MARYLAND
PORT
ADMINISTRATION

Poplar Island
Environmental Restoration Project

2002
Crust Management Review

MPA Contract Number # 502813
PIN # 51030049

January 30, 2002 - November 13, 2002

Prepared for:
MARYLAND PORT ADMINISTRATION
2310 Broening Highway
Baltimore, MD 21224

Prepared by:
MARYLAND ENVIRONMENTAL SERVICE
2011 Commerce Park Drive
Annapolis, MD 21401

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Robert L. Ehrlich, Jr.
Governor

James W. Peck
Director

March 7, 2003

Mr. Frank L. Hamons
Harbor Development
Maryland Port Administration
The Maritime Center II
2310 Broening Highway
Baltimore, MD 21224-6627

RE: Poplar Island 2002 Crust Management Review

Dear Mr. Hamons,

Enclosed is the Poplar Island Environmental Restoration Project Crust Management Review, encompassing the dates January 30, 2002 to November 13, 2002.

If you have any questions or comments regarding this report, please contact me at (410) 974-7261.

Sincerely,

Thomas Reilly
Project Engineer
Environmental Dredging Program

encl.
cc: Dave Bibo
Wayne Young
Dave Wells
Lincoln Tracy
Kevin Barry

2011 Commerce Park Drive • Annapolis, Maryland 21401 • 410/974/7281 • Fax 410/974/7267

<u>**Table of Contents**</u>

2002 Crust Management Review

Figures and Tables

2002 Crust Management Review

Poplar Island Environmental Restoration Project
2002 Crust Management Review

I. Introduction

Crust Management plays a critical role in the effective utilization of placement capacity at dredged material placement sites. This report documents the 2002 crust management operations at the Poplar Island Environmental Restoration Project (PIERP). The 2002 crust management season encompassed roughly nine and a half months, from January 30, 2002 to November 13, 2002. The term crust management denotes the activities performed inside a containment cell to dry and consolidate the placed dredged material. Annual drying and consolidating of the dredged material ultimately acts to not only increase the facility's available capacity but also the bearing and stability of the sediment. 2002 crust management operations took place in upland cell 2 and wetland cell 3D, while some dewatering took place in cell 1 and cell 3.

II. 2001 - 2002 Inflow Operations

2001 –2002 inflow operations began on April 12, 2001 with the unloading of dredged material from the Brewerton Extension Federal Maintenance Project by Great Lakes Dredge and Dock Inc. Great Lakes unloaded approximately 3,929,773 cy of material into cells 2, 3 and 3D. Great Lakes finished unloading on August 31, 2001. Soon afterwards, Norfolk Dredging Inc. mobilized at Poplar Island and started inflow on September 23, 2001. Norfolk unloaded material from Craighill and Tolchester Channels as part of the Federal Maintenance Project. Norfolk unloaded approximately 4,054,458 cy of dredged material into cells 1, 2 and 3D. Norfolk finished unloading on January 29, 2002. For specific information regarding inflow operations, refer to tables II-1 and II-2. The 2002 crust management season began immediately following Norfolk's inflow operations.

There was one inflow project that took place during crust management season – Norfolk dredged the barge access channel in cell 6 from June 12-28, 2002. Norfolk Dredging Inc. inflowed approximately 282,861 cy of sandy sediment into cell 4, where it was stockpiled. This placement of dredged material into cell 4 did not affect crust management operations in cells 1, 3, 3D or 2. The sand gained from this dredging project is to be reclaimed and reused around the island.

Table II-1

Poplar Island ERP
Cut Volume of Dredged Material Placed -
2001-2002 Inflow Season

Contractor	*Dredging Location*	*Dates*	*h/ m*	*Cell*	*Station*	*Quantity (cy)**
Great Lakes Dredge and Dock, Inc.						
	Brewerton Extension	4/12/01 – 8/31/01	h	1	N/A	0
			h	2	535+00	2,239,550
			h	2	970+00	670,320
			h	3	973+00	267,000
			h	3	525+00	468,403
			h	3D	956+00	117,900
			h	3D	971+00	166,600
			Semi-Total:			3,929,773
Norfolk Dredging, Inc.	Craighill	9/23/01 – 1/29/02	h	1	950+00	171,397
			h	1	920+00	593,083
			h	2	528+00	3,289,978
			h	3	N/A	0
			h	3D	N/A	0
	Poplar Barge Access Channel	6/12/02 – 6/28/02	h	4	1216+00	282,861
			Semi-Total:			4,337,319
			Total:			8,267,092

Notes: m=mechanical placement
h=hydraulic placement

* Quantity reflects Cut Volume of Dredged Material and is provided to MES by the Dredging Contractor at the time of unloading.

Table II-2

Poplar Island ERP
Dredged Material Placed Per Containment Cell-
2001-2002 Inflow Season

Cell	*Stations*	*Dates*	*h/ m*	*Quantity (cy)**
1	950+00, 920+00	4/12/01 - 1/29/02	h	764,480
2	535+00, 970+00	4/12/01 – 1/29/02	h	6,199,848
3D	956+00, 971+00	4/12/01 - 1/29/02	h	284,500
3	973+00, 525+00	4/12/01 - 1/29/02	h	735,403
4	1216+00	6/12/-02 –6/28/02	h	282,861
		Total		8,267,092

Notes: m=mechanical placement
h=hydraulic placement

* Quantity reflects Cut Volume of Dredged Material. This volume is provided to MES by the Dredging Contractor at the time of unloading.

III. Crust Management Operations – Cells 2, 3D, 3 and 1

The 2002 crust management season consisted of three phases. During the initial phase, the existing surface water in cells 2 and 3D was drained and perimeter trenching began. Once the surface material had dried and a crust had begun to form, phase II was implemented and the interior trenching effort began throughout all accessible areas of the cells. To properly prepare for the next inflow season, phase III provides a transition period that will allow a smooth conversion from crust management to inflow. Phase III activities include filling in the perimeter trench and sumps and preparing the inflow points for next season's inflow.

Phase I – Cell 2

Phase I immediately began following the completion of dredged material inflow by Norfolk Dredging Inc. The following tasks were performed during phase I.

A. Excavation of Spillway Sumps

1. The settlement pond in cell 2 was drained.

2. Sumps were created at spillways #1 and #3 to promote drainage and to allow solids to settle out from discharge waters.

3. A pontoon excavator and long- and short-reach excavators were utilized to perform these tasks.

B. Perimeter Trench

1. A perimeter trench was excavated around the interior border of cell 2 using the long- and short-reach excavators. The perimeter trench is the primary drainage path to each of the spillways. At the onset of crust management, the material was only able to support a trough, but as the material dried and strengthened, deeper trenching was performed. The trench eventually migrated inward, away from the dike, as the excavators completed additional passes.

2. Material excavated from the perimeter trench was placed on the interior slope of the dike. An excavator scarified this material. MES operators tracked the amount of trench excavated in linear feet.

C. Interior Trenching

1. Interior trenches serve the purpose of accelerating drainage to the

perimeter trench and ultimately to the spillways. The interior trenching effort during this phase was limited due to infirm material conditions in the cell. The upper one to two feet of sediment needs to be able to support such a trench before interior trenching is attempted.

2. The pontoon trencher was used to establish the interior trenches during this stage - where feasible (figure III-1).

3. MES operators tracked the amount of interior trenches excavated in linear feet.

D. Cell 2 Inflow Points

The areas immediately downstream of the inflow points of cell 2 consisted primarily of coarser, heavier dredged sediment. This sediment, being suitable construction-grade material, was reclaimed and reused around the island for dike maintenance, bench construction and island improvements (figure III-3).

E. Pontoon Depressions

Pontoon depressions were not attempted in cell 2 due to the presence of underdrains.

F. Underdrains and Underdrain Sumps

Water that had accumulated at the sumps attached to the underdrain system was pumped out. The excess water was either pumped to the perimeter trench or to cells 1 or 3 (figure III-4).

Phase I – Cell 3D

Phase I immediately began following the completion of dredged material inflow by Norfolk Dredging Inc. The following tasks were performed during phase I.

A. Excavation of Corner Sumps

1. Excess surface water was drained from the cell through the use of the small spillway located on the berm separating cell 3 from cell 3D.

2. Sumps were excavated in three corners of cell 3D using the long- and/or short-reach excavator(s). The sumps acted to promote drainage. Pumps placed at the corners of cell 3D dewatered the sumps. The northern two sumps pumped water to cell 1, while the southern sump pumped water to cell 3.

B. Perimeter Trench

1. A perimeter trench was excavated around the interior border of cell 3D using the long- and short-reach excavators. The perimeter trench is the primary drainage path to each of the sumps. The trench eventually migrated inward, away from the dike as additional passes with excavators took place.

2. Material excavated from the perimeter trench was placed on the interior slope of the dike. An excavator scarified this material.

3. MES operators tracked the amount of trench excavated in linear feet.

C. Interior Depressions

1. The pontoon excavator was used to create shallow depressions by tracking back and forth across the interior of cell 3D. This improved the flow of trapped water and rainwater to the perimeter trench. Most of the crust of cell 3D was comprised of a slurry-like material during the early stages of phase I. The only piece of equipment that can successfully negotiate these conditions while leaving depressions in the crust is the pontoon excavator.

2. As phase I progresses, the distance between pontoon depressions was reduced so as to maximize drainage to the perimeter trench.

3. MES operators tracked the amount of depressions in linear feet (figure III-5).

<u>Phase II – Cell 2</u>

The primary focus of phase II is the establishment of a network of interior trenches. Interior trenching not only accelerated rainwater run-off but also acted to de-water the slurry-like sediment. Personnel and equipment were utilized to maximize trenching during this phase. Some overlapping of phase I and phase II occurred.

A. Perimeter Trench

1. The perimeter trench was widened and deepened through additional passes by the conventional excavator, the long reach excavator, and/or the pontoon excavator. (figure III-1). Material excavated from the perimeter trench was placed along the bench and interior slope of the perimeter dike.

3. MES operators tracked the amount of trench excavated in linear feet.

B. Interior Trenches

1. When a suitable crust developed over the surface of the cell (enough to support the formation of the trench itself and the weight of the trencher), interior trenching began.

2. Interior trenches accelerated water drainage to the perimeter trench, therefore hastening the drying process.

3. As phase II progressed, interior trenches were excavated at shorter intervals to maximize drainage to the perimeter trench (figure III-2).

4. MES operators tracked the amount of interior trenches excavated in linear feet.

C. Cell 2 Inflow Points

The areas immediately downstream of the inflow points of cell 2 consisted primarily of coarser, heavier dredged sediment. This sediment, being suitable construction-grade material, was reclaimed and reused around the island for various dike and operations-pad improvements (figure III-3).

D. Crust Reclamation

1. Once a crust formed in the interior of cell 2, pontoon excavators were utilized to reclaim the dried crust material from inside of the perimeter trench. This accelerated drainage of the interior of cell 2. The reclaimed material was either stockpiled along the bench and the interior of the dike or transported to another area of the island for construction use. The sediment stockpiled on the bench and interior slope of the dike was used to fill in the perimeter trench in phase III (figure III-3).

2. Crust was reclaimed directly downstream of the old inflow points. This sediment, being suitable construction-grade material, was reclaimed and reused around the island for dike maintenance, bench construction and island improvements (figure III-3).

E. Underdrains and Underdrain Sumps

Water that had accumulated at the sumps attached to the underdrain system was continuously pumped out. The excess water was either pumped to the perimeter trench or to cell 1 or cell 3 (figure III-4).

Phase II – Cell 3D

The primary focus of phase II was the establishment of a network of interior trenches. Interior trenching not only accelerated rainwater run-off but also acted to de-water the slurry-like sediment. Personnel and equipment were utilized to maximize trenching during this phase. Some overlapping of phase I and phase II occurred.

A. Excavation of Corner Sumps

1. The sumps in the corners of cell 3D were periodically deepened in order to keep the pumps functioning. The long- and/or short-reach excavator(s) were used to maintain the sumps.

2. Personnel regularly maintained the pumps placed at the corners of cell 3D.

B. Perimeter Trench

1. The perimeter trench was deepened and widened using the long- and short-reach excavators.

2. Material excavated from the perimeter trench was placed on the interior slope of the dike. An excavator scarified this material.

3. MES operators tracked the amount of trench excavated in linear feet.

C. Interior Depressions

1. The pontoon excavator was used to create shallow depressions by tracking back and forth across the interior of cell 3D. Approximately half of the cell was tracked in this fashion. Pontoon depressions in this phase acted to force the dried surface crust downward while exposing new slurry-like sediment to drying.

2. MES operators tracked the amount of depressions in linear feet (figure II-5).

D. Interior Trenches

1. When a suitable crust developed over the surface of the cell (enough to support the formation of the trench itself and the weight of the trencher), the interior trenching effort began.

2. Interior trenches accelerated water drainage to the perimeter trench, therefore hastening the drying process.

3. As phase II progressed, interior trenches were excavated at shorter intervals so as to maximize drainage to the perimeter trench (figure II-2).

4. MES operators tracked the amount of trench excavated in linear feet.

<u>Phase III – Cell 2</u>

In order to take full advantage of the crust management effort, cell 2 was properly prepared for the subsequent inflow season. By properly preparing the site, the time required to establish sumps and perimeter trenches during phase I of the following crust management season is significantly reduced.

A. Perimeter Trench

1. The perimeter trench was filled in to an elevation that is even with the surface of the cell. Dried surface crust material from the inside of the cell and dried and compacted material placed on the slope of the dike in phase II was used to fill in the perimeter trench.

2. The D6R dozers were used to fill in the perimeter trench.

B. Interior Trenches

The interior trenching effort persisted as long as the processes of dewatering and consolidation continued to occur and as long as time permitted.

C. Sumps at Spillways

Sumps created in phase I at spillways #1 and #3 were filled in using larger-grained sediment. Larger-grained sediment will be easier to excavate and will reduce the time needed to reestablish the sumps in phase I of the next crust management season. The long- and short-reach excavators and bulldozers were utilized to perform these tasks.

D. Cell 2 Inflow Points

1. The perimeter dike immediately adjacent to the upcoming 2002-2003 inflow points was graded, strengthened, and widened in preparation for mobilization of the dredging contractor and the inflow pipeline.

2. The new inflow points for the upcoming dredging season were shaped and built up to accommodate the inflow pipe.

E. Crust Reclamation

Crust reclamation around the 2002 inflow points continued as long as time permitted.

<u>Phase III – Cell 3D</u>

A. Perimeter Trench

1. The perimeter trench was filled in to an elevation that is even with the surface of the cell. Dried and compacted material placed on the slope of the dike in phase II was used to fill in the perimeter trench.

2. The D6R dozers were used to fill in the perimeter trench.

B. Interior Trenches

The interior trenching effort continued as long as the processes of dewatering and consolidation continued to occur and as long as time permitted.

C. Sumps at Spillways

Sumps created in phase I at the corners of cell 3D were filled in using larger-grained sediment. Larger-grained sediment will be easier to excavate and will reduce the time needed to reestablish the sumps in phase I of the next crust management season. The long- and short-reach excavators and bulldozers were utilized to perform these tasks.

D. Cell 3D Inflow Point

The perimeter dike immediately adjacent to the upcoming 2003-2004 inflow points was graded, strengthened, and widened in preparation for mobilization of the dredging contractor and the inflow pipeline.

<u>Cell 3</u>

Excavation of Spillway Sumps

1. The settlement pond in cell 3 was drained.

2. Sumps were created at spillways #5 and #6 to promote drainage and to allow solids to settle out from discharge waters.

3. A pontoon excavator and long- and short-reach excavators were utilized to perform these tasks.

Cell 1

A. Excavation of Spillway Sumps

1. The settlement pond in cell 1 was drained.

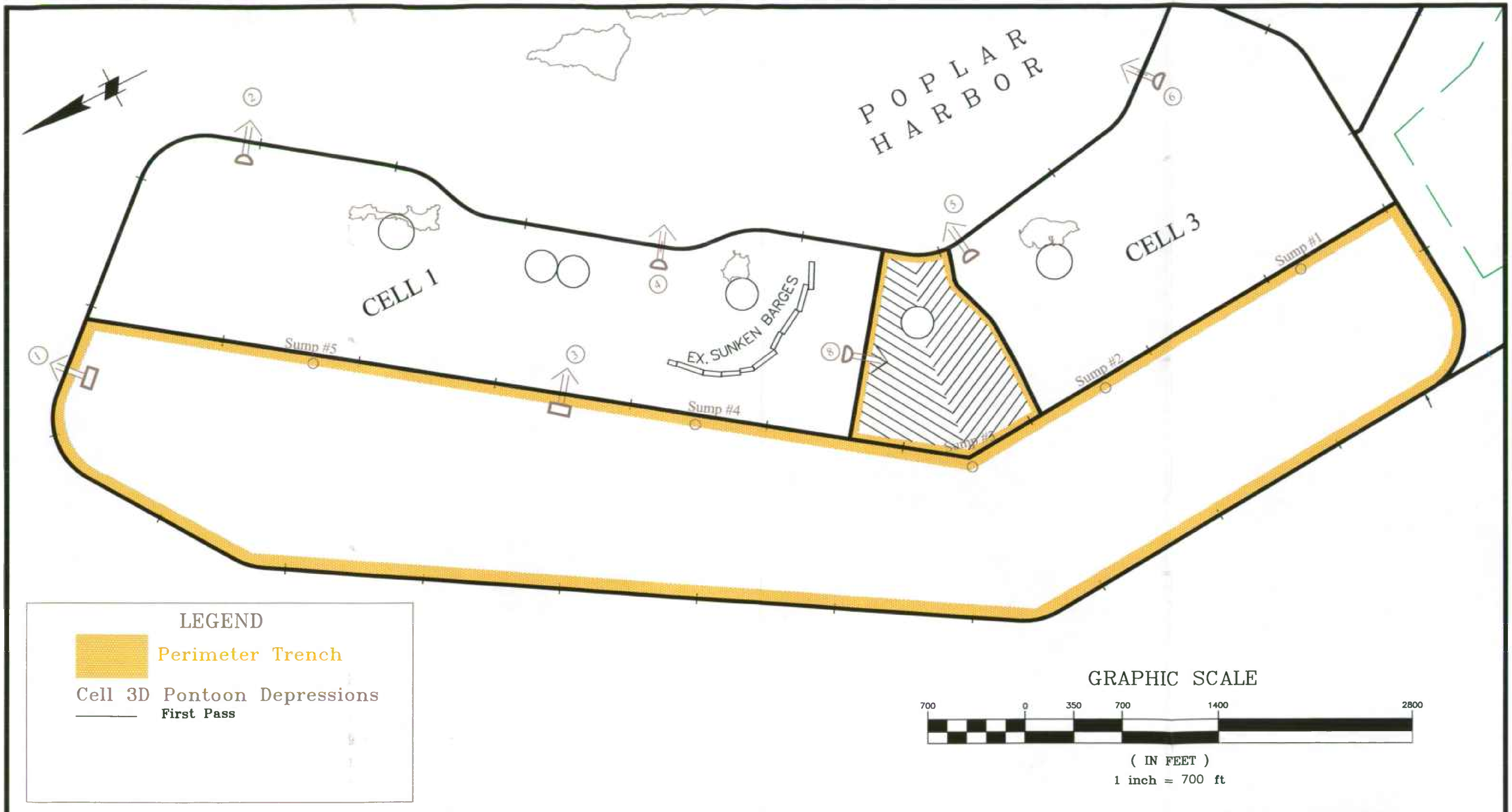
2. Sumps were created at Spillways #4 and #2 to promote drainage and to allow solids to settle out from discharge waters.

3. A pontoon excavator and long- and short-reach excavators were utilized to perform these tasks.

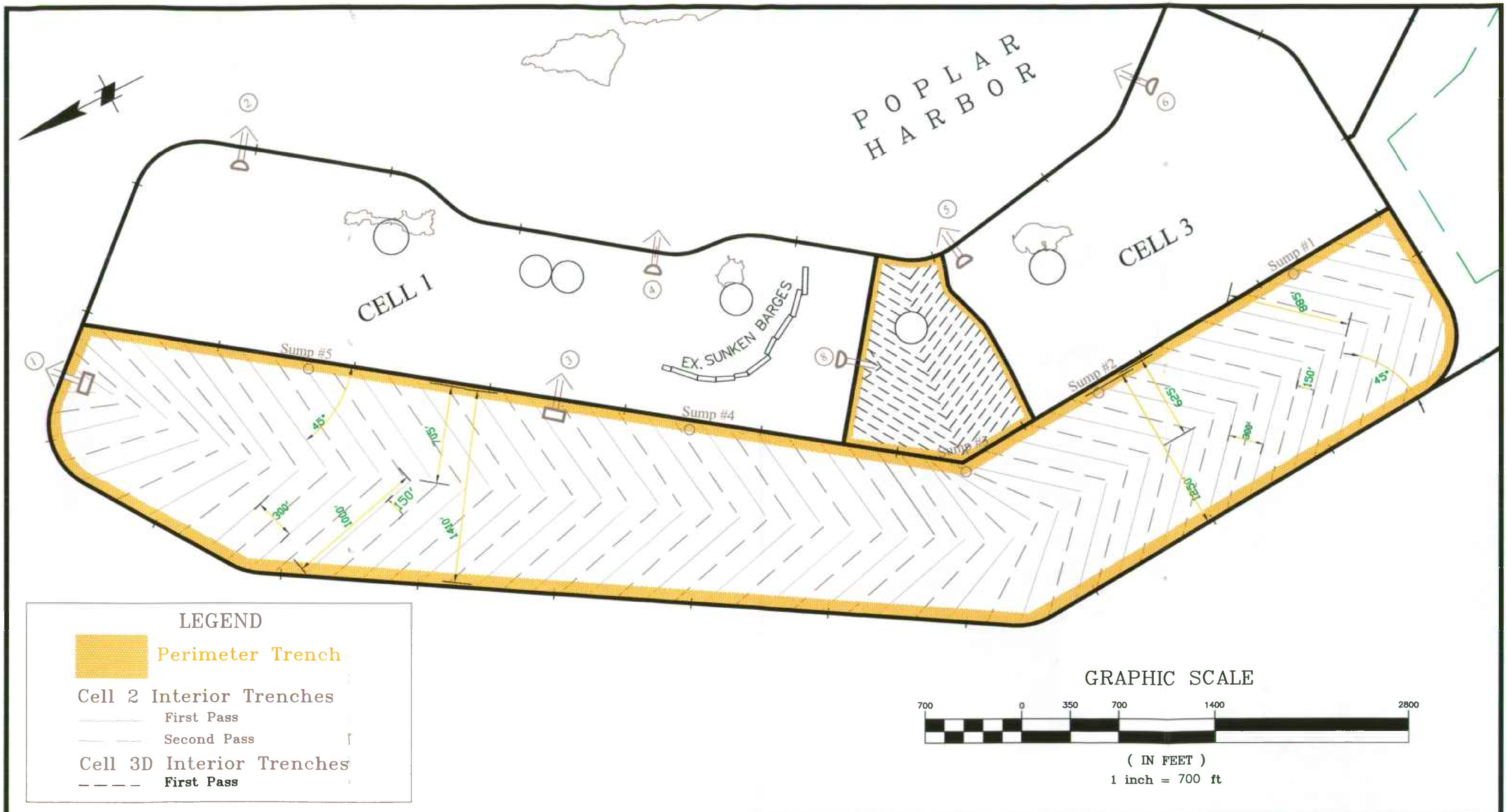
B. Perimeter Trench

1. A perimeter trench was excavated around the interior border of cell 2 using the long- and short-reach excavators.

2. Material excavated from the perimeter trench was placed on the interior slope of the dike. An excavator scarified this material.



DRAWN BY: TMR	Date: February 3, 2003	MARYLAND ENVIRONMENTAL SERVICE	Figure III-1	Poplar Island ERP
CHECKED BY: TMR	DRAWING NO.: FIGURE III-1		Pontoon Depression Plan – Cell 3D	Crust Management Plan
JOB NO.: 792-7305	SHEET 1 OF 1			



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CHECKED BY: TMR	DRAWING NO.: FIGURE III-2
JOB NO.: 792-7305	SHEET 1 OF 1

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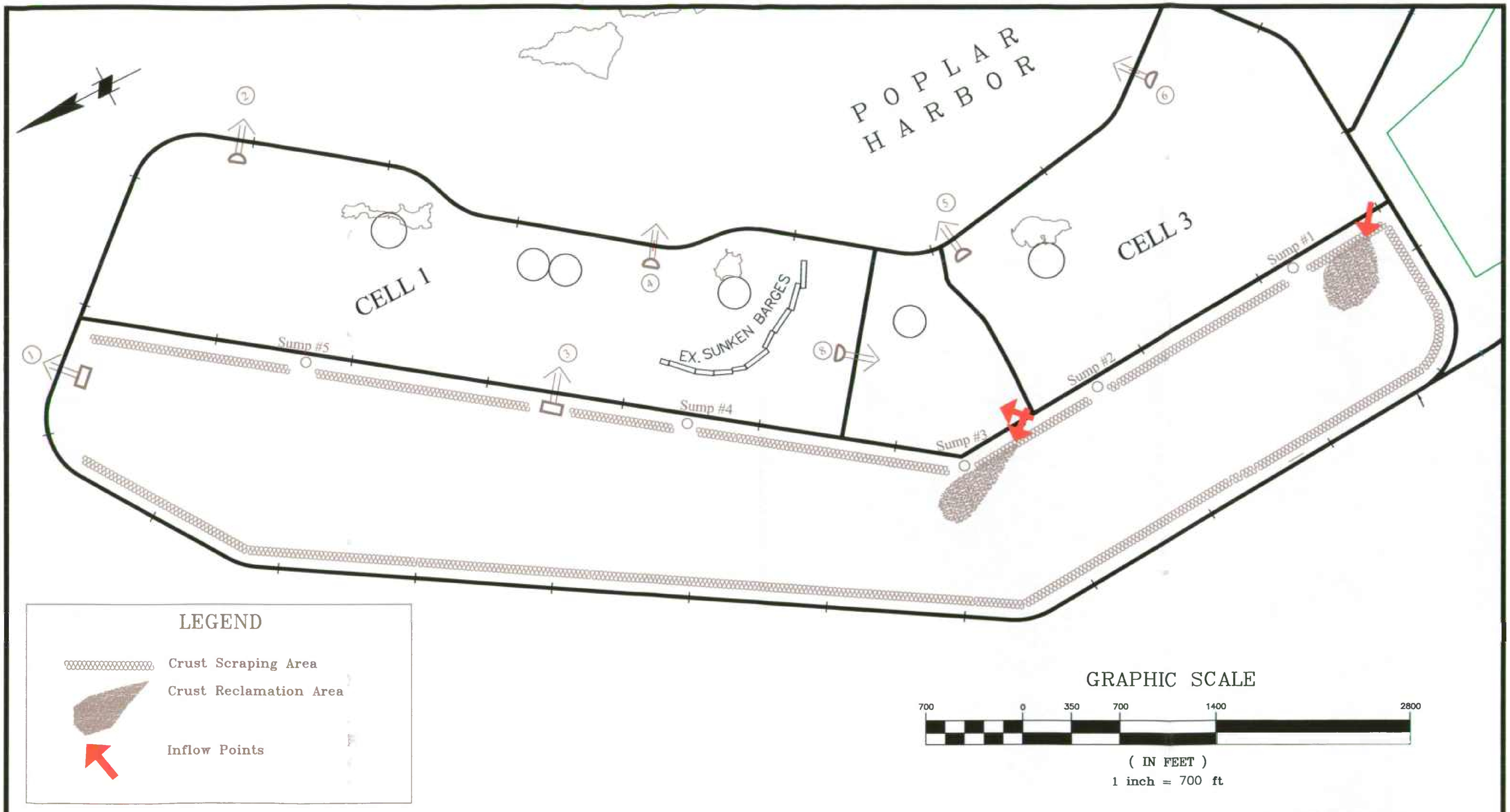
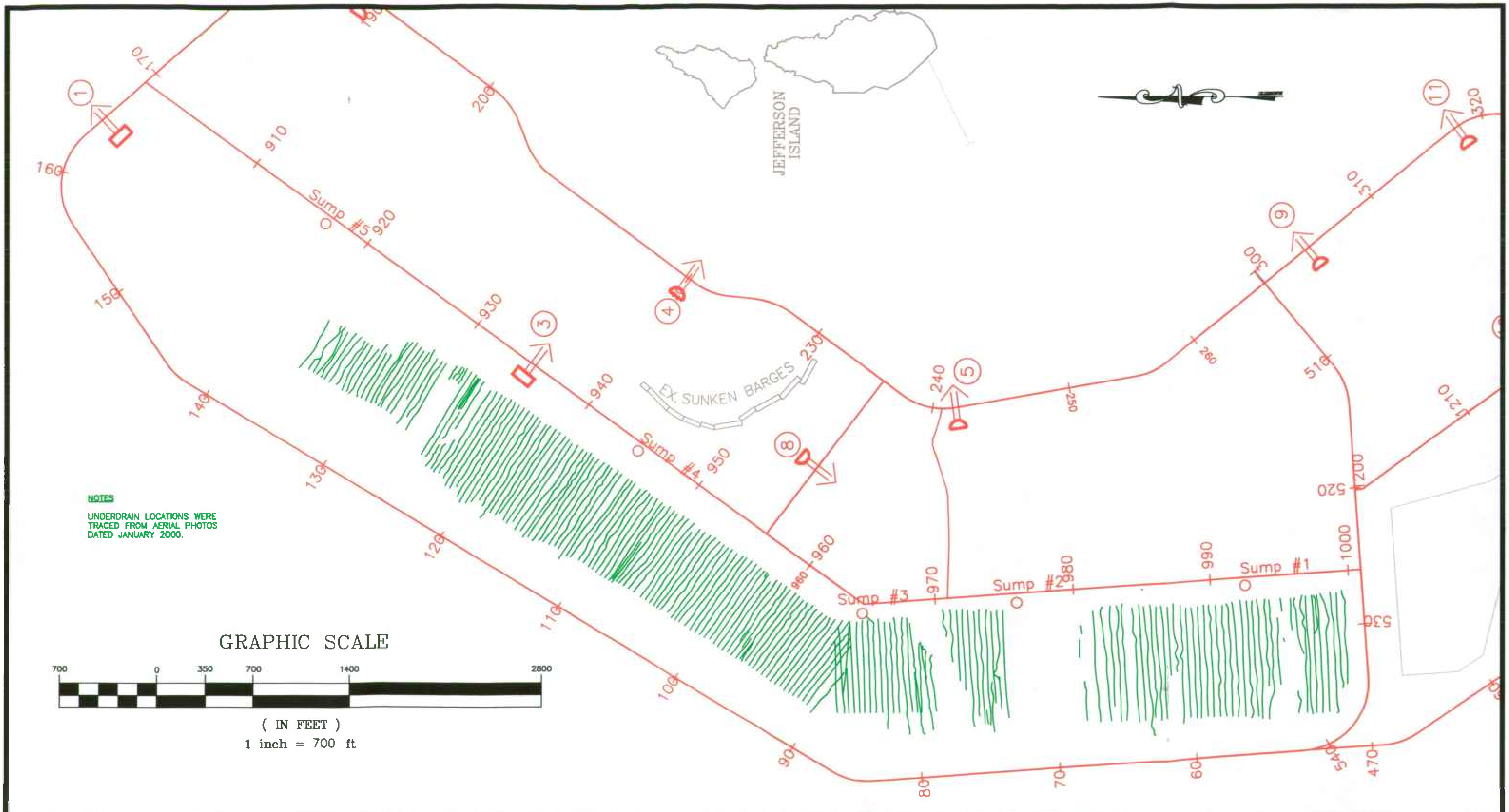
Figure III-2

Interior Trenching Plan – Cell 2 and 3D

Poplar Island ERP Crust Management Plan



DRAWN BY: TMR CHECKED BY: TMR JOB NO.: 792-7305	Date: February 3, 2003 DRAWING NO.: FIGURE III-3 SHEET 1 OF 1	MARYLAND ENVIRONMENTAL SERVICE	Figure III-3 Crust Reclamation and Scraping Plan - Cell 2	Poplar Island ERP Crust Management Plan



DRAWN BY: TMR	DATE: February 3, 2003	MARYLAND ENVIRONMENTAL SERVICE	Figure III–4
CHECKED BY: TMR	DRAWING NO.: FIGURE III–4		Cell 2 Underdrain and Sump Locations
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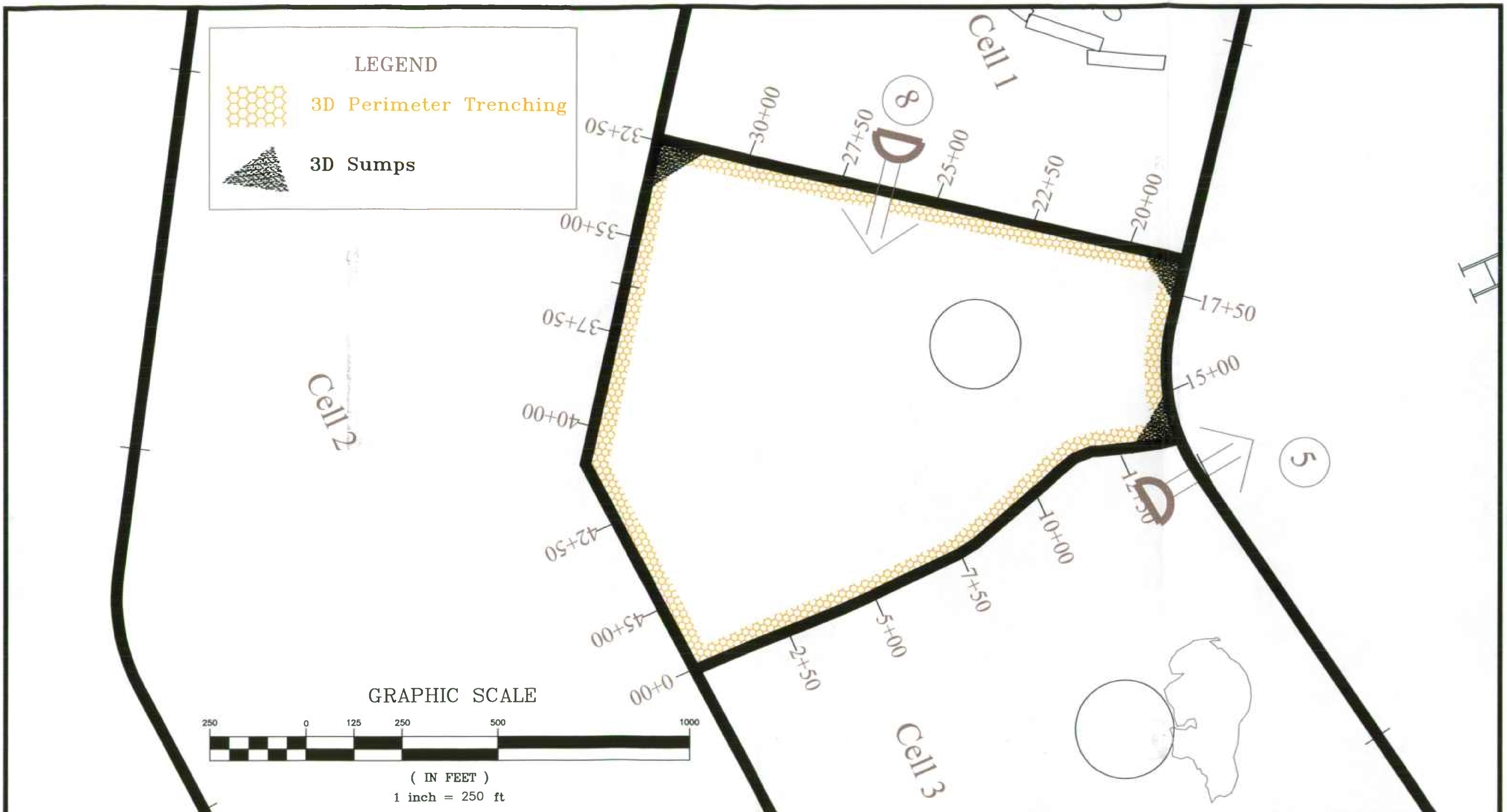
Poplar Island ERP Crust Management Plan



DRAWN BY: TMR	Date: February 3, 2003
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Figure III-5

Cell 3D Sump and Station Locations

Poplar Island ERP Crust Management Plan

IV. 2002 Crust Management Synopsis – Cell 2

Approximately 6.2 mcy of dredged material was deposited in cell 2 during the 2001 – 2002 inflow season, 75% of the total dredged material volume received at Poplar Island. Inflow conditions are exhibited in the aerial photo taken in November 2001 (figure IV-2). In order to maximize long-term capacity in cell 2, crust management was performed in order to dewater the placed sediment. The 2002 Crust Management Season spanned roughly nine and a half months, from January 20, 2002 to November 13, 2002. During this time span, MES personnel were successful in creating 151,500 linear feet of trenches and depressions in cells 1, 2, 3D, and 3 (table IV-2). The aerial photo in figure IV-2 was taken in October 2002 – near the end of crust management season. The trenching pattern in cell 2 is easily discernable in the photo.

These dewatering efforts were augmented by the very dry summer of 2002. According to data collected by the National Climatic Data Center at the Baltimore-Washington International Airport (BWI), Poplar Island received 22% less precipitation than average (table IV-1, figure IV-1). The dry weather helped the dewatering effort.

In an effort to dewater cell 2 during this past crust management season, crust management operations released the pond, extracted water from the underdrain sumps, excavated a perimeter trench and cut a series of interior trenches. As a result of these efforts, the average elevation of cell 2 decreased from +8.65' to +5.51', a difference of 3.14'. Approximately 93.2% of cell 2 decreased in elevation during 2002 crust management season (figure IV-4). The 6.7% of cell 2 that increased in elevation is located directly in front of spillway 1. One possible explanation for this 1.0' to 2.0' increase in elevation directly in front of spillway 1 is that as sediment-laden water drains from the upper portions of cell 2 during crust management it will collect in front of the spillway prior to release. Suspended solids will eventually settle out and act to increase the elevation in front of the spillway. Another possible explanation, which may have worked in tandem with the previous explanation, is that as the pond was drained, a portion of the sediment in cell 2 sloughed downhill toward spillway 1 therefore increasing elevation near this discharge structure.

Table IV-1
Crust Management Season Monthly Precipitation
1/30/2002 – 11/13/2002

Month	*Precipitation – Poplar*	*Average Precipitation***
February	0.95"	3.02"
March	4.51"	3.93"
April	7.40"	3.00"
May	1.16"	3.89"
June	1.22"	3.43"
July	0.34"	3.85"
August	0.75"	3.74"
September	0.62"	3.98"
October	6.98"	3.16"
November *	2.07"	1.31"
Total:	***26.00"***	***33.31"***

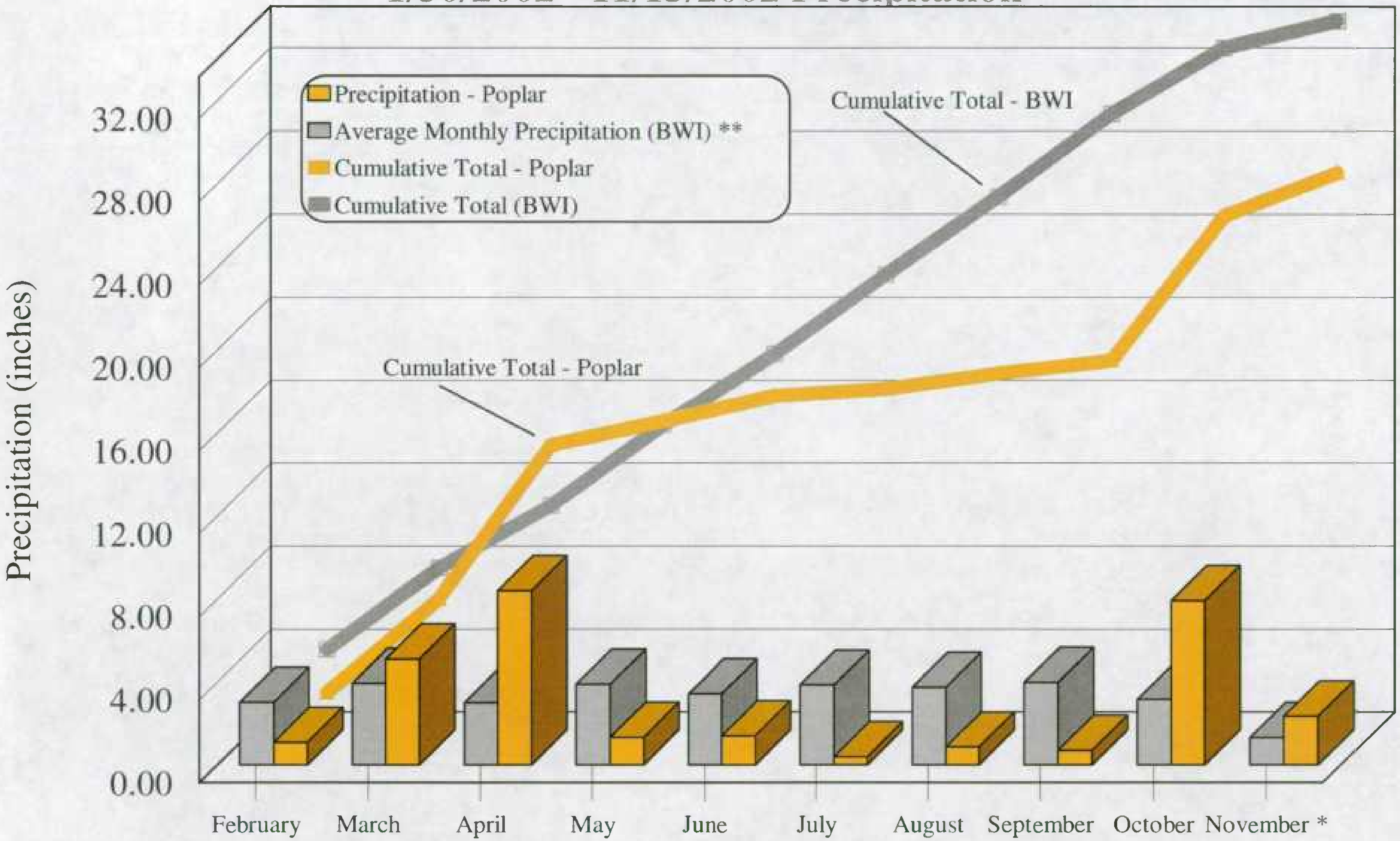
* Totals reflect November 1-13 timespan.
** Reflects precipitation data at BWI from 1871 – present (data courtesy of the National Climatic Data Center).

Table IV-2
Crust Management Season Trenching Totals
1/30/2002 – 11/13/2002

Cell	*Perimeter Trenches (lf)*	*Pontoon Depressions (lf)*	*Interior Trenches (lf)*	*Cumulative Total (lf)*
1	0	0	0	0
2	19,000	0	78,000	97,000
3	1,500	0	0	1,500
3D	5,000	30,000	18,000	53,000
Totals	**25,500**	**30,000**	**96,000**	**151,500**

PIERP 2002 CRUST MANAGEMENT

1/30/2002 - 11/13/2002 Precipitation



* November data span November 1-13, 2002

** Based on precipitation received from 1871 to present

Figure IV-1

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Poplar Island Environmental Restoration Project
Aerial Photo: November 2001

DRAWN BY: TMR	DATE: November 19, 2002
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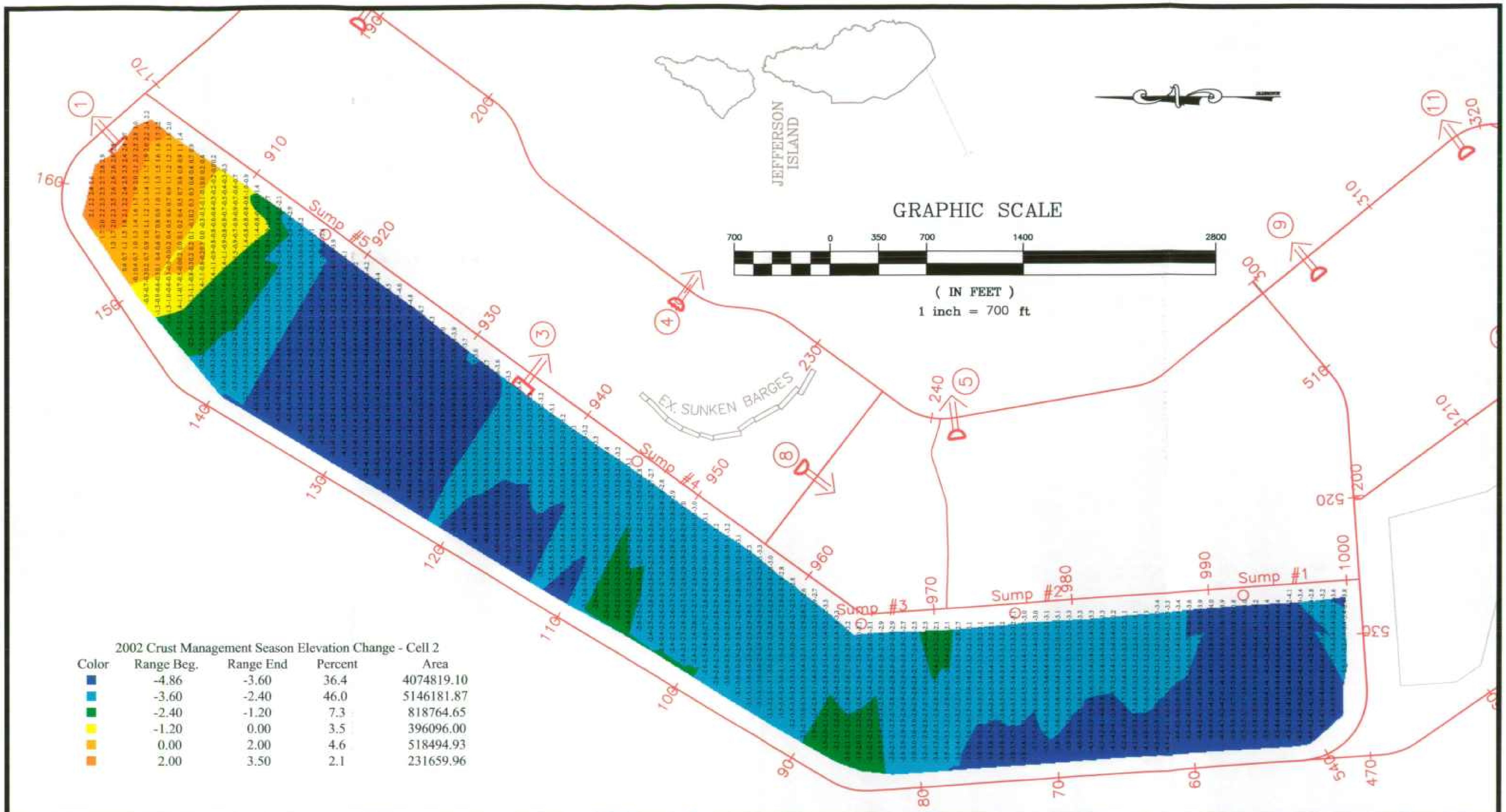
Poplar Island Environmental Restoration Project
Aerial Photo: October 2002



2002 Crust Management Season Elevation Change - Cell 2

Color	Range Beg.	Range End	Percent	Area
	-4.86	-3.60	36.4	4074819.10
	-3.60	-2.40	46.0	5146181.87
	-2.40	-1.20	7.3	818764.65
	-1.20	0.00	3.5	396096.00
	0.00	2.00	4.6	518494.93
	2.00	3.50	2.1	231659.96

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DATE: February 10, 2002
Figure IV-4
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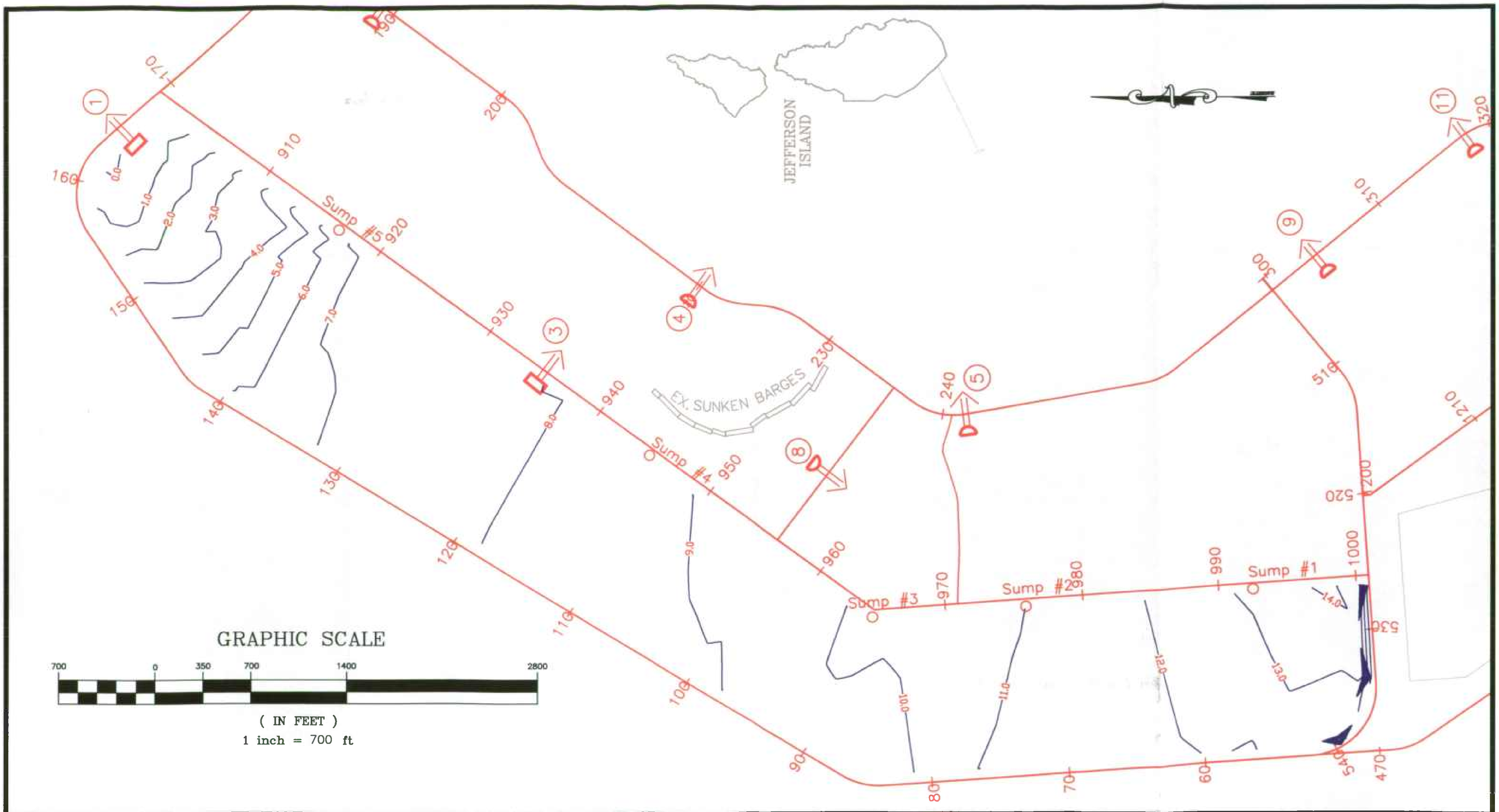
Poplar Island Environmental Restoration Project

2002 Crust Management Season Elevation Change – Cell 2

Appendix
Cell 2 Topographic Surveys



DRAWN BY: TMR	DATE: FEBRUARY 2002
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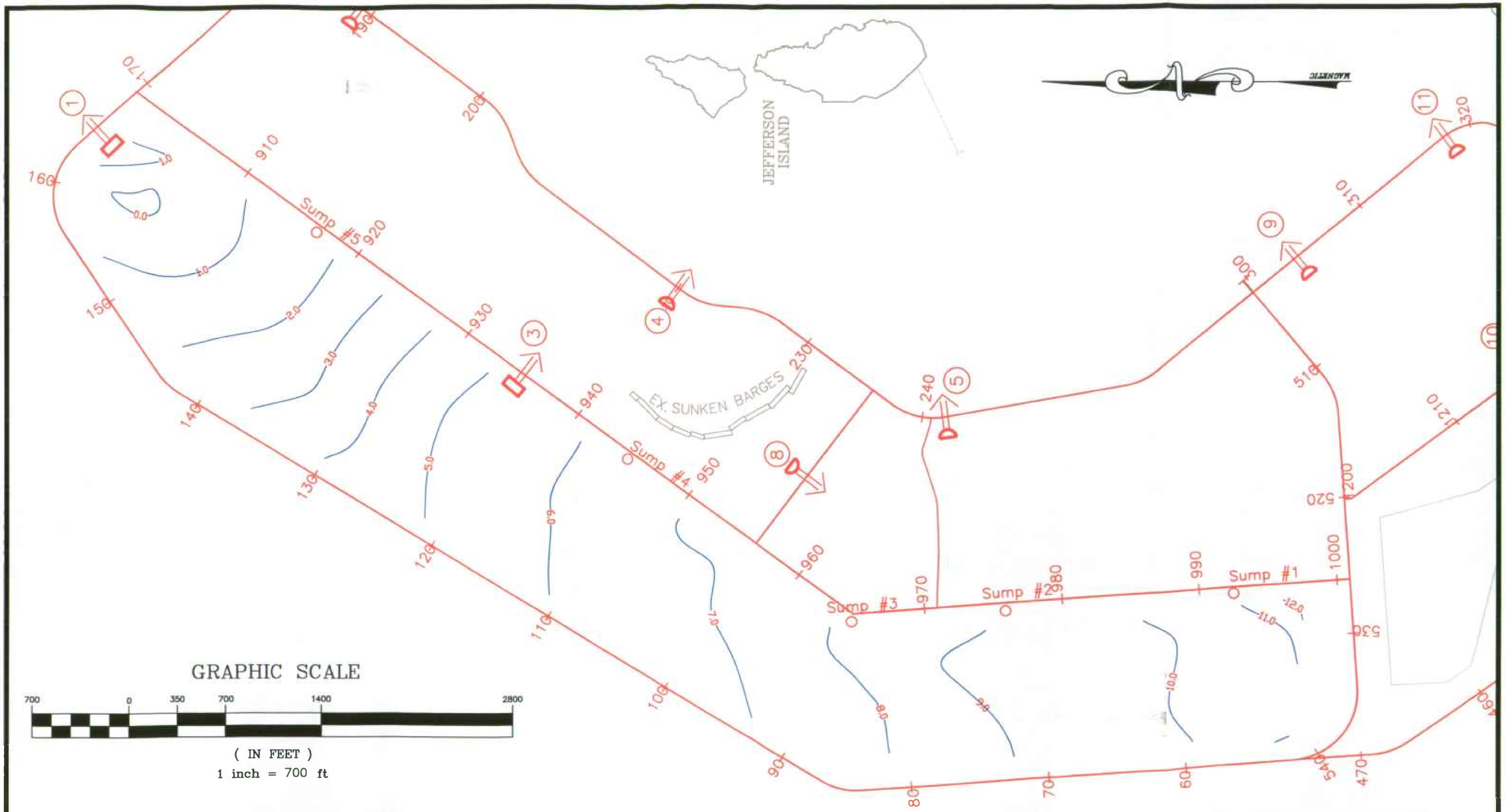
Poplar Island Environmental Restoration Project

GBA Cell 2 Survey: February 2002



DRAWN BY: tmr	Date: JUNE 26, 2002
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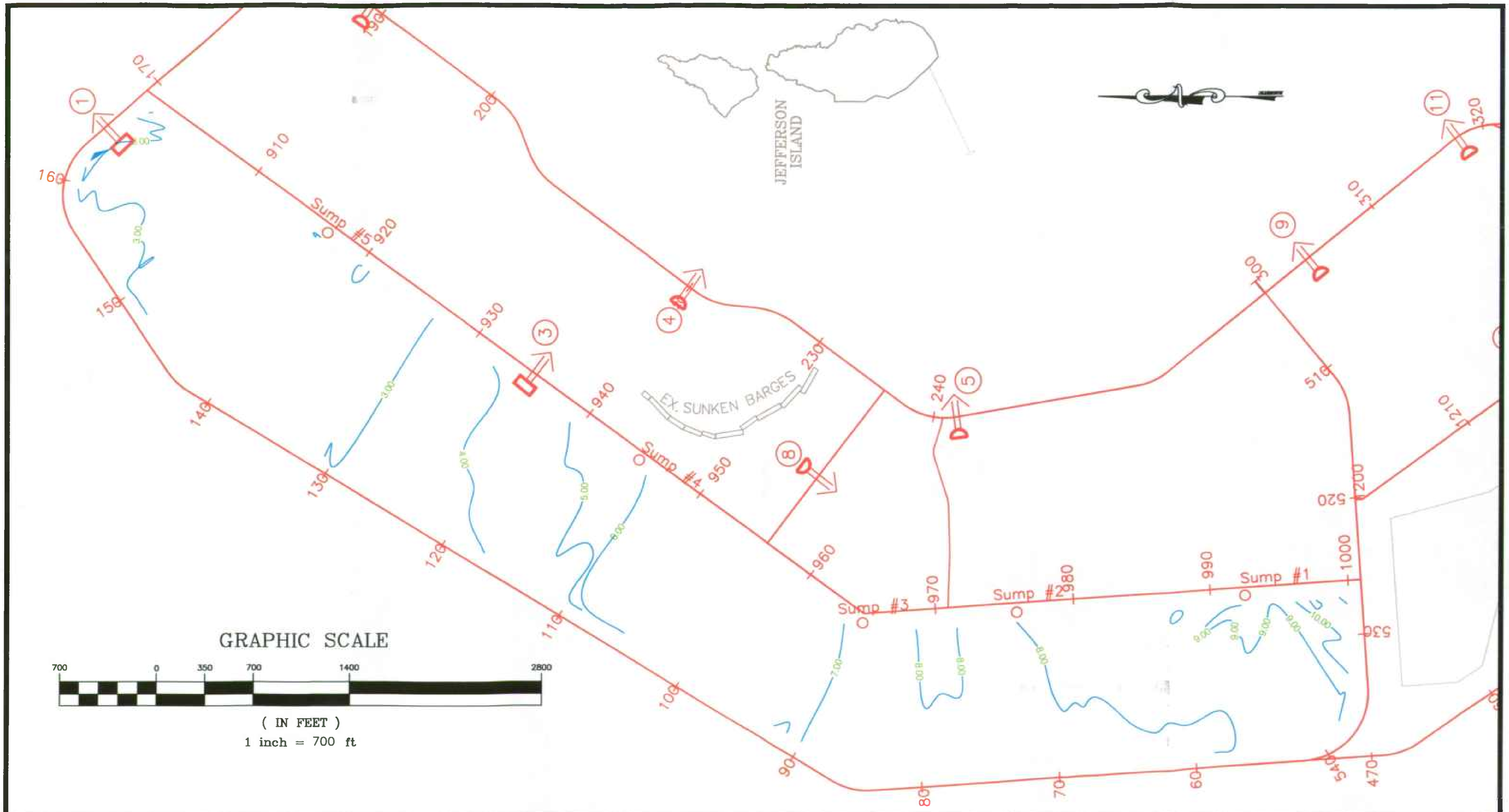
Poplar Island Environmental Restoration Project
Cell 2 Topographic Survey
Survey Completed: June 26, 2002



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Poplar Island Environmental Restoration Project

Survey Completed: October 22, 2002

Appendix Notes

1. Gahagan and Bryant, Inc completed the February 2002 survey.
2. Maryland Environmental Service completed the June 2002 survey.
3. Gahagan and Bryant, Inc. and Maryland Environmental Service jointly completed the October 2002 survey.