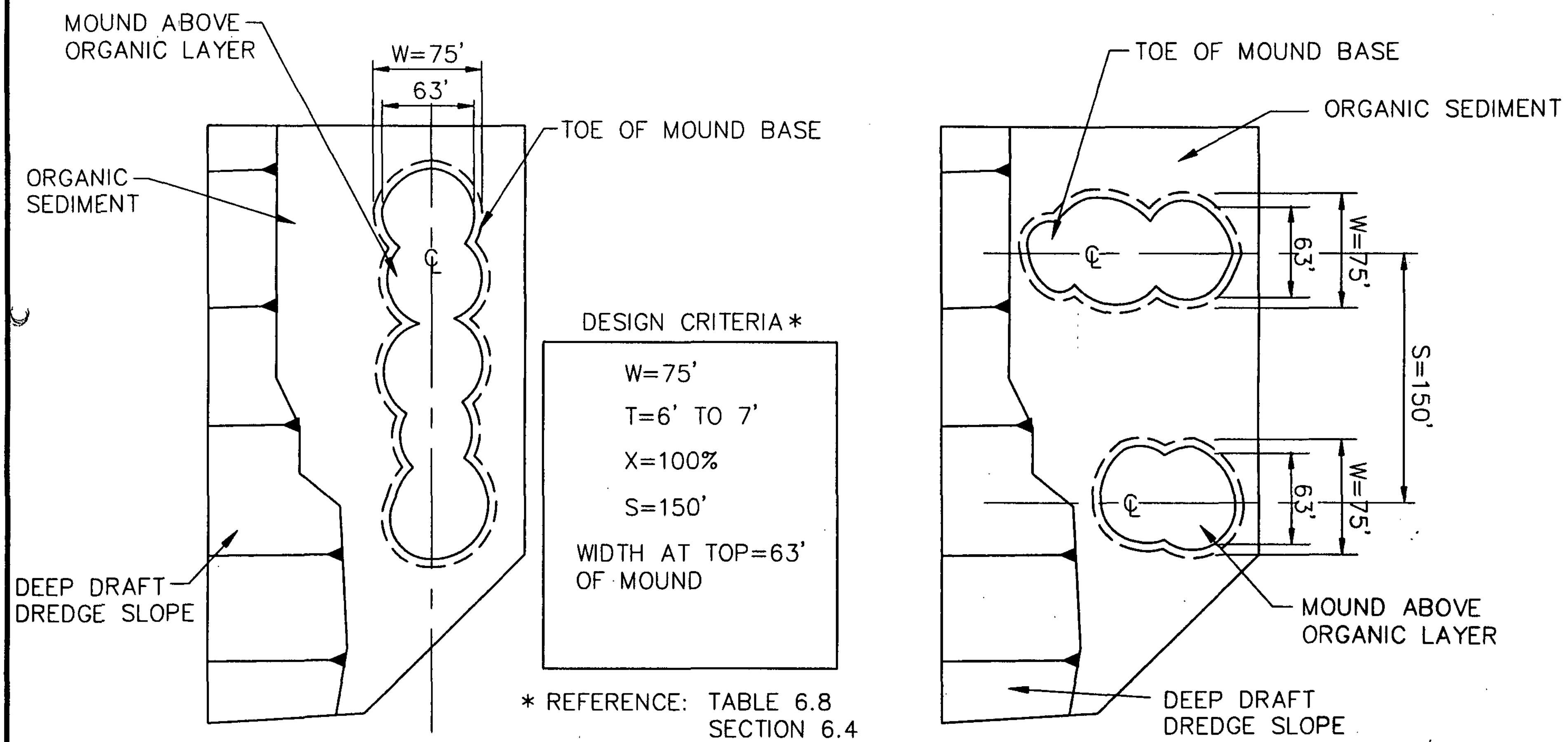


S= SPACING BETWEEN MOUND CENTERLINES
T= THICKNESS OF ORGANIC LAYER
W= WIDTH OF MOUND AT BOTTOM OF MOUND
H= HEIGHT OF MOUND FILL

FOSTER WHEELER AND HARTMAN CONSULTING CORPORATION	
DATE: 6/7/2000 SCALE: NTS DRAWN: MCG	**FIGURE 2-1** **MOUNDING DESIGN CONCEPT** **CROSS SECTION**



EAST-WEST ALIGNMENT
NTS

NORTH-SOUTH ALIGNMENT
NTS

S= SPACING BETWEEN MOUND CENTERLINES
T= THICKNESS OF ORGANIC LAYER
W= WIDTH OF MOUND AT BOTTOM OF MOUND
H= HEIGHT OF MOUND FILL

FOSTER WHEELER AND HARTMAN CONSULTING CORPORATION	
DATE: 3/6/2000 SCALE: NTS DRAWN: MCG	**FIGURE 2-2** **MOUNDING DESIGN CONCEPT** **1 ACRE MOUND AREA** **PLAN VIEWS**

mound, a base consisting of gravel or cobbles could be placed in the first mound lift. Aside from providing foundation support, the gravel or cobbles may provide a more economical solution to construction using only sand.

To construct the mounds, a number of material placement methods were considered. The mounding placement methods are generally the same as would be employed for thin-layer capping. Depending upon required placement tolerance, however, material placement by bottom dumping could also be considered for mounding. Bottom dumping material by split-hull barge or barge with doors would be less accurate and result in some material loss, but would be generally safer and faster than placing material either by hydraulic pipeline, tremie, or mechanical bucket.

Mounding construction will not be done if the thin-cap approach for creating surface clean sediment is working. It is proposed that thin capping will be attempted first in all areas and, based on the relative success of the thin cap, the mound construction may or may not be implemented. Approximately 20 acres in the AOC are suitable for mounding if thin cap placement is not successful.

3. Navigation Channel Design

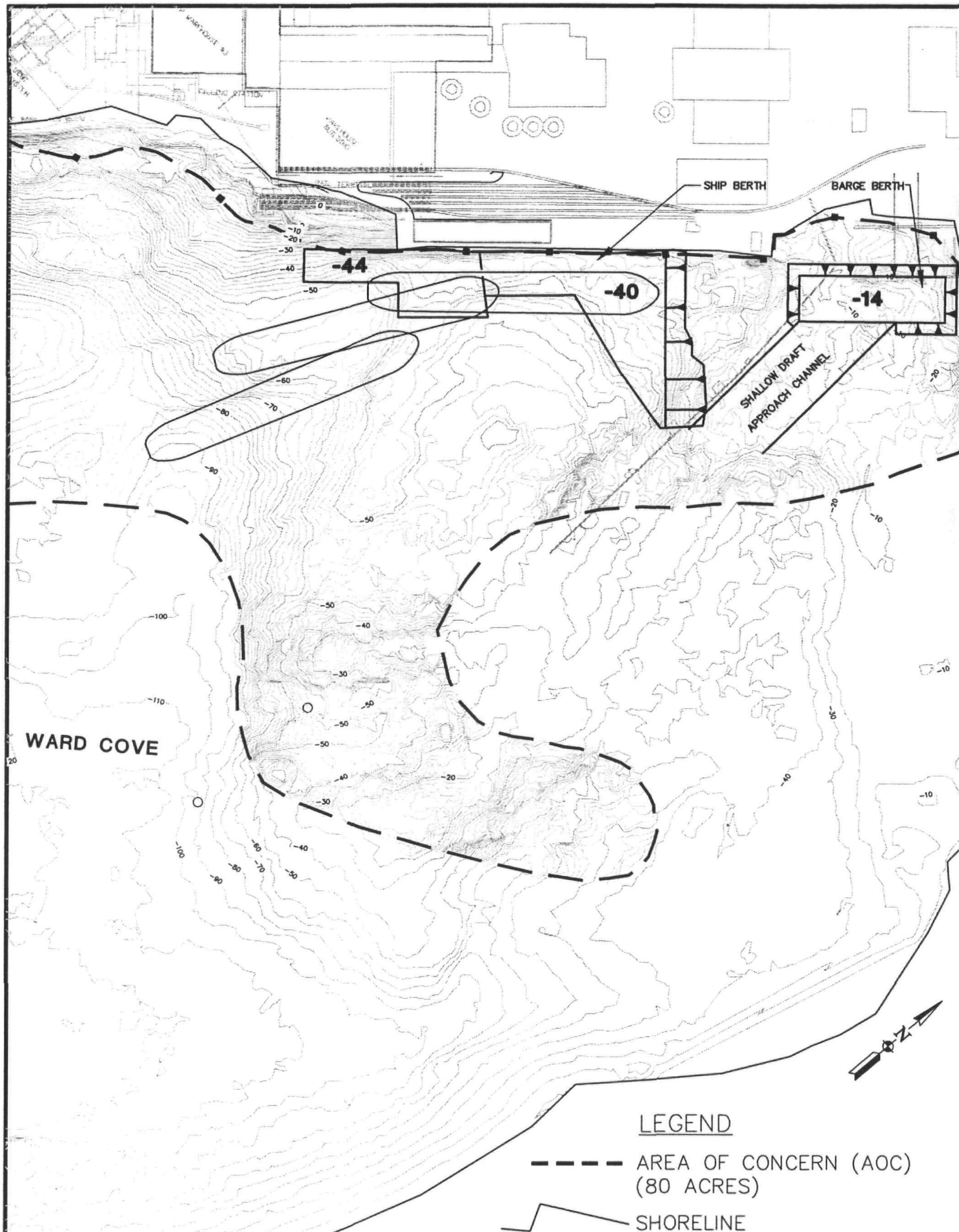
The requirements for reasonably anticipated current and future commercial navigation in Ward Cove are focused on the continued use of the existing main dock facility by deep draft vessels and the planned development of a shallow draft facility by GFP. Dredge elevations are to be determined for safe passage of the identified vessels that are proposed for future trade and development by the new owners of the KPC facility.

Channel design is considered a two-step process, consisting of the concept design and the detailed design. The concept design was presented in the DTSR (Exponent 1999). This section of the design analysis report provides the detailed design that validates, develops, and refines the concept design for the proposed deep draft and shallow draft operations. The basis of future navigation is predominantly the same type of vessel that has recently used the Ward Cove waterway. The dredge volumes are derived from the area and depth dimensions of a deep draft berth area at the deep draft dock, and the initial stages of development for a barge basin and access channel for the proposed shallow draft facility at the upper end of Ward Cove.

3.1 Deep Draft Design—Main Dock

This deep draft design is intended to provide a relatively safe and economical berthing area and approach channel for future commerce. The approach channel is defined as any stretch of waterway linking the berths of a port to open water. For Ward Cove, both the deep draft and shallow draft berth approach channels are considered inner channels that lie in relatively sheltered water.

The design deep draft access to the main dock (Figure 3-1) is based on the initial premise of a design ship, specified to represent the ship expected to use the channel and berthing



FOSTER WHEELER
AND HARTMAN CONSULTING CORPORATION

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FIGURE 3-1
DEEP AND SHALLOW DRAFT BERTH AREA DESIGN

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area. The design ship can be a combination of two or more vessels that represent the most difficult conditions for navigation. The width of the channel is expressed as a multiple of the beam of a ship. The depth of the channel and/or berthing area is expressed in terms of the ship draft. The approach channel and berth are designed to ensure the channel design allows the design ship, and other ships using the channel, to navigate in safety.

3.1.1 Design Vessel

The Ward Cove channel and berth will cater to a range of ship types appropriate for reasonably anticipated current and future shipping activity in Ward Cove. These anticipated uses focus on two types of deep draft ships, the bulk cargo vessel and the cruise ship.

It is anticipated that the Ward Cove channel will be used by bulk cargo vessels, also known as "weight" carriers because they are designed to carry heavy loads. This type of bulk cargo vessel can carry heavy bulk commodities such as ore concentrate and oil in bulk. It is also anticipated that cruise ships may use the Ward Cove facility in the future. The cruise or passenger ship is labeled a "volume" carrier and will carry a relatively light load (PIANC 1997a).

These two types of vessels are approximately the same in length and loaded draft. The bulk cargo vessel will typically have less width than the cruise ship. When loaded, the bulk cargo vessel will sit low in the water, thereby limiting the vessel sail, or windage. The cruise or passenger ship is designed to carry and entertain passengers above deck. The cruise ship will have a high windage. The bulk vessel will have less maneuverability and speed, whereas the cruise ship will have relatively high maneuverability and good speed.

The bulk cargo vessel expected to be in Ward Cove will be a 20,000- to 40,000-ton dead weight carrier. Bulk cargo design vessel length ranges from 520 to 640 ft, and design vessel beam ranges from 80 to 95 ft. Loaded draft for this bulk cargo design vessel ranges from 27 to 33 ft. The bulk cargo design vessel will be 600 ft long and 95 ft wide and have a loaded draft of 30 ft (PIANC 1997a).

The cruise ship expected to be in Ward Cove is similar to vessels already moving along the waterways of Alaska. Large cruise liners are reported to be 40,000 to 60,000 dead weight ton vessels. The overall length can be 820 ft and the beam is 105 ft. Loaded draft is 25 ft (PIANC 1997a).

3.1.2 Approach Channel Dimensions

Approach channel width is primarily a function of the ship beam. Factors other than design vessel size to be considered in channel design include one-way or two-way or passing traffic, wind, swells, current, vessel maneuverability, continuous or intermittent bank, and navigation aids (Corps 1996). Actual ship maneuvering simulation has not been performed for this design.

The existing tidal current velocities are low in Ward Cove, averaging 3 cm/s. These velocities should not create significant maneuvering difficulties. The Ward Cove area is relatively protected from surface swells. The wind fetch conditions limit the development of long waves. In terms of navigation, the transit from the Tongass Narrows through Ward Cove to the dock site is in a protected water area. Wind will impact the channel width requirements in Ward Cove. Windage of a vessel will cause drifting of the vessel similar to tidal cross currents.

The channel will be a one-lane channel. Deep draft ships will not pass in the approach channel. A prevailing wind of 25 knots is considered representative of the difficult wind conditions for navigation in Ward Cove. Because the channel will be a straight one-way channel, there is no need to consider passing distances or bends. Important design considerations include the following:

- Laden single screw bulk carriers are assigned a moderate level of maneuverability. Therefore, the basic maneuvering lane will be 1.5 times the vessel beam (PIANC 1997a).
- A speed of 8 knots is chosen for transit from the Tongass Narrows to the dock berth. No additional width is necessary for this speed.
- The prevailing cross wind for design is 25 knots. For the moderate speed of 8 knots, an addition of the basic lane width is 0.4 times vessel beam.
- The aids to navigation are moderate with frequent poor visibility. For this condition, an addition of the basic lane width is 0.5 times vessel beam.
- The depth of the waterway is 50 ft or greater. The depth/draft ratio is 1.67 or greater. No additional width is needed for the water depths in Ward Cove.
- There is no increase in width due to cross currents, bottom surface, cargo hazard, or bank clearance.

Based on this design evaluation, the channel width should be, at a minimum, 2.4 times the beam of the vessel (1.5+0.4+0.5). The vessel beam for the cruise liner is 105 ft; therefore, the approach channel width must be 260 ft or wider.

3.1.3 Approach Channel and Berth Area Depth

The approach channel depth is a function of vessel draft, vessel squat, and the effect of wind and wave action (Corps 1996). The wind and wave impacts are minimal in Ward Cove. Vessel squat is defined as the increasing draft a vessel experiences when under way. Greater vessel velocity in the water increases vessel squat.

The minimum water depth encountered while the vessel is under way is 50 ft MLLW. This depth yields a depth/draft ratio of 1.67 and a Froude depth number of 0.28. The depth/draft ratio for a sand or soft mud bottom should be 1.1 or greater (PIANC 1997a). The Froude depth number must be less than 0.6. The vessel squat, at 8 knots, will be 0.8 ft (Spencer et al. 1990).

The depth of the berthing area is a function of the depth/draft ratio. An acceptable ratio for a hard, rocky substrate bottom is considered 1.2 or greater. The design vessel draft is 30 ft. The extreme low water at Ward Cove is identified as –4.3 ft MLLW. A berth depth of –40 ft MLLW provides water depth of 35.8 ft and a depth/draft ratio of 1.2 at the extreme low tide condition.

but ours isn't rocky so 1.2 ok?

so ok if 33ft vessel

Final berth depths are also controlled by the presence of physical obstruction (i.e., bedrock) and by the depth of water required to avoid resuspension of bed sediment due to propeller scour. The berth area depth will be dredged to –40 ft MLLW (or until bedrock is reached) at the location of the bow of the vessel to provide acceptable depth for underkeel clearance (vessel safety) and to –44 ft MLLW (or until bedrock is reached) at the location of the stern of the vessel to prevent resuspension of sediment due to propeller scour (see Section 4).

Dredging to a required depth of –44 ft MLLW allows access and departure of deep draft bulk cargo and cruise ships at all tides deeper than an extreme low tide of –1 ft MLLW without significant propeller scour. Tides lower than –1 ft MLLW occur 2.2 percent of the time during the year. To ensure no significant resuspension at the berth area from vessel movement, it will be necessary to cap the area with material that has adequate grain size (small gravel and coarse sand).

3.1.4 Deep Draft Berth Area Volumes

The dredged volume for the deep draft berth area is based on dredging to depths of –40 ft MLLW at the bow and –44 ft MLLW at the stern (Figure 3-1). The –44 ft dredging area is required to prevent resuspension of bed sediments by propeller scour. Approximately 10,250 cy will be dredged from the –40 ft area, and approximately 6,800 cy of sediment will be dredged from the –44 ft area.

No dredging is required in the deep draft berth approach channel.

3.2 Shallow Draft Design—Log Transfer Area

The shallow draft design (Figure 3-1) is intended to provide a relatively safe and economical berth area and approach channel for oceangoing tug and barge navigation.

3.2.1 Design Vessel

To determine the typical tow dimensions (length, width, and draft of vessels) that might transit southeast Alaska waters, information was obtained from Foss Maritime of Portland, Oregon. Foss has made routine calls to KPC prior to 1998 and is familiar with the Ketchikan vicinity. Foss equipment is typical of vessels used in the area. Dimensions are as follows:

Typical barge dimensions:

- 200 to 300 ft in length, with most common length of 286 ft
- 76 ft beam
- 16 ft draft when loaded.

Typical tugboat dimensions:

- 2,000 horsepower
  - 92 ft in length
  - 32 ft beam
  - 13 ft draft
- 3,000 horsepower
  - 112 ft in length
  - 31 ft beam
  - 13.5 ft draft.

3.2.2 Approach Channel Dimensions

A typical tow configuration transiting southeast Alaska waters consists of a tugboat towing a barge. After the tow enters Ward Cove, in a safe location and deep water, the barge would be disconnected from the tug. The tug would then breast up to the barge and proceed to the berthing area. The width of the barge and tugboat together is 76 and 32 ft, or 108 ft. Commercial tug assist would be required to push the barge to the dock.

Additional width of the approach channel would be required to compensate for the deflection angle (also referred to as drift angle). The deflection angle is a variable depending on alignment and velocity of currents and intensity of prevailing winds and the clearance between the tow and channel limits. The approach channel would need to have a width of approximately 150 ft.

The approach channel depth ranges from –10 ft MLLW to deep water. Removal of existing logs and large debris from the surface area of the proposed approach channel would increase the controlling depth to –11 ft MLLW. Barges could then use higher tide stages to get to the berthing area. Mean higher tide elevation in Ward Cove is +15.4 ft MLLW and mean tide is +8.0 ft MLLW. As explained above, a tug with a 16-ft loaded draft barge could access the berthing area at water depths of +8.2 ft MLLW or higher. Therefore, the berthing area would be accessible more than 50 percent of the time due to tides.

Propeller wash scour is evaluated in Section 4. As discussed in Section 4.2, a tug with a 13-ft draft would scour the existing bed sediment within the approach channel. Capping of the channel with a thin cap of medium sand with some small gravel would be necessary to armor the channel bed.

3.2.3 Berthing Area Dimensions

but see p. 3-8 now 7300 ft common is 286 ft

The length of the berthing area has been designed to accommodate a barge length of 286 ft plus 10 percent of length for additional clearances due to tide elevation changes, barge movements, etc. Total length is 286 plus 28.6 ft, or approximately 320 ft. The width of the berthing area has been designed to accommodate a barge width of 76 ft. An additional one-third of the beam width is allowed for clearances necessary for barge movements. Total width is 76 plus 25 ft, or approximately 100 ft.

Ideally, the berthing area should accommodate a loaded 16-ft draft barge over a typical tidal range. The berthing area dimensions are 320 ft long by 100 ft wide. Existing bathymetry data identify the average depth of the berthing area to be approximately −10 ft MLLW. The extreme low water for Ward Cove is identified as –4.3 ft MLLW. A minimum underkeel clearance for vessels in an area with hard or rock bed is 20 percent of the loaded draft, or 3.2 ft. A full tide berthing area design for a 16-ft draft barge (i.e., 19.2 ft of water depth at extreme low tide of –4.2 ft) would require dredging to a depth of −23.4 ft MLLW. Diver surveys and jet probing in the vicinity of the proposed barge basin have indicated that hard sediment or rock exists at −12 to −14 ft MLLW. The actual depth of the barge basin will be limited to a maximum dredged depth of −14 ft by these physical obstructions. Thus, a 16-ft loaded draft barge can be at berth in a fully loaded condition only during tide stage of 5.2 ft (–14 plus 19.2 ft) MLLW or higher. Otherwise, the barge must be moved and anchored in deeper water during low tide events.

3.2.4 Shallow Draft Berth Area Volumes

Prior to dredging of the barge berth, logs and debris will be removed, which will result in an average bed elevation of −11 ft MLLW. The proposed dredging of the barge berth will be to a depth of −14 ft, or to rock and hardpan native sediment. The basin area will be 320 ft long by 100 ft wide. The sediment volume for this removal is estimated at 3,500 cy.

At this time, no dredging of the approach channel is proposed. The approach channel will be thin capped for additional bed armoring to minimize resuspension.

3.3 Summary

The deep draft berth area will be dredged to –40 ft MLLW at the bow end of the vessel and to –44 ft MLLW at the stern end of the vessel. In the dredged areas where native sediment and/or rock have not been exposed, thin-cap placement will be accomplished. The material selected for the thin cap will be of appropriate grain size to prevent resuspension of fine bed sediment from propeller scour at all tide stages.

The deep draft berth approach channel has a natural width greater than 260 ft, and a natural depth greater than 50 ft. No dredging for navigation is required in the deep draft berth approach channel.

The shallow draft berth area will be dredged to –14 ft MLLW, provided that hard native sediment or rock does not extend above this elevation. Thin capping is not proposed for the barge berth after dredging. The dredging is expected to expose native sediment, or rock, and will not require a thin cap.

No dredging of the approach channel is proposed. Tugs with barges can use the higher tides for access and departure from the barge berth area. The shallow draft berth approach channel will be thin capped with medium sand and some gravel.

In the area proposed for development of a shallow draft barge facility, rock material has been identified at or near the –12 to –14 ft MLLW elevation. Based on this condition, the actual barge load may be limited to light loaded barge drafts less than 16 ft. Consideration must also be given for immediate offloading at and from, and transit to, the berthing area during high tide events at +6.5 ft MLLW or higher.

4. Propeller Scour Analysis

An initial propeller scour analysis was completed as part of the DTSR (Exponent 1999). To determine the water depth that will allow deep and shallow draft vessel operations to occur, additional propeller scour analyses were performed for this study. Propeller scour has been evaluated in the deep draft berth area of the main dock of the KPC facility. It has also been evaluated at the proposed barge access and berthing area to the northeast of the main dock.

4.1 Model Parameters

The computer model PROPWASH (Hartman 1995) and data from other studies (Verhey 1983; PIANC 1997b) were used to predict the propeller-induced scour at the berthing facilities. Specific data on local tugboats was provided by Boyer Towing (Halvorson 2000, pers. comm.) and data on oceangoing vessels was provided by Dr. C.H. Kim (Kim 2000, pers. comm.).

Four vessel types were modeled in this study, two bulk/cruise ships for the main berthing area and two tugboats for the barge area. Single-propeller propulsion systems consist of larger propellers of greater depth, thereby holding the greatest potential for scouring. All vessels were therefore modeled as single-propeller. Thrust coefficient K_t was set at the maximum value of 0.27, simulating bollard-pull conditions. Maximum scour is induced in this scenario, where the propeller is turning and creating thrust but the vessel is not advancing.

Surface sediment parameters were varied to simulate soft organic material, fine capping material, and coarser capping material. Index testing conducted by Exponent (1999) revealed that the specific gravity of the organic sediments ranges from 1.86 to 2.52, with the predominant grain size in the range of 0.06 to 4.75 mm. Specific gravity of the organic material was therefore set to 2.2 and grain size was set to 0.06 mm. The capping material is assumed to be a fine sand, with specific gravity of 2.65 and average grain size of 0.2 mm. The coarse capping material is a fine to medium sand, on the coarser end of the scale with an average grain size of 2.0 mm and specific gravity of 2.65.

Maximum allowable scour depth for all scenarios is 6 in. The model analyses were initially done with the depth equal to the dredging depth for each respective area. If the scour depth was greater than 6 in., water depth was increased until propeller-induced scour was 6 in. or less.

Cruise ships and bulk vessels will be the primary users of the main dock at KPC. Vessels of this type and size typically have propellers in the range of 12 to 15 ft diameter, with the tips of the blades several feet above the keel. Propeller shaft speed during berthing operations would be 40–50 RPM maximum. Tugboats with drafts up to 13.5 ft may operate in the barge area. Tugs of this size can have propellers of 5 to 7 ft in diameter. Propeller shaft speed during berthing operations would be from 100 to 250 RPM maximum. Propeller input parameters are shown in Table 4-1.

Table 4-1. Propeller input parameters for PROPWASH models

Model	Main Berthing Area		Barge Berthing Area	
Propeller diameter (ft)	12	15	5	7
Shaft depth (ft)	17	15	6	8
Shaft speed (RPM)	50	40	250	100

The berthing area for the deep draft vessels will be positioned along the southerly portion of the existing dock facility. Cruise ships and off-loading bulk vessels will approach the dock for berthing bow first. If, in the future, it is desirable to load a bulk vessel at this site, the loaded draft vessel would be moved away from the berth area by tug assist into deeper water.

4.2 Model Results

As shown in Table 4-2, propeller wash at the main dock would scour the existing light organic bed material 6 in. at the water depth of 57 ft. If a cap of fine sand were installed, the minimum depth would be 43 ft for 6 in. of scour.

Scouring would be induced in the surface sediments from tug propeller wash. Again, the large propeller with slower shaft speed induces a greater amount of scouring and therefore is used for design purposes. Depths of 27, 20, and 15 ft are thus required for tug operations over organic sediment, over a fine sand, and a medium sand with some small gravel (1/4 in. or less), respectively.

Table 4-2. PROPWASH model results

Sediment Type:	Existing Organics		Fine Sand Cap		Sand/Gravel Cap	
Avg. grain size (mm):	0.06		0.2		2	
Specific gravity:	2.2		2.65		2.65	
	Depth (ft)	Scour (ft)	Depth (ft)	Scour (ft)	Depth (ft)	Scour (ft)
Main berthing areas						
Propeller D=12 ft	40	2.8	40	0.3	40	0
	49	0.5				
Propeller D=15 ft	40	7.1	40	0.9	**40**	**0**
	57	**0.5**	**43**	**0.5**		
Barge berthing areas						
Propeller D=5 ft	18	3.1	18	0.4	14	0.1
	23	0.5				
Propeller D=7 ft	18	11.3	18	1.4	14	0.7
	27	**0.4**	**20**	**0.5**	**15**	**0.3**

Note: Model results that meet the maximum allowable scour depth criterion are presented in bold.

4.3 Conclusions

At the main dock, dredging depths of –40 ft MLLW under the bow and –44 ft MLLW under the stern of the deep draft vessel are required. If native sediment or rock is not exposed by the dredging, the –44 ft deep area must be capped with a fine-to-medium sand to ensure no resuspension of bed sediment by propeller wash. Refer to Section 3, *Navigation Channel Design*, for additional information.

Without dredging, the shallow draft berth approach channel to the barge berthing area will experience sediment resuspension from tug passage. Placement of a thin cap of medium sand and some small gravel on the existing bed sediment would allow barge and tug access at tide stages of +5 ft and higher. Refer to Section 3, *Navigation Channel Design*, for additional information.

5. Dredging and Related Activities

In this section, methods for dredging, log removal, and dredged material handling and dewatering are described. The disposal site and associated access restrictions are also discussed.

5.1 Dredging Methods

Dredging would be performed using an enclosed clamshell dredge bucket, as described in the DTSR (Section 10.1.1.2 in Exponent 1999). The dredge bucket is attached to a barge-mounted crane, which is used to raise and lower the bucket. The dredge barge would be held on station with anchors and winches. The operator would dredge an area within reach of the crane, and then the barge would be moved by either pulling on anchor lines or with tug assistance. Dredge locations would be continuously monitored using a global positioning system to measure location of the bucket. Bucket depth could be measured with pressure sensors or by marks on the cables used to hold the bucket.

The dredged material would be placed from the bucket into a bulk material hauling barge tied to the dredge barge. When the material barge is full, another empty barge would be moved in and the full barge would be taken to the temporary disposal site.

The dredging will be completed to the required depths as specified in the contract plans and specifications, and as noted in this report in Section 3.1.4, *Deep Draft Berth Area Volumes*, and Section 3.2.4, *Shallow Draft Berth Area Volumes*. The dredged depth will be confirmed by pre- and post-dredge surveys. The survey will be accomplished using acceptable methods to control horizontal positioning that may include differential global positioning system, range-range or range-azimuth electronic positioning system, or similar equipment. Accuracy of dredge position will be ±5 ft. Depth of dredging will be determined using survey grade depth sounders. Bed elevations will be converted to MLLW datum, using depth soundings and tide gage readings. Accuracy for measured depths will be ±0.3 ft.

5.2 Log Removal

In the deep draft and shallow draft berth areas, and in the shallow draft berth approach channel, logs would be removed during dredging. The logs would be removed using the same barge-mounted crane used for dredging. The enclosed clamshell bucket could remove logs, but it could be damaged if used extensively for log removal. Therefore, in areas where there are a significant number of logs, the bucket would be replaced with timber tongs. Logs would be removed prior to start of dredging. The logs would be placed onto a separate flat deck barge, and not the dredge material haul barge.

The logs would be transported to the temporary stockpile site. Upon examination and documentation by the construction oversight manager, and written approval by EPA, suitable logs may be chipped and hogged to be used as hog fuel. Logs that are not considered suitable for use as hog fuel will be removed from the stockpile area and disposed at the KPC landfill. Log volume is included in the overall dredge and disposal volume estimate. Logs that are chipped for hog fuel will not be disposed in the KPC landfill, which will result in reduced volume requirements for disposal at the landfill.

5.3 Dredged Material Handling and Dewatering

Design specifications will attempt to not limit the methods available for dredging and moving dredged material from the barge into the temporary stockpile site. The specifications will provide requirements for compliance with the water quality requirements of the Section 401 water quality applicable or relevant and appropriate requirements (ARARs) and other substantive requirements.

Methods that can be used for moving dredged material to the temporary stockpile site include the following:

- Placing a ramp from the barge onto land and moving dredged material with a front-end loader, or similar equipment
- Establishing a temporary dock adjacent to the stockpile area and mechanically excavating material by land-based crane from the barges into the stockpile area
- Excavating material by water-based crane from the barges into the stockpile area
- Establishing a temporary conveyor system on an anchored barge to transfer sediment from the haul barge to the stockpile area
- Pumping dredged material from the barges into the stockpile area.

Compliance monitoring for spillage, return flow of turbid water, or other water quality/contaminant release condition will be established. Compliance monitoring will be conducted at the compliance boundaries established for the point of dredging and/or capping and the point of rehandling to the stockpile site. If water quality exceedances are noted at the compliance boundary, the dredge/capping contractor will be required to adjust or modify operations until compliance is achieved. Modifications that may be required can include, but are not limited to, reducing hoist line speed of the bucket, replacing or repairing bucket seals, installing catch canvas or silt curtains at the rehandling site, adding a secondary pond catchment, and effecting removal via pump truck at the stockpile site.

5.3.1 Dewatering by Gravity Separation

The lowest cost method of dewatering is gravity separation in temporary stockpile sites. The stockpile area is located on the east end of Ward Cove, south of the mouth of Ward Creek. The dredged material would be transported by barge to the vicinity of the stockpile area, and then transferred into the area.

The design for gravity separation and water infiltration to the ground is based on past KPC experience. Dredged material from previous KPC maintenance dredging has been placed into the stockpile area. The water that separated from the sediment infiltrated into the natural sand and gravel soils. There was no direct discharge of effluent to Ward Cove. In cases like this where past experience is directly applicable to a future project, there is no need for calculations.

Gravity separation will occur in the temporary stockpile area after the dredged material is placed. The solid phase material will settle out, and the water will rise to the surface or percolate into the natural sand and gravel soil. The dredging work is planned for winter months, so evaporation will be negligible. Based on previous dredged material work, the water will infiltrate into the native sand soil. In addition to gravity separation, water will be squeezed out of the dredged material by the process of self-weight consolidation.

Self-weight consolidation was modeled in the laboratory with the column dewatering test. Two samples of surface sediment in the proposed dredge area were tested. Vertical stresses of 17 psf to about 640 psf were applied to the samples. These tests demonstrated reductions in volume of 17–20 percent at the low stress and 41 and 44 percent at the maximum stress.

In the stockpile area, the vertical stress on the dredged material will increase in proportion to the height of material stockpile. As the area drains, the total weight of material of 70 pounds per cubic foot (pcf) will act on the material, which means that the effective vertical stress will be 70 times the height of material. If 5 ft of material is placed in the stockpile area, then the stress will increase from zero at the surface to 350 psf at the bottom. Under this weight, the dredged material is expected to consolidate approximately 30–35 percent.

The only potential routes for water that separates from the dredged material are infiltration into the ground, evaporation, or discharge into Ward Cove. Given the weather conditions in Ketchikan, it is assumed that little or no evaporation will occur. Water quality monitoring during historical dewatering of dredged material in this area assessed potential infiltration and subsequent discharge to Ward Cove. No impacts to water quality were observed during past monitoring. Provisions will be made to prevent any direct discharge into Ward Cove, including maintenance of the stockpile area to ensure efficient infiltration into the ground.

5.3.2 Mechanical Dewatering and Volume Reduction

The average *in situ* water content of the organic material tested during the remedial design sampling was 416 percent and the average specific gravity was 1.85. This water content corresponds to a solids content of about 20 percent by weight (which means that 100 lb of organic material has 20 lb of dry solids and 80 lb of water). This finding is consistent with the *in situ* value measured during the previous investigations as reported in the DTSR (Exponent 1999).

For the KPC project, 20,000 cy of *in situ* (in-place) sediment has a dry weight of about 4,000 tons. Gravity separation, self-weight consolidation, and surface drying at the temporary stockpile site will reduce weight by about 50 percent and volume by approximately 25–35 percent. The volume of dewatered sediment would be about 75 percent of the *in situ* volume. Consequently, dredging an *in situ* volume of 20,000 cy would require 15,000 cy of final disposal site capacity.

Mechanical dewatering systems could be used with (or in place of) gravity separation and self-weight consolidation, to further reduce the water content and volume of the dredged material. Traditional mechanical dewatering systems are belt filter presses, centrifuges, and plate and frame presses. These types of equipment are commonly used for sludge dewatering at process plants of all types.

Custom mechanical dewatering systems have been fabricated to separate water from solid particles. Some of these systems have been used to dewater sludge from pulp mill ponds. If mechanical dewatering were used, a custom system would be considered. However, the feasibility and cost of mechanical dewatering needs to be further evaluated to determine if this option is viable. However, the mechanical dewatering does not appear to be warranted at this time because although the method is environmentally equivalent, it is relatively more costly than the gravity/surface drying method in the stockpile area.

5.4 Dredged Material Disposal Site

Dredged sediments will be disposed in an upland landfill owned by KPC. The landfill, which is permitted for industrial use, is located on Dawson Point, adjacent to the former KPC pulp mill property (Alaska Department of Environmental Conservation [ADEC] Solid Waste Permit #9713-BA001). The landfill was constructed in 1997 concurrently with the closure of the previous Dawson Point landfill. Construction specifications include a 60-mil HDPE geomembrane liner system and a leachate collection and treatment system. Treated leachate is discharged through the main Ward Cove facility outfall (Outfall 001), pursuant to National Pollutant Discharge Elimination System permit AK-000092. Currently, the waste contains a mixture of flyash, dredged material, and minor amounts of other industrial waste. The estimated remaining capacity of the landfill is 15,000 cy.

Following placement of the dredged sediments, the landfill will be closed consistent with the closure and post-closure requirements specified in the operating permit. Landfill operations, maintenance, and monitoring are currently being performed as described in the comprehensive monitoring plan.

5.5 Area with Localized, Intermittent Sheen near Main Dock

In conjunction with the planned remedial action, KPC plans to conduct a confined sediment dredging operation in an area near the east end of the main dock (deep draft berth area) where sheen has been intermittently observed. This effort will be conducted in conjunction with dredging of the shallow and deep berth areas, and will be performed in winter to minimize impacts to migrating fish. The affected area appears to be approximately 8 by 15 ft. The sheen appears to be caused by the petroleum-like material rising to the surface from below and is most noticeable during extreme low tides, when the water column is thinnest. A diver survey in the immediate area showed no sign of contamination on the surface of the sediment layer; therefore, the source of the sheen is believed to be buried beneath the sediment surface. Logs, some partially buried, were observed in the area during the diver survey.

The EPA project manager will be notified 2 weeks prior to work in this area to allow for agency oversight. KPC plans to remove logs and dredge sediments in the affected area. Logs will be removed using a log grapple and will be disposed in a manner approved by the agencies. Sediments will be dredged to a depth of 5 ft unless there are visual indications of deeper contamination. Maximum sediment thickness in this area has been measured at 9 ft. Dredging will be performed with a backhoe mounted on a barge. Absorbent booms will be used to control any sheen generated during dredging. The dredged material will be loaded into roll-off containers on barges that are partially filled with bentonite. The bentonite will absorb free liquids, thus stabilizing the sediments and eliminating the need for dewatering. Because oily wastes cannot be disposed at the KPC landfill or the City of Ketchikan Solid Waste Facility, the filled roll-off containers will be shipped to an out-of-state landfill. Samples will be taken and analyzed as required by the landfill.

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5.6 Access Requirements

As a condition of the sale of KPC assets (including patented tidelands) to GFP, GFP has granted KPC continued access to the site for the purposes of implementing the remedy. In addition, an environmental protection easement has been executed between KPC and ADEC for the Ward Cove property. This easement grants rights of access to ADEC (and by designation, EPA) for the purposes of implementing and monitoring response actions pursuant to CERCLA.

All the remedial areas in the Ward Cove sediment remediation project can be accessed by conventional floating marine construction equipment. The types of equipment needed for placing thin caps and mounds and for dredging can be transported to the site on ocean-going barges.

If mechanical dewatering is used, the equipment is designed to be shipped to project sites by standard highway trucks or railroad. For this project, the equipment could be delivered to Ketchikan by trucks on the Alaska ferry or by trucks on barges.

5.7 Summary of Dredging and Dredged Material Disposal

The shallow draft berth area will be dredged to a required depth of –14 ft MLLW, removing approximately 3,500 cy of sediment. The deep draft berth area will be dredged to required depths of –40 and –44 ft MLLW, removing approximately 10,250 and 6,800 cy of sediment, respectively. These approximate dredge volumes include an additional 1 ft of sediment below the required depth as an overdredge safety factor.

In all, an estimated volume of 20,550 cy of sediment will be transported by haul barge to a berth area adjacent the temporary stockpile site in the upper, eastern limit of Ward

Cove. This material will be rehandled to shore and stockpiled behind jersey barrier and hay bale type berms, or other acceptable containment system. The material will be covered and remain at the site for gravity drainage, self-weighted consolidation, and surface drying, until the summer months. It has been calculated that the sediment will dewater, with a reduction in volume of approximately 30 percent, allowing a total volume of 14,400 cy of sediment to be transported from the stockpile site to the KPC landfill.

After several days of surface drying during the milder summer months, the surface material will be removed and transported by dump truck to the disposal site. If necessary, the trucks will be lined to ensure no loss of sediment during transport.

6. Technical Parameters and Design Calculations

Three design calculations are provided in this section: the foundation support analysis for the sand cap, the slope stability analysis, and the short-term fate analysis of capping material using several placement techniques.

6.1 Sand Cap Foundation Support Analysis

6.1.1 Background

Placing cap material over contaminated sediments is a proven technique in the Pacific Northwest. The experiences and successes of the Seattle District of the U.S. Army Corps of Engineers (Corps) in the Puget Sound are described by Sumeri (1989). Sumeri describes three completed and three proposed projects and lists other potential sites. The type of sediment that was capped at the Puget Sound sites is typically a mixture of fine sand and non-plastic silt with low organic content.

The contrast between typical marine sediments in the Puget Sound and the extremely soft organic material identified in Ward Cove is described in the DTSR (Exponent 1999). A primary design concern is that the very loose, or soft, sediment in Ward Cove may not have sufficient shear strength to support the sand cap. The soft sediment will be pushed sideways and upwards by the weight of the sand. Two examples of this type of shear failure are the New York Mud Dump Demonstration site and the New Bedford, Massachusetts, Pilot Study. Both of these projects were demonstration projects with extensive monitoring during and after construction. The Corps Waterways Experiment Station (WES) performed detailed studies of unexpected lateral displacement of sediment and cover sand at the New York Mud Dump Demonstration site. Two companion papers were published in the Proceedings of the 1998 World Dredging Conference (Rollings and Rollings 1998a,b). The New England District Corps prepared a detailed report of the pilot study dredging and disposal project for New Bedford Harbor (Corps 1990).

In the New York Mud Dump Demonstration, contaminated sediment was placed in water depths of greater than 65 ft and covered with a sand cover. During placement of the contaminated sediment, an unexpected lateral displacement of material was observed. Additional movement was observed after placement of a portion of the sand cover. WES personnel evaluated the slope stability of the sediment with and without a cap and the ability of the sediment to support a 3-ft-thick sand cap. The results of the analyses and recommendations for design on future projects were given in the referenced World Dredging Conference papers.

A nearshore confined disposal facility was constructed as part of the New Bedford Pilot Study project. Perimeter berms were constructed from sand and gravel supported by very soft marine sediment. To build the first layer of the perimeter berms, sand was placed over geotextile reinforcement. During this process, the weight of the sand exceeded the bearing capacity of the sediment and the result was shear failure. The sand pushed down from 5 ft to more than 10 ft below the existing mudline, and contaminated sediment was displaced outward and upward on both sides of the berm. The displacement of the very soft sediment is called a "mud wave." Representative cross-sections of the before and after conditions are shown in Appendix 6 of the pilot study report (Corps 1990).

6.1.2 Analysis

The ability of the organic material to support the weight of a sand cap is evaluated using foundation bearing capacity equations. These equations are used to calculate allowable bearing capacity of foundations for all types of facilities. The same equations were applied to evaluate sand cap support at the New York Mud Dump site (Rollings and

Rollings 1998b) and the McCormick and Baxter site (Corps 2000). Calculations are included in Appendix A.

For fine-grained sediments like those at Ward Cove, the bearing capacity depends on the short-term shear strength of the sediment (referred to as the undrained strength). For this project, the minimum shear strength needed to support a 6-in.-thick sand cap was calculated. The minimum shear strength was then compared to the shear measurements taken at specific locations in Ward Cove, to determine where the sediment will support a cap and where it will not.

A sand cap will have a total unit weight of approximately 120 pcf, which will give a buoyant unit weight of 56 pcf. A 6-in.-thick layer will produce an applied unit load of 28 psf on the sediment. Bearing capacity equations give a prediction of the maximum stress a specific sediment can hold at the verge of failure. This capacity is called the "ultimate" capacity. In design practice, the allowable bearing capacity is reduced by dividing the ultimate capacity by a factor of safety. For bearing capacity, the typical factors of safety used for engineering design are 2 to 4.

Overplacement of sand can also create failure of a thin sand cap on the surface of sediment with low shear strength. Placement of a layer thicker than 6 in. will also result in a factor of safety less than 1.0 for a shear strength of 6 psf. A 12-in. thick layer will have an estimated factor of safety of 0.5 for a shear strength of 6 psf. In design, this would constitute surface failure to support the cap. For this project, capping material is being added to sediments to amend, not isolate, *in situ* sediment. Some displacement of existing sediments is expected.

The calculations discussed above are for static capacity and do not include dynamic effects due to the impact of sand settling through the water column onto the sediment. Impact effects were not discussed in any reports or papers available for sediment capping. Dynamic bearing capacity is presented in the textbook *Fundamentals of Soil Dynamics*

(Das 1983). The bearing capacity of soil depends on the duration of the impact loads. Dynamic bearing capacity is generally higher than static bearing capacity for rapid impacts.

The magnitude of impact loads depends on how fast the velocity of the load changes from vertical to horizontal momentum and how much the supporting (bed) material deflects upon impact. The settling velocity of fine sand and silt is much less than 1 fps. Also, the sand particles will not impact the bed sediment at the same instant, but will contact the bed sediment over a period of several seconds. The static load is a result of the mass of sand multiplied by the acceleration of gravity (i.e., 32.2 fps^2). Provided the cap material is placed carefully, it will have a slow settling velocity and the impact load will be a small percentage of the static weight. The release and settlement of the sand cap can be controlled by the placement methods to reduce the rate of settling and bed impact.

For the Ward Cove project, the minimum undrained shear strength needed to support a 6-in. thin cap is 12 psf. This value is based on static bearing capacity analysis with a factor of safety of 2.0. This minimum factor of safety is recommended to account for uneven distribution of sand and the low dynamic impact effects. For a target cap thickness of 6 in., variation due to placement methods is expected to be no greater than a factor of 2, corresponding to a maximum thickness of 12 in. The safety factor of 2.0 accounts for this variation, allowing successful placement of a cap up to 12 in. thick in some places. However, as noted above, capping material is being applied to amend, not isolate, *in situ* sediments and safety factors are considered guidelines only.

6.2 Slope Stability Analysis

This section presents the results of the slope stability analyses for a thin sand cap on the sediment slopes in Ward Cove.

6.2.1 Method of Analysis

The first procedure in slope stability analysis is to determine the geologic cross-sections and to identify appropriate soil parameters for the analysis. For this project, the approach used was to evaluate the stability of slopes from 10 to 40 percent with non-native, organic-rich sediment thickness from 5 to 15 ft. The shear strength and unit weight is based on the design-level field data and physical laboratory testing of the organic-rich sediments.

The slope stability was analyzed using the computer program UTEXAS3, developed by the University of Texas at Austin. This program uses Spencer's Method of Slices to calculate factors of safety for potential surfaces of sliding. The UTEXAS3 program analyzes both circular and linear surfaces of sliding. The potential circular surfaces are defined by a center point and radius of a circular arc that passes through the soil mass. Linear surfaces are defined as a series of straight lines. For this project, linear surfaces were used, because they best represent potential critical surfaces of sliding. Circular surfaces were also analyzed for a typical case to confirm that linear surfaces would be the least stable. This program is described in Edris and Wright (1992) and is the same as that used by the Corps to evaluate cap stability for the New York Mud Dump site (Rollings and Rollings 1998b) and the McCormick and Baxter site (Corps 2000). Example outputs from the program are included in Appendix A.

The factor of safety is defined as the ratio of shear strength of the soil divided by the shear stress induced by gravity acting to push the soil downslope. A minimum factor of safety of 1.5 or greater is generally accepted for long-term stability of slopes. A factor of safety of 1.3 to 1.5 may be acceptable for long-term conditions, if the owner is willing to accept the risk of slope movement and acknowledges that isolated slope failure will occur. A factor of safety of 1.3 is generally acceptable for short-term or construction conditions. A factor of safety of 1.0 to 1.2 is indicative of a slope subject to movement and is not an acceptable situation.

The soil parameters used in this stability analysis are presented in Table 6-1.

Table 6-1. Sediment design parameters for slope stability

Soil Unit	Wet Unit Weight (pcf)	Buoyant Unit Weight (pcf)	Undrained Shear Strength (psf)	Effective Angle of Internal Friction (degrees)
Organic material	70	6	Vary from 6 to 40	Zero
Native silt/clay	110	46	100	Zero
Cover sand	120	56	Zero	32

6.2.2 Results

The minimum factor of safety for a given slope is the lowest factor of safety of all potential surfaces of sliding. For the case of sand cap material placed over soft organic material, two types of sliding surfaces must be considered: shallow sliding surfaces in the cover sand, and deeper sliding surfaces through both the sand and underlying organic material.

Static stability of sand on slopes can be analyzed by the "infinite slope" equations, which are based on the assumption of a long slope with constant sand thickness. In this case, the assumption is made that the underlying material is stronger than the sand. For a silty fine sand and a factor of safety of 1.5, the maximum slope would be 42 percent. This value is consistent with construction experience for underwater placement of sand slopes.

Sand placed underwater has a natural angle of repose between 30 and 50 percent (i.e., slopes of 3H:1V to 2H:1V) depending on the particle size of the sand cap material and the method of placement. For waterfront construction on firm sediment, coarse sand and gravel (1.0 mm to greater than 4 mm) can be placed on 50 percent slopes.

For the Ward Cove remediation project, the sand cap material to be placed on the fine organic sediment cannot be gravel and coarse sand because this type of cap material would sink into the sediment and would not provide quality benthic habitat. Therefore, the sand cap material should be silty, fine-to-medium sand. Because of the very soft existing sediments and steep slopes in Ward Cove, the cap sediment must be released slowly so that the settling velocity is low and bed impact is minimized. The maximum slope for silty sand on material stronger than sand will be 40 percent.

Slope stability factors of safety were calculated for different slopes, various thicknesses of organic material, and different shear strengths of organic material. It was assumed that the sand cap was 6 in. thick. The calculated factors of safety are shown in Table 6-2.

Table 6-2. Slope stability factors of safety

Slope (percent)	Cover Thickness (in.)	Organic Material Thickness (ft)	Shear Strength (psf)	Factor of Safety
10	6	5	6	1.2
			12	
10	6	15	6	0.7
			12	1.4
25	6	5	6	0.5
			12	1.0
			20	1.7
25	6	15	6	0.3
			12	0.5
			20	1.0
			30	1.6
40	6	5	20	1.1
			30	1.7
			40	2.3
25	None	5	3	0.6
			6	1.0
			12	2.0
25	None	15	6	0.4
			12	0.8
			20	1.4

A 10 percent slope means that the sediment surface rises 1.0 ft vertically over a horizontal distance of 10 ft. This slope is also referred to as 10H:1V and has an angle of 5.7 degrees above a horizontal line. In those areas where the sediment slope is 10 percent, minimum shear strength of 12 psf is needed to support a 6-in.-thick sand cap.

A 25 percent slope means that the sediment surface rises 2.5 ft vertically over a horizontal distance of 10 ft. This slope is also referred to as 4H:1V and has an angle of 14 degrees above a horizontal line. In those areas where the sediment slope is 25 percent, the minimum shear strength needed to support a sand cap increases as the thickness of organic material increases. When the organic material is 5 ft thick, the minimum shear strength needed is 20 psf. When the organic material is 15 ft thick, the minimum shear strength needed increases to 30 psf.

A 40 percent slope means that the sediment surface rises 4.0 ft vertically over a horizontal distance of 10 ft. This slope is also referred to as 2.5H:1V and has an angle of 22 degrees above a horizontal line. In those areas where the sediment slope is 40 percent, the minimum shear strength needed to support a sand cap increases as the thickness of organic material increases. When the organic material is 5 ft thick, the minimum shear strength needed is 30 psf.

The previous design described in the DTSR (Exponent 1999) was based on the condition that a 6-in.-thick sand cap could be placed only on sediment with slopes of less than 25 percent. Based on the above analysis, the slope criteria are refined as summarized below:

- The maximum sediment slope for placing a silty-fine sand cap without rip-rap protection is 40 percent
- Where the sediment slope is between 10 and 40 percent, the stability of a 6- to 12-in. thick sand cap depends on the shear strength of the organic material and the thickness of the organic matter
- For slopes less than 10 percent, the cap stability is controlled by the bearing capacity of the organic material.

6.3 Short-Term Fate Analysis of Capping Material

The Corps WES has developed numerical computer models to analyze dredging and dredge disposal projects. The Automated Dredging and Disposal Alternatives Management System (ADDAMS) suite of programs includes several of the computer models developed by WES. One of the models in the ADDAMS suite is Short-Term Fate of Dredged Material Disposal in Open Water (STFATE). This program is designed as a fate analysis tool for sediments released in open water by a split-hull barge or multiple-bin hopper dredge.

Sediment placement by releases from conventional dredge material disposal equipment typically results in a deposition pattern commonly referred to as a "footprint." Excessive mounding within the footprint is undesirable for thin-layer capping operations. However, by adjusting the release conditions, it is possible to deposit the capping material relatively evenly and decrease the mounding.

Short-term fate models are useful tools to determine the geometry of sediment footprints after placement. By adjusting the STFATE input, it is also possible to simulate and better determine the best methods of placement by clamshell dredge and by hydraulic pipeline slurry. As part of this study, several placement scenarios were modeled to:

- Evaluate the feasibility of placing a thin-layer cap over extremely soft organic material
- Determine the most effective placement techniques
- Evaluate the accuracy of cap placement in conditions typical of Ward Cove
- Aid in the selection of the design.

6.3.1 STFATE Analysis

Because of the poor load-bearing capacity of the surface sediments in Ward Cove, it is important to minimize the thickness of the thin-layer capping areas and produce a wide footprint of capping sediment. Cap thickness parameters for the STFATE models were set up to evaluate the effectiveness of different placement methods in achieving a cap thickness goal of approximately 6 in.

Three types of placement were evaluated:

1. Split-hull barge. As the name implies, barges of this type employ a split hull, which opens to release sediment directly through the bottom. This method would be undesirable in shallow water to cap soft sediments because it involves the relatively quick release of a large amount of sediment. The limited water depth would not allow spreading of the sediment load released from the barge, resulting in mounds or ridges. Barges were therefore modeled in deep-water scenarios where the sediment will be more likely to disperse and settle more evenly. An alternative method of placement using a split-hull barge was also evaluated. In the alternative operation, a split-hull barge would be pushed broadside by a tug while the hull opened slowly, to release sediment in a wide swath and increase dispersion.

2. Mechanical clamshell bucket (dredge). A clamshell bucket dredge could be used to place material in individual loads with a higher degree of accuracy. However, the same concerns are raised for this placement method as for the split-hull barge. If each load of sediment is not allowed sufficient depth to adequately disperse, the material will sink into the soft sediment in clumps rather than effectively cap the area.

3. Hydraulic/slurry discharge. A third method, which could be employed in Ward Cove, is the discharge of a sediment/water mixture, or

"slurry." There are several methods of this type of placement, ranging from pumping slurry through a discharge pipe to spraying mounds of sand off a barge with a fire hose. The benefit of this method is that a good dispersion of the sediment is achieved, even in very shallow water. The disadvantage is that it is both difficult to control the location of the slurry discharge and to verify the thickness and location of sediment placed on the bottom during operations, especially in deeper water.

6.3.2 STFATE Model Parameters

All scenarios are for a single release of sediment over a horizontal surface using capping materials of fine sand with some silt. Depth varies among the scenarios from 10 to 120 ft. A table of significant parameters, representations of capping material "footprint" areas and thicknesses calculated by STFATE, and detailed output files displaying all parameters for selected scenarios are presented in Appendix B.

Before the analyses of various placement methods were conducted, the effect of currents in Ward Cove was modeled. Average current velocities for Ward Cove were obtained from the DTSR (Exponent 1999). In the main section of the cove, average velocities vary with depth: 2.4 cm/s (0.079 fps) near the surface and 1.2 cm/s (0.039 fps) near the bottom. Near the entrance to the cove, velocities increase to 3.0 cm/s (0.098 fps) near the surface and 3.2 cm/s (0.10 fps) near the bottom. The highest velocities measured in the cove were in the surface water at the upper end of the cove. Velocities of up to 15 cm/s in the surface water were measured during extreme tidal exchange. Scenarios were constructed in STFATE to model the effect of currents on sediments placed during a capping operation. Current velocities of 0.0 cm/s, 1 cm/s (0.033 fps), 3 cm/s (0.098 fps), 5 cm/s (0.16 fps), and 10 cm/s (0.33 fps) were applied to a typical barge-dump configuration. To evaluate maximum displacement of the capping material, constant velocity profiles were used. Barge velocity was set to zero, and a depth of 120 ft was used. A detailed summary of parameters for all scenarios modeled is presented in Appendix B.

As shown in Table 6-3, the small currents likely to be present in Ward Cove during capping operations should not significantly affect the accuracy of placement. Even under the strongest currents modeled, cap displacement is no more than 100 ft. Little or no displacement was seen in the 1 and 3 cm/s scenarios, which are the currents most likely to be found in the capping areas.

Table 6-3. Effect of currents on cap placement

Scenario	Current Velocity (cm/s)	Release Time (s)	Approximate Cap Displacement (ft)
KPC3D	0	50	0
KPC3A	1	50	0
KPC3B	3	50	20
KPC3C	5	50	60
KPC3E	10	50	100

A portion of the capping material is sheared off the main sediment mass during descent. Fine-grained sediments become suspended and drift completely out of the area, while the other sheared sediments form small clouds and settle at the particle settling velocity, rather than quickly falling to the seafloor in a concentrated jet. Model results from KPC3C indicated that of the 1,000 cy of sand and silt deposited, approximately 10 cy (1 percent of the total) was displaced to a horizontal distance of greater than 600 ft.

6.3.3 Split-Hull Barge Models

Because it is unlikely that split-hull barges will be used in shallower water, depths ranging from 80 to 140 ft were modeled. Six major scenarios were modeled with the barge capacity and dimensions varied within each scenario (Table 6-4). The capping material for all scenarios was set at 50 percent fine sand and 10 percent silts by volume;

the remaining volume is occupied by water. A current of 1 cm/s was applied. Detailed information is presented in Appendix B.

Table 6-4. Split-hull barge model results

Case	Distance from Bottom (ft)	Capacity (cy)	Release Time (s)	Predicted Maximum Thickness[a] (ft)	Predicted Area of Thickness >3 in. (ft^2)	Predicted Area of Thickness >6 in. (ft^2)
B1	120	750	180	0.44	16,800	0
B2	120	1,500	360	0.73	72,000	10,800
B3	120	3,000	600	**1.2**	115,000	75,000
B1B	120	750	300	0.40	41,400	0
B2B	120	1,500	600	0.76	90,000	12,000
B3B	120	3,000	1,200	**1.2**	125,000	90,000
B1BT	120	750	3,600	0.40	31,500	0
B2BT	120	1,500	5,400	0.67	67,500	18,000
B3BT	120	3,000	7,200	**1.1**	120,000	72,800
B1D	80	750	180	0.83	47,500	14,400
B2D	80	1,500	360	**1.3**	72,000	28,000
B3D	80	3,000	600	**2.2**	96,100	72,900
B1DB	80	750	300	0.73	34,000	17,600
B2DB	80	1,500	600	**1.4**	84,100	36,400
B3DB	80	3,000	1,200	**2.2**	93,000	81,200
BF1	140	1,500	10	0.6	72,000	20,000
BF2	80	1,500	10	0.92	69,000	45,000

[a] Predicted maximum thicknesses greater than 1 ft are in bold.

Characteristics of the scenarios were as follows:

- Scenarios B1–B3. Barge capacities were varied from 750 to 3,000 cy, as well as the corresponding barge dimensions and time required to release the material. The barges moved forward at a rate of 2 fps and released the material in 120 ft of water.

- Scenarios B1B–B3B. These scenarios simulated the broadside movement as discussed above. The forward speed of the vessel was reduced to 0.5 fps and material was released more slowly than for B1–B3. In all other respects, these scenarios are the same as B1–B3.

- Scenarios B1BT–B3BT. These scenarios are the same as B1B–B3B, but with an even longer time period over which the material is released.
- Scenarios B1D–B3D. These scenarios are the same as B1–B3, but the depth is decreased to 80 ft.
- Scenarios B1DB–B3DB. These scenarios are the same as B1B–B3B, but with depth of 80 ft.
- Scenarios BF1, BF2. These scenarios are the same as B2 and B2D, respectively, but with a much shorter release time. These scenarios were run to test the influence of release time on the results of the STFATE model.

As described in Section 6.1, the very soft organic material provides limited support for the cap material over large portions of the AOC, and cap thickness should be approximately 6 in. Therefore, the cap material needs to be placed with methods that keep the predicted maximum thickness less than 1 ft. As shown in Table 6-4, a material dump of 3,000 cy results in mounds with maximum thickness of more than 1 ft at all water depths and release times simulated. Given these conditions, the barge would need to be moving at a faster rate during dumping to minimize areas of excessive accumulation (i.e., greater than 1 ft). Similarly, in water depths of 80 ft, barge dumps of 1,500 cy result in thick mounds. The faster release times modeled in scenarios BF1 and BF2 did not result in significant changes in mound geometry.

The large differences in release rates among these three barges with different capacities should have produced significantly different footprints; however, the geometry is nearly identical for all of the model scenarios, with displacement being the only major difference. This similar outcome may be a limitation of the model, and not consistent with actual barge dumps. Representations of the footprint areas are presented in Appendix B.

It is apparent from the results that if split-hull barges are to be used for cap placement at Ward Cove, large capacity barges should be moved at a faster rate to ensure mounding less than 1 ft. If used in such configurations, barge dumping should result in the thin, wide footprint area that is desired for this project.

6.3.4 Clamshell Bucket Model

A mechanical dredge deposits capping material by lowering a loaded bucket, such as a clamshell bucket, and slowly releasing the bucket load over the target area at some prescribed depth in the water column. To produce a wide footprint, the load would have to be released some minimum distance above the bottom so that some dispersion could occur. Model simulations were therefore constructed to represent releases at 10, 20, 40, 60, and 80 ft above the bottom. Three additional model simulations, CF1–CF3, were constructed to determine the effects of a shorter release time. These simulations were run with a release time of 1 second at distances from the bottom of 10, 20, and 60 ft. STFATE does not have an option to simulate clamshell placement, so the model was constructed using a representative very small barge, with a capacity of 50 cy. Capping material for clamshell placement will probably have a slightly lower water content, so volumetric percentages of sediment were set at 55 percent fine sand and 15 percent silt. A current of 1 cm/s was applied to all cases. Results are displayed in Table 6-5, and detailed information is presented in Appendix B.

The cap thickness did not exceed 6 in. in any scenario, so it is likely that this placement method could be used successfully in areas of soft surface sediments. The main drawback is that the footprint areas are much smaller than for the other methods analyzed. The smaller footprints associated with the clamshell placement would require multiple releases to achieve the same coverage area as a single release from a barge. STFATE model results showed only slight variances in footprint geometry for quicker release times. Representations of the footprint areas are presented in Appendix B.

Table 6-5. Clamshell model results

Model	Distance from Bottom (ft)	Release Time (s)	Maximum Thickness (ft)	Predicted Area of Thickness >3 in. (ft^2)	Predicted Area of Thickness >6 in. (ft^2)
C	10	5	0.5	2,800	0
C1	20	5	0.39	2,300	0
C2	40	5	0.28	1,020	0
C3	60	5	0.18	0	0
C4	80	5	0.12	0	0
CF1	10	1	0.49	2,700	0
CF2	20	1	0.37	2,500	0
CF3	60	1	0.15	0	0

6.3.5 Hydraulic/Slurry Model

The most effective method of placing a thin-layer cap evenly over an area is probably by slurry discharge. By this method, capping material is thoroughly mixed with seawater (slurried) and maximum dispersion can occur even in shallow waters. However, as depth increases, it becomes difficult to predict the location and behavior of the discharge and the resulting footprint geometry. At present, STFATE does not have the capability to model discharge by hydraulic means, but approximations can be made by manipulating the input parameters. For all scenarios modeled, water content was increased to that of typical slurry discharges and the percent solids by volume were lowered to 15 percent fine sand and 5 percent silt.

Characteristics of the scenarios were as follows:

- Scenarios H–H4. Depth is set to 20 ft, vessel speed is 1 fps, discharge volume is 1,500 cy, and duration of discharge is varied from 600 to 3,600 seconds.
- Scenarios HA–H4A. Same as H–H4, but depth is 60 ft.

- Scenarios HB–H4B. Same as H–H4, but depth is 140 ft.
- Scenarios H5B. Same as H4B, but discharge volume is 3,000 cy and duration is 5,400 seconds.

As shown by the model results in Table 6-6, hydraulic placement can be an effective technique for achieving a large footprint area with minimal thickness; however, bottom dump releases from barges yielded much greater coverage area per unit volume of capping material (e.g., the coverage area >3 in. for a barge release of 1,500 cy ranged from 67,500 to 90,000 ft^2). The fact that the STFATE model was not originally designed to simulate hydraulic placement techniques limits its ability to accurately predict footprint geometry, but the results are an adequate approximation for pre-design studies. It is likely that hydraulic placement would be used only in shallower waters because it is not possible to accurately monitor the capping material fate at greater depths. Representations of footprint areas are presented in Appendix B.

Table 6-6. Hydraulic/slurry model results

Model	Distance from Bottom (ft)	Release Time (s)	Maximum Thickness (ft)	Predicted Area of Thickness >3 in. (ft^2)	Predicted Area of Thickness >6 in. (ft^2)
H	20	600	0.80	17,600	3,000
H1	20	900	0.81	16,500	2,500
H2	20	1,200	0.81	15,400	2,500
H3	20	2,400	0.82	15,400	2,500
H4	20	3,600	0.71	30,000	3,500
HA	60	600	0.73	27,000	2,500
H1A	60	900	0.73	27,000	2,500
H2A	60	1,200	0.76	20,800	2,500
H3A	60	2,400	0.76	20,800	2,500
H4A	60	3,600	0.58	23,400	3,000
HB	140	600	0.28	11,000	0
H1B	140	900	0.28	11,000	0
H2B	140	1,200	0.28	11,000	0
H3B	140	2,400	0.28	11,000	0
H4B	140	3,600	0.24	0	0
H5B	140	5,400	0.39	50,000	0

6.3.6 Conclusions

The results of the STFATE analyses are considered representative of sediment fate during capping operations. The model does have limitations to applicability for the Ward Cove site. As mentioned previously, it does not appear that varying the release rate in the model has a significant effect on the footprint area results, other than simply displacing the capping footprint a certain distance. In reality, a slower release rate will produce a wider footprint, in more uniform layers, which is desired for the KPC project.

In addition, it is not possible to alter the characteristics of the bottom surface in the model simulations.[1] In the STFATE model, the bottom is assumed flat and relatively solid. This assumption is valid when placing fine materials over coarse sediment. In the case of Ward Cove, with very soft organic sediments, the results based on this assumption are overly optimistic. STFATE models the final mound geometry based on two major phases: the convective descent phase and the dynamic collapse phase. Convective descent is the phase in which the material falls through the water column in a jet of sediment and entrained water, with clouds constantly shearing off of the main column. Dynamic collapse is the phase in which the material strikes the bottom and spreads out along the bottom surface. It is during this dynamic collapse phase that the applicability of STFATE is in question. The soft sediments in Ward Cove will allow a jet of dense slurry to penetrate the surface and absorb most of the kinetic energy. Therefore, there will not be as much spreading via the dynamic collapse mechanism as predicted by the model. Mound geometry will likely involve thicker deposits with smaller footprint areas than seen in the model results.

[1] Limitations of the STFATE model were discussed with U.S. Army Corps of Engineers WES experts (Schroeder 2000, pers. comm.). It was confirmed that STFATE currently has no capabilities for modeling sediment impact onto a soft bottom, but approximations could be made by minimizing the spreading that occurs during the dynamic collapse phase. This could be done by specifying several smaller discrete releases from a stationary barge rather than one continuous release. By using this method, sediment cloud velocity would be reduced, thereby minimizing spreading from the dynamic collapse.

Based on the model results, it is theoretically possible to place capping materials at the maximum proposed depth of 120 ft in Ward Cove. Each method modeled could produce desirable results if appropriate placement techniques are used (e.g., slow release rates for split-hull barges, slow release at depth with clamshell buckets). It is important to note that these model results are theoretical, and they may not be indicative of the actual conditions encountered during capping of the AOC. Further evaluation and recommendations for the best capping methods, based on operational constraints and other factors that will affect the capping operations, are presented in Section 2. Table 6-7 outlines the advantages and disadvantages of each method, based on the model results only.

Table 6-7. Summary of placement methods

Method	Depth Range (ft)	Advantages	Disadvantages
Split-hull barge	80–140	Large volume placed quickly	Inaccurate Possibility of mounding Only applicable in deeper water Sediment is lost to the water column
Clamshell	20–140	Accurate placement Thinner cap layer	Small footprint Low production Should be released near bed to avoid sediment loss
Hydraulic/slurry	20–60	Maximum dispersion Thinner cap layer	Inaccurate Logistically more difficult Should be released near bed to avoid sediment loss

6.4 Mound Construction

Mounding will be attempted in those areas with organic sediments for which shear strength was measured to be acceptable for thin cap support but thin cap placement is not successful. A 1-acre area adjacent the deep draft dock, and positioned between the deep draft and shallow draft berth areas, has been identified for mounding only. No thin cap effort is proposed at this time for the 1-acre area because this area has a combination of sediment thickness (6–7 ft) and shear strength that is not acceptable for capping.

Approximately 14 acres of area are proposed to be thin capped, and 3.6 acres of transition area are proposed to be thin capped. Another 6.7 acres are identified for thin capping or mounding because the shear strength at depth may support a mound, even though the surface sediment has low shear strength. In addition, 2.0 acres are predicted to be capped after dredging. It is proposed that thin capping be attempted at all of these areas before mounding. If in fact the thin capping is not successful in providing suitable surface cover, or amendment of the surface sediment layer, then mounding will be attempted in all of the areas. It is possible that at the completion of remediation, a total of approximately 20 acres will have been remediated by mounding because the thin capping did not prove successful. The only areas where mounding will not be attempted in any circumstances are the deep draft and shallow draft navigation areas.

6.4.1 Mound Volumes

The volume of material needed to successfully create exposed mounds was calculated in a way that accounts for the displacement of organic sediment at the bottom of Ward Cove by the mound material. The calculations were carried out using conservative assumptions and an idealized mound configuration. Mound volumes and the corresponding percentage of the surface of a remediation area with exposed mound material have been calculated for several different thicknesses of organic sediment. Construction of mounds is proposed only for areas where the organic sediment thickness is 5 ft or less, except in the area adjacent to the deep draft dock.

Geotechnical evaluations of the organic material in Ward Cove suggest that the weight of the mound material will sink into the organic material and result in lateral and upwards displacement of the organic material (a "mud wave"). When this occurs, the organic sediment may be compressed somewhat, but the volume change is considered to be insignificant and is not factored into the calculation of mound volumes. This assumption is conservative and will lead to a slight overestimate of the mound material needed. As the spacing between the mounds decreases, there is less room for displaced sediment between the mounds. If the mounds are too large or too close, the existing sediment will be forced up over the mounds, and will tend to reduce the size of the exposed clean sand surface. This effect limits the size and proximity of mounds, and creates a practical limit to the percentage of bottom surface that will be exposed sand. In practice, some of the displaced organic material may move away from the mounding area altogether (e.g., downslope into areas that are neither capped nor mounded). The magnitude of such sediment movement is not considered in the calculation of mound material, however. Therefore, for the purpose of calculating mounding material volumes, all displaced organic material is assumed to remain within the boundary of the remediation area. This is a conservative approach that will lead to an overestimate of the volume of mounding material that will be needed, because of the increase in the estimated height of the mud wave produced by the displaced sediment.

Some compaction and settling of the foundation sediment below the mound material is expected to occur after the mound is placed. Based on the characteristics of the mound material, the organic sediment, and the underlying native sediment, long-term compaction is expected to reduce the final mound height by less than 6 in. To account for compaction, and ensure that the final mound surface remains above the organic sediment, mound material volumes have been calculated so that the mound surface immediately after placement will be 12 in. above the peak of the surrounding mud wave.

The edges of the mound will slope downward from the exposed portion until they reach native sediment underlying the organic material. Mounds are expected to be constructed principally of sand, which has an angle of repose (slope) of approximately 1.5:1 to 1.8:1 in water. When the sand is supported by *in situ* organic sediments, the angle of repose is estimated to be 1:1 or better. If gravel or cobbles are available and are used for a mound footing, the angle of repose of the mound material may be greater. Placement of sand using a clamshell bucket will allow better control of the placment location, will minimize turbulence at the bottom, and will allow optimum side slopes to be achieved.
(Alternatives such as barge dumping or Tremie tubes allow large quantities of water to be

entrained in the sediment and contribute to broader dispersion of the mound material.) For the purpose of calculating mound material volumes, the side slopes are assumed to be 1:1.

Mounds will be created in a circular shape, both to minimize the fraction of mound material that is contained in side slopes and to maximize the internal connectivity of the habitat. Idealized mound volumes have been calculated, therefore, assuming that the shape of the mounds is circular in plan view; including the side slopes, the three-dimensional shape of the mounds is equivalent to a truncated cone. If mounds are placed adjacent to one another (as in Figure 2-2), there will be conservation of mound materials because bases of the cones will overlap. The calculation of mound volumes does not account for this effect, leading to a potential overestimate of the amount of mound material needed. Because acceptance tests and remediation will be done in areas of different sizes and with different thicknesses of organic material, mounding material volumes have been calculated for a variety of conditions. Example mounding material volumes are shown in Table 6-8 and Figure 6-1. These results illustrate that the volume of mound material required increases disproportionally as the exposed area increases. Mound material volumes have been calculated for areas of 0.5, 1.0, and 2.0 acres because slightly more mound material per acre is required for small remediation areas. The principal determinants of mounding costs are directly proportional to mound volume (estimated to be approximately $78 per cy).

Table 6-8. Example mound material volumes

Size of Remediation Area (acres)	Fraction of Area with Exposed Mound Material	Mound Volume for 3-ft Thick Organic Layer (cy)	Mound Volume for 5-ft Thick Organic Layer (cy)	Mound Volume for 7-ft Thick Organic Layer (cy)
0.5	0.10	507	896	1,424
0.5	0.15	780	1,409	2,319
0.5	0.20	1,089	2,029	3,535
0.5	0.25	1,445	2,806	5,379
0.5	0.30	1,861	3,826	9,162
0.5	0.35	2,357	5,266	13,536
1	0.10	906	1,521	2,269
1	0.15	1,396	2,370	3,586
1	0.20	1,942	3,351	5,176
1	0.25	2,556	4,501	7,153
1	0.30	3,253	5,876	9,707
1	0.35	4,053	5,876	13,210
2	0.10	1,677	2,723	3,918
2	0.15	2,591	4,238	6,142
2	0.20	3,598	5,949	8,714
2	0.25	4,718	7,899	11,732
2	0.30	5,970	10,147	15,330
2	0.35	7,382	12,767	19,707

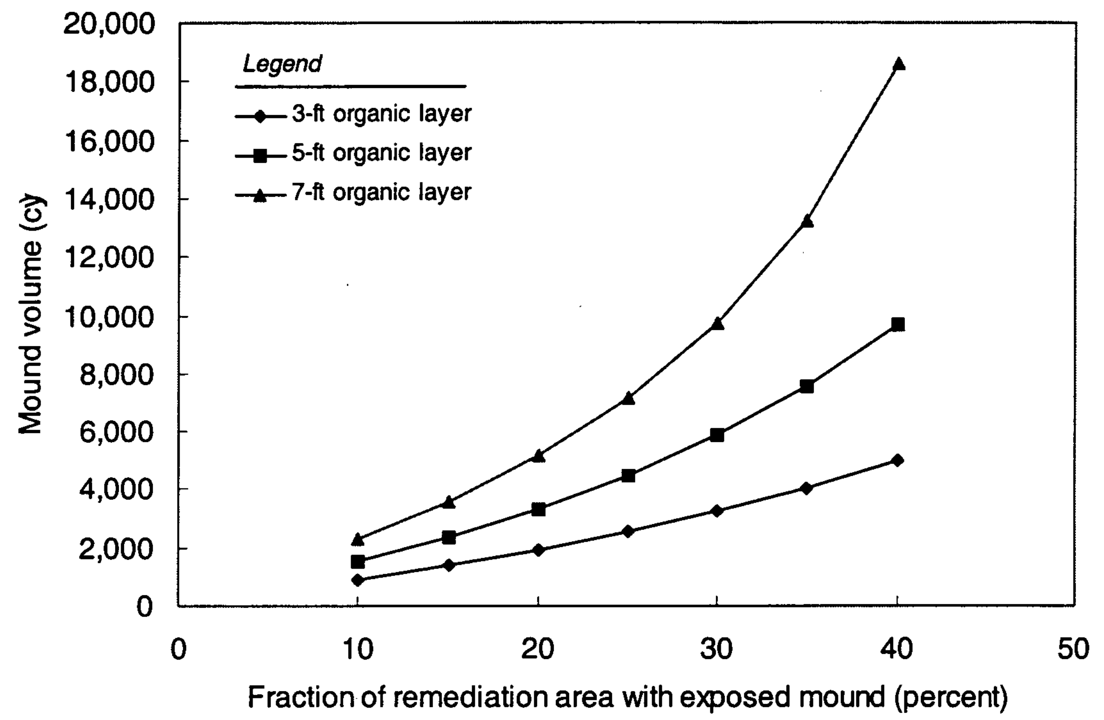

Figure 6-1. Mound material volumes for a 1-acre remediation area

Mound material will be applied at the rate of 2,900 cy per acre, which is estimated to result in coverage of the remediation area ranging from approximately 18 percent (for an organic layer 5 ft thick, the thickest for which mounding will be attempted except adjacent to the deep draft dock) to approximately 30 percent (for an organic layer 3 ft thick). In the 1-acre area adjacent to the deep draft dock, where the organic layer is approximately 7 ft thick, coverage of the completed mound is expected to be approximately 12 percent. Mound material volumes and coverage for each of the actual and potential mounding areas ("M" and "A" areas, respectively) are shown in Table 6-9.

Table 6-9. Mound material design volumes and coverage

Mound Area[a]	Size of Area (acres)	Organic Sediment Thickness (ft)	Mound Volume for Complete Mounding (cy)	Design Coverage for Complete Mounding (percent)
M1	0.98	7	2,842	12
A1	1.38	5	4,002	19
A2	1.79	5	5,191	19
A3	2.14	5	6,206	20
A4	3.27	3	9,483	30
A5	3.03	4	8,787	24
A6	1.84	4	5,336	23
A7	2.13	4	6,177	24
A8a[b]	1.27	5	3,683	18
A8b[b]	1.91	5	5,539	19

[a] Section 7.2.2 discusses the mound areas.

[b] Part *a* is closer to the dock, part *b* is the outer section.

The assumptions used to calculate mound volumes include some that are conservative (movement and compressibility of displaced material) and some that are based on best engineering estimates (side slopes and mound compaction). Actual conditions encountered in the field may vary from those assumed for volume calculations, with the result that the extent of exposed clean sand surface may differ from that which is predicted. Design tests will be conducted in each mounding area to assess the potential success of mounding in that area. These tests, and acceptance criteria for them, are described in the PSVP. If design tests indicate that mounding cannot be successfully carried out in an area, that area would then be subject to natural recovery.

6.4.2 Relative Cost of Mounding

Relative cost for mounding is directly proportional to the mound volume. Given a goal of 20–30 percent cover (25 percent), mounding in the 4-ft thick area will be more than

2 times the cost of thin capping. For the 7- and 10-ft thick areas, respectively, the relative cost will be 3.1 and 5.3 times more than that of thin capping.

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6.4.3 Transition from Capping to Mounding

Thin capping will be attempted for all areas before mounding is considered, with the exception of the 1-acre mounding area between the deep and shallow draft navigation areas. In addition, mounding will not be attempted under any circumstances in the portions of the navigational areas that require thin capping. It is proposed in the contract plans and specifications to identify acceptance areas that have similar conditions of sediment thickness, shear strength, water depth, and surface debris/sediment cover. Thin capping will commence within the limits of an acceptance area. The decision framework for the transition from capping to mounding to natural recovery is described in the PSVP.

7. Overview of Remedial Action

The results of the bearing capacity, slope stability, and STFATE analyses were used to determine where it is reasonably feasible to place a 6- to 12-in. cap, where mounding may be appropriate, and where natural recovery should be specified. Critical information on the bearing capacity and the thickness of the non-native organic layer was collected at several exploration locations during remedial design sampling (Exponent and Hartman 2000a). The first step in the design process is to assess conditions at each exploration location. The next step is to interpolate between the exploration locations.

7.1 Station-Specific Actions

In all areas within the AOC where it is feasible, the goal will be to place a uniform thin layer of inorganic material (i.e., sand) over the existing sediment. Natural recovery is specified for areas that are too deep, are too steep, have a thick layer of organic sediment of limited bearing capacity, or have a very high density of sunken logs. For the remainder of the AOC, the feasibility of capping or mounding was evaluated based on the data collected during remedial design sampling. Thin capping is the preferred remedial action, but, as discussed in Section 2, mounding will be used where thin capping is not effective. The recommended remedial action at each remedial design station location is summarized in Table 7-1. The areas where there is a high probability that the existing sediment will support sand are designated as "Thin Cap" areas. In those areas where the existing sediment is more likely to displace laterally under the weight of the sand, the result will be mounds of sand between areas of existing very soft organic material. These areas are designated as "Mound" areas.

Table 7-1. Remedial actions at exploration locations

Exploration Location No.	Mudline Elevation (ft MLLW)	Organic Material Thickness (ft)	Shear Strength @ Specified Depths[a] (psf @ ft)	Sediment Slope (percent)	Underwater Video Survey[b]	Remedial Action
52	−29	6	V < 3 @ 2.5, 5.0 V 40, 80 @6.5, 7.5 UU 300 @ 6.6	10–20	N,O silt, wood 18 to 48 in.	Mound
53	−32	2 Logs 2-8		10–20	N, O pile of logs	Natural Recovery
54	−44	13	UU 15 @ 5 UU Too soft @ 10 125, 400, 180 @ 13, 15, 20	<10	M silt, >48 in.	Natural Recovery
55	−53	4	V <6 @ 2.5 50 @ 5	10–20	M silt, >48 in.	Thin Cap or Mound
56	−42	5		<10	S silt, 20 to >48 in.	Dredge
57	−44	7	V 6 @ 2.5 V 80 @ 5 UU 50 @ 3	5–15	L, S silt, wood >48 in.	Thin Cap or Mound
58	−39	2		15–25	K, L silt, wood 6 to 12 in.	Thin Cap
59	−85	18	V <3 2.5 to 15 V 15 @ 17.5 V 30 @ 20	10–20	K, L silt >48 in.	Natural Recovery
60	−52	15	V <6 @ 2.5 V 20 @ 5, 7.5 V 50,70 @10, 12.5 V 10 @ 15 V 70, 50 @ 17.5, 20 V 10, 50 @ 22.5, 23.5 UU 30 @ 15	20–30	J silt <48 in.	Natural Recovery
61	−102	10	V < 3 @ 2.5 V 6 @ 5, 7.5 V 60, 40 @ 10. 12.5 UU 20 @ 11	<10	I, J silt >48 in.	Natural Recovery
62	−109	1		20–30		Outside AOC
63	−76	10	V <3 @ 2.5 10, 6 @ 5, 7.5 UU Too soft @ 5.5	30–40	H silt >48 in.	Natural Recovery
64	−125	10	V <3 @ 2.5, 5 V 3 @ 7.5 V 20, 80 @ 10, 12.5	10–20		Natural Recovery
65	−103	3	V 10 @ 2.5 V 140 @ 5	10–20		Thin Cap

[a] "V" indicates strength determined by field vane shear test. "UU" indicates strength determined by unconsolidated undrained triaxial test in the laboratory.

[b] Capital letters refer to diver transect.

- **Exploration 52—Mound Area.** Because the shear strength is less than 3 psf at 2.5 and 5 ft, the sediment is too soft and thick to support a thin cap. However, the underwater video survey showed wood fibers mixed in with the sediments. The fibers will provide some support; therefore, mounding may be possible.

- **Exploration 53—Natural Recovery.** In this exploration, the sampler hit logs at depths of 2 and 8 ft, thus confirming the underwater video survey, which shows a very high log density in this area.

- **Exploration 54—Natural Recovery.** In this exploration, the organic material is 13 ft thick and does not have sufficient shear strength to support either thin capping or mounding. During the design level sampling, field vane shear strength testing was not done at this location because at that time, dredging was planned to an elevation of –50 ft MLLW. The organic material at this location is similar to sediment at Explorations 59 and 61, which had very low shear strength. The mudline elevation at the exploration location is –44 ft MLLW, so dredging would not be needed to provide water depth of –40 ft MLLW.

- **Exploration 55—Thin Cap or Mound.** The organic material is 4 ft thick with shear strength of 6 psf at a depth of 2.5 ft. The shear strength of the native sediment at 5 ft is 50 psf. Thin capping or mounding appears feasible because the native sediment has sufficient strength to support sand.

- **Exploration 56—Dredge.** In this exploration, the organic material is 5 ft thick. During the design level sampling, shear strength testing was not done at this location because at that time, dredging was planned to an elevation of –50 ft MLLW. The organic material at this location is similar to sediment at Explorations 59 and 61, which had very low shear strength. The mudline elevation at the exploration location is –42 ft MLLW, so dredging will be needed to provide water depth of –44 ft MLLW.

- **Exploration 57—Thin Cap or Mound.** In this exploration, the organic material is 7 ft thick; however, the shear strength is 6 psf at 2.5 ft and 50 to 80 psf at depths of 3 to 5 ft. The underwater video survey on Transects L and S show wood fibers mixed in with the organic material. The Shelby tube sample at 2.5 ft contained redwood colored wood fibers 1/4 to 1/2 in. in length. It appears that the wood fibers in this area will give the sediment more strength than organic material in other areas. Therefore, thin capping or mounding appears feasible.

- **Exploration 58—Thin Cap.** Thin capping is recommended at this exploration because the organic material is 2 ft thick and the slope is less than 40 percent. The underwater video survey for Transect K reported that the thickness of very soft sediment was 6 to 12 in. and identified one rock outcrop on the surface.

- **Exploration 59—Natural Recovery.** The organic material is 18 ft thick, and the shear strength is less than 3 psf to a depth of 15 ft. The very soft material is too thick and too weak to support a thin cap or mound.

- **Exploration 60—Natural Recovery.** The organic material at this exploration is 15 ft thick. The shear strength is less than 6 psf at 2.5 ft and increases to 20 psf from 5 to 7.5 ft deep. At this location, the sediment slope is approximately 20 to 30 percent. Based on the slope stability evaluation, the sediment does not have sufficient shear strength to support a 6-in. thick sand cover on the slope. Because the sand thickness with mounding would be more than 12 in., the combination of the slope and low shear strength make mounding infeasible at this location.

- **Exploration 61—Natural Recovery.** The organic material is 10 ft thick and the shear strength is less than 3 psf at 5 ft and 6 psf at 5 and 7.5 ft. The very soft sediment is too thick and too weak to support a thin cap or mound.

- **Exploration 62—Outside AOC.** Neither capping nor mounding is needed at Exploration 62 because it is outside the AOC.

- **Exploration 63—Natural Recovery.** The organic material is 10 ft thick and the strength is less than 3 psf at 2.5 ft and 6 to 10 psf at 5 to 7.5 ft. The sediment slope is 30 to 40 percent in this location. The sediment does not have sufficient shear strength to support a thin cap or mound on the sediment slope.

- **Exploration 64—Natural Recovery.** The mudline elevation at this location is –125 ft MLLW, and the very soft organic material is 10 ft thick. The sediment shear strength is less than 3 psf at 2.5 to 5 ft and 3 psf at 7.5 ft. The sediment is too thick and too soft to support a thin cap or mound, and the area is too deep.

- **Exploration 65—Thin Cap.** The very soft organic material is 3 ft thick, and the shear strength is 10 psf at 2.5 ft. A thin cap appears feasible at this location.

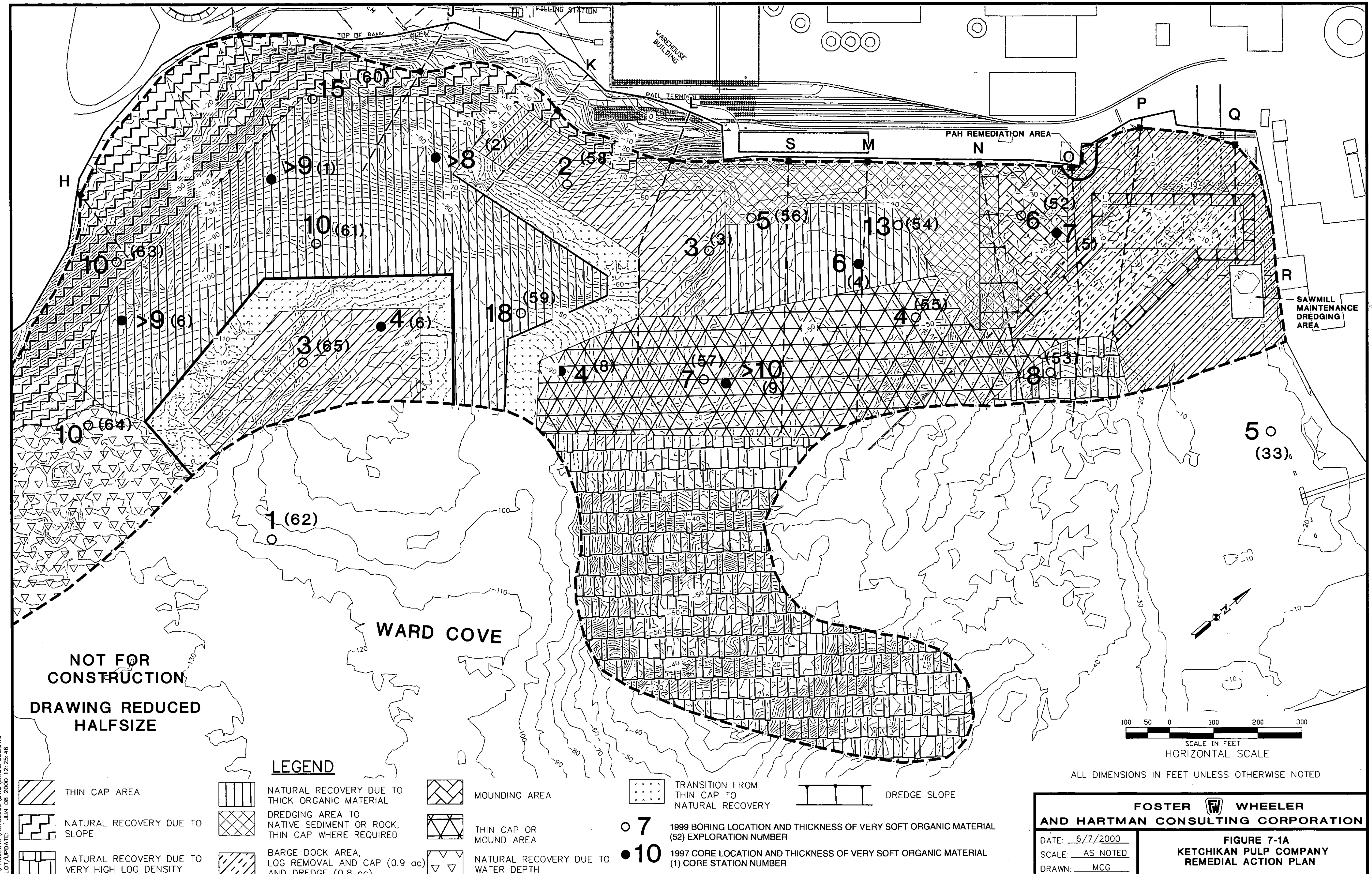
7.2 Remedial Action Sectors

7.2.1 Design Considerations

This section describes the proposed remedial actions in different sectors within the AOC. The remedial actions are shown on Figures 7-1A and 7-1B, and the areas of each remedial action are summarized in Table 7-2. The remedial actions will be described from east to west. The main dock runs roughly east-west, and the sawmill is on the east end of Ward Cove.

Determination of areas too steep for capping was completed using the elevation contours determined by hydrographic survey and plotted using computer assisted drafting. Too steep areas were based on the 40 percent slope criteria described in Section 6.2. To determine what areas consist predominantly of slopes greater than 40 percent, the ratio of 25H:10V (40 percent slope = 10H:4V = 25H:10V) was used. For example, based on a contour map with a horizontal scale of 1 in. equal to 100 ft, areas where the 10-ft contour lines are spaced more closely than 1/4 in. are areas that have slopes greater than 40 percent.

Thin capping is proposed for the sector between the east end of the main dock and the shoreline along the sawmill (which is the area from the sawmill to approximately underwater video survey Transect O). A small area (approximately 0.2 acre) offshore of the sawmill is routinely dredged to maintain access to the sawmill log lift and will not be capped or mounded. There are long-range plans to construct a new shallow draft berth in the northeast corner of the site. A possible shallow draft berth area and an approach channel are shown on the figure in an area labeled "Dredge and Thin Cap." Navigation requirements for shallow draft berthing are described in more detail in Section 3 of this report. The berthing area (0.8 acre) will be dredged to –14 ft MLLW or to bedrock/ hardpan native sediment. The estimated volume of dredged sediment is 3,500 cy. The approach channel (0.9 acre) will not be dredged, but logs will be removed from the area



FILLING STATION
TOP OF BANK
WAREHOUSE BUILDING
RAIL TERMINAL
PAH REMEDIATION AREA
H
I
J
K
L
S
M
N
O
P
Q
R
SAWMILL MAINTENANCE DREDGING AREA
15 (60)
>9 (1)
>8 (2)
2 (58)
10 (61)
10 (63)
5 (56)
13 (54)
6 (52)
7 (5)
3 (3)
6 (4)
>9 (6)
18 (59)
4 (6)
3 (65)
4 (55)
4 (8)
7 (57)
>10 (9)
8 (53)
10 (64)
5 (33)
1 (62)
WARD COVE
NOT FOR CONSTRUCTION
DRAWING REDUCED HALFSIZE
LEGEND
THIN CAP AREA
NATURAL RECOVERY DUE TO SLOPE
NATURAL RECOVERY DUE TO VERY HIGH LOG DENSITY
NATURAL RECOVERY DUE TO THICK ORGANIC MATERIAL
DREDGING AREA TO NATIVE SEDIMENT OR ROCK, THIN CAP WHERE REQUIRED
BARGE DOCK AREA, LOG REMOVAL AND CAP (0.9 ac) AND DREDGE (0.8 ac)
MOUNDING AREA
THIN CAP OR MOUND AREA
NATURAL RECOVERY DUE TO WATER DEPTH
TRANSITION FROM THIN CAP TO NATURAL RECOVERY
DREDGE SLOPE
○ 7 1999 BORING LOCATION AND THICKNESS OF VERY SOFT ORGANIC MATERIAL (52) EXPLORATION NUMBER
● 10 1997 CORE LOCATION AND THICKNESS OF VERY SOFT ORGANIC MATERIAL (1) CORE STATION NUMBER
100 50 0 100 200 300
SCALE IN FEET
HORIZONTAL SCALE
ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED
FOSTER WHEELER
AND HARTMAN CONSULTING CORPORATION
DATE: 6/7/2000
SCALE: AS NOTED
DRAWN: MCG
FIGURE 7-1A
KETCHIKAN PULP COMPANY
REMEDIAL ACTION PLAN
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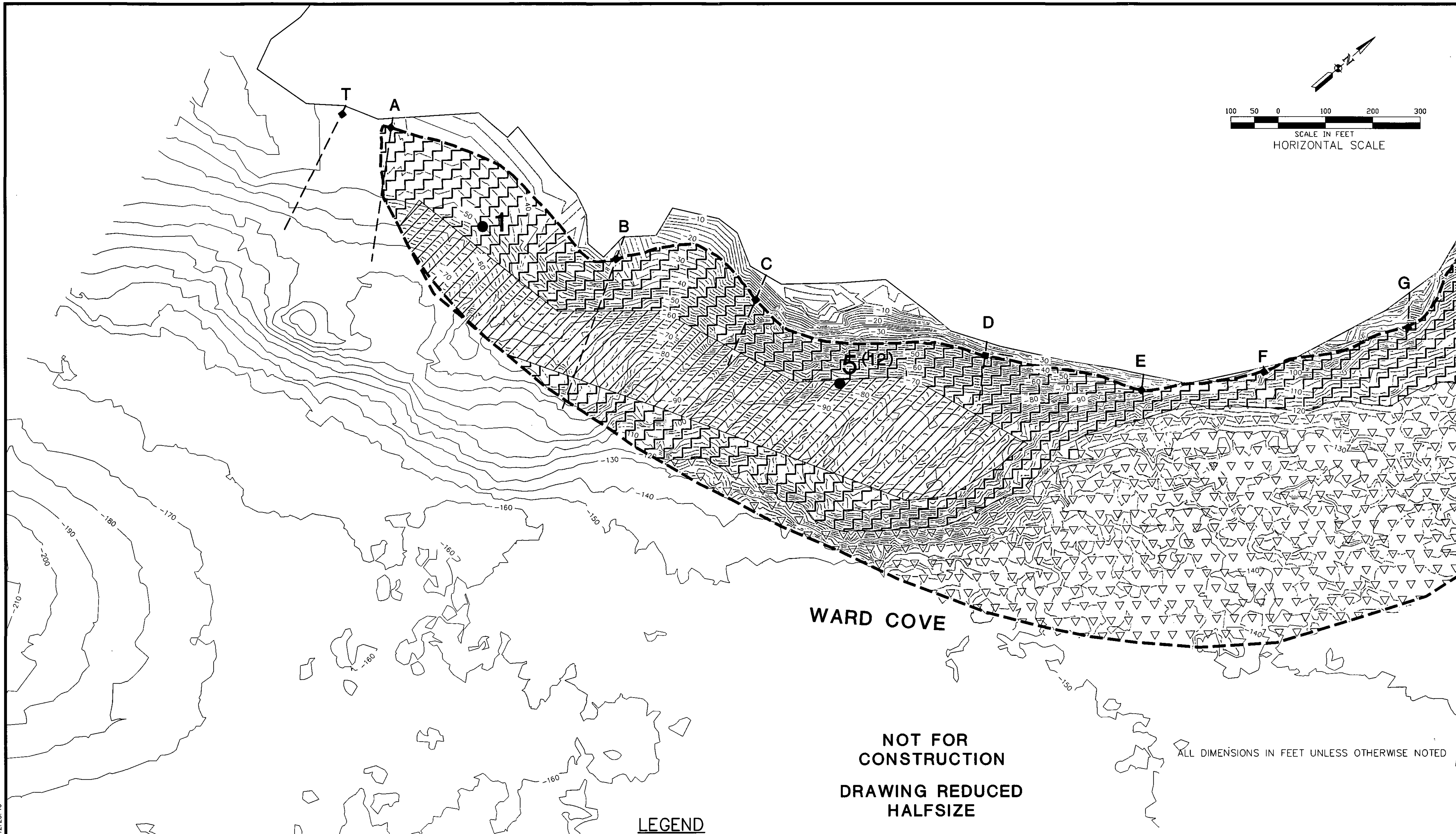

LEGEND

- THIN CAP AREA
- NATURAL RECOVERY DUE TO SLOPE
- NATURAL RECOVERY DUE TO VERY HIGH LOG DENSITY
- NATURAL RECOVERY DUE TO THICK ORGANIC MATERIAL
- DREDGING AREA TO NATIVE SEDIMENT OR ROCK, THIN CAP WHERE REQUIRED
- BARGE DOCK AREA, LOG REMOVAL AND CAP (0.9 ac) AND DREDGE (0.8 ac)
- MOUNDING AREA
- THIN CAP OR MOUND AREA
- NATURAL RECOVERY DUE TO WATER DEPTH
- TRANSITION FROM THIN CAP TO NATURAL RECOVERY
- DREDGE SLOPE
- ○ 7 — 1999 BORING LOCATION AND THICKNESS OF VERY SOFT ORGANIC MATERIAL (52) EXPLORATION NUMBER
- ● 10 — 1997 CORE LOCATION AND THICKNESS OF VERY SOFT ORGANIC MATERIAL (1) CORE STATION NUMBER

FOSTER WHEELER
AND HARTMAN CONSULTING CORPORATION

DATE: 6/7/2000	FIGURE 7-1B
SCALE: AS NOTED	KETCHIKAN PULP COMPANY
DRAWN: MCG	REMEDIAL ACTION PLAN

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Table 7-2. Remedial action areas and volumes

Remedial Action[a]	Area (acres)	Volume (cy) Case Study 1[b]	Case Study 2[c]	Case Study 3[d]	Case Study 4[e]
Thin cap	14.1	11,400	11,400	11,400	11,400
Mounding	1	2,400	2,400	4,000	4,000
Thin cap or mound (14 acres total)					
Scenario 1					
Thin cap 6.7 acres	6.7	5,400		5,400	
Scenario 2					
Thin cap 1.7 acres	1.7		1,300		1,300
Mound 5 acres	5		12,100		20,200
Transition	3.6	2,900	2,900	2,900	2,900
Deep draft berthing area (3.1 acres total)					
Dredge and thin cap[f]	0.8	650	650	650	650
Dredge[g]	2.3				
Shallow draft berthing area and approach channel (1.7 acres total)					
Log removal and thin cap	0.9	750	750	750	750
Dredge[h]	0.8				
Subtotal	**30.2**	23,500	31,500	25,100	41,200
Natural recovery					
Sawmill maintenance dredging	0.2				
Steep slope	14.5				
Very high log density	10.2				
Soft, thick organics	11.3				
Too deep (–120 ft or deeper)	13.5				
Subtotal	**49.7**				
Total	**79.9**	**23,500**	**31,500**	**25,100**	**41,200**

[a] Thin capping will be attempted on all of the 24.4 acres specified as thin cap (14.1 acres), thin cap or mound (6.7 acres), or transition (3.6 acres). Based on the thickness and bearing capacity of sediments in these areas, mounding is estimated to be feasible for approximately 18.8 of the 24.4 acres if capping does not work.

[b] Case Study 1 is based on the assumptions that all 6.7 acres of the "thin-cap or mound" area will be thin capped and that the overall thin-cap thickness will be 0.5 ft and the mound thickness will be 1.5 ft.

[c] Case Study 2 is based on the assumptions that 1.7 acres of the "thin-cap or mound" area will be thin capped and 5 acres will be mounded and that the overall thin-cap thickness will be 0.5 ft and the mound thickness will be 1.5 ft.

[d] Case Study 3 is based on the assumptions that all 6.7 acres of the "thin-cap or mound" area will be thin capped and that the overall thin-cap thickness will be 0.5 ft and the mound thickness will be 2.5 ft.

[e] Case Study 4 is based on the assumptions that 1.7 acres of the "thin-cap or mound" area will be thin capped and 5 acres will be mounded and that the overall thin-cap thickness will be 0.5 ft and the mound thickness will be 2.5 ft.

[f] Dredge deep draft to –44 ft MLLW and thin cap (0.8 acre).

[f] Dredge deep draft to –40 ft MLLW (2.3 acres).

[g] If shallow draft berthing dock is not constructed, this area would be thin capped (requiring an additional 650 cy of capping material).

prior to thin capping. If this area is not developed as a shallow draft berth, the entire 1.7-acre area will be thin capped.

Mounding is the proposed remedial action along the east end of the main dock near Exploration 52 and Transects N to O.

Dredging is proposed along the major length of the main dock down to an elevation of –40 to –44 ft MLLW (or to refusal). It is expected that the dredging to this depth will expose rock or native sediment in most of the area. The estimated volume of dredged sediments is 17,000 cy. In the area where organic material is not removed, it will be covered with a thin cap. For this document, it is assumed that 0.8 acre of the 3.1-acre dredging area will require thin capping.

Neither capping nor mounding is possible south of the dredge area near Explorations 54 and 56 and Transects M and S. The very soft organic material is too soft to support a thin cap and too thick to accommodate mounding.

Thin capping or mounding is proposed north of the "boot" in one 6.7-acre portion of the AOC in the vicinity of Explorations 8, 9, 55, and 57 and the south end of Transects L, S, M, and N. The organic material in this area is more than 5 ft thick but appears to contain enough wood fibers to provide support for a thin cap or mound.

Thin capping is proposed south of the rail barge dock, which is southwest of the main dock, near Explorations 3 and 5 and Transects K and L.

Neither capping nor mounding is possible along the shoreline west of the rail barge dock near Explorations 60 and 63 and Transects H, I, and J. The sediment near the shoreline has a slope of greater than 40 percent north of Exploration 60 and northwest of Exploration 63. At these explorations, the slope is 20 to 40 percent, but the very soft organic material does not have sufficient strength to support a thin cap or mound.

Neither capping nor mounding is possible in a "U" shaped area south of the shoreline in the vicinity of Explorations 1, 2, 6, 59, and 61 and the south ends of Transects H, I, J, and K. In this area, the very soft organic material is 8–18 ft thick and does not have sufficient shear strength to support a thin cap or mound.

Near Explorations 6 and 65, thin capping is proposed. The organic material is 3–4 ft thick and appears to have sufficient strength to support a thin cap.

In the west "tail" of the AOC between Transects A and G, most of the area is either too steep or too deep for thin capping or mounding. Along the entire shoreline, the slope is greater than 40 percent. Between Transects E and G, the steep slope continues into water depths of deeper than –120 ft MLLW where placing cap or mounding material is not considered feasible.

Thin capping is proposed in areas at the western end of the AOC, near Transects A to D. The organic material is 1 to 5 ft thick based on cores taken in 1997. Although no shear strength measurements were made in this area, the sediment contains more wood fibers, which corresponds to sediment with higher shear strength in other areas of Ward Cove.

Maintenance dredging routinely occurs in an approximately 0.2-acre area directly off of the sawmill dock to allow continued access to the dock. Sediments are dredged to bedrock, which occurs at depths to –10 to –20 ft MLLW (Benson 2000, pers. comm.). Given the small size of this area, no effort will be made to avoid this area during capping.

The areas of each type of remedial action are shown in Table 7-2. Section 2 describes thin capping and mounding in more detail. Section 2.3 describes likely mound configuration and percentage of area covered.

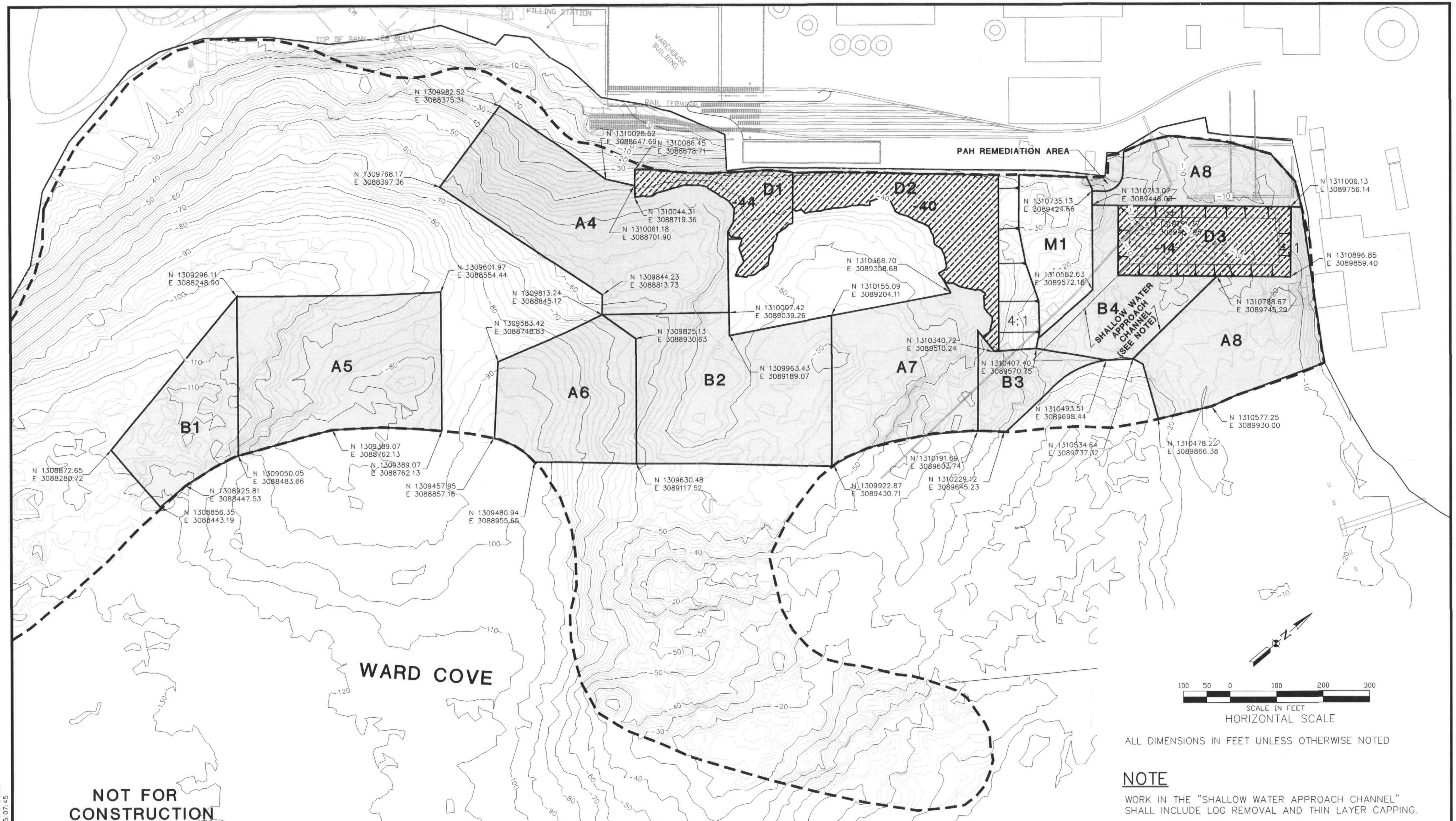
Table 7-2 also shows a range of estimated volumes of capping and mounding material that would be needed. Volumes are estimated for two mounding thicknesses (1.5 and 2.5 ft). In addition, estimates are calculated assuming all of the 6.7 acres of the "thin cap or mound" area could be thin capped and assuming only 1.7 acres of the area could be thin capped with the remaining 5 acres of the area mounded. Depending on mound thickness and the total area that can be thin capped versus mounded, the volume of material necessary for the proposed remedial actions ranges from 23,500 to 41,200 cy. An additional 650 cy of capping material would be needed to cap the barge berthing area if this area is not developed as a barge dock and requires capping instead of dredging.

7.2.2 Final Design Sectors/Acceptance Areas

This section describes the different sectors that resulted from the design considerations integrated with the capabilities and limitations of the equipment that are expected to be used on this project. These sectors, now called acceptance areas, are shown in Figures 7-2A and 7-2B, and the areas of each sector are summarized in Table 7-3.

The term "acceptance area" is used because each area will be treated independently to attempt the succession of methods available for thin capping and mounding. The borders of each area were selected in order to provide acceptance within an area that is relatively consistent in depth and shear strength of existing sediment and also consistent across the area in sediment thickness, shear strength, water depth, and surface debris/sediment cover.

Eight areas have been designated as "A" acceptance areas. These areas are considered suitable for either thin capping or mounding. The total area of Areas A1 through A8 is 18.76 acres. Mounding is considered only in those areas that have a sediment thickness less than 5 ft and are located such that they will not interfere with navigation. This is true for all of the "A" areas.



ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED

NOTE

WORK IN THE "SHALLOW WATER APPROACH CHANNEL" SHALL INCLUDE LOG REMOVAL AND THIN LAYER CAPPING.

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

LEGEND

A1	TYPE "A" THIN CAP AREA/OR MOUNDING	D1	DREDGE AND THIN CAP
B1	TYPE "B" THIN CAP AREA	M1	MOUND AREA ONLY
		4:1	DREDGE SLOPE

FOSTER WHEELER AND HARTMAN CONSULTING CORPORATION

DATE: 6/7/2000
SCALE: AS NOTED
DRAWN: KSK

FIGURE 7-2a
KETCHIKAN PULP COMPANY
THIN CAP PLAN

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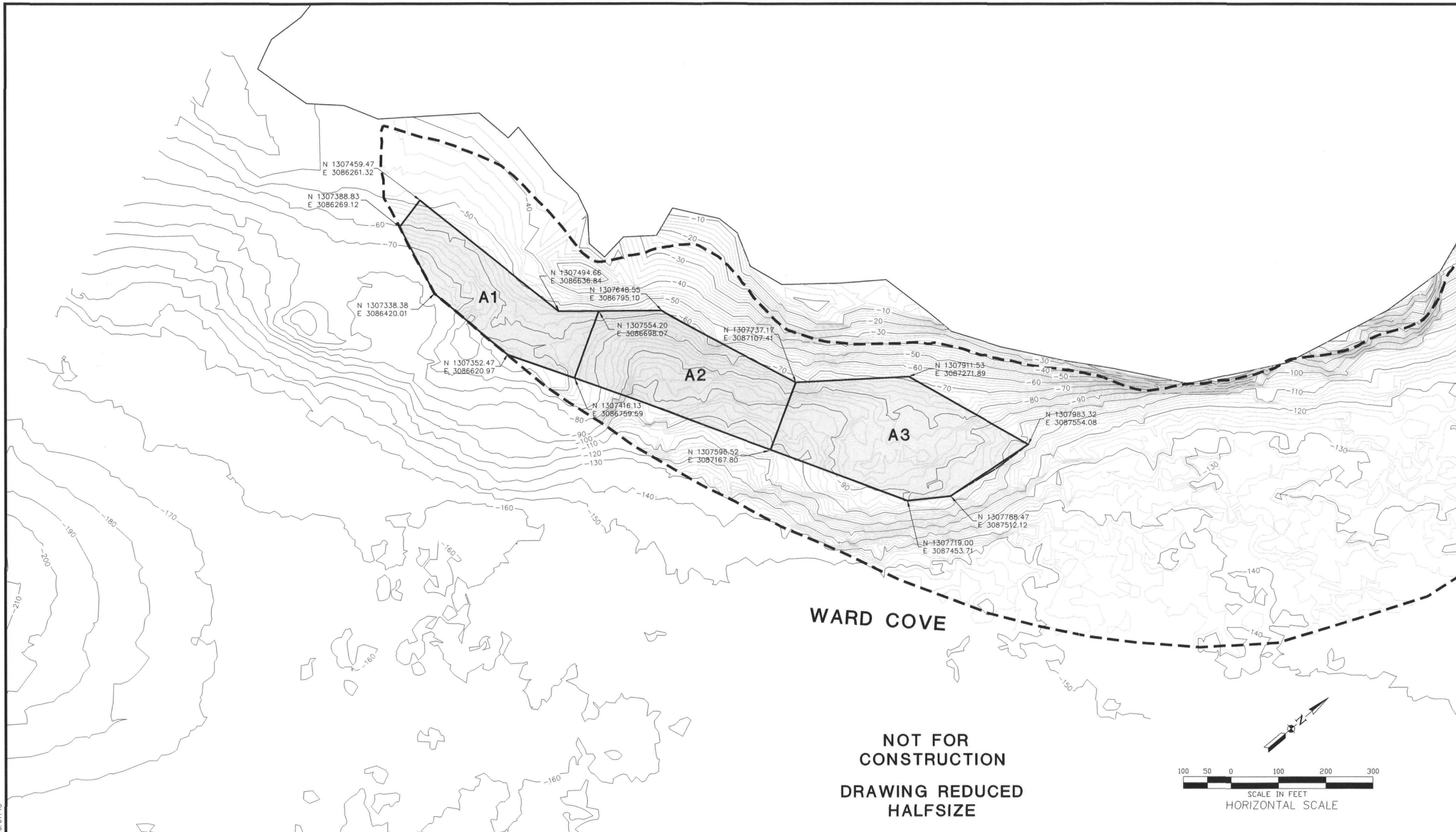

ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED

LEGEND

A1	TYPE "A" THIN CAP AREA/OR MOUNDING
B1	TYPE "B" THIN CAP AREA
D1	DREDGE AND THIN CAP
M1	MOUND AREA ONLY
4:1	DREDGE SLOPE

FOSTER WHEELER
AND HARTMAN CONSULTING CORPORATION

DATE: 6/7/2000	FIGURE 7-2b
SCALE: AS NOTED	KETCHIKAN PULP COMPANY
DRAWN: KSK	THIN CAP PLAN

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Table 7.3 Acceptance areas

Area Designation	Total Acres
A1	1.38
A2	1.79
A3	2.14
A4	3.27
A5	3.03
A6	1.84
A7	2.13
A8	3.18
Total A Areas	18.76
B1	1.42
B2	3.10
B3	0.64
B4	0.96
Total B Areas	6.12
D1	0.88
D2	1.36
D3	0.98
Total D Areas	3.71 but use 2.00 as probable area
M1	0.98

Total Potential Area for **Thin Cap** = Total A + Total B + Total D
= 18.76 + 6.12 + 2.0
= 26.88 ≈ **27 Acres**

Total Potential Area for **Mounding** = Total A + M1
= 18.76 + 0.98
= 19.74 ≈ **20 Acres**

Four areas have been designated as "B" acceptance areas. These areas are suitable for thin capping but are not suitable for mounding because the thickness of sediment is greater than 5 ft or because the area is in a navigation channel. The total area of Areas B1 through B4 is 6.12 acres.

One area is designated "M1" because it does not have the shear strength for thin capping, but because of the thickness of the sediment, it is considered a candidate for mounding.

Dredging is planned for two deep draft areas at the main dock and one area that will become the shallow draft berthing area. These areas have been designated as "D" acceptance areas. The total area of Areas D1 through D3 is 3.71 acres, but it is expected that the dredging will encounter rock or virgin sediment over approximately half of the area. Therefore, only 2.0 acres are expected to be thin capped. Mounding is not a consideration because the dredge areas are navigation areas.

7.3 Dredging

A mechanical dredge is the preferred dredge type for the Ward Cove project. A mechanical dredge can remove bottom sediments at near *in situ* density by using mechanical forces to dislodge Ward Cove sediments. The mechanical dredge is also better suited to operate and remove bed sediment in naturally rocky areas than a hydraulic suction dredge, and most specialty dredges.

The enclosed (environmental type) clamshell bucket offers advantages when excavating light, loose materials and those sediments with extremely high water content as are found at the Ward Cove site. An enclosed bucket is a proven technology for capturing and retaining light, loose sediments.

During the bucket descent phase of the dredging cycle, vents on the top of the enclosed bucket remain open to allow water to pass through, thereby creating minimum downward water pressure on the bed sediment, which minimizes sediment resuspension. Correspondingly, during the bucket ascent phase, the vents are closed so that the light, loose materials are retained in the bucket. Standard design clamshells are not enclosed, and sediments do wash out as the loaded bucket is raised through the water column.

Overlapping side plates also reduce sediment loss during bucket closure. The benefit of these features is a greatly reduced turbidity over conventional dredge buckets.

The modern clamshell bucket has a large footprint and is articulated to create a level cut closing action, which produces a generally level bottom profile. This feature reduces the amount of overdredging, often referred to as allowable overdepth, which is important for the limited disposal site volume.

A disadvantage of the environmental bucket is that it does not work effectively in granular (sand) material and cannot dig material with standard penetration blow counts greater than 3 to 5. This disadvantage is not a concern for the majority of the Ward Cove sediments that are exceptionally loose and soft with very high water content. The enclosed clamshell bucket is required for dredging except where native sediments at higher densities are encountered that require the use of the standard, heavier, digging bucket. A standard digging bucket may be used if firm, dense, or granular sediments are encountered that prevent the satisfactory removal of suitable sediments with a closed bucket.

Also, the large, flat footprint of the bucket is not amenable to excavating side slopes, a sharply undulating bed, or sediments with large amounts of debris. With the exception of the log debris, none of these conditions apply to the Ward Cove project. In the case of large amounts of debris consisting mostly of sunken logs, a heavier standard digging bucket, or a grapple bucket, will be required.

The total volume of sediment that will be dredged from the deep and shallow draft navigation area is estimated to be approximately 20,500 cy. The dredged material will be transported by barge to a stockpile area located on the east end of Ward Cove, south of the mouth of Ward Creek. At the stockpile area the dredged sediment will be allowed to dewater by gravity. Dewatering will reduce the volume of the sediment by at least

30 percent (to approximately 14,400 cy). The dewatered sediment will then be disposed of at the KPC landfill.

7.4 Capping and Mounding

To ensure successful capping and/or mounding, the equipment must be flexible and capable of modifications to operate in the varying conditions found in Ward Cove. The preferred capping and mounding equipment must ultimately be decided upon by the contactor. The contractor will be required to mobilize necessary equipment of his choice for two methods of the three preferred methods of cap and mound placement. The three preferred methods include a tremie tube, hydraulic pipeline with diffuser, and mechanical bucket. The contractor can use any of these systems or propose an alternative system for consideration with the submittal of the project approach. If the contractor chooses to use a system other than described in this report, documentation of success with former projects must be submitted to demonstrate that the proposed system will work in the Ward Cove environment and can meet the performance requirements of capping and mounding.

The total volume of capping and/or mounding material is expected to be approximately 23,500 to 41,200 cy, depending on how much area can be capped (the preferred remedial action) and how thick the mounds must be. Imported clean material with grain size ranging from sand to silt and natural levels of organic matter will be used for capping and mounding.

7.5 Summary

The objective of the remediation of contaminated surface sediment in the 80-acre AOC is to reduce toxicity of sediments to the bottom-dwelling animals and to enhance recolonization of the bottom sediments to support a healthy community of marine animals. The contaminated sediments are not toxic to human health or to birds and mammals living in Ward Cove.

The selected remedy will achieve RAOs (i.e., reduce toxicity in surface sediments and enhance recolonization of sediments to support a healthy benthic community) through a combination of thin-layer capping, mounding, navigational dredging, and natural recovery. The selected remedy for the Marine Operable Unit of the KPC site includes the following elements:

- **Thin-Layer Capping**—A thin-layer cap (approximately 6- to 12-in.) of clean, sandy material will be placed over problem sediments where practicable within the AOC. Thin-layer capping is preferable to mounding. Thin-layer capping is estimated to be practicable to approximately 27 acres, which includes approximately 2 acres that are predicted to be capped after dredging, 7 acres that may be either thin capped or mounded, and approximately 4 acres that are considered transition areas between the different remedial options.

- **Mounding**—Mounds of clean material will be placed in problem sediments where thin-layer capping is not practicable and where mounding is practicable. Mounding will generally be considered practicable in those areas where the organic-rich sediments are less than 5 ft thick and the sediments do not have the bearing capacity to support a thin-layer sediment cap (i.e., the bearing strength is less than 6 psf). Mounding will be the remedial action over at least 1 acre and will also be used in areas where thin capping is not effective.

- **Dredging and Upland Disposal**—Navigational dredging of approximately 17,000 cy of contaminated sediments will be performed in an approximate 3-acre area in the deep draft berth area in front of the main dock facility. To allow reasonable access to vessels, it is estimated that this deep draft berth area will be dredged to approximately –40 ft MLLW at the bow end of the vessel and to –44 ft MLLW at the stern end of the vessel. In addition, dredging of approximately 3,500 cy of contaminated sediments will be performed in an approximate 1-acre area near the planned shallow draft berth area in the northeast corner of Ward Cove. To allow reasonable access to log barges, it is estimated that this shallow draft berth area will be dredged to –14 ft MLLW, provided that bedrock does not extend above this elevation. In both areas, the areal extent of dredging and the dredge depths have been determined to be necessary to maintain current and accommodate reasonably anticipated future navigational needs and because a cap could not be placed in these areas without constraining current and potential future navigational needs.

Dredged sediments will be disposed at an upland landfill authorized to accept the material. After dredging, a thin-layer cap of clean, sandy material will be placed in dredged areas unless native sediments or bedrock is reached during dredging. Potential propeller scouring will be considered in designing the capping remedy for these areas.

- **Log Removal from Selected Locations—**Prior to dredging, sunken logs in the area to be dredged will be removed. Logs removed from the dredged areas will be disposed in an authorized landfill unless they can be otherwise used in a manner (e.g., hog fuel) that is acceptable to the regulatory agencies.

- **Natural Recovery—**Natural recovery is the selected remedy in areas where neither capping nor mounding is practicable. Natural recovery is estimated to be the remedy for approximately 50 acres of the 80-acre AOC, as follows:

1. An 8-acre area in the center of Ward Cove and a 2-acre area near Boring Station 8 that have a very high-density of sunken logs (>500 logs/10,000 m^2)

2. A 13.5-acre area where water depth to the bottom of the cove is deeper than −120 ft MLLW and the depth of the sediment is currently considered to be too great to cap

3. A 14.5-acre area where slopes are estimated to be greater than 40 percent and are currently considered to be too steep for capping or mounding material to remain in place

4. An 11-acre area where the organic-rich sediments do not have the bearing capacity (i.e., strength is less than 6 psf) to support a sediment cap and are too thick (i.e., thickness is greater than 5 ft) to practicably allow for placement of sediment mounds

5. A 0.2-acre area near the sawmill log lift where maintenance dredging generally occurs on an annual basis.

- **Institutional Controls**—An institutional control has been developed for the site to ensure that any future post-remediation activities within the AOC do not result in material damage to the thin-layer cap or mounds. As such, the following requirement is included in an "Environmental Protection Easement and Declaration of Restrictive Covenants" recorded on October 28, 1999:

> Projects or activities that materially damage the cap or mounds applied to tidelands or submerged lands shall be required, at the direction of EPA, to redress such impacts, e.g., a dredging project that may erode or displace large portions of the cap will be required to repair or replace the cap.

The term "cap" in this requirement is inclusive of any clean material (e.g., cap or mound) placed on the bottom of Ward Cove. As an example, when activities in the AOC, such as dredging projects, expose substantial area(s) of non-native organic-rich sediments and thus adversely affect the continued recovery of the benthic community in the sediments, the current owner of the patented tidelands will be required, at the direction of EPA, to include replacement of the cap in exposed areas.

- **Long-Term Monitoring**—Long-term monitoring of surface sediments in both capped/mounded areas and in natural recovery areas will be performed until RAOs are achieved, as determined by EPA. The long-term effectiveness of sediment remediation in the AOC in Ward Cove will be demonstrated by a reduction in sediment toxicity and the existence of a healthy benthic community in the sediments. EPA does not intend to require long-term monitoring of surface sediments within the maintenance dredging area and the very high-density areas of sunken logs.

  The condition of the benthic community will be analyzed using methods that will include, but will not necessarily be limited to, comparisons to areas that are considered to be relatively unimpacted areas of similar habitat (e.g., reference areas or areas of Ward Cove outside of the AOC that are of similar habitat), as well as spatial and temporal comparisons of community structure within the AOC. Benthic community indices will include taxa richness and abundance as well as other relevant indices. EPA will require monitoring of ammonia and 4-methylphenol in surface sediments to assist in interpretation of biological monitoring data.

- **Other Work**—As deemed appropriate by EPA, subtidal sediments associated with an intermittent sheen in a localized area near the east end of the main dock will be addressed through dredging and disposal of suspected PAH-contaminated sediments.

8. Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all ARARs. The ARARs identified below are all applicable requirements for the selected remedy. The text below was excerpted from EPA's ROD for the Marine Operable Unit (U.S. EPA 2000).

Federal Clean Water Act Dredge and Fill Requirements; Sections 401 and 404 (33 USC 401 et seq.; 33 USC 1251–1316; 33 USC 1413; 40 CFR 230, 231; 33 CFR 320–330)—These regulations provide requirements for the discharge of dredged or fill material to waters of the United States and are applicable to any in-water work. The evaluation required under Section 404(b)(1) is complete and is included in the Administrative Record for the Marine Operable Unit of the KPC site. The finding was that this project complies with the requirements of the 404(b)(1) guidelines. As described in the 404(b)(1) analysis, steps will be taken during construction and monitoring of the project to minimize potential impacts to the aquatic resources. Water quality monitoring will occur during construction to ensure that any impacts to water quality will be temporary in nature and minimal in overall impact. Long-term water quality impacts are not expected. EPA will perform oversight of in-water construction windows to ensure that impacts to migratory fish will be avoided or minimized.

Federal Magnuson-Stevens Fishery Conservation and Management Act (1996) (16 USC Section 1851 et seq.)—This act requires that any fishery management plan include a provision to describe and identify essential fish habitat for the fishery, describe adverse effects to that habitat from both fishing and non-fishing activities, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. EPA has determined that the selected remedy will not adversely affect essential fish habitat. No alteration to the subtidal acreage will occur as a result of this project. The proposed remediation, which includes dredging and placement of clean material on bottom sediments, may cause short-term effects to the water column (e.g., increases in suspended particulates and turbidity). However, construction operations will be carefully monitored and managed to minimize adverse short-term effects. Long-term effects are expected to be beneficial, because the clean material placed on the bottom will provide more suitable habitat for benthic communities, which serve as a food source to larger invertebrates and fishes.

Federal Fish and Wildlife Coordination Act (16 USC 661 et seq.)—Ward Cove shorelines provide potential habitat for bald eagles and other avian species, and the surface waters of Ward Cove are used as a migratory route by salmonid species that spawn in Ward Creek. This act prohibits water pollution with any substance deleterious to fish, plant life, or bird life. Criteria are established regarding site selection, navigational impacts, and habitat remediation. The act also requires that fill material on aquatic lands be stabilized to prevent washout. This requirement is applicable to in-water work. The selected remedy complies with this act because it is not deleterious to fish or wildlife.

Federal Rivers and Harbors Appropriations Act (33 USC 403; 33 CFR 322)—Section 10 of this act prohibits the unauthorized obstruction or alteration of any navigable water of the United States. Section 10 is applicable to structures or in-water work (including dredging and filling). The selected remedy is designed so that it will not obstruct or alter navigation in Ward Cove.

Federal Endangered Species Act of 1973 (16 USC 1531 et seq., 50 CFR Part 200, 402)—This regulation is applicable to any remedial actions performed at this site because this area represents potential habitat for threatened and endangered species. Threatened and endangered species potentially occurring within the local area include the American peregrine falcon, which is listed by the U.S. Fish and Wildlife Service (USFWS) as an endangered species, the humpback whale, which is listed by the National Marine Fisheries Service (NMFS) as a threatened species, and the Stellar sea lion, which is listed by NMFS as a threatened species. The activities associated with this remedial action comply with this regulation. NMFS and USFWS concur with EPA's determination that the activities associated with this remedial action would not likely adversely affect any listed species or designated critical habitat.

Federal Coastal Zone Management Act (16 USC 1451 et seq., 15 CFR 923)—Section 307(c)(1) of the Coastal Zone Management Act requires that federal agencies conducting or supporting activities directly affecting the coastal zone, conduct or support those activities in a manner that is consistent with approved state coastal zone management programs. EPA has reviewed the Standards of the Alaska Coastal Management Program and the Ketchikan Gateway Borough Coastal Management Program and has determined that the selected remedy will not adversely affect the coastal zone and is consistent, to the maximum extent practicable, with the Coastal Zone Management Act.

Alaska Water Quality Standards (18 AAC 70; see also ADEC 1991)—The turbidity standard for marine waters of the Alaska Water Quality Standards is the only ARAR identified by the State for the remedial actions in the Marine Operable Unit. The turbidity standard constitutes an ARAR for dredging and capping/island mounding. Excessive turbidity detected during monitoring of the dredging or capping/island mounding operations may trigger some refinement of those operations to reduce disturbances to the quality of the water column.

Alaska Solid Waste Management Regulations (18 AAC 60)—The Alaska solid waste management regulations address the management of solid waste disposal facilities. These regulations will be applicable to remediation of Ward Cove sediments if the sediments are determined to be a solid waste and are disposed of either in an approved onsite disposal facility or in an approved offsite solid waste disposal facility. The onsite landfill is permitted to receive dredged sediments from Ward Cove. KPC, the owner and operator of the landfill, has sought concurrence from the State of Alaska that disposal of dredged sediments, generated during remediation, in the onsite landfill is consistent with the current permit.

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Appendix A

Foundation Support and Slope Stability Calculations

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY MTU DATE 2/10/00 SHEET 1 OF 1

CHKD. BY M.h DATE 2/11/00 OFS NO. DEPT. NO.

CLIENT EXPONENT

PROJECT KPC

SUBJECT CAP BEARING CAPACITY

USE LONG FOOTING MODEL

$q_u = N_c c$ $\quad N_c = 5.14$ REF: ASCE 1993 (EM 1110-1-1055)

c = undrained shear strength
q = applied load

6" SAND $\gamma_b = 124 - 64 = 60 \ \frac{Lb}{ft^3}$

$q = (0.5 \text{ FT})(60 \text{ pcf}) = 30 \ \frac{Lb}{ft^2}$

$c_{req} = \frac{q}{5.14} = \frac{30}{5.14} = 5.8 \ \frac{Lb}{ft^2}$

NEED c of at least 6 psf to support 6 in sand cap. Need c of at least 12 psf to support 12" cap.

USE FACTOR OF SAFETY OF 2
REF: ASCE, DM 7.1, Rollings & Rollings 1998

WITH FS = 2.0

$c_{req} = 2(6) = 12 \text{ psf}$

FWENC 581D 10/96

```
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          TABLE NO. 1
          ******************************************
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          * Originally Coded By Stephen G. Wright  *
          * Version No. 1.205                      *
          * Last Revision Date  1/ 4/95            *
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          * All Rights Reserved                    *
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          **************************************************************
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          * HAVE BEEN VERIFIED BY INDEPENDENT ANALYSES, EXPERIMENTAL   *
          * DATA OR FIELD EXPERIENCE. THE USER SHOULD UNDERSTAND THE   *
          * ALGORITHMS AND ANALYTICAL PROCEDURES USED IN THE COMPUTER  *
          * PROGRAM AND MUST HAVE READ ALL DOCUMENTATION FOR THIS      *
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          KPC EXISTING SLOPE
          25% 15 FT THICK with 6 in. CAP
          C=6, 12, 20, 30 psf

          TABLE NO.  2
          *************************
          * NEW PROFILE LINE DATA *
          *************************

          PROFILE LINE  1 - MATERIAL TYPE =  1
          SAND COVER

               Point      X             Y

                 1          .000        75.500
                 2       200.000       125.500

          PROFILE LINE  2 - MATERIAL TYPE =  2
          ORGANIC MATERIAL

               Point      X             Y

                 1          .000        75.000
```

```
     2       200.000       125.000

PROFILE LINE  3 - MATERIAL TYPE =  3
NATIVE CLAY

     Point      X             Y

       1          .000        60.000
       2       200.000       110.000

All new profile lines defined - No old lines retained
```
```
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    KPC EXISTING SLOPE
    25% 15 FT THICK with 6 in. CAP
    C=6, 12, 20, 30 psf
```
```
TABLE NO.  3
**********************************************************************
* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
**********************************************************************

DATA FOR MATERIAL TYPE  1
SAND COVER

     Unit weight of material =   56.000

     CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
     Cohesion - - - - - - - - -         .000
     Friction angle - - - - -   32.000 degrees

     No (or zero) pore water pressures

DATA FOR MATERIAL TYPE  2
ORGANIC MATERIAL

     Unit weight of material =    6.000

     CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
     Cohesion - - - - - - - - -       6.000
     Friction angle - - - - -     .000 degrees

     No (or zero) pore water pressures

DATA FOR MATERIAL TYPE  3
NATIVE CLAY

     Unit weight of material =   46.000

     CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
     Cohesion - - - - - - - - -     100.000
     Friction angle - - - - -     .000 degrees

     No (or zero) pore water pressures

All new material properties defined - No old data retained
```

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 15
****
* NEW ANALYSIS/COMPUTATION DATA *
****

Noncircular Shear Surface(s)

Automatic Search Performed

Coordinates of points on shear surface which are to be shifted -

Point	X	Y	Shift Angle
1	40.000	85.500	- fixed
2	60.000	77.500	angle to be computed - moveable
3	150.000	100.000	angle to be computed - moveable
4	170.000	118.000	angle to be computed - moveable

Initial distance for shifting points on shear surface = 2.000
Maximum steepness permitted for toe of shear surface = 50.00 degrees

---

THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for the factor of safety = 3.000

Initial trial estimate for side force inclination = 15.000 degrees
(Applicable to Spencer's procedure only)

Maximum number of iterations allowed for
calculating the factor of safety = 40

Allowed force imbalance for convergence = 100.000

Allowed moment imbalance for convergence = 100.000

Initial trial values for factor of safety (and side force inclination
for Spencer's procedure) will be kept constant during search

Number of increments for slice subdivision = 30

Depth of water in crack = .000

Unit weight of water in crack = 62.400

Seismic coefficient = .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 16
****
* NEW SLOPE GEOMETRY DATA *
****

NOTE - NO DATA WERE INPUT, SLOPE GEOMETRY DATA
WERE GENERATED BY THE PROGRAM

Slope Coordinates -

Point	X	Y
1	.000	75.500
2	200.000	125.500

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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 22
****
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE   *
****

Crack depth computed to be - - - .00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - .398
Side Force Inclination - - - - - - - - - 9.43
Number of Iterations - - - - - - - - - - 10
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1

TABLE NO. 23
****
* SEARCH TRIAL NUMBER   1 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.85	75.51	.320	11.13	9

```
   2         60.15      79.49    .369     10.42          10
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR   1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
   3        149.00     101.73    .407      9.75          10
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR   1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
   3        151.00      98.27    .391      9.08          14
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR   1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
   4        168.06     117.51    .398      9.41          10
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR   1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
   4        171.94     118.49    .398      9.44          11
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR   1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1

Maximum distance shifted for new estimate of shear
surface is     2.000 at point   4

Coordinates For New Estimate of Shear Surface

     Point       X           Y

       1       40.00       85.50
       2       59.85       75.51
       3      151.00       98.27
       4      171.94      118.49

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -    .309
Side Force Inclination - - - - - - - - - -    10.90
Number of Iterations - - - - - - - - - - -   9
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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
***************************
* SEARCH TRIAL NUMBER    2 *
***************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =    2.00

                                1-Stage
                                Factor
                                  of     Side Force
Point         X          Y      Safety   Inclination   Iterations

   2        59.60      73.52    2.273      14.32           5
```

2	60.10	77.49	.310	11.31	12
3	149.96	99.98	.319	11.13	9
3	152.04	96.56	2.231	14.56	5
4	170.00	118.00	.311	10.85	9
4	173.88	118.97	.308	10.93	9

Maximum distance shifted for new estimate of shear
surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.98	76.50
3	150.48	99.11
4	173.88	118.97

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - .313
Side Force Inclination - - - - - - - - - 11.22
Number of Iterations - - - - - - - - - - 13
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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 3 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 1.40

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.67	74.12	2.073	14.33	5
2	60.03	76.89	.405	8.82	9

The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1

3	150.27	99.46	.316	11.07	9
3	151.72	97.07	2.064	14.71	5
4	170.58	118.15	.310	10.87	9
4	173.30	118.82	.308	10.92	9

Maximum distance shifted for new estimate of shear
surface is 1.400 at point 4

Coordinates For New Estimate of Shear Surface

Point X Y

1	40.00	85.50
2	59.93	76.13
3	150.64	98.86
4	173.30	118.82

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - .312
Side Force Inclination - - - - - - - - - 11.11
Number of Iterations - - - - - - - - - - 9

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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 4 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .80

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.75	74.71	1.254	14.03	6
2	59.95	76.30	.310	11.04	10
3	150.58	98.95	.313	11.00	9
3	151.41	97.58	1.334	14.27	6
4	171.16	118.29	.310	10.88	9
4	172.72	118.68	.309	10.91	9

Maximum distance shifted for new estimate of shear
surface is .800 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.90	75.90
3	150.79	98.61
4	172.72	118.68

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - .311
Side Force Inclination - - - - - - - - - 11.02
Number of Iterations - - - - - - - - - - 9

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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP

C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.83	75.31	.309	10.87	9
2	59.88	75.70	.309	10.93	9
3	150.89	98.44	.310	10.92	9
3	151.10	98.10	.308	10.87	9
4	171.75	118.44	.309	10.89	9
4	172.13	118.53	.309	10.90	9

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.83	75.31
3	151.10	98.10
4	172.13	118.53

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - .308
Side Force Inclination - - - - - - - - - 10.84
Number of Iterations - - - - - - - - - - 9

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

1-Stage
Factor
of Side Force

Point	X	Y	Safety	Inclination	Iterations
2	59.80	75.11	.308	10.82	9
2	59.85	75.51	.308	10.87	9
3	151.00	98.27	.309	10.87	9
3	151.21	97.92	.307	10.82	9
4	171.94	118.49	.308	10.84	9
4	172.33	118.58	.308	10.85	9

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.80	75.11
3	151.21	97.92
4	172.33	118.58

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - .307
Side Force Inclination - - - - - - - - - - 10.80
Number of Iterations - - - - - - - - - - - 9

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 7 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.77	74.91	.951	13.66	7
2	59.83	75.31	.307	10.82	9
3	151.10	98.10	.308	10.82	9
3	151.31	97.75	1.272	13.69	7
4	172.13	118.53	.307	10.79	9
4	172.52	118.63	.307	10.80	9

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.81	75.21
3	151.15	98.01
4	172.52	118.63

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - .307
Side Force Inclination - - - - - - - - - 10.83
Number of Iterations - - - - - - - - - - 9
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 25
****
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER 7 TRIAL POSITIONS) *
****

X	Y
40.00	85.50
59.80	75.11
151.21	97.92
172.33	118.58

1-Stage Factor of Safety = .307

Side Force Inclination = 10.80
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 26
****
* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the Critical Shear Surface in the *
* Case of an Automatic Search.) *
****

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure

	40.0	85.5					
1	40.3	85.3	9.0	1	.00	32.00	.0
	40.6	85.2					
2	42.6	84.2	141.4	2	6.00	.00	.0
	44.5	83.2					
3	46.4	82.1	209.6	2	6.00	.00	.0
	48.3	81.1					
4	50.2	80.1	277.8	2	6.00	.00	.0
	52.1	79.1					
5	54.1	78.1	346.0	2	6.00	.00	.0
	56.0	77.1					
6	57.9	76.1	414.3	2	6.00	.00	.0
	59.8	75.1					
7	61.9	75.6	486.3	2	6.00	.00	.0
	64.0	76.1					
8	66.0	76.7	486.4	2	6.00	.00	.0
	68.1	77.2					
9	70.2	77.7	486.4	2	6.00	.00	.0
	72.3	78.2					
10	74.3	78.7	486.4	2	6.00	.00	.0
	76.4	79.3					
11	78.5	79.8	486.5	2	6.00	.00	.0
	80.6	80.3					
12	82.7	80.8	486.5	2	6.00	.00	.0
	84.7	81.3					
13	86.8	81.8	486.6	2	6.00	.00	.0
	88.9	82.4					
14	91.0	82.9	486.6	2	6.00	.00	.0
	93.0	83.4					
15	95.1	83.9	486.6	2	6.00	.00	.0
	97.2	84.4					
16	99.3	85.0	486.7	2	6.00	.00	.0
	101.3	85.5					
17	103.4	86.0	486.7	2	6.00	.00	.0
	105.5	86.5					
18	107.6	87.0	486.8	2	6.00	.00	.0
	109.7	87.6					
19	111.7	88.1	486.8	2	6.00	.00	.0
	113.8	88.6					
20	115.9	89.1	486.8	2	6.00	.00	.0
	118.0	89.6					

```
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       25% 15 FT THICK with 6 in. CAP
       C=6, 12, 20, 30 psf

       TABLE NO. 26
       ************************************************************
       *  Coordinate, Weight, Strength and Pore Water Pressure     *
       *  Information for Individual Slices for Conventional       *
       *  Computations or First Stage of Multi-Stage Computations. *
       *  (Information is for the Critical Shear Surface in the    *
       *  Case of an Automatic Search.)                            *
       ************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	118.0	89.6					
21	120.0	90.1	486.9	2	6.00	.00	.0
	122.1	90.7					
22	124.2	91.2	486.9	2	6.00	.00	.0
	126.3	91.7					
23	128.4	92.2	487.0	2	6.00	.00	.0
	130.4	92.7					
24	132.5	93.3	487.0	2	6.00	.00	.0
	134.6	93.8					
25	136.7	94.3	487.1	2	6.00	.00	.0
	138.7	94.8					
26	140.8	95.3	487.1	2	6.00	.00	.0
	142.9	95.9					
27	145.0	96.4	487.1	2	6.00	.00	.0
	147.1	96.9					
28	149.1	97.4	487.2	2	6.00	.00	.0
	151.2	97.9					
29	152.7	99.4	323.7	2	6.00	.00	.0
	154.1	100.8					
30	155.6	102.2	286.5	2	6.00	.00	.0
	157.0	103.6					
31	158.5	105.1	249.3	2	6.00	.00	.0
	160.0	106.5					
32	161.4	107.9	212.0	2	6.00	.00	.0
	162.9	109.3					
33	164.3	110.8	174.8	2	6.00	.00	.0
	165.8	112.2					
34	167.3	113.6	137.6	2	6.00	.00	.0
	168.7	115.1					
35	170.2	116.5	100.4	2	6.00	.00	.0
	171.6	117.9					
36	172.0	118.2	9.6	1	.00	32.00	.0
	172.3	118.6					

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 27

```
*************************************************************
*  Seismic Forces and Forces Due to Surface Pressures for   *
*  Individual Slices for Conventional  Computations or the  *
*  First Stage of Multi-Stage Computations.                 *
*  (Information is for the Critical Shear Surface in the    *
*  Case of an Automatic Search.)                            *
*************************************************************
```

				FORCES DUE TO SURFACE PRESSURES			
Slice No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y

1	40.3	0.	85.5	0.	0.	.0	.0
2	42.6	0.	85.7	0.	0.	.0	.0
3	46.4	0.	85.6	0.	0.	.0	.0
4	50.2	0.	85.4	0.	0.	.0	.0
5	54.1	0.	85.0	0.	0.	.0	.0
6	57.9	0.	84.6	0.	0.	.0	.0
7	61.9	0.	84.9	0.	0.	.0	.0
8	66.0	0.	85.9	0.	0.	.0	.0
9	70.2	0.	87.0	0.	0.	.0	.0
10	74.3	0.	88.0	0.	0.	.0	.0
11	78.5	0.	89.0	0.	0.	.0	.0
12	82.7	0.	90.1	0.	0.	.0	.0
13	86.8	0.	91.1	0.	0.	.0	.0
14	91.0	0.	92.1	0.	0.	.0	.0
15	95.1	0.	93.2	0.	0.	.0	.0
16	99.3	0.	94.2	0.	0.	.0	.0
17	103.4	0.	95.3	0.	0.	.0	.0
18	107.6	0.	96.3	0.	0.	.0	.0
19	111.7	0.	97.3	0.	0.	.0	.0
20	115.9	0.	98.4	0.	0.	.0	.0
21	120.0	0.	99.4	0.	0.	.0	.0
22	124.2	0.	100.5	0.	0.	.0	.0
23	128.4	0.	101.5	0.	0.	.0	.0
24	132.5	0.	102.5	0.	0.	.0	.0
25	136.7	0.	103.6	0.	0.	.0	.0
26	140.8	0.	104.6	0.	0.	.0	.0
27	145.0	0.	105.6	0.	0.	.0	.0
28	149.1	0.	106.7	0.	0.	.0	.0
29	152.7	0.	108.1	0.	0.	.0	.0
30	155.6	0.	109.8	0.	0.	.0	.0
31	158.5	0.	111.5	0.	0.	.0	.0
32	161.4	0.	113.2	0.	0.	.0	.0
33	164.3	0.	114.8	0.	0.	.0	.0
34	167.3	0.	116.3	0.	0.	.0	.0
35	170.2	0.	117.7	0.	0.	.0	.0
36	172.0	0.	118.4	0.	0.	.0	.0

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 29

```
*********************************************************************
*  Information Generated During Iterative Solution for the Factor  *
*  of Safety and Side Force Inclination by Spencer's Procedure     *
*********************************************************************
```

Iter-ation	Trial Factor of Safety	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
1	3.00000	15.0000	.2589E+04	-.1445E+06		

First-order corrections to F and THETA .... -.246E+02 -.119E+01

```
Values factored by  .204E-01 - Deltas too large   -.500E+00 -.243E-01

   2   2.50000    14.9757   .2525E+04  -.1409E+06
First-order corrections to F and THETA .........  -.166E+02 -.121E+01
Values factored by  .301E-01 - Deltas too large   -.500E+00 -.365E-01

   3   2.00000    14.9392   .2430E+04  -.1355E+06
First-order corrections to F and THETA .........  -.102E+02 -.125E+01
Values factored by  .489E-01 - Deltas too large   -.500E+00 -.611E-01

   4   1.50000    14.8780   .2271E+04  -.1264E+06
First-order corrections to F and THETA .........  -.535E+01 -.132E+01
Values factored by  .935E-01 - Deltas too large   -.500E+00 -.123E+00

   5   1.00000    14.7546   .1947E+04  -.1078E+06
First-order corrections to F and THETA .........  -.200E+01 -.154E+01
Values factored by  .251E+00 - Deltas too large   -.500E+00 -.385E+00

   6    .50000    14.3694   .1194E+04  -.6689E+05
First-order corrections to F and THETA .........  -.220E+00 -.240E+01
Second-order correction - Iteration   1 ........  -.119E-01 -.240E+01
Second-order correction - Iteration   2 ........  -.161E+00 -.240E+01
SECOND-ORDER CORRECTIONS DIVERGED
FIRST-ORDER CORRECTIONS USED

   7    .27972    11.9724  -.3361E+03   .2433E+05
First-order corrections to F and THETA .........   .231E-01 -.192E+01
Second-order correction - Iteration   1 ........   .252E-01 -.192E+01
Second-order correction - Iteration   2 ........   .252E-01 -.192E+01

   8    .30496    10.0530   .3174E+01  -.1576E+04
First-order corrections to F and THETA .........   .183E-02  .743E+00
Second-order correction - Iteration   1 ........   .184E-02  .743E+00
Second-order correction - Iteration   2 ........   .184E-02  .743E+00

   9    .30679    10.7962  -.7465E-02   .3638E+01
First-order corrections to F and THETA .........  -.422E-05 -.170E-02

Factor of Safety - - - - - - - -       .307
Side Force Inclination - - - - -     10.80
Number of Iterations - - - - - -     9
```

1

```
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 38
***************************************************************
*  Final Results for Stresses Along the Shear Surface         *
*  (Results for Critical Shear Surface in Case of a Search.)  *
***************************************************************

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety =   .307     Side Force Inclination =  10.80 Degrees
```

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	40.3	85.3	-25.1	-25.1	-51.2
2	42.6	84.2	56.6	56.6	19.6
3	46.4	82.1	76.3	76.3	19.6
4	50.2	80.1	96.1	96.1	19.6
5	54.1	78.1	115.9	115.9	19.6
6	57.9	76.1	135.7	135.7	19.6
7	61.9	75.6	110.6	110.6	19.6
8	66.0	76.7	110.6	110.6	19.6
9	70.2	77.7	110.7	110.7	19.6
10	74.3	78.7	110.7	110.7	19.6
11	78.5	79.8	110.7	110.7	19.6
12	82.7	80.8	110.7	110.7	19.6
13	86.8	81.8	110.7	110.7	19.6
14	91.0	82.9	110.7	110.7	19.6
15	95.1	83.9	110.7	110.7	19.6
16	99.3	85.0	110.7	110.7	19.6
17	103.4	86.0	110.7	110.7	19.6
18	107.6	87.0	110.7	110.7	19.6
19	111.7	88.1	110.7	110.7	19.6
20	115.9	89.1	110.8	110.8	19.6
21	120.0	90.1	110.8	110.8	19.6
22	124.2	91.2	110.8	110.8	19.6
23	128.4	92.2	110.8	110.8	19.6
24	132.5	93.3	110.8	110.8	19.6
25	136.7	94.3	110.8	110.8	19.6
26	140.8	95.3	110.8	110.8	19.6
27	145.0	96.4	110.8	110.8	19.6
28	149.1	97.4	110.8	110.8	19.6
29	152.7	99.4	80.5	80.5	19.6
30	155.6	102.2	69.7	69.7	19.6
31	158.5	105.1	59.0	59.0	19.6
32	161.4	107.9	48.2	48.2	19.6
33	164.3	110.8	37.5	37.5	19.6
34	167.3	113.6	26.7	26.7	19.6
35	170.2	116.5	16.0	16.0	19.6
36	172.0	118.2	5.0	5.0	10.2

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION    =         .00  (=  .272E-03)
     SHOULD NOT EXCEED       .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION  =         .00  (=  .694E-03)
     SHOULD NOT EXCEED       .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =       -3.63  (= -.363E+01)
     SHOULD NOT EXCEED       .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM   =         .00  (=  .156E-03)
     SHOULD NOT EXCEED       .100E+03

///// WARNING ///// EFFECTIVE OR TOTAL NORMAL STRESS ON SHEAR
                    SURFACE IS NEGATIVE AT POINTS ALONG THE
                    LOWER ONE-HALF OF THE SHEAR SURFACE -
```

```
                              SOLUTION MAY NOT BE A VALID SOLUTION.
      ///// WARNING ///// EFFECTIVE OR TOTAL NORMAL STRESS ON SHEAR
                              SURFACE IS NEGATIVE AT POINTS ALONG THE
                              LOWER ONE-HALF OF THE SHEAR SURFACE -
                              SOLUTION MAY NOT BE A VALID SOLUTION.

      ///// WARNING ///// SHEAR STRESS AT SOME POINTS ALONG THE SHEAR
                              SURFACE IS NEGATIVE - SOLUTION MAY NOT BE A
                              VALID SOLUTION.
      ///// WARNING ///// SHEAR STRESS AT SOME POINTS ALONG THE SHEAR
                              SURFACE IS NEGATIVE - SOLUTION MAY NOT BE A
                              VALID SOLUTION.
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      KPC EXISTING SLOPE
      25% 15 FT THICK with 6 in. CAP
      C=6, 12, 20, 30 psf

      TABLE NO. 39
      ***************************************************************
      *  Final Results for Side Forces and Stresses Between Slices.  *
      *  (Results for Critical Shear Surface in Case of a Search.)   *
      ***************************************************************

      SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
      Factor of Safety =    .307     Side Force Inclination =  10.80 Degrees

              -------------- VALUES AT RIGHT SIDE OF SLICE ---------------
```

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	40.6	-42.	85.4	.462	-64.0	-102.1
2	44.5	150.	84.1	.265	-17.4	102.3
3	48.3	382.	83.4	.352	6.6	110.1
4	52.1	655.	82.6	.371	15.6	121.3
5	56.0	969.	81.8	.377	20.0	133.9
6	59.8	1323.	80.9	.377	22.3	147.1
7	64.0	1289.	81.8	.371	18.6	146.4
8	68.1	1255.	82.8	.365	15.2	145.5
9	72.3	1221.	83.7	.359	12.0	144.3
10	76.4	1187.	84.7	.353	8.9	143.0
11	80.6	1152.	85.6	.347	6.1	141.4
12	84.7	1118.	86.6	.342	3.5	139.6
13	88.9	1084.	87.5	.336	1.1	137.6
14	93.0	1050.	88.5	.331	-1.0	135.4
15	97.2	1016.	89.4	.326	-3.0	133.0
16	101.3	982.	90.4	.321	-4.8	130.3
17	105.5	947.	91.4	.316	-6.3	127.5
18	109.7	913.	92.3	.312	-7.6	124.4
19	113.8	879.	93.3	.307	-8.7	121.2
20	118.0	845.	94.3	.304	-9.6	117.7
21	122.1	811.	95.3	.300	-10.3	114.0
22	126.3	776.	96.3	.297	-10.8	110.1
23	130.4	742.	97.3	.294	-11.1	106.0

24	134.6	708.	98.3	.292	-11.1	101.6
25	138.7	674.	99.3	.291	-11.0	97.1
26	142.9	639.	100.3	.290	-10.6	92.3
27	147.1	605.	101.3	.290	-10.1	87.4
28	151.2	571.	102.4	.291	-9.3	82.2
29	154.1	395.	104.4	.276	-10.1	68.7
30	157.0	251.	106.4	.252	-10.8	55.0
31	160.0	137.	108.4	.208	-11.3	41.2
32	162.9	55.	110.0	.094	-11.3	27.0
33	165.8	4.	104.6	BELOW	-10.3	12.0
34	168.7	-15.	116.3	.492	-5.5	-6.0
35	171.6	-4.	117.4	BELOW	63.5	-78.1
36	172.3	0.	533.4	ABOVE	.0	.0

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION     =          .00  (=  .272E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION   =          .00  (=  .694E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =        -3.63  (= -.363E+01)
     SHOULD NOT EXCEED      .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM    =          .00  (=  .156E-03)
     SHOULD NOT EXCEED      .100E+03

***** CAUTION ***** FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                    ALONG THE UPPER ONE-HALF OF THE SHEAR SURFACE -
                    A TENSION CRACK MAY BE NEEDED.

///// WARNING ///// FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                    ALONG THE LOWER ONE-HALF OF THE SHEAR SURFACE -
                    SOLUTION MAY NOT BE A VALID SOLUTION.
///// WARNING ///// FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                    ALONG THE LOWER ONE-HALF OF THE SHEAR SURFACE -
                    SOLUTION MAY NOT BE A VALID SOLUTION.

***** CAUTION ***** SOME OF THE FORCES BETWEEN SLICES ACT AT POINTS
                    ABOVE THE SURFACE OF THE SLOPE OR BELOW THE
                    SHEAR SURFACE - EITHER A TENSION CRACK MAY BE
                    NEEDED OR THE SOLUTION MAY NOT BE A VALID
SOLUTION.
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          25% 15 FT THICK with 6 in. CAP
          C=6, 12, 20, 30 psf

          TABLE NO.  3
          *********************************************************************
          * NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
          *********************************************************************

          DATA FOR MATERIAL TYPE  2
          ORGANIC MATERIAL

               Unit weight of material =    6.000
```

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - - 12.000
Friction angle - - - - - .000 degrees

No (or zero) pore water pressures

Data input for 1 new materials - Data retained
for 2 old materials (SEE PREVIOUS DATA)
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TABLE NO. 22
****
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE *
****

Crack depth computed to be - - - .00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - .672
Side Force Inclination - - - - - - - - - - 10.93
Number of Iterations - - - - - - - - - - - 8

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 1 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.85	75.51	.662	10.68	8
2	60.15	79.49	.690	11.16	8
3	149.00	101.73	.699	11.13	8
3	151.00	98.27	.651	10.66	12
4	168.06	117.51	.675	10.89	8
4	171.94	118.49	.669	10.95	8

Maximum distance shifted for new estimate of shear
surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.85	75.51

3	151.00	98.27
4	171.94	118.49

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - .536
Side Force Inclination - - - - - - - - - 14.77
Number of Iterations - - - - - - - - - - 9
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1
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C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.60	73.52	2.417	13.90	4
2	60.10	77.49	.647	10.70	13
3	149.96	99.98	.660	10.70	8
3	152.04	96.56	2.366	13.88	4
4	170.00	118.00	.538	14.86	9

The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1

4	173.88	118.97	.535	14.71	9

The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1

Maximum distance shifted for new estimate of shear
surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.96	76.39
3	150.54	99.01
4	173.88	118.97

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - .532
Side Force Inclination - - - - - - - - - 16.65
Number of Iterations - - - - - - - - - - 14

DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 3 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.76	74.40	1.454	13.80	6
2	60.17	78.38	.659	10.94	10
3	149.58	100.76	.673	10.90	8
3	151.51	97.26	1.487	13.64	6
4	171.94	118.49	.649	10.69	22
4	175.82	119.46	.645	10.73	17

Maximum distance shifted for new estimate of shear
surface is .757 at point 2

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	60.04	77.14
3	150.18	99.66
4	173.90	118.97

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - .660
Side Force Inclination - - - - - - - - - - 10.88
Number of Iterations - - - - - - - - - - - 8
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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 4 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 1.40

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.82	75.00	.548	14.24	9

The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1

2	60.11	77.78	.655	10.88	10
3	149.87	100.24	.664	10.85	8
3	151.22	97.79	.667	10.66	8
4	172.52	118.63	.533	16.70	12

The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW - 1 1

4	175.24	119.31	.645	10.73	17

Maximum distance shifted for new estimate of shear surface is .689 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.91	75.85
3	150.54	99.02
4	173.21	118.80

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - .646
Side Force Inclination - - - - - - - - - - 10.65
Number of Iterations - - - - - - - - - - - 17

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .80

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.88	75.59	.540	15.18	9

The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR 1 SLICES

```
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -      1      1
   2          60.04        77.18      .651        10.81            12
   3         150.16        99.71      .657        10.80            14
   3         150.93        98.31      .638        10.63            10
   4         173.10       118.78      .532        16.68            12
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -      1      1
   4         174.66       119.16      .646        10.73            19

Maximum distance shifted for new estimate of shear
surface is      .396 at point    4

Coordinates For New Estimate of Shear Surface

     Point         X           Y

        1        40.00       85.50
        2        59.93       76.04
        3       150.56       98.99
        4       173.50      118.87

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -     .535
Side Force Inclination - - - - - - - - -    15.98
Number of Iterations - - - - - - - - - -  15
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -      1      1
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    6 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =      .20

                               1-Stage
                               Factor
                                 of     Side Force
Point         X          Y     Safety   Inclination   Iterations

   2          59.94      76.19    .534      16.27            10
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -      1      1
   2          59.98      76.59    .648      10.74            10
   3         150.45      99.19    .534      16.75            11
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -      1      1
   3         150.64      98.84    .645      10.71            11
```

```
   4        173.69      118.92     .532       16.66            14
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
   4        174.07      119.02     .532       16.65            16
The following applies to the above point -
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1

Computed shift distances for newly estimated shear surface
factored by  1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is      .200 at point   4

Coordinates For New Estimate of Shear Surface

     Point        X            Y

         1       40.00        85.50
         2       59.95        76.29
         3      150.50        99.10
         4      174.07       119.02

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -    .533
Side Force Inclination - - - - - - - - - -   16.50
Number of Iterations - - - - - - - - - - -  10
DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR    1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
```
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TABLE NO. 25
*******************************************************************
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER   6 TRIAL POSITIONS) *
*******************************************************************

      X          Y

    40.00      85.50
    59.96      76.39
   150.54      99.01
   173.88     118.97

1-Stage Factor of Safety =     .532

Side Force Inclination =  16.65
```
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KPC EXISTING SLOPE
```

25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 26

```
**************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure      *
*  Information for Individual Slices for Conventional        *
*  Computations or First Stage of Multi-Stage Computations.  *
*  (Information is for the Critical Shear Surface in the     *
*  Case of an Automatic Search.)                             *
**************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	40.0	85.5					
1	40.4	85.3	9.9	1	.00	32.00	.0
	40.7	85.2					
2	42.6	84.3	139.3	2	12.00	.00	.0
	44.6	83.4					
3	46.5	82.5	202.1	2	12.00	.00	.0
	48.4	81.7					
4	50.3	80.8	265.0	2	12.00	.00	.0
	52.3	79.9					
5	54.2	79.0	327.8	2	12.00	.00	.0
	56.1	78.1					
6	58.0	77.3	390.7	2	12.00	.00	.0
	60.0	76.4					
7	62.1	76.9	472.8	2	12.00	.00	.0
	64.3	77.5					
8	66.4	78.0	472.9	2	12.00	.00	.0
	68.6	78.5					
9	70.7	79.1	472.9	2	12.00	.00	.0
	72.9	79.6					
10	75.1	80.2	472.9	2	12.00	.00	.0
	77.2	80.7					
11	79.4	81.2	472.9	2	12.00	.00	.0
	81.5	81.8					
12	83.7	82.3	473.0	2	12.00	.00	.0
	85.8	82.9					
13	88.0	83.4	473.0	2	12.00	.00	.0
	90.2	83.9					
14	92.3	84.5	473.0	2	12.00	.00	.0
	94.5	85.0					
15	96.6	85.5	473.0	2	12.00	.00	.0
	98.8	86.1					
16	100.9	86.6	473.1	2	12.00	.00	.0
	103.1	87.2					
17	105.3	87.7	473.1	2	12.00	.00	.0
	107.4	88.2					
18	109.6	88.8	473.1	2	12.00	.00	.0
	111.7	89.3					
19	113.9	89.9	473.1	2	12.00	.00	.0
	116.0	90.4					
20	118.2	90.9	473.2	2	12.00	.00	.0
	120.3	91.5					

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 26

```
***************************************************************
* Coordinate, Weight, Strength and Pore Water Pressure        *
* Information for Individual Slices for Conventional          *
* Computations or First Stage of Multi-Stage Computations.    *
* (Information is for the Critical Shear Surface in the       *
* Case of an Automatic Search.)                               *
***************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	120.3	91.5					
21	122.5	92.0	473.2	2	12.00	.00	.0
	124.7	92.5					
22	126.8	93.1	473.2	2	12.00	.00	.0
	129.0	93.6					
23	131.1	94.2	473.2	2	12.00	.00	.0
	133.3	94.7					
24	135.4	95.2	473.3	2	12.00	.00	.0
	137.6	95.8					
25	139.8	96.3	473.3	2	12.00	.00	.0
	141.9	96.9					
26	144.1	97.4	473.3	2	12.00	.00	.0
	146.2	97.9					
27	148.4	98.5	473.3	2	12.00	.00	.0
	150.5	99.0					
28	152.2	100.4	334.1	2	12.00	.00	.0
	153.8	101.8					
29	155.4	103.1	296.6	2	12.00	.00	.0
	157.0	104.5					
30	158.6	105.9	259.0	2	12.00	.00	.0
	160.2	107.3					
31	161.8	108.6	221.5	2	12.00	.00	.0
	163.4	110.0					
32	165.0	111.4	183.9	2	12.00	.00	.0
	166.6	112.8					
33	168.2	114.1	146.4	2	12.00	.00	.0
	169.8	115.5					
34	171.4	116.9	108.8	2	12.00	.00	.0
	173.1	118.3					
35	173.5	118.6	11.6	1	.00	32.00	.0
	173.9	119.0					

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C=6, 12, 20, 30 psf

TABLE NO. 27

```
*************************************************************
*  Seismic Forces and Forces Due to Surface Pressures for   *
*  Individual Slices for Conventional  Computations or the  *
*  First Stage of Multi-Stage Computations.                 *
*  (Information is for the Critical Shear Surface in the    *
*  Case of an Automatic Search.)                            *
*************************************************************
```

				FORCES DUE TO SURFACE PRESSURES			
Slice No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y
1	40.4	0.	85.5	0.	0.	.0	.0
2	42.6	0.	85.7	0.	0.	.0	.0
3	46.5	0.	85.8	0.	0.	.0	.0
4	50.3	0.	85.7	0.	0.	.0	.0
5	54.2	0.	85.4	0.	0.	.0	.0
6	58.0	0.	85.1	0.	0.	.0	.0
7	62.1	0.	85.5	0.	0.	.0	.0
8	66.4	0.	86.6	0.	0.	.0	.0
9	70.7	0.	87.7	0.	0.	.0	.0
10	75.1	0.	88.8	0.	0.	.0	.0
11	79.4	0.	89.8	0.	0.	.0	.0
12	83.7	0.	90.9	0.	0.	.0	.0
13	88.0	0.	92.0	0.	0.	.0	.0
14	92.3	0.	93.1	0.	0.	.0	.0
15	96.6	0.	94.2	0.	0.	.0	.0
16	100.9	0.	95.2	0.	0.	.0	.0
17	105.3	0.	96.3	0.	0.	.0	.0
18	109.6	0.	97.4	0.	0.	.0	.0
19	113.9	0.	98.5	0.	0.	.0	.0
20	118.2	0.	99.5	0.	0.	.0	.0
21	122.5	0.	100.6	0.	0.	.0	.0
22	126.8	0.	101.7	0.	0.	.0	.0
23	131.1	0.	102.8	0.	0.	.0	.0
24	135.4	0.	103.9	0.	0.	.0	.0
25	139.8	0.	104.9	0.	0.	.0	.0
26	144.1	0.	106.0	0.	0.	.0	.0
27	148.4	0.	107.1	0.	0.	.0	.0
28	152.2	0.	108.5	0.	0.	.0	.0
29	155.4	0.	110.2	0.	0.	.0	.0
30	158.6	0.	111.9	0.	0.	.0	.0
31	161.8	0.	113.5	0.	0.	.0	.0
32	165.0	0.	115.1	0.	0.	.0	.0
33	168.2	0.	116.6	0.	0.	.0	.0
34	171.4	0.	118.0	0.	0.	.0	.0
35	173.5	0.	118.7	0.	0.	.0	.0

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C=6, 12, 20, 30 psf

TABLE NO. 29

```
*******************************************************************
```

```
*  Information Generated During Iterative Solution for the Factor  *
*  of Safety and Side Force Inclination by Spencer's Procedure     *
*******************************************************************

          Trial      Trial
         Factor   Side Force    Force      Moment                Delta
  Iter-    of    Inclination  Imbalance  Imbalance    Delta-F    Theta
  ation  Safety   (degrees)     (lbs.)   (ft.-lbs.)            (degrees)

    1   3.00000    15.0000   .2193E+04  -.1248E+06
  First-order corrections to F and THETA .........  -.107E+02 -.107E+01
  Values factored by  .468E-01 - Deltas too large   -.500E+00 -.503E-01

    2   2.50000    14.9497   .2070E+04  -.1177E+06
  First-order corrections to F and THETA .........  -.700E+01 -.111E+01
  Values factored by  .714E-01 - Deltas too large   -.500E+00 -.793E-01

    3   2.00000    14.8704   .1884E+04  -.1070E+06
  First-order corrections to F and THETA .........  -.409E+01 -.117E+01
  Values factored by  .122E+00 - Deltas too large   -.500E+00 -.143E+00

    4   1.50000    14.7274   .1576E+04  -.8909E+05
  First-order corrections to F and THETA .........  -.193E+01 -.128E+01
  Values factored by  .260E+00 - Deltas too large   -.500E+00 -.333E+00

    5   1.00000    14.3941   .9563E+03  -.5270E+05
  First-order corrections to F and THETA .........  -.525E+00 -.162E+01
  Values factored by  .952E+00 - Deltas too large   -.500E+00 -.154E+01

    6    .50000    12.8523  -.1263E+04   .8902E+05
  First-order corrections to F and THETA .........   .186E+00  .101E+02
  Values factored by  .847E+00 - Deltas too large    .157E+00  .859E+01

    7    .65749    21.4467  -.1254E+04   .9679E+05
  First-order corrections to F and THETA .........  -.214E+00 -.102E+02
  Values factored by  .845E+00 - Deltas too large   -.181E+00 -.859E+01

    8    .47657    12.8523   .8858E+04  -.6639E+06
  First-order corrections to F and THETA .........   .973E-02  .615E+00
  Second-order correction - Iteration   1 ........   .106E-01  .615E+00
  Second-order correction - Iteration   2 ........   .980E-02  .615E+00
  Second-order correction - Iteration   3 ........   .108E-01  .615E+00
  Second-order correction - Iteration   4 ........   .101E-01  .615E+00
  Second-order correction - Iteration   5 ........   .136E-01  .615E+00
  Second-order correction - Iteration   6 ........   .118E-01  .615E+00
  Second-order correction - Iteration   7 ........   .108E-01  .615E+00
  Second-order correction - Iteration   8 ........   .101E-01  .615E+00
  Second-order correction - Iteration   9 ........   .154E-01  .615E+00
  Second-order correction - Iteration  10 ........   .127E-01  .615E+00
  SECOND-ORDER CORRECTIONS DID NOT CONVERGE
  IN  10 ITERATIONS - FIRST-ORDER CORRECTIONS
  USED

    9    .48630    13.4669   .4033E+04  -.3023E+06
  First-order corrections to F and THETA .........   .151E-01  .956E+00
  Second-order correction - Iteration   1 ........   .168E-01  .956E+00
  Second-order correction - Iteration   2 ........   .155E-01  .956E+00
```

```
Second-order correction - Iteration   3 ........   .183E-01  .956E+00
Second-order correction - Iteration   4 ........   .167E-01  .956E+00
Second-order correction - Iteration   5 ........   .152E-01  .956E+00
Second-order correction - Iteration   6 ........   .170E-01  .956E+00
Second-order correction - Iteration   7 ........   .157E-01  .956E+00
Second-order correction - Iteration   8 ........   .230E-01  .956E+00
Second-order correction - Iteration   9 ........   .193E-01  .956E+00
Second-order correction - Iteration  10 ........   .173E-01  .956E+00
SECOND-ORDER CORRECTIONS DID NOT CONVERGE
IN  10 ITERATIONS - FIRST-ORDER CORRECTIONS
USED

  10    .50143    14.4227   .1735E+04  -.1298E+06
First-order corrections to F and THETA .........   .169E-01  .109E+01
Second-order correction - Iteration   1 ........   .208E-01  .109E+01
Second-order correction - Iteration   2 ........   .183E-01  .109E+01
Second-order correction - Iteration   3 ........   .133E-01  .109E+01
Second-order correction - Iteration   4 ........   .162E-01  .109E+01
Second-order correction - Iteration   5 ........   .188E-01  .109E+01
Second-order correction - Iteration   6 ........   .155E-01  .109E+01
Second-order correction - Iteration   7 ........   .179E-01  .109E+01
Second-order correction - Iteration   8 ........   .463E-03  .109E+01
Second-order correction - Iteration   9 ........   .926E-02  .109E+01
Second-order correction - Iteration  10 ........   .138E-01  .109E+01
SECOND-ORDER CORRECTIONS DID NOT CONVERGE
IN  10 ITERATIONS - FIRST-ORDER CORRECTIONS
USED

  11    .51835    15.5157   .7036E+03  -.5216E+05
First-order corrections to F and THETA .........   .104E-01  .757E+00
Second-order correction - Iteration   1 ........   .101E+00  .757E+00
Second-order correction - Iteration   2 ........   .556E-01  .757E+00
Second-order correction - Iteration   3 ........   .329E-01  .757E+00
Second-order correction - Iteration   4 ........   .214E-01  .757E+00
Second-order correction - Iteration   5 ........   .154E-01  .757E+00
Second-order correction - Iteration   6 ........   .117E-01  .757E+00
Second-order correction - Iteration   7 ........   .614E-02  .757E+00
Second-order correction - Iteration   8 ........   .970E-02  .757E+00
Second-order correction - Iteration   9 ........   .181E-01  .757E+00
Second-order correction - Iteration  10 ........   .135E-01  .757E+00
SECOND-ORDER CORRECTIONS DID NOT CONVERGE
IN  10 ITERATIONS - FIRST-ORDER CORRECTIONS
USED

  12    .52874    16.2731   .2484E+03  -.1808E+05
First-order corrections to F and THETA .........   .288E-02  .310E+00
Second-order correction - Iteration   1 ........   .138E-02  .310E+00
Second-order correction - Iteration   2 ........   .537E-03  .310E+00
Second-order correction - Iteration   3 ........  -.196E-03  .310E+00
Second-order correction - Iteration   4 ........   .897E-03  .310E+00
Second-order correction - Iteration   5 ........   .191E-03  .310E+00
Second-order correction - Iteration   6 ........  -.156E-02  .310E+00
Second-order correction - Iteration   7 ........  -.608E-03  .310E+00
Second-order correction - Iteration   8 ........   .835E-04  .310E+00
Second-order correction - Iteration   9 ........  -.698E-02  .310E+00
Second-order correction - Iteration  10 ........  -.343E-02  .310E+00
SECOND-ORDER CORRECTIONS DID NOT CONVERGE
```

```
IN  10 ITERATIONS - FIRST-ORDER CORRECTIONS
USED

  13    .53162    16.5826   .5512E+02  -.3953E+04
First-order corrections to F and THETA .........   .325E-03  .711E-01
Second-order correction - Iteration   1 ........   .247E-03  .711E-01
Second-order correction - Iteration   2 ........   .247E-03  .711E-01

  14    .53187    16.6537  -.3527E+00   .1350E+02
First-order corrections to F and THETA .........   .894E-04  .487E-02

Factor of Safety - - - - - - - -      .532
Side Force Inclination - - - - -     16.65
Number of Iterations - - - - - -    14

DENOMINATOR IN EQUATIONS FOR F WAS SMALL FOR   1 SLICES
FIRST AND LAST SLICES WHERE DENOMINATOR WAS LOW -     1     1
```

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KPC EXISTING SLOPE

25% 15 FT THICK with 6 in. CAP

C=6, 12, 20, 30 psf

TABLE NO. 38

```
***************************************************************
*  Final Results for Stresses Along the Shear Surface           *
*  (Results for Critical Shear Surface in Case of a Search.)   *
***************************************************************
```

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY

Factor of Safety =   .532   Side Force Inclination = 16.65 Degrees

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	40.4	85.3	-576.6	-576.6	-677.5
2	42.6	84.3	61.6	61.6	22.6
3	46.5	82.5	80.5	80.5	22.6
4	50.3	80.8	99.4	99.4	22.6
5	54.2	79.0	118.3	118.3	22.6
6	58.0	77.3	137.2	137.2	22.6
7	62.1	76.9	103.0	103.0	22.6
8	66.4	78.0	103.0	103.0	22.6
9	70.7	79.1	103.0	103.0	22.6
10	75.1	80.2	103.1	103.1	22.6
11	79.4	81.2	103.1	103.1	22.6
12	83.7	82.3	103.1	103.1	22.6
13	88.0	83.4	103.1	103.1	22.6
14	92.3	84.5	103.1	103.1	22.6
15	96.6	85.5	103.1	103.1	22.6
16	100.9	86.6	103.1	103.1	22.6
17	105.3	87.7	103.1	103.1	22.6
18	109.6	88.8	103.1	103.1	22.6

19	113.9	89.9	103.1	103.1	22.6
20	118.2	90.9	103.1	103.1	22.6
21	122.5	92.0	103.1	103.1	22.6
22	126.8	93.1	103.1	103.1	22.6
23	131.1	94.2	103.1	103.1	22.6
24	135.4	95.2	103.1	103.1	22.6
25	139.8	96.3	103.1	103.1	22.6
26	144.1	97.4	103.1	103.1	22.6
27	148.4	98.5	103.1	103.1	22.6
28	152.2	100.4	72.7	72.7	22.6
29	155.4	103.1	63.4	63.4	22.6
30	158.6	105.9	54.1	54.1	22.6
31	161.8	108.6	44.9	44.9	22.6
32	165.0	111.4	35.6	35.6	22.6
33	168.2	114.1	26.3	26.3	22.6
34	171.4	116.9	17.0	17.0	22.6
35	173.5	118.6	7.3	7.3	8.6

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION     =          .00  (=  .235E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION   =          .00  (=  .360E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =       -13.41  (= -.134E+02)
     SHOULD NOT EXCEED      .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM    =          .00  (=  .126E-03)
     SHOULD NOT EXCEED      .100E+03

///// WARNING ///// EFFECTIVE OR TOTAL NORMAL STRESS ON SHEAR
                    SURFACE IS NEGATIVE AT POINTS ALONG THE
                    LOWER ONE-HALF OF THE SHEAR SURFACE -
                    SOLUTION MAY NOT BE A VALID SOLUTION.
///// WARNING ///// EFFECTIVE OR TOTAL NORMAL STRESS ON SHEAR
                    SURFACE IS NEGATIVE AT POINTS ALONG THE
                    LOWER ONE-HALF OF THE SHEAR SURFACE -
                    SOLUTION MAY NOT BE A VALID SOLUTION.

///// WARNING ///// SHEAR STRESS AT SOME POINTS ALONG THE SHEAR
                    SURFACE IS NEGATIVE - SOLUTION MAY NOT BE A
                    VALID SOLUTION.
///// WARNING ///// SHEAR STRESS AT SOME POINTS ALONG THE SHEAR
                    SURFACE IS NEGATIVE - SOLUTION MAY NOT BE A
                    VALID SOLUTION.
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           KPC EXISTING SLOPE
           25% 15 FT THICK with 6 in. CAP
           C=6, 12, 20, 30 psf

           TABLE NO. 39
           ****************************************************************
           *  Final Results for Side Forces and Stresses Between Slices.  *
           *  (Results for Critical Shear Surface in Case of a Search.)   *
           ****************************************************************
```

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = .532 Side Force Inclination = 16.65 Degrees

--------------- VALUES AT RIGHT SIDE OF SLICE ---------------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	40.7	-695.	85.4	.535	-1609.4	-1053.6
2	44.6	-491.	87.3	ABOVE	-767.1	474.9
3	48.4	-253.	93.5	ABOVE	-406.0	324.5
4	52.3	20.	-83.2	BELOW	-259.8	264.3
5	56.1	328.	69.5	BELOW	-180.6	235.8
6	60.0	671.	74.3	BELOW	-130.8	221.9
7	64.3	656.	75.6	BELOW	-124.7	213.9
8	68.6	642.	76.8	BELOW	-118.8	206.0
9	72.9	628.	78.1	BELOW	-112.9	198.2
10	77.2	614.	79.4	BELOW	-107.1	190.5
11	81.5	599.	80.6	BELOW	-101.5	182.8
12	85.8	585.	81.9	BELOW	-95.9	175.3
13	90.2	571.	83.1	BELOW	-90.4	167.8
14	94.5	556.	84.4	BELOW	-84.9	160.5
15	98.8	542.	85.7	BELOW	-79.6	153.2
16	103.1	528.	87.0	BELOW	-74.4	146.0
17	107.4	513.	88.3	.002	-69.2	138.9
18	111.7	499.	89.6	.018	-64.2	131.9
19	116.0	485.	90.9	.033	-59.2	125.0
20	120.3	470.	92.2	.050	-54.3	118.1
21	124.7	456.	93.5	.067	-49.5	111.4
22	129.0	441.	94.8	.084	-44.8	104.7
23	133.3	427.	96.1	.102	-40.2	98.1
24	137.6	413.	97.5	.121	-35.7	91.6
25	141.9	398.	98.8	.141	-31.2	85.2
26	146.2	384.	100.2	.161	-26.9	78.9
27	150.5	369.	101.6	.183	-22.6	72.7
28	153.8	236.	103.5	.144	-21.1	58.3
29	157.0	130.	105.2	.065	-19.6	43.9
30	160.2	50.	105.8	BELOW	-17.9	29.5
31	163.4	-3.	152.1	ABOVE	-15.9	15.1
32	166.6	-29.	115.8	.694	-13.7	1.0
33	169.8	-29.	116.8	.527	-13.1	-9.4
34	173.1	-2.	124.2	ABOVE	-219.9	213.5
35	173.9	0.	91.8	BELOW	.0	.0

CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION = .00 (= .235E-03)
SHOULD NOT EXCEED .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION = .00 (= .360E-03)
SHOULD NOT EXCEED .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN = -13.41 (= -.134E+02)
SHOULD NOT EXCEED .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM = .00 (= .126E-03)
SHOULD NOT EXCEED .100E+03

***** CAUTION ***** FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS

```
                                         ALONG THE UPPER ONE-HALF OF THE SHEAR SURFACE -
                                         A TENSION CRACK MAY BE NEEDED.

          ///// WARNING ///// FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                                         ALONG THE LOWER ONE-HALF OF THE SHEAR SURFACE -
                                         SOLUTION MAY NOT BE A VALID SOLUTION.
          ///// WARNING ///// FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                                         ALONG THE LOWER ONE-HALF OF THE SHEAR SURFACE -
                                         SOLUTION MAY NOT BE A VALID SOLUTION.

          ***** CAUTION ***** SOME OF THE FORCES BETWEEN SLICES ACT AT POINTS
                                         ABOVE THE SURFACE OF THE SLOPE OR BELOW THE
                                         SHEAR SURFACE - EITHER A TENSION CRACK MAY BE
                                         NEEDED OR THE SOLUTION MAY NOT BE A VALID
SOLUTION.
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          KPC EXISTING SLOPE
          25% 15 FT THICK with 6 in. CAP
          C=6, 12, 20, 30 psf

          TABLE NO.  3
          ********************************************************************
          * NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
          ********************************************************************

          DATA FOR MATERIAL TYPE  2
          ORGANIC MATERIAL

               Unit weight of material =    6.000

               CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
               Cohesion - - - - - - - -      20.000
               Friction angle - - - - -    .000 degrees

               No (or zero) pore water pressures

          Data input for  1 new materials - Data retained
          for  2 old materials (SEE PREVIOUS DATA)
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          KPC EXISTING SLOPE
          25% 15 FT THICK with 6 in. CAP
          C=6, 12, 20, 30 psf

          TABLE NO.  3
          ********************************************************************
          * NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
          ********************************************************************

          DATA FOR MATERIAL TYPE  2
          ORGANIC MATERIAL

               Unit weight of material =    6.000
```

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - -   30.000
Friction angle - - - - -   .000 degrees

No (or zero) pore water pressures

Data input for 1 new materials - Data retained for 2 old materials (SEE PREVIOUS DATA)

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 22
****
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE *
****

Crack depth computed to be - - -   .00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -   1.661
Side Force Inclination - - - - - - - - -   11.10
Number of Iterations - - - - - - - - - -   6

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 1 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.85	75.51	1.631	10.91	6
2	60.15	79.49	1.710	11.30	5
3	149.00	101.73	1.729	11.30	5
3	151.00	98.27	1.611	10.82	6
4	168.06	117.51	1.669	11.06	6
4	171.94	118.49	1.655	11.12	6

Maximum distance shifted for new estimate of shear surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.85	75.51
3	151.00	98.27

4 171.94 118.49

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 1.571
Side Force Inclination - - - - - - - - - - 10.70
Number of Iterations - - - - - - - - - - - 6

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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.60	73.52	2.846	12.76	3
2	60.10	77.49	1.599	10.87	6
3	149.96	99.98	1.625	10.93	6
3	152.04	96.56	2.777	12.42	3
4	170.00	118.00	1.581	10.64	6
4	173.88	118.97	1.563	10.74	6

Maximum distance shifted for new estimate of shear
surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.97	76.45
3	150.52	99.05
4	173.88	118.97

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 1.598
Side Force Inclination - - - - - - - - - - 10.92
Number of Iterations - - - - - - - - - - - 6

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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****

```
* SEARCH TRIAL NUMBER     3 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =     1.40

                                    1-Stage
                                    Factor
                                      of     Side Force
Point          X           Y        Safety   Inclination   Iterations

   2         59.67       74.12    2.785        12.87            3
   2         60.03       76.89    1.589        10.82            6
   3        150.27       99.46    1.607        10.86            6
   3        151.72       97.07    2.739        12.33            3
   4        170.58      118.15    1.578        10.66            6
   4        173.30      118.82    1.565        10.73            6

Maximum distance shifted for new estimate of shear
surface is      1.400 at point    4

Coordinates For New Estimate of Shear Surface

     Point        X            Y

        1       40.00        85.50
        2       59.94        76.18
        3      150.66        98.83
        4      173.30       118.82

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -    1.590
Side Force Inclination - - - - - - - - -     10.86
Number of Iterations - - - - - - - - - -    6
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER     4 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =      .80

                                    1-Stage
                                    Factor
                                      of     Side Force
Point          X           Y        Safety   Inclination   Iterations

   2         59.75       74.71    2.257        12.49            4
   2         59.95       76.30    1.580        10.76            6
   3        150.58       98.95    1.591        10.80            6
   3        151.41       97.58    2.282        11.54            4
   4        171.16      118.29    1.575        10.67            6
```

4	172.72	118.68	1.568	10.71	6

Maximum distance shifted for new estimate of shear
surface is .800 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.90	75.89
3	150.80	98.59
4	172.72	118.68

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 1.581
Side Force Inclination - - - - - - - - - - 10.79
Number of Iterations - - - - - - - - - - - 6

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.83	75.31	1.569	10.68	6
2	59.88	75.70	1.573	10.71	6
3	150.89	98.44	1.576	10.72	6
3	151.10	98.10	1.566	10.67	6
4	171.75	118.44	1.572	10.69	6
4	172.13	118.53	1.570	10.70	6

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.83	75.31
3	151.10	98.10

4	172.13	118.53

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.564
Side Force Inclination - - - - - - - - - 10.66
Number of Iterations - - - - - - - - - - 6

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C=6, 12, 20, 30 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.80	75.11	1.562	10.64	6
2	59.85	75.51	1.565	10.67	6
3	151.00	98.27	1.568	10.68	6
3	151.21	97.92	1.559	10.63	6
4	171.94	118.49	1.564	10.65	6
4	172.33	118.58	1.563	10.66	6

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.80	75.11
3	151.21	97.92
4	172.33	118.58

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.556
Side Force Inclination - - - - - - - - - 10.62
Number of Iterations - - - - - - - - - - 6

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 23

```
****************************
* SEARCH TRIAL NUMBER    7 *
****************************
```

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.77	74.91	2.032	12.11	5
2	59.83	75.31	1.558	10.64	6
3	151.10	98.10	1.561	10.65	6
3	151.31	97.75	2.249	11.39	4
4	172.13	118.53	1.557	10.61	6
4	172.52	118.63	1.555	10.62	6

Computed shift distances for newly estimated shear surface factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	40.00	85.50
2	59.81	75.21
3	151.15	98.01
4	172.52	118.63

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.559
Side Force Inclination - - - - - - - - - 10.65
Number of Iterations - - - - - - - - - - 6

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KPC EXISTING SLOPE
25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 25

```
*******************************************************************
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER   7 TRIAL POSITIONS) *
*******************************************************************
```

X	Y
40.00	85.50
59.80	75.11
151.21	97.92

172.33   118.58

1-Stage Factor of Safety =   1.556

Side Force Inclination = 10.62

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 26

```
**************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure      *
*  Information for Individual Slices for Conventional        *
*  Computations or First Stage of Multi-Stage Computations.  *
*  (Information is for the Critical Shear Surface in the     *
*  Case of an Automatic Search.)                             *
**************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	40.0	85.5					
1	40.3	85.3	9.0	1	.00	32.00	.0
	40.6	85.2					
2	42.6	84.2	141.4	2	30.00	.00	.0
	44.5	83.2					
3	46.4	82.1	209.6	2	30.00	.00	.0
	48.3	81.1					
4	50.2	80.1	277.8	2	30.00	.00	.0
	52.1	79.1					
5	54.1	78.1	346.0	2	30.00	.00	.0
	56.0	77.1					
6	57.9	76.1	414.3	2	30.00	.00	.0
	59.8	75.1					
7	61.9	75.6	486.3	2	30.00	.00	.0
	64.0	76.1					
8	66.0	76.7	486.4	2	30.00	.00	.0
	68.1	77.2					
9	70.2	77.7	486.4	2	30.00	.00	.0
	72.3	78.2					
10	74.3	78.7	486.4	2	30.00	.00	.0
	76.4	79.3					
11	78.5	79.8	486.5	2	30.00	.00	.0
	80.6	80.3					
12	82.7	80.8	486.5	2	30.00	.00	.0
	84.7	81.3					
13	86.8	81.8	486.6	2	30.00	.00	.0
	88.9	82.4					
14	91.0	82.9	486.6	2	30.00	.00	.0
	93.0	83.4					
15	95.1	83.9	486.6	2	30.00	.00	.0
	97.2	84.4					
16	99.3	85.0	486.7	2	30.00	.00	.0
	101.3	85.5					

17	103.4	86.0	486.7	2	30.00	.00	.0
	105.5	86.5					
18	107.6	87.0	486.8	2	30.00	.00	.0
	109.7	87.6					
19	111.7	88.1	486.8	2	30.00	.00	.0
	113.8	88.6					
20	115.9	89.1	486.8	2	30.00	.00	.0
	118.0	89.6					

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 26

```
*************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure     *
*  Information for Individual Slices for Conventional       *
*  Computations or First Stage of Multi-Stage Computations. *
*  (Information is for the Critical Shear Surface in the    *
*  Case of an Automatic Search.)                            *
*************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	118.0	89.6					
21	120.0	90.1	486.9	2	30.00	.00	.0
	122.1	90.7					
22	124.2	91.2	486.9	2	30.00	.00	.0
	126.3	91.7					
23	128.4	92.2	487.0	2	30.00	.00	.0
	130.4	92.7					
24	132.5	93.3	487.0	2	30.00	.00	.0
	134.6	93.8					
25	136.7	94.3	487.1	2	30.00	.00	.0
	138.7	94.8					
26	140.8	95.3	487.1	2	30.00	.00	.0
	142.9	95.9					
27	145.0	96.4	487.1	2	30.00	.00	.0
	147.1	96.9					
28	149.1	97.4	487.2	2	30.00	.00	.0
	151.2	97.9					
29	152.7	99.4	323.7	2	30.00	.00	.0
	154.1	100.8					
30	155.6	102.2	286.5	2	30.00	.00	.0
	157.0	103.6					
31	158.5	105.1	249.3	2	30.00	.00	.0
	160.0	106.5					
32	161.4	107.9	212.0	2	30.00	.00	.0
	162.9	109.3					
33	164.3	110.8	174.8	2	30.00	.00	.0
	165.8	112.2					
34	167.3	113.6	137.6	2	30.00	.00	.0
	168.7	115.1					
35	170.2	116.5	100.4	2	30.00	.00	.0

	171.6	117.9					
36	172.0	118.2	9.6	1	.00	32.00	.0
	172.3	118.6					

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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 27

```
**************************************************************
* Seismic Forces and Forces Due to Surface Pressures for     *
* Individual Slices for Conventional  Computations or the    *
* First Stage of Multi-Stage Computations.                   *
* (Information is for the Critical Shear Surface in the      *
* Case of an Automatic Search.)                              *
**************************************************************
```

Slice No.	X	Seismic Force	Y for Seismic Force	FORCES DUE TO SURFACE PRESSURES Normal Force	Shear Force	X	Y
1	40.3	0.	85.5	0.	0.	.0	.0
2	42.6	0.	85.7	0.	0.	.0	.0
3	46.4	0.	85.6	0.	0.	.0	.0
4	50.2	0.	85.4	0.	0.	.0	.0
5	54.1	0.	85.0	0.	0.	.0	.0
6	57.9	0.	84.6	0.	0.	.0	.0
7	61.9	0.	84.9	0.	0.	.0	.0
8	66.0	0.	85.9	0.	0.	.0	.0
9	70.2	0.	87.0	0.	0.	.0	.0
10	74.3	0.	88.0	0.	0.	.0	.0
11	78.5	0.	89.0	0.	0.	.0	.0
12	82.7	0.	90.1	0.	0.	.0	.0
13	86.8	0.	91.1	0.	0.	.0	.0
14	91.0	0.	92.1	0.	0.	.0	.0
15	95.1	0.	93.2	0.	0.	.0	.0
16	99.3	0.	94.2	0.	0.	.0	.0
17	103.4	0.	95.3	0.	0.	.0	.0
18	107.6	0.	96.3	0.	0.	.0	.0
19	111.7	0.	97.3	0.	0.	.0	.0
20	115.9	0.	98.4	0.	0.	.0	.0
21	120.0	0.	99.4	0.	0.	.0	.0
22	124.2	0.	100.5	0.	0.	.0	.0
23	128.4	0.	101.5	0.	0.	.0	.0
24	132.5	0.	102.5	0.	0.	.0	.0
25	136.7	0.	103.6	0.	0.	.0	.0
26	140.8	0.	104.6	0.	0.	.0	.0
27	145.0	0.	105.6	0.	0.	.0	.0
28	149.1	0.	106.7	0.	0.	.0	.0
29	152.7	0.	108.1	0.	0.	.0	.0
30	155.6	0.	109.8	0.	0.	.0	.0
31	158.5	0.	111.5	0.	0.	.0	.0
32	161.4	0.	113.2	0.	0.	.0	.0
33	164.3	0.	114.8	0.	0.	.0	.0

```
   34    167.3        0.        116.3        0.        0.        .0        .0
   35    170.2        0.        117.7        0.        0.        .0        .0
   36    172.0        0.        118.4        0.        0.        .0        .0
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        25% 15 FT THICK with 6 in. CAP
        C=6, 12, 20, 30 psf

        TABLE NO. 29
        ********************************************************************
        *  Information Generated During Iterative Solution for the Factor  *
        *  of Safety and Side Force Inclination by Spencer's Procedure     *
        ********************************************************************

                Trial     Trial
               Factor   Side Force    Force      Moment                Delta
        Iter-    of     Inclination  Imbalance  Imbalance   Delta-F    Theta
        ation  Safety   (degrees)     (lbs.)   (ft.-lbs.)            (degrees)

           1   3.00000   15.0000   .1337E+04  -.7055E+05
        First-order corrections to F and THETA .........  -.264E+01 -.172E+01
        Values factored by  .189E+00 - Deltas too large   -.500E+00 -.326E+00

           2   2.50000   14.6737   .1032E+04  -.5388E+05
        First-order corrections to F and THETA .........  -.144E+01 -.185E+01
        Values factored by  .348E+00 - Deltas too large   -.500E+00 -.643E+00

           3   2.00000   14.0304   .5782E+03  -.2882E+05
        First-order corrections to F and THETA .........  -.539E+00 -.203E+01
        Values factored by  .928E+00 - Deltas too large   -.500E+00 -.188E+01

           4   1.50000   12.1458  -.1551E+03   .1306E+05
        First-order corrections to F and THETA .........   .501E-01 -.183E+01
        Second-order correction - Iteration   1 ........   .524E-01 -.183E+01
        Second-order correction - Iteration   2 ........   .524E-01 -.183E+01

           5   1.55240   10.3188   .2897E+00  -.5854E+03
        First-order corrections to F and THETA .........   .394E-02  .300E+00
        Second-order correction - Iteration   1 ........   .396E-02  .301E+00
        Second-order correction - Iteration   2 ........   .396E-02  .301E+00

           6   1.55636   10.6197  -.2666E-03   .1679E+01
        First-order corrections to F and THETA .........  -.119E-04 -.879E-03

        Factor of Safety - - - - - - - -     1.556
        Side Force Inclination - - - - -     10.62
        Number of Iterations - - - - - -     6
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        25% 15 FT THICK with 6 in. CAP
        C=6, 12, 20, 30 psf

        TABLE NO. 38
```

```
***************************************************************
*  Final Results for Stresses Along the Shear Surface         *
*  (Results for Critical Shear Surface in Case of a Search.)  *
***************************************************************
```

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 1.556   Side Force Inclination = 10.62 Degrees

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	40.3	85.3	22.7	22.7	9.1
2	42.6	84.2	56.2	56.2	19.3
3	46.4	82.1	75.9	75.9	19.3
4	50.2	80.1	95.7	95.7	19.3
5	54.1	78.1	115.4	115.4	19.3
6	57.9	76.1	135.2	135.2	19.3
7	61.9	75.6	110.7	110.7	19.3
8	66.0	76.7	110.7	110.7	19.3
9	70.2	77.7	110.7	110.7	19.3
10	74.3	78.7	110.7	110.7	19.3
11	78.5	79.8	110.7	110.7	19.3
12	82.7	80.8	110.7	110.7	19.3
13	86.8	81.8	110.7	110.7	19.3
14	91.0	82.9	110.7	110.7	19.3
15	95.1	83.9	110.7	110.7	19.3
16	99.3	85.0	110.8	110.8	19.3
17	103.4	86.0	110.8	110.8	19.3
18	107.6	87.0	110.8	110.8	19.3
19	111.7	88.1	110.8	110.8	19.3
20	115.9	89.1	110.8	110.8	19.3
21	120.0	90.1	110.8	110.8	19.3
22	124.2	91.2	110.8	110.8	19.3
23	128.4	92.2	110.8	110.8	19.3
24	132.5	93.3	110.8	110.8	19.3
25	136.7	94.3	110.8	110.8	19.3
26	140.8	95.3	110.9	110.9	19.3
27	145.0	96.4	110.9	110.9	19.3
28	149.1	97.4	110.9	110.9	19.3
29	152.7	99.4	80.8	80.8	19.3
30	155.6	102.2	70.1	70.1	19.3
31	158.5	105.1	59.3	59.3	19.3
32	161.4	107.9	48.5	48.5	19.3
33	164.3	110.8	37.7	37.7	19.3
34	167.3	113.6	26.9	26.9	19.3
35	170.2	116.5	16.2	16.2	19.3
36	172.0	118.2	9.3	9.3	3.7

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION    =          .00   (=  .304E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION  =          .00   (=  .469E-03)
     SHOULD NOT EXCEED      .100E+03
```

```
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =        -1.69  (= -.169E+01)
     SHOULD NOT EXCEED       .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM    =         .00  (=  .128E-03)
     SHOULD NOT EXCEED       .100E+03
```
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25% 15 FT THICK with 6 in. CAP
C=6, 12, 20, 30 psf

TABLE NO. 39
***************************************************************
*  Final Results for Side Forces and Stresses Between Slices.  *
*  (Results for Critical Shear Surface in Case of a Search.)   *
***************************************************************

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety =  1.556     Side Force Inclination =  10.62 Degrees
```

--------------- VALUES AT RIGHT SIDE OF SLICE ---------------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	40.6	14.	85.4	.460	20.6	33.8
2	44.5	204.	84.6	.425	31.6	83.9
3	48.3	434.	83.8	.419	34.0	98.6
4	52.1	705.	83.0	.411	34.3	113.0
5	56.0	1016.	82.1	.404	34.0	127.5
6	59.8	1368.	81.2	.397	33.4	141.9
7	64.0	1333.	82.1	.390	29.1	141.6
8	68.1	1297.	83.1	.384	25.1	141.1
9	72.3	1262.	84.0	.377	21.4	140.3
10	76.4	1227.	85.0	.371	17.8	139.3
11	80.6	1191.	85.9	.365	14.5	138.0
12	84.7	1156.	86.8	.359	11.5	136.6
13	88.9	1121.	87.8	.353	8.6	134.9
14	93.0	1085.	88.7	.348	6.0	132.9
15	97.2	1050.	89.7	.342	3.6	130.8
16	101.3	1015.	90.7	.337	1.5	128.4
17	105.5	979.	91.6	.332	-.4	125.8
18	109.7	944.	92.6	.327	-2.1	122.9
19	113.8	908.	93.6	.323	-3.6	119.8
20	118.0	873.	94.5	.319	-4.8	116.5
21	122.1	837.	95.5	.315	-5.8	112.9
22	126.3	802.	96.5	.312	-6.5	109.1
23	130.4	767.	97.5	.309	-7.1	105.1
24	134.6	731.	98.5	.307	-7.4	100.9
25	138.7	696.	99.5	.305	-7.4	96.4
26	142.9	660.	100.5	.305	-7.3	91.7
27	147.1	625.	101.6	.305	-6.9	86.7
28	151.2	589.	102.6	.306	-6.3	81.6
29	154.1	412.	104.7	.296	-6.8	67.9
30	157.0	265.	106.8	.282	-7.2	54.1
31	160.0	150.	108.8	.261	-7.1	40.0

32	162.9	67.	110.9	.223	-6.3	25.4
33	165.8	15.	112.8	.127	-3.7	9.7
34	168.7	-7.	115.1	.027	4.5	-9.4
35	171.6	4.	118.6	ABOVE	49.3	-34.5
36	172.3	0.	5365.7	ABOVE	.0	.0

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION        =        .00   (=  .304E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION      =        .00   (=  .469E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN     =      -1.69   (= -.169E+01)
     SHOULD NOT EXCEED      .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM       =        .00   (=  .128E-03)
     SHOULD NOT EXCEED      .100E+03
```

***** CAUTION ***** FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS ALONG THE UPPER ONE-HALF OF THE SHEAR SURFACE - A TENSION CRACK MAY BE NEEDED.

***** CAUTION ***** SOME OF THE FORCES BETWEEN SLICES ACT AT POINTS ABOVE THE SURFACE OF THE SLOPE OR BELOW THE SHEAR SURFACE - EITHER A TENSION CRACK MAY BE NEEDED OR THE SOLUTION MAY NOT BE A VALID
SOLUTION.

END-OF-FILE ENCOUNTERED WHILE READING COMMAND
WORDS - END OF PROBLEM(S) ASSUMED

```
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          TABLE NO. 1
          *****************************************
          * COMPUTER PROGRAM DESIGNATION - UTEXAS3 *
          * Originally Coded By Stephen G. Wright  *
          * Version No. 1.205                      *
          * Last Revision Date  1/ 4/95            *
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          *****************************************

          *************************************************************
          *                                                           *
          *      RESULTS OF COMPUTATIONS PERFORMED USING THIS COMPUTER *
          * PROGRAM SHOULD NOT BE USED FOR DESIGN PURPOSES UNLESS THEY *
          * HAVE BEEN VERIFIED BY INDEPENDENT ANALYSES, EXPERIMENTAL   *
          * DATA OR FIELD EXPERIENCE. THE USER SHOULD UNDERSTAND THE   *
          * ALGORITHMS AND ANALYTICAL PROCEDURES USED IN THE COMPUTER  *
          * PROGRAM AND MUST HAVE READ ALL DOCUMENTATION FOR THIS      *
          * PROGRAM BEFORE ATTEMPTING ITS USE.                         *
          *                                                           *
          *      NEITHER SHINOAK SOFTWARE NOR STEPHEN G. WRIGHT        *
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          * OR ADAPTABILITY OF THIS COMPUTER PROGRAM.                  *
          *                                                           *
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          40% 5FT THICK with 6 in. CAP
          C=20, 30, 40 psf

          TABLE NO.  2
          *************************
          * NEW PROFILE LINE DATA *
          *************************

          PROFILE LINE  1 - MATERIAL TYPE =  1
          SAND COVER

               Point      X            Y

                 1          .000       60.500
                 2       200.000      140.500

          PROFILE LINE  2 - MATERIAL TYPE =  2
          ORGANIC MATERIAL

               Point      X            Y

                 1          .000       60.000
```

```
    2        200.000        140.000

PROFILE LINE  3 - MATERIAL TYPE =  3
NATIVE CLAY

    Point      X               Y

      1          .000        55.000
      2       200.000       135.000

All new profile lines defined - No old lines retained
```
1
```
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TABLE NO.  3
*********************************************************************
* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
*********************************************************************

DATA FOR MATERIAL TYPE  1
SAND COVER

     Unit weight of material =   56.000

     CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
     Cohesion - - - - - - - -          .000
     Friction angle - - - - -  32.000 degrees

     No (or zero) pore water pressures

DATA FOR MATERIAL TYPE  2
ORGANIC MATERIAL

     Unit weight of material =    6.000

     CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
     Cohesion - - - - - - - -        20.000
     Friction angle - - - - -      .000 degrees

     No (or zero) pore water pressures

DATA FOR MATERIAL TYPE  3
NATIVE CLAY

     Unit weight of material =   46.000

     CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
     Cohesion - - - - - - - -       100.000
     Friction angle - - - - -      .000 degrees

     No (or zero) pore water pressures

All new material properties defined - No old data retained
```

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TABLE NO. 15
****
* NEW ANALYSIS/COMPUTATION DATA *
****

Noncircular Shear Surface(s)

Automatic Search Performed

Coordinates of points on shear surface which are to be shifted -

Point	X	Y	Shift Angle
1	50.000	80.500	- fixed
2	60.000	79.500	angle to be computed - moveable
3	150.000	115.500	angle to be computed - moveable
4	160.000	124.500	angle to be computed - moveable

Initial distance for shifting points on shear surface = 2.000
Maximum steepness permitted for toe of shear surface = 50.00 degrees

---

THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for the factor of safety = 3.000

Initial trial estimate for side force inclination = 15.000 degrees
(Applicable to Spencer's procedure only)

Maximum number of iterations allowed for
calculating the factor of safety = 40

Allowed force imbalance for convergence = 100.000

Allowed moment imbalance for convergence = 100.000

Initial trial values for factor of safety (and side force inclination
for Spencer's procedure) will be kept constant during search

Number of increments for slice subdivision = 30

Depth of water in crack = .000

Unit weight of water in crack = 62.400

Seismic coefficient = .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
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TABLE NO. 16
****
* NEW SLOPE GEOMETRY DATA *
****

NOTE - NO DATA WERE INPUT, SLOPE GEOMETRY DATA
WERE GENERATED BY THE PROGRAM

Slope Coordinates -

Point	X	Y
1	.000	60.500
2	200.000	140.500

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TABLE NO. 22
****
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE *
****

Crack depth computed to be - - - .00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.167
Side Force Inclination - - - - - - - - - 20.06
Number of Iterations - - - - - - - - - - 7

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 1 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.70	81.48	1.280	20.51	7
2	60.30	77.52	2.812	21.90	4
3	148.91	117.18	1.294	19.62	7

3	151.09	113.82	2.780	22.11	3
4	158.14	123.76	1.169	20.05	7
4	161.86	125.24	1.166	20.06	7

Maximum distance shifted for new estimate of shear
surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	59.87	80.36
3	149.53	116.22
4	161.86	125.24

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 1.265
Side Force Inclination - - - - - - - - - - 20.44
Number of Iterations - - - - - - - - - - - 7

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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 1.40

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.79	80.88	1.241	20.44	7
2	60.21	78.12	2.940	22.22	3
3	149.24	116.67	1.252	19.95	7
3	150.76	114.33	2.948	30.66	5
4	158.70	123.98	1.169	20.05	7
4	161.30	125.02	1.167	20.06	7

Maximum distance shifted for new estimate of shear
surface is 1.400 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	59.90	80.14
3	149.65	116.03
4	161.30	125.02

```
FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.237
Side Force Inclination - - - - - - - - - -    20.35
Number of Iterations - - - - - - - - - - -   7
```

1

```
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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    3 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =     .80
```

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.88	80.29	1.207	20.31	7
2	60.12	78.71	2.516	22.10	3
3	149.56	116.17	1.213	20.08	7
3	150.44	114.83	2.517	20.75	4
4	159.26	124.20	1.168	20.06	7
4	160.74	124.80	1.167	20.07	7

```
Maximum distance shifted for new estimate of shear
surface is      .800 at point   4

Coordinates For New Estimate of Shear Surface
```

Point	X	Y
1	50.00	80.50
2	59.94	79.87
3	149.80	115.81
4	160.74	124.80

```
FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.206
Side Force Inclination - - - - - - - - - -    20.23
Number of Iterations - - - - - - - - - - -   7
```

1

```
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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    4 *
```

****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.97	79.70	1.177	20.13	7
2	60.03	79.30	1.158	20.00	7
3	149.89	115.67	1.178	20.08	7
3	150.11	115.33	1.157	20.04	7
4	159.81	124.43	1.167	20.06	7
4	160.19	124.57	1.167	20.07	7

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.03	79.30
3	150.11	115.33
4	160.19	124.57

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.148
Side Force Inclination - - - - - - - - - 19.98
Number of Iterations - - - - - - - - - - 7
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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	60.00	79.50	1.157	20.04	7
2	60.06	79.10	1.139	19.91	7
3	150.00	115.50	1.158	20.00	7

3	150.22	115.17	1.138	19.95	7
4	160.00	124.50	1.148	19.98	7
4	160.37	124.65	1.148	19.98	7

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.06	79.10
3	150.22	115.17
4	160.37	124.65

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 1.129
Side Force Inclination - - - - - - - - - - 19.88
Number of Iterations - - - - - - - - - - - 7

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C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	60.03	79.30	1.138	19.95	7
2	60.08	78.91	3.271	22.03	4
3	150.11	115.33	1.139	19.91	7
3	150.33	115.00	3.257	20.26	4
4	160.19	124.57	1.129	19.87	7
4	160.56	124.72	1.129	19.88	7

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.04	79.20
3	150.16	115.25
4	160.56	124.72

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.138
Side Force Inclination - - - - - - - - - 19.94
Number of Iterations - - - - - - - - - - 7
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C=20, 30, 40 psf

TABLE NO. 25
****
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER 6 TRIAL POSITIONS) *
****

X	Y
50.00	80.50
60.06	79.10
150.22	115.17
160.37	124.65

1-Stage Factor of Safety = 1.129

Side Force Inclination = 19.88
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TABLE NO. 26
****
* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the Critical Shear Surface in the *
* Case of an Automatic Search.) *
****

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	50.0	80.5					
1	50.5	80.4	13.0	1	.00	32.00	.0
	50.9	80.4					
2	52.4	80.2	100.2	2	20.00	.00	.0

	54.0	79.9					
3	55.5	79.7	130.1	2	20.00	.00	.0
	57.0	79.5					
4	58.5	79.3	160.1	2	20.00	.00	.0
	60.1	79.1					
5	61.7	79.8	192.1	2	20.00	.00	.0
	63.4	80.4					
6	65.1	81.1	192.1	2	20.00	.00	.0
	66.7	81.8					
7	68.4	82.4	192.1	2	20.00	.00	.0
	70.1	83.1					
8	71.7	83.8	192.1	2	20.00	.00	.0
	73.4	84.4					
9	75.1	85.1	192.1	2	20.00	.00	.0
	76.8	85.8					
10	78.4	86.4	192.1	2	20.00	.00	.0
	80.1	87.1					
11	81.8	87.8	192.1	2	20.00	.00	.0
	83.4	88.5					
12	85.1	89.1	192.1	2	20.00	.00	.0
	86.8	89.8					
13	88.4	90.5	192.1	2	20.00	.00	.0
	90.1	91.1					
14	91.8	91.8	192.1	2	20.00	.00	.0
	93.5	92.5					
15	95.1	93.1	192.1	2	20.00	.00	.0
	96.8	93.8					
16	98.5	94.5	192.1	2	20.00	.00	.0
	100.1	95.1					
17	101.8	95.8	192.1	2	20.00	.00	.0
	103.5	96.5					
18	105.1	97.1	192.1	2	20.00	.00	.0
	106.8	97.8					
19	108.5	98.5	192.1	2	20.00	.00	.0
	110.1	99.1					
20	111.8	99.8	192.1	2	20.00	.00	.0
	113.5	100.5					

```
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          KPC EXISTING SLOPE
          40% 5FT THICK with 6 in. CAP
          C=20, 30, 40 psf

          TABLE NO. 26
          **************************************************************
          *  Coordinate, Weight, Strength and Pore Water Pressure       *
          *  Information for Individual Slices for Conventional         *
          *  Computations or First Stage of Multi-Stage Computations.   *
          *  (Information is for the Critical Shear Surface in the      *
          *  Case of an Automatic Search.)                              *
          **************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	113.5	100.5					

21	115.2	101.1	192.1	2	20.00	.00	.0
	116.8	101.8					
22	118.5	102.5	192.1	2	20.00	.00	.0
	120.2	103.1					
23	121.8	103.8	192.1	2	20.00	.00	.0
	123.5	104.5					
24	125.2	105.1	192.1	2	20.00	.00	.0
	126.8	105.8					
25	128.5	106.5	192.1	2	20.00	.00	.0
	130.2	107.2					
26	131.9	107.8	192.1	2	20.00	.00	.0
	133.5	108.5					
27	135.2	109.2	192.1	2	20.00	.00	.0
	136.9	109.8					
28	138.5	110.5	192.1	2	20.00	.00	.0
	140.2	111.2					
29	141.9	111.8	192.1	2	20.00	.00	.0
	143.5	112.5					
30	145.2	113.2	192.1	2	20.00	.00	.0
	146.9	113.8					
31	148.5	114.5	192.1	2	20.00	.00	.0
	150.2	115.2					
32	151.4	116.2	124.1	2	20.00	.00	.0
	152.5	117.3					
33	153.7	118.4	107.0	2	20.00	.00	.0
	154.8	119.5					
34	156.0	120.5	90.0	2	20.00	.00	.0
	157.1	121.6					
35	158.3	122.7	73.0	2	20.00	.00	.0
	159.4	123.8					
36	159.9	124.2	13.1	1	.00	32.00	.0
	160.4	124.6					

```
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          40% 5FT THICK with 6 in. CAP
          C=20, 30, 40 psf

          TABLE NO. 27
          ************************************************************
          *  Seismic Forces and Forces Due to Surface Pressures for  *
          *  Individual Slices for Conventional  Computations or the *
          *  First Stage of Multi-Stage Computations.                *
          *  (Information is for the Critical Shear Surface in the   *
          *  Case of an Automatic Search.)                           *
          ************************************************************
```

Slice No.	X	Seismic Force	Y for Seismic Force	FORCES DUE TO SURFACE PRESSURES Normal Force	Shear Force	X	Y
1	50.5	0.	80.6	0.	0.	.0	.0
2	52.4	0.	81.1	0.	0.	.0	.0
3	55.5	0.	81.9	0.	0.	.0	.0
4	58.5	0.	82.6	0.	0.	.0	.0

5	61.7	0.	83.6	0.	0.	.0	.0
6	65.1	0.	84.9	0.	0.	.0	.0
7	68.4	0.	86.2	0.	0.	.0	.0
8	71.7	0.	87.6	0.	0.	.0	.0
9	75.1	0.	88.9	0.	0.	.0	.0
10	78.4	0.	90.2	0.	0.	.0	.0
11	81.8	0.	91.6	0.	0.	.0	.0
12	85.1	0.	92.9	0.	0.	.0	.0
13	88.4	0.	94.2	0.	0.	.0	.0
14	91.8	0.	95.6	0.	0.	.0	.0
15	95.1	0.	96.9	0.	0.	.0	.0
16	98.5	0.	98.2	0.	0.	.0	.0
17	101.8	0.	99.6	0.	0.	.0	.0
18	105.1	0.	100.9	0.	0.	.0	.0
19	108.5	0.	102.2	0.	0.	.0	.0
20	111.8	0.	103.6	0.	0.	.0	.0
21	115.2	0.	104.9	0.	0.	.0	.0
22	118.5	0.	106.3	0.	0.	.0	.0
23	121.8	0.	107.6	0.	0.	.0	.0
24	125.2	0.	108.9	0.	0.	.0	.0
25	128.5	0.	110.3	0.	0.	.0	.0
26	131.9	0.	111.6	0.	0.	.0	.0
27	135.2	0.	112.9	0.	0.	.0	.0
28	138.5	0.	114.3	0.	0.	.0	.0
29	141.9	0.	115.6	0.	0.	.0	.0
30	145.2	0.	116.9	0.	0.	.0	.0
31	148.5	0.	118.3	0.	0.	.0	.0
32	151.4	0.	119.6	0.	0.	.0	.0
33	153.7	0.	121.0	0.	0.	.0	.0
34	156.0	0.	122.3	0.	0.	.0	.0
35	158.3	0.	123.5	0.	0.	.0	.0
36	159.9	0.	124.3	0.	0.	.0	.0

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 29

```
*********************************************************************
*  Information Generated During Iterative Solution for the Factor   *
*  of Safety and Side Force Inclination by Spencer's Procedure      *
*********************************************************************
```

```
          Trial      Trial
          Factor   Side Force    Force      Moment                 Delta
 Iter-     of     Inclination  Imbalance   Imbalance    Delta-F     Theta
 ation   Safety    (degrees)     (lbs.)    (ft.-lbs.)             (degrees)

   1    3.00000     15.0000   .1374E+04  -.9386E+05
 First-order corrections to F and THETA .........    -.502E+01   .397E+00
 Values factored by  .997E-01 - Deltas too large     -.500E+00   .396E-01

   2    2.50000     15.0396   .1210E+04  -.8268E+05
 First-order corrections to F and THETA .........    -.307E+01   .444E+00
 Values factored by  .163E+00 - Deltas too large     -.500E+00   .724E-01
```

```
   3   2.00000    15.1120   .9634E+03  -.6593E+05
First-order corrections to F and THETA .........  -.156E+01  .538E+00
Values factored by  .320E+00 - Deltas too large   -.500E+00  .172E+00

   4   1.50000    15.2842   .5525E+03  -.3811E+05
First-order corrections to F and THETA .........  -.502E+00  .837E+00
Values factored by  .996E+00 - Deltas too large   -.500E+00  .834E+00

   5   1.00000    16.1177  -.2702E+03   .1646E+05
First-order corrections to F and THETA .........   .107E+00 -.307E+01
Second-order correction - Iteration   1 ........   .121E+00 -.307E+01
Second-order correction - Iteration   2 ........   .121E+00 -.307E+01
Second-order correction - Iteration   3 ........   .121E+00 -.307E+01

   6   1.12109    13.0485   .4283E+01  -.2177E+04
First-order corrections to F and THETA .........   .773E-02  .683E+01
Second-order correction - Iteration   1 ........   .813E-02  .683E+01
Second-order correction - Iteration   2 ........   .813E-02  .683E+01

   7   1.12922    19.8777  -.1881E+00   .1754E+02
First-order corrections to F and THETA .........   .584E-04 -.243E-01

Factor of Safety - - - - - - - -      1.129
Side Force Inclination - - - - -      19.88
Number of Iterations - - - - - -      7
```

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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 38

```
*************************************************************
*  Final Results for Stresses Along the Shear Surface       *
*  (Results for Critical Shear Surface in Case of a Search.) *
*************************************************************
```

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 1.129 Side Force Inclination = 19.88 Degrees

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	50.5	80.4	20.8	20.8	11.5
2	52.4	80.2	44.0	44.0	17.7
3	55.5	79.7	54.3	54.3	17.7
4	58.5	79.3	64.7	64.7	17.7
5	61.7	79.8	49.7	49.7	17.7
6	65.1	81.1	49.7	49.7	17.7
7	68.4	82.4	49.7	49.7	17.7
8	71.7	83.8	49.7	49.7	17.7
9	75.1	85.1	49.7	49.7	17.7

10	78.4	86.4	49.7	49.7	17.7
11	81.8	87.8	49.7	49.7	17.7
12	85.1	89.1	49.7	49.7	17.7
13	88.4	90.5	49.7	49.7	17.7
14	91.8	91.8	49.7	49.7	17.7
15	95.1	93.1	49.7	49.7	17.7
16	98.5	94.5	49.7	49.7	17.7
17	101.8	95.8	49.7	49.7	17.7
18	105.1	97.1	49.7	49.7	17.7
19	108.5	98.5	49.7	49.7	17.7
20	111.8	99.8	49.7	49.7	17.7
21	115.2	101.1	49.7	49.7	17.7
22	118.5	102.5	49.7	49.7	17.7
23	121.8	103.8	49.7	49.7	17.7
24	125.2	105.1	49.7	49.7	17.7
25	128.5	106.5	49.7	49.7	17.7
26	131.9	107.8	49.7	49.7	17.7
27	135.2	109.2	49.7	49.7	17.7
28	138.5	110.5	49.7	49.7	17.7
29	141.9	111.8	49.7	49.7	17.7
30	145.2	113.2	49.7	49.7	17.7
31	148.5	114.5	49.7	49.7	17.7
32	151.4	116.2	32.7	32.7	17.7
33	153.7	118.4	27.1	27.1	17.7
34	156.0	120.5	21.6	21.6	17.7
35	158.3	122.7	16.1	16.1	17.7
36	159.9	124.2	8.5	8.5	4.7

CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION = .00 (= .111E-03)
SHOULD NOT EXCEED .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION = .00 (= .883E-04)
SHOULD NOT EXCEED .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN = -17.54 (= -.175E+02)
SHOULD NOT EXCEED .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM = .00 (= .472E-04)
SHOULD NOT EXCEED .100E+03

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C=20, 30, 40 psf

TABLE NO. 39
****
* Final Results for Side Forces and Stresses Between Slices. *
* (Results for Critical Shear Surface in Case of a Search.) *
****

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 1.129 Side Force Inclination = 19.88 Degrees

--------------- VALUES AT RIGHT SIDE OF SLICE ---------------

Y-Coord. of Fraction Sigma Sigma

Slice No.	X-Right	Side Force	Side Force Location	of Height	at Top	at Bottom
1	50.9	14.	80.6	.464	21.0	32.4
2	54.0	91.	80.9	.428	22.8	57.4
3	57.0	173.	81.2	.436	26.4	59.7
4	60.1	259.	81.5	.437	28.0	62.1
5	63.4	252.	82.7	.426	24.3	63.1
6	66.7	244.	84.0	.415	20.8	63.9
7	70.1	236.	85.3	.405	17.6	64.5
8	73.4	229.	86.6	.394	14.5	65.0
9	76.8	221.	87.9	.384	11.6	65.2
10	80.1	214.	89.1	.373	8.9	65.3
11	83.4	206.	90.4	.363	6.3	65.1
12	86.8	198.	91.7	.353	4.0	64.8
13	90.1	191.	93.0	.343	1.9	64.3
14	93.5	183.	94.3	.333	-.1	63.6
15	96.8	175.	95.5	.323	-1.9	62.7
16	100.1	168.	96.8	.314	-3.4	61.7
17	103.5	160.	98.1	.304	-4.8	60.4
18	106.8	152.	99.4	.295	-6.0	58.9
19	110.1	145.	100.7	.287	-7.0	57.3
20	113.5	137.	102.0	.278	-7.9	55.5
21	116.8	130.	103.3	.270	-8.5	53.4
22	120.2	122.	104.6	.263	-8.9	51.2
23	123.5	114.	105.9	.256	-9.2	48.8
24	126.8	107.	107.2	.250	-9.3	46.3
25	130.2	99.	108.5	.245	-9.1	43.5
26	133.5	91.	109.8	.240	-8.8	40.5
27	136.9	84.	111.1	.238	-8.3	37.4
28	140.2	76.	112.4	.237	-7.6	34.0
29	143.5	68.	113.8	.238	-6.8	30.5
30	146.9	61.	115.1	.243	-5.7	26.8
31	150.2	53.	116.5	.253	-4.4	22.9
32	152.5	22.	118.4	.257	-2.2	12.0
33	154.8	3.	121.9	.810	2.7	-.8
34	157.1	-3.	119.3	BELOW	17.1	-20.5
35	159.4	3.	125.9	ABOVE	146.8	-134.0
36	160.4	0.	157.1	ABOVE	.0	.0

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION      =          .00   (=  .111E-03)
     SHOULD NOT EXCEED       .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION    =          .00   (=  .883E-04)
     SHOULD NOT EXCEED       .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =        -17.54   (= -.175E+02)
     SHOULD NOT EXCEED       .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM     =          .00   (=  .472E-04)
     SHOULD NOT EXCEED       .100E+03

***** CAUTION ***** FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                    ALONG THE UPPER ONE-HALF OF THE SHEAR SURFACE -
                    A TENSION CRACK MAY BE NEEDED.

***** CAUTION ***** SOME OF THE FORCES BETWEEN SLICES ACT AT POINTS
                    ABOVE THE SURFACE OF THE SLOPE OR BELOW THE
```

```
                    SHEAR SURFACE - EITHER A TENSION CRACK MAY BE
                    NEEDED OR THE SOLUTION MAY NOT BE A VALID
SOLUTION.
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          40% 5FT THICK with 6 in. CAP
          C=20, 30, 40 psf

          TABLE NO.  3
          ***********************************************************************
          * NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
          ***********************************************************************

          DATA FOR MATERIAL TYPE  2
          ORGANIC MATERIAL

               Unit weight of material =    6.000

               CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
               Cohesion - - - - - - - -      30.000
               Friction angle - - - - -    .000 degrees

               No (or zero) pore water pressures

          Data input for  1 new materials - Data retained
          for  2 old materials (SEE PREVIOUS DATA)
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          40% 5FT THICK with 6 in. CAP
          C=20, 30, 40 psf

          TABLE NO. 15
          *********************************
          * NEW ANALYSIS/COMPUTATION DATA *
          *********************************

          Noncircular Shear Surface(s)

          Automatic Search Performed


          Coordinates of points on shear surface which are to be shifted -

          Point       X           Y      Shift Angle

            1        50.000      80.500                          - fixed
            2        60.000      79.500   angle to be computed - moveable
            3       150.000     115.500   angle to be computed - moveable
            4       160.000     124.500   angle to be computed - moveable

          Initial distance for shifting points on shear surface =   2.000
          Maximum steepness permitted for toe of shear surface = 50.00 degrees
```

```
-----------------------------------------------------------------------
THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for the factor of safety =   3.000

Initial trial estimate for side force inclination =  15.000 degrees
(Applicable to Spencer's procedure only)

Maximum number of iterations allowed for
calculating the factor of safety =   40

Allowed force imbalance for convergence =     100.000

Allowed moment imbalance for convergence =     100.000

Initial trial values for factor of safety (and side force inclination
for Spencer's procedure) will be kept constant during search

Number of increments for slice subdivision =   30

Depth of water in crack =        .000

Unit weight of water in crack =    62.400

Seismic coefficient =  .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
```
1
```
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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 22
*******************************************
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE          *
*******************************************

Crack depth computed to be - - -       .00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -     1.745
Side Force Inclination - - - - - - - - -     20.13
Number of Iterations - - - - - - - - - -     6

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    1 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =    2.00

                              1-Stage
```

Point	X	Y	Factor of Safety	Side Force Inclination	Iterations
2	59.70	81.48	1.913	20.59	5
2	60.30	77.52	2.957	21.27	4
3	148.91	117.18	1.933	19.78	6
3	151.09	113.82	2.920	21.22	3
4	158.14	123.76	1.749	20.11	6
4	161.86	125.24	1.744	20.13	6

Maximum distance shifted for new estimate of shear surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	59.89	80.25
3	149.61	116.11
4	161.86	125.24

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.867
Side Force Inclination - - - - - - - - - -   20.49
Number of Iterations - - - - - - - - - - -   6

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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER   2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =   1.40

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.79	80.88	1.856	20.56	5
2	60.21	78.12	3.150	21.87	4
3	149.24	116.67	1.871	20.07	6
3	150.76	114.33	3.129	22.25	5
4	158.70	123.98	1.748	20.11	6
4	161.30	125.02	1.744	20.14	6

Maximum distance shifted for new estimate of shear surface is 1.400 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	59.91	80.09
3	149.68	115.99
4	161.30	125.02

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.840
Side Force Inclination - - - - - - - - - -   20.42
Number of Iterations - - - - - - - - - - -   6

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C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER   3 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .80

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.88	80.29	1.805	20.39	6
2	60.12	78.71	2.877	21.90	3
3	149.56	116.17	1.814	20.17	6
3	150.44	114.83	2.874	21.15	5
4	159.26	124.20	1.746	20.13	6
4	160.74	124.80	1.745	20.14	6

Maximum distance shifted for new estimate of shear
surface is .800 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	59.95	79.86
3	149.81	115.80
4	160.74	124.80

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.801
Side Force Inclination - - - - - - - - - -   20.31
Number of Iterations - - - - - - - - - - -   6

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER   4 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =   .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.97	79.70	1.759	20.21	6
2	60.03	79.30	1.732	20.06	6
3	149.89	115.67	1.762	20.16	6
3	150.11	115.33	1.730	20.10	6
4	159.81	124.43	1.746	20.13	6
4	160.19	124.57	1.745	20.14	6

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is   .200 at point   4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.03	79.30
3	150.11	115.33
4	160.19	124.57

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.716
Side Force Inclination - - - - - - - - - -   20.04
Number of Iterations - - - - - - - - - - -   6

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER   5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =   .20

1-Stage

Point	X	Y	Factor of Safety	Side Force Inclination	Iterations
2	60.00	79.50	1.729	20.11	6
2	60.06	79.10	1.704	19.96	6
3	150.00	115.50	1.732	20.06	6
3	150.22	115.17	1.701	20.00	6
4	160.00	124.50	1.717	20.03	6
4	160.37	124.65	1.716	20.04	6

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.06	79.10
3	150.22	115.17
4	160.37	124.65

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 1.689
Side Force Inclination - - - - - - - - - 19.94
Number of Iterations - - - - - - - - - - 6

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	60.03	79.30	1.701	20.01	6
2	60.08	78.91	3.542	21.85	7
3	150.11	115.33	1.703	19.97	6
3	150.33	115.00	3.530	20.61	5
4	160.19	124.57	1.689	19.94	6
4	160.56	124.72	1.688	19.94	6

Computed shift distances for newly estimated shear surface

```
factored by  1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is       .200 at point   4

Coordinates For New Estimate of Shear Surface

     Point        X           Y

         1       50.00       80.50
         2       60.04       79.20
         3      150.16      115.25
         4      160.56      124.72

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   1.702
Side Force Inclination - - - - - - - - - -    19.99
Number of Iterations - - - - - - - - - - -   6
```
1
```
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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf


TABLE NO. 25
*****************************************************************
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER   6 TRIAL POSITIONS) *
*****************************************************************

      X          Y

    50.00     80.50
    60.06     79.10
   150.22    115.17
   160.37    124.65

1-Stage Factor of Safety =   1.689

Side Force Inclination =  19.94
```
1
```
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Date:  2:12:2000   Time:  7: 8:44   Input file: kpc405v.in
KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 26
*************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure      *
*  Information for Individual Slices for Conventional        *
*  Computations or First Stage of Multi-Stage Computations.  *
*  (Information is for the Critical Shear Surface in the     *
*  Case of an Automatic Search.)                             *
*************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	50.0	80.5					
1	50.5	80.4	13.0	1	.00	32.00	.0
	50.9	80.4					
2	52.4	80.2	100.2	2	30.00	.00	.0
	54.0	79.9					
3	55.5	79.7	130.1	2	30.00	.00	.0
	57.0	79.5					
4	58.5	79.3	160.1	2	30.00	.00	.0
	60.1	79.1					
5	61.7	79.8	192.1	2	30.00	.00	.0
	63.4	80.4					
6	65.1	81.1	192.1	2	30.00	.00	.0
	66.7	81.8					
7	68.4	82.4	192.1	2	30.00	.00	.0
	70.1	83.1					
8	71.7	83.8	192.1	2	30.00	.00	.0
	73.4	84.4					
9	75.1	85.1	192.1	2	30.00	.00	.0
	76.8	85.8					
10	78.4	86.4	192.1	2	30.00	.00	.0
	80.1	87.1					
11	81.8	87.8	192.1	2	30.00	.00	.0
	83.4	88.5					
12	85.1	89.1	192.1	2	30.00	.00	.0
	86.8	89.8					
13	88.4	90.5	192.1	2	30.00	.00	.0
	90.1	91.1					
14	91.8	91.8	192.1	2	30.00	.00	.0
	93.5	92.5					
15	95.1	93.1	192.1	2	30.00	.00	.0
	96.8	93.8					
16	98.5	94.5	192.1	2	30.00	.00	.0
	100.1	95.1					
17	101.8	95.8	192.1	2	30.00	.00	.0
	103.5	96.5					
18	105.1	97.1	192.1	2	30.00	.00	.0
	106.8	97.8					
19	108.5	98.5	192.1	2	30.00	.00	.0
	110.1	99.1					
20	111.8	99.8	192.1	2	30.00	.00	.0
	113.5	100.5					

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 26

```
***************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure       *
*  Information for Individual Slices for Conventional         *
*  Computations or First Stage of Multi-Stage Computations.   *
*  (Information is for the Critical Shear Surface in the      *
```

* Case of an Automatic Search.)   *
****

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	113.5	100.5					
21	115.2	101.1	192.1	2	30.00	.00	.0
	116.8	101.8					
22	118.5	102.5	192.1	2	30.00	.00	.0
	120.2	103.1					
23	121.8	103.8	192.1	2	30.00	.00	.0
	123.5	104.5					
24	125.2	105.1	192.1	2	30.00	.00	.0
	126.8	105.8					
25	128.5	106.5	192.1	2	30.00	.00	.0
	130.2	107.2					
26	131.9	107.8	192.1	2	30.00	.00	.0
	133.5	108.5					
27	135.2	109.2	192.1	2	30.00	.00	.0
	136.9	109.8					
28	138.5	110.5	192.1	2	30.00	.00	.0
	140.2	111.2					
29	141.9	111.8	192.1	2	30.00	.00	.0
	143.5	112.5					
30	145.2	113.2	192.1	2	30.00	.00	.0
	146.9	113.8					
31	148.5	114.5	192.1	2	30.00	.00	.0
	150.2	115.2					
32	151.4	116.2	124.1	2	30.00	.00	.0
	152.5	117.3					
33	153.7	118.4	107.0	2	30.00	.00	.0
	154.8	119.5					
34	156.0	120.5	90.0	2	30.00	.00	.0
	157.1	121.6					
35	158.3	122.7	73.0	2	30.00	.00	.0
	159.4	123.8					
36	159.9	124.2	13.1	1	.00	32.00	.0
	160.4	124.6					

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TABLE NO. 27
****
* Seismic Forces and Forces Due to Surface Pressures for   *
* Individual Slices for Conventional Computations or the   *
* First Stage of Multi-Stage Computations.   *
* (Information is for the Critical Shear Surface in the   *
* Case of an Automatic Search.)   *
****

FORCES DUE TO SURFACE PRESSURES

Y for

Slice No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	50.5	0.	80.6	0.	0.	.0	.0
2	52.4	0.	81.1	0.	0.	.0	.0
3	55.5	0.	81.9	0.	0.	.0	.0
4	58.5	0.	82.6	0.	0.	.0	.0
5	61.7	0.	83.6	0.	0.	.0	.0
6	65.1	0.	84.9	0.	0.	.0	.0
7	68.4	0.	86.2	0.	0.	.0	.0
8	71.7	0.	87.6	0.	0.	.0	.0
9	75.1	0.	88.9	0.	0.	.0	.0
10	78.4	0.	90.2	0.	0.	.0	.0
11	81.8	0.	91.6	0.	0.	.0	.0
12	85.1	0.	92.9	0.	0.	.0	.0
13	88.4	0.	94.2	0.	0.	.0	.0
14	91.8	0.	95.6	0.	0.	.0	.0
15	95.1	0.	96.9	0.	0.	.0	.0
16	98.5	0.	98.2	0.	0.	.0	.0
17	101.8	0.	99.6	0.	0.	.0	.0
18	105.1	0.	100.9	0.	0.	.0	.0
19	108.5	0.	102.2	0.	0.	.0	.0
20	111.8	0.	103.6	0.	0.	.0	.0
21	115.2	0.	104.9	0.	0.	.0	.0
22	118.5	0.	106.3	0.	0.	.0	.0
23	121.8	0.	107.6	0.	0.	.0	.0
24	125.2	0.	108.9	0.	0.	.0	.0
25	128.5	0.	110.3	0.	0.	.0	.0
26	131.9	0.	111.6	0.	0.	.0	.0
27	135.2	0.	112.9	0.	0.	.0	.0
28	138.5	0.	114.3	0.	0.	.0	.0
29	141.9	0.	115.6	0.	0.	.0	.0
30	145.2	0.	116.9	0.	0.	.0	.0
31	148.5	0.	118.3	0.	0.	.0	.0
32	151.4	0.	119.6	0.	0.	.0	.0
33	153.7	0.	121.0	0.	0.	.0	.0
34	156.0	0.	122.3	0.	0.	.0	.0
35	158.3	0.	123.5	0.	0.	.0	.0
36	159.9	0.	124.3	0.	0.	.0	.0

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TABLE NO. 29

```
*******************************************************************
*  Information Generated During Iterative Solution for the Factor *
*  of Safety and Side Force Inclination by Spencer's Procedure    *
*******************************************************************
```

Iter-ation	Trial Factor of Safety	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)

```
   1    3.00000     15.0000    .9672E+03   -.6647E+05
First-order corrections to F and THETA .........   -.236E+01  .554E+00
Values factored by  .212E+00 - Deltas too large    -.500E+00  .118E+00

   2    2.50000     15.1175    .7212E+03   -.4969E+05
First-order corrections to F and THETA .........   -.122E+01  .700E+00
Values factored by  .410E+00 - Deltas too large    -.500E+00  .287E+00

   3    2.00000     15.4045    .3521E+03   -.2463E+05
First-order corrections to F and THETA .........   -.378E+00  .117E+01
Second-order correction - Iteration   1 ........   -.327E+00  .117E+01
Second-order correction - Iteration   2 ........   -.326E+00  .118E+01
Second-order correction - Iteration   3 ........   -.326E+00  .118E+01

   4    1.67400     16.5800   -.9483E+01   -.3287E+03
First-order corrections to F and THETA .........    .152E-01  .372E+01
Second-order correction - Iteration   1 ........    .155E-01  .372E+01
Second-order correction - Iteration   2 ........    .155E-01  .372E+01

   5    1.68955     20.3034    .2106E-02    .1044E+03
First-order corrections to F and THETA .........   -.842E-03 -.366E+00
Second-order correction - Iteration   1 ........   -.838E-03 -.365E+00

   6    1.68871     19.9380    .3624E-04    .3525E+00
First-order corrections to F and THETA .........   -.287E-05 -.125E-02

Factor of Safety - - - - - - - -     1.689
Side Force Inclination - - - - -     19.94
Number of Iterations - - - - - -     6
```

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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 38

```
***************************************************************
*  Final Results for Stresses Along the Shear Surface         *
*  (Results for Critical Shear Surface in Case of a Search.)  *
***************************************************************
```

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 1.689 Side Force Inclination = 19.94 Degrees

------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	50.5	80.4	18.3	18.3	6.8
2	52.4	80.2	44.0	44.0	17.8
3	55.5	79.7	54.4	54.4	17.8
4	58.5	79.3	64.8	64.8	17.8
5	61.7	79.8	49.6	49.6	17.8
6	65.1	81.1	49.6	49.6	17.8

7	68.4	82.4	49.7	49.7	17.8
8	71.7	83.8	49.7	49.7	17.8
9	75.1	85.1	49.7	49.7	17.8
10	78.4	86.4	49.7	49.7	17.8
11	81.8	87.8	49.7	49.7	17.8
12	85.1	89.1	49.7	49.7	17.8
13	88.4	90.5	49.7	49.7	17.8
14	91.8	91.8	49.7	49.7	17.8
15	95.1	93.1	49.7	49.7	17.8
16	98.5	94.5	49.7	49.7	17.8
17	101.8	95.8	49.7	49.7	17.8
18	105.1	97.1	49.7	49.7	17.8
19	108.5	98.5	49.7	49.7	17.8
20	111.8	99.8	49.7	49.7	17.8
21	115.2	101.1	49.7	49.7	17.8
22	118.5	102.5	49.7	49.7	17.8
23	121.8	103.8	49.7	49.7	17.8
24	125.2	105.1	49.7	49.7	17.8
25	128.5	106.5	49.7	49.7	17.8
26	131.9	107.8	49.7	49.7	17.8
27	135.2	109.2	49.7	49.7	17.8
28	138.5	110.5	49.7	49.7	17.8
29	141.9	111.8	49.7	49.7	17.8
30	145.2	113.2	49.7	49.7	17.8
31	148.5	114.5	49.7	49.7	17.8
32	151.4	116.2	32.6	32.6	17.8
33	153.7	118.4	27.1	27.1	17.8
34	156.0	120.5	21.6	21.6	17.8
35	158.3	122.7	16.1	16.1	17.8
36	159.9	124.2	9.0	9.0	3.3

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION      =         .00  (=  .117E-03)
     SHOULD NOT EXCEED       .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION    =         .00  (=  .128E-03)
     SHOULD NOT EXCEED       .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN   =        -.35  (= -.353E+00)
     SHOULD NOT EXCEED       .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM     =         .00  (=  .542E-04)
     SHOULD NOT EXCEED       .100E+03
```

1

```
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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 39
****************************************************************
*  Final Results for Side Forces and Stresses Between Slices.  *
*  (Results for Critical Shear Surface in Case of a Search.)   *
****************************************************************

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety =  1.689     Side Force Inclination = 19.94 Degrees
```

-------------- VALUES AT RIGHT SIDE OF SLICE ---------------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	50.9	9.	80.6	.465	13.7	20.9
2	54.0	87.	80.8	.406	16.6	59.4
3	57.0	168.	81.1	.424	22.7	61.1
4	60.1	255.	81.4	.429	25.4	63.1
5	63.4	248.	82.7	.419	22.0	63.9
6	66.7	240.	84.0	.408	18.7	64.6
7	70.1	233.	85.3	.398	15.7	65.1
8	73.4	225.	86.5	.388	12.8	65.4
9	76.8	218.	87.8	.378	10.1	65.5
10	80.1	210.	89.1	.368	7.5	65.5
11	83.4	203.	90.4	.358	5.2	65.3
12	86.8	196.	91.7	.348	3.0	64.8
13	90.1	188.	93.0	.338	1.0	64.3
14	93.5	181.	94.2	.329	-.8	63.5
15	96.8	173.	95.5	.320	-2.5	62.6
16	100.1	166.	96.8	.311	-3.9	61.4
17	103.5	158.	98.1	.302	-5.2	60.1
18	106.8	151.	99.4	.293	-6.3	58.7
19	110.1	143.	100.7	.285	-7.2	57.0
20	113.5	136.	102.0	.277	-8.0	55.2
21	116.8	129.	103.3	.269	-8.6	53.2
22	120.2	121.	104.6	.262	-9.0	51.0
23	123.5	114.	105.9	.256	-9.2	48.6
24	126.8	106.	107.2	.250	-9.2	46.1
25	130.2	99.	108.5	.245	-9.1	43.3
26	133.5	91.	109.8	.241	-8.8	40.4
27	136.9	84.	111.1	.239	-8.3	37.3
28	140.2	76.	112.4	.238	-7.6	34.1
29	143.5	69.	113.8	.239	-6.7	30.6
30	146.9	61.	115.2	.244	-5.7	27.0
31	150.2	54.	116.5	.253	-4.5	23.2
32	152.5	23.	118.4	.247	-2.7	12.9
33	154.8	4.	120.8	.453	1.0	1.7
34	157.1	-2.	119.2	BELOW	9.3	-11.1
35	159.4	5.	124.1	.684	20.0	-1.0
36	160.4	0.	-4699.4	BELOW	.0	.0

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION     =          .00  (=  .117E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION   =          .00  (=  .128E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =         -.35  (= -.353E+00)
     SHOULD NOT EXCEED      .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM    =          .00  (=  .542E-04)
     SHOULD NOT EXCEED      .100E+03

***** CAUTION ***** FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                    ALONG THE UPPER ONE-HALF OF THE SHEAR SURFACE -
                    A TENSION CRACK MAY BE NEEDED.
```

```
***** CAUTION ***** SOME OF THE FORCES BETWEEN SLICES ACT AT POINTS
                    ABOVE THE SURFACE OF THE SLOPE OR BELOW THE
                    SHEAR SURFACE - EITHER A TENSION CRACK MAY BE
                    NEEDED OR THE SOLUTION MAY NOT BE A VALID
SOLUTION.
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       C=20, 30, 40 psf

       TABLE NO.  3
       *******************************************************************
       * NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
       *******************************************************************

       DATA FOR MATERIAL TYPE  2
       ORGANIC MATERIAL

            Unit weight of material =    6.000

            CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
            Cohesion - - - - - - - -      40.000
            Friction angle - - - - -    .000 degrees

            No (or zero) pore water pressures

       Data input for  1 new materials - Data retained
       for  2 old materials (SEE PREVIOUS DATA)
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       C=20, 30, 40 psf

       TABLE NO. 15
       *********************************
       * NEW ANALYSIS/COMPUTATION DATA *
       *********************************

       Noncircular Shear Surface(s)

       Automatic Search Performed


       Coordinates of points on shear surface which are to be shifted -

       Point        X            Y       Shift Angle

          1       50.000       80.500                          - fixed
          2       60.000       79.500    angle to be computed - moveable
          3      150.000      115.500    angle to be computed - moveable
          4      160.000      124.500    angle to be computed - moveable
```

```
Initial distance for shifting points on shear surface =   2.000
Maximum steepness permitted for toe of shear surface = 50.00 degrees

---------------------------------------------------------------------
THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for the factor of safety =   3.000

Initial trial estimate for side force inclination =  15.000 degrees
(Applicable to Spencer's procedure only)

Maximum number of iterations allowed for
calculating the factor of safety =   40

Allowed force imbalance for convergence =     100.000

Allowed moment imbalance for convergence =     100.000

Initial trial values for factor of safety (and side force inclination
for Spencer's procedure) will be kept constant during search

Number of increments for slice subdivision =   30

Depth of water in crack =        .000

Unit weight of water in crack =    62.400

Seismic coefficient =  .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
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TABLE NO. 22
*******************************************
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE          *
*******************************************

Crack depth computed to be - - -       .00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -     2.324
Side Force Inclination - - - - - - - - -     20.18
Number of Iterations - - - - - - - - - -     5

TABLE NO. 23
***************************
* SEARCH TRIAL NUMBER    1 *
***************************
```

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 2.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.70	81.48	2.546	20.64	4
2	60.30	77.52	3.100	20.42	4
3	148.91	117.18	2.573	19.87	6
3	151.09	113.82	3.060	20.70	3
4	158.14	123.76	2.329	20.15	5
4	161.86	125.24	2.322	20.18	5

Maximum distance shifted for new estimate of shear surface is 2.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	59.92	80.05
3	149.73	115.91
4	161.86	125.24

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 2.434
Side Force Inclination - - - - - - - - - - 20.47
Number of Iterations - - - - - - - - - - - 4
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C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 1.40

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.79	80.88	2.471	20.57	4
2	60.21	78.12	3.360	21.46	6
3	149.24	116.67	2.490	20.14	4
3	150.76	114.33	3.331	21.05	4
4	158.70	123.98	2.327	20.16	5
4	161.30	125.02	2.322	20.18	5

Maximum distance shifted for new estimate of shear

```
surface is      1.400 at point   4

Coordinates For New Estimate of Shear Surface

     Point        X            Y

       1        50.00        80.50
       2        59.92        80.02
       3       149.73       115.92
       4       161.30       125.02

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -    2.432
Side Force Inclination - - - - - - - - -     20.46
Number of Iterations - - - - - - - - - -    4
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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    3 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =     .80

                                  1-Stage
                                  Factor
                                    of     Side Force
Point         X           Y       Safety   Inclination   Iterations

   2        59.88       80.29    2.403       20.45           4
   2        60.12       78.71    3.238       21.66           4
   3       149.56      116.17    2.414       20.26           4
   3       150.44      114.83 See Message on Next Line(s)
FATAL ERROR IN CALCULATING FACTOR OF SAFETY
SOLUTION DID NOT CONVERGE WITHIN  40 ITERATIONS
   4       159.26      124.20    2.325       20.17           5
   4       160.74      124.80    2.323       20.18           5

Maximum distance shifted for new estimate of shear
surface is       .800 at point   4

Coordinates For New Estimate of Shear Surface

     Point        X            Y

       1        50.00        80.50
       2        59.95        79.83
       3       150.00       115.50
       4       160.74       124.80

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -    2.354
```

Side Force Inclination - - - - - - - - - 20.34
Number of Iterations - - - - - - - - - - 4

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C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 4 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	59.97	79.70	2.342	20.25	5
2	60.03	79.30	2.306	20.10	5
3	149.89	115.67	2.345	20.20	5
3	150.11	115.33	2.303	20.14	5
4	159.81	124.43	2.324	20.18	5
4	160.19	124.57	2.323	20.18	5

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.03	79.30
3	150.11	115.33
4	160.19	124.57

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 2.285
Side Force Inclination - - - - - - - - - 20.08
Number of Iterations - - - - - - - - - - 5

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40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *

****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	60.00	79.50	2.303	20.15	5
2	60.06	79.10	2.268	20.00	5
3	150.00	115.50	2.306	20.10	5
3	150.22	115.17	2.265	20.04	5
4	160.00	124.50	2.285	20.07	5
4	160.37	124.65	2.285	20.08	5

Computed shift distances for newly estimated shear surface factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.06	79.10
3	150.22	115.17
4	160.37	124.65

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 2.248
Side Force Inclination - - - - - - - - - - 19.98
Number of Iterations - - - - - - - - - - - 5

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = .20

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
2	60.03	79.30	2.265	20.05	5
2	60.08	78.91	3.814	21.66	6
3	150.11	115.33	2.268	20.01	5

3	150.33	115.00	3.797	19.70	7
4	160.19	124.57	2.249	19.98	5
4	160.56	124.72	2.248	19.98	5

Computed shift distances for newly estimated shear surface
factored by 1.000 to prevent over-shift

Maximum distance shifted for new estimate of shear
surface is .200 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	50.00	80.50
2	60.04	79.20
3	150.16	115.25
4	160.56	124.72

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 2.266
Side Force Inclination - - - - - - - - - 20.03
Number of Iterations - - - - - - - - - - 5

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 25

```
*****************************************************************
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER   6 TRIAL POSITIONS) *
*****************************************************************
```

X	Y
50.00	80.50
60.06	79.10
150.22	115.17
160.37	124.65

1-Stage Factor of Safety = 2.248

Side Force Inclination = 19.98

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 26

```
*************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure      *
*  Information for Individual Slices for Conventional        *
```

* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the Critical Shear Surface in the *
* Case of an Automatic Search.) *
****

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	50.0	80.5					
1	50.5	80.4	13.0	1	.00	32.00	.0
	50.9	80.4					
2	52.4	80.2	100.2	2	40.00	.00	.0
	54.0	79.9					
3	55.5	79.7	130.1	2	40.00	.00	.0
	57.0	79.5					
4	58.5	79.3	160.1	2	40.00	.00	.0
	60.1	79.1					
5	61.7	79.8	192.1	2	40.00	.00	.0
	63.4	80.4					
6	65.1	81.1	192.1	2	40.00	.00	.0
	66.7	81.8					
7	68.4	82.4	192.1	2	40.00	.00	.0
	70.1	83.1					
8	71.7	83.8	192.1	2	40.00	.00	.0
	73.4	84.4					
9	75.1	85.1	192.1	2	40.00	.00	.0
	76.8	85.8					
10	78.4	86.4	192.1	2	40.00	.00	.0
	80.1	87.1					
11	81.8	87.8	192.1	2	40.00	.00	.0
	83.4	88.5					
12	85.1	89.1	192.1	2	40.00	.00	.0
	86.8	89.8					
13	88.4	90.5	192.1	2	40.00	.00	.0
	90.1	91.1					
14	91.8	91.8	192.1	2	40.00	.00	.0
	93.5	92.5					
15	95.1	93.1	192.1	2	40.00	.00	.0
	96.8	93.8					
16	98.5	94.5	192.1	2	40.00	.00	.0
	100.1	95.1					
17	101.8	95.8	192.1	2	40.00	.00	.0
	103.5	96.5					
18	105.1	97.1	192.1	2	40.00	.00	.0
	106.8	97.8					
19	108.5	98.5	192.1	2	40.00	.00	.0
	110.1	99.1					
20	111.8	99.8	192.1	2	40.00	.00	.0
	113.5	100.5					

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KPC EXISTING SLOPE
40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 26

```
*************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure     *
*  Information for Individual Slices for Conventional       *
*  Computations or First Stage of Multi-Stage Computations. *
*  (Information is for the Critical Shear Surface in the    *
*  Case of an Automatic Search.)                            *
*************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	113.5	100.5					
21	115.2	101.1	192.1	2	40.00	.00	.0
	116.8	101.8					
22	118.5	102.5	192.1	2	40.00	.00	.0
	120.2	103.1					
23	121.8	103.8	192.1	2	40.00	.00	.0
	123.5	104.5					
24	125.2	105.1	192.1	2	40.00	.00	.0
	126.8	105.8					
25	128.5	106.5	192.1	2	40.00	.00	.0
	130.2	107.2					
26	131.9	107.8	192.1	2	40.00	.00	.0
	133.5	108.5					
27	135.2	109.2	192.1	2	40.00	.00	.0
	136.9	109.8					
28	138.5	110.5	192.1	2	40.00	.00	.0
	140.2	111.2					
29	141.9	111.8	192.1	2	40.00	.00	.0
	143.5	112.5					
30	145.2	113.2	192.1	2	40.00	.00	.0
	146.9	113.8					
31	148.5	114.5	192.1	2	40.00	.00	.0
	150.2	115.2					
32	151.4	116.2	124.1	2	40.00	.00	.0
	152.5	117.3					
33	153.7	118.4	107.0	2	40.00	.00	.0
	154.8	119.5					
34	156.0	120.5	90.0	2	40.00	.00	.0
	157.1	121.6					
35	158.3	122.7	73.0	2	40.00	.00	.0
	159.4	123.8					
36	159.9	124.2	13.1	1	.00	32.00	.0
	160.4	124.6					

```
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         40% 5FT THICK with 6 in. CAP
         C=20, 30, 40 psf

         TABLE NO. 27
         ************************************************************
         *  Seismic Forces and Forces Due to Surface Pressures for  *
         *  Individual Slices for Conventional  Computations or the *
         *  First Stage of Multi-Stage Computations.                *
         *  (Information is for the Critical Shear Surface in the   *
```

```
*  Case of an Automatic Search.)                             *
**************************************************************
```

Slice No.	X	Seismic Force	Y for Seismic Force	FORCES DUE TO SURFACE PRESSURES Normal Force	Shear Force	X	Y
1	50.5	0.	80.6	0.	0.	.0	.0
2	52.4	0.	81.1	0.	0.	.0	.0
3	55.5	0.	81.9	0.	0.	.0	.0
4	58.5	0.	82.6	0.	0.	.0	.0
5	61.7	0.	83.6	0.	0.	.0	.0
6	65.1	0.	84.9	0.	0.	.0	.0
7	68.4	0.	86.2	0.	0.	.0	.0
8	71.7	0.	87.6	0.	0.	.0	.0
9	75.1	0.	88.9	0.	0.	.0	.0
10	78.4	0.	90.2	0.	0.	.0	.0
11	81.8	0.	91.6	0.	0.	.0	.0
12	85.1	0.	92.9	0.	0.	.0	.0
13	88.4	0.	94.2	0.	0.	.0	.0
14	91.8	0.	95.6	0.	0.	.0	.0
15	95.1	0.	96.9	0.	0.	.0	.0
16	98.5	0.	98.2	0.	0.	.0	.0
17	101.8	0.	99.6	0.	0.	.0	.0
18	105.1	0.	100.9	0.	0.	.0	.0
19	108.5	0.	102.2	0.	0.	.0	.0
20	111.8	0.	103.6	0.	0.	.0	.0
21	115.2	0.	104.9	0.	0.	.0	.0
22	118.5	0.	106.3	0.	0.	.0	.0
23	121.8	0.	107.6	0.	0.	.0	.0
24	125.2	0.	108.9	0.	0.	.0	.0
25	128.5	0.	110.3	0.	0.	.0	.0
26	131.9	0.	111.6	0.	0.	.0	.0
27	135.2	0.	112.9	0.	0.	.0	.0
28	138.5	0.	114.3	0.	0.	.0	.0
29	141.9	0.	115.6	0.	0.	.0	.0
30	145.2	0.	116.9	0.	0.	.0	.0
31	148.5	0.	118.3	0.	0.	.0	.0
32	151.4	0.	119.6	0.	0.	.0	.0
33	153.7	0.	121.0	0.	0.	.0	.0
34	156.0	0.	122.3	0.	0.	.0	.0
35	158.3	0.	123.5	0.	0.	.0	.0
36	159.9	0.	124.3	0.	0.	.0	.0

```
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         40% 5FT THICK with 6 in. CAP
         C=20, 30, 40 psf

         TABLE NO. 29
         *******************************************************************
         *  Information Generated During Iterative Solution for the Factor *
         *  of Safety and Side Force Inclination by Spencer's Procedure    *
         *******************************************************************
```

```
        Trial      Trial
        Factor   Side Force    Force      Moment                  Delta
Iter-     of     Inclination  Imbalance  Imbalance    Delta-F     Theta
ation   Safety    (degrees)    (lbs.)    (ft.-lbs.)              (degrees)

   1    3.00000    15.0000   .5602E+03  -.3908E+05
First-order corrections to F and THETA .........  -.102E+01   .893E+00
Values factored by  .489E+00 - Deltas too large   -.500E+00   .437E+00

   2    2.50000    15.4367   .2319E+03  -.1664E+05
First-order corrections to F and THETA .........  -.290E+00   .158E+01
Second-order correction - Iteration   1 ........  -.263E+00   .158E+01
Second-order correction - Iteration   2 ........  -.263E+00   .158E+01

   3    2.23720    17.0139  -.2572E+01  -.6621E+03
First-order corrections to F and THETA .........   .114E-01   .308E+01
Second-order correction - Iteration   1 ........   .116E-01   .308E+01
Second-order correction - Iteration   2 ........   .116E-01   .309E+01

   4    2.24882    20.0992  -.8000E-02   .3489E+02
First-order corrections to F and THETA .........  -.355E-03 -.121E+00
Second-order correction - Iteration   1 ........  -.353E-03 -.121E+00
Second-order correction - Iteration   2 ........  -.352E-03 -.120E+00
Second-order correction - Iteration   3 ........  -.350E-03 -.120E+00
Second-order correction - Iteration   4 ........  -.349E-03 -.120E+00
Second-order correction - Iteration   5 ........  -.347E-03 -.119E+00
Second-order correction - Iteration   6 ........  -.346E-03 -.119E+00
Second-order correction - Iteration   7 ........  -.345E-03 -.118E+00
Second-order correction - Iteration   8 ........  -.343E-03 -.118E+00
Second-order correction - Iteration   9 ........  -.342E-03 -.117E+00
Second-order correction - Iteration  10 ........  -.340E-03 -.117E+00
SECOND-ORDER CORRECTIONS DID NOT CONVERGE
IN  10 ITERATIONS - FIRST-ORDER CORRECTIONS
USED

   5    2.24847    19.9778  -.2627E-03   .4516E-01
First-order corrections to F and THETA .........  -.485E-07 -.108E-03

Factor of Safety - - - - - - - -     2.248
Side Force Inclination - - - - -     19.98
Number of Iterations - - - - - -     5
```

```
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        40% 5FT THICK with 6 in. CAP
        C=20, 30, 40 psf

        TABLE NO. 38
        ***************************************************************
        *  Final Results for Stresses Along the Shear Surface         *
        *  (Results for Critical Shear Surface in Case of a Search.)  *
        ***************************************************************

        SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
        Factor of Safety =  2.248     Side Force Inclination =  19.98 Degrees
```

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	50.5	80.4	17.3	17.3	4.8
2	52.4	80.2	44.1	44.1	17.8
3	55.5	79.7	54.4	54.4	17.8
4	58.5	79.3	64.8	64.8	17.8
5	61.7	79.8	49.6	49.6	17.8
6	65.1	81.1	49.6	49.6	17.8
7	68.4	82.4	49.6	49.6	17.8
8	71.7	83.8	49.6	49.6	17.8
9	75.1	85.1	49.6	49.6	17.8
10	78.4	86.4	49.7	49.7	17.8
11	81.8	87.8	49.7	49.7	17.8
12	85.1	89.1	49.7	49.7	17.8
13	88.4	90.5	49.7	49.7	17.8
14	91.8	91.8	49.7	49.7	17.8
15	95.1	93.1	49.7	49.7	17.8
16	98.5	94.5	49.7	49.7	17.8
17	101.8	95.8	49.7	49.7	17.8
18	105.1	97.1	49.7	49.7	17.8
19	108.5	98.5	49.7	49.7	17.8
20	111.8	99.8	49.7	49.7	17.8
21	115.2	101.1	49.7	49.7	17.8
22	118.5	102.5	49.7	49.7	17.8
23	121.8	103.8	49.7	49.7	17.8
24	125.2	105.1	49.7	49.7	17.8
25	128.5	106.5	49.7	49.7	17.8
26	131.9	107.8	49.7	49.7	17.8
27	135.2	109.2	49.7	49.7	17.8
28	138.5	110.5	49.7	49.7	17.8
29	141.9	111.8	49.7	49.7	17.8
30	145.2	113.2	49.7	49.7	17.8
31	148.5	114.5	49.7	49.7	17.8
32	151.4	116.2	32.6	32.6	17.8
33	153.7	118.4	27.1	27.1	17.8
34	156.0	120.5	21.6	21.6	17.8
35	158.3	122.7	16.1	16.1	17.8
36	159.9	124.2	9.3	9.3	2.6

```
CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION     =          .00  (=  .143E-03)
     SHOULD NOT EXCEED      .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION   =          .00  (=  .903E-04)
     SHOULD NOT EXCEED      .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =         -.04  (= -.449E-01)
     SHOULD NOT EXCEED      .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM    =          .00  (=  .585E-04)
     SHOULD NOT EXCEED      .100E+03
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     KPC EXISTING SLOPE
```

40% 5FT THICK with 6 in. CAP
C=20, 30, 40 psf

TABLE NO. 39

```
*******************************************************************
*  Final Results for Side Forces and Stresses Between Slices.    *
*  (Results for Critical Shear Surface in Case of a Search.)     *
*******************************************************************
```

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 2.248   Side Force Inclination = 19.98 Degrees

--------------- VALUES AT RIGHT SIDE OF SLICE ----------------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	50.9	7.	80.6	.466	10.7	16.1
2	54.0	85.	80.8	.396	14.1	60.2
3	57.0	167.	81.1	.419	21.2	61.6
4	60.1	253.	81.4	.426	24.4	63.5
5	63.4	246.	82.7	.416	21.1	64.2
6	66.7	239.	84.0	.406	18.0	64.8
7	70.1	231.	85.3	.396	15.0	65.2
8	73.4	224.	86.5	.386	12.3	65.4
9	76.8	217.	87.8	.376	9.7	65.4
10	80.1	209.	89.1	.367	7.2	65.3
11	83.4	202.	90.4	.357	5.0	65.0
12	86.8	195.	91.7	.348	2.9	64.6
13	90.1	187.	93.0	.338	1.0	63.9
14	93.5	180.	94.2	.329	-.7	63.1
15	96.8	172.	95.5	.321	-2.3	62.1
16	100.1	165.	96.8	.312	-3.7	60.9
17	103.5	158.	98.1	.303	-4.9	59.6
18	106.8	150.	99.4	.295	-6.0	58.1
19	110.1	143.	100.7	.287	-6.8	56.4
20	113.5	136.	102.0	.280	-7.5	54.6
21	116.8	128.	103.3	.273	-8.1	52.6
22	120.2	121.	104.6	.266	-8.4	50.4
23	123.5	114.	105.9	.260	-8.6	48.0
24	126.8	106.	107.2	.255	-8.6	45.5
25	130.2	99.	108.5	.251	-8.5	42.7
26	133.5	92.	109.8	.248	-8.1	39.9
27	136.9	84.	111.2	.246	-7.6	36.8
28	140.2	77.	112.5	.246	-7.0	33.6
29	143.5	69.	113.8	.249	-6.1	30.2
30	146.9	62.	115.2	.255	-5.1	26.6
31	150.2	55.	116.6	.265	-3.9	22.9
32	152.5	24.	118.5	.274	-1.9	12.5
33	154.8	5.	121.1	.535	2.0	1.3
34	157.1	-1.	113.9	BELOW	10.6	-11.3
35	159.4	6.	124.0	.543	14.5	8.5
36	160.4	0.	221.1	ABOVE	.0	.0

CHECK SUMS - (ALL SHOULD BE SMALL)

```
SUM OF FORCES IN VERTICAL DIRECTION     =          .00  (=  .143E-03)
     SHOULD NOT EXCEED     .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION   =          .00  (=  .903E-04)
     SHOULD NOT EXCEED     .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN =          -.04  (= -.449E-01)
     SHOULD NOT EXCEED     .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM    =          .00  (=  .585E-04)
     SHOULD NOT EXCEED     .100E+03

***** CAUTION ***** FORCES BETWEEN SLICES ARE NEGATIVE AT POINTS
                    ALONG THE UPPER ONE-HALF OF THE SHEAR SURFACE -
                    A TENSION CRACK MAY BE NEEDED.

***** CAUTION ***** SOME OF THE FORCES BETWEEN SLICES ACT AT POINTS
                    ABOVE THE SURFACE OF THE SLOPE OR BELOW THE
                    SHEAR SURFACE - EITHER A TENSION CRACK MAY BE
                    NEEDED OR THE SOLUTION MAY NOT BE A VALID
SOLUTION.

END-OF-FILE ENCOUNTERED WHILE READING COMMAND
WORDS - END OF PROBLEM(S) ASSUMED
```

Appendix B

Short-Term Fate Calculations

Appendix B1

Summary of Input Parameters and Model Results

APPENDIX B1

SUMMARY TABLE OF INPUT PARAMETERS AND MODEL RESULTS

Key

Capping Area Parameters

Dimensions: Dimensions of the disposal area grid in feet

Grid Spacing: Spacing in feet between each grid point

Current: Velocity in ft/sec of local current with a constant velocity profile

Vessel Parameters

Capacity: Volume in cubic yards of material placed in the scenario

Length, beam: Dimensions of barge (or bucket for clamshell)

Velocity: Speed of the vessel in the left-to-right direction as it is dumping material

Placement parameters

Dump Z,X: Location of start of release. In the model, Z is left-to-right and X is top-to-bottom

Release Time: Duration of sediment release in seconds

Sand Vf: Volumetric fraction of sand. Equal to the volume of sand divided by the total volume

Silt Vf: Volumetric fraction of silt.

Model Results

Max thickness: Maximum cap thickness in feet as seen on the footprint plot

Area >3": Footprint area in square feet that is covered by at least 3 inches of capping material

Area >6": Footprint area covered by at least 6 inches of capping material

Center Z: Z-coordinate of mound center. Measure of mound displacement from original release location

Model	Capping Area Parameters				Vessel Parameters				Placement Parameters				Model Results			
	Dimensions	Grid Spacing	Depth	Current	Capacity (cy)	Length	Beam	Velocity	Dump Z,X	Release Time (s)	Sand Vf	Silt Vf	Max Thickness	Area >3"	Area >6"	Center Z
Currents																
KPC3D	2000x2000	100	140	0	1000	60	30	0	1000,1000	50	0.3	0.1	0.35	14,400	0	1000
KPC3A	2000x2000	100	140	0.033	1000	60	30	0	1000,1000	50	0.3	0.1	0.35	14,400	0	1000
KPC3B	2000x2000	100	140	0.099	1000	60	30	0	1000,1000	50	0.3	0.1	0.32	13,300	0	1000
KPC3C	2000x2000	100	140	0.165	1000	60	30	0	1000,1000	50	0.3	0.1	0.3	13,300	0	1100
KPC3E	2000x2000	100	140	0.33	1000	60	30	0	500,1000	50	0.3	0.1	0.3	12,000	0	600
Barge																
B1	2000x2000	100	140	1	750	60	25	2	500,1000	180	0.5	0.1	0.44	16,800	0	900
B2	2000x2000	100	140	1	1500	100	30	2	500,1000	360	0.5	0.1	0.73	72,000	10,800	1200
B3	2000x2000	100	140	1	3000	200	50	2	100,1000	600	0.5	0.1	1.2	115,000	75,000	1300
B1B	2000x2000	100	140	1	750	25	60	0.5	500,1000	300	0.5	0.1	0.4	41,400	0	700
B2B	2000x2000	100	140	1	1500	30	100	0.5	500,1000	600	0.5	0.1	0.76	90,000	12,000	800
B3B	2000x2000	100	140	1	3000	50	200	0.5	100,1000	1200	0.5	0.1	1.2	125,000	90,000	1100
B1BT	2000x2000	100	140	1	750	25	60	0.1	500,1000	3600	0.5	0.1	0.4	31,500	0	900
B2BT	2000x2000	100	140	1	1500	30	100	0.1	500,1000	5400	0.5	0.1	0.67	67,500	18,000	1000
B3BT	2000x2000	100	140	1	3000	50	200	0.1	100,1000	7200	0.5	0.1	1.1	120,000	72,800	800
B1D	2000x2000	100	80	1	750	60	25	2	500,1000	180	0.5	0.1	0.83	47,500	14,400	900
B2D	2000x2000	100	80	1	1500	100	30	2	500,1000	360	0.5	0.1	1.3	72,000	28,000	1200
B3D	2000x2000	100	80	1	3000	200	50	2	100,1000	600	0.5	0.1	2.2	96,100	72,900	1300
B1DB	2000x2000	100	80	1	750	25	60	0.5	500,1000	300	0.5	0.1	0.73	34,000	17,600	700
B2DB	2000x2000	100	80	1	1500	30	100	0.5	500,1000	600	0.5	0.1	1.4	84,100	36,400	800
B3DB	2000x2000	100	80	1	3000	50	200	0.5	100,1000	1200	0.5	0.1	2.2	93,000	81,200	1100
BF1	2000X2000	100	140	1	1500	30	100	2	500,1000	10	0.5	0.1	0.6	72,000	20,000	500
BF2	2000X2000	100	80	1	1500	30	100	2	500,1000	10	0.5	0.1	0.92	69,000	45,000	500
Clamshell																
C	400x400	20	10	1	50	10	5	0	200,200	5	0.55	0.15	0.5	2,800	64	220
C1	400x400	20	20	1	50	10	5	0	200,200	5	0.55	0.15	0.39	2,300	0	200
C2	400x400	20	40	1	50	10	5	0	200,200	5	0.55	0.15	0.28	1,020	0	200
C3	400x400	20	60	1	50	10	5	0	200,200	5	0.55	0.15	0.18	0	0	200
C4	400x400	20	80	1	50	10	5	0	200,200	5	0.55	0.15	0.12	0	0	200
CF1	400x400	20	10	1	50	10	5	0	200,200	1	0.55	0.15		2,700	0	200
CF2	400x400	20	20	1	50	10	5	0	200,200	1	0.55	0.15		2,500	0	200
CF3	400X400	20	60	1	50	10	5	0	200,200	1	0.55	0.15		0	0	200
Hydraulic/Slurry																
H	2000x2000	100	20	1	1500	100	35	1	300,1000	600	0.15	0.05	0.8	17,600	3,000	900
H1	2000x2000	100	20	1	1500	100	35	1	300,1000	900	0.15	0.05	0.81	16,500	2,500	1200
H2	2000x2000	100	20	1	1500	100	35	1	300,1000	1200	0.15	0.05	0.81	15,400	2,500	1500
H3	2000x2000	100	20	1	1500	100	35	1	300,1000	2400	0.15	0.05	0.82	15,400	2,500	1500
H4	2000x2000	100	20	1	1500	100	35	0.1	100,1000	3600	0.15	0.05	0.71	20,000	3,000	500
HA	2000x2000	100	60	1	1500	100	35	1	300,1000	600	0.15	0.05	0.73	27,000	2,500	900
H1A	2000x2000	100	60	1	1500	100	35	1	300,1000	900	0.15	0.05	0.73	27,000	2,500	1200
H2A	2000x2000	100	60	1	1500	100	35	1	300,1000	1200	0.15	0.05	0.76	20,800	2,500	1500
H3A	2000x2000	100	60	1	1500	100	35	1	300,1000	2400	0.15	0.05	0.76	20,800	2,500	1500
H4A	2000x2000	100	60	1	1500	100	35	0.1	100,1000	3600	0.15	0.05	0.58	23,400	3,000	500
HB	2000x2000	100	140	1	1500	100	35	1	300,1000	600	0.15	0.05	0.28	11,000	0	900
H1B	2000x2000	100	140	1	1500	100	35	1	300,1000	900	0.15	0.05	0.28	11,000	0	1200
H2B	2000x2000	100	140	1	1500	100	35	1	300,1000	1200	0.15	0.05	0.28	11,000	0	1500
H3B	2000x2000	100	140	1	1500	100	35	1	300,1000	2400	0.15	0.05	0.28	11,000	0	1500
H4B	2000x2000	100	140	1	1500	100	35	0.1	100,1000	3600	0.15	0.05	0.24	0	0	500
H5B	2000x2000	100	140	1	3000	200	50	0.1	100,1000	5400	0.15	0.05	0.39	50,000	0	600

Note: All length units in feet, velocities in ft/s and areas in square feet.

Appendix B2

Cap Footprint Areas

APPENDIX B2

CAP FOOTPRINT AREAS

TABLE OF CONTENTS

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000         (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 0000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   .   .   .   .   .   .   0   0   0   00000
 7 0000   0   0   0   0   0   .   .   +   +   +   +   .   .   0   0   00000
 8 0000   0   0   0   0   .   +   +   +   +   +   +   +   .   .   0   00000
 9 0000   0   0   0   .   .   +   + .02 .05 .03 .01   +   +   .   0   00000
10 0000   0   0   0   .   +   + .02 .11 .21 .14 .04   +   +   .   .   00000
11 0000   0   0   0   .   +   + .04 .18 .35 .24 .06   +   +   .   .   00000
12 0000   0   0   0   .   +   + .02 .11 .21 .14 .04   +   +   .   .   00000
13 0000   0   0   0   .   .   +   + .02 .05 .03 .01   +   +   .   0   00000
14 0000   0   0   0   0   .   +   +   +   +   +   +   +   .   .   0   00000
15 0000   0   0   0   0   0   .   .   +   +   +   +   .   .   0   0   00000
16 0000   0   0   0   0   0   0   .   .   .   .   .   .   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 0000000000000000000000000000000000000000000000000000000000000000000000

    *** RUN COMPLETED ***
```

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	000000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	.	.	.	.	.	.	0	0	00000	
7	0000	0	0	0	0	0	.	.	+	+	+	+	.	.	.	0	00000	
8	0000	0	0	0	0	.	.	+	+	+	+	+	+	+	.	.	00000	
9	0000	0	0	0	0	.	+	+	.02	.04	.04	.01	+	+	+	.	.0000	
10	0000	0	0	0	0	.	+	.01	.08	.19	.17	.06	.01	+	+	.	.0000	
11	0000	0	0	0	0	.	+	.02	.14	.32	.28	.10	.02	+	+	.	.0000	
12	0000	0	0	0	0	.	+	.01	.08	.19	.17	.06	.01	+	+	.	.0000	
13	0000	0	0	0	0	.	+	+	.02	.04	.04	.01	+	+	+	.	.0000	
14	0000	0	0	0	0	.	.	+	+	+	+	+	+	+	.	.	00000	
15	0000	0	0	0	0	0	.	.	+	+	+	+	.	.	.	0	00000	
16	0000	0	0	0	0	0	0	0	.	.	.	.	.	.	0	0	00000	
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	000000000000000000000000000000000000000000000000000000000000000000000000																	

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000         (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)

M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000  0   0   0   0   0   0   0   .   .   .   .   .   .   0   0   00000
  7 0000  0   0   0   0   0   0   .   .   +   +   +   +   .   .   .   00000
  8 0000  0   0   0   0   0   .   +   +   +   +   +   +   +   .   .   .0000
  9 0000  0   0   0   0   .   +   + .01 .04 .04 .02   +   +   +   +   .0000
 10 0000  0   0   0   0   .   +   + .06 .17 .18 .08 .02   +   +   +   +0000
 11 0000  0   0   0   0   .   + .01 .10 .28 .30 .14 .04   +   +   +   +0000
 12 0000  0   0   0   0   .   +   + .06 .17 .18 .08 .02   +   +   +   +0000
 13 0000  0   0   0   0   .   +   + .01 .04 .04 .02   +   +   +   +   .0000
 14 0000  0   0   0   0   0   .   +   +   +   +   +   +   +   .   .   .0000
 15 0000  0   0   0   0   0   0   .   .   +   +   +   +   .   .   .   00000
 16 0000  0   0   0   0   0   0   0   .   .   .   .   .   .   0   0   00000
 17 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
  3 OOOO   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   OOOOO
  4 OOOO   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   OOOOO
  5 OOOO   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   OOOOO
  6 OOOO   0   0   0   0   0   0   .   .   .   .   .   0   0   0   0   OOOOO
  7 OOOO   0   0   0   0   .   .   .   +   +   +   .   .   .   0   0   OOOOO
  8 OOOO   0   0   0   0   .   +   +   +   +   +   +   +   .   0   0   OOOOO
  9 OOOO   0   0   0   .   .   +   + .03 .05 .03   +   +   .   .   0   OOOOO
 10 OOOO   0   0   0   .   +   + .03 .13 .21 .13 .03   +   +   .   0   OOOOO
 11 OOOO   0   0   0   .   +   + .05 .21 .35 .21 .05   +   +   .   0   OOOOO
 12 OOOO   0   0   0   .   +   + .03 .13 .21 .13 .03   +   +   .   0   OOOOO
 13 OOOO   0   0   0   .   .   +   + .03 .05 .03   +   +   .   .   0   OOOOO
 14 OOOO   0   0   0   0   .   +   +   +   +   +   +   +   .   0   0   OOOOO
 15 OOOO   0   0   0   0   .   .   .   +   +   +   .   .   .   0   0   OOOOO
 16 OOOO   0   0   0   0   0   0   .   .   .   .   .   0   0   0   0   OOOOO
 17 OOOO   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   OOOOO
 18 OOOO   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   OOOOO
 19 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 6 0000    0    0    0    .    .    .    .    .    .    .    0    0    0    0    0   00000
 7 0000    0    .    .    .    +    +    +    +    .    .    .    .    0    0    0   00000
 8 0000    .    .    +    +    +    +    +    +    +    +    .    .    .    .    .   .0000
 9 0000    .    +    +  .02  .04  .03  .01    +    +    +    +    .    .    .    .   .0000
10 0000    +    +  .02  .11  .17  .13  .06  .02    +    +    +    +    +    +    +   +0000
11 0000    +    +  .04  .18  .28  .21  .09  .03  .01    +    +    +    +    +    +   +0000
12 0000    +    +  .02  .11  .17  .13  .06  .02    +    +    +    +    +    +    +   +0000
13 0000    .    +    +  .02  .04  .03  .01    +    +    +    +    .    .    .    .   .0000
14 0000    .    .    +    +    +    +    +    +    +    +    .    .    .    .    .   .0000
15 0000    0    .    .    .    +    +    +    +    .    .    .    .    0    0    0   00000
16 0000    0    0    0    .    .    .    .    .    .    .    0    0    0    0    0   00000
17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000         (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 00000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   .   .   .   .   .   0   0   0   0   0   00000
  7 0000   0   0   0   .   .   .   +   +   +   .   .   0   0   0   0   00000
  8 0000   0   0   0   .   +   +   +   +   +   +   .   .   0   0   0   00000
  9 0000   0   0   .   +   + .01 .04 .05 .02   +   +   .   0   0   0   00000
 10 0000   0   0   .   +   + .06 .20 .24 .10 .01   +   .   .   0   0   00000
 11 0000   0   0   .   + .01 .10 .35 .44 .17 .03   +   .   .   0   0   00000
 12 0000   0   0   .   +   + .06 .20 .24 .10 .01   +   .   .   0   0   00000
 13 0000   0   0   .   +   + .01 .04 .05 .02   +   +   .   0   0   0   00000
 14 0000   0   0   0   .   +   +   +   +   +   +   .   .   0   0   0   00000
 15 0000   0   0   0   .   .   .   +   +   +   .   .   0   0   0   0   00000
 16 0000   0   0   0   0   0   .   .   .   .   .   0   0   0   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 00000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   .   .   .   .   0   0   00000
 6 0000   0   0   0   0   0   0   0   .   .   .   .   .   .   .   .   00000
 7 0000   0   0   0   0   0   0   .   .   +   +   +   +   +   +   .   .0000
 8 0000   0   0   0   0   0   .   .   +   + .01 .01 .01   +   +   +   .0000
 9 0000   0   0   0   0   0   .   +   + .01 .07 .13 .11 .04   +   +   .0000
10 0000   0   0   0   0   0   .   +   + .05 .23 .45 .38 .14 .02   +   +0000
11 0000   0   0   0   0   0   .   +   + .08 .35 .73 .59 .21 .03   +   +0000
12 0000   0   0   0   0   0   .   +   + .05 .23 .45 .38 .14 .02   +   +0000
13 0000   0   0   0   0   0   .   +   + .01 .07 .13 .11 .04   +   +   .0000
14 0000   0   0   0   0   0   .   .   +   + .01 .01 .01   +   +   +   .0000
15 0000   0   0   0   0   0   0   .   .   +   +   +   +   +   +   .   .0000
16 0000   0   0   0   0   0   0   0   .   .   .   .   .   .   .   .   00000
17 0000   0   0   0   0   0   0   0   0   0   .   .   .   .   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    0    0    .    .    .    0    0   00000
 5 0000    0    0    0    0    0    0    0    0    .    .    .    .    .    .    .   .0000
 6 0000    0    0    0    0    0    0    .    .    .    +    +    +    +    +    .   .0000
 7 0000    0    0    0    0    0    0    .    .    +    +    +    +    +    +    +   +0000
 8 0000    0    0    0    0    0    .    .    +    +  .01  .04  .06  .04  .02    +   +0000
 9 0000    0    0    0    0    0    .    +    +  .01  .07  .20  .30  .23  .09  .02   +0000
10 0000    0    0    0    0    0    .    +    +  .03  .19  .55  .83  .62  .24  .05   +0000
11 0000    0    0    0    0    .    .    +    +  .05  .26  .77  1.2  .89  .34  .07   +0000
12 0000    0    0    0    0    0    .    +    +  .03  .19  .55  .83  .62  .24  .05   +0000
13 0000    0    0    0    0    0    .    +    +  .01  .07  .20  .30  .23  .09  .02   +0000
14 0000    0    0    0    0    0    .    .    +    +  .01  .04  .06  .04  .02    +   +0000
15 0000    0    0    0    0    0    0    .    .    +    +    +    +    +    +    +   +0000
16 0000    0    0    0    0    0    0    .    .    .    +    +    +    +    +    .   .0000
17 0000    0    0    0    0    0    0    0    0    .    .    .    .    .    .    .   .0000
18 0000    0    0    0    0    0    0    0    0    0    0    .    .    .    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

B1B

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000        (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000  0   0   0   .   .   .   .   0   0   0   0   0   0   0   0   00000
  7 0000  0   .   .   .   +   +   +   .   .   0   0   0   0   0   0   00000
  8 0000  .   .   +   +   +   +   +   +   .   .   0   0   0   0   0   00000
  9 0000  .   +   + .01 .05 .05 .02   +   +   .   0   0   0   0   0   00000
 10 0000  .   + .01 .08 .22 .23 .08 .01   +   .   0   0   0   0   0   00000
 11 0000  .   + .01 .13 .39 .40 .14 .02   +   .   .   0   0   0   0   00000
 12 0000  .   + .01 .08 .22 .23 .08 .01   +   .   0   0   0   0   0   00000
 13 0000  .   +   + .01 .05 .05 .02   +   +   .   0   0   0   0   0   00000
 14 0000  .   .   +   +   +   +   +   +   .   .   0   0   0   0   0   00000
 15 0000  0   .   .   .   +   +   +   .   .   0   0   0   0   0   0   00000
 16 0000  0   0   0   .   .   .   .   0   0   0   0   0   0   0   0   00000
 17 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	.	.	.	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	.	.	.	.	.	.	.	0	0	0	0	0	00000	
7	0000	0	0	.	.	+	+	+	+	+	.	.	0	0	0	0	00000	
8	0000	0	.	.	+	+	.01	.01	.01	+	+	.	.	0	0	0	00000	
9	0000	0	.	+	+	.02	.09	.13	.09	.03	+	+	.	.	0	0	00000	
10	0000	.	.	+	.01	.08	.30	.47	.31	.09	.01	+	.	.	0	0	00000	
11	0000	.	.	+	.01	.13	.46	.76	.48	.14	.02	+	.	.	0	0	00000	
12	0000	.	.	+	.01	.08	.30	.47	.31	.09	.01	+	.	.	0	0	00000	
13	0000	0	.	+	+	.02	.09	.13	.09	.03	+	+	.	.	0	0	00000	
14	0000	0	.	.	+	+	.01	.01	.01	+	+	.	.	0	0	0	00000	
15	0000	0	0	.	.	+	+	+	+	+	.	.	0	0	0	0	00000	
16	0000	0	0	0	.	.	.	.	.	.	.	0	0	0	0	0	00000	
17	0000	0	0	0	0	0	.	.	.	0	0	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000000																	

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000  0   0   0   0   0   0   0   0   .   .   .   0   0   0   0   00000
  5 0000  0   0   0   0   0   0   .   .   .   .   .   .   .   0   0   00000
  6 0000  0   0   0   0   .   .   .   +   +   +   +   +   .   .   .   00000
  7 0000  0   0   0   0   .   .   +   +   +   +   +   +   +   .   .   00000
  8 0000  0   0   0   .   .   +   + .01 .04 .06 .04 .01   +   +   .   .0000
  9 0000  0   0   0   .   +   + .01 .08 .21 .30 .22 .08 .01   +   +   .0000
 10 0000  0   0   .   .   +   + .04 .21 .57 .83 .60 .22 .04   +   +   .0000
 11 0000  0   0   .   .   +   + .05 .29 .81 1.2 .85 .31 .06   +   +   .0000
 12 0000  0   0   .   .   +   + .04 .21 .57 .83 .60 .22 .04   +   +   .0000
 13 0000  0   0   0   .   +   + .01 .08 .21 .30 .22 .08 .01   +   +   .0000
 14 0000  0   0   0   .   .   +   + .01 .04 .06 .04 .01   +   +   .   .0000
 15 0000  0   0   0   0   .   .   +   +   +   +   +   +   +   .   .   00000
 16 0000  0   0   0   0   .   .   .   +   +   +   +   +   .   .   .   00000
 17 0000  0   0   0   0   0   0   .   .   .   .   .   .   .   0   0   00000
 18 0000  0   0   0   0   0   0   0   0   .   .   .   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000

    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 000000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  6 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0    00000
  7 0000    0    0    0    .    .    .    +    +    +    .    .    0    0    0    0    00000
  8 0000    0    0    .    .    +    +    +    +    +    +    .    .    0    0    0    00000
  9 0000    0    0    .    +    +  .01  .04  .05  .02    +    +    .    0    0    0    00000
 10 0000    0    0    .    +    +  .07  .21  .23  .09  .01    +    .    .    0    0    00000
 11 0000    0    0    .    +  .01  .11  .35  .40  .16  .02    +    .    .    0    0    00000
 12 0000    0    0    .    +    +  .07  .21  .23  .09  .01    +    .    .    0    0    00000
 13 0000    0    0    .    +    +  .01  .04  .05  .02    +    +    .    0    0    0    00000
 14 0000    0    0    .    .    +    +    +    +    +    +    .    .    0    0    0    00000
 15 0000    0    0    0    .    .    .    +    +    +    .    .    0    0    0    0    00000
 16 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0    00000
 17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000000
```

```
*** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   6600.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   .   .   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   .   .   .   .   .   .   .   .   0   0   00000
  7 0000   0   0   0   0   .   .   +   +   +   +   +   +   .   .   0   00000
  8 0000   0   0   0   0   .   +   +   + .01 .01   +   +   +   .   0   00000
  9 0000   0   0   0   .   .   + .01 .06 .12 .11 .05 .01   +   .   .   00000
 10 0000   0   0   0   .   +   + .04 .20 .43 .39 .16 .03   +   +   .   00000
 11 0000   0   0   0   .   +   + .06 .30 .67 .62 .24 .04   +   +   .   00000
 12 0000   0   0   0   .   +   + .04 .20 .43 .39 .16 .03   +   +   .   00000
 13 0000   0   0   0   .   .   + .01 .06 .12 .11 .05 .01   +   .   .   00000
 14 0000   0   0   0   0   .   +   +   + .01 .01   +   +   +   .   0   00000
 15 0000   0   0   0   0   .   .   +   +   +   +   +   +   .   .   0   00000
 16 0000   0   0   0   0   0   .   .   .   .   .   .   .   .   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   .   .   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 8400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	.	.	.	.	.	.	.	0	0	0	0	0	00000	
6	0000	0	0	.	.	+	+	+	+	+	.	.	0	0	0	0	00000	
7	0000	0	.	.	+	+	+	+	+	+	+	.	.	0	0	0	00000	
8	0000	0	.	+	+	.01	.03	.05	.04	.02	+	+	.	.	0	0	00000	
9	0000	.	.	+	.01	.06	.18	.29	.24	.10	.02	+	+	.	0	0	00000	
10	0000	.	+	+	.02	.16	.48	.79	.65	.27	.06	+	+	.	.	0	00000	
11	0000	.	+	+	.03	.22	.68	1.1	.92	.38	.08	.01	+	.	.	0	00000	
12	0000	.	+	+	.02	.16	.48	.79	.65	.27	.06	+	+	.	.	0	00000	
13	0000	.	.	+	.01	.06	.18	.29	.24	.10	.02	+	+	.	0	0	00000	
14	0000	0	.	+	+	.01	.03	.05	.04	.02	+	+	.	.	0	0	00000	
15	0000	0	.	.	+	+	+	+	+	+	+	.	.	0	0	0	00000	
16	0000	0	0	.	.	+	+	+	+	+	.	.	0	0	0	0	00000	
17	0000	0	0	0	.	.	.	.	.	.	.	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000000																	

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)

M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 00000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 6 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 7 0000    0    0    0    0    0    0    0    .    0    0    0    0    0    0    0    00000
 8 0000    0    0    0    0    .    .    +    +    .    .    0    0    0    0    0    00000
 9 0000    0    0    0    0    .    +  .01  .01    +    +    .    0    0    0    0    00000
10 0000    0    0    0    .    +  .02  .19  .28  .05    +    .    0    0    0    0    00000
11 0000    0    0    0    .    +  .05  .55  .83  .15    +    .    0    0    0    0    00000
12 0000    0    0    0    .    +  .02  .19  .28  .05    +    .    0    0    0    0    00000
13 0000    0    0    0    0    .    +  .01  .01    +    +    .    0    0    0    0    00000
14 0000    0    0    0    0    .    .    +    +    .    .    0    0    0    0    0    00000
15 0000    0    0    0    0    0    0    0    .    0    0    0    0    0    0    0    00000
16 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
19 00000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  7 0000   0   0   0   0   0   0   0   0   .   .   .   .   .   0   0   00000
  8 0000   0   0   0   0   0   0   0   .   .   +   +   +   +   .   0   00000
  9 0000   0   0   0   0   0   0   0   .   + .01 .05 .04   +   +   .   00000
 10 0000   0   0   0   0   0   0   .   + .01 .17 .58 .41 .06   +   .   00000
 11 0000   0   0   0   0   0   0   .   + .02 .37 1.3 .93 .13   +   .   .0000
 12 0000   0   0   0   0   0   0   .   + .01 .17 .58 .41 .06   +   .   00000
 13 0000   0   0   0   0   0   0   0   .   + .01 .05 .04   +   +   .   00000
 14 0000   0   0   0   0   0   0   0   .   .   +   +   +   +   .   0   00000
 15 0000   0   0   0   0   0   0   0   0   .   .   .   .   .   0   0   00000
 16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001   0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 0000000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 6 0000    0    0    0    0    0    0    0    0    0    .    .    .    .    .    0    00000
 7 0000    0    0    0    0    0    0    0    0    .    .    +    +    +    .    .    00000
 8 0000    0    0    0    0    0    0    0    .    +    +    +  .01    +    +    +    .0000
 9 0000    0    0    0    0    0    0    .    .    +  .01  .09  .19  .11  .02    +    .0000
10 0000    0    0    0    0    0    0    .    +    +  .08  .55  1.1  .70  .13    +    +0000
11 0000    0    0    0    0    0    0    .    +    +  .15  1.0  2.2  1.2  .23  .01    +0000
12 0000    0    0    0    0    0    0    .    +    +  .08  .55  1.1  .70  .13    +    +0000
13 0000    0    0    0    0    0    0    .    .    +  .01  .09  .19  .11  .02    +    .0000
14 0000    0    0    0    0    0    0    0    .    +    +    +  .01    +    +    +    .0000
15 0000    0    0    0    0    0    0    0    0    .    .    +    +    +    .    .    00000
16 0000    0    0    0    0    0    0    0    0    0    .    .    .    .    .    0    00000
17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
19 0000000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

B1DB

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M	N= 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
7	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
8	0000	0	0	.	.	+	+	.	.	0	0	0	0	0	0	0	00000	
9	0000	0	0	.	+	.01	.01	+	.	.	0	0	0	0	0	0	00000	
10	0000	0	.	+	.03	.24	.25	.03	+	.	0	0	0	0	0	0	00000	
11	0000	0	.	+	.08	.68	.73	.10	+	.	0	0	0	0	0	0	00000	
12	0000	0	.	+	.03	.24	.25	.03	+	.	0	0	0	0	0	0	00000	
13	0000	0	0	.	+	.01	.01	+	.	.	0	0	0	0	0	0	00000	
14	0000	0	0	.	.	+	+	.	.	0	0	0	0	0	0	0	00000	
15	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000000000																	

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)

M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   .   .   .   .   .   0   0   0   0   0   0   00000
 8 0000   0   0   0   .   +   +   +   +   +   .   0   0   0   0   0   00000
 9 0000   0   0   .   +   + .02 .06 .03   +   +   .   0   0   0   0   00000
10 0000   0   0   .   + .02 .27 .62 .29 .03   +   .   0   0   0   0   00000
11 0000   0   0   .   + .05 .59 1.4 .65 .06   +   .   0   0   0   0   00000
12 0000   0   0   .   + .02 .27 .62 .29 .03   +   .   0   0   0   0   00000
13 0000   0   0   .   +   + .02 .06 .03   +   +   .   0   0   0   0   00000
14 0000   0   0   0   .   +   +   +   +   +   .   0   0   0   0   0   00000
15 0000   0   0   0   0   .   .   .   .   .   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   .   .   .   .   .   0   0   0   00000
 7 0000   0   0   0   0   0   0   .   .   +   +   +   .   .   0   0   00000
 8 0000   0   0   0   0   0   .   +   +   + .01   +   +   +   .   0   00000
 9 0000   0   0   0   0   .   .   + .01 .10 .19 .11 .02   +   .   .   00000
10 0000   0   0   0   0   .   +   + .09 .60 1.1 .65 .11   +   +   .   00000
11 0000   0   0   0   0   .   +   + .17 1.1 2.2 1.2 .20 .01   +   .   00000
12 0000   0   0   0   0   .   +   + .09 .60 1.1 .65 .11   +   +   .   00000
13 0000   0   0   0   0   .   .   + .01 .10 .19 .11 .02   +   .   .   00000
14 0000   0   0   0   0   0   .   +   +   + .01   +   +   +   .   0   00000
15 0000   0   0   0   0   0   0   .   .   +   +   +   .   .   0   0   00000
16 0000   0   0   0   0   0   0   0   .   .   .   .   .   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

BF1

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)

 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0     00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0     00000
  5 0000    0    .    .    .    .    .    .    0    0    0    0    0    0    0    0     00000
  6 0000    .    .    +    +    +    +    .    .    0    0    0    0    0    0    0     00000
  7 0000    +    +    +    +    +    +    +    .    .    0    0    0    0    0    0     00000
  8 0000    +    +  .01  .02  .02  .01    +    +    .    .    0    0    0    0    0     00000
  9 0000    +  .02  .08  .14  .12  .05  .01    +    +    .    0    0    0    0    0     00000
 10 0000  .01  .07  .23  .40  .35  .15  .03    +    +    .    0    0    0    0    0     00000
 11 0000  .01  .10  .33  .60  .50  .21  .05    +    +    .    .    0    0    0    0     00000
 12 0000  .01  .07  .23  .40  .35  .15  .03    +    +    .    0    0    0    0    0     00000
 13 0000    +  .02  .08  .14  .12  .05  .01    +    +    .    0    0    0    0    0     00000
 14 0000    +    +  .01  .02  .02  .01    +    +    .    .    0    0    0    0    0     00000
 15 0000    +    +    +    +    +    +    +    .    .    0    0    0    0    0    0     00000
 16 0000    .    .    +    +    +    +    .    .    0    0    0    0    0    0    0     00000
 17 0000    0    .    .    .    .    .    .    0    0    0    0    0    0    0    0     00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0     00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

```
    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000        (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0    00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0    00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0    00000
  6 0000   0   0   0   .   .   .   0   0   0   0   0   0   0   0   0    00000
  7 0000   0   .   .   +   +   .   .   0   0   0   0   0   0   0   0    00000
  8 0000   .   +   +   +   +   +   +   .   0   0   0   0   0   0   0    00000
  9 0000   +   + .03 .09 .08 .02   +   +   .   0   0   0   0   0   0    00000
 10 0000   + .02 .18 .51 .45 .13 .01   +   .   0   0   0   0   0   0    00000
 11 0000   + .04 .32 .92 .84 .23 .02   +   .   0   0   0   0   0   0    00000
 12 0000   + .02 .18 .51 .45 .13 .01   +   .   0   0   0   0   0   0    00000
 13 0000   +   + .03 .09 .08 .02   +   +   .   0   0   0   0   0   0    00000
 14 0000   .   +   +   +   +   +   +   .   0   0   0   0   0   0   0    00000
 15 0000   0   .   .   +   +   .   .   0   0   0   0   0   0   0   0    00000
 16 0000   0   0   0   .   .   .   0   0   0   0   0   0   0   0   0    00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0    00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0    00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

c

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    .    .    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
 6 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0   00000
 7 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   00000
 8 0000    0    0    0    .    +    +    +  .02  .04  .04  .02    +    +    +    .   .0000
 9 0000    0    0    .    .    +    +  .03  .09  .15  .15  .09  .03    +    +    .   .0000
10 0000    0    0    .    +    +  .01  .07  .20  .36  .36  .20  .06  .01    +    +   .0000
11 0000    0    0    .    +    +  .01  .09  .27  .49  .50  .26  .09  .01    +    +   .0000
12 0000    0    0    .    +    +  .01  .07  .20  .36  .36  .20  .06  .01    +    +   .0000
13 0000    0    0    .    .    +    +  .03  .09  .15  .15  .09  .03    +    +    .   .0000
14 0000    0    0    0    .    +    +    +  .02  .04  .04  .02    +    +    +    .   .0000
15 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   00000
16 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0   00000
17 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
18 0000    0    0    0    0    0    0    0    0    .    .    0    0    0    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

C1

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
  3 OOOO    0    0    0    0    0    0    0    0    .    .    0    0    0    0    0   OOOOO
  4 OOOO    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   OOOOO
  5 OOOO    0    0    0    .    .    .    +    +    +    +    +    .    .    .    0   OOOOO
  6 OOOO    0    0    .    .    .    +    +    +    +    +    +    +    +    .    .   OOOOO
  7 OOOO    0    0    .    .    +    +    +  .01  .01  .01    +    +    +    +    .   .OOOO
  8 OOOO    0    .    .    +    +    +  .02  .04  .05  .05  .03  .01    +    +    .   .OOOO
  9 OOOO    0    .    .    +    +  .02  .06  .12  .16  .14  .08  .03    +    +    +   .OOOO
 10 OOOO    0    .    +    +    +  .03  .10  .22  .30  .27  .16  .06  .01    +    +   .OOOO
 11 OOOO    0    .    +    +  .01  .04  .13  .27  .39  .35  .20  .07  .02    +    +   .OOOO
 12 OOOO    0    .    +    +    +  .03  .10  .22  .30  .27  .16  .06  .01    +    +   .OOOO
 13 OOOO    0    .    .    +    +  .02  .06  .12  .16  .14  .08  .03    +    +    +   .OOOO
 14 OOOO    0    .    .    +    +    +  .02  .04  .05  .05  .03  .01    +    +    .   .OOOO
 15 OOOO    0    0    .    .    +    +    +  .01  .01  .01    +    +    +    +    .   .OOOO
 16 OOOO    0    0    .    .    .    +    +    +    +    +    +    +    +    .    .   OOOOO
 17 OOOO    0    0    0    .    .    .    +    +    +    +    +    .    .    .    0   OOOOO
 18 OOOO    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   OOOOO
 19 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)

M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
 3 0000   0   0   0   .   .   .   .   .   .   .   .   .   .   .   0   00000
 4 0000   0   0   .   .   .   .   +   +   +   +   +   .   .   .   .   00000
 5 0000   0   .   .   .   +   +   +   +   +   +   +   +   +   .   .   .0000
 6 0000   0   .   .   +   +   +   +   +   +   +   +   +   +   +   .   .0000
 7 0000   .   .   +   +   +   + .01 .02 .02 .02 .01   +   +   +   +   .0000
 8 0000   .   .   +   +   + .01 .03 .05 .07 .06 .04 .02   +   +   +   .0000
 9 0000   .   +   +   + .01 .03 .07 .12 .15 .13 .08 .04 .01   +   +   +0000
10 0000   .   +   +   + .01 .05 .11 .19 .24 .21 .14 .06 .02   +   +   +0000
11 0000   .   +   +   + .02 .06 .13 .23 .28 .25 .16 .07 .02   +   +   +0000
12 0000   .   +   +   + .01 .05 .11 .19 .24 .21 .14 .06 .02   +   +   +0000
13 0000   .   +   +   + .01 .03 .07 .12 .15 .13 .08 .04 .01   +   +   +0000
14 0000   .   .   +   +   + .01 .03 .05 .07 .06 .04 .02   +   +   +   .0000
15 0000   .   .   +   +   +   + .01 .02 .02 .02 .01   +   +   +   +   .0000
16 0000   0   .   .   +   +   +   +   +   +   +   +   +   +   +   .   .0000
17 0000   0   .   .   .   +   +   +   +   +   +   +   +   +   .   .   .0000
18 0000   0   0   .   .   .   .   +   +   +   +   +   .   .   .   .   00000
19 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO

     *** RUN COMPLETED ***
```

C3

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,  2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000        (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   .   .   .   .   +   +   +   +   +   +   +   +   +   .   .  .0000
  4 0000   .   .   .   +   +   +   +   +   +   +   +   +   +   +   .  .0000
  5 0000   .   .   +   +   +   +   +   +   +   +   +   +   +   +   +  .0000
  6 0000   .   +   +   +   +   + .01 .01 .01 .01 .01   +   +   +   +  +0000
  7 0000   .   +   +   +   + .01 .02 .03 .03 .03 .02 .01   +   +   +  +0000
  8 0000   +   +   +   + .01 .02 .04 .06 .07 .06 .05 .03 .01   +   +  +0000
  9 0000   +   +   + .01 .02 .04 .07 .10 .11 .11 .08 .05 .02 .01   +  +0000
 10 0000   +   +   + .01 .03 .06 .10 .14 .16 .15 .11 .07 .03 .01   +  +0000
 11 0000   +   +   + .01 .03 .06 .11 .16 .18 .16 .12 .07 .04 .01   +  +0000
 12 0000   +   +   + .01 .03 .06 .10 .14 .16 .15 .11 .07 .03 .01   +  +0000
 13 0000   +   +   + .01 .02 .04 .07 .10 .11 .11 .08 .05 .02 .01   +  +0000
 14 0000   +   +   +   + .01 .02 .04 .06 .07 .06 .05 .03 .01   +   +  +0000
 15 0000   .   +   +   +   + .01 .02 .03 .03 .03 .02 .01   +   +   +  +0000
 16 0000   .   +   +   +   +   + .01 .01 .01 .01 .01   +   +   +   +  +0000
 17 0000   .   .   +   +   +   +   +   +   +   +   +   +   +   +   +  .0000
 18 0000   .   .   .   +   +   +   +   +   +   +   +   +   +   +   .  .0000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)

M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   .   .   +   +   +   +   +   +   +   +   +   +   +   +   +   .0000
 4 0000   .   +   +   +   +   +   +   +   +   +   +   +   +   +   +   +0000
 5 0000   +   +   +   +   +   +   + .01 .01 .01   +   +   +   +   +   +0000
 6 0000   +   +   +   +   + .01 .01 .02 .02 .02 .01 .01   +   +   +   +0000
 7 0000   +   +   +   + .01 .02 .03 .03 .04 .03 .03 .02 .01   +   +   +0000
 8 0000   +   +   + .01 .02 .03 .04 .06 .06 .06 .05 .03 .02 .01   +   +0000
 9 0000   +   +   + .01 .03 .04 .06 .08 .09 .08 .07 .05 .03 .01   +   +0000
10 0000   +   +   + .02 .03 .05 .08 .10 .11 .11 .08 .06 .03 .02 .01   +0000
11 0000   +   + .01 .02 .03 .06 .09 .11 .12 .12 .09 .06 .04 .02 .01   +0000
12 0000   +   +   + .02 .03 .05 .08 .10 .11 .11 .08 .06 .03 .02 .01   +0000
13 0000   +   +   + .01 .03 .04 .06 .08 .09 .08 .07 .05 .03 .01   +   +0000
14 0000   +   +   + .01 .02 .03 .04 .06 .06 .06 .05 .03 .02 .01   +   +0000
15 0000   +   +   +   + .01 .02 .03 .03 .04 .03 .03 .02 .01   +   +   +0000
16 0000   +   +   +   +   + .01 .01 .02 .02 .02 .01 .01   +   +   +   +0000
17 0000   +   +   +   +   +   +   + .01 .01 .01   +   +   +   +   +   +0000
18 0000   .   +   +   +   +   +   +   +   +   +   +   +   +   +   +   +0000
19 000000000000000000000000000000000000000000000000000000000000000000000000

    *** RUN COMPLETED ***
```

CF1

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 0000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    .    .    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
 6 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0   00000
 7 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   00000
 8 0000    0    0    0    .    +    +    +  .02  .04  .04  .02    +    +    +    .   .0000
 9 0000    0    0    .    .    +    +  .03  .09  .15  .15  .09  .03    +    +    .   .0000
10 0000    0    0    .    +    +  .01  .07  .20  .36  .35  .20  .07  .01    +    +   .0000
11 0000    0    0    .    +    +  .01  .09  .27  .49  .49  .27  .09  .01    +    +   .0000
12 0000    0    0    .    +    +  .01  .07  .20  .36  .35  .20  .07  .01    +    +   .0000
13 0000    0    0    .    .    +    +  .03  .09  .15  .15  .09  .03    +    +    .   .0000
14 0000    0    0    0    .    +    +    +  .02  .04  .04  .02    +    +    +    .   .0000
15 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   00000
16 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0   00000
17 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
18 0000    0    0    0    0    0    0    0    0    .    .    0    0    0    0    0   00000
19 0000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    .    .    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
 5 0000    0    0    0    0    .    .    .    +    +    +    +    .    .    .    .   00000
 6 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   .0000
 7 0000    0    0    .    .    +    +    +    +  .01  .01    +    +    +    +    .   .0000
 8 0000    0    .    .    +    +    +  .01  .03  .05  .05  .03  .01    +    +    +   .0000
 9 0000    0    .    .    +    +  .01  .04  .10  .15  .15  .10  .04  .01    +    +   .0000
10 0000    0    .    .    +    +  .02  .08  .19  .29  .29  .19  .08  .02    +    +   .0000
11 0000    0    .    .    +    +  .03  .10  .23  .36  .37  .24  .10  .03    +    +   .0000
12 0000    0    .    .    +    +  .02  .08  .19  .29  .29  .19  .08  .02    +    +   .0000
13 0000    0    .    .    +    +  .01  .04  .10  .15  .15  .10  .04  .01    +    +   .0000
14 0000    0    .    .    +    +    +  .01  .03  .05  .05  .03  .01    +    +    +   .0000
15 0000    0    0    .    .    +    +    +    +  .01  .01    +    +    +    +    .   .0000
16 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   .0000
17 0000    0    0    0    0    .    .    .    +    +    +    +    .    .    .    .   00000
18 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

CF3

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 2400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 19
2	000000000000000000000000000000000000000000000000000000000000000000000000																
3	0000	.	.	.	+	+	+	+	+	+	+	+	+	+	+	.	.0000
4	0000	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+0000
5	0000	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+0000
6	0000	+	+	+	+	+	+	.01	.01	.01	.01	.01	.01	+	+	+	+0000
7	0000	+	+	+	+	+	.01	.02	.03	.03	.03	.03	.02	.01	+	+	+0000
8	0000	+	+	+	+	.01	.03	.04	.06	.06	.06	.05	.03	.02	.01	+	+0000
9	0000	+	+	+	.01	.02	.04	.06	.09	.10	.10	.08	.05	.03	.01	+	+0000
10	0000	+	+	+	.01	.03	.05	.08	.12	.13	.13	.10	.07	.04	.02	.01	+0000
11	0000	+	+	+	.01	.03	.06	.09	.13	.15	.14	.11	.08	.04	.02	.01	+0000
12	0000	+	+	+	.01	.03	.05	.08	.12	.13	.13	.10	.07	.04	.02	.01	+0000
13	0000	+	+	+	.01	.02	.04	.06	.09	.10	.10	.08	.05	.03	.01	+	+0000
14	0000	+	+	+	+	.01	.03	.04	.06	.06	.06	.05	.03	.02	.01	+	+0000
15	0000	+	+	+	+	+	.01	.02	.03	.03	.03	.03	.02	.01	+	+	+0000
16	0000	+	+	+	+	+	+	.01	.01	.01	.01	.01	.01	+	+	+	+0000
17	0000	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+0000
18	0000	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+0000
19	000000000000000000000000000000000000000000000000000000000000000000000000																

*** RUN COMPLETED ***

H

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 8 0000   0   0   0   0   0   0   .   .   .   .   0   0   0   0   0   00000
 9 0000   0   0   0   0   0   .   +   +   +   +   .   0   0   0   0   00000
10 0000   0   0   0   0   .   + .05 .22 .10   +   .   .   0   0   0   00000
11 0000   0   0   0   0   .   + .16 .80 .32 .01   +   .   0   0   0   00000
12 0000   0   0   0   0   .   + .05 .22 .10   +   .   .   0   0   0   00000
13 0000   0   0   0   0   0   .   +   +   +   +   .   0   0   0   0   00000
14 0000   0   0   0   0   0   0   .   .   .   .   0   0   0   0   0   00000
15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

H1

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  4 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  5 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  6 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  7 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  8 0000     0    0    0    0    0    0    0    0    0    .    .    .    .    0    0   00000
  9 0000     0    0    0    0    0    0    0    0    .    +    +    +    +    .    0   00000
 10 0000     0    0    0    0    0    0    0    .    +  .06  .22  .09    +    .    0   00000
 11 0000     0    0    0    0    0    0    0    .    +  .18  .81  .28  .01    .    0   00000
 12 0000     0    0    0    0    0    0    0    .    +  .06  .22  .09    +    .    0   00000
 13 0000     0    0    0    0    0    0    0    0    .    +    +    +    +    .    0   00000
 14 0000     0    0    0    0    0    0    0    0    0    .    .    .    .    0    0   00000
 15 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 16 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 17 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 18 0000     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 00000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 6 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 7 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 8 0000    0    0    0    0    0    0    0    0    0    0    0    0    .    .    .    .0000
 9 0000    0    0    0    0    0    0    0    0    0    0    0    .    +    +    +    +0000
10 0000    0    0    0    0    0    0    0    0    0    0    .    +  .06  .22  .09    +0000
11 0000    0    0    0    0    0    0    0    0    0    0    .    +  .18  .81  .28  .010000
12 0000    0    0    0    0    0    0    0    0    0    0    .    +  .06  .22  .09    +0000
13 0000    0    0    0    0    0    0    0    0    0    0    0    .    +    +    +    +0000
14 0000    0    0    0    0    0    0    0    0    0    0    0    0    .    .    .    .0000
15 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
16 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
19 00000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000         (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  8 0000   0   0   0   0   0   0   0   0   0   0   0   0   .   .   .   .0000
  9 0000   0   0   0   0   0   0   0   0   0   0   0   .   +   +   +   +0000
 10 0000   0   0   0   0   0   0   0   0   0   0   .   + .06 .22 .08   +0000
 11 0000   0   0   0   0   0   0   0   0   0   0   .   + .19 .82 .26 .010000
 12 0000   0   0   0   0   0   0   0   0   0   0   .   + .06 .22 .08   +0000
 13 0000   0   0   0   0   0   0   0   0   0   0   0   .   +   +   +   +0000
 14 0000   0   0   0   0   0   0   0   0   0   0   0   0   .   .   .   .0000
 15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 8 0000   0   .   .   .   .   0   0   0   0   0   0   0   0   0   0   00000
 9 0000   .   +   +   +   +   .   0   0   0   0   0   0   0   0   0   00000
10 0000   + .01 .14 .20 .03   +   .   0   0   0   0   0   0   0   0   00000
11 0000   + .03 .44 .71 .09   +   .   0   0   0   0   0   0   0   0   00000
12 0000   + .01 .14 .20 .03   +   .   0   0   0   0   0   0   0   0   00000
13 0000   .   +   +   +   +   .   0   0   0   0   0   0   0   0   0   00000
14 0000   0   .   .   .   .   0   0   0   0   0   0   0   0   0   0   00000
15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

HA

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000        (LEGEND... + = .LT. .01   . =
.LT. .0001   0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  7 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  8 0000  0   0   0   0   0   .   .   .   .   .   0   0   0   0   0   00000
  9 0000  0   0   0   0   0   .   +   +   +   +   .   0   0   0   0   00000
 10 0000  0   0   0   0   .   + .05 .23 .11   +   +   .   0   0   0   00000
 11 0000  0   0   0   0   .   + .16 .73 .34 .02   +   .   0   0   0   00000
 12 0000  0   0   0   0   .   + .05 .23 .11   +   +   .   0   0   0   00000
 13 0000  0   0   0   0   0   .   +   +   +   +   .   0   0   0   0   00000
 14 0000  0   0   0   0   0   .   .   .   .   .   0   0   0   0   0   00000
 15 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 16 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 17 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000

     *** RUN COMPLETED ***
```

H1A

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
 3 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
 4 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
 5 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
 6 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
 7 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
 8 OOOO     0    0    0    0    0    0    0    0    .    .    .    .    .    0    0   OOOOO
 9 OOOO     0    0    0    0    0    0    0    0    .    +    +    +    +    .    0   OOOOO
10 OOOO     0    0    0    0    0    0    0    .    +  .05  .23  .11    +    +    .   OOOOO
11 OOOO     0    0    0    0    0    0    0    .    +  .16  .73  .34  .02    +    .   OOOOO
12 OOOO     0    0    0    0    0    0    0    .    +  .05  .23  .11    +    +    .   OOOOO
13 OOOO     0    0    0    0    0    0    0    0    .    +    +    +    +    .    0   OOOOO
14 OOOO     0    0    0    0    0    0    0    0    .    .    .    .    .    0    0   OOOOO
15 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
16 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
17 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
18 OOOO     0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   OOOOO
19 OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

*** RUN COMPLETED ***

H2A

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  8 0000   0   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .0000
  9 0000   0   0   0   0   0   0   0   0   0   0   .   +   +   +   +   +0000
 10 0000   0   0   0   0   0   0   0   0   0   0   .   + .06 .24 .09   +0000
 11 0000   0   0   0   0   0   0   0   0   0   0   .   + .20 .76 .27 .010000
 12 0000   0   0   0   0   0   0   0   0   0   0   .   + .06 .24 .09   +0000
 13 0000   0   0   0   0   0   0   0   0   0   0   .   +   +   +   +   +0000
 14 0000   0   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .0000
 15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

H3A

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,    4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
   2 000000000000000000000000000000000000000000000000000000000000000000000000
   3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
   4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
   5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
   6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
   7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
   8 0000   0   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .0000
   9 0000   0   0   0   0   0   0   0   0   0   0   .   +   +   +   +   +0000
  10 0000   0   0   0   0   0   0   0   0   0   0   .   + .07 .24 .08   +0000
  11 0000   0   0   0   0   0   0   0   0   0   0   .   + .21 .76 .26 .010000
  12 0000   0   0   0   0   0   0   0   0   0   0   .   + .07 .24 .08   +0000
  13 0000   0   0   0   0   0   0   0   0   0   0   .   +   +   +   +   +0000
  14 0000   0   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .0000
  15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   .   .   0   0   0   0   0   0   0   0   0   0   0   00000
 8 0000   .   .   +   +   .   .   0   0   0   0   0   0   0   0   0   00000
 9 0000   .   +   + .01   +   +   .   0   0   0   0   0   0   0   0   00000
10 0000   + .01 .16 .20 .03   +   .   0   0   0   0   0   0   0   0   00000
11 0000   + .04 .44 .58 .09   +   .   0   0   0   0   0   0   0   0   00000
12 0000   + .01 .16 .20 .03   +   .   0   0   0   0   0   0   0   0   00000
13 0000   .   +   + .01   +   +   .   0   0   0   0   0   0   0   0   00000
14 0000   .   .   +   +   .   .   0   0   0   0   0   0   0   0   0   00000
15 0000   0   0   .   .   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  5 0000    0    0    0    0    0    0    0    .    0    0    0    0    0    0    0    00000
  6 0000    0    0    0    0    0    .    .    .    .    .    .    0    0    0    0    00000
  7 0000    0    0    0    .    .    .    +    +    +    +    .    .    .    0    0    00000
  8 0000    0    0    0    .    +    +    +    +    +    +    +    .    .    0    0    00000
  9 0000    0    0    .    .    +    +  .02  .04  .03  .01    +    +    .    .    0    00000
 10 0000    0    0    .    +    +  .02  .09  .17  .13  .04    +    +    .    .    0    00000
 11 0000    0    0    .    +    +  .03  .15  .28  .21  .07  .01    +    .    .    0    00000
 12 0000    0    0    .    +    +  .02  .09  .17  .13  .04    +    +    .    .    0    00000
 13 0000    0    0    .    .    +    +  .02  .04  .03  .01    +    +    .    .    0    00000
 14 0000    0    0    0    .    +    +    +    +    +    +    +    .    .    0    0    00000
 15 0000    0    0    0    .    .    .    +    +    +    +    .    .    .    0    0    00000
 16 0000    0    0    0    0    0    .    .    .    .    .    .    0    0    0    0    00000
 17 0000    0    0    0    0    0    0    0    .    0    0    0    0    0    0    0    00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

H1B

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M	N= 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	000000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	.	.	.	.	.	.	.	0	00000	
7	0000	0	0	0	0	0	0	.	.	+	+	+	+	+	.	.	00000	
8	0000	0	0	0	0	0	.	.	+	+	+	+	+	+	+	.	.0000	
9	0000	0	0	0	0	0	.	+	+	+	.03	.05	.03	.01	+	+	.0000	
10	0000	0	0	0	0	0	.	+	+	.03	.11	.18	.12	.03	+	+	.0000	
11	0000	0	0	0	0	0	.	+	+	.04	.17	.28	.19	.05	+	+	.0000	
12	0000	0	0	0	0	0	.	+	+	.03	.11	.18	.12	.03	+	+	.0000	
13	0000	0	0	0	0	0	.	+	+	+	.03	.05	.03	.01	+	+	.0000	
14	0000	0	0	0	0	0	.	.	+	+	+	+	+	+	+	.	.0000	
15	0000	0	0	0	0	0	0	.	.	+	+	+	+	+	.	.	00000	
16	0000	0	0	0	0	0	0	0	.	.	.	.	.	.	.	0	00000	
17	0000	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	000000000000000000000000000000000000000000000000000000000000000000000000																	

*** RUN COMPLETED ***

H2B

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000        (LEGEND... + = .LT. .01   . =
.LT. .0001    0 = .LT. .000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   .   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .   .0000
 7 0000   0   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +0000
 8 0000   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +   +0000
 9 0000   0   0   0   0   0   0   0   0   .   +   +   + .03 .05 .03 .010000
10 0000   0   0   0   0   0   0   0   0   .   +   + .03 .11 .18 .12 .030000
11 0000   0   0   0   0   0   0   0   0   .   +   + .04 .17 .28 .19 .050000
12 0000   0   0   0   0   0   0   0   0   .   +   + .03 .11 .18 .12 .030000
13 0000   0   0   0   0   0   0   0   0   .   +   +   + .03 .05 .03 .010000
14 0000   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +   +0000
15 0000   0   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +0000
16 0000   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .   .0000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   .   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .   .0000
  7 0000   0   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +0000
  8 0000   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +   +0000
  9 0000   0   0   0   0   0   0   0   0   .   +   +   + .03 .05 .03 .010000
 10 0000   0   0   0   0   0   0   0   0   .   +   + .03 .11 .18 .12 .030000
 11 0000   0   0   0   0   0   0   0   0   .   +   + .04 .17 .28 .18 .050000
 12 0000   0   0   0   0   0   0   0   0   .   +   + .03 .11 .18 .12 .030000
 13 0000   0   0   0   0   0   0   0   0   .   +   +   + .03 .05 .03 .010000
 14 0000   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +   +0000
 15 0000   0   0   0   0   0   0   0   0   0   .   .   +   +   +   +   +0000
 16 0000   0   0   0   0   0   0   0   0   0   0   .   .   .   .   .   .0000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

H4B

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000         (LEGEND... + = .LT. .01    . =
.LT. .0001    0 = .LT. .000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   .   .   .   .   .   .   0   0   0   0   0   0   0   0   0   00000
  7 0000   .   +   +   +   +   .   .   0   0   0   0   0   0   0   0   00000
  8 0000   +   +   +   +   +   +   +   .   0   0   0   0   0   0   0   00000
  9 0000   + .01 .04 .04 .02   +   +   .   .   0   0   0   0   0   0   00000
 10 0000 .01 .05 .14 .16 .07 .01   +   +   .   0   0   0   0   0   0   00000
 11 0000 .01 .08 .22 .24 .11 .02   +   +   .   0   0   0   0   0   0   00000
 12 0000 .01 .05 .14 .16 .07 .01   +   +   .   0   0   0   0   0   0   00000
 13 0000   + .01 .04 .04 .02   +   +   .   .   0   0   0   0   0   0   00000
 14 0000   +   +   +   +   +   +   +   .   0   0   0   0   0   0   0   00000
 15 0000   .   +   +   +   +   .   .   0   0   0   0   0   0   0   0   00000
 16 0000   .   .   .   .   .   .   0   0   0   0   0   0   0   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
```

```
    *** RUN COMPLETED ***
```

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM, 6600.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	.	.	.	.	.	.	0	0	0	0	0	0	0	00000	
6	0000	0	.	.	.	+	+	.	.	.	0	0	0	0	0	0	00000	
7	0000	.	.	+	+	+	+	+	+	.	.	0	0	0	0	0	00000	
8	0000	.	+	+	.01	.02	.01	+	+	+	.	.	0	0	0	0	00000	
9	0000	+	+	.01	.05	.10	.09	.04	.01	+	+	.	0	0	0	0	00000	
10	0000	+	+	.04	.15	.28	.26	.12	.03	+	+	.	0	0	0	0	00000	
11	0000	+	+	.06	.21	.39	.37	.17	.04	+	+	.	.	0	0	0	00000	
12	0000	+	+	.04	.15	.28	.26	.12	.03	+	+	.	0	0	0	0	00000	
13	0000	+	+	.01	.05	.10	.09	.04	.01	+	+	.	0	0	0	0	00000	
14	0000	.	+	+	.01	.02	.01	+	+	+	.	.	0	0	0	0	00000	
15	0000	.	.	+	+	+	+	+	+	.	.	0	0	0	0	0	00000	
16	0000	0	.	.	.	+	+	.	.	.	0	0	0	0	0	0	00000	
17	0000	0	0	.	.	.	.	.	.	0	0	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000000																	

*** RUN COMPLETED ***

Appendix B3

Complete STFATE Output Files

APPENDIX B3

COMPLETE STFATE OUTPUT FILES

```
MODEL:  SHORT-TERM FATE OF DREDGED MATERIAL FROM SPLIT HULL BARGE OR HOPPER DREDGE
                (PC Version 5.01  MAY, 1993)


TITLE:   B1


FILE:    B1       .DUE


AREA:    THE PROJECT AREA IS DESCRIBED BY A 20 X 20 GRID.

         THERE ARE 20 GRID POINTS (NMAX) IN THE Z-DIRECTION (FROM LEFT TO RIGHT)
           AND 20 GRID POINTS (MMAX) IN THE X-DIRECTION (FROM TOP TO BOTTOM).


EXECUTION PARAMETERS:

         MODEL COEFFICIENTS SPECIFIED IN INPUT DATA (KEY1 = 1).

         PERFORM COMPLETE ANALYSIS INCLUDING DESCENT, COLLAPSE, AND TRANSPORT-DIFFUSION (KEY2 = 0).

         NO CONTAMINANT OR TRACER TRANSPORT-DIFFUSION COMPUTIONS DESIRED (KEY3 = 0).

         PRINTING OF CONVECTIVE DESCENT RESULTS NOT REQUESTED (IPCN = 0).

         PRINTING OF CONVECTIVE DESCENT RESULTS NOT REQUESTED (IPCN = 0).

         PRINTING OF DYNAMIC COLLAPSE RESULTS NOT REQUESTED (IPCL = 0).

         QUARTERLY PRINTING OF LONG-TERM TRANSPORT DIFFUSION RESULTS REQUESTED (IPLT = 0).

         LONG-TERM TRANSPORT DIFFUSION RESULTS REQUESTED AT THE FOLLOWING 1 DEPTH(S):
               0.00 FT


GRID:    NUMBER OF LONG TERM GRID POINTS IN Z-DIRECTION (NMAX) = 20
```

NUMBER OF LONG TERM GRID POINTS IN X-DIRECTION (MMAX) = 20

GRID SPACING IN Z-DIRECTION (DZ) = 100.00000 FT

GRID SPACING IN X-DIRECTION (DX) = 100.00000 FT

CONSTANT DEPTH GRID SPECIFIED HAVING A DEPTH (DEPC) OF 140.00000 FT.

DEPTH GRID, FEET:

M N =	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
2	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
3	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
4	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
5	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
6	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
7	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
8	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
9	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
10	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
11	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
12	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
13	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
14	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
15	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
16	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
17	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
18	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
19	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.	140.

```
 20    140.   140.   140.   140.   140.   140.   140.   140.   140.   140.   140.   140.   140.   140.
140.   140.   140.
```

—

```
 M N =18      19     20
  1    140.   140.   140.
  2    140.   140.   140.
  3    140.   140.   140.
  4    140.   140.   140.
  5    140.   140.   140.
  6    140.   140.   140.
  7    140.   140.   140.
  8    140.   140.   140.
  9    140.   140.   140.
 10    140.   140.   140.
 11    140.   140.   140.
 12    140.   140.   140.
 13    140.   140.   140.
 14    140.   140.   140.
 15    140.   140.   140.
 16    140.   140.   140.
 17    140.   140.   140.
 18    140.   140.   140.
 19    140.   140.   140.
 20    140.   140.   140.
```

—

```
 CODED GRID:

          RANGE OF N IS   1 TO  20

           X X X X X X X X X X X X X X X X X X X X
           X O O O O O O O O O O O O O O O O O O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W D W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
```

```
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O O O O O O O O O O O O O O O O O O X
X X X X X X X X X X X X X X X X X X X X
```

```
LEGEND FOR CODED GRID:  W = WATER POINT
                        L = LAND POINT
                        O = OPEN BOUNDARY
                        B = DISPOSAL SITE BOUNDARY
                        D = DUMP LOCATION
                        X = DUMMY POINT
```

NUMBER OF GRID POINTS WITHIN ESTUARY = 256

DISPOSAL LOCATION:

THE DUMP LOCATION IS 1000. FT (XBARGE) OR ABOUT GRID POINT #11 FROM THE TOP OF THE GRID

AND 500.0 FT (ZBARGE) OR ABOUT GRID POINT # 6 FROM THE LEFT EDGE OF THE GRID.

THE BOTTOM SLOPE IN THE X-DIRECTION AT THE DUMP SITE (SLOPEX, POSITIVE IF DEPTH INCREASES FROM TOP OF GRID TO BOTTOM OF GRID) IS 0.00 DEGREES.

THE BOTTOM SLOPE IN THE Z-DIRECTION AT THE DUMP SITE (SLOPEZ, POSITIVE IF DEPTH INCREASES FROM LEFT SIDE OF GRID TO RIGHT SIDE OF GRID) IS 0.00 DEGREES.

THE DISPOSAL LOCATION IS NOT AT A HOLE OR DEPRESSION. (DHOLE = 0.0)

AMBIENT DENSITY PROFILE:

DEPTH (FT)	DENSITY (G/CC)
30.00	1.0000
60.00	1.0200
140.0	1.0200

COMPUTED DEPTH:

THE DEPTH AT THE DUMP LOCATION WAS INTERPOLATED TO BE 140.0 FT.

VELOCITY DISTRIBUTION:

VERTICALLY AVERAGED X-DIRECTION (VAX = 0.000E+00 FPS) AND
Z-DIRECTION (VAZ = 0.330E-01 FPS) VELOCITIES CONSTRUCTED AT EACH GRID POINT
FROM A SINGLE OBSERVATION AT A DEPTH (D) OF 10.0 FT.

VELOCITY GRID: X-DIRECTION, FPS

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

M N=	18	19	20
1	0.000	0.000	0.000
2	0.000	0.000	0.000
3	0.000	0.000	0.000
4	0.000	0.000	0.000
5	0.000	0.000	0.000
6	0.000	0.000	0.000
7	0.000	0.000	0.000
8	0.000	0.000	0.000
9	0.000	0.000	0.000
10	0.000	0.000	0.000
11	0.000	0.000	0.000
12	0.000	0.000	0.000
13	0.000	0.000	0.000
14	0.000	0.000	0.000
15	0.000	0.000	0.000
16	0.000	0.000	0.000
17	0.000	0.000	0.000
18	0.000	0.000	0.000
19	0.000	0.000	0.000
20	0.000	0.000	0.000

VELOCITY GRID: Z-DIRECTION, FPS

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
2	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
3	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
4	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
5	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
6	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002

7	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
8	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
9	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
10	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
11	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
12	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
13	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
14	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
15	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
16	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
17	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
18	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
19	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
20	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002

M N=	18	19	20
1	0.002	0.002	0.002
2	0.002	0.002	0.002
3	0.002	0.002	0.002
4	0.002	0.002	0.002
5	0.002	0.002	0.002
6	0.002	0.002	0.002
7	0.002	0.002	0.002
8	0.002	0.002	0.002
9	0.002	0.002	0.002
10	0.002	0.002	0.002
11	0.002	0.002	0.002
12	0.002	0.002	0.002
13	0.002	0.002	0.002
14	0.002	0.002	0.002
15	0.002	0.002	0.002
16	0.002	0.002	0.002
17	0.002	0.002	0.002
18	0.002	0.002	0.002

19	0.002	0.002	0.002
20	0.002	0.002	0.002

BOTTOM SHEAR STRESS, LBS/SQ FT:

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

M N=	18	19	20

1	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000

TIME PARAMETERS:

DURATION OF THE DISPOSAL, TREL = 180.00 SECONDS

DURATION OF THE SIMULATION, TSTOP = 4200.00 SECONDS

LONG-TERM TIME STEP USED IN THE SIMULATION, DTL = 300.00 SECONDS

BARGE DESCRIPTION:

LENGTH OF BARGE, BARGL = 60. FT

WIDTH OF BARGE, BARGW = 25. FT

DRAFT OF LOADED BARGE, DREL1 = 15.0 FT

DRAFT OF UNLOADED BARGE, DREL2 = 5.00 FT

MODEL COEFFICIENTS READ FROM INPUT:

TURBULENT THERMAL ENTRAINMENT ALPHA0 = 0.2350

SETTLING COEFFICIENT	BETA	=	0.0000
APPARENT MASS COEFFICIENT	CM	=	1.0000
DRAG COEFFICIENT FOR A SPHERE	CD	=	0.5000
RATIO--CLOUD/AMBIENT DENSITY GRADIENTS	GAMA	=	0.2500
FORM DRAG FOR COLLAPSING CLOUD	CDRAG	=	1.0000
SKIN FRICTION FOR COLLAPSING CLOUD	CFRIC	=	0.0100
DRAG FOR AN ELLIPSOIDAL WEDGE	CD3	=	0.1000
DRAG FOR A PLATE	CD4	=	1.0000
ENTRAINMENT IN COLLAPSE	ALPHAC	=	0.1000
FRICTION BETWEEN CLOUD AND BOTTOM	FRICTN	=	0.0100
4/3 LAW HORIZ. DIFF. DISSIPATION FACTOR	ALAMDA	=	0.0010
UNSTRATIFIED WATER VERT. DIFF. COEF.	AKYO	=	0.0250
STRIPPING COEF. OF FINES DURING CONVERTIVE DESCENT=			0.0030

MATERIAL DESCRIPTION: 2 SOLIDS FRACTIONS

LAYER 1

DESCRIPTION	SPEC. GRAV. OR DENSITY (GM/CC)	VOLUMETRIC CONCENTRATION (VOL/VOL)	FALL VELOCITY (FPS)	DEPOSITIONAL VOID RATIO	CHARACTER
FSAND	2.700	0.5000	0.02000	0.7000	NONCOHESIVE

CRITICAL SHEAR STRESS FOR DEPOSITION = 0.1500E-01 LBS/SQ. FT.

SEDIMENT FRACTION WILL BE STRIPPED DURING CONVECTIVE DESCENT.

SILT	2.650	0.1000	0.01000	4.500	COHESIVE

CRITICAL SHEAR STRESS FOR DEPOSITION = 0.9000E-01 LBS/SQ. FT.

SEDIMENT FRACTION WILL BE STRIPPED DURING CONVECTIVE DESCENT.

DESCRIPTION	SPEC. GRAV. OR DENSITY (GM/CC)	VOLUMETRIC CONCENTRATION (VOL/VOL)
FLUID	1.000	0.4000

DISCHARGE PARAMETERS:

VOLUME OF LAYER 1 = 750.0 CU YD

INITIAL RADIUS OF CLOUD, RB = 21.30373 FT

INITIAL DEPTH OF CLOUD CENTROID, DREL = 17.99 FT

INITIAL CLOUD VELOCITIES...

X-DIRECTION (FROM TOP TO BOTTOM OF GRID), CU(1) = 0.0000E+00 FPS

Y-DIRECTION (FROM SURFACE TO BOTTOM), CV(1) = 0.5556E-01 FPS

Z-DIRECTION (FROM LEFT TO RIGHT OF GRID), CW(1) = 2.000 FPS

BULK PARAMETERS:

BULK DENSITY, ROO = 2.015000 G/CC

AGGREGATE OR BULK VOIDS RATIO, BVOID = 1.333

CONVECTIVE DESCENT PHASE:

IN TRIAL #1 THE DESCENT PHASE TIME STEP (DT) WAS 0.12079319E-02 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) WAS 1200.

THE BOTTOM WAS NOT ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

IN TRIAL #2 THE DESCENT PHASE TIME STEP (DT) WAS 0.36237957E-02 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) WAS 1200.

THE BOTTOM WAS NOT ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

IN TRIAL #3 THE DESCENT PHASE TIME STEP (DT) WAS 0.10871387E-01 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) WAS 649.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

IN TRIAL #4 THE DESCENT PHASE TIME STEP (DT) WAS 0.17638825E-01 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) WAS 400.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

CLOUD COLLAPSE PHASE:

IN TRIAL #1 THE COLLAPSE PHASE TIME STEP (DT) WAS 0.17638825E-01 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) FOR CONVECTIVE DESCENT AND COLAPSE WAS 1199.

THE INTEGRATION TIME STEP NUMBER WHEN THE BED WAS ENCOUNTERED (IBED) WAS 400.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

TIME FROM DISPOSAL	CLOUD CENTROID X-LOCATION	Z-LOCATION	CLOUD X-Z DIAMETER	DEPTH OF TOP OF CLOUD	CLOUD VERT. THICKNESS	T O T A L M A S S	ENTRAINED MASS	TIME STEP WHEN THIS CLOUD	TIME STEP WHEN PREVIOUS CLOUD

```
      (SEC)          (FT)         (FT)         (FT)         (FT)         (FT)       (CU FT)      (CU FT)
WAS CREATED      WAS CREATED

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    1
      182.1         1000.       863.4        50.41       10.000        30.22        112.4      0.0000E+00
120                 1

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    2
      184.2         1000.       864.9        65.27        40.22        35.81        99.16      0.0000E+00
239                120

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    3
      186.3         1000.       865.7        77.53        76.03        29.50        65.34      0.0000E+00
358                239

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    4
      188.4         1000.       866.1        117.7        105.5        20.85        170.2      0.0000E+00
477                400

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    5
      190.5         1000.       866.5        176.1        126.4        11.23        146.7      0.0000E+00
596                477

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    6
      192.6         1000.       866.7        226.2        136.2        3.845        79.32      0.0000E+00
715                596

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    7
      194.7         1000.       866.9        262.4        138.4        1.647        43.55      0.0000E+00
834                715

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    8
      196.8         1000.       867.0        288.1        139.1       0.8601        26.15      0.0000E+00
953                834

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    9
      198.9         1000.       867.0        307.5        139.5       0.5376        17.86      0.0000E+00
1072                953

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =   10
      201.0         1000.       867.0        323.3        139.6       0.3827        13.53      0.0000E+00
1191               1072

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =   11
      201.1         1000.       867.0        324.3        133.4        6.558        9351.      0.0000E+00
1199               1191
```

NOTE -- When all solid material has settled from a cloud, the cloud is erased and the remaining clouds for this solids type are renumbered.

TIME STEP WHEN THIS CLOUD WAS CREATED	TIME FROM DISPOSAL (SEC)	CLOUD CENTROID X-LOCATION (FT)	Z-LOCATION (FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	T O T A L M A S S (CU FT)	ENTRAINED MASS (CU FT)	TIME STEP WHEN PREVIOUS CLOUD WAS CREATED
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 1									
120	182.1	1000.	863.4	50.41	10.000	30.22	22.49	0.0000E+00	1
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 2									
239	184.2	1000.	864.9	65.27	40.22	35.81	19.83	0.0000E+00	120
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 3									
358	186.3	1000.	865.7	77.53	76.03	29.50	13.07	0.0000E+00	239
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 4									
477	188.4	1000.	866.1	117.7	105.5	20.85	34.05	0.0000E+00	400
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 5									
596	190.5	1000.	866.5	176.1	126.4	11.23	29.34	0.0000E+00	477
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 6									
715	192.6	1000.	866.7	226.2	136.2	3.845	15.87	0.0000E+00	596
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 7									
834	194.7	1000.	866.9	262.4	138.4	1.647	8.710	0.0000E+00	715
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 8									
953	196.8	1000.	867.0	288.1	139.1	0.8601	5.232	0.0000E+00	834
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 9									
1072	198.9	1000.	867.0	307.5	139.5	0.5376	3.571	0.0000E+00	953

```
     NEW CLOUD CREATED, NTCLD(K) (K =      2) =   10
       201.0        1000.        867.0        323.3        139.6       0.3827        2.709       0.0000E+00
1191            1072

     NEW CLOUD CREATED, NTCLD(K) (K =      2) =   11
       201.1        1000.        867.0        324.3        133.4        6.558        1870.       0.0000E+00
1199            1191
```

NOTE -- When all solid material has settled from a cloud, the cloud is erased and the remaining clouds for this solids type are renumbered.

LONG TERM DIFFUSION RESULTS:

BEGIN LONG TERM SIMULATION OF FATE OF FSAND

SUMMARY OF FSAND DISTRIBUTIONS AFTER 300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 7190.7

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 2934.3

SUMMARY OF FSAND DISTRIBUTIONS AFTER 600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 473.15

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9651.8

SUMMARY OF FSAND DISTRIBUTIONS AFTER 900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 372.84

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9752.2

MAX CONC IS 0.00000002 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 900.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 10.00 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0   00000
 6 0000    0    0    0    .    .    +    +    +    +    .    .    0    0    0    0   00000
 7 0000    0    0    .    .    +  .01  .04  .05  .02    +    +    .    0    0    0   00000
 8 0000    0    0    .    +  .05  .44  1.3  1.6  .74  .12    +    +    .    0    0   00000
 9 0000    0    .    +  .02  .60  5.0   16   19  8.5  1.4  .09    +    .    0    0   00000
10 0000    0    .    +  .11  2.6   22   74   89   38  6.2  .39  .01    +    0    0   00000
11 0000    0    .    +  .19  4.2   37  126  156   64   10  .64  .01    +    0    0   00000
12 0000    0    .    +  .11  2.6   22   74   89   38  6.2  .39  .01    +    0    0   00000
13 0000    0    .    +  .02  .60  5.0   16   19  8.5  1.4  .09    +    .    0    0   00000
14 0000    0    0    .    +  .05  .44  1.3  1.6  .74  .12    +    +    .    0    0   00000
15 0000    0    0    .    .    +  .01  .04  .05  .02    +    +    .    0    0    0   00000
16 0000    0    0    0    .    .    +    +    +    +    .    .    0    0    0    0   00000
17 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0   00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 900.00 SECONDS ELAPSED TIME FOR FSAND

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	865.1	112.4	0.0000E+00	92.49	23.35	32.24	0.200000E-01
2	1000.	866.6	94.93	0.0000E+00	110.5	53.52	86.48	0.200000E-01
3	1000.	867.4	55.34	0.0000E+00	125.0	89.30	50.70	0.200000E-01

4	1000.	867.8	106.4	0.0000E+00	171.4	118.8	21.25
0.200000E-01							
5	1000.	868.2	3.768	0.0000E+00	236.8	139.6	0.4378
0.200000E-01							

SUMMARY OF FSAND DISTRIBUTIONS AFTER 1200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 326.23

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9798.8

SUMMARY OF FSAND DISTRIBUTIONS AFTER 1500.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 284.23

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9840.8

SUMMARY OF FSAND DISTRIBUTIONS AFTER 1800.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 243.49

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9881.5

CONCENTRATIONS ABOVE BACKGROUND OF FSAND (MG/L) IN THE CLOUD 1800.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
```

```
 8 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 9 0000   0   0   0   0   0   0   .   .   0   0   0   0   0   0   0   00000
10 0000   0   0   0   0   0   . .01 .04   +   0   0   0   0   0   0   00000
11 0000   0   0   0   0   0   + .25 .61   +   0   0   0   0   0   0   00000
12 0000   0   0   0   0   0   . .01 .04   +   0   0   0   0   0   0   00000
13 0000   0   0   0   0   0   0   .   .   0   0   0   0   0   0   0   00000
14 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

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```
BOTTOM ACCUMULATION OF FSAND    (CU FT/GRID SQUARE) ,   1800.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    10.00        (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   .   .   .   .   0   0   0   0   0   0   00000
 6 0000   0   0   0   .   .   +   +   +   +   .   .   0   0   0   0   00000
 7 0000   0   0   .   .   + .01 .04 .05 .02   +   +   .   0   0   0   00000
 8 0000   0   0   .   + .05 .44 1.3 1.6 .74 .12   +   +   .   0   0   00000
 9 0000   0   .   + .02 .60 5.0  16  19 8.5 1.4 .09   +   .   0   0   00000
10 0000   0   .   + .11 2.6  22  74  90  38 6.2 .39 .01   +   0   0   00000
11 0000   0   .   + .19 4.2  37 129 161  64  10 .64 .01   +   0   0   00000
12 0000   0   .   + .11 2.6  22  74  90  38 6.2 .39 .01   +   0   0   00000
13 0000   0   .   + .02 .60 5.0  16  19 8.5 1.4 .09   +   .   0   0   00000
14 0000   0   0   .   + .05 .44 1.3 1.6 .74 .12   +   +   .   0   0   00000
15 0000   0   0   .   .   + .01 .04 .05 .02   +   +   .   0   0   0   00000
16 0000   0   0   0   .   .   +   +   +   +   .   .   0   0   0   0   00000
17 0000   0   0   0   0   0   .   .   .   .   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

—

```
SMALL CLOUDS AT    1800.00 SECONDS ELAPSED TIME FOR FSAND


        LOCATION OF CLOUD CENTROID   MASS FROM   ENTRAINED   CLOUD X-Z   DEPTH OF    CLOUD VERT.
SOLIDS FALL
CLOUD          DISTANCE FROM          DISPOSAL      MASS      DIAMETER  TOP OF CLOUD  THICKNESS
VELOCITY
  #     TOP OF GRID   LEFT OF GRID   (CU FT)     (CU FT)       (FT)        (FT)         (FT)
(FPS)
```

1	1000.	867.2	112.4	0.0000E+00	156.6	40.19	92.88
0.200000E-01							
2	1000.	868.7	75.32	0.0000E+00	178.1	70.36	69.64
0.200000E-01							
3	1000.	869.5	35.94	0.0000E+00	195.1	106.1	33.87
0.200000E-01							
4	1000.	869.9	19.79	0.0000E+00	248.5	135.6	4.410
0.200000E-01							

SUMMARY OF FSAND DISTRIBUTIONS AFTER 2100.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 205.61

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9919.4

SUMMARY OF FSAND DISTRIBUTIONS AFTER 2400.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 186.11

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9938.9

SUMMARY OF FSAND DISTRIBUTIONS AFTER 2700.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 166.80

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9958.2

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 2700.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 10.00 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
```

4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
5	0000	0	0	0	0	0	.	.	.	.	0	0	0	0	0	0	00000
6	0000	0	0	0	.	.	+	+	+	+	.	.	0	0	0	0	00000
7	0000	0	0	.	.	+	.01	.04	.05	.02	+	+	.	0	0	0	00000
8	0000	0	0	.	+	.05	.44	1.3	1.6	.74	.12	+	+	.	0	0	00000
9	0000	0	.	+	.02	.60	5.0	16	19	8.5	1.4	.09	+	.	0	0	00000
10	0000	0	.	+	.11	2.6	22	75	91	38	6.2	.39	.01	+	0	0	00000
11	0000	0	.	+	.19	4.2	37	131	164	64	10	.64	.01	+	0	0	00000
12	0000	0	.	+	.11	2.6	22	75	91	38	6.2	.39	.01	+	0	0	00000
13	0000	0	.	+	.02	.60	5.0	16	19	8.5	1.4	.09	+	.	0	0	00000
14	0000	0	0	.	+	.05	.44	1.3	1.6	.74	.12	+	+	.	0	0	00000
15	0000	0	0	.	.	+	.01	.04	.05	.02	+	+	.	0	0	0	00000
16	0000	0	0	0	.	.	+	+	+	+	.	.	0	0	0	0	00000
17	0000	0	0	0	0	0	.	.	.	.	0	0	0	0	0	0	00000
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000

19 00000000000000000000000000000000000000000000000000000000000000000000000

SMALL CLOUDS AT 2700.00 SECONDS ELAPSED TIME FOR FSAND

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	869.3	93.53	0.0000E+00	231.6	57.02	82.98	0.200000E-01
2	1000.	870.8	56.02	0.0000E+00	256.1	87.20	52.80	0.200000E-01
3	1000.	871.6	17.23	0.0000E+00	275.3	123.0	17.03	0.200000E-01
4	1000.	872.1	0.2120E-01	0.0000E+00	335.0	91.95	48.05	0.200000E-01

SUMMARY OF FSAND DISTRIBUTIONS AFTER 3000.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 147.72

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9977.3

SUMMARY OF FSAND DISTRIBUTIONS AFTER 3300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 128.93

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 9996.0

SUMMARY OF FSAND DISTRIBUTIONS AFTER 3600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 110.76

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 10014.

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 3600.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 10.00 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0   00000
 6 0000    0    0    0    .    .    +    +    +    +    .    .    0    0    0    0   00000
 7 0000    0    0    .    .    +  .01  .04  .05  .02    +    +    .    0    0    0   00000
 8 0000    0    0    .    +  .05  .44  1.3  1.6  .74  .12    +    +    .    0    0   00000
 9 0000    0    .    +  .02  .60  5.0   16   20  8.6  1.4  .09    +    .    0    0   00000
10 0000    0    .    +  .11  2.6   23   75   91   39  6.2  .39  .01    +    0    0   00000
11 0000    0    .    +  .19  4.2   37  132  165   65   10  .64  .01    +    0    0   00000
12 0000    0    .    +  .11  2.6   23   75   91   39  6.2  .39  .01    +    0    0   00000
13 0000    0    .    +  .02  .60  5.0   16   20  8.6  1.4  .09    +    .    0    0   00000
14 0000    0    0    .    +  .05  .44  1.3  1.6  .74  .12    +    +    .    0    0   00000
15 0000    0    0    .    .    +  .01  .04  .05  .02    +    +    .    0    0    0   00000
16 0000    0    0    0    .    .    +    +    +    +    .    .    0    0    0    0   00000
17 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0   00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 3600.00 SECONDS ELAPSED TIME FOR FSAND

LOCATION OF CLOUD CENTROID			MASS FROM	ENTRAINED	CLOUD X-Z	DEPTH OF	CLOUD VERT.	SOLIDS FALL
CLOUD	DISTANCE FROM		DISPOSAL	MASS	DIAMETER	TOP OF CLOUD	THICKNESS	VELOCITY
#	TOP OF GRID	LEFT OF GRID	(CU FT)	(CU FT)	(FT)	(FT)	(FT)	(FPS)
1	1000.	871.5	73.39	0.0000E+00	316.2	73.86	66.14	0.200000E-01
2	1000.	873.0	37.16	0.0000E+00	343.4	104.0	35.96	0.200000E-01
3	1000.	873.7	0.1969	0.0000E+00	364.7	138.7	1.271	0.200000E-01
4	1000.	874.2	0.1638E-01	0.0000E+00	430.0	60.73	79.27	0.200000E-01

SUMMARY OF FSAND DISTRIBUTIONS AFTER 3900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 97.781

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 10027.

SUMMARY OF FSAND DISTRIBUTIONS AFTER 4200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 85.094

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 10040.

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 10.00 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 0000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   .   .   .   .   0   0   0   0   0   0   00000
```

```
 6 0000   0   0   0   .   .   +   +   +   +   .   .   0   0   0   0   00000
 7 0000   0   0   .   .   + .01 .04 .05 .02   +   +   .   0   0   0   00000
 8 0000   0   0   .   + .05 .44 1.3 1.6 .74 .12   +   +   .   0   0   00000
 9 0000   0   .   + .02 .60 5.1  16  20 8.6 1.4 .09   +   .   0   0   00000
10 0000   0   .   + .11 2.6  23  76  92  39 6.2 .40 .01   +   0   0   00000
11 0000   0   .   + .19 4.2  37 132 165  65  10 .65 .01   +   0   0   00000
12 0000   0   .   + .11 2.6  23  76  92  39 6.2 .40 .01   +   0   0   00000
13 0000   0   .   + .02 .60 5.1  16  20 8.6 1.4 .09   +   .   0   0   00000
14 0000   0   0   .   + .05 .44 1.3 1.6 .74 .12   +   +   .   0   0   00000
15 0000   0   0   .   .   + .01 .04 .05 .02   +   +   .   0   0   0   00000
16 0000   0   0   0   .   .   +   +   +   +   .   .   0   0   0   0   00000
17 0000   0   0   0   0   0   .   .   .   .   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000
```

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SMALL CLOUDS AT   4200.00 SECONDS ELAPSED TIME FOR FSAND

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	872.9	60.16	0.0000E+00	377.5	85.09	54.91	0.200000E-01
2	1000.	874.4	24.91	0.0000E+00	406.4	115.3	24.74	0.200000E-01
3	1000.	875.1	0.1659E-01	0.0000E+00	428.8	99.74	40.26	0.200000E-01
4	1000.	875.6	0.1408E-01	0.0000E+00	497.7	60.62	79.38	0.200000E-01

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BOTTOM ACCUMULATION OF FSAND   (CU FT/GRID SQUARE) ,   4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY   10.00   (LEGEND... + = .LT. .01   . = .LT. .0001   0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   .   .   .   .   0   0   0   0   0   0   00000
 6 0000   0   0   0   .   .   +   +   +   +   .   .   0   0   0   0   00000
 7 0000   0   0   .   .   + .01 .04 .05 .02   +   +   .   0   0   0   00000
 8 0000   0   0   .   + .05 .44 1.3 1.6 .74 .12   +   +   .   0   0   00000
 9 0000   0   .   + .02 .60 5.1  16  20 8.6 1.4 .09   +   .   0   0   00000
```

```
10 0000   0   .   + .11 2.6  23  76  92  39 6.2 .40 .01   +   0   0   00000
11 0000   0   .   + .19 4.2  37 132 165  65  10 .65 .01   +   0   0   00000
12 0000   0   .   + .11 2.6  23  76  92  39 6.2 .40 .01   +   0   0   00000
13 0000   0   .   + .02 .60 5.1  16  20 8.6 1.4 .09   +   .   0   0   00000
14 0000   0   0   .   + .05 .44 1.3 1.6 .74 .12   +   +   .   0   0   00000
15 0000   0   0   .   .   + .01 .04 .05 .02   +   +   .   0   0   0   00000
16 0000   0   0   0   .   .   +   +   +   +   .   .   0   0   0   0   00000
17 0000   0   0   0   0   0   .   .   .   .   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

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THICKNESS (FT) OF FSAND   ACCUMULATED ON BOTTOM,   4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY   1.000   (LEGEND... + = .LT. .01   . = .LT. .0001   0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   .   .   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   .   .   .   .   .   .   0   0   0   0   0   00000
 8 0000   0   0   0   .   .   +   +   +   +   +   .   0   0   0   0   00000
 9 0000   0   0   0   .   +   + .02 .03 .01   +   +   .   0   0   0   00000
10 0000   0   0   .   +   + .03 .12 .15 .06 .01   +   .   0   0   0   00000
11 0000   0   0   .   +   + .06 .22 .28 .11 .01   +   .   0   0   0   00000
12 0000   0   0   .   +   + .03 .12 .15 .06 .01   +   .   0   0   0   00000
13 0000   0   0   0   .   +   + .02 .03 .01   +   +   .   0   0   0   00000
14 0000   0   0   0   .   .   +   +   +   +   +   .   0   0   0   0   00000
15 0000   0   0   0   0   .   .   .   .   .   .   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   .   .   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

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BEGIN LONG TERM SIMULATION OF FATE OF SILT

SUMMARY OF SILT   DISTRIBUTIONS AFTER   300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) =   1833.1

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =   191.90

SUMMARY OF SILT   DISTRIBUTIONS AFTER   600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) =   1281.5

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =   743.46

SUMMARY OF SILT   DISTRIBUTIONS AFTER   900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) =   777.72

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =   1247.3

CONCENTRATIONS ABOVE BACKGROUND OF SILT   (MG/L) IN THE CLOUD   900.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

...MULTIPLY DISPLAYED VALUES BY   1.000   (LEGEND... + = .LT. .01   . = .LT. .0001   0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 00000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 8 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 9 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
10 0000   0   0   0   0   0   0   0   +   +   0   0   0   0   0   0   0   00000
11 0000   0   0   0   0   0   0 .44 3.8   .   0   0   0   0   0   0   00000
12 0000   0   0   0   0   0   0   +   +   0   0   0   0   0   0   0   00000
13 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
14 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
```

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 19 0000000000000000000000000000000000000000000000000000000000000000000000
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 BOTTOM ACCUMULATION OF SILT      (CU FT/GRID SQUARE) ,     900.00 SECONDS AFTER DUMP
 ...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  5 0000    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0    00000
  6 0000    0    0    0    .    +    +    +    +    +    +    .    .    0    0    0    00000
  7 0000    0    0    .    +    + .04  .12  .14  .07  .01    +    .    .    0    0    00000
  8 0000    0    .    +    + .14  .92  2.5  3.0  1.4  .31  .02    +    .    0    0    00000
  9 0000    0    .    + .07  1.2  8.2   24   28   13  2.6  .23    +    +    .    0    00000
 10 0000    0    +    + .28  4.5   31   92  109   52   10  .85  .03    +    .    0    00000
 11 0000    .    + .01  .43  7.0   50  146  173   81   16  1.3  .05    +    .    0    00000
 12 0000    0    +    + .28  4.5   31   92  109   52   10  .85  .03    +    .    0    00000
 13 0000    0    .    + .07  1.2  8.2   24   28   13  2.6  .23    +    +    .    0    00000
 14 0000    0    .    +    + .14  .92  2.5  3.0  1.4  .31  .02    +    .    0    0    00000
 15 0000    0    0    .    +    + .04  .12  .14  .07  .01    +    .    .    0    0    00000
 16 0000    0    0    0    .    +    +    +    +    +    +    .    .    0    0    0    00000
 17 0000    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0    00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000
```

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SMALL CLOUDS AT   900.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	865.1	22.49	0.0000E+00	92.49	9.500	32.24	0.412278E-03
2	1000.	866.6	19.83	0.0000E+00	110.5	39.34	100.7	0.772156E-04
3	1000.	867.4	13.06	0.0000E+00	125.0	75.09	64.91	0.515426E-04
4	1000.	867.8	33.96	0.0000E+00	171.4	104.6	35.36	0.114632E-03
5	1000.	868.2	29.12	0.0000E+00	236.8	125.5	14.52	0.120729E-03
6	1000.	868.4	15.42	0.0000E+00	291.6	135.3	4.730	0.134126E-03

7	1000.	868.6	8.274	0.0000E+00	330.8	137.5	2.547
0.108692E-03							
8	1000.	868.6	4.867	0.0000E+00	358.3	138.2	1.775
0.835569E-04							
9	1000.	868.7	3.281	0.0000E+00	378.9	138.5	1.465
0.656350E-04							
10	1000.	868.7	2.470	0.0000E+00	395.7	138.7	1.317
0.543451E-04							
11	1000.	868.7	624.9	0.0000E+00	396.7	137.3	2.733
0.690000E-02							

SUMMARY OF SILT DISTRIBUTIONS AFTER 1200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 344.72

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1680.3

SUMMARY OF SILT DISTRIBUTIONS AFTER 1500.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 152.21

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1872.8

SUMMARY OF SILT DISTRIBUTIONS AFTER 1800.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 152.04

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.0

CONCENTRATIONS ABOVE BACKGROUND OF SILT (MG/L) IN THE CLOUD 1800.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N= 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

2 000000000000000000000000000000000000000000000000000000000000000000000

3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
6	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
7	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
8	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
9	0000	0	0	0	0	0	0	.	+	.	0	0	0	0	0	0	00000
10	0000	0	0	0	0	0	+	.13	.33	+	.	0	0	0	0	0	00000
11	0000	0	0	0	0	0	+	1.7	4.1	.06	.	0	0	0	0	0	00000
12	0000	0	0	0	0	0	+	.13	.33	+	.	0	0	0	0	0	00000
13	0000	0	0	0	0	0	0	.	+	.	0	0	0	0	0	0	00000
14	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
15	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
19	0000000000000000000000000000000000000000000000000000000000000000000																

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 1800.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	.	.	.	.	.	.	0	0	0	0	0	00000	
5	0000	0	0	0	.	.	+	+	+	+	+	.	.	0	0	0	00000	
6	0000	0	0	.	+	+	+	.02	.02	.01	+	+	.	.	0	0	00000	
7	0000	0	.	+	+	.04	.19	.43	.50	.28	.08	.01	+	.	.	0	00000	
8	0000	.	+	+	.05	.47	2.2	5.5	6.3	3.4	.93	.13	.01	+	.	0	00000	
9	0000	.	+	.01	.29	2.8	15	39	45	23	5.8	.75	.05	+	.	.	00000	
10	0000	.	+	.04	.84	8.8	50	132	154	78	18	2.2	.15	+	+	.	00000	
11	0000	.	+	.06	1.2	13	75	202	236	119	27	3.1	.21	+	+	.	00000	
12	0000	.	+	.04	.84	8.8	50	132	154	78	18	2.2	.15	+	+	.	00000	
13	0000	.	+	.01	.29	2.8	15	39	45	23	5.8	.75	.05	+	.	.	00000	
14	0000	.	+	+	.05	.47	2.2	5.5	6.3	3.4	.93	.13	.01	+	.	0	00000	
15	0000	0	.	+	+	.04	.19	.43	.50	.28	.08	.01	+	.	.	0	00000	
16	0000	0	0	.	+	+	+	.02	.02	.01	+	+	.	.	0	0	00000	
17	0000	0	0	0	.	.	+	+	+	+	+	.	.	0	0	0	00000	
18	0000	0	0	0	0	.	.	.	.	.	.	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000																	

SMALL CLOUDS AT 1800.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	867.2	22.49	0.0000E+00	156.6	8.478	34.56	0.951592E-04
2	1000.	868.7	19.82	0.0000E+00	178.1	38.21	101.8	0.340000E-04
3	1000.	869.5	13.06	0.0000E+00	195.1	73.96	66.04	0.340000E-04
4	1000.	869.9	33.90	0.0000E+00	248.5	103.5	36.46	0.524993E-04
5	1000.	870.3	28.99	0.0000E+00	322.0	124.4	15.61	0.592063E-04
6	1000.	870.5	15.21	0.0000E+00	382.6	134.2	5.822	0.601682E-04
7	1000.	870.7	8.128	0.0000E+00	425.4	136.3	3.656	0.463505E-04
8	1000.	870.8	4.779	0.0000E+00	455.3	137.1	2.897	0.363140E-04
9	1000.	870.8	3.224	0.0000E+00	477.7	137.4	2.593	0.340000E-04
10	1000.	870.8	2.429	0.0000E+00	495.8	137.6	2.448	0.340000E-04

SUMMARY OF SILT DISTRIBUTIONS AFTER 2100.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.90

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.1

SUMMARY OF SILT DISTRIBUTIONS AFTER 2400.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.78

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.2

SUMMARY OF SILT   DISTRIBUTIONS AFTER   2700.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) =   151.68

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =   1873.3

CONCENTRATIONS ABOVE BACKGROUND OF SILT   (MG/L) IN THE CLOUD   2700.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

```
...MULTIPLY DISPLAYED VALUES BY    1.000         (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  6 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  7 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  8 0000    0    0    0    0    0    .    .    +    .    0    0    0    0    0    0    00000
  9 0000    0    0    0    0    .    +  .02  .03    +    .    0    0    0    0    0    00000
 10 0000    0    0    0    0    +  .04  .70  1.1  .17    +    .    0    0    0    0    00000
 11 0000    0    0    0    0    +  .14  2.2  3.5  .54    +    .    0    0    0    0    00000
 12 0000    0    0    0    0    +  .04  .70  1.1  .17    +    .    0    0    0    0    00000
 13 0000    0    0    0    0    .    +  .02  .03    +    .    0    0    0    0    0    00000
 14 0000    0    0    0    0    0    .    .    +    .    0    0    0    0    0    0    00000
 15 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 16 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

BOTTOM ACCUMULATION OF SILT   (CU FT/GRID SQUARE) ,   2700.00 SECONDS AFTER DUMP

```
...MULTIPLY DISPLAYED VALUES BY    1.000         (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  4 0000    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0    00000
  5 0000    0    0    0    .    .    +    +    +    +    +    .    .    0    0    0    00000
  6 0000    0    .    .    +    +    +  .02  .02  .01    +    +    .    .    0    0    00000
  7 0000    0    .    +    +  .04  .19  .44  .50  .28  .08  .01    +    .    .    0    00000
  8 0000    .    +    +  .05  .47  2.2  5.5  6.3  3.4  .93  .13  .01    +    .    0    00000
```

```
 9 0000    .    + .01 .29 2.8   15   39   45   23 5.8 .75 .05    +    .    .    00000
10 0000    .    + .04 .84 8.8   50  132  154   78   18 2.2 .15    +    +    .    00000
11 0000    .    + .06 1.2  13   75  202  236  119   27 3.1 .21    +    +    .    00000
12 0000    .    + .04 .84 8.8   50  132  154   78   18 2.2 .15    +    +    .    00000
13 0000    .    + .01 .29 2.8   15   39   45   23 5.8 .75 .05    +    .    .    00000
14 0000    .    +    + .05 .47 2.2 5.5 6.3 3.4 .93 .13 .01    +    .    0    00000
15 0000    0    .    +    + .04 .19 .44 .50 .28 .08 .01    +    .    .    0    00000
16 0000    0    .    .    +    +    + .02 .02 .01    +    +    .    .    0    0    00000
17 0000    0    0    0    .    .    +    +    +    +    +    .    .    0    0    0    00000
18 0000    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0    00000
19 000000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 2700.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	869.3	22.49	0.0000E+00	231.6	7.366	36.89	0.437310E-04
2	1000.	870.8	19.82	0.0000E+00	256.1	37.08	102.9	0.340000E-04
3	1000.	871.6	13.05	0.0000E+00	275.3	72.83	67.17	0.340000E-04
4	1000.	872.1	33.87	0.0000E+00	335.0	102.4	37.59	0.347631E-04
5	1000.	872.4	28.92	0.0000E+00	415.8	123.3	16.73	0.386592E-04
6	1000.	872.7	15.12	0.0000E+00	481.6	133.1	6.945	0.377334E-04
7	1000.	872.8	8.067	0.0000E+00	527.9	135.2	4.786	0.340000E-04
8	1000.	872.9	4.739	0.0000E+00	559.9	136.0	4.030	0.340000E-04
9	1000.	872.9	3.195	0.0000E+00	583.9	136.3	3.726	0.340000E-04
10	1000.	872.9	2.405	0.0000E+00	603.3	136.4	3.581	0.340000E-04

SUMMARY OF SILT DISTRIBUTIONS AFTER 3000.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.58

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.4

SUMMARY OF SILT DISTRIBUTIONS AFTER 3300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.50

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.5

SUMMARY OF SILT DISTRIBUTIONS AFTER 3600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.42

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.6

CONCENTRATIONS ABOVE BACKGROUND OF SILT (MG/L) IN THE CLOUD 3600.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 6 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 7 0000    0    0    0    0    .    .    +    +    .    .    0    0    0    0    0   00000
 8 0000    0    0    0    .    +    +    +  .01    +    +    .    0    0    0    0   00000
 9 0000    0    0    0    .    +  .04  .18  .24  .09    +    +    .    0    0    0   00000
10 0000    0    0    .    +  .01  .26  1.2  1.5  .58  .06    +    .    0    0    0   00000
11 0000    0    0    .    +  .03  .49  2.2  2.9  1.1  .11    +    .    0    0    0   00000
12 0000    0    0    .    +  .01  .26  1.2  1.5  .58  .06    +    .    0    0    0   00000
13 0000    0    0    0    .    +  .04  .18  .24  .09    +    +    .    0    0    0   00000
14 0000    0    0    0    .    +    +    +  .01    +    +    .    0    0    0    0   00000
15 0000    0    0    0    0    .    .    +    +    .    .    0    0    0    0    0   00000
16 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
```

```
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 3600.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   .   .   .   .   .   .   .   0   0   0   0   00000
 5 0000   0   0   .   .   .   +   +   +   +   +   .   .   0   0   0   00000
 6 0000   0   .   .   +   +   + .02 .02 .01   +   +   .   .   0   0   00000
 7 0000   0   .   +   + .04 .19 .44 .50 .28 .08 .01   +   .   .   0   00000
 8 0000   .   +   + .05 .47 2.2 5.5 6.3 3.4 .94 .13 .01   +   .   0   00000
 9 0000   .   + .01 .29 2.8  15  39  45  23 5.8 .75 .05   +   .   .   00000
10 0000   .   + .04 .84 8.8  50 132 154  78  18 2.2 .15   +   +   .   00000
11 0000   .   + .06 1.2  13  75 202 236 119  27 3.1 .21   +   +   .   00000
12 0000   .   + .04 .84 8.8  50 132 154  78  18 2.2 .15   +   +   .   00000
13 0000   .   + .01 .29 2.8  15  39  45  23 5.8 .75 .05   +   .   .   00000
14 0000   .   +   + .05 .47 2.2 5.5 6.3 3.4 .94 .13 .01   +   .   0   00000
15 0000   0   .   +   + .04 .19 .44 .50 .28 .08 .01   +   .   .   0   00000
16 0000   0   .   .   +   +   + .02 .02 .01   +   +   .   .   0   0   00000
17 0000   0   0   .   .   .   +   +   +   +   +   .   .   0   0   0   00000
18 0000   0   0   0   0   .   .   .   .   .   .   .   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 3600.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	871.5	22.49	0.0000E+00	316.2	6.236	39.21	0.340000E-04
2	1000.	873.0	19.81	0.0000E+00	343.4	35.95	104.1	0.340000E-04
3	1000.	873.7	13.05	0.0000E+00	364.7	71.70	68.30	0.340000E-04
4	1000.	874.2	33.84	0.0000E+00	430.0	101.3	38.72	0.340000E-04
5	1000.	874.5	28.87	0.0000E+00	517.5	122.1	17.86	0.340000E-04

6	1000.	874.8	15.06	0.0000E+00	588.2	131.9	8.078
0.340000E-04							
7	1000.	874.9	8.024	0.0000E+00	637.6	134.1	5.919
0.340000E-04							
8	1000.	875.0	4.709	0.0000E+00	671.8	134.8	5.163
0.340000E-04							
9	1000.	875.0	3.173	0.0000E+00	697.3	135.1	4.859
0.340000E-04							
10	1000.	875.0	2.388	0.0000E+00	717.9	135.3	4.714
0.340000E-04							

SUMMARY OF SILT DISTRIBUTIONS AFTER 3900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.34

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.6

SUMMARY OF SILT DISTRIBUTIONS AFTER 4200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 151.26

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1873.7

CONCENTRATIONS ABOVE BACKGROUND OF SILT (MG/L) IN THE CLOUD 4200.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	.	.	.	.	.	.	0	0	0	0	0	00000	
7	0000	0	0	0	.	.	+	+	+	+	+	.	0	0	0	0	00000	
8	0000	0	0	.	+	+	.01	.04	.05	.02	+	+	.	0	0	0	00000	
9	0000	0	0	.	+	.01	.12	.36	.44	.22	.04	+	+	.	0	0	00000	
10	0000	0	.	.	+	.06	.46	1.3	1.6	.85	.18	.01	+	.	0	0	00000	
11	0000	0	.	+	+	.10	.72	2.1	2.6	1.3	.27	.02	+	.	0	0	00000	

```
 12 0000   0    .    .    + .06  .46 1.3  1.6  .85  .18  .01   +    .    0    0    00000
 13 0000   0    0    .    + .01  .12  .36  .44  .22  .04   +    +    .    0    0    00000
 14 0000   0    0    .    +    + .01  .04  .05  .02   +    +    .    0    0    0    00000
 15 0000   0    0    0    .    .    +    +    +    +    +    .    0    0    0    0    00000
 16 0000   0    0    0    0    .    .    .    .    .    .    0    0    0    0    0    00000
 17 0000   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 18 0000   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
```

—

```
 BOTTOM ACCUMULATION OF SILT     (CU FT/GRID SQUARE) ,    4200.00 SECONDS AFTER DUMP
 ...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0    00000
  4 0000   0    0    0    .    .    .    .    .    .    .    .    .    .    0    0    0    00000
  5 0000   0    .    .    .    +    +    +    +    +    +    .    .    .    0    0    00000
  6 0000   0    .    .    +    +    + .02  .02  .01    +    +    .    .    .    0    00000
  7 0000   .    .    +    + .04  .19  .44  .50  .28  .08  .01    +    .    .    .    00000
  8 0000   .    +    + .05  .47  2.2  5.5  6.3  3.4  .94  .13  .01    +    .    .    00000
  9 0000   .    + .01  .29  2.8   15   39   45   23  5.8  .75  .05    +    .    .    00000
 10 0000   .    + .04  .84  8.8   50  132  154   78   18  2.2  .15    +    +    .    .0000
 11 0000   .    + .06  1.2   13   75  202  236  119   27  3.1  .21    +    +    .    .0000
 12 0000   .    + .04  .84  8.8   50  132  154   78   18  2.2  .15    +    +    .    .0000
 13 0000   .    + .01  .29  2.8   15   39   45   23  5.8  .75  .05    +    .    .    00000
 14 0000   .    +    + .05  .47  2.2  5.5  6.3  3.4  .94  .13  .01    +    .    .    00000
 15 0000   .    .    +    + .04  .19  .44  .50  .28  .08  .01    +    .    .    .    00000
 16 0000   0    .    .    +    +    + .02  .02  .01    +    +    .    .    .    0    00000
 17 0000   0    .    .    .    +    +    +    +    +    +    .    .    .    0    0    00000
 18 0000   0    0    0    .    .    .    .    .    .    .    .    .    .    0    0    0    00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
```

—

```
 SMALL CLOUDS AT    4200.00 SECONDS ELAPSED TIME FOR SILT


        LOCATION OF CLOUD CENTROID   MASS FROM    ENTRAINED    CLOUD X-Z   DEPTH OF    CLOUD VERT.
SOLIDS FALL
 CLOUD          DISTANCE FROM          DISPOSAL      MASS       DIAMETER  TOP OF CLOUD  THICKNESS
VELOCITY
   #     TOP OF GRID   LEFT OF GRID    (CU FT)     (CU FT)       (FT)         (FT)         (FT)
(FPS)


   1        1000.          872.9        22.49     0.0000E+00   377.5        5.482        40.76
0.340000E-04
```

2	1000.	874.4	19.81	0.0000E+00	406.4	35.19	104.8
0.340000E-04							
3	1000.	875.1	13.04	0.0000E+00	428.8	70.95	69.05
0.340000E-04							
4	1000.	875.6	33.82	0.0000E+00	497.7	100.5	39.47
0.340000E-04							
5	1000.	875.9	28.84	0.0000E+00	589.4	121.4	18.62
0.340000E-04							
6	1000.	876.2	15.03	0.0000E+00	663.2	131.2	8.833
0.340000E-04							
7	1000.	876.3	7.999	0.0000E+00	714.6	133.3	6.675
0.340000E-04							
8	1000.	876.4	4.693	0.0000E+00	750.1	134.1	5.918
0.340000E-04							
9	1000.	876.5	3.161	0.0000E+00	776.5	134.4	5.615
0.340000E-04							
10	1000.	876.5	2.379	0.0000E+00	797.9	134.5	5.470
0.340000E-04							

```
BOTTOM ACCUMULATION OF SILT      (CU FT/GRID SQUARE) ,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001   0 = .LT.
.000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    .    .    .    .    .    0    0    0    0    0   00000
  4 0000    0    0    0    .    .    .    .    .    .    .    .    .    0    0    0   00000
  5 0000    0    .    .    .    +    +    +    +    +    +    .    .    .    0    0   00000
  6 0000    0    .    .    +    +    +  .02  .02  .01    +    +    .    .    .    0   00000
  7 0000    .    .    +    +  .04  .19  .44  .50  .28  .08  .01    +    .    .    .   00000
  8 0000    .    +    +  .05  .47  2.2  5.5  6.3  3.4  .94  .13  .01    +    .    .   00000
  9 0000    .    +  .01  .29  2.8   15   39   45   23  5.8  .75  .05    +    .    .   00000
 10 0000    .    +  .04  .84  8.8   50  132  154   78   18  2.2  .15    +    +    .   .0000
 11 0000    .    +  .06  1.2   13   75  202  236  119   27  3.1  .21    +    +    .   .0000
 12 0000    .    +  .04  .84  8.8   50  132  154   78   18  2.2  .15    +    +    .   .0000
 13 0000    .    +  .01  .29  2.8   15   39   45   23  5.8  .75  .05    +    .    .   00000
 14 0000    .    +    +  .05  .47  2.2  5.5  6.3  3.4  .94  .13  .01    +    .    .   00000
 15 0000    .    .    +    +  .04  .19  .44  .50  .28  .08  .01    +    .    .    .   00000
 16 0000    0    .    .    +    +    +  .02  .02  .01    +    +    .    .    .    0   00000
 17 0000    0    .    .    .    +    +    +    +    +    +    .    .    .    0    0   00000
 18 0000    0    0    0    .    .    .    .    .    .    .    .    .    0    0    0   00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000000

THICKNESS (FT) OF SILT      ACCUMULATED ON BOTTOM,      4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001   0 = .LT.
.000001)
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000000
```

```
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  6 0000    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0   00000
  7 0000    0    0    0    .    .    +    +    +    +    .    .    0    0    0    0   00000
  8 0000    0    0    .    .    +    +    +    +    +    +    .    .    0    0    0   00000
  9 0000    0    0    .    +    +    +  .02  .02  .01    +    +    .    .    0    0   00000
 10 0000    0    0    .    +    +  .02  .07  .08  .04  .01    +    .    .    0    0   00000
 11 0000    0    .    .    +    +  .04  .11  .12  .06  .01    +    +    .    0    0   00000
 12 0000    0    0    .    +    +  .02  .07  .08  .04  .01    +    .    .    0    0   00000
 13 0000    0    0    .    +    +    +  .02  .02  .01    +    +    .    .    0    0   00000
 14 0000    0    0    .    .    +    +    +    +    +    +    .    .    0    0    0   00000
 15 0000    0    0    0    .    .    +    +    +    +    .    .    0    0    0    0   00000
 16 0000    0    0    0    0    .    .    .    .    .    .    0    0    0    0    0   00000
 17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 19 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000
-
     FINAL DISTRIBUTIONS OF TOTAL SETTLED MATERIAL FOLLOW.....
-
 TOTAL ACCUMULATED SOLID VOLUME ON BOTTOM (CU FT/GRID SQR),    4200.00 SECONDS AFTER DUMP
 ...MULTIPLY DISPLAYED VALUES BY   10.00        (LEGEND... + = .LT. .01   . = .LT. .0001   0 = .LT.
.000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  4 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0   00000
  5 0000    0    0    0    .    .    .    .    .    .    .    .    0    0    0    0   00000
  6 0000    0    0    .    .    +    +    +    +    +    +    .    .    .    0    0   00000
  7 0000    0    .    .    +    +  .03  .09  .10  .05  .01    +    +    .    0    0   00000
  8 0000    0    .    +    +  .10  .67  1.9  2.3  1.0  .22  .02    +    .    .    0   00000
  9 0000    .    .    +  .05  .89  6.6   20   24   11  2.0  .16    +    +    .    0   00000
 10 0000    .    +    +  .20  3.5   28   89  107   47  8.1  .62  .02    +    .    0   00000
 11 0000    .    +  .01  .31  5.5   45  152  189   77   13  .97  .03    +    .    .   00000
 12 0000    .    +    +  .20  3.5   28   89  107   47  8.1  .62  .02    +    .    0   00000
 13 0000    .    .    +  .05  .89  6.6   20   24   11  2.0  .16    +    +    .    0   00000
 14 0000    0    .    +    +  .10  .67  1.9  2.3  1.0  .22  .02    +    .    .    0   00000
 15 0000    0    .    .    +    +  .03  .09  .10  .05  .01    +    +    .    0    0   00000
 16 0000    0    0    .    .    +    +    +    +    +    +    .    .    .    0    0   00000
 17 0000    0    0    0    .    .    .    .    .    .    .    .    0    0    0    0   00000
 18 0000    0    0    0    0    0    .    .    .    .    0    0    0    0    0    0   00000
 19 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000
-
```

```
TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)

M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19

 2 0000000000000000000000000000000000000000000000000000000000000000000000000

 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000

 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000

 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000

 6 0000    0    0    0    0    0    .    .    .    .    .    0    0    0    0    0    00000

 7 0000    0    0    0    .    .    .    +    +    +    .    .    0    0    0    0    00000

 8 0000    0    0    0    .    +    +    +    +    +    +    .    .    0    0    0    00000

 9 0000    0    0    .    +    + .01  .04  .05  .02    +    +    .    0    0    0    00000

10 0000    0    0    .    +    + .06  .20  .24  .10  .01    +    .    .    0    0    00000

11 0000    0    0    .    + .01  .10  .35  .44  .17  .03    +    .    .    0    0    00000

12 0000    0    0    .    +    + .06  .20  .24  .10  .01    +    .    .    0    0    00000

13 0000    0    0    .    +    + .01  .04  .05  .02    +    +    .    0    0    0    00000

14 0000    0    0    0    .    +    +    +    +    +    +    .    .    0    0    0    00000

15 0000    0    0    0    .    .    .    +    +    +    .    .    0    0    0    0    00000

16 0000    0    0    0    0    0    .    .    .    .    .    0    0    0    0    0    00000

17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000

18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000

19 0000000000000000000000000000000000000000000000000000000000000000000000000


    *** RUN COMPLETED ***
```

C

MODEL: SHORT-TERM FATE OF DREDGED MATERIAL FROM SPLIT HULL BARGE OR HOPPER DREDGE
(PC Version 5.01 MAY, 1993)

TITLE: C

FILE: C - .DUE

AREA: THE PROJECT AREA IS DESCRIBED BY A 20 X 20 GRID.

THERE ARE 20 GRID POINTS (NMAX) IN THE Z-DIRECTION (FROM LEFT TO RIGHT)
AND 20 GRID POINTS (MMAX) IN THE X-DIRECTION (FROM TOP TO BOTTOM).

EXECUTION PARAMETERS:

MODEL COEFFICIENTS SPECIFIED IN INPUT DATA (KEY1 = 1).

PERFORM COMPLETE ANALYSIS INCLUDING DESCENT, COLLAPSE, AND TRANSPORT-DIFFUSION (KEY2 = 0).

NO CONTAMINANT OR TRACER TRANSPORT-DIFFUSION COMPUTIONS DESIRED (KEY3 = 0).

PRINTING OF CONVECTIVE DESCENT RESULTS NOT REQUESTED (IPCN = 0).

PRINTING OF CONVECTIVE DESCENT RESULTS NOT REQUESTED (IPCN = 0).

PRINTING OF DYNAMIC COLLAPSE RESULTS NOT REQUESTED (IPCL = 0).

QUARTERLY PRINTING OF LONG-TERM TRANSPORT DIFFUSION RESULTS REQUESTED (IPLT = 0).

LONG-TERM TRANSPORT DIFFUSION RESULTS REQUESTED AT THE FOLLOWING 1 DEPTH(S):
0.00 FT

GRID: NUMBER OF LONG TERM GRID POINTS IN Z-DIRECTION (NMAX) = 20

NUMBER OF LONG TERM GRID POINTS IN X-DIRECTION (MMAX) = 20

GRID SPACING IN Z-DIRECTION (DZ) = 20.00000 FT

GRID SPACING IN X-DIRECTION (DX) = 20.00000 FT

CONSTANT DEPTH GRID SPECIFIED HAVING A DEPTH (DEPC) OF 10.00000 FT.

DEPTH GRID, FEET:

M	N = 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
2	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
3	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
4	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
5	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
6	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
7	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
8	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
9	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
10	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
11	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
12	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
13	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
14	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
15	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
16	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
17	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
18	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.

```
 19     10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.
10.    10.    10.

 20     10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.    10.
10.    10.    10.

-

  M N =18      19     20
  1     10.    10.    10.
  2     10.    10.    10.
  3     10.    10.    10.
  4     10.    10.    10.
  5     10.    10.    10.
  6     10.    10.    10.
  7     10.    10.    10.
  8     10.    10.    10.
  9     10.    10.    10.
 10     10.    10.    10.
 11     10.    10.    10.
 12     10.    10.    10.
 13     10.    10.    10.
 14     10.    10.    10.
 15     10.    10.    10.
 16     10.    10.    10.
 17     10.    10.    10.
 18     10.    10.    10.
 19     10.    10.    10.
 20     10.    10.    10.
-
 CODED GRID:

          RANGE OF N IS   1 TO  20

           X X X X X X X X X X X X X X X X X X X X
           X O O O O O O O O O O O O O O O O O O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W W W W W W W W W O X
           X O W W W W W W W W D W W W W W W W O X
```

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X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W O X
X O O O O O O O O O O O O O O O O O O X
X X X X X X X X X X X X X X X X X X X X
```

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LEGEND FOR CODED GRID:  W = WATER POINT
                        L = LAND POINT
                        O = OPEN BOUNDARY
                        B = DISPOSAL SITE BOUNDARY
                        D = DUMP LOCATION
                        X = DUMMY POINT
```

NUMBER OF GRID POINTS WITHIN ESTUARY = 256

DISPOSAL LOCATION:

THE DUMP LOCATION IS 200.0 FT (XBARGE) OR ABOUT GRID POINT #11 FROM THE TOP OF THE GRID

AND 200.0 FT (ZBARGE) OR ABOUT GRID POINT #11 FROM THE LEFT EDGE OF THE GRID.

THE BOTTOM SLOPE IN THE X-DIRECTION AT THE DUMP SITE (SLOPEX, POSITIVE IF DEPTH INCREASES FROM TOP OF GRID TO BOTTOM OF GRID) IS 0.00 DEGREES.

THE BOTTOM SLOPE IN THE Z-DIRECTION AT THE DUMP SITE (SLOPEZ, POSITIVE IF DEPTH INCREASES FROM LEFT SIDE OF GRID TO RIGHT SIDE OF GRID) IS 0.00 DEGREES.

THE DISPOSAL LOCATION IS NOT AT A HOLE OR DEPRESSION. (DHOLE = 0.0)

AMBIENT DENSITY PROFILE:

DEPTH (FT)	DENSITY (G/CC)
0.0000E+00	1.0000
10.00	1.0200

COMPUTED DEPTH:

THE DEPTH AT THE DUMP LOCATION WAS INTERPOLATED TO BE 10.00 FT.

VELOCITY DISTRIBUTION:

VERTICALLY AVERAGED X-DIRECTION (VAX = 0.000E+00 FPS) AND
Z-DIRECTION (VAZ = 0.330E-01 FPS) VELOCITIES CONSTRUCTED AT EACH GRID POINT
FROM A SINGLE OBSERVATION AT A DEPTH (D) OF 10.0 FT.

VELOCITY GRID: X-DIRECTION, FPS

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

M N=	18	19	20
1	0.000	0.000	0.000
2	0.000	0.000	0.000
3	0.000	0.000	0.000
4	0.000	0.000	0.000
5	0.000	0.000	0.000
6	0.000	0.000	0.000
7	0.000	0.000	0.000
8	0.000	0.000	0.000
9	0.000	0.000	0.000
10	0.000	0.000	0.000
11	0.000	0.000	0.000
12	0.000	0.000	0.000
13	0.000	0.000	0.000
14	0.000	0.000	0.000
15	0.000	0.000	0.000
16	0.000	0.000	0.000
17	0.000	0.000	0.000
18	0.000	0.000	0.000
19	0.000	0.000	0.000
20	0.000	0.000	0.000

VELOCITY GRID: Z-DIRECTION, FPS

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
2	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
3	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
4	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
5	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
6	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033

7	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
8	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
9	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
10	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
11	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
12	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
13	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
14	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
15	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
16	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
17	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
18	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
19	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
20	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033

M N=	18	19	20
1	0.033	0.033	0.033
2	0.033	0.033	0.033
3	0.033	0.033	0.033
4	0.033	0.033	0.033
5	0.033	0.033	0.033
6	0.033	0.033	0.033
7	0.033	0.033	0.033
8	0.033	0.033	0.033
9	0.033	0.033	0.033
10	0.033	0.033	0.033
11	0.033	0.033	0.033
12	0.033	0.033	0.033
13	0.033	0.033	0.033
14	0.033	0.033	0.033
15	0.033	0.033	0.033
16	0.033	0.033	0.033
17	0.033	0.033	0.033
18	0.033	0.033	0.033

19	0.033	0.033	0.033
20	0.033	0.033	0.033

BOTTOM SHEAR STRESS, LBS/SQ FT:

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

M N=	18	19	20

1	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000

TIME PARAMETERS:

DURATION OF THE DISPOSAL, TREL = 5.00 SECONDS

DURATION OF THE SIMULATION, TSTOP = 2400.00 SECONDS

LONG-TERM TIME STEP USED IN THE SIMULATION, DTL = 300.00 SECONDS

BARGE DESCRIPTION:

LENGTH OF BARGE, BARGL = 10. FT

WIDTH OF BARGE, BARGW = 5.0 FT

DRAFT OF LOADED BARGE, DREL1 = 2.00 FT

DRAFT OF UNLOADED BARGE, DREL2 = 1.00 FT

MODEL COEFFICIENTS READ FROM INPUT:

TURBULENT THERMAL ENTRAINMENT ALPHA0 = 0.2350

SETTLING COEFFICIENT	BETA	=	0.0000
APPARENT MASS COEFFICIENT	CM	=	1.0000
DRAG COEFFICIENT FOR A SPHERE	CD	=	0.5000
RATIO--CLOUD/AMBIENT DENSITY GRADIENTS	GAMA	=	0.2500
FORM DRAG FOR COLLAPSING CLOUD	CDRAG	=	1.0000
SKIN FRICTION FOR COLLAPSING CLOUD	CFRIC	=	0.0100
DRAG FOR AN ELLIPSOIDAL WEDGE	CD3	=	0.1000
DRAG FOR A PLATE	CD4	=	1.0000
ENTRAINMENT IN COLLAPSE	ALPHAC	=	0.1000
FRICTION BETWEEN CLOUD AND BOTTOM	FRICTN	=	0.0100
4/3 LAW HORIZ. DIFF. DISSIPATION FACTOR	ALAMDA	=	0.0010
UNSTRATIFIED WATER VERT. DIFF. COEF.	AKYO	=	0.0250
STRIPPING COEF. OF FINES DURING CONVERTIVE DESCENT		=	0.0030

MATERIAL DESCRIPTION: 2 SOLIDS FRACTIONS

L A Y E R 1

DESCRIPTION	SPEC. GRAV. OR DENSITY (GM/CC)	VOLUMETRIC CONCENTRATION (VOL/VOL)	FALL VELOCITY (FPS)	DEPOSITIONAL VOID RATIO	CHARACTER
FSAND	2.700	0.5500	0.02000	0.7000	NONCOHESIVE

CRITICAL SHEAR STRESS FOR DEPOSITION = 0.1500E-01 LBS/SQ. FT.
SEDIMENT FRACTION WILL BE STRIPPED DURING CONVECTIVE DESCENT.

SILT	2.650	0.1500	0.01000	4.500	COHESIVE

CRITICAL SHEAR STRESS FOR DEPOSITION = 0.9000E-01 LBS/SQ. FT.

SEDIMENT FRACTION WILL BE STRIPPED DURING CONVECTIVE DESCENT.

DESCRIPTION	SPEC. GRAV. OR DENSITY (GM/CC)	VOLUMETRIC CONCENTRATION (VOL/VOL)
FLUID	1.000	0.3000

DISCHARGE PARAMETERS:

VOLUME OF LAYER 1 = 50.00 CU YD

DEPTH IS TOO SHALLOW FOR CONVECTIVE DESCENT SO DESCENT IS BYPASSED.

CLOUD COLLAPSE PHASE:

IN TRIAL #1 THE COLLAPSE PHASE TIME STEP (DT) WAS 0.23385589E-02 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) FOR CONVECTIVE DESCENT AND COLAPSE WAS 1199.

THE INTEGRATION TIME STEP NUMBER WHEN THE BED WAS ENCOUNTERED (IBED) WAS 200.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

IN TRIAL #2 THE COLLAPSE PHASE TIME STEP (DT) WAS 0.38937007E-02 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) FOR CONVECTIVE DESCENT AND COLAPSE WAS 1199.

THE INTEGRATION TIME STEP NUMBER WHEN THE BED WAS ENCOUNTERED (IBED) WAS 200.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

THE DISCHARGE DID NOT OBTAIN A NEUTRALLY BUOYANT CONDITION DURING CONVECTIVE DESCENT.

IN TRIAL #3 THE COLLAPSE PHASE TIME STEP (DT) WAS 0.64830114E-02 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) FOR CONVECTIVE DESCENT AND COLAPSE WAS 805.

THE INTEGRATION TIME STEP NUMBER WHEN THE BED WAS ENCOUNTERED (IBED) WAS 200.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

DIFFUSION OF THE DISCHARGE IS GREATER THAN DYNAMIC SPREADING FROM THE COLLAPSE.

TIME FROM DISPOSAL	CLOUD CENTROID X-LOCATION	Z-LOCATION	CLOUD X-Z DIAMETER	DEPTH OF TOP OF CLOUD	CLOUD VERT. THICKNESS	T O T A L M A S S	ENTRAINED MASS TIME STEP WHEN THIS CLOUD	TIME STEP WHEN PREVIOUS CLOUD

```
     (SEC)          (FT)          (FT)          (FT)          (FT)          (FT)          (CU FT)       (CU FT)
WAS CREATED      WAS CREATED


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     1

     5.187          200.0         200.0         15.45         1.500         0.3336        0.2570        0.0000E+00
81               1


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     2

     5.374          200.0         200.0         15.82         1.834         0.9046        0.6849        0.0000E+00
161              81


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     3

     5.731          200.0         200.0         21.81         2.738         3.518         9.570         0.0000E+00
241              200


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     4

     6.250          200.0         200.0         37.47         6.256         2.889         13.78         0.0000E+00
321              241


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     5

     6.768          200.0         200.0         51.23         9.145         0.7587        6.189         0.0000E+00
401              321


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     6

     7.287          200.0         200.0         60.54         9.715         0.2846        2.960         0.0000E+00
481              401


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     7

     7.806          200.0         200.0         66.87         9.856         0.1439        1.690         0.0000E+00
561              481


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     8

     8.324          200.0         200.0         71.68         9.909         0.9145E-01    1.157         0.0000E+00
641              561


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =     9

     8.843          200.0         200.0         75.67         9.933         0.6686E-01    0.8929        0.0000E+00
721              641


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =    10

     9.362          200.0         200.0         79.17         9.947         0.5298E-01    0.7386        0.0000E+00
801              721


         NEW CLOUD CREATED, NTCLD(K)  (K =       1) =    11

     9.388          200.0         200.0         79.33         8.735         1.265         704.6         0.0000E+00
805              801
```

NOTE -- When all solid material has settled from a cloud, the cloud is erased and the remaining clouds for this solids type are renumbered.

TIME FROM DISPOSAL (SEC)	CLOUD CENTROID X-LOCATION (FT)	Z-LOCATION (FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	T O T A L M A S S (CU FT)	ENTRAINED MASS (CU FT)	TIME STEP WHEN THIS CLOUD WAS CREATED	TIME STEP WHEN PREVIOUS CLOUD WAS CREATED
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 1									
5.187	200.0	200.0	15.45	1.500	0.3336	0.7008E-01	0.0000E+00	81	1
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 2									
5.374	200.0	200.0	15.82	1.834	0.9046	0.1869	0.0000E+00	161	81
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 3									
5.731	200.0	200.0	21.81	2.738	3.518	2.610	0.0000E+00	241	200
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 4									
6.250	200.0	200.0	37.47	6.256	2.889	3.759	0.0000E+00	321	241
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 5									
6.768	200.0	200.0	51.23	9.145	0.7587	1.688	0.0000E+00	401	321
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 6									
7.287	200.0	200.0	60.54	9.715	0.2846	0.8071	0.0000E+00	481	401
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 7									
7.806	200.0	200.0	66.87	9.856	0.1439	0.4611	0.0000E+00	561	481
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 8									
8.324	200.0	200.0	71.68	9.909	0.9145E-01	0.3155	0.0000E+00	641	561
NEW CLOUD CREATED, NTCLD(K) (K = 2) = 9									
8.843	200.0	200.0	75.67	9.933	0.6686E-01	0.2435	0.0000E+00	721	641

NEW CLOUD CREATED, NTCLD(K) (K = 2) = 10

```
     9.362        200.0       200.0       79.17       9.947      0.5298E-01  0.2015      0.0000E+00
801            721
```

NEW CLOUD CREATED, NTCLD(K) (K = 2) = 11

```
     9.388        200.0       200.0       79.33       8.735      1.265       192.2       0.0000E+00
805            801
```

NOTE -- When all solid material has settled from a cloud, the cloud is erased and the remaining clouds for this solids type are renumbered.

LONG TERM DIFFUSION RESULTS:

BEGIN LONG TERM SIMULATION OF FATE OF FSAND

SUMMARY OF FSAND DISTRIBUTIONS AFTER 300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.9455

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 737.55

SUMMARY OF FSAND DISTRIBUTIONS AFTER 600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 0.00000E+00

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 742.50

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 600.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    .    .    .    .    0    0    0    0   00000
  4 0000    0    0    0    0    0    .    .    .    +    +    .    .    .    0    0   00000
  5 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   00000
  6 0000    0    0    .    .    +    + .01  .04  .07  .07  .04  .01    +    +    .   .0000
  7 0000    0    0    .    +    + .03  .17  .49  .82  .82  .47  .16  .03    +    +   .0000
  8 0000    0    .    .    + .02  .22  1.1  3.1  5.2  5.1  3.0  1.0  .21  .02    +   .0000
  9 0000    0    .    +    + .10  .85  4.1   12   20   20   11  3.9  .79  .09    +   +0000
 10 0000    0    .    + .01  .23  1.8  9.0   26   46   45   25  8.6  1.7  .21  .01   +0000
 11 0000    0    .    + .02  .30  2.4   12   35   64   64   34   11  2.2  .27  .01   +0000
 12 0000    0    .    + .01  .23  1.8  9.0   26   46   45   25  8.6  1.7  .21  .01   +0000
 13 0000    0    .    +    + .10  .85  4.1   12   20   20   11  3.9  .79  .09    +   +0000
 14 0000    0    .    .    + .02  .22  1.1  3.1  5.2  5.1  3.0  1.0  .21  .02    +   .0000
 15 0000    0    0    .    +    + .03  .17  .49  .82  .82  .47  .16  .03    +    +   .0000
 16 0000    0    0    .    .    +    + .01  .04  .07  .07  .04  .01    +    +    .   .0000
 17 0000    0    0    0    .    .    +    +    +    +    +    +    +    +    .    .   00000
 18 0000    0    0    0    0    0    .    .    .    +    +    .    .    .    0    0   00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 600.00 SECONDS ELAPSED TIME FOR FSAND

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	200.0	219.6	0.0000E+00	0.0000E+00	40.02	9.951	0.4866E-01	0.200000E-01

COMPUTATIONS FOR FSAND TERMINATED AT 600.00 SEC. ELAPSED TIME...MATERIAL SETTLED TO BOTTOM

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 600.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    .    .    .    .    0    0    0    0   00000
  4 0000    0    0    0    0    0    .    .    .    +    +    .    .    .    0    0   00000
```

```
 5 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   00000
 6 0000   0   0   .   .   +   + .01 .04 .07 .07 .04 .01   +   +   .   .0000
 7 0000   0   0   .   +   + .03 .17 .49 .82 .82 .47 .16 .03   +   +   .0000
 8 0000   0   .   .   + .02 .22 1.1 3.1 5.2 5.1 3.0 1.0 .21 .02   +   .0000
 9 0000   0   .   +   + .10 .85 4.1  12  20  20  11 3.9 .79 .09   +   +0000
10 0000   0   .   + .01 .23 1.8 9.0  26  46  45  25 8.6 1.7 .21 .01   +0000
11 0000   0   .   + .02 .30 2.4  12  35  64  64  34  11 2.2 .27 .01   +0000
12 0000   0   .   + .01 .23 1.8 9.0  26  46  45  25 8.6 1.7 .21 .01   +0000
13 0000   0   .   +   + .10 .85 4.1  12  20  20  11 3.9 .79 .09   +   +0000
14 0000   0   .   .   + .02 .22 1.1 3.1 5.2 5.1 3.0 1.0 .21 .02   +   .0000
15 0000   0   0   .   +   + .03 .17 .49 .82 .82 .47 .16 .03   +   +   .0000
16 0000   0   0   .   .   +   + .01 .04 .07 .07 .04 .01   +   +   .   .0000
17 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   00000
18 0000   0   0   0   0   0   .   .   .   +   +   .   .   .   0   0   00000
19 0000000000000000000000000000000000000000000000000000000000000000000000
```

```
THICKNESS (FT) OF FSAND    ACCUMULATED ON BOTTOM,      600.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 0000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   0   .   .   .   .   .   .   0   0   0   00000
 6 0000   0   0   0   0   .   .   .   +   +   +   +   .   .   .   0   00000
 7 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   00000
 8 0000   0   0   0   .   +   +   + .01 .02 .02 .01   +   +   +   .   00000
 9 0000   0   0   .   .   +   + .01 .04 .08 .08 .04 .01   +   +   .   .0000
10 0000   0   0   .   .   +   + .03 .11 .19 .19 .10 .03   +   +   .   .0000
11 0000   0   0   .   .   + .01 .05 .14 .26 .27 .14 .04   +   +   .   .0000
12 0000   0   0   .   .   +   + .03 .11 .19 .19 .10 .03   +   +   .   .0000
13 0000   0   0   .   .   +   + .01 .04 .08 .08 .04 .01   +   +   .   .0000
14 0000   0   0   0   .   +   +   + .01 .02 .02 .01   +   +   +   .   00000
15 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   00000
16 0000   0   0   0   0   .   .   .   +   +   +   +   .   .   .   0   00000
17 0000   0   0   0   0   0   0   .   .   .   .   .   .   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 0000000000000000000000000000000000000000000000000000000000000000000000
```

BEGIN LONG TERM SIMULATION OF FATE OF SILT

SUMMARY OF SILT DISTRIBUTIONS AFTER 300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 5.6506

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 196.85

SUMMARY OF SILT DISTRIBUTIONS AFTER 600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 5.1233

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.38

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 600.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    00000
  4 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0    00000
  5 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0    00000
  6 0000    0    0    0    .    +    +    +  .01  .02  .02  .01    +    +    +    .    00000
  7 0000    0    0    .    .    +    +  .04  .13  .22  .22  .13  .04    +    +    .    .0000
  8 0000    0    0    .    +    +  .06  .30  .85  1.4  1.4  .82  .28  .05    +    +    .0000
  9 0000    0    .    .    +  .02  .23  1.1  3.1  5.3  5.3  3.0  1.0  .21  .02    +    .0000
 10 0000    0    .    +    +  .06  .51  2.4  7.0   12   12  6.8  2.3  .47  .05    +    +0000
 11 0000    0    .    +    +  .08  .67  3.2  9.2   16   16  9.0  3.0  .62  .07    +    +0000
 12 0000    0    .    +    +  .06  .51  2.4  7.0   12   12  6.8  2.3  .47  .05    +    +0000
 13 0000    0    .    .    +  .02  .23  1.1  3.1  5.3  5.3  3.0  1.0  .21  .02    +    .0000
 14 0000    0    0    .    +    +  .06  .30  .85  1.4  1.4  .82  .28  .05    +    +    .0000
 15 0000    0    0    .    .    +    +  .04  .13  .22  .22  .13  .04    +    +    .    .0000
 16 0000    0    0    0    .    +    +    +  .01  .02  .02  .01    +    +    +    .    00000
 17 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0    00000
 18 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0    00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 600.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	200.0	219.6	0.7008E-01	0.0000E+00	39.50	2.198	1.884	0.263379E-03
2	200.0	219.6	0.1869	0.0000E+00	40.02	2.533	2.454	0.511968E-03
3	200.0	219.6	2.610	0.0000E+00	48.32	4.750	5.067	0.251927E-02
4	200.0	219.6	2.256	0.0000E+00	68.53	7.564	2.436	0.175102E-02

SUMMARY OF SILT DISTRIBUTIONS AFTER 900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.8626

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.64

SUMMARY OF SILT DISTRIBUTIONS AFTER 1200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.7459

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.75

MAX CONC IS 0.00000007 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 1200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 00000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    .    .    .    .    .    .    .    .    0    0   00000
 5 0000    0    0    0    0    .    .    +    +    +    +    +    +    .    .    0   00000
 6 0000    0    0    0    .    +    +    +  .01  .02  .02  .01    +    +    +    .   00000
```

```
 7 0000   0   0   .   .   +   + .04 .13 .22 .22 .13 .04   +   +   .   ,0000
 8 0000   0   0   .   +   + .06 .30 .85 1.4 1.4 .82 .28 .05   +   +   ,0000
 9 0000   0   .   .   + .02 .23 1.1 3.1 5.3 5.3 3.1 1.0 .21 .02   +   ,0000
10 0000   0   .   +   + .06 .51 2.4 7.1  12  12 6.9 2.3 .48 .05   +   +0000
11 0000   0   .   +   + .08 .67 3.2 9.2  16  16 9.0 3.0 .62 .07   +   +0000
12 0000   0   .   +   + .06 .51 2.4 7.1  12  12 6.9 2.3 .48 .05   +   +0000
13 0000   0   .   .   + .02 .23 1.1 3.1 5.3 5.3 3.1 1.0 .21 .02   +   .0000
14 0000   0   0   .   +   + .06 .30 .85 1.4 1.4 .82 .28 .05   +   +   ,0000
15 0000   0   0   .   .   +   + .04 .13 .22 .22 .13 .04   +   +   .   .0000
16 0000   0   0   0   .   +   +   + .01 .02 .02 .01   +   +   +   .   00000
17 0000   0   0   0   0   .   .   +   +   +   +   +   +   .   .   0   00000
18 0000   0   0   0   0   0   .   .   .   .   .   .   .   .   0   0   00000
19 00000000000000000000000000000000000000000000000000000000000000000000000
```

SMALL CLOUDS AT 1200.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	200.0	239.4	0.7008E-01	0.0000E+00	71.38	1.453	3.433	0.340000E-04
2	200.0	239.4	0.1869	0.0000E+00	72.03	1.811	4.003	0.522830E-04
3	200.0	239.4	2.482	0.0000E+00	82.20	4.320	5.680	0.342419E-03
4	200.0	239.4	2.007	0.0000E+00	106.2	7.093	2.907	0.316010E-03

SUMMARY OF SILT DISTRIBUTIONS AFTER 1500.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.6918

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.81

SUMMARY OF SILT DISTRIBUTIONS AFTER 1800.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.6631

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.84

CONCENTRATIONS ABOVE BACKGROUND OF SILT (MG/L) IN THE CLOUD 1800.00 SECONDS AFTER DUMP

0.00 FT BELOW THE WATER SURFACE

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M	N= 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	.	.	.	.	.	0	00000	
4	0000	0	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.0000	
5	0000	0	0	0	0	0	0	.	.	+	+	+	+	+	+	+	.0000	
6	0000	0	0	0	0	0	.	.	+	+	+	+	.01	+	+	+	+0000	
7	0000	0	0	0	0	.	.	+	+	.01	.03	.05	.06	.05	.02	.01	+0000	
8	0000	0	0	0	0	.	+	+	.01	.04	.12	.23	.28	.22	.12	.04	+0000	
9	0000	0	0	0	.	.	+	+	.03	.13	.36	.66	.79	.63	.33	.11	.020000	
10	0000	0	0	0	.	.	+	+	.05	.24	.67	1.2	1.4	1.1	.62	.22	.050000	
11	0000	0	0	0	.	.	+	.01	.07	.29	.82	1.5	1.8	1.4	.77	.27	.060000	
12	0000	0	0	0	.	.	+	+	.05	.24	.67	1.2	1.4	1.1	.62	.22	.050000	
13	0000	0	0	0	.	.	+	+	.03	.13	.36	.66	.79	.63	.33	.11	.020000	
14	0000	0	0	0	0	.	+	+	.01	.04	.12	.23	.28	.22	.12	.04	+0000	
15	0000	0	0	0	0	.	.	+	+	.01	.03	.05	.06	.05	.02	.01	+0000	
16	0000	0	0	0	0	0	.	.	+	+	+	+	.01	+	+	+	+0000	
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	000000000000000000000000000000000000000000000000000000000000000000																	

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 1800.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M	N= 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	.	.	.	.	.	.	.	.	.	.	00000	
5	0000	0	0	0	0	.	.	+	+	+	+	+	+	.	.	.	.0000	
6	0000	0	0	0	.	+	+	+	.01	.02	.02	.01	+	+	+	.	.0000	
7	0000	0	0	.	.	+	+	.04	.13	.22	.22	.13	.04	+	+	+	.0000	
8	0000	0	0	.	+	+	.06	.30	.85	1.4	1.4	.82	.28	.05	+	+	.0000	
9	0000	0	.	.	+	.02	.23	1.1	3.1	5.3	5.3	3.1	1.0	.22	.02	+	+0000	
10	0000	0	.	+	+	.06	.51	2.4	7.1	12	12	6.9	2.3	.48	.05	+	+0000	
11	0000	0	.	+	+	.08	.67	3.2	9.2	16	16	9.0	3.0	.63	.07	+	+0000	

12	0000	0	.	+	+	.06	.51	2.4	7.1	12	12	6.9	2.3	.48	.05	+	+0000
13	0000	0	.	.	+	.02	.23	1.1	3.1	5.3	5.3	3.1	1.0	.22	.02	+	+0000
14	0000	0	0	.	+	+	.06	.30	.85	1.4	1.4	.82	.28	.05	+	+	.0000
15	0000	0	0	.	.	+	+	.04	.13	.22	.22	.13	.04	+	+	+	.0000
16	0000	0	0	0	.	+	+	+	.01	.02	.02	.01	+	+	+	.	.0000
17	0000	0	0	0	0	.	.	+	+	+	+	+	+	.	.	.	.0000
18	0000	0	0	0	0	0	.	.	.	.	.	.	.	.	.	.	00000

19 000000000000000000000000000000000000000000000000000000000000000000000

SMALL CLOUDS AT 1800.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	200.0	259.2	0.7008E-01	0.0000E+00	109.6	0.6987	4.982	0.340000E-04
2	200.0	259.2	0.1869	0.0000E+00	110.3	1.057	5.553	0.340000E-04
3	200.0	259.2	2.448	0.0000E+00	122.1	3.628	6.372	0.102044E-03
4	200.0	259.2	1.958	0.0000E+00	149.5	6.396	3.604	0.963811E-04

SUMMARY OF SILT DISTRIBUTIONS AFTER 2100.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.6457

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.85

SUMMARY OF SILT DISTRIBUTIONS AFTER 2400.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 4.6339

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 197.87

```
CONCENTRATIONS ABOVE BACKGROUND OF SILT     (MG/L) IN THE CLOUD   2400.00 SECONDS AFTER DUMP


                     0.00 FT BELOW THE WATER SURFACE
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . = .LT. .0001   0 = .LT.
.000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   .   .   .   +   +   +   +   +   +   +   +   +   +0000
  4 0000   0   0   0   .   .   +   +   +   +   + .01 .01 .01 .01 .01   +0000
  5 0000   0   0   0   .   +   +   +   + .01 .02 .04 .06 .07 .06 .04 .020000
  6 0000   0   0   0   .   +   +   + .01 .04 .09 .15 .20 .22 .20 .14 .080000
  7 0000   0   0   0   +   +   + .01 .04 .11 .23 .39 .53 .58 .52 .37 .220000
  8 0000   0   0   0   +   +   + .03 .09 .23 .48 .81 1.1 1.2 1.0 .78 .460000
  9 0000   0   0   0   +   + .01 .05 .15 .40 .82 1.3 1.8 2.0 1.8 1.3 .770000
 10 0000   0   0   0   +   + .01 .06 .21 .54 1.1 1.8 2.5 2.8 2.4 1.8 1.00000
 11 0000   0   0   0   +   + .02 .07 .24 .60 1.2 2.0 2.8 3.1 2.7 2.0 1.10000
 12 0000   0   0   0   +   + .01 .06 .21 .54 1.1 1.8 2.5 2.8 2.4 1.8 1.00000
 13 0000   0   0   0   +   + .01 .05 .15 .40 .82 1.3 1.8 2.0 1.8 1.3 .770000
 14 0000   0   0   0   +   +   + .03 .09 .23 .48 .81 1.1 1.2 1.0 .78 .460000
 15 0000   0   0   0   +   +   + .01 .04 .11 .23 .39 .53 .58 .52 .37 .220000
 16 0000   0   0   0   .   +   +   + .01 .04 .09 .15 .20 .22 .20 .14 .080000
 17 0000   0   0   0   .   +   +   +   + .01 .02 .04 .06 .07 .06 .04 .020000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000

BOTTOM ACCUMULATION OF SILT      (CU FT/GRID SQUARE) ,    2400.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . = .LT. .0001   0 = .LT.
.000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   .   .   .   .   .   .   .   .   .0000
  4 0000   0   0   0   0   0   .   .   .   .   .   .   .   .   .   .   .0000
  5 0000   0   0   0   0   .   .   +   +   +   +   +   +   .   .   .   .0000
  6 0000   0   0   0   .   +   +   + .01 .02 .02 .01   +   +   +   .   .0000
  7 0000   0   0   .   .   +   + .04 .13 .22 .22 .13 .04   +   +   +   +0000
  8 0000   0   0   .   +   + .06 .30 .85 1.4 1.4 .82 .28 .05   +   +   +0000
  9 0000   0   .   .   + .02 .23 1.1 3.1 5.3 5.3 3.1 1.0 .22 .02   +   +0000
 10 0000   0   .   +   + .06 .51 2.4 7.1  12  12 6.9 2.3 .48 .06   +   +0000
 11 0000   0   .   +   + .08 .67 3.2 9.2  16  16 9.0 3.0 .63 .07   +   +0000
 12 0000   0   .   +   + .06 .51 2.4 7.1  12  12 6.9 2.3 .48 .06   +   +0000
 13 0000   0   .   .   + .02 .23 1.1 3.1 5.3 5.3 3.1 1.0 .22 .02   +   +0000
 14 0000   0   0   .   +   + .06 .30 .85 1.4 1.4 .82 .28 .05   +   +   +0000
 15 0000   0   0   .   .   +   + .04 .13 .22 .22 .13 .04   +   +   +   +0000
 16 0000   0   0   0   .   +   +   + .01 .02 .02 .01   +   +   +   .   .0000
```

17	0000	0	0	0	0	.	.	+	+	+	+	+	+	.	.	.		.0000
18	0000	0	0	0	0	0	.	.	.	.	.	.	.	.	.	.		.0000
19	0000000000000000000000000000000000000000000000000000000000000000000000																	

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SMALL CLOUDS AT 2400.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	200.0	279.0	0.7008E-01	0.0000E+00	153.2	0.0000E+00	6.531	0.340000E-04
2	200.0	279.0	0.1869	0.0000E+00	154.1	0.3028	7.102	0.340000E-04
3	200.0	279.0	2.435	0.0000E+00	167.3	2.888	7.112	0.490430E-04
4	200.0	279.0	1.942	0.0000E+00	197.7	5.655	4.345	0.469219E-04

—

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 2400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	.	.	.	.	.	.	.	.		.0000
4	0000	0	0	0	0	0	.	.	.	.	.	.	.	.	.	.		.0000
5	0000	0	0	0	0	.	.	+	+	+	+	+	+	.	.	.		.0000
6	0000	0	0	0	.	+	+	+	.01	.02	.02	.01	+	+	+	.		.0000
7	0000	0	0	.	.	+	+	.04	.13	.22	.22	.13	.04	+	+	+		+0000
8	0000	0	0	.	+	+	.06	.30	.85	1.4	1.4	.82	.28	.05	+	+		+0000
9	0000	0	.	.	+	.02	.23	1.1	3.1	5.3	5.3	3.1	1.0	.22	.02	+		+0000
10	0000	0	.	+	+	.06	.51	2.4	7.1	12	12	6.9	2.3	.48	.06	+		+0000
11	0000	0	.	+	+	.08	.67	3.2	9.2	16	16	9.0	3.0	.63	.07	+		+0000
12	0000	0	.	+	+	.06	.51	2.4	7.1	12	12	6.9	2.3	.48	.06	+		+0000
13	0000	0	.	.	+	.02	.23	1.1	3.1	5.3	5.3	3.1	1.0	.22	.02	+		+0000
14	0000	0	0	.	+	+	.06	.30	.85	1.4	1.4	.82	.28	.05	+	+		+0000
15	0000	0	0	.	.	+	+	.04	.13	.22	.22	.13	.04	+	+	+		+0000
16	0000	0	0	0	.	+	+	+	.01	.02	.02	.01	+	+	+	.		.0000
17	0000	0	0	0	0	.	.	+	+	+	+	+	+	.	.	.		.0000
18	0000	0	0	0	0	0	.	.	.	.	.	.	.	.	.	.		.0000
19	0000000000000000000000000000000000000000000000000000000000000000000000																	

—

THICKNESS (FT) OF SILT ACCUMULATED ON BOTTOM, 2400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M	N= 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	.	.	.	.	.	.	.	0	0	00000	
6	0000	0	0	0	0	.	.	.	+	+	+	+	.	.	.	.	00000	
7	0000	0	0	0	.	.	+	+	+	+	+	+	+	+	.	.	.0000	
8	0000	0	0	0	.	+	+	+	.01	.01	.01	.01	+	+	+	.	.0000	
9	0000	0	0	.	.	+	+	.01	.04	.07	.07	.04	.01	+	+	.	.0000	
10	0000	0	0	.	.	+	+	.03	.09	.16	.16	.09	.03	+	+	.	.0000	
11	0000	0	0	.	.	+	+	.04	.12	.21	.21	.12	.04	+	+	.	.0000	
12	0000	0	0	.	.	+	+	.03	.09	.16	.16	.09	.03	+	+	.	.0000	
13	0000	0	0	.	.	+	+	.01	.04	.07	.07	.04	.01	+	+	.	.0000	
14	0000	0	0	0	.	+	+	+	.01	.01	.01	.01	+	+	+	.	.0000	
15	0000	0	0	0	.	.	+	+	+	+	+	+	+	+	.	.	.0000	
16	0000	0	0	0	0	.	.	.	+	+	+	+	.	.	.	.	00000	
17	0000	0	0	0	0	0	0	.	.	.	.	.	.	.	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000																	

FINAL DISTRIBUTIONS OF TOTAL SETTLED MATERIAL FOLLOW.....

TOTAL ACCUMULATED SOLID VOLUME ON BOTTOM (CU FT/GRID SQR), 2400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M	N= 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.	.0000	
4	0000	0	0	0	0	.	.	.	+	+	+	+	.	.	.	.	.0000	
5	0000	0	0	0	.	.	+	+	+	+	+	+	+	+	.	.	.0000	
6	0000	0	0	.	.	+	+	.02	.05	.09	.09	.05	.01	+	+	+	.0000	
7	0000	0	0	.	+	+	.04	.22	.63	1.0	1.0	.61	.21	.04	+	+	+0000	
8	0000	0	.	+	+	.03	.29	1.4	3.9	6.6	6.6	3.8	1.3	.27	.03	+	+0000	
9	0000	0	.	+	+	.13	1.0	5.2	15	25	25	14	4.9	1.0	.12	+	+0000	
10	0000	0	.	+	.02	.29	2.4	12	33	58	57	32	11	2.2	.27	.02	+0000	
11	0000	0	.	+	.02	.38	3.1	15	44	79	80	43	14	2.9	.35	.02	+0000	
12	0000	0	.	+	.02	.29	2.4	12	33	58	57	32	11	2.2	.27	.02	+0000	
13	0000	0	.	+	+	.13	1.0	5.2	15	25	25	14	4.9	1.0	.12	+	+0000	
14	0000	0	.	+	+	.03	.29	1.4	3.9	6.6	6.6	3.8	1.3	.27	.03	+	+0000	
15	0000	0	0	.	+	+	.04	.22	.63	1.0	1.0	.61	.21	.04	+	+	+0000	
16	0000	0	0	.	.	+	+	.02	.05	.09	.09	.05	.01	+	+	+	.0000	

```
17 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   .0000
18 0000   0   0   0   0   .   .   .   +   +   +   +   .   .   .   .   .0000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   2400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY   1.000   (LEGEND... + = .LT. .01   . = .LT. .0001   0 = .LT. .000001)

```
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000   0   0   0   0   0   0   0   0   .   .   0   0   0   0   0   00000
 5 0000   0   0   0   0   0   .   .   .   .   .   .   .   .   0   0   00000
 6 0000   0   0   0   0   .   .   +   +   +   +   +   +   .   .   0   00000
 7 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   00000
 8 0000   0   0   0   .   +   +   + .02 .04 .04 .02   +   +   +   .   .0000
 9 0000   0   0   .   .   +   + .03 .09 .15 .15 .09 .03   +   +   .   .0000
10 0000   0   0   .   +   + .01 .07 .20 .36 .36 .20 .06 .01   +   +   .0000
11 0000   0   0   .   +   + .01 .09 .27 .49 .50 .26 .09 .01   +   +   .0000
12 0000   0   0   .   +   + .01 .07 .20 .36 .36 .20 .06 .01   +   +   .0000
13 0000   0   0   .   .   +   + .03 .09 .15 .15 .09 .03   +   +   .   .0000
14 0000   0   0   0   .   +   +   + .02 .04 .04 .02   +   +   +   .   .0000
15 0000   0   0   0   .   .   +   +   +   +   +   +   +   +   .   .   00000
16 0000   0   0   0   0   .   .   +   +   +   +   +   +   .   .   0   00000
17 0000   0   0   0   0   0   .   .   .   .   .   .   .   .   0   0   00000
18 0000   0   0   0   0   0   0   0   0   .   .   0   0   0   0   0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

*** RUN COMPLETED ***

H

MODEL: SHORT-TERM FATE OF DREDGED MATERIAL FROM SPLIT HULL BARGE OR HOPPER DREDGE
(PC Version 5.01 MAY, 1993)

TITLE: H

FILE: H .DUE

AREA: THE PROJECT AREA IS DESCRIBED BY A 20 X 20 GRID.

THERE ARE 20 GRID POINTS (NMAX) IN THE Z-DIRECTION (FROM LEFT TO RIGHT)
AND 20 GRID POINTS (MMAX) IN THE X-DIRECTION (FROM TOP TO BOTTOM).

EXECUTION PARAMETERS:

MODEL COEFFICIENTS SPECIFIED IN INPUT DATA (KEY1 = 1).

PERFORM COMPLETE ANALYSIS INCLUDING DESCENT, COLLAPSE, AND TRANSPORT-DIFFUSION (KEY2 = 0).

NO CONTAMINANT OR TRACER TRANSPORT-DIFFUSION COMPUTIONS DESIRED (KEY3 = 0).

PRINTING OF CONVECTIVE DESCENT RESULTS NOT REQUESTED (IPCN = 0).

PRINTING OF CONVECTIVE DESCENT RESULTS NOT REQUESTED (IPCN = 0).

PRINTING OF DYNAMIC COLLAPSE RESULTS NOT REQUESTED (IPCL = 0).

QUARTERLY PRINTING OF LONG-TERM TRANSPORT DIFFUSION RESULTS REQUESTED (IPLT = 0).

LONG-TERM TRANSPORT DIFFUSION RESULTS REQUESTED AT THE FOLLOWING 1 DEPTH(S):
0.00 FT

GRID: NUMBER OF LONG TERM GRID POINTS IN Z-DIRECTION (NMAX) = 20

NUMBER OF LONG TERM GRID POINTS IN X-DIRECTION (MMAX) = 20

GRID SPACING IN Z-DIRECTION (DZ) = 100.00000 FT

GRID SPACING IN X-DIRECTION (DX) = 100.00000 FT

CONSTANT DEPTH GRID SPECIFIED HAVING A DEPTH (DEPC) OF 20.00000 FT.

DEPTH GRID, FEET:

M N =	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
2	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
3	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
4	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
5	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
6	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
7	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
8	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
9	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
10	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
11	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
12	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
13	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
14	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
15	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
16	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
17	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
18	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
19	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.

```
 20     20.    20.    20.    20.    20.    20.    20.    20.    20.    20.    20.    20.    20.    20.
20.    20.    20.
```

M N =18	19	20
1 20.	20.	20.
2 20.	20.	20.
3 20.	20.	20.
4 20.	20.	20.
5 20.	20.	20.
6 20.	20.	20.
7 20.	20.	20.
8 20.	20.	20.
9 20.	20.	20.
10 20.	20.	20.
11 20.	20.	20.
12 20.	20.	20.
13 20.	20.	20.
14 20.	20.	20.
15 20.	20.	20.
16 20.	20.	20.
17 20.	20.	20.
18 20.	20.	20.
19 20.	20.	20.
20 20.	20.	20.

CODED GRID:

```
        RANGE OF N IS   1 TO  20

         X X X X X X X X X X X X X X X X X X X X
         X O O O O O O O O O O O O O O O O O O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
         X O W D W W W W W W W W W W W W W W O X
         X O W W W W W W W W W W W W W W W W O X
```

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X O W W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W W O X
X O W W W W W W W W W W W W W W W W W O X
X O O O O O O O O O O O O O O O O O O O X
X X X X X X X X X X X X X X X X X X X X X
```

LEGEND FOR CODED GRID: W = WATER POINT
L = LAND POINT
O = OPEN BOUNDARY
B = DISPOSAL SITE BOUNDARY
D = DUMP LOCATION
X = DUMMY POINT

NUMBER OF GRID POINTS WITHIN ESTUARY = 256

DISPOSAL LOCATION:

THE DUMP LOCATION IS 1000. FT (XBARGE) OR ABOUT GRID POINT #11 FROM THE TOP OF THE GRID

AND 300.0 FT (ZBARGE) OR ABOUT GRID POINT # 4 FROM THE LEFT EDGE OF THE GRID.

THE BOTTOM SLOPE IN THE X-DIRECTION AT THE DUMP SITE (SLOPEX, POSITIVE IF DEPTH INCREASES FROM TOP OF GRID TO BOTTOM OF GRID) IS 0.00 DEGREES.

THE BOTTOM SLOPE IN THE Z-DIRECTION AT THE DUMP SITE (SLOPEZ, POSITIVE IF DEPTH INCREASES FROM LEFT SIDE OF GRID TO RIGHT SIDE OF GRID) IS 0.00 DEGREES.

THE DISPOSAL LOCATION IS NOT AT A HOLE OR DEPRESSION. (DHOLE = 0.0)

AMBIENT DENSITY PROFILE:

DEPTH (FT)	DENSITY (G/CC)
10.00	1.0000
20.00	1.0200

COMPUTED DEPTH:

THE DEPTH AT THE DUMP LOCATION WAS INTERPOLATED TO BE 20.00 FT.

VELOCITY DISTRIBUTION:

VERTICALLY AVERAGED X-DIRECTION (VAX = 0.000E+00 FPS) AND
Z-DIRECTION (VAZ = 0.330E-01 FPS) VELOCITIES CONSTRUCTED AT EACH GRID POINT
FROM A SINGLE OBSERVATION AT A DEPTH (D) OF 20.0 FT.

VELOCITY GRID: X-DIRECTION, FPS

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

M N=	18	19	20
1	0.000	0.000	0.000
2	0.000	0.000	0.000
3	0.000	0.000	0.000
4	0.000	0.000	0.000
5	0.000	0.000	0.000
6	0.000	0.000	0.000
7	0.000	0.000	0.000
8	0.000	0.000	0.000
9	0.000	0.000	0.000
10	0.000	0.000	0.000
11	0.000	0.000	0.000
12	0.000	0.000	0.000
13	0.000	0.000	0.000
14	0.000	0.000	0.000
15	0.000	0.000	0.000
16	0.000	0.000	0.000
17	0.000	0.000	0.000
18	0.000	0.000	0.000
19	0.000	0.000	0.000
20	0.000	0.000	0.000

VELOCITY GRID: Z-DIRECTION, FPS

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
2	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
3	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
4	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
5	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
6	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
7	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033

8	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
9	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
10	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
11	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
12	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
13	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
14	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
15	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
16	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
17	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
18	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
19	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
20	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033

M N=	18	19	20
1	0.033	0.033	0.033
2	0.033	0.033	0.033
3	0.033	0.033	0.033
4	0.033	0.033	0.033
5	0.033	0.033	0.033
6	0.033	0.033	0.033
7	0.033	0.033	0.033
8	0.033	0.033	0.033
9	0.033	0.033	0.033
10	0.033	0.033	0.033
11	0.033	0.033	0.033
12	0.033	0.033	0.033
13	0.033	0.033	0.033
14	0.033	0.033	0.033
15	0.033	0.033	0.033
16	0.033	0.033	0.033
17	0.033	0.033	0.033
18	0.033	0.033	0.033
19	0.033	0.033	0.033
20	0.033	0.033	0.033

BOTTOM SHEAR STRESS, LBS/SQ FT:

M N=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

M N=	18	19	20
1	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000

3	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000

TIME PARAMETERS:

DURATION OF THE DISPOSAL, TREL = 600.00 SECONDS

DURATION OF THE SIMULATION, TSTOP = 4200.00 SECONDS

LONG-TERM TIME STEP USED IN THE SIMULATION, DTL = 300.00 SECONDS

BARGE DESCRIPTION:

LENGTH OF BARGE, BARGL = 0.10E+03 FT

WIDTH OF BARGE, BARGW = 35. FT

DRAFT OF LOADED BARGE, DREL1 = 5.00 FT

DRAFT OF UNLOADED BARGE, DREL2 = 4.00 FT

MODEL COEFFICIENTS READ FROM INPUT:

TURBULENT THERMAL ENTRAINMENT ALPHA0 = 0.2350

SETTLING COEFFICIENT BETA = 0.0000

APPARENT MASS COEFFICIENT	CM	=	1.0000
DRAG COEFFICIENT FOR A SPHERE	CD	=	0.5000
RATIO--CLOUD/AMBIENT DENSITY GRADIENTS	GAMA	=	0.2500
FORM DRAG FOR COLLAPSING CLOUD	CDRAG	=	1.0000
SKIN FRICTION FOR COLLAPSING CLOUD	CFRIC	=	0.0100
DRAG FOR AN ELLIPSOIDAL WEDGE	CD3	=	0.1000
DRAG FOR A PLATE	CD4	=	1.0000
ENTRAINMENT IN COLLAPSE	ALPHAC	=	0.1000
FRICTION BETWEEN CLOUD AND BOTTOM	FRICTN	=	0.0100
4/3 LAW HORIZ. DIFF. DISSIPATION FACTOR	ALAMDA	=	0.0010
UNSTRATIFIED WATER VERT. DIFF. COEF.	AKYO	=	0.0250

STRIPPING COEF. OF FINES DURING CONVERTIVE DESCENT= 0.0030

MATERIAL DESCRIPTION: 2 SOLIDS FRACTIONS

L A Y E R 1

DESCRIPTION	SPEC. GRAV. OR DENSITY (GM/CC)	VOLUMETRIC CONCENTRATION (VOL/VOL)	FALL VELOCITY (FPS)	DEPOSITIONAL VOID RATIO	CHARACTER
FSAND	2.700	0.1500	0.02000	0.7000	NONCOHESIVE

CRITICAL SHEAR STRESS FOR DEPOSITION = 0.1500E-01 LBS/SQ. FT.
SEDIMENT FRACTION WILL BE STRIPPED DURING CONVECTIVE DESCENT.

SILT	2.650	0.5000E-01	0.01000	4.500	COHESIVE

CRITICAL SHEAR STRESS FOR DEPOSITION = 0.9000E-01 LBS/SQ. FT.
SEDIMENT FRACTION WILL BE STRIPPED DURING CONVECTIVE DESCENT.

DESCRIPTION	SPEC. GRAV. OR DENSITY (GM/CC)	VOLUMETRIC CONCENTRATION (VOL/VOL)
FLUID	1.000	0.8000

_ DISCHARGE PARAMETERS:

VOLUME OF LAYER 1 = 1500. CU YD

DEPTH IS TOO SHALLOW FOR CONVECTIVE DESCENT SO DESCENT IS BYPASSED.

CLOUD COLLAPSE PHASE:

IN TRIAL #1 THE COLLAPSE PHASE TIME STEP (DT) WAS 0.10000000 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) FOR CONVECTIVE DESCENT AND COLAPSE WAS 99.

THE INTEGRATION TIME STEP NUMBER WHEN THE BED WAS ENCOUNTERED (IBED) WAS 1.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

DIFFUSION OF THE DISCHARGE IS GREATER THAN DYNAMIC SPREADING FROM THE COLLAPSE.

IN TRIAL #2 THE COLLAPSE PHASE TIME STEP (DT) WAS 0.32666668E-01 SECONDS.

THE TOTAL NUMBER OF INTEGRATION TIME STEPS (ISTEP) FOR CONVECTIVE DESCENT AND COLAPSE WAS 300.

THE INTEGRATION TIME STEP NUMBER WHEN THE BED WAS ENCOUNTERED (IBED) WAS 1.

THE BOTTOM WAS ENCOUNTERED DURING CONVECTIVE DESCENT.

DIFFUSION OF THE DISCHARGE IS GREATER THAN DYNAMIC SPREADING FROM THE COLLAPSE.

TIME FROM DISPOSAL (SEC)	CLOUD CENTROID X-LOCATION (FT)	CLOUD CENTROID Z-LOCATION (FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	T O T A L M A S S (CU FT)	ENTRAINED MASS (CU FT)

TIME STEP WHEN THIS CLOUD WAS CREATED — TIME STEP WHEN PREVIOUS CLOUD WAS CREATED

NEW CLOUD CREATED, NTCLD(K) (K = 1) = 1

601.0	1000.	900.9	72.35	8.000	3.523	401.5	0.0000E+00

31 1

NEW CLOUD CREATED, NTCLD(K) (K = 1) = 2

602.0	1000.	901.6	98.27	11.52	4.376	63.02	0.0000E+00

61 31

NEW CLOUD CREATED, NTCLD(K) (K = 1) = 3

```
        602.9       1000.        902.1       125.8       15.90       2.151       44.92      0.0000E+00
91                61

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    4

        603.9       1000.        902.5       148.3       18.05       1.026       27.39      0.0000E+00
121               91

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    5

        604.9       1000.        902.9       164.9       19.08       0.5436      16.80      0.0000E+00
151               121

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    6

        605.9       1000.        903.2       177.6       19.62       0.3346      11.33      0.0000E+00
181               151

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    7

        606.9       1000.        903.4       187.9       19.77       0.2340      8.457      0.0000E+00
211               181

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    8

        607.8       1000.        903.6       196.7       19.82       0.1788      6.792      0.0000E+00
241               211

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =    9

        608.8       1000.        903.8       204.5       19.86       0.1445      5.725      0.0000E+00
271               241

     NEW CLOUD CREATED, NTCLD(K)  (K =      1) =   10

        609.8       1000.        903.9       211.5       16.63       3.371       5489.      0.0000E+00
300               271


     NOTE -- When all solid material has settled from a cloud, the cloud is erased and
             the remaining clouds for this solids type are renumbered.


     TIME FROM        CLOUD CENTROID       CLOUD X-Z   DEPTH OF    CLOUD VERT.  T O T A L  ENTRAINED
TIME STEP WHEN    TIME STEP WHEN
      DISPOSAL    X-LOCATION  Z-LOCATION    DIAMETER  TOP OF CLOUD THICKNESS     M A S S      MASS
THIS CLOUD        PREVIOUS CLOUD
        (SEC)        (FT)        (FT)         (FT)        (FT)        (FT)      (CU FT)     (CU FT)
WAS CREATED       WAS CREATED

     NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    1

        601.0       1000.        900.9       72.35       8.000       3.523       133.8      0.0000E+00
31                1
```

```
      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    2
        602.0      1000.        901.6       98.27       11.52       4.376       21.01       0.0000E+00
61                 31

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    3
        602.9      1000.        902.1       125.8       15.90       2.151       14.97       0.0000E+00
91                 61

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    4
        603.9      1000.        902.5       148.3       18.05       1.026       9.130       0.0000E+00
121                91

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    5
        604.9      1000.        902.9       164.9       19.08       0.5436      5.599       0.0000E+00
151                121

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    6
        605.9      1000.        903.2       177.6       19.62       0.3346      3.778       0.0000E+00
181                151

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    7
        606.9      1000.        903.4       187.9       19.77       0.2340      2.819       0.0000E+00
211                181

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    8
        607.8      1000.        903.6       196.7       19.82       0.1788      2.263       0.0000E+00
241                211

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =    9
        608.8      1000.        903.8       204.5       19.86       0.1445      1.909       0.0000E+00
271                241

      NEW CLOUD CREATED, NTCLD(K)  (K =      2) =   10
        609.8      1000.        903.9       211.5       16.63       3.371       1830.       0.0000E+00
300                271


      NOTE -- When all solid material has settled from a cloud, the cloud is erased and
              the remaining clouds for this solids type are renumbered.

-
 LONG TERM DIFFUSION RESULTS:
```

BEGIN LONG TERM SIMULATION OF FATE OF FSAND

SUMMARY OF FSAND DISTRIBUTIONS AFTER 900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 437.73

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 5637.3

SUMMARY OF FSAND DISTRIBUTIONS AFTER 1200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 62.031

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 6013.0

SUMMARY OF FSAND DISTRIBUTIONS AFTER 1500.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 0.00000E+00

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 6075.0

BOTTOM ACCUMULATION OF FSAND (CU FT/GRID SQUARE) , 1500.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 10.00 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
7	0000	0	0	0	0	0	0	0	.	.	0	0	0	0	0	0	00000	
8	0000	0	0	0	0	0	.	+	+	+	+	0	0	0	0	0	00000	
9	0000	0	0	0	0	.	.01	.52	2.1	.96	.04	+	0	0	0	0	00000	
10	0000	0	0	0	0	+	.39	15	64	28	1.3	+	.	0	0	0	00000	
11	0000	0	0	0	0	+	1.1	47	241	89	3.9	.02	.	0	0	0	00000	

```
12 0000   0   0   0   0   + .39  15  64  28 1.3   +   .   0   0   0   00000
13 0000   0   0   0   0   . .01 .52 2.1 .96 .04   +   0   0   0   0   00000
14 0000   0   0   0   0   0   .   +   +   +   +   0   0   0   0   0   00000
15 0000   0   0   0   0   0   0   0   .   .   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 0000000000000000000000000000000000000000000000000000000000000000000000
```

```
     COMPUTATIONS FOR FSAND    TERMINATED AT    1500.00  SEC. ELAPSED TIME...MATERIAL SETTLED TO
BOTTOM
```

```
 BOTTOM ACCUMULATION OF FSAND    (CU FT/GRID SQUARE) ,   1500.00 SECONDS AFTER DUMP
 ...MULTIPLY DISPLAYED VALUES BY   10.00          (LEGEND... + = .LT. .01    . = .LT. .0001   0 = .LT.
.000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  7 0000   0   0   0   0   0   0   0   .   .   0   0   0   0   0   0   00000
  8 0000   0   0   0   0   0   .   +   +   +   +   0   0   0   0   0   00000
  9 0000   0   0   0   0   . .01 .52 2.1 .96 .04   +   0   0   0   0   00000
 10 0000   0   0   0   0   + .39  15  64  28 1.3   +   .   0   0   0   00000
 11 0000   0   0   0   0   + 1.1  47 241  89 3.9 .02   .   0   0   0   00000
 12 0000   0   0   0   0   + .39  15  64  28 1.3   +   .   0   0   0   00000
 13 0000   0   0   0   0   . .01 .52 2.1 .96 .04   +   0   0   0   0   00000
 14 0000   0   0   0   0   0   .   +   +   +   +   0   0   0   0   0   00000
 15 0000   0   0   0   0   0   0   0   .   .   0   0   0   0   0   0   00000
 16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 19 0000000000000000000000000000000000000000000000000000000000000000000000
```

```
 THICKNESS (FT) OF FSAND    ACCUMULATED ON BOTTOM,     1500.00 SECONDS AFTER DUMP
 ...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01    . = .LT. .0001   0 = .LT.
.000001)
 M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
  2 0000000000000000000000000000000000000000000000000000000000000000000000
  3 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
  4 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
```

```
 5 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 8 0000   0   0   0   0   0   0   .   .   .   0   0   0   0   0   0   00000
 9 0000   0   0   0   0   0   .   +   +   +   .   0   0   0   0   0   00000
10 0000   0   0   0   0   .   + .02 .10 .04   +   .   0   0   0   0   00000
11 0000   0   0   0   0   .   + .07 .40 .15   +   .   0   0   0   0   00000
12 0000   0   0   0   0   .   + .02 .10 .04   +   .   0   0   0   0   00000
13 0000   0   0   0   0   0   .   +   +   +   .   0   0   0   0   0   00000
14 0000   0   0   0   0   0   0   .   .   .   0   0   0   0   0   0   00000
15 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 00000000000000000000000000000000000000000000000000000000000000000000000
```

```
    BEGIN LONG TERM SIMULATION OF FATE OF SILT



SUMMARY OF SILT     DISTRIBUTIONS AFTER     900.00 SEC.

    TOTAL SUSPENDED MATERIAL (CU FT) =      998.16
    TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =      1026.8



SUMMARY OF SILT     DISTRIBUTIONS AFTER    1200.00 SEC.

    TOTAL SUSPENDED MATERIAL (CU FT) =      197.29
    TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =      1827.7



SUMMARY OF SILT     DISTRIBUTIONS AFTER    1500.00 SEC.

    TOTAL SUSPENDED MATERIAL (CU FT) =      182.95
```

```
     TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) =      1842.1


     MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT     0.00 FT

-
 BOTTOM ACCUMULATION OF SILT      (CU FT/GRID SQUARE) ,    1500.00 SECONDS AFTER DUMP
 ...MULTIPLY DISPLAYED VALUES BY    1.000          (LEGEND... + = .LT. .01    . = .LT. .0001    0 = .LT.
.000001)
 M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  6 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  7 0000    0    0    0    0    0    .    .    +    .    .    0    0    0    0    0   00000
  8 0000    0    0    0    0    .    +  .02  .08  .05    +    .    0    0    0    0   00000
  9 0000    0    0    0    0    +  .09  2.6   10  5.6  .48    +    .    0    0    0   00000
 10 0000    0    0    0    .  .01  1.8   52  207  108  8.2  .11    +    0    0    0   00000
 11 0000    0    0    0    .  .02  4.8  146  581  296   22  .29    +    0    0    0   00000
 12 0000    0    0    0    .  .01  1.8   52  207  108  8.2  .11    +    0    0    0   00000
 13 0000    0    0    0    0    +  .09  2.6   10  5.6  .48    +    .    0    0    0   00000
 14 0000    0    0    0    0    .    +  .02  .08  .05    +    .    0    0    0    0   00000
 15 0000    0    0    0    0    0    .    .    +    .    .    0    0    0    0    0   00000
 16 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 19 000000000000000000000000000000000000000000000000000000000000000000000000
-
 SMALL CLOUDS AT     1500.00 SECONDS ELAPSED TIME FOR SILT
```

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	930.5	133.8	0.0000E+00	132.0	13.04	5.852	0.690000E-02
2	1000.	931.2	21.01	0.0000E+00	163.4	11.58	6.705	0.617932E-03
3	1000.	931.7	14.81	0.0000E+00	195.8	15.71	4.288	0.440774E-03
4	1000.	932.1	8.004	0.0000E+00	221.8	17.67	2.326	0.320595E-03
5	1000.	932.4	3.461	0.0000E+00	240.7	18.57	1.430	0.197533E-03

6	1000.	932.7	1.022	0.0000E+00	255.0	18.98	1.018
0.794520E-04							
7	1000.	932.9	0.4047	0.0000E+00	266.6	19.06	0.9424
0.398679E-04							
8	1000.	933.1	0.2454	0.0000E+00	276.4	19.08	0.9248
0.340000E-04							
9	1000.	933.2	0.1623	0.0000E+00	285.2	19.09	0.9131
0.340000E-04							

SUMMARY OF SILT DISTRIBUTIONS AFTER 1800.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 158.41

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1866.6

SUMMARY OF SILT DISTRIBUTIONS AFTER 2100.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 128.64

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1896.4

SUMMARY OF SILT DISTRIBUTIONS AFTER 2400.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 111.93

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1913.1

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 2400.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
  2 000000000000000000000000000000000000000000000000000000000000000000000000
  3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
  4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
```

5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
6	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
7	0000	0	0	0	0	0	.	.	+	.	.	0	0	0	0	0	00000
8	0000	0	0	0	0	.	+	.02	.08	.05	+	+	0	0	0	0	00000
9	0000	0	0	0	0	+	.09	2.6	10	5.6	.48	+	.	0	0	0	00000
10	0000	0	0	0	.	.01	1.8	52	211	111	8.3	.11	+	0	0	0	00000
11	0000	0	0	0	.	.02	4.8	146	610	322	22	.29	+	0	0	0	00000
12	0000	0	0	0	.	.01	1.8	52	211	111	8.3	.11	+	0	0	0	00000
13	0000	0	0	0	0	+	.09	2.6	10	5.6	.48	+	.	0	0	0	00000
14	0000	0	0	0	0	.	+	.02	.08	.05	+	+	0	0	0	0	00000
15	0000	0	0	0	0	0	.	.	+	.	.	0	0	0	0	0	00000
16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
19	0000000000000000000000000000000000000000000000000000000000000000000000																

SMALL CLOUDS AT 2400.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	960.2	63.85	0.0000E+00	203.2	16.32	3.678	0.301068E-02
2	1000.	960.9	21.01	0.0000E+00	239.4	10.64	9.029	0.148593E-03
3	1000.	961.4	14.29	0.0000E+00	276.1	14.72	5.282	0.122946E-03
4	1000.	961.8	7.656	0.0000E+00	305.3	16.63	3.367	0.861482E-04
5	1000.	962.1	3.335	0.0000E+00	326.4	17.48	2.524	0.495827E-04
6	1000.	962.4	0.9988	0.0000E+00	342.2	17.85	2.146	0.340000E-04
7	1000.	962.6	0.3961	0.0000E+00	355.0	17.93	2.074	0.340000E-04
8	1000.	962.8	0.2401	0.0000E+00	365.9	17.94	2.056	0.340000E-04
9	1000.	962.9	0.1588	0.0000E+00	375.5	17.96	2.044	0.340000E-04

SUMMARY OF SILT DISTRIBUTIONS AFTER 2700.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 102.53

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = .1922.5

SUMMARY OF SILT DISTRIBUTIONS AFTER 3000.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 97.145

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1927.8

SUMMARY OF SILT DISTRIBUTIONS AFTER 3300.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 93.986

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1931.0

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 3300.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
7	0000	0	0	0	0	0	.	.	+	+	.	.	0	0	0	0	00000	
8	0000	0	0	0	0	.	+	.02	.08	.05	+	+	.	0	0	0	00000	
9	0000	0	0	0	.	+	.09	2.6	10	5.7	.51	.01	+	.	0	0	00000	
10	0000	0	0	0	.	.01	1.8	52	212	113	8.8	.13	+	.	0	0	00000	
11	0000	0	0	0	.	.02	4.8	146	613	327	24	.34	+	.	0	0	00000	
12	0000	0	0	0	.	.01	1.8	52	212	113	8.8	.13	+	.	0	0	00000	
13	0000	0	0	0	.	+	.09	2.6	10	5.7	.51	.01	+	.	0	0	00000	
14	0000	0	0	0	0	.	+	.02	.08	.05	+	+	.	0	0	0	00000	

15	0000	0	0	0	0	0	.	.	+	+	.	.	0	0	0	0	00000
16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000

19 000000000000000000000000000000000000000000000000000000000000000000

SMALL CLOUDS AT 3300.00 SECONDS ELAPSED TIME FOR SILT

CLOUD #	LOCATION OF CLOUD CENTROID DISTANCE FROM TOP OF GRID	LEFT OF GRID	MASS FROM DISPOSAL (CU FT)	ENTRAINED MASS (CU FT)	CLOUD X-Z DIAMETER (FT)	DEPTH OF TOP OF CLOUD (FT)	CLOUD VERT. THICKNESS (FT)	SOLIDS FALL VELOCITY (FPS)
1	1000.	989.9	46.32	0.0000E+00	284.5	16.31	3.695	0.766019E-03
2	1000.	990.6	20.91	0.0000E+00	324.9	9.549	10.45	0.626811E-04
3	1000.	991.1	14.13	0.0000E+00	365.5	13.62	6.379	0.565654E-04
4	1000.	991.5	7.563	0.0000E+00	397.5	15.52	4.482	0.419191E-04
5	1000.	991.8	3.300	0.0000E+00	420.6	16.35	3.654	0.340000E-04
6	1000.	992.1	0.9874	0.0000E+00	437.9	16.72	3.277	0.340000E-04
7	1000.	992.3	0.3915	0.0000E+00	451.7	16.80	3.205	0.340000E-04
8	1000.	992.5	0.2373	0.0000E+00	463.5	16.81	3.187	0.340000E-04
9	1000.	992.6	0.1569	0.0000E+00	473.9	16.82	3.176	0.340000E-04

SUMMARY OF SILT DISTRIBUTIONS AFTER 3600.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 92.065

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1932.9

SUMMARY OF SILT DISTRIBUTIONS AFTER 3900.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 90.848

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1934.1

SUMMARY OF SILT DISTRIBUTIONS AFTER 4200.00 SEC.

TOTAL SUSPENDED MATERIAL (CU FT) = 90.042

TOTAL MATERIAL SETTLED TO BOTTOM (CU FT) = 1934.9

MAX CONC IS 0.00000000 OUTPUT SUPPRESSED AT 0.00 FT

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 19
2	000000000000000000000000000000000000000000000000000000000000000000																
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
6	0000	0	0	0	0	0	0	.	.	.	.	.	.	0	0	0	00000
7	0000	0	0	0	0	.	.	+	+	+	+	.	.	.	0	0	00000
8	0000	0	0	0	0	.	+	.02	.09	.05	+	+	+	.	.	0	00000
9	0000	0	0	0	.	+	.10	2.6	10	5.8	.56	.02	+	+	.	0	00000
10	0000	0	0	0	.	.01	1.8	53	212	114	9.0	.19	+	+	.	0	00000
11	0000	0	0	0	.	.02	4.8	146	613	328	24	.43	+	+	.	.	00000
12	0000	0	0	0	.	.01	1.8	53	212	114	9.0	.19	+	+	.	0	00000
13	0000	0	0	0	.	+	.10	2.6	10	5.8	.56	.02	+	+	.	0	00000
14	0000	0	0	0	0	.	+	.02	.09	.05	+	+	+	.	.	0	00000
15	0000	0	0	0	0	.	.	+	+	+	+	.	.	.	0	0	00000
16	0000	0	0	0	0	0	0	.	.	.	.	.	.	0	0	0	00000
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000
19	000000000000000000000000000000000000000000000000000000000000000000																

SMALL CLOUDS AT 4200.00 SECONDS ELAPSED TIME FOR SILT

LOCATION OF CLOUD CENTROID MASS FROM ENTRAINED CLOUD X-Z DEPTH OF CLOUD VERT. SOLIDS FALL

CLOUD #	DISTANCE FROM TOP OF GRID	DISTANCE FROM LEFT OF GRID	DISPOSAL (CU FT)	MASS (CU FT)	DIAMETER (FT)	TOP OF CLOUD (FT)	THICKNESS (FT)	VELOCITY (FPS)
1	1000.	1020.	42.62	0.0000E+00	374.7	15.48	4.523	0.249278E-03
2	1000.	1020.	20.83	0.0000E+00	419.0	8.428	11.57	0.394351E-04
3	1000.	1021.	14.05	0.0000E+00	463.2	12.50	7.504	0.363160E-04
4	1000.	1021.	7.515	0.0000E+00	497.8	14.39	5.612	0.340000E-04
5	1000.	1022.	3.276	0.0000E+00	522.7	15.22	4.785	0.340000E-04
6	1000.	1022.	0.9795	0.0000E+00	541.2	15.59	4.409	0.340000E-04
7	1000.	1022.	0.3883	0.0000E+00	556.2	15.66	4.336	0.340000E-04
8	1000.	1022.	0.2353	0.0000E+00	568.8	15.68	4.319	0.340000E-04
9	1000.	1022.	0.1556	0.0000E+00	580.0	15.69	4.307	0.340000E-04

BOTTOM ACCUMULATION OF SILT (CU FT/GRID SQUARE) , 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

```
M N=  2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19
 2 000000000000000000000000000000000000000000000000000000000000000000000000
 3 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 4 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 5 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
 6 0000    0    0    0    0    0    0    .    .    .    .    .    .    0    0    0   00000
 7 0000    0    0    0    0    .    .    +    +    +    +    .    .    .    0    0   00000
 8 0000    0    0    0    0    .    +  .02  .09  .05    +    +    +    .    .    0   00000
 9 0000    0    0    0    .    +  .10  2.6   10  5.8  .56  .02    +    +    .    0   00000
10 0000    0    0    0    .  .01  1.8   53  212  114  9.0  .19    +    +    .    0   00000
11 0000    0    0    0    .  .02  4.8  146  613  328   24  .43    +    +    .    .   00000
12 0000    0    0    0    .  .01  1.8   53  212  114  9.0  .19    +    +    .    0   00000
13 0000    0    0    0    .    +  .10  2.6   10  5.8  .56  .02    +    +    .    0   00000
14 0000    0    0    0    0    .    +  .02  .09  .05    +    +    +    .    .    0   00000
15 0000    0    0    0    0    .    .    +    +    +    +    .    .    .    0    0   00000
16 0000    0    0    0    0    0    0    .    .    .    .    .    .    0    0    0   00000
17 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
18 0000    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   00000
19 000000000000000000000000000000000000000000000000000000000000000000000000
```

THICKNESS (FT) OF SILT ACCUMULATED ON BOTTOM, 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 1.000 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
7	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
8	0000	0	0	0	0	0	0	.	.	.	.	0	0	0	0	0	00000	
9	0000	0	0	0	0	0	.	+	+	+	+	.	0	0	0	0	00000	
10	0000	0	0	0	0	.	+	.02	.11	.06	+	+	.	0	0	0	00000	
11	0000	0	0	0	0	.	+	.08	.33	.18	.01	+	.	0	0	0	00000	
12	0000	0	0	0	0	.	+	.02	.11	.06	+	+	.	0	0	0	00000	
13	0000	0	0	0	0	0	.	+	+	+	+	.	0	0	0	0	00000	
14	0000	0	0	0	0	0	0	.	.	.	.	0	0	0	0	0	00000	
15	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
19	0000000000000000000000000000000000000000000000000000000000000000000000																	

\-

FINAL DISTRIBUTIONS OF TOTAL SETTLED MATERIAL FOLLOW.....

\-

TOTAL ACCUMULATED SOLID VOLUME ON BOTTOM (CU FT/GRID SQR), 4200.00 SECONDS AFTER DUMP

...MULTIPLY DISPLAYED VALUES BY 10.00 (LEGEND... + = .LT. .01 . = .LT. .0001 0 = .LT. .000001)

M N=	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	0000000000000000000000000000000000000000000000000000000000000000000000																	
3	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
4	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
5	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	
6	0000	0	0	0	0	0	0	0	.	.	.	0	0	0	0	0	00000	
7	0000	0	0	0	0	0	.	.	.	.	.	.	.	0	0	0	00000	
8	0000	0	0	0	0	.	+	+	.01	+	+	+	.	.	0	0	00000	
9	0000	0	0	0	0	+	.02	.79	3.2	1.5	.10	+	+	.	0	0	00000	
10	0000	0	0	0	.	+	.57	20	85	39	2.2	.02	+	.	.	0	00000	
11	0000	0	0	0	.	+	1.6	62	302	122	6.3	.06	+	.	.	0	00000	
12	0000	0	0	0	.	+	.57	20	85	39	2.2	.02	+	.	.	0	00000	
13	0000	0	0	0	0	+	.02	.79	3.2	1.5	.10	+	+	.	0	0	00000	
14	0000	0	0	0	0	.	+	+	.01	+	+	+	.	.	0	0	00000	
15	0000	0	0	0	0	0	.	.	.	.	.	.	.	0	0	0	00000	
16	0000	0	0	0	0	0	0	0	.	.	.	0	0	0	0	0	00000	
17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000	

```
18 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 00000000000000000000000000000000000000000000000000000000000000000000000

TOTAL THICKNESS (FT) OF NEW MATERIAL ON BOTTOM,   4200.00 SECONDS AFTER DUMP
...MULTIPLY DISPLAYED VALUES BY   1.000          (LEGEND... + = .LT. .01   . = .LT. .0001   0 = .LT.
.000001)
M N=  2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
 2 00000000000000000000000000000000000000000000000000000000000000000000000
 3 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 4 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 5 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 6 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 7 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
 8 0000  0   0   0   0   0   0   .   .   .   .   0   0   0   0   0   00000
 9 0000  0   0   0   0   0   .   +   +   +   +   .   0   0   0   0   00000
10 0000  0   0   0   0   .   + .05 .22 .10   +   .   .   0   0   0   00000
11 0000  0   0   0   0   .   + .16 .80 .32 .01   +   .   0   0   0   00000
12 0000  0   0   0   0   .   + .05 .22 .10   +   .   .   0   0   0   00000
13 0000  0   0   0   0   0   .   +   +   +   +   .   0   0   0   0   00000
14 0000  0   0   0   0   0   0   .   .   .   .   0   0   0   0   0   00000
15 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
16 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
17 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
18 0000  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   00000
19 00000000000000000000000000000000000000000000000000000000000000000000000

     *** RUN COMPLETED ***
```

Appendix C

Propeller Scour Calculations

Propeller wash scour calculations

Maximum scour depth = depth from top of bed

☐ = input
☐ = output

Number of Propellers	1
Propeller diameter (D), ft.	7
Shaft depth (s), ft.	8
Thrust coefficient (K) (max=0.27	0.27
Shaft speed (n), RPM	100
Water depth (h), ft.	20
Mean grain size (d50), mm.	0.2
Specific gravity of solids:	2.65
Specific gravity of water:	1.015

Distance behind prop (X), ft.	Maximum scour depth (S), ft.	
46	0.4	
50	0.4	
55	0.5	
60	0.5	
67	0.5	Maximum
75	0.5	
86	0.4	
100	0.3	
120	0.2	

PELLER SCOUR CALCULATIONS

h model (Blaauw and van de Kaa, 1978; Verhey, 1983) used for all propellers.

Number of propellers does not influence these calculations
Maximum scour range is 0.10 < z/x < 0.25 and y/x < 0.2

Number of Propellers	1	1	1	1	1	1	1
Propeller diameter (D), ft.	7	7	7	7	7	7	7
Shaft depth (s), ft.	8	8	8	8	8	8	8
Thrust coefficient (K)	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Shaft speed (n), RPM	100	100	100	100	100	100	100
Water depth (h), ft.	20	20	20	20	20	20	20
Shaft elevation (Z), ft.	12	12	12	12	12	12	12
Distance behind prop (X), ft.	46	50	55	60	67	75	86
Mean grain size (d50), mm.	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Effective propeller diameter (Do), ft.	4.95	4.95	4.95	4.95	4.95	4.95	4.95
Propeller efflux velocity (Vo), cm/sec.	296	296	296	296	296	296	296
Prop axis velocity (Vxo), cm/sec.	78	71	65	58	52	46	39
Bottom velocity (Vxz), cm/sec.	27	29	31	32	32	31	29
Relative density of bottom sediment	1.61	1.61	1.61	1.61	1.61	1.61	1.61
Densimetric Froude number (F)	4.89	5.23	5.47	5.61	5.62	5.48	5.19
Maximum scour depth (S), ft.	0.4	0.4	0.5	0.5	0.5	0.5	0.4
Z/X	0.26	0.24	0.22	0.20	0.18	0.16	0.14

Effective prop diameter $$D_o = \frac{D_p}{\sqrt{2}}$$

Prop efflux velocity $$V_o = 1.6 n D_p \sqrt{K_T}$$

<---X 30.48 (ft-cm)
<---/ 60 (rpm-rps)

$$T_p = 205.72 D^2 2.9 \left(\frac{1.36 P_d}{\frac{\pi}{4} D^2} \right)^{2/3}$$

T= thrust
Pd in kW
D in m
p in kg/m^3

Prop axis velocity $$V_{xo} = V_o \left(\frac{D_o}{2cx} \right)^b$$

b = { 1.1 for single rudder
0.6 for double rudder

c=.18

$$K_T = \frac{T_p}{\rho n^2 D^4}$$

Range for Kt: 0<Kt<0.27
Kt is at a maximum when rate of advance=0
i.e. when vessel is starting or stopping

Bottom velocity $$V_{xz} = V_{xo} \exp\left(-15.43 \frac{z^2}{x^2} \right)$$

Froude # $$F = \frac{V_{xz}}{\sqrt{g \Delta d_{50}}}$$

delta = "relative density" --------->
d50*.1 to convert to cm
g=980.8 cm/s^2

$$\Delta = \frac{\rho_s - \rho}{\rho}$$

rho=density of water
rho(s)=density of solids

Scour depth $$S = .004 z \left(\frac{F D_o}{z} \right)^{2.9}$$

Summary of Propwash Results

		Organics SG=2.3 d50=0.06		Fine Sand/SiltCap SG=2.65 d50=0.06		Fine Sand Cap SG=2.65 d50=0.2		Coarse Sand Cap SG=2.65 d50=1		Gravel Cap SG=2.65 d50=6	
Shallow berth											
Depth:		Depth	Max scour	Depth	Max scour	Depth	Max scour	Depth	Max scour	Depth	Max scour
Number of Propellers	1	18	3.1	18	2.2	18	0.4	18	0	18	0
Propeller diameter (D), ft.	5	20	1.4	20	1						
Shaft depth (s), ft.	6	22	0.7	22	0.5						
Thrust coefficient (K) (max=0.27)	0.27	23	0.5								
Shaft speed (n), RPM	250										
Water depth (h), ft.	18										
Number of Propellers	1	18	11.3	18	8	18	1.4	18	0.1	18	0
Propeller diameter (D), ft.	7	20	4.5	20	3.1	20	0.5				
Shaft depth (s), ft.	8	22	2	22	1.4						
Thrust coefficient (K) (max=0.27)	0.27	24	1	24	0.7						
Shaft speed (n), RPM	100	26	0.6	25	0.5						
Water depth (h), ft.	18	27	0.4								
Deep berth											
Number of Propellers	1	40	2.8	40	2	40	0.3	40	0	40	0
Propeller diameter (D), ft.	12	42	1.8	42	1.3						
Shaft depth (s), ft.	17	44	1.2	44	0.9						
Thrust coefficient (K) (max=0.27)	0.27	46	0.9	46	0.6						
Shaft speed (n), RPM	50	48	0.6	47	0.5						
Water depth (h), ft.	40	49	0.5								
Number of Propellers	1	40	7.1	40	5	40	0.9	40	0.2	40	0
Propeller diameter (D), ft.	15	45	2.8	45	2	42	0.6				
Shaft depth (s), ft.	15	50	1.3	50	0.9	43	0.5				
Thrust coefficient (K) (max=0.27)	0.27	55	0.6	55	0.5						
Shaft speed (n), RPM	50	57	0.5								
Water depth (h), ft.	40										

Assumptions:

Bollard-pull condition (rate of advance = 0)

Appendix D

Technical Memorandum on Area of Concern

Ward Cove Sediment Remediation Project
Marine Operable Unit
Ketchikan Pulp Company Site
Ketchikan, Alaska

Technical Memorandum
on
AREA OF CONCERN

Prepared for

Ketchikan Pulp Company
Ketchikan, Alaska

Prepared by
Exponent
15375 SE 30th Place, Suite 250
Bellevue, Washington 98007

HARTMAN CONSULTING CORPORATION
Subsidiary of FOSTER WHEELER ENVIRONMENTAL CORPORATION
10900 NE 8th Street, Suite 1300
Bellevue, Washington 98004

February 2000

CONTENTS

FIGURES

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
DTSR	Detailed Technical Studies Report
KPC	Ketchikan Pulp Company
MLLW	mean lower low water

1. INTRODUCTION

In May 1999, Ketchikan Pulp Company (KPC) completed a Detailed Technical Studies Report (DTSR) (Exponent 1999a) for remediation of contaminated sediments in Ward Cove, Alaska. This report identified an Area of Concern (AOC) that represented an area where, based on a human health assessment and ecological evaluation, remedial action may be warranted. The procedure for establishing the AOC for Ward Cove is described in detail in Section 8 of the DTSR.

This Technical Memorandum describes modifications to the AOC. These modifications are a result of additional information required for final design that has been developed since the submittal of the DTSR for remediation of Ward Cove.

Subsequent to the DTSR, additional fieldwork was conducted in Ward Cove in September and October 1999. The field work was performed in accordance with the Field Sampling Plan for Remedial Design Sampling (Exponent 1999b). As part of that fieldwork, divers completed an underwater video survey along the north shoreline of Ward Cove. The divers videotaped bottom conditions and provided documentation on sediment depths and character along the transects from the shoreline out to depths as great as 80 feet. The results of the underwater video survey are presented in the Cruise and Data Report (Exponent 2000). The videotapes and still digital photographs recorded during the survey are on file at Exponent's Bellevue office. In addition, all field notes and logbooks are on file at Exponent's Bellevue office.

2. AREA OF CONCERN

The location of each diver's transect was plotted by Exponent on a base map with existing bathymetry. The divers started each survey at the shoreline and proceeded outward into deeper water. As they maneuvered along the bottom, they reported water depth and visual observations of the video survey. In particular, they noted the water depth where they observed changes in the type of sediment on the bottom surface.

A key finding from the divers' transects was that the first surface sediment observed along the shoreline are described as rocky shoreline, sloping rock ledge, rock face, shot rock, or riprap shoreline with gravel. Rock was reported in all transects, except Transect R, which is adjacent to the active log lift structure. For most transects, the rocky area generally transitions into silts and bark and not the fine organic material associated with areas that may have adverse ecological impact.

The AOC in the DTSR was assumed to extend to the shoreline. The AOC is defined, however, as areas where sediment may have adverse ecological impact, and the rock areas should not be part of the AOC. Therefore, the AOC should exclude the areas along the shoreline where rock is present on the surface.

The following procedure was used to establish the AOC. The divers reported the water depth where the surface first changes from rock to sand, silt, bark-type material, or wood chips. The water depths were converted to elevation relative to mean lower low water (MLLW) and Exponent prepared a summary table showing the elevations and corresponding diver observations, which is included in Appendix A. The elevations where rock surface was not observed were marked with a solid square on Figures 2-1A and 2-1B. Between the shoreline and the solid square, the sediment is rock, riprap, or gravel. There is no exposed silt, sand, bark, wood chips, or organic material on the shore side of the solid squares.

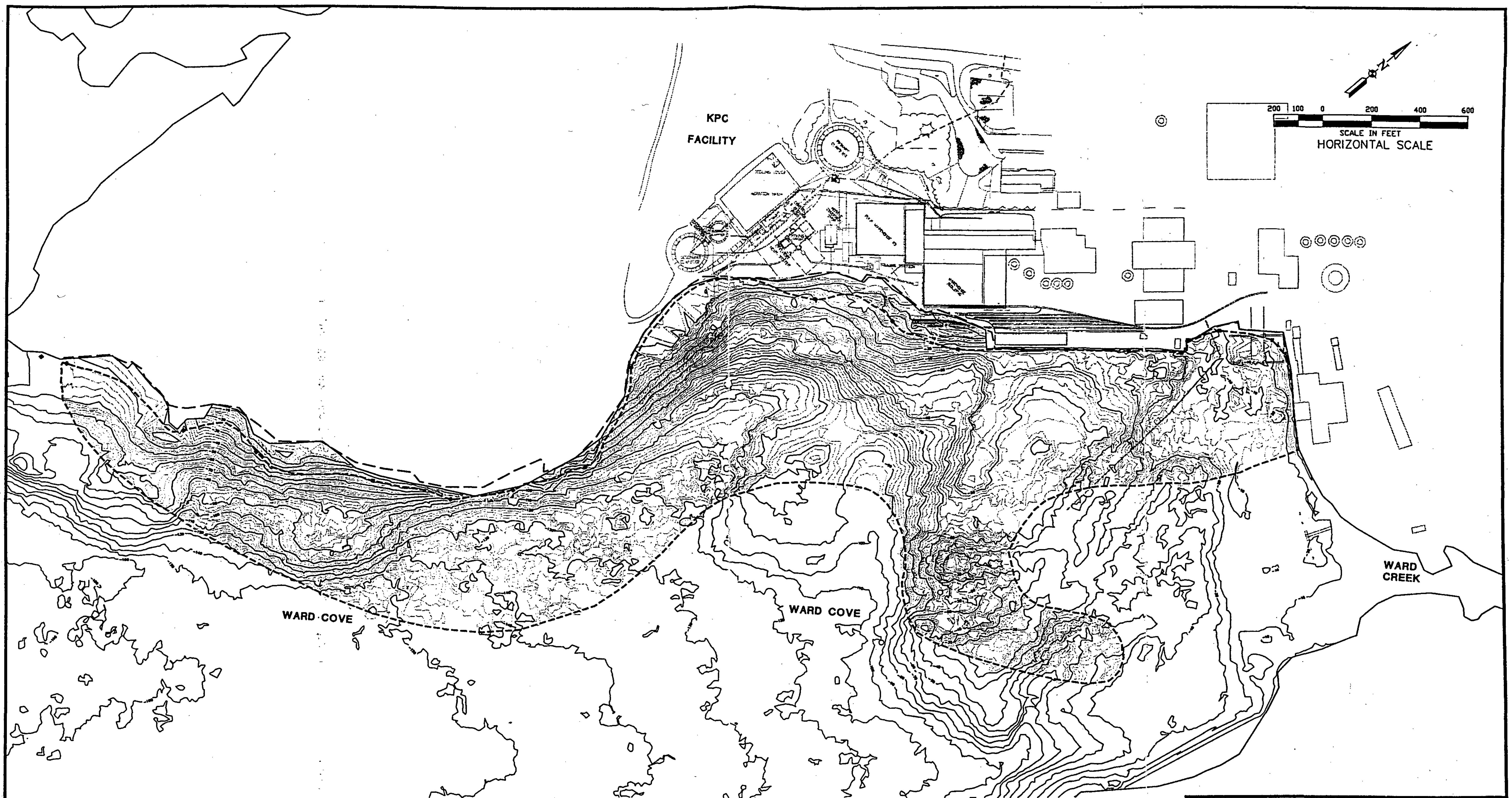
The AOC boundary was made by connecting the solid squares. The boundary was drawn with a smooth curve that follows the shape of the shoreline or the face of the existing dock structures. No changes were made to the AOC away from the shoreline. Therefore, along the shoreline, there are separate lines for the AOC shown in the DTSR and the AOC. There is only one AOC line shown for the rest of the AOC because the two lines coincide. The area of the AOC is approximately 80 acres (compared to an area of approximately 87 acres shown in the DTSR).

3. REFERENCES

Exponent. 1999a. Ward Cove Sediment Remediation Project. Detailed Technical Studies Report. Volume I. Remedial Investigation and Feasibility Study. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA. May 1999.

Exponent. 1999b. Ward Cove Sediment Remediation Project. Field Sampling Plan for Remedial Design Sampling. Prepared for Ketchikan Pulp Company. Exponent, Bellevue, WA and Hartman Consulting Corp., Bellevue, WA. August 1999.

Exponent. 2000. Ward Cove Sediment Remediation Project. Cruise and Data Report for Remedial Design Sampling at the Marine Operable Unit of the Ketchikan Pulp Company Site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA. February 2000.



NOTE

ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED
ELEVATIONS IN FEET, MLLW

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

LEGEND

- — — — — AOC SHOWN IN FEASIBILTY STUDY (87 ACRES)
- - - - - - - AREA OF CONCERN (AOC) (80 ACRES)
- SHORELINE

"THIS DOCUMENT IS THE PROPERTY OF KETCHIKAN PULP CO., PREPARED BY FWENC, AND IS PROVIDED UPON THE CONDITION THAT IT WILL NEITHER BE REPRODUCED, COPIED, ISSUED TO A THIRD PARTY, WILL BE USED SOLELY FOR THE ORIGINAL INTENDED PURPOSE AND SOLELY FOR THE EXECUTION OR REVIEW OF THE ENGINEERING AND CONSTRUCTION OF THE SUBJECT PROJECT."

Figure 1-1
KETCHIKAN PULP COMPANY AREA OF CONCERN

HARTMAN CONSULTING CORPORATION
BELLEVUE, WA
HOUSTON, TX
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION

SCALE: AS NOTED	APPROVED	DATE:
DIVISION:		H3180002
DRAWN: MCG		
CHECKED: M. OTTEN		MWDCFG04

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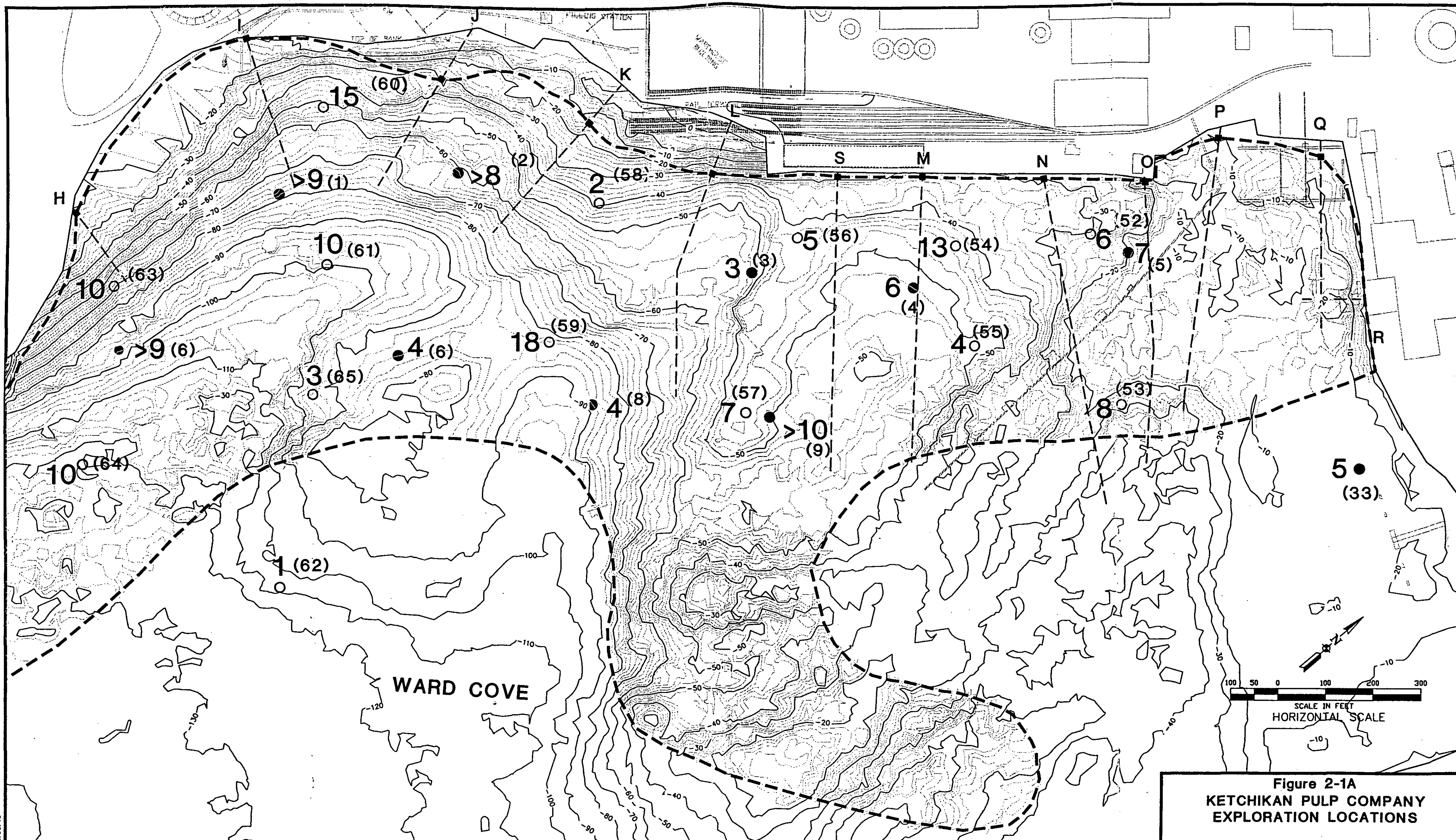

Figure 2-1A
KETCHIKAN PULP COMPANY
EXPLORATION LOCATIONS

HARTMAN CONSULTING CORPORATION
BELLEVUE, WA
HOUSTON, TX
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION

SCALE: AS NOTED	APPROVED	DATE:
DIVISION:		H3180002
DRAWN: MCG		
CHECKED: M. OTTEN		MWDCFG05

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

LEGEND

○ 7 — 1999 BORING LOCATION AND THICKNESS OF VERY SOFT ORGANIC MATERIAL (52) EXPLORATION NUMBER

● 10 — 1977 CORE LOCATION AND THICKNESS OF VERY SOFT ORGANIC MATERIAL (1) CORE STATION NUMBER

NOTE

ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED
ELEVATIONS IN FEET, MLLW

SHORELINE

DIVER SURVEY WITH ZERO PENETRATION LIMIT ALONG TRANSECT

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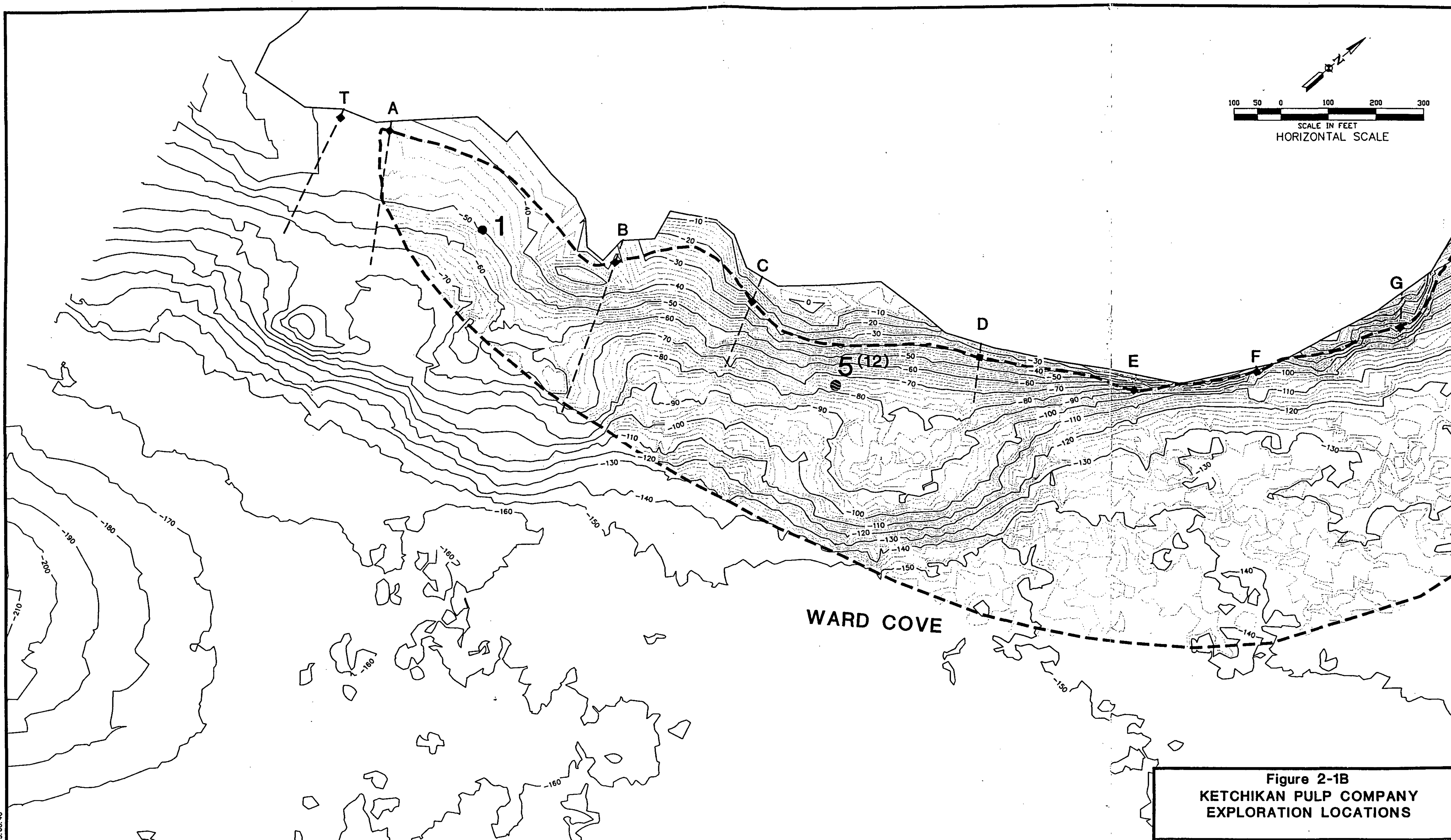

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

LEGEND

○7 1999 BORING LOCATION

●10 1977 CORE LOCATION

SHORELINE

DIVER SURVEY WITH ZERO PENETRATION LIMIT ALONG TRANSECT

NOTE

ALL DIMENSIONS IN FEET UNLESS OTHERWISE NOTED
ELEVATIONS IN FEET, MLLW

Figure 2-1B
KETCHIKAN PULP COMPANY
EXPLORATION LOCATIONS

HARTMAN CONSULTING CORPORATION
BELLEVUE, WA
HOUSTON, TX
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION

SCALE: AS NOTED	APPROVED	DATE:
DIVISION:		H3180002
DRAWN: MCG		
CHECKED: M. OTTEN		MWDCFG05

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PLOT/UPDATE: FEB 25 2000 13:00:40

APPENDIX A

RESULTS OF UNDERWATER VIDEO SURVEY

Table 1. Results of underwater video survey

Transect	Water Depth (ft) (adjusted MLLW)	Sediment Penetration (in.)	Sediment Description
A	1.3 to -6.7	0	rocky shoreline
	-16.7	5	sand and silt mixture
	-18.7	6	silt layer on top of sand with shell mixture
	-36.7	7	silt with very little sand
	-38.7	--	log
	-48.7	--	log
	-55.7	3	sand with intact shell on surface
	-60.7	--	log
	-68.7	18	silt
	-74.7	25	silt
	-75.7	15	silt
B	0.8 to -12.2	0	rocky shoreline; rock face
	-23.2	--	log
	-27.2	5	silt with shell material
	-38.1	3	silt
	-41.1	6	silt over large pieces of bark
	-60.0	10	silt with bark-type material
	-66.0	--	logs
	-69.9	--	log
	-72.9	31	silt over hard substance
	-78.8	34	very fine silt
C	0.6 to -24.38	0	sloping rock ledge
	-24.4	<1	little silt covering rock
	-54.4	4	little silt covering rock
	-64.3	7	little silt covering rock
	-70.3	--	log
	-72.3	22	silt over rock
	-79.3	30	silt over hard substance (not rock)
D	0.5 to -39.5	0	sloping shale rock ledge
	-39.5	30	silt
	-57.5	26	silt
	-60.5	--	log
	-65.5	>48	silt
	-69.5	--	log
	-71.5	--	
	-72.5	--	
	-75.5	30	silt
E	0.6 to -79.4	0	rock face
F	0.7 to -79.4	0	rock face
G	3.9 to -72.7	0	rock face

Table 1. (cont.)

Transect	Water Depth (ft) (adjusted MLLW)	Sediment Penetration (in.)	Sediment Description
H	3.2 to -4.8	0	rock face
	-34.7	--	log
	-51.7	>48	silt with white surface layer and bark
	-63.6	--	log
	-66.6	>48	silt and bark-type material
	-71.5	>48	silt, bark-type material, and wood chips
I	2.2 to -5.8	0	shot rock along shoreline
	-9.7	40	bark-type material
	-27.7	26	bark with white surface layer
	-36.6	>48	bark-type material
	-50.6	>48	bark fragments and wood chips
	-67.6	>48	silt
	-68.5	>48	silt
	-77.5	>48	silt
J	1.8 to -33.2	0	riprap shoreline with some fine gravel
	-33.2	>48	silt and bark-type material
	-47.1	>48	silt and bark-type material
	-58.1	--	log
	-65.1	>48	silt
	-68.1	>48	silt
	-73.0	>48	silt
	-78.0	>48	silt
K	1.7 to -10.3	0	rock shoreline with some gravel
	-10.3	41	silt and wood chips
	-22.3	39	wood chips and silt
	-30.4	--	wood chips, bark fragments, and logs
	-33.4	7	wood chips, bark-type material, and silt
	-44.3	--	rock outcropping
	-49.3	10	silt covering rock
	-63.2	48	silt (solid material at 48 in.)
	-76.2	>48	silt with white surface layer and bark
L	2.8 to -25.3	0	riprap shoreline with some fine gravel
	-35.3	14	silt with some bark
	-39.3	12	silt with white surface layer and bark
	-44.5	6	silt (firmer)
	-51.6	8	silt with white surface layer
	-51.6	20	silt
	-51.7	--	log
	-57.8	28	silt and bark
	-56.8	24	silt with white surface layer and bark
	-57.9	>48	silt and bark-type material
	-58.9	>48	silt and bark-type material
	-63.0	>48	silt and bark-type material
	-65.11[a]	>48	silt and bark-type material

Table 1. (cont.)

Transect	Water Depth (ft) (adjusted MLLW)	Sediment Penetration (in.)	Sediment Description
M	12.6 to -32.2	0	rock
	-32.2	23	silt and wood chips
	-31.9	--	log
	-39.7	>48	silt and bark-type material
	-44.5	>48	silt
	-46.1	>48	silt
	-48.9	48	silt
	-54.8	>48	silt
	-54.7[a]	>48	sandy silt
N	9.5 to -23.3	0	rock
	-23.3	18	wood chips and silt
	-31.1	22	wood chips and silt
	-32.9	33	silt
	-36.8	>48	silt, wood chips, bark-type material
	-26.5	--	logs
	-26.4	48	silt, wood chips, bark-type material
	-33.2	26	silt, wood chips, bark-type material
	-33.0	>48	silt, wood chips, bark-type material
	-28.8	21	bark-type material
	-28.6	--	log
	-21.5	--	log
	-31.2	18	silt, wood chips, bark-type material
	-31.0	--	pile of logs
	-18.9[a]	--	pile of logs
O	6.0 to -4.8	0	loose rock
	-4.8	7	gravel, sand, bark-type material
	-13.6	31	bark-type material and silt
	-25.2	37	silt
	-14.9	10	bark and silt
	-15.7	22	bark-type material and silt
	-10.4	28	bark
	-11.2	12	silt
	-14.0	6	bark-type material
	-15.7	10	log, bark-type material, silt
	-18.4	<1	log buried under thin layer of silt
	-51.2	--	logs
	-32.08[a]	--	pile of logs
P	14.1 to -0.9	0	shot rock on shoreline
	-0.9	22	gravel, bark-type material, some silt with white surface layer
	-12.8	32	silt and bark
	-9.8	23	silt and bark-type material
	-12.7	35	silt and bark-type material
	-12.7	34	silt
	-11.7	27	silt and sand
	-12.6	31	large rock

Table 1. (cont.)

Transect	Water Depth (ft) (adjusted MLLW)	Sediment Penetration (in.)	Sediment Description
P (cont.)	-13.6	22	silt and bark-type material
	-22.5	--	log
	-25.5	>48	silt and bark-type material
	-25.5	--	big logs
	-35.4	>48	silt and bark-type material
	end[b]	--	over log pile
Q	15.1 to 0.1	0	rocky shoreline
	0.1	16	silt and bark
	-4.9	18	silt with bark-type material and white surface layer
	-11.9	>48	silt with bark-type material and white surface layer
	-10.0	--	logs
	-14[c]	--	logs
R	15 to -17.2	0	log lift
	-17.2	43	bark-type material only
	-23.4	48	silt and bark-type material
	-15.5	36	silt and bark-type material
	-9.7[c]	34	silt and bark
S	14.8 to -25.1	0	rock and logs
	-32.0	20	silt
	-34.8	20	silt and large rock
	-41.7	--	logs
	-46.5	>48	silt
	-44.5	>48	silt with white surface layer
	-44.4	>48	silt with white surface layer and bark
	-52.4	>48	silt with white surface layer
	-52.3	>48	silt with white surface layer and bark
	-54.3	>48	silt with white surface layer and bark
	-54.3[a]	>48	silt with white surface layer and bark
T	4.9 to -5.1	0	rock face
	-5.1	3	shells
	-22.0	7	sand with layer of silt on surface
	-30.0	10	silt and bark-type material
	-36.9	11	wood chips and bark-type material
	-46.8	--	log
	-52.8	--	logs
	-57.8	23	silt and bark
	-66.7	25	silt and bark-type material
	-74.6	34	silt and bark-type material

Note: MLLW - mean lower low water

[a] Transect never reached 80-ft contour; total transect length 600 ft.

[b] Diver over log pile; ended transect due to safety concerns.

[c] End of maintenance dredging area.