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GEOTECHNICAL POST-CONSTRUCTION REPORT

NIAGARA FALLS STORAGE SITE LEWISTON, NEW YORK

Volume 1 July-October 1982
Volume 2 September-November 1983
Volume 3 August-October 1984
Volume 4 June-November 1985
Volume 5 June-November 1986



Bechtel Job 14501 Bechtel National, Inc. Advanced Technology Division

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Special Note

This report is one of a series of engineering and environmental reports planned for the U.S. Department of Energy's properties at the Niagara Falls Storage Site in Lewiston, New York. The report describes the construction of the containment cutoff walls, dikes and cap for the storage areas at the site. It is not intended to be a definitive statement of the engineering methods and designs required to obtain desired performance features for any permanent waste disposal at the site. Such requirements, if developed, will be reported separately.

I FORWARD

The information contained in this report details the results of the remedial construction measures being performed at the Niagara Falls Storage Site (NFSS). The storage site, which is located in the Town of Lewiston, Niagara County, New York, is presently used for the storage of low-level radioactive wastes. The radioactive wastes resulted from the processing of uranium ores (pitchblende) during the early development of the atomic bomb. Additional low-level wastes, which were generated at other locations, were also deposited at NFSS for several years following World War II.

The site was originally controlled by the Manhattan Engineer District with subsequent responsibility transferred to the U.S. Atomic Energy Commission, the U.S. Energy Research and Development Administration, and the U.S. Department of Energy (DOE).

Niagara Falls Storage Site is one of numerous DOE-owned radioactively contaminated surplus facilities grouped under the DOE's Surplus Facilities Management Program (SFMP). Lead responsibility for administering the program resides with the DOE Richland Operations Office (Richland, WA), while specific responsibility for detailed planning and execution of remedial actions at NFSS is assigned to the DOE Oak Ridge Operations Office (Oak Ridge, TN).

The interim remedial construction activities at NFSS were started in 1982 with completion in 1986. At the conclusion of these interim activities, all radioactively contaminated materials will be consolidated within the diked containment area in the southwest corner of NFSS. The details of major construction activities conducted at the site are contained in the five attached reports.

II GEOTECHNICAL POST-CONSTRUCTION REPORTS

VOLUME 1
R-10 WASTE PILE DIKE CONSTRUCTION
JULY-OCTOBER, 1982

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1.0 INTRODUCTION

Volume 1 of the Post-Construction Report contains the results of the initial remedial construction activities associated with the stabilization of the R-10 waste pile. A general site location map and site plan are shown in Figures 1-1 and 1-2, respectively. Specifically covered and documented in this volume is the construction of a 1700-foot-long perimeter dike and cutoff wall surrounding the R-10 waste pile. This includes the excavation and backfilling activities, logging of the cutoff trench excavation wall, quality control testing for backfill placement, and soil and water sampling for the uranium and radium distribution coefficient measurements.

The work described in this volume was conducted during the period July through October, 1982.

Participants and their involvement with the stabilization of the R-10 area are summarized below:

Department of Energy: Owner

<u>Bechtel</u>: Project Manager Contractor: Subsurface investigation; dike embankment and cutoff wall design; dike foundation inspection; and management of construction operations.

<u>Armand Cerrone, Inc.</u>: Construction of the cutoff wall and dike including excavation and backfilling.

<u>Empire Soils Investigations, Inc.</u>: On-site soil testing of fill material, and laboratory testing.

<u>Eberline</u>, <u>Inc.</u>: On-site radiological survey, and radiological safety for all site personnel.

2.0 BACKGROUND

The initially planned remedial engineering measures for the R-10 waste pile consisted of constructing a low perimeter dike around the area. The original plan called for founding the dike on the surficial brown clay unit at elevation 317. However, geologic mapping of the brown clay subgrade for the dike in June and July, 1982, indicated the presence of sand deposits within the brown clay. These sand deposits were confirmed by a further investigation that included geophysical methods and a limited subsurface exploration program (see Section 3).

In order to assure that the sand deposits in the brown clay unit would not provide a pathway for the migration of contaminated ground water from under the R-10 water pile, the original design of the perimeter dike was modified to include a compacted low permeability clay cutoff wall beneath the entire dike. The cutoff wall, which was keyed into the underlying gray clay unit, would then provide a complete cutoff for the R-10 waste pile.

 $^{^{1}}$ All elevations shown are in feet above Mean Sea Level (MSL).

3.0 PREVIOUS SUBSURFACE INFORMATION

Two previous geological reports were utilized in preparing this report. The first report, which was prepared by Acres American Incorporated, Buffalo, New York, presents the evaluation of the geology and hydrology of the NFSS (Reference 1). The second report, which was prepared by Bechtel (Reference 2), presents the results of the subsurface investigation that included geologic mapping, geophysical surveys and a drilling program conducted around the R-10 waste pile during the period June through August, 1982.

4.0 SITE AND SUBSURFACE CONDITIONS

Prior to placement of the residues and spoils, the topography at the R-10 waste pile site was essentially flat, ranging from elevation 317 on the north and east sides, to elevation 320 along Lutts Road at the west side. The residues and spoils are currently piled to about elevation 330 at the south end of the site as shown in Figure 1-3.

A description of subsurface conditions in the R-10 waste pile area is presented in References 1 and 2. In general, the overburden soils consist of the five units shown in Figure 1-4: surficial soils and fill, underlain by brown clay, gray clay, brown sand and gravels, and red silt. The red silt unit is underlain by the red shales and siltstones of the Queenston Formation. The gray clay, which is about 20 feet thick in the vicinity of the R-10 area is the most homogeneous unit on the site and provides a natural blanket that acts as a ground water barrier. However, due to erosion of the surface of the gray clay layer, the top of the gray clay unit is not uniform in elevation.

5.0 R-10 WASTE PILE STABILIZATION DESIGN FEATURES

The cutoff wall excavation extends a minimum of 1 to 2 feet into the gray clay. The minimum width at the bottom of the cutoff wall is 12 feet. The depth of the cutoff wall varies as the top of the gray clay varies, ranging from about elevation 295 to elevation 309 feet. In general, the cutoff wall is not centered on the dike centerline; its location varies according to the subsurface conditions. Typical cross sections of the dike are shown on Figure 1-4.

The dike and cutoff wall consists of three main segments: the east dike, the north dike and the west dike (see Figure 1-5). The Building 411 is located on the south side of the R-10 waste pile. The dike and cutoff wall abuts this building on both its east and west sides. Embankment slopes for the dike are 2 horizontal to 1 vertical, with slope protection consisting of 4 inches of crushed stone.

All the contaminated material handled during the 1982 construction was placed within the perimeter dikes. In addition, a polymeric liner material (EPDM) was installed over the R-10 wastes following construction operations in the Fall of 1982 to reduce erosion potential and radioactive emissions and prevent rainfall from entering the material.

6.0 TRENCH EXCAVATION

Prior to the start of excavation for the cutoff wall, all areas were surveyed for radioactive contamination by Eberline, Inc. All contaminated areas were overexcavated; the material was disposed of on the R-10 waste pile; and the

overexcavated areas were resurveyed. This procedure was repeated until the radiological survey indicated compliance with criteria for allowable soil contamination.

Excavation for the cutoff trench was performed using Caterpillar Model 225 and 245 excavators. These machines have maximum digging depths of 10 and 17 feet, with 3/4 and 4 cubic yard buckets, respectively. Slopes were cut to approximately 1 horizontal to 1 vertical with vertical benches, each bench being less than 5 feet in height. A typical cross section of the excavation is shown on Figure 1-4. In several locations within the brown clay unit fissures and cracks had developed after the excavation had been open for extended periods. Potentially unstable slopes in brown clay were further flattened to ensure safety. Slopes were inspected for cracks at the beginning of each day and after each rainstorm. Some shallow sloughing of the brown clay into the trench did occur occasionally during or immediately after heavy rainfall.

In general, the bottom of the trench was excavated at least 1 to 2 feet into the gray clay. In some locations, where sand and silt lenses or thicker sands and mixed sand and gravel deposits were encountered in the transitional zone from brown clay to gray clay, the excavation was carried deeper. Ground water seeped from these granular deposits at rates up to 20 gpm. In most cases, the volume of flow reduced substantially after the excavation had been open 3 to 5 hours, and usually stopped after 2 to 5 days, indicating that these permeable deposits did not form a continuous aquifer across the site. Rather, they probably represented a series of isolated lenses. The bottom of the cutoff

trench was dewatered periodically by sump pumps. Water was pumped into the on-site retention ponds located on the east side of the Central Drainage Ditch.

The excavated uncontaminated materials from the trench were stockpiled on-site on the north side of the R-10 waste pile, with sand and gravel portions stockpiled separately from the clay portions. Only brown clay, with up to a trace of sand and gravel, was accepted as suitable material for reuse as backfill for the cutoff wall and dike embankments.

A log of the soil conditions of the sides of the cutoff trench excavation was prepared by a Bechtel geotechnical engineer. Subsurface conditions found during the dike excavation are described in the following paragraphs; as-built profiles are presented in Figure 1-6. It should be noted that, at certain locations, the transitional zone from the brown clay to the underlying gray clay was not clearly distinguishable. This explains any variation in the elevation of the top of the gray clay between the information interpreted from the boring logs and the as-built profiles.

6.1 EAST DIKE AREA

Borings in the east dike area (Reference 2) revealed isolated deposits of principally very fine to fine sand and silty sands in the upper brown clay unit. The excavation started on August 16, 1982, and was completed on September 1, 1982. Figure 1-6, Profile B-B', presents the as-built subsurface information for the east dike area. Of note, was a 7-foot-thick deposit of sand and gravel with cobbles encountered in the excavation at coordinate S 11+59. This deposit was not continuous. The top of the gray clay in the east dike area was encountered in the excavation between elevations 296 and 306.

6.2 NORTH DIKE AREA

Borings in the north dike area (Reference 2) indicated deposits of sand and mixed sand and gravel in the brown clay unit between coordinates E 2+20 and E 4+20 along the north dike centerline. These deposits are believed to be isolated from each other. Excavation started on September 14, 1982, and was completed on October 4, 1982. Figure 1-6, Profile C-C', presents the as-built subsurface information for the north dike area. During excavation, a 15-foot-thick sand and gravel layer overlying the gray clay was encountered between coordinates E 3+60 and E 3+90. The rate of ground water flowing into the excavation reached as high as 20 gpm, but essentially stopped after 5 days. These sand and gravel deposits were not considered continuous. The top of the gray clay in the north dike area was encountered during the excavation between elevations 300 and 309.

6.3 WEST DIKE AREA

Borings in the west dike area (Reference 2) indicated extensive deposits of predominately silty sands and gravels in the brown clay. Excavation started on September 4, 1982, and was completed on September 26, 1982. A thick sand and gravel deposit was found in the excavation between coordinates S 10+35 and S 10+70. This deposit was excavated over 20 feet in depth, down to elevation 290, without gray clay being encountered on the outside wall of the trench. The gray clay was visible in the north, south and east sides (inside wall) of the excavation after removing the sand and gravel (see Figure 1-7). The excavation was discontinued at that depth to avoid any possibility of puncturing through the gray clay unit in the bottom of the excavation. Three additional borings (Borings A-19, A-20, and A-21) were then drilled in this area to determine the extent of the sand and gravel deposit. Logs of these

borings are presented in Appendix 1-A. The gray clay was encountered at elevation 306 in all three borings, with no sand and gravel deposits found below that elevation. Based on the field observations and the additional subsurface investigation, it was concluded that the sand and gravel deposits between coordinates S 10+35 and S 10+70 was not continuous. Further, with the sand not being continuous, and the fact that the gray clay was present on the inside wall of the excavation, it is believed an effective cutoff was maintained by the cutoff wall. The compacted clay cutoff wall, which was started at elevation 290 in this area, extends a minimum of 12 feet (see Figures 1-6 and 1-7) below the top of gray clay unit on the inside wall of the excavation.

Figure 1-6, the as-built Profile A-A' along the west dike area, indicates the sand and gravel deposits extending from ground surface to the gray clay. The gray clay was generally encountered between elevations 304 and 309.

6.4 SOUTHWEST DIKE AREA

No borings were drilled in the southwest dike area that abuts the west side of Building 411. Excavation in this area started on August 31, 1982, and was completed on September 3, 1982. Profile D-D' (Figure 1-6) presents the subsurface conditions found during the excavation. A thick layer of hard clayey silt with gravel and cobbles overlying the gray clay unit was encountered between coordinates E 2+00 and E 1+00. The excavation of the 30-foot section adjacent to Building 411 was discontinued at elevation 308 feet before encountering the gray clay, since a deeper excavation might have endangered the 411 building foundation at elevation 312 feet. The subsurface of the gray clay in the southwest dike area slopes gently westward from elevation 300 at E 1+90 to elevation 305 at E 0+50.

6.5 SUMMARY OF EXCAVATION QUANTITIES

The excavation for the cutoff wall was started on August 16, 1982, and was completed on October 4, 1982. A total of about 23,900 cubic yards was excavated. The average elevation of the base of the excavation was 301 feet, with an average bottom width of 13 feet. The average excavation rate was approximately 600 cubic yards per day.

7.0 BACKFILLING

7.1 SOURCE OF MATERIALS

Three sources of clayey material were used for constructing the cutoff wall and the dike embankments. These sources consisted of the uncontaminated brown clay from the excavation for the dike and cutoff wall, brown clay from an on-site borrow pit south of NFSS parking lot, and off-site borrow material from the Lake Road borrow pit (see Figure 1-1).

Typical fill material properties and compaction characteristics are shown in Table 1-1. The technical specification requirement for the fill material was a clay material with a minimum of 50 percent passing the No. 200 sieve. The compaction criteria for the fill material was 90 and 95 percent of maximum Modified Proctor density (ASTM D-1557) for the cutoff wall and dike embankments, respectively.

7.2 COMPACTION EQUIPMENT AND PROCEDURES

The fill placement operation utilized the following equipment:

- o Excavators Two Caterpillar Model 225's and one Caterpillar Model 245
- o Dozers Two Caterpillar Model D-7's and on Caterpillar Model D-5

o Compactors - Two Ingersoll-Rand Model SPF56 pad-foot rollers and one
Tampo smooth-drum roller

Prior to placement of backfill, the bottom and the outside face of the cutoff wall excavation was surveyed for radioactive contamination by Eberline, Inc. In situ soil samples were obtained for radiological testing at 20-foot intervals horizontally and 5-foot intervals vertically. On-site laboratory tests on these soil samples indicated that levels of radium-226 contamination were below DOE's maximum permissible concentration of 5 pCi/g. Backfilling was then allowed to proceed on the uncontaminated subgrade.

The first lift of fill was placed in a 2 to 3-foot-thick layer to avoid causing pumping of the soft gray clay subgrade. After the initial lift was stabilized, additional fill was placed in 8-inch loose lifts and compacted with, on the average, four passes of the Ingersoll-Rand pad-foot roller in uniform layers parallel to the axis of the embankment. The fill surface was sealed with the Tampo smooth steel drum roller at the end of each day. At the beginning of each day, the fill surface was scarified by a bulldozer prior to placement of subsequent fill.

The rate of placement of backfill for the cutoff wall was relatively slow in the beginning because of access limitations. The rate averaged 400 cubic yards per day. As the fill was placed to a higher elevation, and a correspondingly wider area became available for the operation of construction equipment, progress improved and reached an average placement rate of 700 cubic yards per day.

7.3 QUALITY CONTROL

Field density tests were performed for every 200 cubic yards of fill placed to ensure that the backfill met technical specification requirements. The field density tests conformed to ASTM D 1556 and were conducted by a technician from Empire Soils Investigations, Inc. Available data for 94 field density tests are presented in Appendix 1-B.

The compaction criteria for cutoff wall backfill was a minimum of 90 percent of maximum dry density in accordance with ASTM D 1557. Actual degree of compaction, measured by the field density testing, averaged nearly 94 percent. Similarly, the dike embankment, with a compaction criteria of at least 95 percent maximum dry density (ASTM D 1557), averaged a relative compaction of nearly 97 percent. In addition, Atterberg Limit tests were performed on a routine basis on the fill material to determine the soil classification. The results of the Atterberg Limit tests are shown on Figure 1-8 and in Appendix 1-C. As can be seen from Figure 1-8 the fill material is classified as a CL (low-plasticity clay) in accordance with the Unified Soil Classification System.

The moisture content of the fill materials obtained from the dike excavation was generally 2 to 7 percent higher than the optimum moisture content based on the compaction tests. Some difficulty was experienced trying to reduce the moisture content of the clayey material to enable the required degree of compaction to be obtained. Disking and aerating the wet fill was required and this caused some delay in the backfill operation. Several advantages of placement of the clayey fill on the wet side of optimum moisture is a lower resulting permeability and greater ability to deform without cracking. The

off-site borrow material from the Lake Road source was found to be within 2 percent of the optimum moisture content. However, due to limited availability, this material comprised only about one-third of the total fill placed.

8.0 ON-SITE SAMPLE COLLECTION OF K ANALYSIS

During excavation and backfilling for the cutoff wall, uncontaminated soil and water samples were obtained at selected locations for the determination of the uranium and radium distribution coefficients (K_d). Three soil samples were collected from the gray clay subgrade, and three additional samples were obtained from cutoff wall backfill material after compaction. A 4-gallon sample was collected from ground water seeping from a sand and gravel deposit at coordinates E 1+90 S 7+50, elevation 309. Locations of the soil samples and the water sample are shown on Figure 1-6. The samples were tested for radiation by Eberline, Inc. Results indicated that the levels of radium-226 contamination were below DOE's maximum permissible concentration 5 pCi/g for soil and 30 pCi/l for water. The soil and water samples were then sent to 0ak Ridge National Laboratory, 0ak Ridge, Tennessee, for the uranium and radium distribution coefficient measurements. Details of the sampling procedures and data sheets prepared for each sample are presented in Appendix 1-D.

9.0 SUMMARY OF RESULTS AND CONCLUSIONS

1. At all locations along the R-10 waste pile dike the cutoff wall extends a minimum of 18-inches below the top of the gray clay unit.

The only exception is the southwest section adjacent to Building 411.

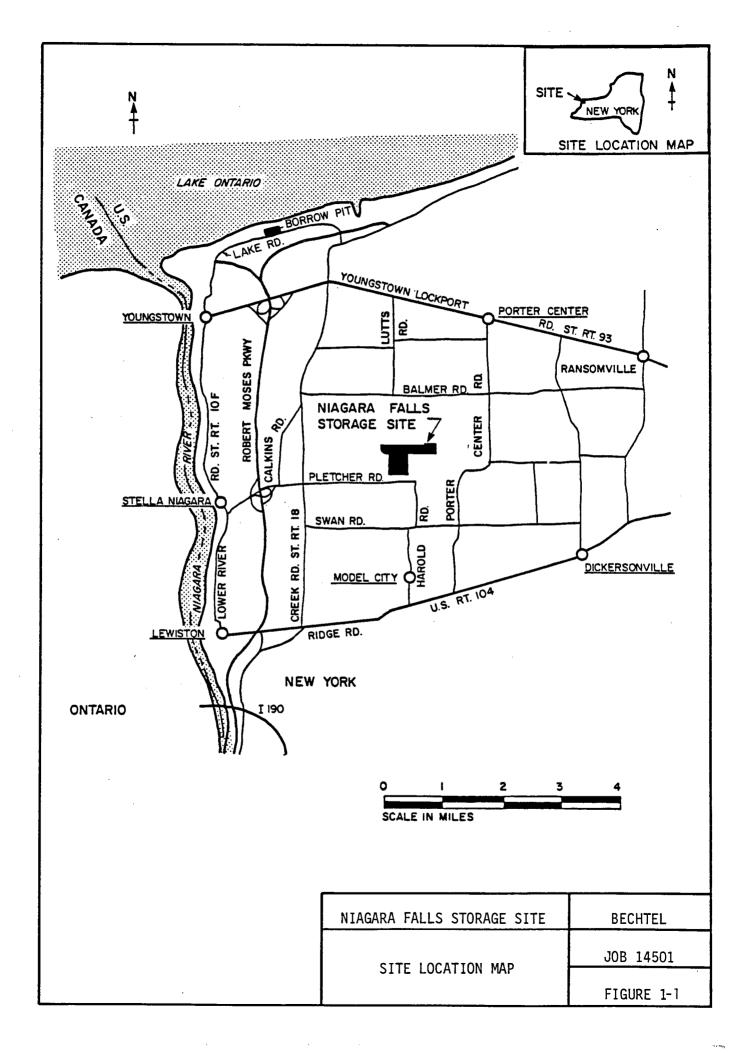
- 2. Sand and gravel deposits exist within the brown clay unit. Almost all deposits were dry and are believed to be isolated.
- 3. The compaction of the cutoff wall and dike fill material either met or exceeded the required percent of Modified Proctor density.

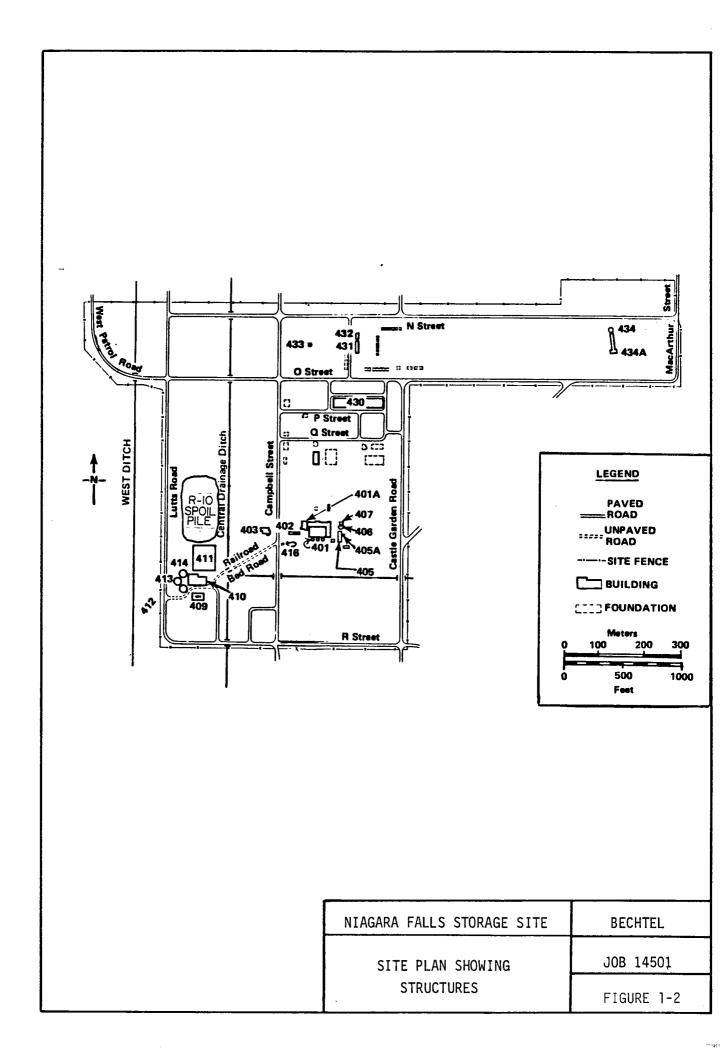
10.0 REFERENCES

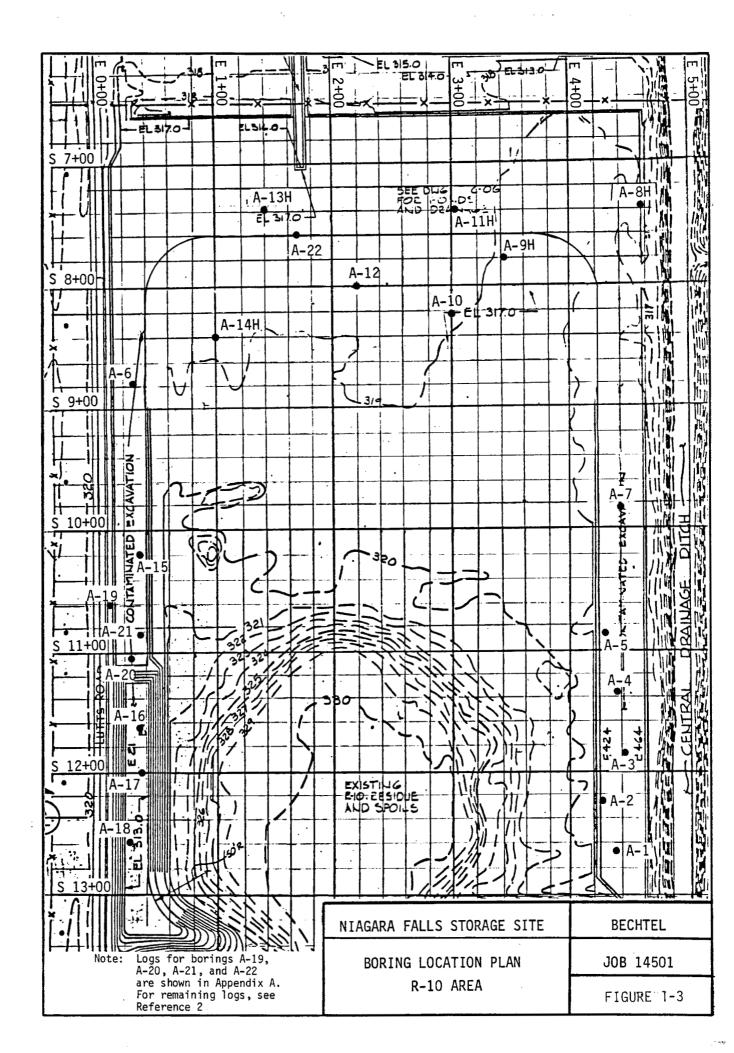
- Acres American Incorporated, 1981, "Hydrologic and Geologic Characterization of the DOE - Niagara Falls Storage Site."
- 2. Bechtel National, Incorporated, 1984, "Geologic Report, Niagara Falls Storage Site."

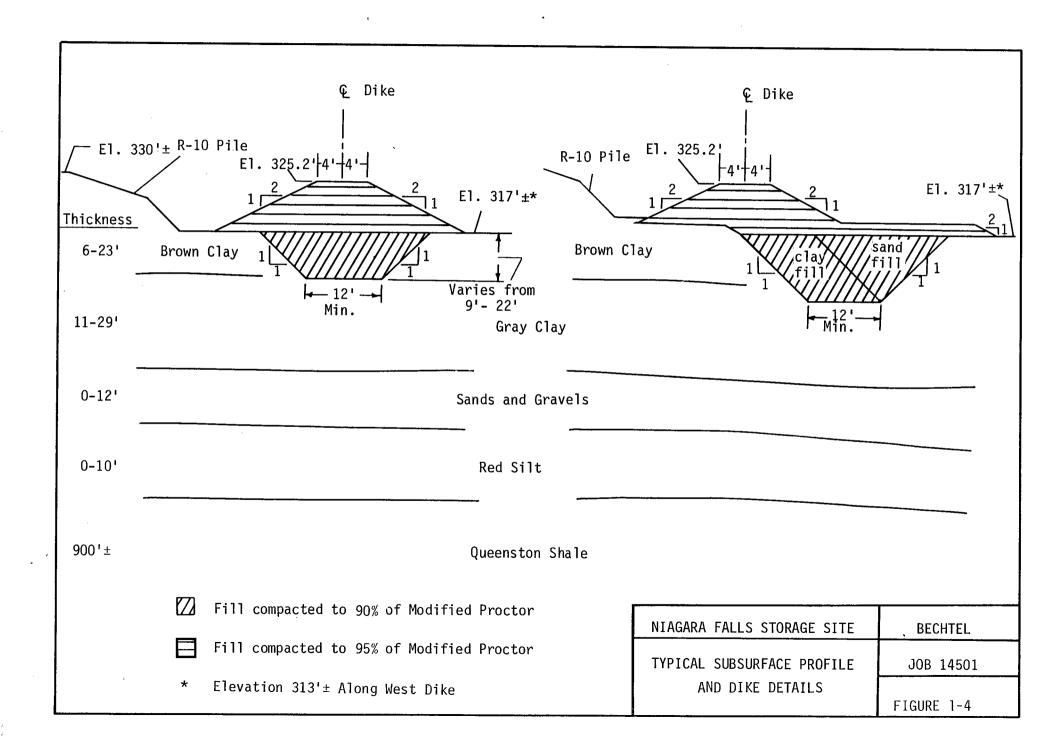
TABLE 1-1 - TYPICAL FILL MATERIAL INDEX CHARACTERISTICS

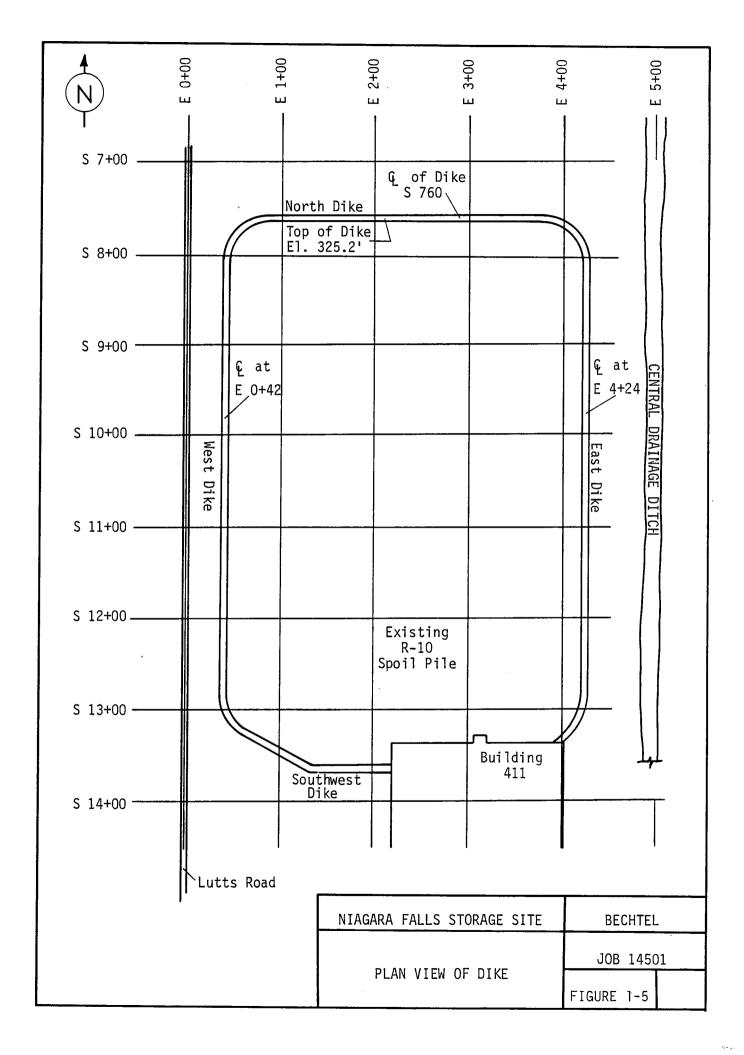
MATERIAL SOURCES	ON-SITE EXCAVATED MATERIAL	ON-SITE BORROW MATERIAL	OFF-SITE BORROW MATERIAL
VISUAL DESCRIPTION	RED-BROWN SILTY CLAY	BROWN SILTY CLAY	YELLOW-BROWN SILTY CLAY
USCS	CL	CL	CL
SIEVE SIZE	% FINER	% FINER	% FINER
2"	100	100	
3/4"	99.2	97.7	100
No. 4	97.0	94.3	99.5
No. 10	93.8	90.6	98.9
No. 40	89.6	85.9	98.2
No. 200	80.1	78.5	97.5
Liquid Limit	32	37	41
Plasticity Index	12	20	16
Maximum Dry Density ASTM D 1557	128.6 pcf	124.2 pcf	116.4 pcf
Optimum Water Content	11.0%	12.2%	16.9%

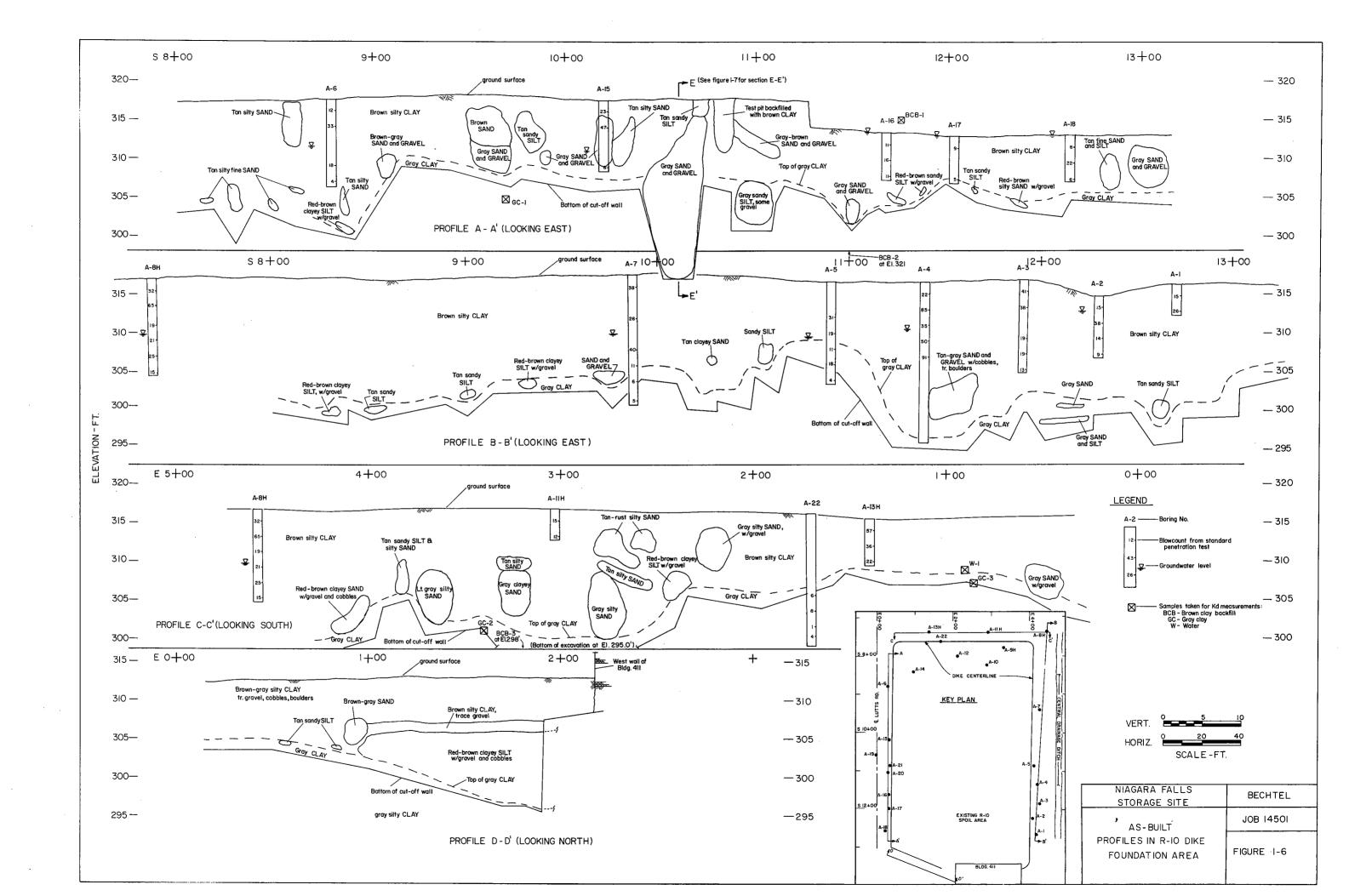


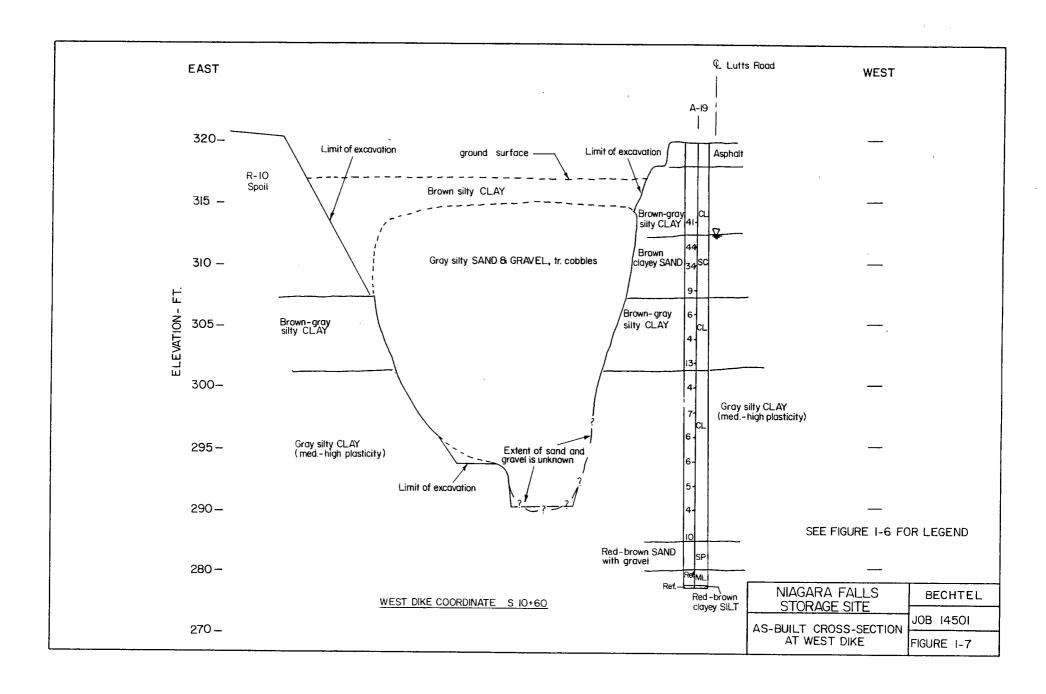


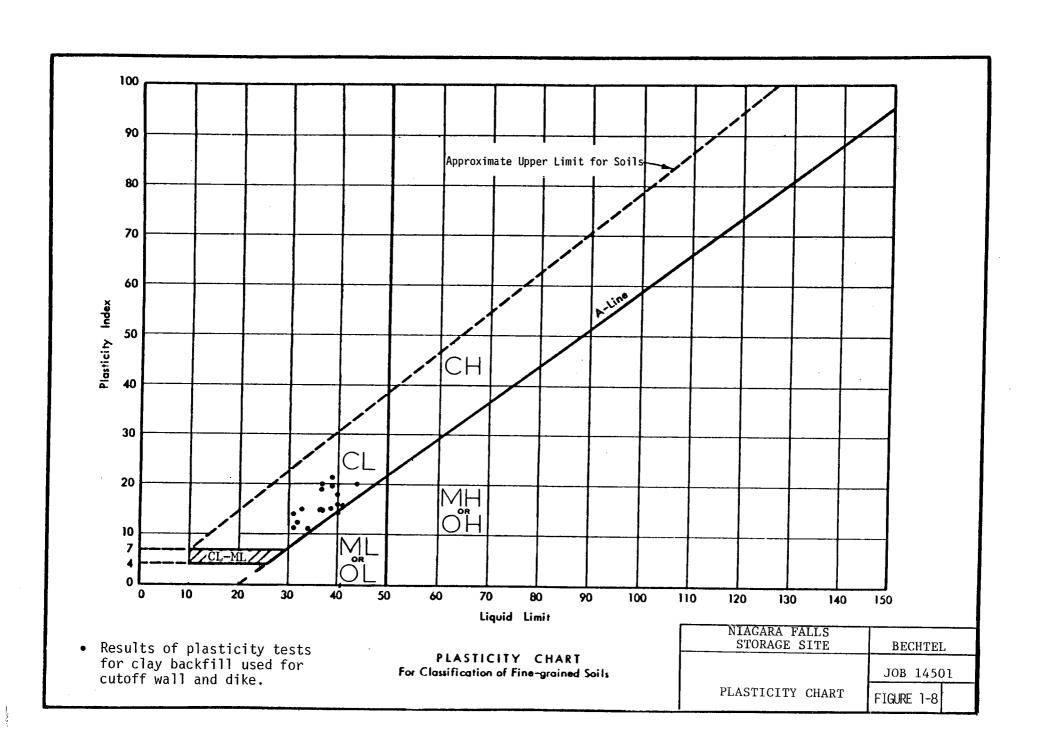












APPENDIX 1-A

Logs of Borings - A-19, A-20, A-21, and A-22 $\,$



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SAMPLER AND DIAM	SAMPLER ADVANCE (In.) LENGTH CORERUN (Ft.)	SAMPL	SAMPLE BLOWS 'N' PERCENT CORE PERCENT CORE	1ST 6"	ZND 6"	3RD 6" 4TH 6"	(FT.) 319.9	O DEPTH-FT	UNIFIED SOIL CLASSIFICATION	SAMPLE	DESCRIPTIO	DESCRIPTION AND CLASSIFICATION			WATER RETURN, CHARACTER OF DRILLING, ETC.	
									-		Augered to 4.5	' throug	h asphalt an	ıd	Drille	d with -stem auger
		•							1 1 1							
S\$	2.0	1.3	41	14	20	21	315.4	5.6	CL	1	Brown and gray gravel. Grade clay with gray	s to red	CLAY, trace I-brown sandy)		
SS	2.0	1.3	44	7	12	32 49	312.4	-	sc	2	Brown clayey S	AND with			모	
SS ——	2.0	1.6	34	15	18	1610		10.6	7	3	to brown silty gravel.	fine SA	ND, trace of	•		
ss	2.0	1.0	. 9	8	4	5	307.4			4						
SS —	2.0	1.5	6	1	3	3		15.0	CL	5	Brown-gray sil plastic.	ty CLAY,	trace grave	el,		
S\$ 	2.0			1	2	2		15.6		6	16.5'-18.5':	Brown gr	ay fine sand	ly		
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BORING	LOG	#81E67 FU:	SRAF	P -	SHEET NO	2 of 2 A-19			
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S 2.0 1.8 10 1	284.4	3	SP- SC		☐ Gray silty CLAY Red-brown SAND with gravel	, wet.			
A U G E R E D T O S 2.0 0.5 REF. 100/6	42.21	40.0			Similar; grades to clayey sgravel, wet. Red-brown clayey SILT with laminated greenish-gray sbottom. Boring completed @ 42.7'. Boring grouted with bentonito ground surface.	SAND with gravel, ilt at			
S = SPLIT SPOON; ST = SHELB		10 Was	L :ta	ــاــ 1 p q			HOLE	No. A-19	

GPD - 13234 - A Rev. 2/82 (Form 10070 - 2)



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BEG			ste Pi		DRILL	==		S 1	1+05	E 0					, -	╝.	90		
	1/83	- 1	9/21/83	j	ļ		Dimens	ions				ile B-34	: L	HOLE SIZE		.0	T.) ROC	:K (FT.)	TOTAL DEPTH (FT.) 22.0
COR	E PEC	OVE	9V (FT./%)	,				EL TOP	OF CAS	ING	G R	OUND EL. (FT.)			DWATER		DEPTI		F ROCK (FT.)
SAM			ER WEIGH	IT/F	.1	 c/	SING LE	FT IN HOLE	: DIA./	ENGT		323.8		ot Determ	nined			N/A	
	140	#/30)"					None			_		L	. T. Chur	ıg			·-•	
TVPE	(iii)	1	BLOWS.	2		ETRA BLOW	TION		1. _	19.								NOT	ES ON:
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE (III.	NE RY	SAMPLE BLOWS "N" PERCENT CORE	COVE			**************************************	ELEVATION (FT.)	DEPTH-FT	UNIFIED SOIL	SAMPLE	DES	CRIPTIO	N AND CLAS	SIFICATIO	on		WAT	ER LEVELS, ER RETURN, RACTER OF
2 4 4 A	SEAD	HE ST	SAMPLE	2	1ST 6"	ZND 6	3RO 6"			CLASS	`								LING, ETC.
	<u> </u>	-	3	+			-	323.8	0	-	╁	A., = = = = 4 +	- 10 (N					
]		Augered t No sampl	ing.) throug	in clay	Dack.	.וווי	Drillin hollow-	g with stem auger
									-	†									
										1									
									5.0	1									
	ļ									1									
									-	-									
									-	1									
							İ		10.0			_							
		L.						312.3	:	1	Н	Encounter depth of	ed ori	ginal ma	terial	at a			3.
SS	2.0	2.0	27		8	16	12	312.3		SM	7	Brown-gra	y silt	y SAND,	with in	iterbe	edded	1	
	0.0	1.6		+			11/				Н	silty ČLA	r, tra	ce or gr	avel.				
SS	2.0	1.6	22		9	12	19/13		15.0		2								
ss	2.0	2.0	44	2	20	28	14				٦							ļ	
			ļ	4			16	305.8	-		Ĭ								
SS	2.0	2.0	14		3	6	8/10			CL	4	Gray silt medium to	y CLAY high	, trace plastici	of grav tv.	el,			
SS	2.0	2.0	14	\dagger	3	7	8		20.0-		Н		,		-3				
							7				5	<u> </u>							
					1] =			Boring co	nplete	d @ 22.0	·				
									-			Boring ground sur	rface.	with ben	tonite	cemen	it to		
		ł							25.0										
]										
					j				=										
] =										
					,														
]										
		LIT =	POON; 81			Y Tue	r: SI	TE	L		Ţ							HOLE NO.	
			PH; P = P				•		10 Was	te P	í l	e						A-2	20



		В	ORII	NG	L	OG		PROJE		ΔD	- NFSS		JOB NO.		SHERT NO.	HOLE NO.
ITE							COORDIN						1450		E FROM HORIZ,	A-21
EG			Waste Pil		ER		5 10)+85 	E C		KE AND MODEL	HOLE SIZE	OVERBURDE	N (FT.)	90°	TOTAL DEPTH
•	1/82		9/21/82 ** (** 1./%)			imensi				_	ile B-34	6	21.0			21.0
	-					6					_	ot Deter		'	N/A	PF WOCK (FT.)
	140#		R WEIGHT/	FALL	CA	SING LE	None	DIA./L	ENGT		LOGGED BY	L. T. Ch	una			
	<u> </u>	وَ إ	# H			TION		T	z	T						
AMET	SAMPLER ADVANCE (In.) LENGTH CORERUN (Ft.)	ERY (In	SAMPLE BLOWS "N" PERCENT CONS		BLOW	·5	ELEVATION	DEPTH.FT	UNIFIED SOIL	SAMPLE	DESCRIPTIO	N AND CLAS	SIFICATION		NOT WAT WAT	ES ON: ER LEVELS, ER RETURN,
SAMPLER TYPE AND DIAMETER	SAM ABOV CENG COREF	RECOV	SAMPLE 'N' PERCENT	1ST 6"	3ND 6	380 6" 4TH	(FT.)	OEP	LASSIF	448					CHA DRII	RACTER OF LLING, ETC.
	1	'8				[5	315.0	0	1 "	H	Au	1 41 1	1 ,			
									1		Augered to 9.0 No sampling.	through	i clay bac	kt i i		ng with -stem augen
								-	1							
		}						.	-							
								5.8								
									1							
							306.0] :								
SS	2.0	1.9	9	2	4	7 5	300.0	10.0	CL	1	Pinkish-gray s	ilty CLA	, trace o	f		
SS	2.0	1 7	6	1	2	7				Н	gravel, plasti	с.				
	2.0	,	Ů			4				2						
ss	2.0	1.3	8	2	3	7 5		:		3						
ss	2.0	1 9	52	7	12	31		15.0		Н						
_			"-	, 		40		=		4	16.5'-17.5': 1	Red-browr	silty fi	ne S	AND.	
SS	2.0	1.7	14 ′	7	7	7 10				5						
SS	2.0	1.5	7	2	3	6		20.0		H						
\dashv						4	294.0 -	20.6		6						
	İ							-			Boring complete Boring grouted	with ber		ment		
]			mix to the sur	face.				
İ								25.0								
								=								
								-								
								-								
								-								
								=								
								-								
81	- 22		POON; ST =) Wast						-	HOLE NO.	

APPENDIX 1-B

Field Density Tests



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		B	ORII	NG	L	OG		PROJE		P.	- NFSS			1450		EET NO.	A-22
SITE			te Pile				COORDIN		F 1.	70						OM HORIZ.	BEARING
BEG			DMPLETED	DRIL	LER		S 7-		E 1+		KE AND MODE		HOLE SIZE (INCHES)	OVERBURDEN		0° к (Fт.)	TOTAL DEPTH
	1/82		/21/82			imensi					1e B-34		6	17.5			17.5
COR	E REC -		Y (FT./%)	COR	*E BOX	4	ES EL TOP	OF CAS	ING	G R	316.3		Determin		DEPT	N/A	F ROCK (FT.)
1			R WEIGHT/	FALL	c	L	FT IN HOLE	: DIA./	ENGT	H	LOGGED						
	140#	/30" T	1				None	_		_		L	. T. Chun	g			
TYPE	(= (= (= (= (= (= (= (= (= (= (= (= (= (SAMPLE SAMPLE CORE RECOVERY (In.)	8 90 Y	PEN	BLOW			·F	15 NO	L						NOT	ES ON:
SAMPLER AND DIAME	SAMPLER ADVANCE (III. LENGTH CORE BUN (Ft.)	WERY COVE	PERCENT CORP				ELEVATION (FT.)	DEPTH-FT	UNIFIED SOIL	BAMPLE	DESC	RIPTIO	N AND CLASS	SIFICATION		WAT WAT	ER LEVELS, ER RETURN, RACTER OF
S A M	SAD	RECO	SAMA	1ST 6"	2ND 6"	3RD 6"		1	UNIF	3						D#16	LING, ETC.
	H	1 8	-	ļ	-	= \	316.3	0	<u> </u>	╀						-	
						ļ			-		Augered to No sampli	9.5 1g.	' through	brown cla	у.	Drillir hollow-	ng with stem augers
								.	1								
		1				ļ]								
							ĺ	5.0-	}							}	
									1								
]								
Ì								1 -	3								
		ļ			ļ.,		306.8] :	<u> </u>	Ц				·			
SS	2.0	1.2	6	1	3	3		10.0	CL	١,	Pinkish-gr gravel; sa	ay s	ilty CLAY	, trace of		}	
<u> </u>		_			ļ	1,7		:	1	L	graver; sa	ina ie	ens, pias	tic.			
SS	2.0	1.2	8	1	2	6 4]	2							
SS	2.0	1 7	1		1/12				-	Н							
33	2.0	'''	'		1712	1/		15.0	1	3							
SS	2.0	2.0	4	1	1	3]								
					ļ	3	298.8] :	<u> </u>	4					-		
								:	1		Boring con	plete	ed @ 17.5	'. 			
								20.0]		Boring gro top of gra	y cla	with ben ay.	conite cem	ent to		
								20.6									
						l] =	1	$\ \ $							
								-	1								
								-		П							
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			OON; ST			~'	TE			L						HOLE NO.	
	- 02		N; P - PIT	CHER:	J = 01		R-10	Wast	e Pil	e						A-2	2

20.11. -	I.VII	JU] Hisai		WAY.	CHARD PA	: ■wool	PRICT OFFICE: S-3858					
Proje	ct:	Niaga	ra Fal	ls Sto	rage Si	te		_ Report No	DT-1			
Clien	t	Becht	el Nat	ional,	Inc.			_ Date:	6/8/82			
Conti	ractor:	Scrut	fari Co	nstruc	ton			Job No	BT-32-67			
Test Ko.	Date of Test	Depth of Elevation	in-place Density (pci)	in-pizce Moisture (%)	% Compaction	Proctor Code		Location and Rema				
1	6/8	319.0	124.9	9.8	94.1	Α	S1324 x E770 I	70 Decon Pad.				
2	6/8	319.0	137.4	10.2	100+	А	Retest of #1 a E770 Decon Pag	after recompaction				
						ļ		<u> </u>				
				!								
						ļ <u></u>						
			,									
Proctor Code	Maxim Density		Optimum olsture (%)			<u></u>	Material Typ	oe and Source				
A	132.		9.5	Pad	Brown S		Clay	mrain				
	132.	<u>' </u>	<u> </u>	I Keu	DI UMIT 3	iity	Clay	JUN 17	3087			
		-		1				- Jun 1 1	1502			
	<u> </u>			J								
							Respectfully	y submitted,	. –			
Rema	rks:	<u> </u>			· · · · · · · ·		_ EMPIRE SC	DILS INVESTIGATION	NS, INC.			
	 -		12.20	2.00								
			12:30 - C. Keip				-	,	156 OB. 3			
Inspe	ctor:		. Keip	he!			- Chur	udeippe	mo			

FIELD 'N-PLACE DENSITY TEST F 'PORT



ORCHARD PARK & ROCHESTER & GROTON & ALRANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA.

Proje	ct:	Niagar	a Fall	s Stor	age Sit	e		Report No	DT-2	
Clien	t	Bechte	l Nati	onal,	Inc.			Date:		
Conti	ractor:	Scrufa	ri Con	struct	ion			Job No	BT-82-67	
Test Ko.	Date of Test	Depth of Elevation	In-place Density (pcl)	In-place Moisture (%)	% Compaction	Proctor Code	L	Location and Remarks		
1	6/10	320	139.7	2.3	100+	L2	E7+84 x S13+04	Decon Pad.		
	1	,								
			,						9	
Proctor Code	Maximu Density (p		ptimum isture (%)			<u></u>	Material Type	and Source		
L2	135.7		06.6	2" R.	0.C	 Niaga	ra Stone.	MEMIN		
								IIIN 171	G82	
									-	
							Respectfully s	ubmitted.		
Remar	ks:		-	·	·······		_ EMPIRE SOIL	S INVESTIGATION	IS, INC.	
			8·30 _	9 - 30			-			
			8:30 -				<u>.</u>	, .	156 OB.3	
Inspector: Chuck Keipper							Chucke	Keipper	49	

E	1	[.دِ	12	JE
) INV	STELL	ili ili	i) li

DRIGHARD PARK & ROCHESTER & GRIDTON & ALRANY & SYRACUSE & NEW YORK CITY

WASHINGTON D.S. # WOODBRIDGE N.J. # HARRISBURG PA

				UN	CHARD PA	HK, NE	W TORK I	• 12		CODE	710-045-0110			
Projec	et:	Niag	ara Fal	ls Sto	rage Si	te	·——·—			Rep	oort No.	DT-3		
											e:			
Contr	actor:	Scru	fari Co	nstruc	tion						No			
Test Ko.	Date of Test	Depth of Elevation		In-place Moisture (%)	% Compaction	Proctor Code			L	ocatio	n and Rema	arks		
1	6/15	320	123.6	3.1	64.1	L2	E7+39	x	S13+17	West	Approach	Slab	Decon	Area.
2	6/15	320	134.8	2.0	97.6	L2	E8+01	х	\$13+00	West	Approach	Slab	Decon	Area.
3	6/15	320	133.5	3.3	94.0	L2	E7+40	x	S13+16	West	Approach	Slab	Decon	Area.
			,						-					
												181		
			,											
			į											
Proctor Code	Kzxim Density		Optimum Koisture (%)				M	late	erial Type	and S	Source (C)	7115	ner	<u>. J</u>
L2	135.	.7	106.6	2" R	.0.C. S	tone	- Niaga			,				- 1
											אטע אַנּ	171	982	
											THE TOTAL		٠	,)
1		-					R	es	pectfully	submi	1: 1:	ا مشاء	<u>, L</u>	
Rema	rks:						E	MF	PIRE SOI	LS IN	/ESTIGATIO	ONS, II	۷C.	
							_						ا المراث ال	
Inspe	ction Ti	me:	8:00 -	12:30								15 G	a.12	3
Inspe	ctor: _		Chuck K	eipper		 -			لعط	c d	SIPPU Y FOR TESTING &	m	10	
		SURS	URFACE EXPL	DRATION .	SOIL AND CO	CRETE TI	ESTING . MEI	MBF	R = AMERICAL	N SOCIET	FOR TESTING &	MATERIAL	s۲	

FIE' O IN-PLACE DENSITY TEST PEPORT



ORCHARD PARK® ROCHESTER # GROTON® ALBANY® SYRACUSE® NEW YORK CITY WASHINGTON D.C. ® WOODBRIDGE N.J. ® HARRISBURG PA

Project:		Niaga	ra Fall	s Stor	age Sit	e	Report No
Clien	ıt	Becht	el Nati	onal,	Inc.		Date:6/22/82
Cont	ractor:	S	crufari	Const	ruction		Job No. <u>BT-82-67</u>
Test No.	Date of Test	Depth of Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	6/22	316	117.1	9.0	95.6	L-4	E670 x S1287 Grit Chamber
					·		
	ļ. 1	ļ					
				-			
							
					,		
Proctor Code	Maximu Density (i Iptimum Isture (%)			L	Material Type and Source
L-4	İ		13.2	Claye	y SILT,	litt	cle Sand, trace garve po site
							3.1982 !!!
101 0	1000	7/13					
) (2 150						Respectfully submitted,
Rema	rks:						EMPIRE SOILS INVESTIGATIONS, INC.
Inence	ction Tin		8:30 -	10:30)		15 q 3.21 C
			ck Keip				- Chuck Keipper
mopector.					DIL AND CONC	RETE TES	STING MEMBER MAMERICAN SOCIETY FOR TESTING & MATERIALS



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE IN J. & HARRISBURG PA

Proje	ct:	Niagar	a Falls	Store	age Site	<u> </u>		Report No. DT-5	<u>, </u>
Clien	t	Becht	el Nat	ional,	Inc.			Date: 7/26/82	
Contr	actor:	A	. Cero	ne	· · · · · · · · · · · · · · · · · · ·			Job NoBT-82-6	57
Test No.	Date of Test	Depth of Elevation	In-place Density (pcf)	In-place Moisture (%)	1	Proctor Code	L	ocation and Remarks	
1	7/16	317	110.4	14.9	88.0	L-9	S840 x E310	TEST FAIL	EĎ
							Recom	pact to	
							(98%)	pact to Modified Pr	octor
							,	_	
								N. H. Bu	1/11/82
							(90)	REOD BOS S'	7=0
								E RECOMPACTET	
							on AS	=12-13 15 som	PLETET
		,						RETEST WHEN E	-8/16/82
	···								
Proctor Code	Maximu Density (-	ptimum isture (%)				Material Type	and Source	
L-9	125.5	5	11.9		Silty Cl	ay -	On Site		
	-							MICT THE	
								Auc - San	:
							Respectfully s	$\mathbb{R}^{1/2}$ AUG $ au \mapsto \mathbb{R}^3$	i.
Remari	ks:		 				EMPIRE SOIL	S INVESTIGATIONS, INC	Principle of
nsnec	tion Tim	ne. 12	:30 - :	3:30			-		
nspec			k Keip				- Charle	s C. Keipper	3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. . WOODBRIDGE, N.J. . HARRISBURG, PA

Proje	ct:	Niagar	a Falls	Stora	age Site	<u> </u>	·	Report No	DT-5
Clien	t	Becht	el Nati	ional,	Inc.	···.		Date:	7/26/82
Cont	ractor:	A	. Ceror	ne				Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	in-place Density (pci)	In-place Moisture (%)	% Compaction	Proctor Code	L	ocation and R	
1	7/16	317	110.4	14.9	88.0	L-90	S840 x E310		
							·		
							· · · · · · · · · · · · · · · · · · ·		
			<u></u>						
		,							
			-						
Proctor Code	Maximu Density (ptimum isture (%)				Material Type	and Source	
L-9	125.5	5	11.9	Ç	Silty Cl	lay -	On Site		manica (a)
								mrain	
								NIG -	3 1982
			11.12		- 		Respectfully si		
Remar	ks:					~·········	EMPIRE SOILS	Į.	TIONS, INC.
	_			*					
nspec	tion Tim		:30 - 3						5.5 C r 3.5.2
nspec	tor:		k Keipp		W AND 22:			s C. Keippe	
		SUBSURF	NUE EXPLOR	AHUN #50	IL AND CONC	ME IE TES	TING =MEMBER = AMERICAN S	OCIETY FOR TESTING	a & MATERIALS



■ ORCHARD PARK ■ ROCHESTER ■ GROTON ■ ALBANY ■ SYRACUSE ■ NEW YORK CITY WASHINGTON, D.C. ■ WOODBRIDGE, N.J. ■ HARRISBURG, PA

Proje	ct:	Niag	ara Fal	1s Sto	rage Si	te		Report No	DT-6
Client	t	Bech	tel Nat	ional,	Inc.			Date:	8/3/82
Contr	actor:	Cerr	one			. <u>-</u> .		Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code		ocation and Rema	
1	8/3	317	108.8	17.0	93.5	L6	EL. 317t East Dike Area,	S10+80 x E4+3	O (RETEST REQD)
							·		
	- · · <u>-</u> · · ·								
								····	
			_			· · · · · · · · · · · · · · · · · · ·			
							*SPEC. REQMT	14501-SC 12	Sect 35,4.6 95
								•	
		,							
									n and a second
Proctor Code	Maximu Density (;)ptimum isture (%)				Material Type a	nd Source	
L6	116.	4	16.9	Clay	ey Silt	, Lak			200
		_	_			-		PI HUO	4. 1/3
			-		· · · · · · · · · · · · · · · · · · ·		·	His His	
				•			Respectfully su	bmitted,	
Remar	ks:			· · · · · · · · · · · · · · · · · · ·			EMPIRE SOILS	INVESTIGATION	NS, INC.
nspec	tion Tim	ne. 8:	:00 - 4	:30	<u></u>		_		
nspec			huck Kê	ipper			- Chuck	hairan	
T Form C					IL AND CONC	RETE TES	TING - MEMBER - AMERICAN SO	CIETY FOR TESTING & MA	TERIALS 3.2.2

EMPIRE SOILS INVESTIGATIONS INC.

FIELD RELATIVE DENSITY TEST REPORT PRICHARD PARK & ROCHESTER & GROTON & ALBANY & SYR RE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, P.

Proi	act:	Niaga	ara Fal	ls Sto	rage Si	te	Report No. DT-7
•	nt:	Bechi	tel Nat	ional,	Inc.		Date: <u>8/4/82</u>
	ractor	: Scru	ufari				Job No. BT-82-67
Tos!	5	Depth or Elevation		In-Place Moisture (%)	Relative Density (%)	Proctor Code	Location and Remarks
1	8/4	320.45		7.9		L-2	TOPACOMO
2	8/4			20.2		L-6	17301 3C/3 SPECDY MOISIURE JEST
							Proctor L-6 - Optimum Moisture = 16.9%
-							
		·					
			,				
							1890
rector Code	Moximur Density (:	m Min.	Density PCF)				Material Type and Source
L-2	135.7	106	5.6	2" R	.0.C. S1	tone -	Niagara Stone
					·· ······		
R	EMARKS:						Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
I	NSPECTIO	ON TIME:	8:0	00 - 2	: 30		Chuck Keipper
I	NSPECTO		Chuck Ke		DIL AND CONCE	ETE TEST	\overline{N} • Member • American society for testing & materials $3.5.2$



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Projec	ct:	Nia	gara Fal	ls Sto	Report No. DT-8		
Client			htel Nat		Date:8/11/82		
Contr	actor:	Sic	011 & Ma	ssaro			Job NoBT-82-67
Test No.	Date of Test	Depth (in-place of Density	in-piace Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	8/11	328.7	75 82.1	15.7	76.0	L-11	Building 413 Northeast Quadrant. Test failed 90% required.
	·						
							,
		,					
Proctor Code	Maxim Density		Optimum Moisture (%)				Material Type and Source
L-11	108.	0	16.5	Clay	ey Silt	- La	ke Road.
	·				· <u>-</u> -		
		L		 			Respectfully submitted, AUS 2 3 1982
Remar	ks:	~			<u> </u>		EMPIRE SOILS INVESTIGATIONS, INC.
Inspec	tion Tir		3:00 - 4				- -
Inspector: Chuck Keipper						Chuck of sipper	
R/T Form (:	SUBS	URFACE EXPLO	RATION B S	DIL AND CON	CRETE TES	TING MEMBER MAMERICAN SOCIETY FOR TESTING A MATERIALS



Project: _

Niagara Falls Storage Site

ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY

WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Report No. DT-9

t	Bechte	1 Natio	onal,	Inc.		Date:8/12/82
ractor:	Sicoli	& Mas	saro			Job NoBT-82-67
Date of Test	Depth of Elevation	in-place Density (pcf)	in-place Moisture (%)		Proctor Code	Location and Remarks
8/12	328 <i>.</i> 75	94.5	15.1	87.5	L-11	Building #413, southwest quadrant, retest of test #1 on 8/11/82. Failed 90% required.
8/12	328 <i>J</i> 5	107.1	16.1	99.2	1	Building #413, northeast quadrant, retest of #1 this date, passed 90% required.
						Retests taken after recompaction of entire
						area.
			15.9			Moisture test taken on fill stockpiled for
·						building 414.
· · ·						
	,					
						Material Type and Source
						Material Type and Source
108.0)	16.5	Claye	y Silt	- Lak	e Road
	1					Respectfully submitted.
ks:				•		EMPIRE SOILS INVESTIGATIONS 211582
tion Tim	ne:1	:00 - 4	:30			
nspector: C. Keipper						Chuck of Ligou
	SUBSURFA	ACE EXPLOR	ATION # 50	IL AND CONC	RETE TES	TING EMEMBER EMERICAN SOCIETY FOR TESTING & MATERIALS 3. 2. 2
	Maximu Density (108.0	Date of Test Bepth of Elevation 8/12 328.75 8/12 328.75 Maximum Density (pcf) Moi 108.0	Date of Test Depth of Elevation Density (pcf)	Date of Test Depth of Elevation Density (pcf) Moisture (%)	Date of Depth of Test Elevation Depth of Depth of Depth of Depth of Depth of Depth of Place Moisture % Compaction	Date of Test Depth of Test



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niaga	ra Fall	s Stor	age Sit	e	Report NoT-10		
Clien	t	Becht	el Nati	onal,	Inc.		Date:8/13/82		
Conti	ractor:	Sico1	i & Mas	saro			Job NoBT-82-67		
Test No.	Date of Test	Depth of Elevation	in-piace Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks		
1	8/13	328.5	100.7	16.3	93.2	L-11			
2	8/13	328.25	103.6	16.9	95.9	L-11	Building 413, southwest quadrant, meets 90% requirement.		
							,		
							·		
Proctor Code	Maxim Density		Optimum oisture (%)				Material Type and Source		
L-11	108	.0	16.5	Clay	ey Silt	- Lal	ke Road.		
							Respectfully submitted		
Remar	′ks:	-				·	EMPIRE SOILS INVESTIGATIONS 19982		
Inspec	tion Tir	ne: 8:0	00 - 4:	30					
Inspec	Inspector: Chuck Ketpper						Chukaleipermas		
SUBSURFACE EXPLORATION #SOIL AND CONCRETE TEST							STING DIMEMBER DAMERICAN SOCIETY FOR TESTING & MATERIALS		



ORCHARD PARK # ROCHESTER # GROTON # ALBANY # SYRACUSE # NEW YORK CITY
WASHINGTON, D.C. # WOODBRIDGE, N.J. # HARRISBURG, PA

Proje	ct:	Niagar	a Fall	s Stor	Report No. <u>DT-11</u>		
Clien	t	Bechte	1 Nati	onal,	Inc.		Date:8/16/82
Conti	ractor:	Sico	11 & M	assaro	· · · · · · · · · · · · · · · · · · ·		Job NoBT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Density (pci)	in-place Moisture (%)	% Compaction	Practor Ceds	Location and Remarks
1	8/16	329.0	99.5	16.3	92.1	L-11	Building 414, northwest quadrant, meets 90% requirement.
2	8/16	329 <i>J</i> 5	101.0		93.5	L-11	requirement. Building 413, southeast quadrant, meets 90% requirement.
							,
Proctor Code	Maximu Density ()ptimum isture (%)				Material Type and Source
L-11	108.	0 1	6.5	Cla	yey Sil	t - L	ake Road.
							Respectfully submitted.
Remar	ks:						EMPIRE SOILS INVESTIGATIONS JUGG2
~							- 150 0.2 120Z
Inspection Time: 12:00 - 4:00							
Inspector: Chuck Ketpper							Chuck Keiger
SUBSURFACE EXPLORATION SOIL AND CONCRETE TEST						RETE TES	STING DEMEMBER DE AMERICAN SOCIETY FOR TESTING & MATERIALS 3. 2. 2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY
WASHINGTON, D.C. & WOODBRIDGE N. J. & HARRISBURG, PA

Proje	ct:		liagara F	alls S	torage	Site		Report No	o. <u>DT-12</u>
Client	l		Bechtel N	ationa	1, Inc.		•	Date:	8/17/82
Contr	actor:		Sicoli &	Massar	о		·	Job No	BT-82-67
Test No.	Date of Test	Bepth Elevat	,	In-place Moisture (%)	% Compaction	Proctor Code	Lo	ocation and R	emarks
1	8/17	329.	.5 98.1	17.0	90.8	L-11	Building #414, requirement.	northeast	quadrant, meets 90%
2	8/17	330.	.1 100.9	17.1	93.4	L-11	Ruilding #413	southwest	quadrant , meets 90%
			,						
								7	
							,		
		\vdash	,						
Proctor	Maxim		Optimum Moisture (9/1)			l	Material Type	and Source	
Code L-11	Density 108		Moisture (%)		2 voveľ		Lake Road.		
L-11	100	.0	10.5		layey 3	116 -	Lake Nodu.		
Remai	rks:						Respectfully s	S INVESTIGA	
Inspection Time: 8:00 - 3:30							_		3
Inspector: Chuck Keipper								هنه	NG & MATERIALS
R/T Form (c.	SUB	SURFACE EXPL	DRATION # 5	OIL AND CON	CRETE TE	STING - MEMBER - AMERICAN S	SUCIETY FOR TESTIN	S. 2 2



. R.T Form C

ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C . WOODBRIDGE N.J . HARRISBURG PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proje	ct:	Niagar	a Fall	s Stor	age Sit	е	Report No. DT-13	
Clien	t	Bechte	1 Natio	onal,	Inc.		Date:8/21/82	
Conti	ractor:	Cerone	<u> </u>	56-	r		Job NoBT-82-67	
Test Na.	Date of Test	Depth of Elevation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Location and Remarks		
1	8/21	298.0	107.5	16.5	87.8	L-4	Sta. S12+60 x E4+40, East Dike R-10. Doe not meet 90% requirement.	
2	8/21	298.0	119.5	15.5	97.7	L-4	Retest of Test #1 after recompaction.	
3	8/21	299.0	112.2	16.0	91.6	L-4	Sta. S12+50 x E4+40.	
	,						*Tests 2 & 3 meet 90% requirement.	
						,		
				,		m F M F M M F M M M M M M M M M M M M M		
		,					SEP 2 1982	
					,			
Proctor Code	Maximi Density (ptimum isture (%)		<u></u>	<u> </u>	Material Type and Source	
L-4	122.		13.2	Claye	y Silt,	liti	tle Sand, trace gravel - on site.	
								
					·			
<u>_</u>				<u>L.</u>				
rele	d 9/	115	-				Respectfully submitted,	
Remar	ks:						EMPIRE SOILS INVESTIGATIONS, INC.	
				<u>-</u>				
Inspec	tion Tin	ne: <u>9:</u> 1						
Inspec	tor:	Uni	uck Kei	pper	_		Chukkinger	

3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE N.J. & HARRISBURG PA

loje	ct:	Miaga	14 1411	3 3 601	rage Sit	<u> </u>	Report No. DT-14				
Clien	t	Becht	el Nati	onal,	Inc.	Date: 8/23/82					
Conti	ractor:	Cer	rone		c-12		Job NoBT-82-67				
Test No.	Date of Yest	Depth of Elevation	in-piace Density (pcf)	in-place Moisture (%)	% Cempaction	Proctor Cede	Location and Remarks				
1.	8/23	306.0	109.6	16.0	89.5	L-4	Sta. S12+70 x E4+40, East R-10 Dike. Area recompacted & accepted by Bechtel.				
2	8/23	307.0	109.5	16.5	94.1	L-6	Sta. S13+10 x E4+40, East R-10 Dike. Meet: 90% requirement.				
			İ								
							MICOLOR				
							SEP 2 1982				
							SEP 2 1982				
Proctor Code	Maxim Density)plimum pisture (%)	 			Material Type and Source				
L4	122.	5 1	3.2	Clay	ey Silt	, lit	tle Sand, trace gravel - on site.				
L6	116.	4 1	6.9	Silt	y Clay,	trac	e gravel - Lake Road.				
	ed :	9/15-		<u> </u>			Respectfully submitted,				
Remai				-		EMPIRE SOILS INVESTIGATIONS, INC.					
nspec	ction Tir	me:8:	00 - 4	:30			- -				
			uck Ke								



ORCHARD PARK & ROCHESTER & GROTON® ALRANY & SYRACUSE® NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE IN J. & HARRISBURG. PA

Proje	ct:	Niag	ara Fa	lls Sto	orage S	ite		_ Report No.	DT-15	
Clien	t	Bech	_ Date:	8/24/82						
Contractor: Cerrone Sc-12								_ Job No	BT-82-67	
Test No.	Date of Test	Depth of Elevation	in-place Density {pcf}	in-piace Moisture (%)	% Cempaction	Proctor Code		Location and Remarks		
1	8/24	308.0	112.5	16.5	91.8	L-4	Sta. S13+00 x requirement.	E4+40, East R-1	O Dike. Meets	
							· · · · · · · · · · · · · · · · · · ·			
								TRITTA		
								NEP SEP	2 1982	
						-				
Proctor Code	Maximi Density (1	ptimum isture (%)			<u> </u>	Material Typ	e and Source		
L4								gravel - on si	te.	
·act	ad .	9/15-		<u> </u>	<u> </u>		Respectfully	submitted,		
Remar	ks:	, 					EMPIRE SO	ILS INVESTIGATIO	ONS, INC.	
Inspec	tion Tin	ne:	3⅓ hour	·s			-			
Inspec	tor:		huck K	eipper			_ Chix	× dion		



ORCHARD PARK B ROCHESTER & GROTON & ALBANY & BYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ect:	Nia	gara Fall	s Stor	age Sit	ce	Report No. DT-16
Clien	t	Вес	htel Nati	onal,	Inc.		. Date:8/26/82
Cont	ractor:	Ce	rrone	sc-	12		Job NoBT-82-67
Test No.	Date of Test	Depti Eleva		in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	8/26	310.	0 108.9	18.0	93.6	L6	Sta. S13+10 x E4+40. Meets 90% requirement.
2	8/26	315.	0 106.3	18.6	91.3	L6	Sta. S13+25 x E405, meets 90% requirement.
					-		
							nfarmen.
							SEP 2 1982
Proctor Code	Maxim Density		Optimum Moisture (%)				Material Type and Source
L6	116	.4	16.9	Sil	ty Clay,	, tra	ce gravel
			<u>.</u>				
		1	9/15 ⁻ 12	<u>. </u>			Respectfully submitted,
Romai	icell eks	وم -SC	12				EMPIRE SOILS INVESTIGATIONS, INC.
nemai	N3						EINFINE GOILS INVESTIGATIONS, INC.
Incocc	tion Tir	no:	11:30 -	- 3:30			_
•		iie	Chuck I		r		- Churk Obioox
R/T Form (ctor:	SUB				RETE TE	ESTING B MEMBER B AMERICAN SOCIETY FOR TESTING & MATERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niag	ara Fall	s Store	age Site	<u></u>	Report NoDT-17
Clien	it	Bech	tel Nati	onal,	Inc.		Date:8/27/82
Cont	ractor:		errone		C-12		Job No. <u>BT-82-67</u>
Test No.	Date of Test	Depti Eleva		in-place Moixture (%)		Proctor Code	Location and Remarks
1	8/27	300.	0 105.1	18.0	90.3	L - 6	S12+00 x E4+30.
2	8/27	306.	0 107.1	17.6	92.0	L-6	S12+50 x E4+35.
3	8/27	<u> </u>	_	14.2	-	L-4	On Site Stockpile.
4	8/27	302.	0 118.4	14.5	96.7	L-4	S11+75 x E4+30.
							*Tests meet 90% requirement.
					`		MIRE TOURS
-		<u> </u>				ļ	
			-		ļ		SEP 7.1982
Proctor Code	Maxim Density	T I	Optimum Moisture (%)		<u> </u>	<u>.</u>	Material Type and Source
L6	116		16.9	Sil	ty Clay,	, tra	ce gravel
L4	122	.5	13.2	Cla	yey Sili	t, li	ttle Sand, trace gravel.
							Door ook ally out without
			9/15-				Respectfully submitted,
Remai	rks:						EMPIRE SOILS INVESTIGATIONS, INC.
Inspec	ction Ti	me:	9:00 -	3:00		.,	_
Inspec			Chuck k	Keipper			Chuck driego
R/T Form (SUB	SURFACE EXPL	DRATION . S	OIL AND CON	CRETE TE	STING MEMBER MAMERICAN SOCIETY FOR TESTING & MATERIALS 3. 2. 2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE. N.J. & MARRISBURG, PA

Proje	ct:	Niagar	a Falls	Stor	age Site	2	Report No	DT-18
Clien	t	Bechte	<u>l Natio</u>	onal.	Inc.	<u></u>	Date:	8/28/82
Contr	actor:	Cerron	e				Job No	BT-82-67
Tesi No.	Date of Test	Depth of Elevation	In-piace Density (pcf)	in-place Meisture (%)	% Compaction	Prector Cede	Location and Remar	ks
1	8/28	297.0	112.3	12.5	91.7	L-4	S11+50 x E4+30.	
2	8/28	316.0 ⁻	110.3	13.5	90.0	L-4	S13+12 x E4+25.	
3	8/28	310.0	114.5	16.9	93.5	L-4	S12+85 x E4+40.	
							*Tests meet 90% requirement.	
				•				
							SEP 1 4 1982	
Proctor	Maxim	um C	ptimum					
Code	Density ((pcf) Mo	isture (%)				Material Type and Source	
L-4	122.	5 1	3.2	Clay	ey Silt	, lit	tle Sand, trace gravel - On Sit	e
			·				· · · · · · · · · · · · · · · · · · ·	
Remar	ks:	SC-12		1			Respectfully submitted, EMPIRE SOILS INVESTIGATION	IS, INC.
			9:00 -				- -	
SUBSURFACE EXPLORATION SOIL AND CONCRETE TESTING TFORM C MALLEL O. C. 9601							STING MEMBER MAMERICAN SOCIETY FOR TESTING & MA	TERIALS 8 2 2
/I Form C	mo	west	OR.	9/2	/		,	3. 2. 2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ct:	Niaga	ra Fall	ls Sto	rage Si	<u>te</u>	Report No. DT-19				
t	Becht	el Nat	ional,	Inc.						
ractor:	Cerr	one				Job NoBT-82-67				
Date of Text	Depth of Elevation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks				
8/30	316.0	108.9	17.5	88.9	L-4	S13+25 x E4+40.				
8/30	316.0	106.8	15.6	87.2	L-4	Retest of Test #1, this date.				
			•							
						*Tests failed to meet 90% requirement.				
						SEE REPORT DT-22 8/31/82 FOR				
						SEE REPORT DT-22 8/31/82 FOR PASSING RETEST WEH 9/17/82				
			•							
						SEP 1 4 1982				
	, _									
1						Material Type and Source				
122.		13.2	Clay	ey Silt	, lit	tle Sand, trace gravel.				
				·						
	·••		•	· · · · · · · · · · · · · · · · · · ·		Respectfully submitted,				
rke.	SC-12					_ EMPIRE SOILS INVESTIGATIONS, INC.				
		·				EMPINE SOILS INVESTIGATIONS, INC.				
tion Ti-	8	:00 - 3	:00		-	_				
					- Charles Laborate					
	SUBSUR	FACE EXPLOR	RATION ES	OIL AND CONC	RETE TE	STING OMEMBER OMERICAN SOCIETY FOR TESTING & MATERIALS 3. 2. 2				
	maximum Density 122.	Becht	Bechtel Nation	Bechtel National, ractor: Cerrone	Bechtel National, Inc.	Date of Depth of Elevation In-place Moisture % Proctor Code				



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE N.J. & HARRISBURG PA

Proje	ct:	Niagar	a Falls	Stor	age Site	e	Report No.	DT-20
Clien	t	Bechte	1 Natio	onal,	Inc.		Date:	8/30/82
Conti	ractor:	Sico	1i & Ma	ssaro			Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	in-piace Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Cade	Location and Rema	arks
1	8/30	331.0	106.6	15.5	98.7	L-11	Building 413, S.E. Quad., Ret	est due to rain.
2	8/30	331.0	100.4	13.5	93.0	L-11	Building 414, Northwest Quad.	
3	8/30	331.5	109.0	14.0	100+	L-11	Building 413, Southwest Quad.	
							*Tests meet 90% requirement.	
			·					
					·		- REGERMEN	
_							SEP 1 4 1982	
		,					lim:	
		<u> </u>						
Proctor Code	Maximi Density (ptimum isture (%)				Material Type and Source	
L=11	108.0)	16.5	Clay	ey Silt	t - La	ake Road.	
			·····				· · · · · · · · · · · · · · · · · · ·	
							Respectfully submitted,	
Remar	ks:	SC-15					EMPIRE SOILS INVESTIGATIO	NS, INC.
Inspec	tion Tin	ne:8	:00 - 3	3:00			_	
Inspec	tor:	С	huck Ke	ipper			Chiroteisou	
/T Form C		SUBSURF	ACE EXPLOR	ATION S	OIL AND CONC	RETE TES	TING MEMBER MAMERICAN SOCIETY FOR TESTING & M	ATERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niagar	a Fall	s Stor	age Sit	е		_ Report No	DT-21
Clien	t	Bechte	l Nati	onal,	Inc.			_ Date:	8/31/82
Cont	ractor:	Bechte	1 Natio	onal,	Inc.		·	_ Job No	BT-82-67
Test Na.	Date of Test	Depth of Elevation	in-place Density (pcf)	in-piace Moisture (%)	% Composition	Proctor Cade		Location and Rema	rks
1	8/31	331.5	97.8	16.3	90.6	L-11	Building 414,	Northeast Quadra	int.
2	8/31	332.0	101.9	17.6	•	ı		Southwest Quadra	•
	`								
							·		
							MI	MFDDDD	•
						ļ	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	P 1 4 1982	
							للأناب		
					·				
Proctor Code	Maxim Density	1	Optimum pisture (%)				Material Typ	e and Source	
L-1	108.0) 1	6.5	Clay	yey Sili	t - Li	ake Road.		
									
L	<u> </u>			1	·	· · · · · · · · · · · · · · · · · · ·	Respectfully	submitted	
Remai	ks:	SC-15					, -	ILS INVESTIGATION	NS, INC.
Inspec	tion Tir	ne: _8:	00 - 4:	30			-		
•	ctor:	Ch	uck Kei	pper			_Chu	x oxigen,	
R/T Form (:	SUBSUR	FACE EXPLOR	RATION S	OIL AND CONG	CRETE TES	STING - MEMBER - AMERICA	N SOCIETY FOR TESTING & MA	TERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON® ALBANY & BYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niaga	ra Fal	ls Sto	rage Si	<u>te</u>	Report No	DT-22
Clien	t	Becht	el Nat	ional,	Inc.		Date:	8/31/82
Contr	ractor:	Cerr	one		·		Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Practor Ceds	Location and Remar	ks
1	8/31	317.0	113.7	15.5	92.8	L-4	S13+25 x E4+40, Retests of #1	& #2 on 8/30.
2	8/31	298.0	113.6	16.6	92.7	L-4	S11+50 x E4+30.	
3	8/31	302.0	110.6	16.0	90.3	L-4	S11+50 x E4+30.	
				-			THE THE REAL PROPERTY.	
							SEP 1 4 1982	
		,						
					-			
Proctor Code	Maximu Density (ptimum isture (%)				Material Type and Source	
L-4	122.5	1	3.2	Clay	yey_Sili	t, 1i	tle Sand, trace gravel - On Si	te.
		_						
<u></u>				L	· · · · · · · · · · · · · · · · · · ·		Respectfully submitted,	
Remar	ks:		SC-12	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	EMPIRE SOILS INVESTIGATION	S, INC.
	tion Tim	· ·	8:00 -	4:30				
Inspec			Chuck k	Keipper			Chark chains	
1115 PCC 8/T Form C		SUBSURF		ATION . SO		RETE TES	ING & MEMBER & AMERICAN SOCIETY FOR TESTING & MAT	ERIALS 3. 2. 2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	_Niaga	ra Fa]	s Sto	rage Sii	te	Report No	DT-23
Clien [.]	t	Becht	el Nat	ional.	Inc.		Date:	9/1/82
Contr	actor:	Sicol	i & Mas	ssaro			Job No	BT-82-67
Tost No.	Date of Test	Depth of Elevation	in-place Density (pcf)	in-place Meisture (%)		Prector Cade	Location and Rema	rks
1_	9/1	332.0	98.1	15.5	90.8	L-11	Building 414, Northwest Quadra	int.
							*Test meets 90% requirement.	
					•			
·								
				-				
							1.1 4 1982	
							SEP 1 4 1982	
Proctor Code	Maximu Density ()ptimum isture (%)				Material Type and Source	
L-11	108.0	0	16.5	Clay	ey Silt	- La	ke Road.	
							Respectfully submitted,	
Remar	ks:	SC-13	3				_ EMPIRE SOILS INVESTIGATION	NS, INC.
nspec	tion Tin		10:30 Chuck				-	
nspec	tor:						STING & MEMBER & AMERICAN SOCIETY FOR TESTING & MA	TERIAL
/T Form C	بر ر	nail	end o	12 1	/2/	, IE:	THE SHEMBER & PRICE PARTY SOUR IT FOR TESTING & MA	3. 2. 2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niaga	ra Fall	s Sto	rage Sit	te	Report No. <u>DT-24</u>	
Clien	t	Becht	el Nati	ional,	Inc.		Date: 9/1/82	
Contr	actor:	Cerro	ne				Job NoBT-82-67	,
Test No.	Date of Text	Depth of Elevation	In-piace Density (pcl)	in-place Moisture (%)	% Compaction	Practer Cade	Location and Remarks	
1	9/1	305.0	116.8	16.3	95.3	L-4	S11+55 x E4+30.	
2	9/1	310.0	110.7	17.0	90.3	L-4	S12+25 x E4+40.	
3	9/1	306.0	111.7	16.5	91.2	L-4	S11+20 x E4+35.	
							*Tests meet 90% requirement.	
							THE THEFT	
				-	· ,		SEP = 2 4 1982	-, -
		,						
					•			
Proctor Code	Maximu Density (ptimum isture (%)				Material Type and Source	
L-4	122.5	5	13.2	Claye	ey Silt,	lit	tle Sand, trace gravel - On Site.	······································
	·		<u></u>					
Remar	ke:	SC-	12	L			Respectfully submitted,	
nemar 	ns						EMPIRE SOILS INVESTIGATIONS, INC.	
nspec	tion Tin	ne: <u>10</u>	:30 - 4	:30			_	
nspec	tor:	Ch	uck Kei	pper			Check deipou	
∕T Form C	1	SUBSURF	ACE EXPLOR	ATION = SO	NL AND CONC	RETE TES	STING MMEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS 3.	2.2



DRCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WABHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niagar	a Falls	Stor	age Site	2	Report No. DT-25
Clien	t	Bechte	1 Natio	onal,	Inc.		. Date:9/2/82
Conti	ractor:	Cerron	e				Job NoBT-82-67
Test No.	Date of Test	Bepth of Elevation	In-place Bensity (pcf)	in-place Moixture (%)	% Compaction	Procter Code	Location and Remarks
1	9/2	307.0	108.1	20.2	88.2	L-4	S11+35 x E4+35 2' of material removed & re- worked. Test failed 90% requirement.
2	9/2	305.5	110.3	19.0	90.0	L-4	S11+30 x E4+35, Test passed 90% requirement.
3	9/2	-	-	17.7	•	L-4	Moisture test in Ares of S11+40 after re- working material.
4	9/2	-	•	20.2	•	L-4	Moisture test from west side excavation.
5	9/2	306.0	112.4	16.7	91.8	L-4	S11+20 x E4+30, Sample taken from Atterberg. Test passed 90% requirement.
							SFP 1 1 1982
							1502
					,		
Proctor Code	Maximi Density (ptimum isture (%)			- 	Material Type and Source
L-4	122.	.5 1	3.2	Claye	y Silt,	lit	tle Sand, trace gravel - On Site.
		· •	-				Respectfully submitted,
Remar	ks:						_ EMPIRE SOILS INVESTIGATIONS, INC.
							_
nspec	tion Tin	ne:	8:30 -	4:30			_
nspec			Chuck k	Ceipper	•		- Check Kringer:
/T Form C		SUBSURF	ACE EXPLOR	ATION SC	IL AND CONC	RETE TES	STING MEMBER MAMERICAN SOCIETY FOR TESTING & MATERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Date: 9/3/82 Date: 9/3/82 Date: 9/3/82
Test Bate of Test Elevation
Test Bate of Test Elevation Density (pcf) (%) Compaction Proctor Code 1 9/3 310.0 112.7 16.6 92.0 L-4 S11+90 x E4+40 Test meets 90% requirement. 2 9/3 302.0 108.5 16.8 88.6 L-4 S10+35 x E4+35 Test failed. 3 9/3 302.0 111.1 17.3 90.7 L-4 Retest of test #2 test meets 90% requirement. 4 9/3 310.0 113.3 16.9 92.5 L-4 S11+60 x E4+30 Test meets 90% requirement. 5 9/3 305.0 117.8 16.5 96.2 L-4 S10+55 x E4+35 Test meets 90% requirement.
2 9/3 302.0 108.5 16.8 88.6 L-4 S10+35 x E4+35, Test failed. 3 9/3 302.0 111.1 17.3 90.7 L-4 Retest of test #2, test meets 90% requirement. 4 9/3 310.0 113.3 16.9 92.5 L-4 S11+60 x E4+30, Test meets 90% requirement. 5 9/3 305.0 117.8 16.5 96.2 L-4 S10+55 x E4+35, Test meets 90% requirement.
3 9/3 302.0 111.1 17.3 90.7 L-4 Retest of test #2, test meets 90% requirement. 4 9/3 310.0 113.3 16.9 92.5 L-4 S11+60 x E4+30, Test meets 90% requirement. 5 9/3 305.0 117.8 16.5 96.2 L-4 S10+55 x E4+35, Test meets 90% requirement.
4 9/3 310.0 113.3 16.9 92.5 L-4 S11+60 x E4+30, Test meets 90% requirement. 5 9/3 305.0 117.8 16.5 96.2 L-4 S10+55 x E4+35, Test meets 90% requirement.
5 9/3 305.0 117.8 16.5 96.2 L-4 S10+55 x E4+35, Test meets 90% requirement.
SED 4 MARCH TO THE SED 4 MARCH T
SED :
1 4 1982
Proctor Maximum Optimum Material Type and Source Code Density (pcf) Moisture (%)
L-4 122.5 13.2 Clayey Silt, little Sand, trace gravel - On Site.
Respectfully submitted,
Remarks: EMPIRE SOILS INVESTIGATIONS, INC.
Inspection Time: 8:00 - 4:30
Chuck Kainnan
SUBSURFACE EXPLORATION & SOIL AND CONCRETE TESTING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS 3.2.



ORCHARD PARK PROCHESTER & GROTON PALBANY # SYRACUSE # NEW YORK CITY WASHINGTON, D.C. # WOODBRIDGE N.J. # HARRISBURG PA

Projec	ct:	Niagara	Falls	Stora	ge Site		Report No.	DT-27
- Client		Bechtel	Natio	nal, I	nc.			9/4/82
	actor:	Cerr	one				Job No	BT-82-67
Test No.	Date of Test	Septh of Elevation	in-place Density (pcf)	in-place Moisture (%)	% Cempaction	Prector Code	Location and Rem	arks
1	9/4	30.7	116.7	16.5	95.3	L-4	S10+30 x E4+32.	<u> </u>
2	9/4	310.0	114.0	16.9	93.1	L-4	S11+55 x E4+50.	
3	9/4	307.0	112.6	17.0	91.9	1L+4	S9+90 x E4+35.	
4	9/4	305.0	117.8	15.5	96.2	L-4	S8+89 x E4+40.	
					•		*Tests meet 90% requirement.	<u> </u>
								Tron .
				·			SEP 1 4 1982	
							$M_{He} = M_{He}$	
	•	,						
					<u> </u>			
Proctor Code	Maximi Density ()ptimum isture (%)				Material Type and Source	
L-4	122	.5 1	3.2	Clay	ey Silt	, lit	tle Sand, trace gravel - On S	ite.
			_					
							Respectfully submitted,	
Remar	'ks:		SC-12				EMPIRE SOILS INVESTIGATION	ONS, INC.
Inspec	tion Tir	ne:	9:00 -	4:30			_	
inspec	tor:		huck K			··	Check obsision	
9/1 Form (SUBSURI	FACE EXPLOR	RATION S	OIL AND CONG	RETE TE	STING - MEMBER - AMERICAN SOCIETY FOR TESTING &	MATERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niagara	Falls	Stora	ge Site		Report No. <u>DT-28</u>	
Clien	t	Bechte1	Natio	nal, I	nc.		Date:9/7/82	
Contr	actor:	Cerro	ne				Job NoBT-82-67	
Test No.	Bate of Test	Depth of Elevation	in-piace Density (pcf)	in-place Moisture (%)	% Compaction	Prector Cede	Location and Remarks	
า	9/7	310.0	120.5	14.9	98.4	L-4	S11+80 x E4+40, Test meets 90% requirement.	
2	9/7	306.0	111.7	15.6	91.2	L-4	S9+28 x E4+40, Test meets 90% requirement.	
3	9/7	312.0	112.4	16.6	87.4	L-14	S12+40 x E4+32, test fails 90% requirement.	,
4	9/7	312.0	117.3	14.9	91.2	4-14	Retest of test #3 this date, meets 90% req'	t.
								
							SEP 1 4 1982	
					-			
Proctor Code	Maximu Density (ptimum Isture (%)		· · · · · · · · · · · · · · · · · · ·		Material Type and Source	
L-4	122.	5 13	3.2	Claye	y Silt,	litt	le Sand, trace gravel - On Site.	
L-14	128.	6 11	.0	Claye	y Silt,	some	Sand, trace gravel - On Site.	
							Respectfully submitted,	
Remar	ks:		SC-	12		<u> </u>	EMPIRE SOILS INVESTIGATIONS, INC.	
	tion Tim		8:0	0 - 4:	00		-	
•	tor:		Chu	ck Kei	pper		Church Maison	
.∕T Form C		SUBSURF	ACE EXPLOR	ATION SO	HL AND CONC	RETE TES	TING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS 3.2.2	



ORCHARD PARK® ROCHESTER® GROTON® ALBANY® SYRACUSE® NEW YORK CITY WASHINGTON, D.C. ® WOODBRIDGE, N.J. ® HARRISBURG, PA

						te		Report No.	DT-29
Clien	t	Bed	htel Nat	ional,	Inc.			Date:	9/8/82
Conti	ractor:	Cer	rone		····			Job No	
Test No.	Date of Test	Depth Eleval	in-place Sensity	in-place Moisture (%)	% Cempaction	Precter Cede	Lo	ocation and Rema	
1	9/8	316.	0 110.5	15.0	90.2	L-4	S12+69 x E4+35.	·	
2	9/8	303.	0 106.8	16.9	91.8	L-4	S13+70 x E1+40.	<u></u>	
3	9/8	306.	0 106.7	-18.0	91.7	L-6	S13+70 x E1+60.		
4	9/8	310.	0 110.6	17.4	90.3	L-4	S10+00 x E4+40.		
5	9/8	313.	0 107.0	18.0		Į.	S11+40 x E4+38.		
							*Tests meet 90%		
									r n
							[
								SEP 1 @ 1982	
			,				ن د د د		
	I				-				
Proctor Code	Maximu Density (Optimum Moisture (%)				Material Type a	and Source	
L-4	122.		13.2	Claye	ey Silt	, lit	tle Sand, trace g	ravel - On Si	te.
L-6	116.4	1	16.9	Silty	y Clay,	trac	e gravel - Lake R	oad.	
l	<u>.</u>	1		L					· · · · · · · · · · · · · · · · · · ·
_		SC-	.12				Respectfully su		
Remar	'ks:	30-	16				_ EMPIRE SOILS	INVESTIGATIO	NS, INC.
			8:00 -	4 + 20		 	-		
Inspec •	tion Tin	ne:			 _		-		•
Inspec	tor:		Chuck I				TING I MEMBER II AMERICAN SC		ATERIALS 3.2.2



ORCHARD PARK® ROCHESTER B GROTON® ALBANY® SYRACUSE B NEW YORK CITY WASHINGTON, D.C. B WOODBRIDGE. N.J. ® HARRISBURG. PA

Proje	ct:	Niaga	ra Fall:	s Stor	age Site	e	Report No. DT-30
							Date:9/9/82
Cont	ractor:	Cerro	ne		 		Job No. <u>BT-82-67</u>
Test No.	Date of Test	Depth of Elevation		In-place Maisture (%)	% Cempaction	Proctor Code	Location and Remarks
1	9/9	308.0	108.8	16.5	93.5	L-6	S12+70 x E0+50.
2	9/9	313.0	108.0	17.5	92.8	L-6	S10+80 x E4+35.
3	9/9	316.0	114.4	16.8	98.3	L-6	S12+30 x E4+30.
4	9/9	310.0	107.9	19.0	92.7	L-6	S13+70 x E1+90.
5	9/9	312.0	111.5	17.8	95.8	L-6	S10+28 x E4+45.
			<u> </u>				
							*Tests meet 90% requirement.
							Mrarimra
	·	,,	-				SEP 1 4 1982
Proctor Code	Maximu Density (p		Optimum pisture (%)				Material Type and Source
L-6	116.4		16.9	Silt	y Clay,	trac	e gravel - Lake Road.
							Respectfully submitted,
Remar	rks [.]	SC-	12				_ EMPIRE SOILS INVESTIGATIONS, INC.
						,	Emi inte ooito inveoridationo, ino.
Inspec	ction Tim	e: 8:0	00 - 4:	30			- ·
Inspec			ıck Kei	pper			Churk Asions
R/T Form C		SUBSUR	FACE EXPLOR	IATION • SO	OIL AND CONC	RETE TES	TING MEMBER MAMERICAN SOCIETY FOR TESTING & MATERIALS 3.2.

FIF' D IN-PLACE DENSITY TEST PEPORT



ORCHARD PARK @ ROCHESTER @ GROTON @ ALBANY @ SYRACUSE @ NEW YORK CITY WASHINGTON D.C. @ WOODBRIDGE, N.J. @ HARRISBURG, PA

Test No.	Date of	Depth of	in-place Density (pcf)	in-piace Moisture (%)	% Compaction	Proctor Code	Job No. BT-82-67 Location and Remarks
1	9-10		114.3			 	S 12 + 60 x E 0 + 35
2	9-10	317.0	116.7	15.5			S 12 + 65 x E 4 + 40
3	9-10	313.0	112.4	16.6	96.6	L-6	S 10 + 50 x E 4 + 50
4	9-10	309.0	111.4	17.2	95.7	L-6	S 13 + 30 x E 0 + 50
5	9-10	317.0	114.9	17.0	98.7	L-6	S 11 + 85 x E 4 + 40
							* Tests meet 90% requirement
	·						
Proctor Code	Maximus Density (p		ptimum sture (%)				Material Type and Source
L-6	116.4	1	16.9	Silt	y Clay,	trac	e gravel
						···	
. Ve al	9/3	2 2					Respectfully submitted,
Remark	•	SC-12					EMPIRE SOILS INVESTIGATIONS, INC.
·							-



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. # WOODBRIDGE N.J. # HARRISBURG, PA

Clien	t	Bechi	el Nat	ional,	Inc.		Date:9-11-82		
		Cerro					Job NoBT-82-67		
Test No.	Date of Test	Depth of Elevation	in-place Density (pcl)	In-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks		
1	9-11	311.0	111.5	19.7	86.7	*	S 9 + 74 x E 4 + 30 Test fails 90% require		
2	9-11	306.0	109.2	16.9	93.8	L-6	S 11 + 50 x E 0 + 32 Test meets 90% requir		
3	9-11	314.0	113.1	15.9	87.9	*	S 13 + 20 x E 1 + 50 Test fails 90% requir		
4	9-11	311.0	120.4	15.6	93.6	*	Retest of test #1 Test meets 90% requir		
5	9-11	314.0	115.1	16.9	89.5	*	Test accepted by Bech Retest of test #3 meets 90% requirement		
6	9-11	310.0	117.9	12.8	91.7	*	S 11 + 80 x E 0 + 30 Test meets 90% requi		
				•					
	· <u>-</u>								
					-				
	1								
Proctor	Maximu		otimum				Material Type and Source		
Code *	Density (p		sture (%)	C#1+			2015/11/		
							sand, some gravel on site		
L-6	116.	4 10	.9	SIIE	y Clay,	trac	e gravel - Lake Road		
nile	el 9,	127		, , , , , , , , , , , , , , , , , , , 			Respectfully submitted,		
Remar	ks: <u>SC</u>	-12					EMPIRE SOILS INVESTIGATIONS, INC.		
	· ·	Ω.	00 - 4	• 30			- -		
inspec	tion Tim	e:o: huck Ke		. 10			Check toppen ET		



ORCHARD PARK @ ROCHESTER # GROTON @ ALBANY @ SYRACUSE @ NEW YORK CITY WASHINGTON, D.C. WOODBRIDGE, N.J. WHARRISBURG, PA

Cont	ractor:	Cerro		in-place			Job NoBT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Density (pcf)	Location and Remarks			
1	9-13	312.0	112.3	16.9	96.5	L-6	S 9 + 45 x E 4 + 33 *
2	9-13	315.0	108.8	16.5	93.5	L-6	S 13 + 70 x E 2 + 20 *
3	9-13	318.0	111.8	16.8	96.0	L-6	S 12 + 15 x E 4 + 30 **
4	9-13	313.5	111.9	16.9	96.1	L-6	S 9 + 00 x E 4 + 38 *
			 		-		
				* Test meets 90% requirement			
				** Test meets 95% requirement			
		~					
		,					
Decetes							
Proctor Code	Maximus Bensity (p		otimum sture (%)				Material Type and Source
L-6	116.4	16	. 9	Silt	y clay,	tra	ce gravel - Lake Road
					- 		\ ceff
ail	الميت	9/5-	7				Respectfully submitted,
Remari	ks:	SC - 1	2			···	EMPIRE SOILS INVESTIGATIONS, INC.
							-



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct: Ni	aga	ra l	alls S	torage	Site		Report No. DT-34
Clien	it <u>Be</u>	cht	el N	lationa	1, Inc		·	Date:9-14-82
Cont	ractor:		Ceri	one				Job NoBT-82-67
Test No.	Date of Test		th of ation	in-place Density (pcl)	in-place Moisture (%)		Proctor Code	Location and Remarks
1	9-14	31	6.0	110.9	16.4	95.3	L-6	S 13 + 40 x E 1 + 10 *
2	9-14	31	2.0	108.8	17.5	93.5	L-6	S 9 + 13 x E 4 + 35 *
3	9-14	30	9.0	109.6	18.4	94.2	L-6	S 11 + 40 x E 0 + 30 *
4	9-14	31	1.0	117.7	13.4	91.5	*	S 8 + 75 x E 4 + 40 *
5	9-14	32	0.0	110.8	16.3	95.2	L-6	S 13 + 50 x E 1 + 79 *
								* Test meets 90% requirement
			,					
				· .				
Proctor Code	Maximu Density (p		•	otimum sture (%)				Material Type and Source
L-6	116	.4	16	.9	Silt	y Clay,	trac	e gravel - Lake Road
*	128	.6	11	.0	Silt	y Clay,	some	sand, some gravel On site
								Million & Bragan
	liel	9/:					<u>-</u>	Respectfully submitted,
Remar		C-12						 EMPIRE SOILS INVESTIGATIONS, INC.
i iomai,	<u></u>							
Inches	tion Tim		8:0	0 - 4:	30			-
	tion Tim			Keippe		Chuck Kerpper ET		
Inspect						IL AND CONC	RETE TES	TING MEMBER MAMERICAN SOCIETY FOR TESTING & MATERIALS 2.2.2



R/T Form C

ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. . WOODBRIDGE, N.J. . HARRISBURG, PA

Proje	ct:	Niagar	a Falls	Stora	ge Site	<u> </u>		Report No	DT-35
Clien	t	Bechte	l Natio	nal, 1	inc.			Date:	9/15/82
Contr	actor:	Cerro	ne		<u> </u>			Job No	BT-82-67
Test No.								cation and Rema	rks
1	9/15	312.0	114.1	16.5	98.0	L-6	S12+16 x E0+30*	•	
2	9/15	317.0	112.3	16.7	96.5	L-6	S10+00 x E4+45.	**	
3	9/15	321.0	110.7	17.0	95.1	L-6	S13+55 x E1+78.	**	
4	9/15	312.0	110.2	16.3	94.7	L-6	S8+60 x E4+35.*		
							*Meets 90% requ	irement.	
							**Meets 95% requ	irement.	
								SEP	5 0 1932
		,							الله الله الله
`									
Proctor Code	Maximu Density (ptimum isture (%)			<u> </u>	Material Type a	and Source	
L-6	116.		5.9	Silty	Clav.	trace	e gravel		
							Respectfully su	ubmitted,	
Remar	ks:	SC-12				1-2	_ EMPIRE SOILS	S INVESTIGATION	NS, INC.
Inspec	tion Tim	ne:{	3:00 -	4:30			- -		
Inspec			Chuck K	eipper	•		Chriek	Majoon	
R/T Form C						CRETE TE	STING MEMBER MAMERICAN S	OCIETY FOR TESTING & MA	ATERIALS 3. 2. 2



R/T Form C

ORCHARD PARK @ ROCHESTER BIGROTON @ ALBANY @ SYRACUSE @ NEW YORK CITY WASHINGTON D.C. @ WOODBRIDGE, N.J. BIHARRISBURG, PA

Proje	ct:	Niag	gara Fa	lls St	orage S	ite	Report No
Clien	t	Becl	ntel Na	tional	,-Inc.		Date:9/17/82
Conti	ractor:	Cer	rone			<u> </u>	Job NoBT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	9/17	319.0	116.9	15.2	93.1	L-10	S10+40 x E4+25, Fails 95% Requirement.
2	9/17	313.0	115.7	15.0	92.2	L-10	S11+50 x E0+25, Fails 95% Requirement.
3	9/17	318.0	112.8	15.4	96.9	L-6	S13+35 x E1+20, Meets 95% Requirement.
4	9/17	319.0	119.3	13.3	95.1	L-10	Retest of Test #1 this date. Meets 95% Req.
5	9/17	3 313.0	119.4	13.5	95.1	L-10	Retest of Test #2 this date. Meets 95% Req.
							mraspana.
							SEP 3 0 1982
		,					
	- 1						,
Proctor Code	Maximu Density (p	t -	optimum isture (%)			<u> </u>	Material Type and Source
L-10	125.		11.9	Silt	y Clay,	litt	le Sand, little Gravel
L-6	116.4	1 1	16.9	Silt	y Clay,	trace	e gravel
							
L				L			Respectfully submitted,
Remar	ks:	SC-12	?				EMPIRE SOILS INVESTIGATIONS, INC.
Inspec	tion Tim	e:	8:00 -	4:30			
Inspec			Chuck	Keippe	r		Churk Deinner.
		SUBSURF	ACE EXPLOR	ATION . SO	IL AND CONC	RETE TEST	TING MEMBER MAMERICAN SOCIETY FOR TESTING & MATERIALS 3.2.2



R/T Form C

ORCHARD PARK III ROCHESTER III GROTON III ALBANY III SYRACUSE III NEW YORK CITY WASHINGTON, D.C. WOODBRIDGE N.J. B. HARRISBURG, PA

Proje	ct:	liagara	Falls	Storag	ge Site			Report No	DT-36
Clien	tB	echte1	Nation	nal, In	nc.			Date:	9/16/82
Contr	ractor:	Cerr	one					Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Loc	cation and Rema	rks
1	9/16	313.0	108.0	15.8	92.8	L-6	S11+65 x E0+35*		
2	9/16	318.0	110.7	16.3	95.1	L-6	S9+30 x E4+35**		
3	9/16	319.0	112.2	16.9	96.4	L-6	S12+40 x E4+28**		
4	9/16	323.0	111.5	16.7	95.8	L-6	S13+70 x E1+70**		
5	9/16	301.0	111.4	17.0	97.9	L-6	S7+60 x E4+00*		
							*Meets 90% Requi	rement.	
						_	**Meets 95% Requi	rement.	
							nr'i	n	
			;		· · · · · · · · · · · · · · · · · · ·			SEP 3 0 1982	
		,					* :	•	
							. }		1312/
Proctor Code	Maximu Density (p	1	ptimum sture (%)				Material Type ar	nd Source	,
L-6	116.4	10	5.9	Silty	/ Clay,	trace	gravel		
						·			
			<u> </u>					·	
				•			Respectfully sub	emitted,	
Remar	ks:	SC-12					EMPIRE SOILS	INVESTIGATIO	NS, INC.
nspec	tion Tim	e:{	3:00 -	4:30			- -		
nspec	tor:		Chuck k	Keipper	<u>^</u>		Chuck 1	Kriper_	N 9
/T Form C		SUBSURFA	CE EXPLOR	ATION ■ SC	IL AND CONC	RETE TES	TING MEMBER SAMERICAN SOC	CIETY FOR TESTING & MA	TERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. EWOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Ni	agara Fal	ls St	Report No. <u>DT-38</u>		
	t	_	chtel Nat	ional	, Inc.		Date: 9/20/82
Contr	actor:	Ce	rrone				Job NoBT-82-67
Test No.	Date of Test	Depth Elevat		in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	9/20	315.	0 123.0	14.1	98.0	L-10	S12+60 x E0+25*
2	9/20	316.	0 117.5	13.4	95.9	L-4	S12+75 x E0+20*
					ļ		
		<u> </u>		-			*Meets 95% Requirement.
							
		!					SEP 3 0 1982
			,				
Proctor Code	Maximu Density (Optimum Moisture (%)				Material Type and Source
L-10	125.		11.9	Silt	, little	e Sano	i, little Gravel
L-4	122.	.5	13.2	Clay	ey Silt	, litt	le Sand, trace gravel
							Respectfully submitted,
Remar	ks:	SC-	12				EMPIRE SOILS INVESTIGATIONS, INC.
	<u> </u>		8:00 -	4.30			- -
·	tion Tim	1e:	Chuck k				
Inspec	tor:	SUBS				RETE TES	TING MEMBER MATERICAN SOCIETY FOR TESTING & MATERIALS 3.2.2



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. WOODBRIDGE N.J. WHARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proje	ct:	Niagar	a Fall:	s Stor	age Sit	e		Report No.	DT-39		
Clien	t	Bechte	l Nati	onal,	Inc.			Date:			
Cont	ractor:	Cerror	ie					Job No			
Test No.	Date of Test	Depth of Elevation	In-place Density (pcf)	in-place Moisture (%)		Proctor Code	L	ocation and Rema	arks		
1	9/21	319.0	114.8	14.0	93.7		S10+50 x E4+25	, Test fails 9	5% requirement.		
2	9/21	319.0	121.0	13.5	98.8		Retest of Test #1 this date*.				
3	9/21	305.0	120.9	13.5	98.7		S7+50 x E3+94**	*			
4	9/21	323.0	126.6	14.2	100+		S13+60 x E1+40	*			
5	9/21	317.0	116.9	14.0	95.4		S12+15 x E0+40	*			
6	9/21	321.0	122.1	13.7	99.7		S12+40 x E4+20*				
7	9/21	306.0	116.4	13.8	95.0		S7+50 x E4+00**				
							*Test meets 95%	% requirement.			
							**Test meets 90%	% requirement.			
							Proctor value u	used determine	d by Bechtel to)	
							be closest to t	the source loc	ation.		
					,						
Proctor Code	Maximu Density (ptimum isture (%)				Material Type	and Source			
L-4	122.5	5	13.2	Claye	ey Silt,	, lit	tle Sand, trace o	grave			
				·				SEP	3 0 1982		
							Respectfully su	ubmitted,	,		
Remar	ks:		SC-12		· · · · · · · · · · · · · · · · · · ·	.	_ EMPIRE SOILS	S INVESTIGATIO	NS, INC.		
Inspec	tion Tim	ne:	8:00 -	4:30			-				
Inspector: Chuck Keipper				Chuck	Lippu	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					
R/T Form C		SUBSURF	ACE EXPLOR	ATION -SO	IL AND CONC	RETE TES	TING # MEMBER # AMERICAN S	OCIETY FOR TESTING & M	ATERIALS 3. 2. 2		

R/T Form C



OPPOHABLE PARKIE ROCHET TERIE GROTONIE ALBANY E SYRACUSE EINEW YORK CITY.
WASHINGTOIL DICIEM/COURRIDGE IN J. B. HARRISBURG. PA

Proje	ect:	Niagai	ra Fall	Report NoT-41			
Clier	nt	Bechte	el Nati	onal,	Inc.		Date:9/30/82
Cont	ractor:	Cerro	ne				Job NoBT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Density (pcf)	in-piace Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	9/30	308.5	112.6	15.5	90.7	L19	S10+60 x E0+30*
2	9/30	304.0	97.4	14.5	78.4	L19	S8+60 x E0+30** herested 10/1/82 #1
3	9/30	316.0	115.4	12.0	92.9	L19	S11+30 x E0+35*
4	9/30	311.0	114.8	15.3	92.4	L19	S9+20 x E0+30*
				·			
							*Meets 90% requirement.
							**Does not meet 90% requirement.
							D D O LE UUULE LA
							OCT 1 4 1982
	1						
Proctor	Maximu	m ¦ fi	atimum				
Cade	Density (i	isture (%)				Material Type and Source
L19	124.	2 12	2.2	Silt	y Clay,	litt	tle Sand, trace gravel.
					·		
							
							Respectfully submitted,
Remarks: SC-			SC-12				EMPIRE SOILS INVESTIGATIONS, INC.
Insped	nspection Time:			- 4:30			- -
Insped	nspector: C. Ke			pper	· · · · · · · · · · · · · · · · · · ·		Chukakippu
t/T Form (c	SUBSURF	ACE EXPLOR	IATION -SO	IL AND CONC	AETE TES	STING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS 3.3.3

NOTE: THERE IS NO REPORT NO. DT-40



OMCHARD PAHK & ROCHESTER & GROTON & ALBANY & SYNAGUŚE & NEW YORK CITY WASHINGTON DIC & WOODBRIDGE IN J. & HARRISBURG IPA

Proje	ct:	Niagara	Falls	Stora	<u>ge Site</u>			Report No.	DT-42		
Clien	ti	Bechte]	Natio	nal. I	nc.	 .	•	Date:	10/1/82		
Cont	ractor:	Cerro	one			-		Job No	BT-82-67		
Test No.	Date of Test	Depth of Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Prector Code	Lo	cation and Rema	arks		
1	10/1	305.0	113.3	13.0	91.2	L19	S8+60 x E0+30*	RETEST OF	#2 9-30-82		
2	10/1	311.0	118.8	14.3	95.6	L19	S10+05 x E0+30*				
3	10/1	298.0	113.6	12.3	91.5	L19	S7+60 x E3+40*		;		
4 -	10/1	319.0	120.4	12.9	96.9	L19	S12+50 x E0+25**		•		
5	10/1	307.0	118.3	14.9	95.2	L19	S8+25 x E0+35*				
6	10/1	320.0	122.4	13.5	98.6	L19	S9+50 x E4+25**				
7	10/1	301.0	112.0	13.7	90.2	L19	S7+60 x E3+20*	MIP	ntillian.		
8	10/1	313.0	118.0	14.0	95.0	L 19	S10+30 x E3+30*	0(CT 1 4 1982		
9	10/1	310.0	118.5	13.1	95.4	L19	S7+65 x E1+00*	<u>}</u>			
							*Test meets 90%	requirement.			
		,					**Test meets 95%	requirement.			
Proctor Code	Maximu Density (,	ptimum isture (%)	: 			Material Type a	nd Source			
L19	124	.2	12.2	Silt	y Clay,	litt	le Sand, trace gr	avel.			
				·							
							Respectfully sui	bmitted.			
Remai	ks:	SC-1	12					INVESTIGATIO	DNS. INC.		
Inspec	tion Tim	ne:7	:00 - 4	:30			- -				
Insped	ctor:	Cł	nutk Ke	ipper			Chucka	Lippy			
1/T Form (:	SUBSURF	ACE EXPLOR	IATION #SC	RE AND CONC	RETE TES	TING - MEMBER - AMERICAN SO	CIETY FOR TESTING & M	Arterials 3. 2. 2		



OHUMAPD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON DIC & WOODBHIDGE IN J. & HARRISBURG PA

Proje	ct:	Niaga	ra Fal	ls Sto	Report NoDT-43		
Clien	t	Becht	el Nat	ional,	Inc.		
Conti	ractor;	Cerro	ne		 		Job No. BT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	10/2	311.0	112.3	13.3	90.4	L19	S7+70 x E3+70*
2	10/2	322.0	118.9	13.4	95.7	L19	S11+50 x E4+20**
3	10/2	313.0	116.5	12.5	93.8	L19.	S9+50 x E0+35*
4	10/2	316.0	117.9	14.5	94.9	L19	S7+80 x E4+20*
5	10/2	311.0	120.8	13.6	97.3	L19	S7+60 x E1+00*
6	10/2	308.0	113.8	14.2	91.6	L19	S7+60 x E3+00*
7	10/2	321.0	111.8	18.2	90.0	RETESTED 210/4/82 #1 S10+55 x E4+30 - Fails 95% requirement.	
				•			
							*Meets 90% requirement.
			·				**Meets 95% requirement.
							0 CT 1 4 1982
Proctor Code	Maximu Density (Optimum Disture (%)	i			Material Type and Source
L19	124.	.2 1	2.2	Silt	y Clay,	litt	le Sand, trace gravel
							Respectfully submitted,
Remar	·ks:	S	C-12	·			EMPIRE SOILS INVESTIGATIONS, INC.
inspec	tion Tin	ne:8	3:00 -	4:30			<u>.</u>
Inspec			. Keip	oer			modimu
•		SUBSUR	FACE EXPLO	RATION = SC	DIL AND CONC	RETE TES	STING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS



OFCHARD PARK BROCHESTER & GROTON BALRANY 8 SYRACUSE BINEW YORK CITY WASHINGTON ELL BWOODHRIDGE IN JI BIHARRISBURG PA

Proje	ct:	Niaga	ara Fal	ls Sto	rage Si	te	Report No
Clien	1	Bech	tel Nat	ional,	Inc.		Date:10/4/82
Conti	ractor:	Cerro	one				Job NoBT-82-67
Test No.	Date of Test	Depth of Elevation	in-piace Density (pcf)	in-piace Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	10/4	321.0	119.4	15.0	96.1	L19	S10+50 x E4+30** RETEST OF #7 10-2-82
2	10/4	313.0	119.2	14.3	96.0	L19	
3	10/4	313.0	121.5	13.7	97.8	L19.	S8+60 x E0+20**
4	10/4	311.0	117.2	14.7	94.4	L19	S7+60 x E1+50*
5	10/4	321.0	121.6	14.8	97.9	L19	S9+00 x E4+20**
6	10/4	314.0	116.7	13.8	94.0	L19	S7+60 x E3+65*
7	10/4	317.0	118.1	14.2	95.1	L19	S10 +90 x E0+30**
8	10/4	311.0	117.2	14.7	94.4	L19	S7+60 x E1+40*
							*Meets 90% requirement.
							**Meets 95% requirement. 0 CT 1 4 1982
	 ! i						
Proctor Code	Maximu Density ()ptimum pisture (%)	<u> </u>		<u> </u>	Material Type and Source
L19		<u> </u>	12.2	Silty	Clay,	littl	le Sand, trace gravel
<u> </u>	I			 	= 3		Respectfully submitted,
Remai	rks:	SC-	-12				_ EMPIRE SOILS INVESTIGATIONS, INC.
Inspec	tion Tin	ne:8:1	00-4:30)			
Inspector: Chuck Keipper							Church Misper
l T Form (=	SUBSUR	FACE EXPLO	RATION - SC	OIL AND CONC	RETE TE	STING MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS



OFFCHAPTS PARK BIRGS HESTER BIGROTON BIAL BANK BISTRACUSE BINEW YORK CITY WASHINGTON DIS BIWOODBRIDGE IN J. BIMARRISBURG PA

Proje	ect:	Niaga	ra Fall	s Stor		Report No.	DT-45		
Clier	ıt	Bechte	el Nati	onal,	Inc.	·	•	Date:	
Cont	ractor:	Cerro	ne					Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	in-place Density (pci)	In-place Moisture [%]	% Compaction	Proctor Code	Lo	cation and Rem	arks
1	10/5	325.0	118.2	14.7	95.2	L19	S13+60 x E1+65*		
2	10/5	322.0	118.1	13.8	95.1	L19	S13+00 x E0+40*		
3	10/5	321.0	119.5	14.0	96.0	L19	S11+80 x E0+40**		
4	10/5	306.0	121.9	14.1	98.0	L19	S7+60 x E2+60*		
5	10/5	320.0	113.7	14.6	91.5	L19	S13+25 x E4+20*		
6	10/5 308.0 120.8 14.9 97.3 L19						S7+60 x E2+30*		
7	7 10/5 322.0 119.9 14.8 96.5 L19 S						S9+50 x E4+15**		
8	10/5	323.0	119.2	139	96.0	L19	S11 +30 x E4+20*	* MPa	
9	10/5	311.0	114.5	13.6	92.2	L19	S7+70 x E3+00*		
10	10/5	312.0	118.1	14.2	95.1	L19	S7+60 x E1+80*	וטט וין	1 4 1982
			1				·		1: 1:1
		; ;	! !				*Meets 90% requi	rement.	
ļ 		<u>.</u>					**Meets 95% requi	rement.	
Proctor Code	Maximu Density ()ptimum sisture (%)	;			Material Type a	nd Source	
L19	124.2	72	2.2	Silt	y Clay,	some	Sand, trace grav	·el	
							Respectfully su	bmitted,	
Remai	rks:	SC-	-12		···········		EMPIRE SOILS		NS, INC.
Inspec	ction Tim	ne:7::	30-5:00)			_		
Inspec		Chi	uck Kei	• •			Once of		
R.T Form (SUBSUR	ACE EXPLOR	RATION -SC	OIL AND CONC	RETE TES	TING -MEMBER - AMERICAN SO	CIETY FOR TESTING & M	ATERIALS 3. J. 2



OHCMARD PAHK & RUT HESTER & GROTON & ALHANY & SYRACUSE & NEW YORK CITY WASHINGTON. D.C. & WOODPRIDGE IN J. & HARRISBURG PA

Proje	ect:	Niaga	ra Fall	s Stor	age Sit	e		Report No	DT-46			
Clien	it	Becht	el Nati	onal.	Inc.							
Cont	ractor:	Cerro	ne		 			Job No	BT-82-67			
Test No.	Date of Test	Depth of Elevation	in-place Density (pcl)	in-piace Moistura (%)	% Compaction	Proctor Code	Lo	cation and Rema	arks			
1	10/6	322.0	120.7	15.2	97.2	L19	S11+80 x E0+25**					
2	10/6	317.0	120.3	14.9	96.9	L19	S10+00 x E0+20**					
3	10/6	315.0	118.4	14.3	95.3	L19.	S8+20 x E0+15**	-	; 			
4	10/6	323.0	118.8	14.2	95.7	L19	S13+20 x E4+20*					
5	10/6	323.0	118.6	13.8	95.5	L19	S11+00 x E4+20**					
6	10/6	326.0	118.7	13.8	95.6	L19	S13+60 x E1+00**					
7	10/6	312.0	119.1	15.0	95.9	L19	S7+60 x E2+75*					
8	10/6	325.0	119.1	14.2	95.9	L19	S13+20 x E4+25**	ोटिल	APART T			
9	10/6	318.0	123.4	14.8	99.4	L19	S9+80 x E0+20**					
10	10/6	316.0	119.1	13.9	95.9	L19	S7+60 x E0+90**	000	1 4 1982			
11	10/6	316.0	114.8	13.6	92.4	L19	S7+60 x E2+30*					
							*Meets 90% requi	rement.				
							**Meets 95% requi	rement.				
Code	Maximu Density (Optimum pisture (%)	<u> </u>	·		Material Type a	nd Source				
L19	124.2	2 12	2.2	Silt	y Clay,	litt	le Sand, trace gr	avel				
								·				
			·									
							Respectfully sui	bmitted,				
Remai	'ks:		SC-12				- EMPIRE SOILS	INVESTIGATIO	NS, INC.			
Inspec	tion Tim	ne:	7:30-5:	00			_					
Inspec		. (Chuck K	eipper			Church	Kaipou				
R/T Form (:	SUBSURI	ACE EXPLOR	RATION . SC	IL AND CONC	RETE TES	TING # MEMBER # AMERICAN SO	CIETY FOR TESTING & M.	ATERIALS 3.2.2			



ORCHARD PARKIE ROCHESTERIE GEFFONIE ALBANY'E SYRACUSE EINEW YORK CITY WASHINGTON, D.C. & WOODHRIDGE IN J. B. HARRISBURG, PA

Proje	ct:	Niagara	Falls	Stora	ge Site	. <u> </u>		Report No.	DT-47
Clien	it	Bechte1	Natio	nal, I	nc.	- <u></u>	Date:	10/7/82	
Cont	ractor:	A. Ce	rrone					Job No.	BT-82-67
Test Ko.	Date of Test	Depth of Elevation	In-place Density (pct)	in-place Moisture [%]	% Compaction	Proctor Code	Lo	cation and Rema	irks
1	10/7	325.0	118.2	14.0	95.2	L19	S12+00 x E4+15**		
2	10/7	323.0	121.1	13.8	97.5	L19	S9+60 x E4+20**		
3	10/7	316.0	115.3	13.0	92.8	L19	S7+60 x E2+20*		,
4	10/7	317.0	119.6	15.6	96.3	L19	S7+60 x E2+70**		
				•					
							*Meets 90% compa	ction require	ment.
			İ				**Meets 95% compa		
	<u> </u>			•					
								Wille.	كاستانان لاخا
								nrt	1.4000
								13 4	1 4 1982
		l.						ULU	4111111
Proctor Code	Maximu Density (,	iptimum isture (%)	·			Material Type a	nd Source	
L19	124.2		12.2	į	/ Clay,	litt	le Sand, trace gra	avel	
				<u></u>			· · · · · · · · · · · · · · · · · · ·		.,
	.	 		<u>. </u>			D		
D	-1	SC-	12				Respectfully su		NO 1810
Remai	rks:			·· · · · · · · · · · · · · · · · · · ·			_ EMPIRE SOILS	INVESTIGATION	NS, INC.
		8:0	0 - 4:0	00	· · · · · · · · · · · · · · · · · · ·		_		
•	ction Tin	ie			D233 C =		- 	•	
Inspec	ctor:				Bill Sc		STING DEMBER DAMERICAN SO	CIETY FOR TESTING IN	iterials 3.2.2



ORCHARD PAPIL® ROCHESTER & GROTON® ALBANY & SYRACUSE® NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE IN J. & HARRISBURG PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proje	ct:	Niaga	ra Fal	ls Sto	rage Si	te		Report No.	DT-48
Clien	t	Bechi	tel Nat	ional,	Inc.			Date:	10/8/82
Conti	ractor:	Cerro	one			Job No	BT-82-67		
Test No.	Date of Test	Depth of Elevation	in-place Density (pcf)	in-place Moisture [%]	% Compaction	Lo	ocation and Rem	arks	
1	10/8	321	122.7	13.1	98.8	L19	S8+20 x E4+25,	* 95%	
2	10/8	316	113.4	15.1	91.3	L19	S8+20 x E0+45,	* 90%	
3	10/8	318	114.2	13.3	91.9	L19.	S7+70 x E1+80,	**95%	•
4	10/8	320	124.3	12.3	100.1	L19	S7+60 x E3+60,	* 95%	
5	10/8	319	118.8	12.2	95.6	L19	S7+65 x E1+90,	*95% RETE	st of#3
6	10/8	322	121.2	13.1	97.6	L19	S7+80 x E4+15,	* 95%	
				•			*Meets Requireme	ents.	
2				·			**Does Not Meet	Requirements	•
			,						
		,							
Proctor Code	Maximu Density (j	1	ptimum isture (%)				Material Type a	and Source	
L19	124.	2 12	2.2	Silty	Clay,	littl	e Sand, trace gra	avel, On Site	Material.
	-					,	Respectfully su	hmitted	
Remar	ks:	SC-12					•	S INVESTIGATIO	ONS INC
	-								
nsner	tion Tim	ne (3:00 -	4:30			-		2
nspec			Schmi tz			. **	· 2.45	و المسلمة	3.2.2
pcc		SUBSURF	ACE EXPLOR	ATION . SC	OIL AND CONC	RETE TES	TING # MEMBER # AMERICAN SO	OCIETY FOR TESTING &	MATERIALS 1

A T Form C



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE IN J. & HARRISBURG PA

Proje	ct:	Niaga	ra Fall	s Stor	age Sit	e	Report No. DT-49					
Clien	1	Becht	el Nati	onal,	Inc.							
Cont	ractor:	Cerro	ne				Job No. <u>BT-82-67</u>					
Test No.	Date of Test	Depth of Elevation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks					
1	10/9	321	124.1	10.3	99.9	L19	S7+60 x E3+20, *95%					
2	10/9	325	112.9	13.6	90.9	L19	S13+50 x E0+70, **95%					
3	10/9	325	118.4	12.5	95.1	L19	S12+70 x E0+35, *95%					
4 -	10/9	325	119.1	11.7	95.9	L19	S13+55 x E1+00 *95% RETEST OF #2					
5	10/9	323	118.6	13.9	95.5	L19	S10+80 x E0+40, *95%					
6	10/9	322	119.7	12.5	96.4	L19	S9+50 x E0+35 *95%					
7	10/9	322	117.9	14.1	95.0	L19	S10+85 x E4+30 *95%					
				-								
							*Meets Requirement					
							**Does Not Meet Requirement.					
					·							
Proctor Code	Maximu Density (Optimum Disture (%)		<u> </u>		Material Type and Source					
L19	124.		12.4	Silty	Clay,	littl	e Sand, trace gravel.					
<u> </u>	L			L	······································							
_		SC-12	,				Respectfully submitted,					
Remai	rks:		-				EMPIRE SOILS INVESTIGATIONS, INC.					
		8	:00- 4:	 30			_					
	tion Tin	ie					3.2.2					
Inspec			III Sch		OIL AND CON	RETE TES	STING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS					



ORCHARTI PARK B ROCHESTER B GROTON B ALRANY B SYRACUSE B NEW YORK CITY WASHINGTON D.C. B WOODBRIDGE IN J. B HARRISBURG PA

Proje	ect:	Niag	ara Fal	ls Sto	rage Si	te		Report No.	DT-52
Clier	ıt	Bech	tel Nat	ional,	Inc.		•	Date:	10/14/82
Cont	ractor:	Cerr	one	 				Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	In-place Bensity (pcl)	In-place Moisture [%]	% Compaction	Proctor Code	L	ocation and Rema	ırks
1	10/14	322	122.8	12.9	98.9	L19	S8+95 x E0+45,	*95%	
2	10/14	322	119.0	14.8	95.8	L19	S7+90 x E4+20,	* 95%	
3	10/14	324	118.6	14.3	95.5	L19	S10+00 x E0+45,	*95 %	į
4 -	10/14	322	111.2	14.9	89.5	L19	S7+60 x E2+20,	**95%	•
5	10/14	322	122.4	15.6	98.5	L19	S7+65 x E3+00,	*95%	
6	10/14	325	119.3	14.9	96.1	L19	S11+00 x E+45,	*95%	
7	10/14	322	116.0	16.0	93.4	L19	S7+60 x E2+15,	**95% RETESTED	on 10/15/82 TEST #1
							*Meets Required	Compaction.	
							**Does Not Meet	Required Comp	action.
Proctor Code	Maximu Density (t	Optimum Disture (%)				Material Type	and Source	
L19	124.	2 1:	2.2	Silty	Clay,	littl	e Sand, trace gr	ravel.	
									
							Respectfully s	ubmitted	
Rema	rks: Tes	t #7,	Retest	of #4.				S INVESTIGATION	NS. INC.
	Sc-	12						5 25 (16A(16)	,
Insper	ction Tin	ne:	B:30 -	5:00			_		·
Inspec			Schmit	z			- えい	Schit-	3.2.2
R/T Form (IL AND CONC	RETE TES	TING MEMBER WAMERICAN	SOCIETY FOR TESTING & MA	RTERIALS



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE IN J. & HARRISBURG PA

Proje	ct:	Niag	ara Fal	1s Sto	rage S	ite	· · · · · · · · · · · · · · · · · · ·	Report No.	DT-50
Clien	t							Date:	10/12/82
Cont	ractor:	_Cerr	one					Job No	BT-82-67
Test No.	Date of Test	Depth of Elevation	,	in-place Moisture (%)	% Compaction	Proctor Cods	Lo	ocation and Rem	arks
1	10/12	319.5	125.3	15.5	100.9	L19	S7+55 x E1+65,	*95%	
2	10/12	321	126.4	14.5	101.8	L19	S8+40 x E0+40,	*95%	
3	10/12	324	123.8	13.4	99.7	L19.	S12+40 x E0+36,	*95%	<i>:</i>
				-			*Meets Required	Compaction.	
				•					
-									
		,							
									
Proctor Code	Maximu Density (ī	Optimum oisture (%)	<u> </u>		•	Material Type a	and Source	
L19	124.		12.2	Silt	y Clay,	litt	le Sand, trace gr	ravel - On Si	te.
	<u> </u>								
							Respectfully su	ıbmitted,	
Remai	rks:	SC-1	2	····		 	EMPIRE SOILS	INVESTIGATIO	NS, INC.
· · · · · ·	· *: *					 , ,	-		
Inspec	ction Tin		00 - 5:				-		3. 2. 2
Inspec	ctor:		11 Schm		NI AND CON	PETE TEA	TING MEMBER & AMERICAN SO	CHAMPESTING & M	NATE HAI S
A/T Form (c	300306	H HOL EAFLU	HON = 50	AND CONC	ME 16 162	TING SMEMBER SCAN SC	JUIC IT FUR 1251ING & W	- Interiors



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRAGUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proje	ct:	Niaga	ara Fal	1s Sto	rage Si	te	Report No. DT-51
Clien	t	Becht	tel Nat	ional,	Inc.		Date:10/13/82
Conti	ractor:	Cerro	one				Job NoBT-82-68
Test No.	Date of Test	Depth of Elevation	in-place Density (pcl)	In-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	10/13	323	121.6	16.1	97.9	L19	S10+40 x E0+45, *95%
2	10/13	324	114.0	13.6	91.8	L19	S10+80 x E4+25, **95%
3	10/13	323	120.9	13.6	97.3	L19	S8+15 x E4+20, *95%
4 -	10/13	324	119.2	14.3	96.0	L19	S10+55 x E4+20, *95% RETEST of #2
5	10/13	325	118.2	13.1	95.1	L19	S11+60 x E0+40, *95%
6	10/13	322	113.3	16.9	91.3	L19	S7+60 x E2+75, **95%
7	10/13	322	119.6	14.6	96.3	L19	S7+55 x E2+35 *95% RETEST OF #6
							*Meets Required Compaction.
							**Does Not Meet Required Compaction.
Proctor Code	Maximu Density (1	ptimum isture (%)				Material Type and Source
L19	124.	2 12	2.2	Silty	Clay,	littl	e Sand, trace gravel - On Site.
							Respectfully submitted,
Remar	ks:	SC-12	2			···	EMPIRE SOILS INVESTIGATIONS, INC.
	:			· · · · ·			-
nspec	tion Tim	ne: 8:0	00 - 5:	00			- 3,2,2
nspec	tor:		ll Schm				Bu Schmidz
		SUBSURF	ACL EXPLOR	TATION # SC	HL AND CONC	HETE TES	STING # MEMBER # AMERICAN SOCIETY FOR TESTING & MATERIALS

R/T Form C



R/T Form C

ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON, D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	Niagai	<u>ra Fall</u>	s Stor	age Sit	<u>e</u>	Report No. DT-53
Clien	t	Bechte	el Nati	onal,	Inc.		Date:10/15/82
Cont	ractor:	Cerro	ne				Job NoBT-82-67
Test No.	Date of Test	In-place In-place Proctor		Code	Location and Remarks		
1	10/15	322	126.3	15.0	101.7	L19	S7+55 x E2+15 (retest) *95%. RETEST OF 10/14
2	10/15	324	120.6	14.5	97.1	L19	39740 X E4723, "93%.
3	10/15	324	122.0	15.7	98.3	L19	S9+50 x E0+45, *95%.
4	10/15	323	119.1	15.8	95.9	L19	S7+60 x E2+15, *95%.
5	10/15	324	113.4	15.7	91.3	L19	S7+75 x E4+10, **95%.
6	10/15	324	119.2	15.4	95.9	L19	S7+55 x E4+00, *95% (retest of TEST #5
							*Meets Required Compaction.
							**Does Not Meet Required Compaction.
		,					·
Proctor Code	Maximu Density (;		ptimum isture (%)		<u></u>		Material Type and Source
L19	124.		12.2	Silt	y Clay,	litt	le Sand, trace gravel
	·						
			y			·	
•	L			٠			Poppostfully submitted
Danas		SC-12	,				Respectfully submitted,
Remai	KS		<u> </u>				EMPIRE SOILS INVESTIGATIONS, INC.
<u></u>		q	30 - 5	:00			9 2 2
·	tion Tim	ie	ill Sch	-		·	3.2.2
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ORCHARD PARK & ROCHESTER III GROTON & ALBANY III SYRACUSE & NEW YORK CITY WASHINGTON, D.C. III WOODBRIDGE, N.J. & HARRISBURG, PA

Proje	ct:	<u>Niaga</u>	ra Fall	s Stor	<u>age Sit</u>	e	Report No. <u>DT-54</u>
Clien	t	Becht	<u>el Nati</u>	onal,	Inc.		Date:10/18/82
Cont	ractor:	Cer	rone		'		Job No. <u>BT-82-67</u>
Test No.	Date of Test	Depth of Elevation	In-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1	10/18	324.5	125.0	10.8	100.6	L19	S8+20 x E0+45, *95%.
2	10/18	324	121.3	12.3	97.7	L19	S7+60 x E2+60, *95%.
3	10/18	325	119.4	11.2	96.2	L19	S7+60 x E3+50, *95%.
							*Meets Required Compaction.
				·			
-							
							·
Proctor Code	Maximu Density (p		ptimum isture (%)				Material Type and Source
L19	124	.2	12.2	Silt	y Clay,	litt	le Sand, trace gravel.
							Respectfully submitted,
Remar	ks:						EMPIRE SOILS INVESTIGATIONS, INC.
nspec	tion Tim	ne:8:	30 - 3	:00			- - 3.2.2
nspec	tor:	B-	<u>11 Sch</u>	mitz_	· · · · · · · · · · · · · · · · · · ·		Bu Schmitz
		SUBSURF	ACE EXPLOR	ATION = SO	IL AND CONC	RETE TES	TING MMEMBER DAMERICAN SOCIETY FOR TESTING & MATERIALS

APPENDIX 1-C

Results of Laboratory Tests



PROJECT:

Niagara Falls Storage Site

CLIENT:

Bechtel National, Inc.

DATE:

June 1, 1982

PROJECT NO:

BT-82-67

REPORT NO:

L-2 (Revised)

REPORT OF RELATIVE DENSITY

ASTM D-2049

Material: Crusher Run Stone sampled at Niagara Stone on 5/25/82 by William Schmitz of Empire Soils

Investigations, Inc.

Average Minimum Density = 106.6 pcf Average Dry Maximum Density = 135.7 pcf Atterberg Limits, PI = 0%, Non-Plastic

Sieve Size	Percent Finer
2"	100.0%
_	
3/4"	65.7%
1/4"	32.6%
#10	18.5%
#40	11.0%
#200	6.7%

NOTE: Scoop used to place material in 0.1 cubic foot mold

Respectfully submitted,

EMPIRE SOILS INVESTIGATIONS, ANC.

Stanley J. Blas Jr., C.E.

Regional Manager

gel

JUN 17 1932



size distribution and Atterberg limits) were run on each compaction test sample. The test results are plotted on Figure 3-5. Shown on this figure are the specification limits and the individual test results. As is shown on this figure, all the test results were either within or very close to the specification limits.

6.5 PERMEABILITY TESTING

6.5.1 Background

The specification for the construction of the clay cap requires the material when compacted to have an in-place permeability equal to or less than 1×10^{-7} cm/sec. In order to verify the permeability of the compacted material, laboratory tests were conducted on both undisturbed Shelby tube samples and laboratory compacted samples. No field permeability testing was conducted because the anticipated range of permeability values is lower than the range that can be effectively tested by normal field test. As an example, Reference 3 indicates the lower end of measurable values from field tests are between 1×10^{-6} and 1×10^{-7} cm/sec.

The permeability testing of the compacted clay also included the dikes and cutoff wall surrounding the waste pile. The dikes and cutoff wall were also designed for an in-place permeability equal to or less than 1×10^{-7} cm/sec.

6.5.2 Undisturbed Sample Testing

The undisturbed Shelby tube samples were taken between July 3 and July 9, 1984. All the samples were taken from either the dike or cutoff wall. The drill holes were advanced to the selected sampling depth by rotary drilling using hollow stem augers. The samples were obtained by pushing a 3-inch diameter Shelby tube into the soil. No water was used in the drilling process. The six sampling locations are shown on Figure 3-1. As can be seen in this figure the sampling locations were spaced on all sides of the enclosure. The boring logs showing the depth and number of samples taken from each boring are contained in Appendix 3-C. All borings were grouted upon completion with a mixture of cement, sand, and bentonite.

Eight samples were selected for permeability testing from those collected. Of the eight samples tested two were from the dike section with the remaining six coming from the cutoff wall. An equal number of samples were taken from the R-10 dike area and the South dike area. It was important to test both areas because the fill material was from different borrow areas and was placed by different contractors over a two-year period.

The test procedure that was used to determine the permeability, in general, was performed as follows. The sample after being extruded and cut from the Shelby tube was sealed in a rubber membrane and placed in a triaxial chamber. In this method, the rubber membrane acts as the outer boundary of the permeameter. The triaxial chamber is used inorder to allow a confining pressure to be applied to the membrane and sample, in an effort to stop any leakage along the interface between the sample and the permeameter. In soil samples of low permeability it is extremely important to eliminate all leakage to ensure meaningful test results. After the sample was sealed in the chamber, it was saturated by applying a back pressure at both ends of the sample. The average degree of saturation of the test samples was over 99 percent. Upon completion of the saturation, the sample was placed under a differential head to initiate flow through the sample. The flow quantity was measured until a steady state condition was obtained over a 24 to 48-hour period. Once the steady state condition was obtained the sample permeability was calculated. Each sample was tested at both 5 and 10 pounds per square inch differential head. The test results of the permeability are contained in Appendix 3-D with a summary shown in Table 3-2. Also included in Appendix 3-D is the test procedure used by Empire Soils Investigations, Inc. for permeability testing.

6.5.3 <u>Laboratory Compacted Sample Testing</u>

Permeability testing was conducted on laboratory compacted samples of the fill material used for the clay cap. Three sets of tests were performed, two samples were from the Lew-Port material with the third coming from the Swann Road soil. The material used for the permeability testing was taken from samples that were collected for Proctor testing. For each set of tests two individual samples were compacted, one at approximately 90 percent of maximum

density and one at approximately 95 percent of maximum density. This method of testing was selected in order to determine the effect on the measured permeability due to a variation in the degree of compaction. Both samples were compacted at 1 to 3 percent above optimum moisture.

The test procedure after the samples were molded was identical to that previously described for the undisturbed samples. Again, each sample was tested under two different differential heads, 5 and 10 pounds per square inch. The average degree of saturation for the compacted samples was also over 99 percent. After the completion of each test the results were evaluated and the sample permeability was calculated. The test results are also contained in Appendix 3-D and summarized in Table 3-3. Figure 3-6 shows the permeability test results plotted as a function of degree of compaction.

6.5.4 Summary of Test Results

All the test results indicate the measured permeability is less than 1×10^{-7} cm/sec. The average permeability of all the undisturbed samples was calculated to be 2.80×10^{-8} cm/sec. and for the laboratory samples the average value was 1.35×10^{-8} cm/sec. The average for the laboratory samples was taken from Figure 3-6 at 95 percent compaction. Therefore, it can be concluded that the in-place permeability of the clay material in both the dikes and cutoff walls, and the clay cap is less than 1×10^{-7} cm/sec.

It was also noted that the range of permeability values was fairly consistent between the undisturbed samples from the R-10 dike area and the South dike area. This factor is significant for several reasons. Firstly, it tends to indicate that slight variations in the material and material sources had little effect on the permeability of the compacted clay material. Secondly, there was no significant difference in the measured permeability between the material placed two years prior to sampling (R-10 dike) and the material placed one year prior to sampling.

6.6 STRENGTH TESTING

Strength tests were performed on laboratory compacted samples of the clay material. The tests were performed to verify the design parameters used in the stability analysis of the interim and final covers. Those values were ϕ' (effective angle of internal friction) of 25 degrees and c' (effective shear strength) of 200 pounds per square foot. The test procedure, which was used to determine the strength parameters, was a three-stage consolidated undrained triaxial test with pore pressure meassurements. In total three sets of samples were tested, two from the Lew-Port material and one from the Swann Road material. The samples were taken from the same three samples used for the permeability testing. Each sample was compacted to a density equal to 95 percent of optimum density for that particular sample. The moisture level was maintained at 1 to 3 percent above optimum moisture.

The test results from the triaxial testing are contained in Appendix 3-E and summarized in Table 3-4. As can be seen from the test results the average c' value is nearly equal to the design parameter of 200 pounds per square foot and the ϕ ' value exceeds the design value of 25 degrees. Therefore, it can be concluded the slope stability factors of safety are acutally higher than those reported in Section 4.3.2 of the Waste Containment Design Report (Reference 1).

7.0 INSPECTION OF INTERIM CAP

The inspection requirements of for the interim cap are discussed in detail in Section 3.3.1 of the Waste Containment Design Report (Reference 1). A commitment is made in the Design Report to inspect the cap every Spring following the last frost and also in the Fall. The inspection would include a visual check for surface erosion, shrinkage cracks, animial borrows, and deep-rooted vegetation. In addition, the elevation of the top of the interim cover would be checked for depressions due to possible settlement. The interim cover will be recompacted or reworked if any damage or deterioration was noted during the inspection. It will be very important during the first inspection (Spring 1985) to check for possible deterioration due to freeze-thaw since the topsoil layer has not been placed.

8.0 SUMMARY

The initial construction of the interim cap was conducted between August and October 1984. The work was performed by Cowper Construction Company, Inc. under the technical direction of Bechtel National, Inc. All work was done in accordance with the appropriate specifications and design drawings. Field density tests showed that the average degree of compaction of 98 percent was achieved thus exceeding the required 95 percent. Laboratory tests results indicated all required material properties were maintained throughout the construction period and the permeability of the compacted soil was less than 1×10^{-7} cm/sec.

9.0 REFERENCES

- 1. "Waste Containment Design Report for the Niagara Falls Storage Site," by Bechtel National, Inc., Advanced Technology Division, prepared for US DOE, DOE/OR/20722-21, Draft, June 1984.
- 2. "Geologic Report Niagara Falls Storage Site Lewiston, New York," by Bechtel National, Inc., Advanced Technology Division, prepared for US DOE, DOE/OR/20722-8, June 1984.
- 3. <u>Earth Manual</u>, A Water Resources Technical Publication, 2nd Edition, U.S. Department of the Interior, 1974.

TABLE 3-1

PERCENT MOISTURE TEST RESULTS FIELD DENSITY TESTS

PROCTOR CODE	OPTIMUM MOISTURE	RANGE	AVERAGE
L-12	11.9	10.5 - 15.7	12.2
L-14	13.9	11.0 - 11.4	11.3
L-15	12.6	9.2 - 13.3	11.7
L-16	10.5	10.8 - 14.3	12.4
Average	11.9		12.0

PERMEABILITY TEST RESULTS UNDISTURBED SAMPLES

TABLE 3-2

SAMPLE	SAMPLE DEPTH	DRY UNIT WEIGHT	MOISTURE CONTENT	PERMEAE @ 5psi @	
	(FT)	(PCF)	(%)	х 10 ⁻⁷ ст	ı/sec)
BP-SW	18-19.5	117.3	14.7	0.664	0.599
BP-S	5-6.8	110.9	18.4	0.136	0.131
BP-S	15-16.4	117.0	16.5	0.140	0.145
BP-SE	18.5-19.7	119.6	14.9	0.0974	0.0978
BP-NE	9.5-11.4	108.0	20.4	0.252	0.230
BP-NE	3.0-4.5	111.3	17.4	0.409	0.368
BP-N	15.0-17.0	103.6	22.4	0.498	0.436
BP-NW	5.0-6.5	101.6	24.1	0.137	0.132

STRENGTH TEST RESULTS
LABORATORY COMPACTED SAMPLES

TABLE 3-4

SAMPLE	SOURCE OF MATERIAL	DRY UNIT	MOISTURE CONTENT	PERCENT COMPACTION	φ'	c'
		(PCF)	(%)	(%)	(DEGREES)	(PSF)
1	LEW-PORT #1 SAMPLE 10-Au	116.5	15.5	96	29.5	170
2	LEW-PORT #2 SAMPLE 11-Au	125.1	12.4	99	31.0	300
3	SWANN ROAD SAMPLE 12-Au	122.8	11.6	96	31.8	115
			AVERAGE		30.8	195

APPENDIX 3-A

FIELD DENSITY TESTS

- o General Notes
- o Test Results

NOTES:

- 1. Field density tests marked "Contaminated Pile" refers to contaminated soil in the R-10 waste pile below the clay cap.
- 2. Field density tests marked "Clay Cap" refers to uncontaminated soil used to construct the clay cap.
- 3. Test reports prior to Report No. DT-37 do not include any test results on the clay cap. The first field density test conducted on the clay cap was Test No. 35u. The last field density test was Test No. 147U.

M SINVES	P	R	INC.

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202

☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

					635 JAMES S	TREET,	SYRACUSE, NY 13203 315-472-9333
Proje	ct: _Ni	agara	Falls S	Storage	Site		Report No
Clien	tBe	chtel	-				Date:8-20-84
Contr	actor:	Seve	enson/Co	wper			Job No. <u>BT-84-53</u>
Test No.	Date of Text	Dapth or Elevation		In-place Moisture [%]	% Compaction	Practor Code	Location and Remarks
89 0	8.20	330,7	111.2	15.0	91.8%	C-1	Contaminated Pile - S1025,E370 - 90% Requested Bechtel accepted high moisture - (see remarks)
900	8-20_	328.5	115.9	12.8	95.7%	C-1	Contaminated Pile - S1065, £395 - 90% Requested
91C	8-20	3324	112.4	12.2	92.8	C-1	Contaminated Pile - S825,E280 - 90% Requested
35U	8-20	333.5	123.6	10.5	98.9	L-12	Clay Cap - Phase #1 - S1100,E130 - 90% Requested
			 				
			 -				
		<u> </u>					
Proctor Code	Maximu Density (Oplimum loisture (%)				Material Type and Source
C-1	121.1		2.0%	Clav	- Conta	minat	ted Pile - Sample # 1C
L-12	125.0		.9%	1			# 6U
	•		•	·			Respectfully submitted,
Remar	·ks:	Sand (one Met	hod Us	ed		_ EMPIRE SOILS INVESTIGATIONS, INC.
							urther drying
Techni	cian Tim	e: _8	10:00	- 6:00)		
Techni	cian:	1	arl E.	Dubin			Earl E. Dubin

E N SOILS IN	/PI	RE

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-696-5881

□ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837

☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 835 JAMES STREET, SYRACUSE, NY 13203 315-472-8333

Project:	Niagara Falls Storage Site	Report No.	DT-38	<u>Revise</u> d
Client	- Bechtel	Date:	8-21-84	
	. W Cowner		RT -84-53	

Cont	Contractor:						Job NoBT -84-53		
Test No.	Date of Test	Depth or Elevation	In-place Density (pcf)	In-place Moisture (%)	% Cempaction	Proctor Code	Location and Remarks		
92C	8-21	336.3	115.0	16.0	95.0	€ - 1	Contaminated pile - \$1030, E280 - 90% required accepted by Bechtel, after further drying		
36U	11	327.6	109.5	13.6	87.6	L-12	Clay Cap - Phase #1 - S1130, E60 - 95% Req'd to be retested after further compaction		
							(see test 37C)		
					·				
	1								
Proctor	Maximu	m 1	plimum						
Code	Denzity (isture (%)	Material Type and Source					
C-1	121.1	1:	2.0	Cont	aminate	d pil	e - Sample #1C		
L-12	125.0	1	1.9	Clay	- Lewp	ort -	Sample #6U		

Remarks: Sand	Cone Method Used	Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
Technician Time:	2:00 - 6:00	_ _ ,
Technician:	Earl E. Dubin	Earl E. Dubin

SUBSURFACE EXPLORATION & CONSTRUCTION QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES

roje	ct:	Niag	ara Fa	lls St	orage S	ite	Report NoDT-39 Revised
lien	t	Bech	itel				Date: 8-22-84
Cont	ractor:	J. k	I. Cowp	er			Job No. <u>BT-84-53</u>
Test No.	Date of Test	Bepth or Elavation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Practer Cade	Location and Remarks
37U	8-22	328.0	111.6	13.4	89.3	L-12	ay cap - phase #1 - S1125,E70 - 95% req'd be retested after further compaction (see
18U	13	334.0	119.5	12.4	95.6	L-12	remar ay cap - Phase #1 ~ S955, EllO 95% req'd
-							
roctor Code	Maximu Density (ptimum sture (%)				Material Type and Source
-12	125.0	11.	9	Clay		ort -	ample #6U
		٠					Respectfully submitted,

Earl E. Dubin

Technician Time: _____

Technician:

Earl E. Dubin



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 20 ☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333 201-225-0202

Proje	ct:	Niag	gara Fa	lls St	orage S	ite	Report NoDT-40		
Clien	it	Bech	itel				Date: 8-23-84		
Cont	ractor:	J. k	V. Cowp	er			Job No. BT-84-53 -		
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Prector Code	Location and Remarks		
39U_	8-23-8	328.0	134.5	11.0	100+	L-12	Clay cap - Phase I (95% reg'd) S1125 E75 (re-test of 37U A.F.C.)		
4 OU_	81		124.9	11.8	99.9	L-12 *	Clay cap. Phase I (95% req'd)		
					·				
							·		
							·		
Proctor Code	Maximu Density (ç		ptimum isture (%)				Material Type and Source		
L-12	125.0		.9	Cla	v - Lewi	ort ·	- Sample #6U		
-									
		•	•				Respectfully submitted,		
Remar	ks: Sa	and Con	e Meth	od Use	d		EMPIRE SOILS INVESTIGATIONS, INC.		
Techni	cian Time	. 12	2:00 -	5:00			-		
Techni			o Wiea				Otto Wieand		
•			UBCUBS ACS	EVD: 00+7	ION M CONST		ONALITY CONTROL & ENGINEERING SPECIALTY SERVICES		

EMPIRE SOILS INVESTIGATIONS INC.	☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 /16-649-8110 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
	☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proie	ct:	Ni	agara	Falls	Storage	Site		Report No	DT-41	Revised
Clien			chtel					Date:	8-24-84	
	actor:	J.	W. Co	wper					BT-84-53	<u></u>
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Campaction	Proctor Code		cation and F	Remarks	
410	8-24-8	334.8	124.2	13.2	99.4	L-12	Clay cap - Phase S 990 - E 110	I (9	95% req'd)	
					<u>.</u>					
										ŕ
				ļ						
					<u>.</u>		•			
				ļ						
					<u> </u>	<u> </u>				
Proctor Code	Maximu Density (pcf) M	Optimum pisture (%)	ļ			Material Type a	and Source		
L-12	125.0	1	1.9	C1	ay - Sar	nple	# 6U			
					:					
					•		Respectfully su	bmitted,		
Rema	rks:S	and Cor	ne Meth	od Use	<u>d</u>		_ EMPIRE SOILS	INVESTIG	ATIONS, INC.	
Tooba	ician Tim]():30AM	- 4:30	PM		_			
	ician:		to Wiea	nd		,		Otto Wiear	nd	
. 501111	a.i							NAC CRECIAL TV SI	- Duces	



ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-549-8110

Proja	ect. N	iagara	Falls S	torage	Site		Report No. DT-41A Revised
Clier	nt:B	echtel					Date:8/24/84
Cont	ractor	. (errone				Job No. BT-84-53
Tes! 140.	Date of	Depth or Elevation	In Place Density	In-Place Moisture (%)	Relative Density (%)	Proctor	Location and Remarks
4 2u	8/24	293.3	136.4	2.8	100+		Lutz Road Culvert Centerline 74' West of Lutz Road Culvert Inlet
		 			100+	L-12	10' South of Lutz Road Culvert Centeline
43u	8/24	293.8	127.8	2.8	76.1	L-12	70' West of Culvert Inlet (Must Retest)
		ł		İ			See test 44U for retest
			:				
							·
							·
				<u> </u>		-	"
							·
			 		<u> </u>		
						-	
						<u> </u>	-
rictor Cose	Moximu Density (m Min	.Densit	ý I	}		Material Type and Source
L-12	325		06.6	R.O.	C. Ston	e - P	roctor Value provided by Bechtel
				·			
							•
R	EMARKS:	San	d Concr	ete Me	thod Us	ed	Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
I	NSPECTI	MIT NO	E: 1	:45 pm	- 3:30) pm	Otto Wieand
	NSPECT(.	O. Wiea	nd			THIS . MEMBER . AMERICAN SOCIETY FOR TESTING & MATERIALS



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY
WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proj.	ac1:	Niagar	a Falls	Stora	age Site	<u> </u>	Report No. DT-42
-	nt:	Bechte	1				Date:8/27/84
- Cont	ractor	:Cer	rone				Job No. BT-84-53
7001	Dote of Test	Depth or Elevation	In Place Density	In-Place Moisture (%)	Relative Density (%)	Proctor Code	Location and Remarks
4 4u	8-27	293.8	142.9	2.0	100+%	*	10 5 N of Lutts Road Culvert Centerline 70'W of Culvert Inlet - 95% Required (See Remarks
45u		294.0	144.0	1.8	100+	*	10.5 S of Lutz Road Gulvert Centerline 75' W of Culvert Inlet - 95% Required
4 7u		297.3	134.3	1.8	96.2	*-	10.5 S of Lutz Road Culvert Centerline 45' W of Culvert inlet - 95% Required
			:				
							·
							-
							. •
							·
							_
Proctor Cote	Mozimus Density (s	m Min.	Density PCF)	,	*	<u> </u>	Material Type and Source
*	135.7	\neg	06.6	2" R	OC - Ni	agara	Stone
					· · · · · · · · · · · · · · · · · · ·		
R -	EMARKS:	Test	Cone Me 14U - R 8/24/8	etest	of Test	43U	Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
	NSPECTI				5:30		Earl Dubin
I	NSPECTO	R:	Earl Du	bin	SOIL AND CONG	AETE TES	TING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS

ntractor: J. W. Cowper In-place in-place Meisture % Prector Test Elevation (pcf) (%) Compaction Code	RT-84-53
in-place in-	Job No. <u>BT-84-53</u>
	Location and Remarks
U 8-27 333.2 104.7 14.0 83.8 L-12 Clay Cap - required.	Phase #1 - \$885.E85 - 95% compaction
	sted after further compaction.
For retest	- see tests 50U, 51U
ctor Maximum Optimum Materia de Density (pcf) Moisture (%)	I Type and Source
12 125.0 11.9 Clay - Lewport - Sample #6U	

Earl E. Dubin

TOW & CONSTRUCTION QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES

Technician Time: 8:00 -5:30

Technician: Earl E. Dubin

	SINVE	STIGAT			S-3858 SHEL 105 CORONA RARITAN CE 1164 RIDGE 635 JAMES S	DON REAL AND A AVENT NTER, S RD. EAS STREET,	CTADY RD., LATHAM, NY 12110 518-783-1555 D., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 DE, GROTON, NY 13073 607-898-5881 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202 ST, ROCHESTER, NY 14621 716-342-5320 , SYRACUSE, NY 13203 315-472-9333 REPORT NO.
Clien	t	Ве	htel				Date:8-27-84
	ractor:	Se	enson	·			Job NoBT-84-53
Test No.	Date of Test	Depth or Elevation	in-place Density (pci)	In-place Moisture [%]	% Compaction	Proctor Code	Location and Remarks
9 3C	8-27	336.2	126.5	9.1	100+	C-1	Contaminated Pile - S995, E164 - 90% reg'd
			<u> </u>				
						-	
Proctor Code	Maximu Density (ptimum isture (%)				Material Type and Source
C-1				Cont		n#1-	*
U-1	121.1		2.0	contai	minateo		e - Sample #1C
		.					
L	<u> </u>						

Respectfully submitted.

Remarks: Sand Cone Method used EMPIRE SOILS INVESTIGATIONS, INC.

Technician Time: 8:00 - 5:30

Technician: Earl E. Dubin Earl E. Dubin

EMPIRE SOILS INVESTIGATIONS INC.	☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-698-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
	☐ 1164 RIDGE RD. EAST, ROCHESTER: 1;Y 14621 716-342-5320 ☐ 835 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niagar	a Falls	Store	Report NoDT-45 Revised		
ClientBechtel							Date: 8-28-84
Contractor:J. W. Cowper						Job No. BT-84-53	
Test No.	Date of Test	Depth or Elevation	in-place Density (pci)	in-place Moisture (%)	% Compaction	Precier Code	Location and Remarks
50U	8-28	333.0	113.0	11.6%	90.4%	L-12	Clay Cap - Phase #1 - S885, E80 - 95% compaction req'd. To be retested after further compaction. See test 51U (see remarks)
5טן	8-28	333.0	118.0	12.2%	94.4%	L-12	Clay Cap - Phase #1 - S880,E80 - 95% compaction req'd. Accepted by Bechtel after further compaction. (see remarks)
53 U	"	334.4	108.1	13.4	86.5	L-12	Clay Cap - Phase #1 - S1070, E100 - 95% compaction reg'd. To be retested after further compaction. (see tests 540,560,600,630)
-			·				
Proctor Code	Mazim Density)ptimum isture (%)				Material Type and Source
L-12	-12 125.0 11.9 Clay - lewport Sample #6U						Sample #6U
		_				-	
		`		1			Respectfully submitted,
Remar	ks:	Sand Co	one Met	hod Us	ed		EMPIRE SOILS INVESTIGATIONS, INC.
							_, after further
compa Techni	action. cian Tim	. Test		retest		t 50i	(see also test 46U) after further compaction.
Techni	cían:	Earl E	Dubi		·		Earl E. Dubin



ORCHARC PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG. P.

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proj	ect:	Niaga	ra Fall	Report No. DT-46			
•	nt:	Becht	e1			Date: 8/28/84	
	tractor	. Cer	rone				Job No. BT-84-53
70.	8	Depth or Elevation	In Place Density	In-Place Moisture	Relative Density (%)	Proctor Code	Location and Remarks
48u	8/28	298.9	138.5			*	Centerline of Lutz Road Culvert 40' W of Inlet - 95% Required
49u	8/28	298.9	130.4	4.0	85.1	*	10.5' N of Lutz Road Culvert Centerline 45' W of Culvert Inlet - 95% Required
							To be retested after further compaction.
52u	8/28	298.9	141_4	3.9	100+	*	10.5' N of Lutz Road Culvert Centerline 45' W of Culvert Inlet - 95% Re quired
							Retest of Test 49u - after further compaction
							-
							·
			-			·	
							#
Proctor Code	Moximus Density (s	m Min.	Densit; PCF)	, ,			Material Type and Source
*	135.7	10	06.6	2"	R.O.C.	- Nia	gara Stone
		1					
							
Ŕ	EMARKS:	Sand	Cone M	ethod	Used		Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
_ I	NSPECTI	ON TIME	: 10	:00 -	5:00		Earl Dubin
I	NSPECTO		arl Dub		OH AND COM	B675 5557	ING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS
		2082	MALE END				

EMPIRE SOILS INVESTIGATIONS INC.	00000
Niagara Falle	9

Technician: __

585 TROY-SCHENECT	ADY RD., LATHAM, NY 12	110 518-783-1555	
S-3856 SHELDON RD.	P.O. BOX 229, OPCHARD	PARK, NY 14127	716-649-8110
TO 105 CORONA AVENUE	GROTON NY 13073	607-906-5381	

⊒ 105 CORONA AYENUE, GROTON, NY 13073 **607-898-5881** ⊇ Raritan Center 300 m∈gaw drive edison nu ora37 201-225-0202

				_ o	1164 RIDGE	RD. EAS	T, ROCHESTER, NY 14621 716-342-5320 SYRACUSE, NY 13203 315-472-8333				
Proje	ct:	Nia	gara Fa	alls St	torage :	Site	Report NoDT-47 Revised				
Clien	t	Bec	htel				Date:8-31-84				
	ractor:	J. ¹	W. Cowp	er			Job No. <u>BT-84-53</u> -				
			In-place	in-place							
Test No.	Date of Test	Dapth or Elevation	Density (pcf)	Moisture (%)	Compaction	Proctor Code	Location and Remarks				
600	8-31	334.4	116.5	13.0	93.2	L-12	Clay Cap - Phase I 95% required S1070 E 105 (retest of 530)				
6 1U		333.8	127.0	12.4	100+	L-12	Clay Cap - Phase I 95% req'd S865 E85 - restest of 55U				
63 U	. 11	334.8	123.4	11.4	98.7	L-12	Clay Cap - Phase I 95% required S1070 - E110 (retest of 53U)				
64 U	11	335.3	121.2			L-12	Clay Cap - Phase I 95% required S1000 - E120				
							·				
							·				
			-								
Proctor	Maximu		ptimum	!		<u>1</u>	Material Type and Source				
Code	Density (1.8	C1-	y from		ort stockpile.				
<u>L-12</u>	123.0		1.0	012	29 17 0111	Lewpo	ort stockprie.				
				,							
				<u> </u>							
							Respectfully submitted,				
Remar	ks:	Sand Co	one Met	hod Us	sed		EMPIRE SOILS INVESTIGATIONS, INC.				
							•				
Technic	cian Time	e:			BOPM		•				
Technic	rian.	0t	to Wiea	ınd			Otto Wieand				



B/T Form C

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Project:Niagara ClientBechtel Contractor:Cerrone			iagara	Falls	Storage	Site	Report No. DT-48					
			echtel				Date: 8-31-84					
			errone	<u> </u>	· <u>-</u> -		Job NoBT-84-53	•				
			in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks						
6 2U	8-31	300.3	125.5	14.1	100+	N.A	Lutz road - 50' West of culvert inlet 20' North of culvert inlet					
					ł	1 1	Lutz road - 50' West of culvert inlet					
65U		301.8	117.2	14.2	93.5	N.A.	15' South of culvert inlet					
	<u> </u>											
								-				
							-					
								. ~				
						-						
Proctor Code	Maximu Bensity (Optimum Disture (%)				Material Type and Source					
	125.4	11		Lutz	Lutz road culvert fill - Clay (Proctor supplied by Bechtel)							
-			<u> </u>			_						
			•	•			Respectfully submitted,					
Bomo	·l·n·	Sa	nd Cone	Metho	d Used		_ EMPIRE SOILS INVESTIGATIONS, INC.					
Remai	ns						_ EMFINE SOILS INVESTIGATIONS, INC.					
Techni	cian Time	e. 9:	00AM -	4:30PM			_					
Techni		··	tto Wie				Otto Wieand					
			CURCUREACE	EVOLOBAT	ON E CONST	PUCTION	CHALLEY CONTROL & ENGINEERING SPECIALTY SERVICES					

SOILS	INVEST	GATIC	RE

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

635 .	IAMES	STREET,	SYRACUSE,	NY 13203	315-472-9333

Project: Niagara Falls Storage Site								Report No. DT-49			
ClientBechtel								Date:			
Cont	ractor:		Sevens	on				Job No	BT-84-53		
Test No.	Date of Test	Dapth or Elevation	in-place Density (pcf)	in-placa Moistura (%)	% Cempaction	Proctor Cade	L	ocation and Re			
94C	8-31	337.3	127.0	10.2	100+	C-1	Phase II - S1135	5 E 185 (fir	ish grade)		
95C	1	İ	115.5		ŀ	l	Phase II \$815 E				
		<u> </u>									
Proctor Code	Maximu Density (;		isture (%)				Material Type	and Source			
C-1	121.1	12.	. 0	cont	<u>aminate</u>	d_fil	1.	<u> </u>			
					·						
			•				Respectfully s	ubmitted,			
Remai	rks:	Sand Co	ne Met	hod Us	ed		_ EMPIRE SOIL	S INVESTIGAT	IONS, INC.		
Techni	ician Time	9:00)AM - 4	:30PM			<u>-</u>				
Techni	ician:	Ott	o Wiean	d			Otto	Wieand			
							,	DING SPECIALTY SERVI	CFS		

				= 0		RD. EAST	ROCHESTER, NY 14621	5-472-9333		
Proje	ct:	Nia	agara f	alls :	Storage	Site			DT-50 Revised	
Client	<u> </u>	Be	chtel	 .					8-29-84	
Contr	actor:	Ce	rrone						BT-84-53 -	
Test No.	Date of Test	Depth or Elevation	In-place Bensity (pcl)	In-place Moisture (%)	% Compaction	Proctor Code	Lo	ocation and Rema		
E-711	8-29	- 3 00-0	110.3	12 7	88.0	1 12		ert centerline		
370	0-29	300.8	110.3	14.7	88.0	L-13		lvert inlet	n requirements.	
1										
				·						
					·					
Proctor Code	,		Material Type and Source							
L-13 125.4		11.8		Clay - Lutts road - culvert fill.						
							Respectfully su	hmitted		

Technician Time: 1:00 - 6:30

Technician: Ear E. Dubin

CONTROL . ENGINEERING SPECIALTY SERVICES

Earl E. Dubin

EMPIRE SOILS INVESTIGATIONS INC	
	=
	=

D 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555

S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 807-898-5881

201-225-0202

☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 20 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-242-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:		Niagar	a Fall	s Stora	te Report NoDT-51 Revised	
Clien	t	<u>.</u>	Bechte	1			Date:8-29-84
Cont	ractor:		J. W.	Cowper			Job No. <u>BT-84-53</u> —
Test Date of Dapth or Density No. Test Elevation (pcf)			in-place Moisture % [%] Compaction		Practer Cade	Location and Remarks	
54U	8-29	334.4	113.7	13.4	91.0	L-12	Clay Cap - Phase #1 - S1070,E100 95% reg'd to be retested - after further compaction
							See test 56U (see remarks)
55U	11	333.8	116.8	12.8	93.4	L-12	Clay Cap Phase #1 - S885,E85 - 95% req'd to be retested after further compaction.
56ປ	"	334.4	114.8	14.1	91,8	L-12	Clay Cap - Phase #1 - \$1075,E100 - 95% required Material to be reworked and recompacted.
					-		
Proctor Code							Material Type and Source
L-12	125.0						
			•	<u> </u>	21.5.51.00	·	IIID I E # UM
							Respectfully submitted,
Remarks: Sand Cone Method Used							EMPIRE SOILS INVESTIGATIONS, INC.
Test <u>Test</u>	54U - 56U	rețest	of tes	t 53U 54U	- taken - (see	8-28 also	after further compaction test 53U)
	cian Time	1.0	0 - 6:3				•
Technician: Earl E. Dubin							Earl E. Dubin
			UBCUBEACE	EVO: 00471	ON # CONCTE		HALTY CONTROL MENCINEEDING COECIALTY SERVICES

AP INVESTIGA	TIONS INC.

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08537 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14821 7:6-342-5320
☐ 835 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

				<u> </u>	OUD JAMES S	intti,	STHACUSE, NY 13203 315-472-8333		
Proje	ct:	Ni	iagara	Falls	Storage	Site	Report No. DT-52		
Clien:	t	Ве	chtel				Date:9-4-84		
Contr	ractor:	Ċe	errone			<u></u>	Job No		
Test No.	Date of Test	Depth or Elevation	in-place Bensity (pcf)	in-placs Moisture (%)	% Compaction	Prector Cade	Location and Remarks		
66U -	9.4	301.8	115.0	15.7	91.7	*	Lutts road culvert - 50' West of culvert inlet 15' South of culvert centerline - 95% required.		
000							Retest of test 65U taken 8-31-84 after further compaction.		
							Area to be windrowed and recompacted and then retested (see test 67U)		
67 U	9-4	301.8	125.4	13.6	100	*-	Lutts road culver - 50' West of culvert inlet 15' South of culvert center line 95% reg'd		
							Retest of test 66U - after windrowing and recompaction.		
69U	9-4	303.0	121.9	11.2	97.2		Lutts Road culvert - 40' West of culvert inlet along center line of culvert - 95% req'd.		
					37.62		arong center time of curvere - 33% req q.		
	-						·		
			·						
Proctor Code	Maximu Density (plimum sture (%)	Material Type and Source					
*	125.4			Clay	- Lutts	road	- culvert fill		
						•	·		
			•				Respectfully submitted,		
Remar	ks:S	and Con	e Metho	od Use	<u>d</u>		EMPIRE SOILS INVESTIGATIONS, INC.		
				, , ,,			-		
rechnic	cian Tim	e:9	:00 AM	- 5:30) PM		-		
Fechnician: Earl E. Dubin							Earl E. Dubin		

VOLUME 2
SOUTH DIKE CONSTRUCTION
SEPTEMBER-NOVEMBER, 1983

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1.0 INTRODUCTION

Volume 2 of the Post-Construction Report contains the results of the remedial construction activities associated with the construction of the South Dike at the Niagara Falls Storage Site (NFSS). The South Dike construction was a continuation of the work documented in Volume 1 of the Post-Construction Report. During this phase of the work, the cutoff wall and perimeter dike surrounding the R-10 waste pile was extended toward the south to include the area containing several buildings. These buildings include the 410, 411, 413, 414, and 415. The location of the South Dike is shown on Figure 2-1. As shown on Figure 2-1, it was necessary to demolish Building 412 to construct the South Dike. The construction of the 1100-feet-long South Dike was done between September and November 1983. A general site location map os shown on Figure 2-2.

Listed below are the relevant entities involved with the South Dike Construction:

Department of Energy: Owner

<u>Bechtel National, Inc.</u>: Project Management Contractor: Dike embankment and cutoff wall design; dike foundation inspection; and management of construction operations.

<u>Kimmins Contracting, Inc.</u>: Construction of the cutoff wall and dike including excavation and backfilling.

<u>Parratt Wolff, Inc.</u>: Laboratory and in-place density testing of fill material.

<u>Eberline</u>, <u>Inc.</u>: On-site radiological survey and radiological safety for all site personnel.

2.0 BACKGROUND

The construction of the South Dike was necessary to contain any possible migration of contaminated radioactive materials from the buildings enclosed within the South Dike. In addition, the enclosed area provided additional storage capacity for contaminated wastes. The dike and cutoff wall, which is keyed into the underlying gray clay, was designed to provide an effective barrier against the migration of contaminated ground water from the enclosed area.

The cutoff wall was keyed into the underlying gray clay because it had been determined from previous geologic investigations that the gray clay unit was the most uniform, homogeneous and impervious soil layer in the site area. The upper soil layer, which is a brown silty clay, has many sand seams and pockets that could allow the migration of contaminated ground water if the cutoff wall was not constructed.

3.0 AVAILABLE INFORMATION

Prior to the initial construction (Volume 1) subsurface investigations had been performed by Acres American, Incorporated (Reference 1), and by Bechtel National, Inc. (Reference 2, Appendix J). The Acres report deals with the overall geology and hydrology of the entire NFSS. The initial Bechtel work,

which included geologic mapping, geophysical surveys and drilling, was concentrated around the R-10 waste pile. During the time period between the initial dike construction and the South Dike construction Bechtel National, Inc. (Reference 2), conducted a more detailed subsurface investigation at the NFSS. This investigation included drilling several borings, and the installation of observation wells and piezometers. Some of the work done during this investigation phase was in the area of the South Dike. The location of the borings, observation wells and piezometers in the area of the South Dike are shown on Figure 2-2.

4.0 SUBSURFACE CONDITIONS

A description of the subsurface conditions is contained in References 1 and 2. The subsurface profiles (References 1 and 2) along the perimeter of the South Dike are shown on Figures 2-3, 2-4, and 2-5. The location of the cross sections are shown on Figure 2-2.

5.0 SOUTH DIKE DESIGN FEATURES

As previously stated, the purpose of the South Dike and cutoff wall is to provide a barrier against the migration of contaminated ground water from within the enclosed area. The dike, which is constructed above natural grade, is provided to contain all rain water falling inside the dike, while the below grade cutoff wall is provided to contain any ground water flow. The cutoff wall, which has a minimum width of 12 feet, has a base elevation between elevation 302 and elevation 297. The cutoff wall penetrates into the gray clay layer a minimum of 1.5 feet. The two ends of the South Dike were keyed into the existing R-10 Waste Pile Dike to provide a continuous barrier.

Slopes for the perimeter dike are at 2 horizontal to 1 vertical with the outside slope protected with 4 inches of crushed stone. The proposed final design for this area will include an engineered clay cover to prevent additional rainfall from entering the contaminated wastes and residues. During the non-work (winter) periods of construction of the dike, the waste pile is temporarily covered with the synthetic rubber liner.

6.0 TRENCH EXCAVATION

After the areas to be excavated were checked for radioactive contamination, the initial excavation was started on the eastern section of the South Dike adjacent to the Building 411. Shortly after that time the excavation of the western section was also started. The excavation for the South Dike was performed using two Caterpillar Model 235 excavators. The excavated slopes were cut to approximately 1 horizontal to 1 vertical in a stair-step like manner. The horizontal and vertical benches varied from 2 to 3 feet with the exception of the last step cut into the gray clay unit. The depth of this final vertical cut was a function of the required depth needed into the gray clay. This depth varied from 2 to 6 feet. In all cases the base minimum width of 12 feet was maintained. A profile of the base of the cutoff wall excavation is shown in Figure 2-6.

In many areas, especially when the excavation remained opened for more than a day, sloughing occurred in the excavation within the gray clay unit. The sloughing usually occurred as block failures in the bottom cut area. It is believed the sloughing occurred due to stress release and the development of tension cracks and not due to an inherent weakness in the clay unit. However,

all loose material was removed from the excavation prior to fill placement. When required, the slopes were cut further back to maintain a safe slope condition.

During the excavation of the cutoff trench, water was observed flowing into the excavation in only a few isolated locations. These locations were in the upper brown clay unit. The water flow, which was estimated to be between 2 to 5 gallons per minute, lasted only for a short duration, usually less than 24 hours. This would tend to indicate that the water was from an isolated pocket of permeable material within the soil profile. The only area that any appreciable water was entering the excavation was along the southern section of the South Dike (E 1+20 S 16+72). At that location, the excavation was extended through the gray clay unit into the underlying brown sand and gravel unit. A detailed description of this one area is given below. In all cases the water was removed from the excavation by pumping prior to the placement of fill.

All excavated material was removed from the excavation and stockpiled to the south of the dike. No excavated material was used as fill for the cutoff wall. All fill material was borrow material from two off-site locations. During the excavation operation, periodic visits were made to the site by a Bechtel geotechnical engineer. Subsurface conditions observed during these visits are described below.

6.1 EAST DIKE SECTION

The borings and subsurface profile (Figure 2-3) along the eastern section of the dike indicated a fairly uniform soil profile with the top of the gray clay

at approximately elevation 304. The inspection of the eastern trench during the excavation indicated that the actual conditions were similar to those expected with the following exceptions. At several locations within the brown silty clay unit, small, dry sand and gravel deposits were noted. In addition, near the top of the gray clay unit, a continuous horizontal reddish brown sandy clay layer was noted. Due to the presence of this 2 to 3 inch thick layer, it was elected to extend the excavation a minimum of 18 inches into the gray clay below this layer. A typical section along the eastern excavation is shown in Figure 2-7.

6.2 WEST DIKE SECTION

The borings and subsurface profile (Figure 2-5) along the western section of the dike also indicated a fairly uniform soil profile with the top of the gray clay between elevation 305 and elevation 300. The profile, as well as the inspection, indicated the presence of many sandy and gravelly pockets within the brown silty clay unit. However, as was present on the eastern side, a continuous thin layer of reddish-brown sandy clay was observed. This layer is most likely the same one identified in Boring A-28 (Figure 2-5) at about elevation 298. At one location (E 0+42, S 14+60) this layer graded into a dry thicker reddish brown gravel and sand pocket. This pocket, with a width of 5 feet and a height of 3 feet, was entirely within the gray clay unit. At this location the excavation was extended deeper to provide a minimum of 18 inches of gray clay below this pocket. Typical sections of the western excavation are shown in Figures 2-8 and 2-9.

6.3 SOUTH DIKE SECTION

The borings and subsurface profile (Figure 2-4) along the southern section of the dike again indicated a very uniform profile with the top of the gray clay between elevation 305 and elevation 302. The inspection during the excavation indicated similar findings as for both the eastern and western sections. At one location along the southern section (E 1+20 S 16+72), a gray sand pocket was encountered near the top of the gray clay unit. The sand was first encountered in the base of the excavation trench. At that time, it was elected to deepen the excavation to remove the sand. As the sand was removed, the areal extent of the sand pocket spread to include both walls of the excavation. The excavation was continued in that area until the underlying brown sand and gravel unit was reached. It was then elected to further deepen the excavation in a limited area (one bucket width) to determine if the gray clay unit would reappear. However, it was found the brown sand and gravel unit extended down to the underlying bedrock. It was estimated that water was entering the excavation at a rate of 5 gallons per minute.

After the bedrock was reached, the excavation was backfilled in an uncontrolled manner to the elevation of the surrounding trench area (elevation 299±). The fill was placed in a rapid manner to avoid further undercutting of the side slopes due to the presence of running sand.

The following day, an inspection and evaluation was made by a Bechtel geotechnical engineer of that area to evaluate the required corrective actions. The inspection indicated that the sand pocket was dipping downward in all directions from the center of the trench. As a result of this dip toward the north (inside wall of the excavation) a thin layer of gray clay was exposed on the inside wall. It was also noted that large cracks had developed in both side slopes due to undercutting of the slopes. The base of the trench

in this area was not inspected due to the presence of standing water. It was again estimated that water was entering the excavation at a rate of 5 gallons per minute.

Based on the results of the inspection, it was elected to remove the top two feet of uncontrolled fill placed and all loose material from the side walls. Prior to removing the fill, a sump was excavated and the water was drawn down below the planned excavated depth. It was decided not to remove all the uncontrolled fill in order to avoid further undercutting of the slopes and to maintain their stability. When the upper fill and loose material was removed, it was observed due to the further downward dip of the sand the thickness of the gray clay increased and the exposed width of the sand decreased. After the final excavation elevation was reached, new clay fill material was placed and compacted as required for the rest of the excavation. It is believed, due to the fact that the final cutoff wall extended several feet below the top of the gray clay as exposed on the inside wall, that an effective cutoff had been maintained in this particular area. Details of the fill placement and compaction processes are discussed later. Typical sections along the southern excavation are shown in Figures 2-10 and 2-11.

7.0 BACKFILLING

7.1 MATERIAL

The clayey material used for the cutoff wall came from two off-site borrow areas. The location of the borrow areas are shown on Figure 2-2. The borrow areas were periodically inspected by Bechtel and the materials were tested by Parratt Wolff, Inc. to verify conformance with technical specification

requirements. Appendix 2-A contains the laboratory test results for the borrow material. The test results show both gradation and plasticity test results. The classification of the material based on the test results is a low-plasticity clay. The Unified Soil Classification symbol is CL.

7.2 COMPACTION EQUIPMENT AND PROCEDURES

The fill material was trucked onto the site and end dumped into the excavation. The material was then spread using a Caterpillar Model D-5 dozer and compacted using an Ingersoll-Rand Model SPF56 pad-foot roller. The initial lift over the gray clay had an uncompacted thickness of 2 to 3 feet. This thick lift was required inorder to avoid pumping and displacing the relatively soft gray clay in the bottom of the excavation. After the initial lift was spread and compacted, additional fill material was then placed. All additional fill was placed in 8-inch loose lifts and compacted with the SPF56 compactor.

At the end of each work day, the upper lift was compacted with a small steel drum roller to seal the surface. The surface would then be scarified by the D-5 dozer or by discing prior to placing additional fill. The fill operation was originally being conducted on both the eastern and western sections simultaneously. The final work in the south section was conducted as a single operation due to limited work space.

7.3 QUALITY CONTROL

Field density testing was performed to insure that the design compaction criteria was being met. The field tests were performed in accordance with ASTM D 1556, sand cone method, and were conducted by Parratt Wolff, Inc.

Periodic testing was performed throughout the construction period of the cutoff wall and dike. The results of the field tests were compared with laboratory compaction tests for the same material to determine the percent compaction. The compaction tests were performed in accordance with ASTM D 1557, Modified Proctor density. Acceptance criteria for in-place compaction was 95 percent of maximum Modified Proctor density. In-place moisture was determined using a "Speedy Moisture Meter." An initial comparison was performed between the Speedy Moisture Meter results and laboratory oven-dried moisture tests. The results of this comparison are shown in Appendix 2-A. Field and laboratory density test results are shown in Appendix 2-B.

The only major problem in obtaining the required compaction was when the fill material was above optimum moisture by 4 to 8 percent. In these cases, the lift was either reworked or removed and replaced with drier fill. In total 113 passing tests were recorded with an average degree of compaction of 96.7 percent.

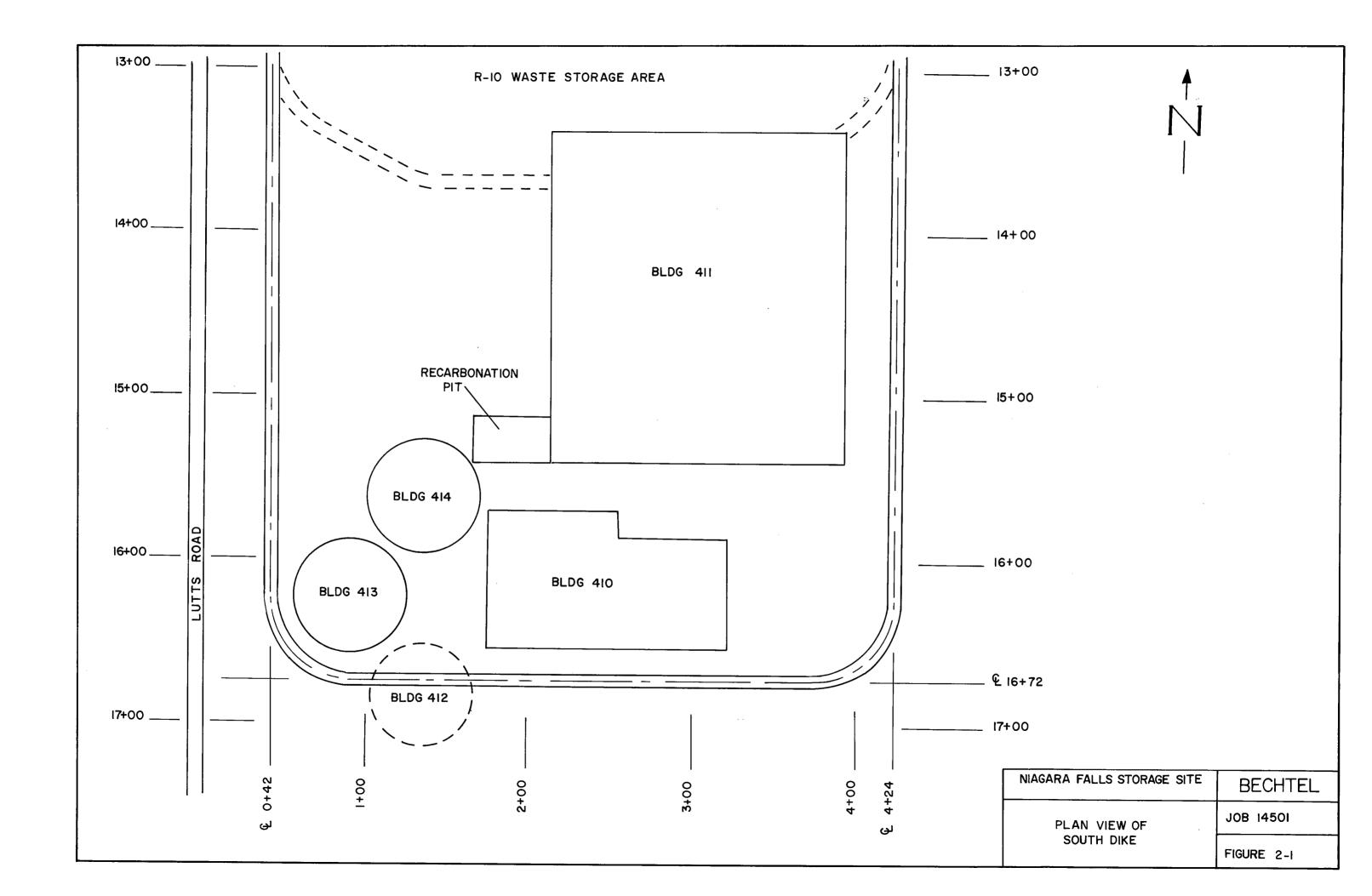
8.0 SUMMARY OF RESULTS AND CONCLUSIONS

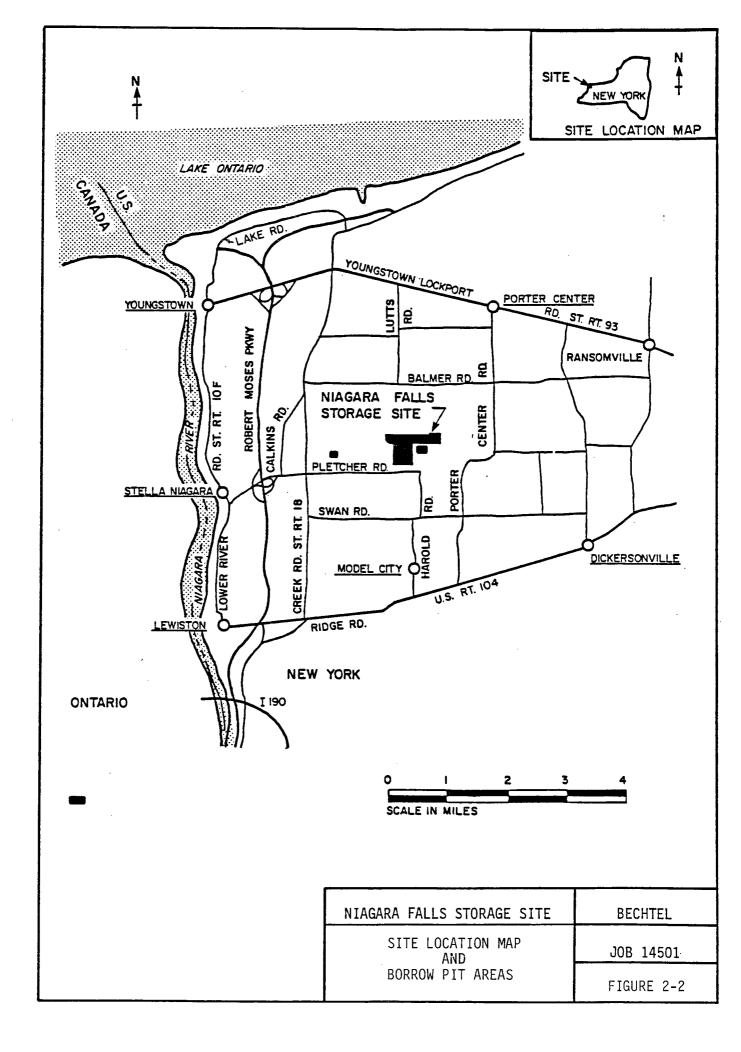
- 1. In all locations along the South Dike the cutoff wall extends a minimum of 18 inches below the top of the gray clay unit.
- 2. Sand and gravel deposits exists in the brown silty clay unit and upper transitional section of the gray clay unit. Almost all deposits were dry and are believed to be isolated. The cutoff wall was extended a minimum of 18 inches below any observed sand areas in the gray clay to obtain the effective cutoff.

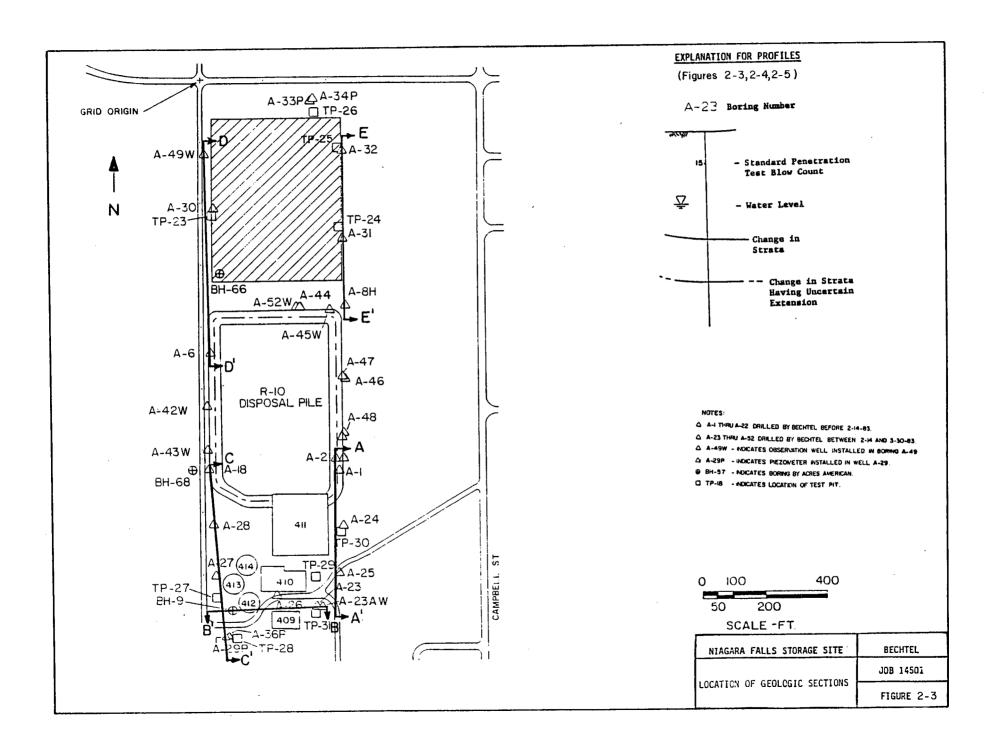
3. The compaction of the cutoff wall and dike fill material either met or exceeded the required 95 percent of Modified Proctor density.

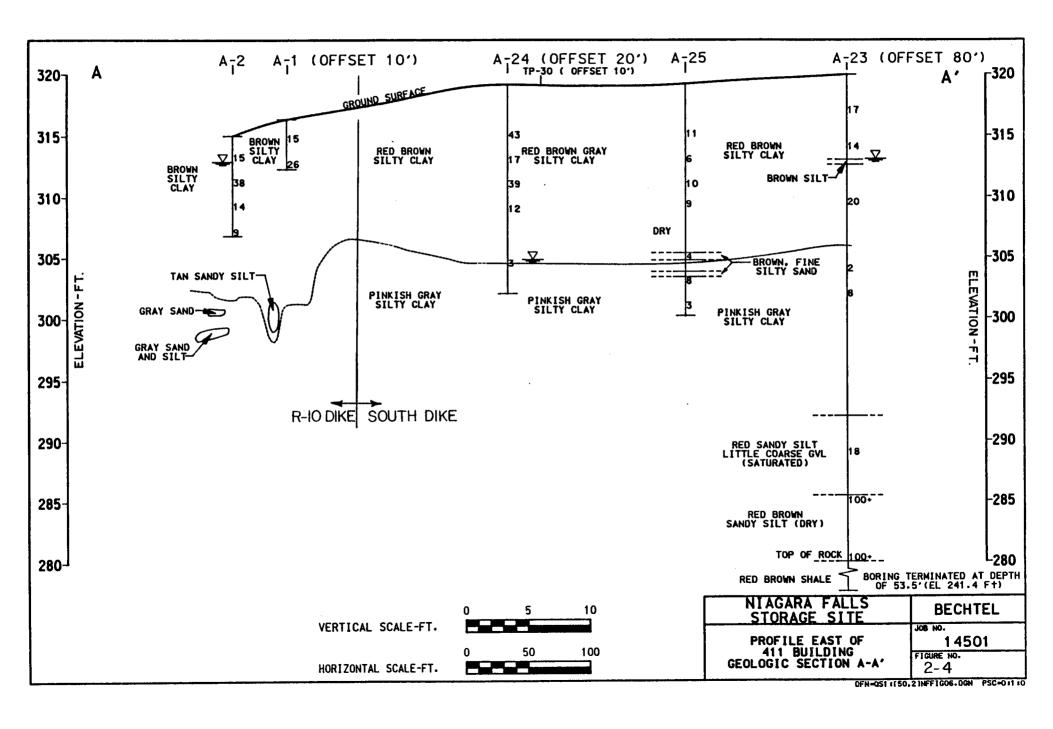
9.0 <u>REFERENCES</u>

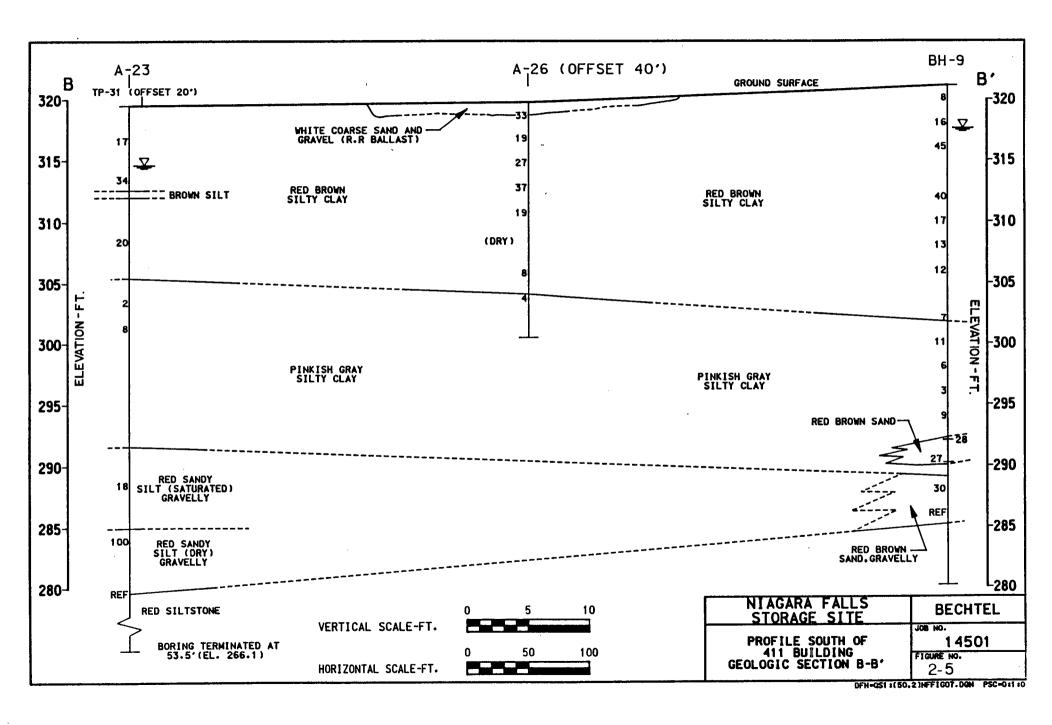
- Acres American Incorporated, 1981, "Hydrologic and Geologic Characterization of the DOE - Niagara Falls Storage Site."
- Bechtel National, Inc., 1984, "Geologic Report, Niagara Falls Storage Site."

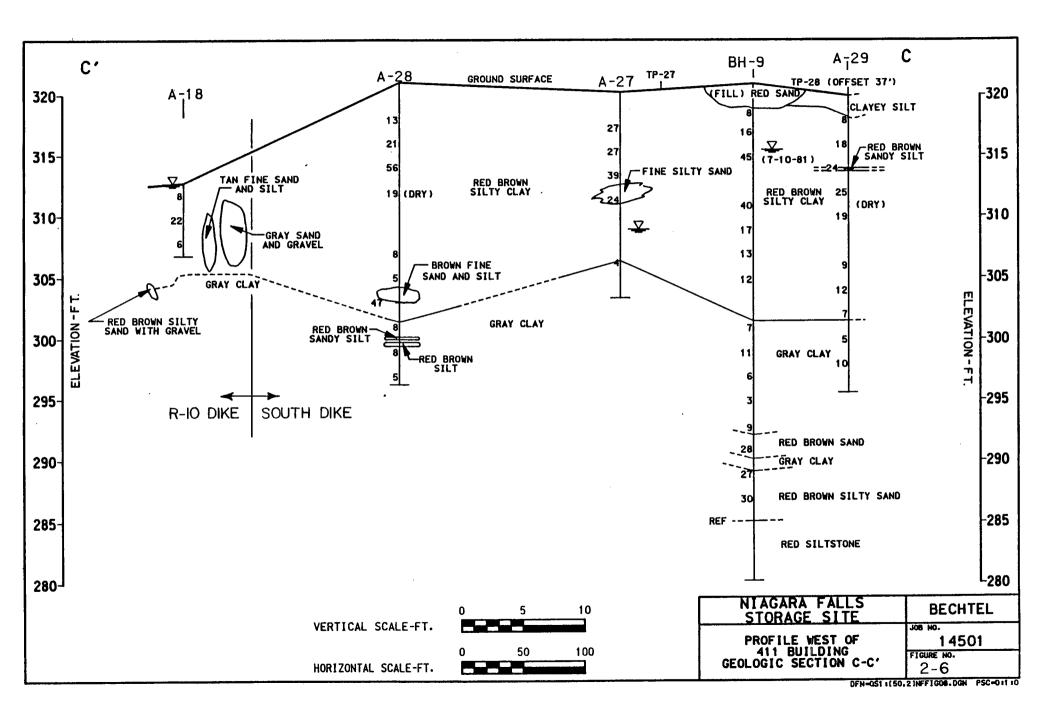


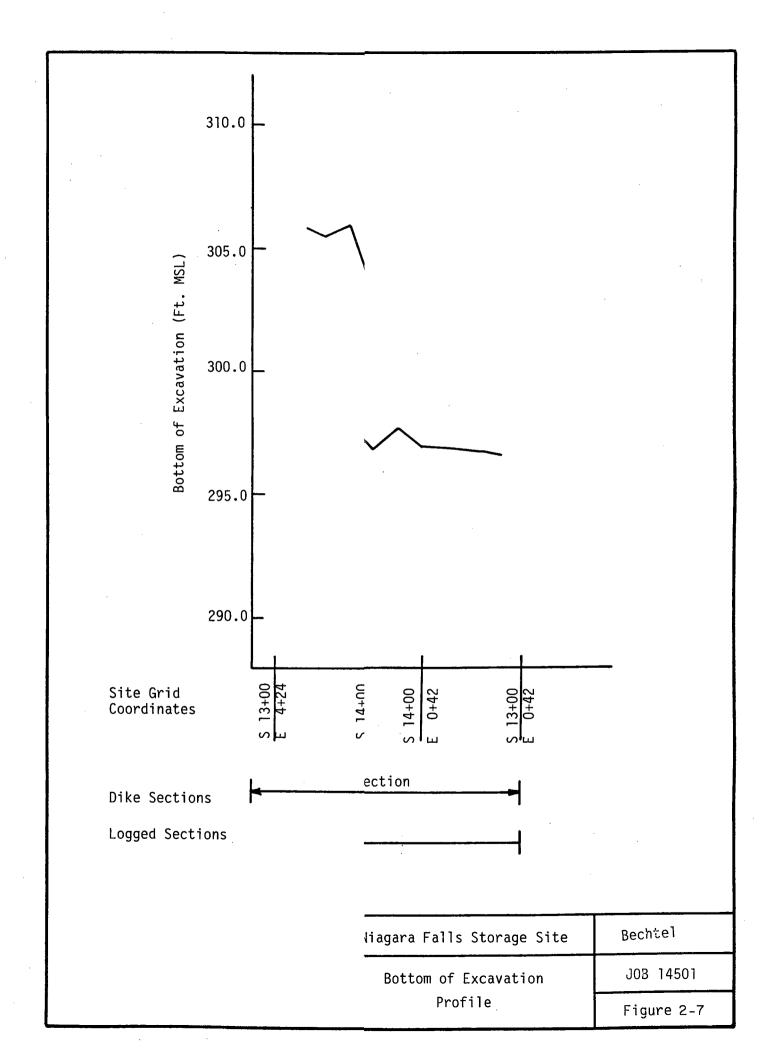


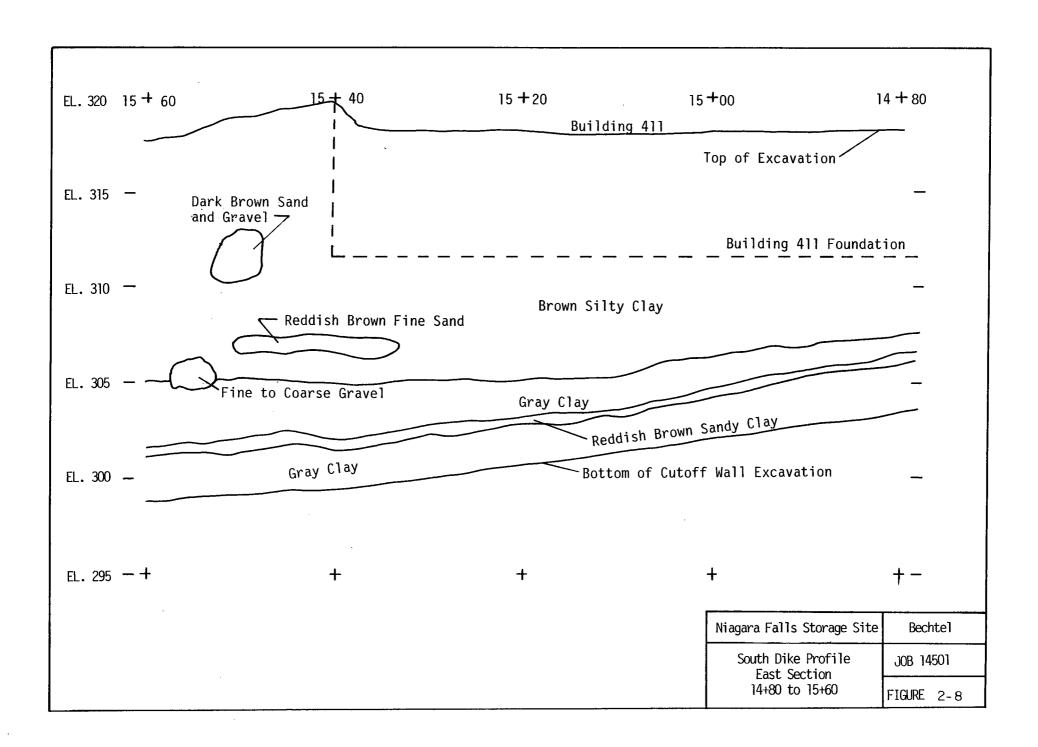


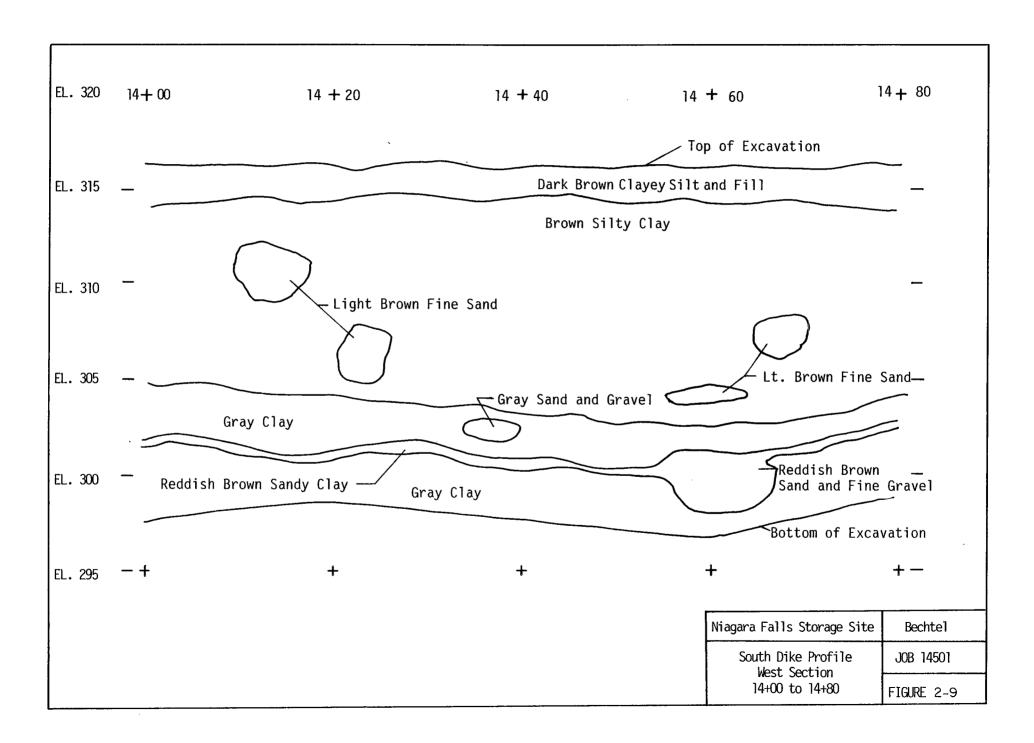


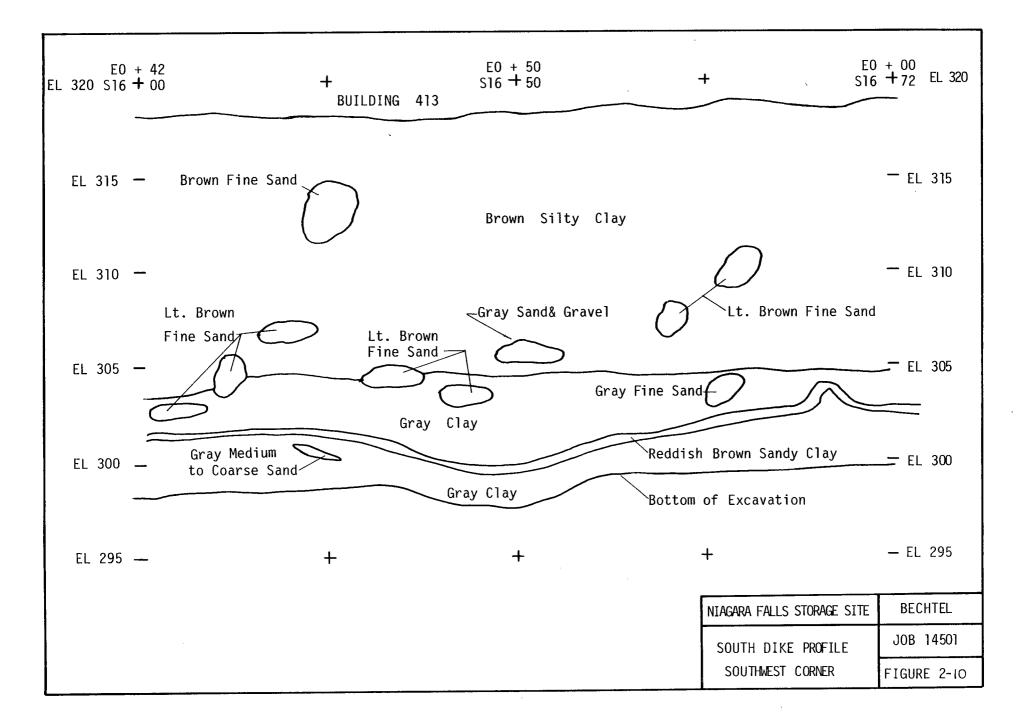


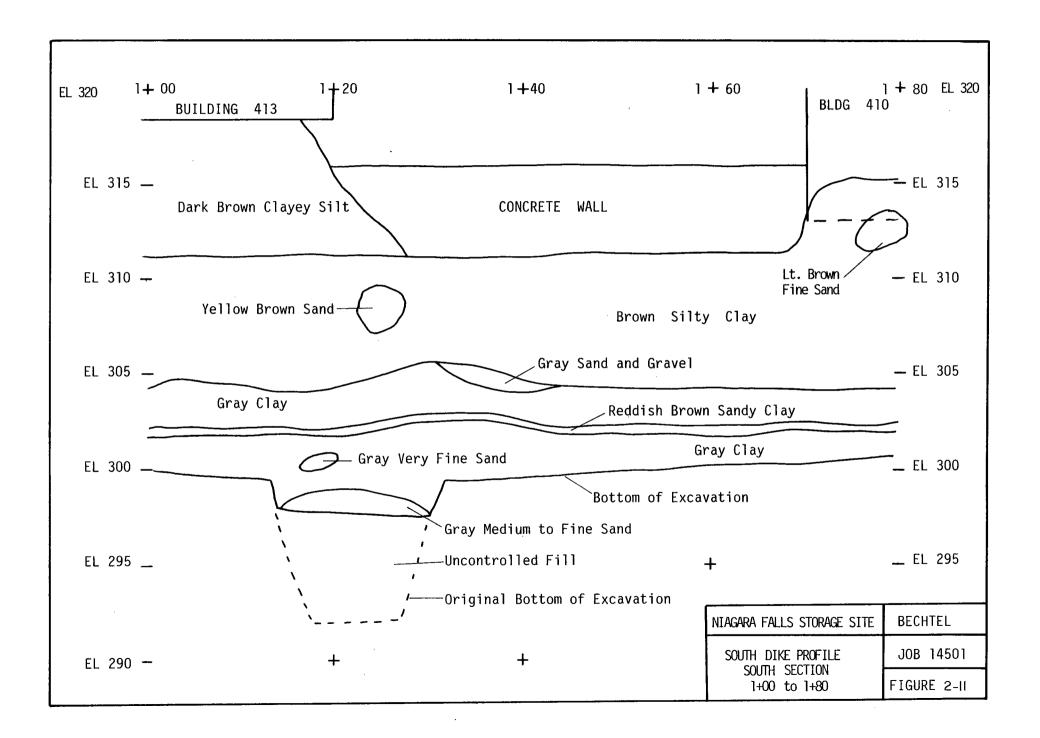


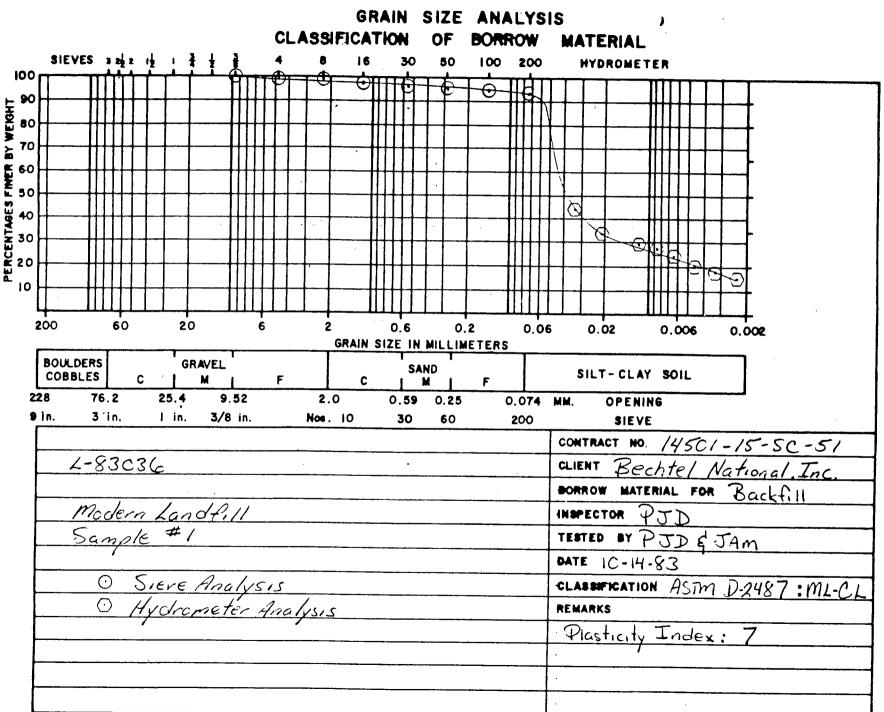












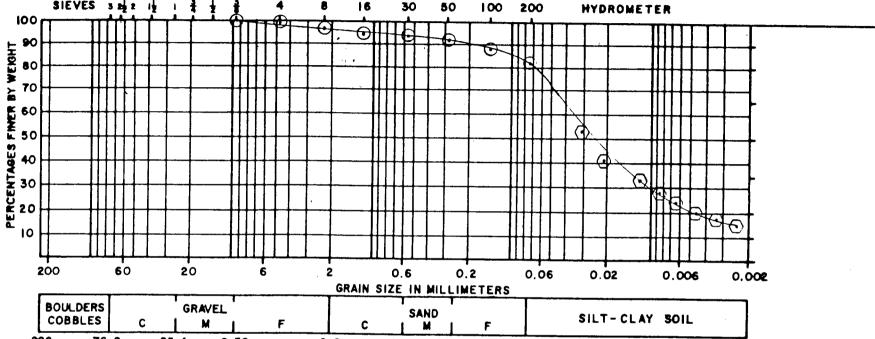


MEPORT NO.

APPENDIX 2-A

Results of Laboratory Tests

GRAIN SIZE ANALYSIS CLASSIFICATION OF BORROW MATERIAL \$1EVES 3 2 2 1 16 30 50 100 200 100 90



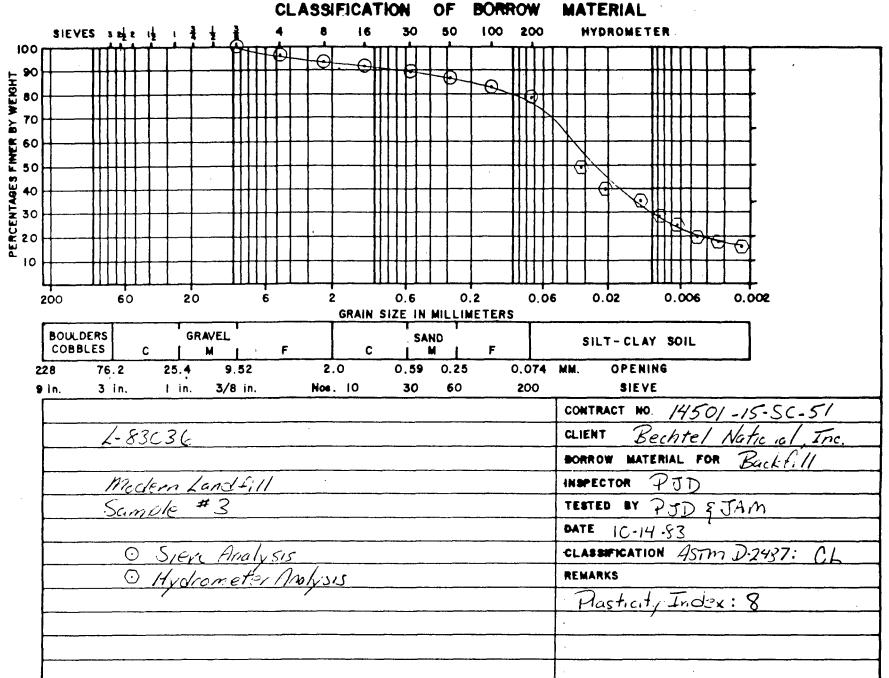
	ULDERS BBLES	С	_	AVEL M	F		C 1	SAN		F			SILT-CLAY SOIL	
228	76, 2	2	25.4	9.5	2	2.0	0.	59	0.25		0.074	MM.	OPENING	
9 in.	3 in.	1	in.	3/8 i	n.	Nos. 10	3	0	60		200		SIEVE	

	CONTRACT NO. 14501 -15-50 -51
L-83036	alient Bechtel National Inc
	BORROW MATERIAL FOR Backfill
Modern Landfill Sample #2	INSPECTOR PJD
Sample #2	TESTED BY PJD & JAM
	DATE 10.14.83
O Sieve Analysis	CLASSIFICATION ASTM D2487: CL
O Sieve Analysis O Hydrometic Aralysis	REMARKS
, , , , , , , , , , , , , , , , , , ,	Plusticity Index: 10



PEPORT 1-87036

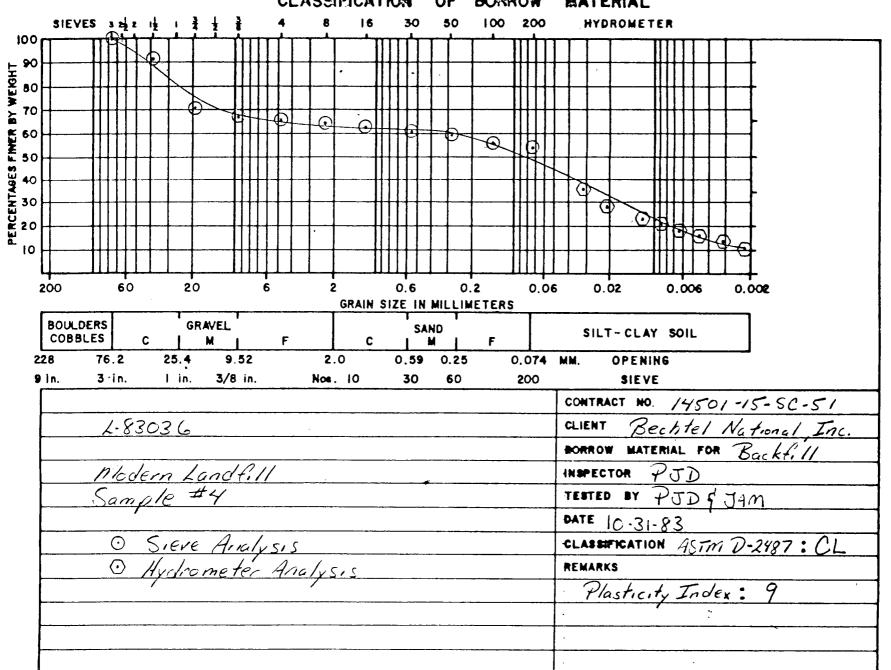
GRAIN SIZE ANALYSIS





MEPORT NO. 3

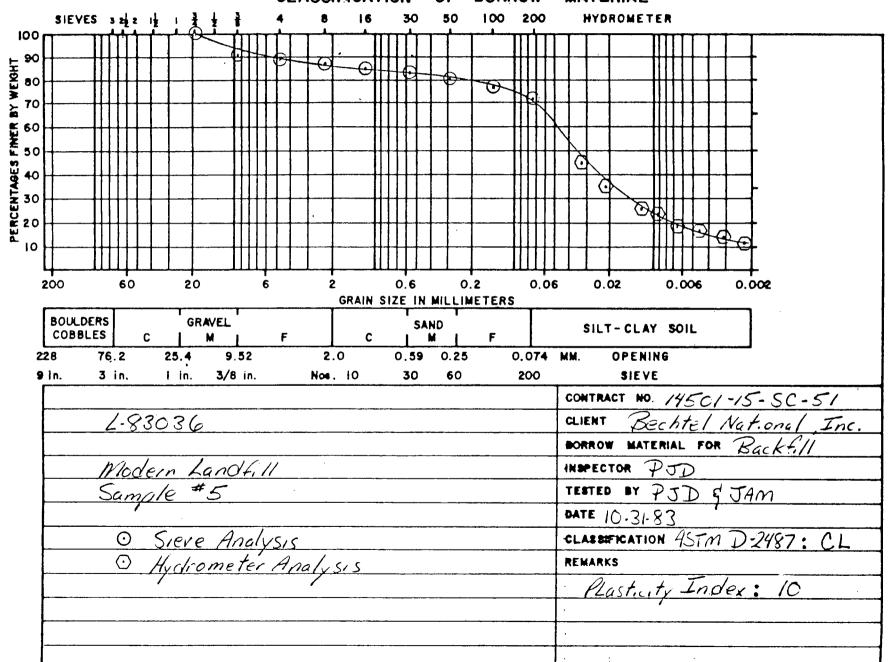
GRAIN SIZE ANALYSIS CLASSIFICATION OF BORROW MATERIAL





MEPORT NO. -

GRAIN SIZE ANALYSIS CLASSIFICATION OF BORROW MATERIAL





NEPONT NO 1

TA SHEET:		
	FISHER R	
WATER	D. EAST SY NE AREA C	2
WATER CONTENT DETERMINATION	FISHER RD., EAST SYRACUSE, N.Y. 13057 TELEPHONE AREA CODE 315/437-1429	L WOII Inc
H	Y. 13057 37-1429	Ę
ETERM		
ITANI		
8		

Sample No.	1	2	3	4	5	6
Specimen No.				,	·	
(Depth) (Elev.) ft.						
Classification:						
W.Gl. (Dish) No.						
No. blows-(LL Test)						
Wet wt. W _t + glass	128.6	175.0	132.9	129.6	133,6	127.9
Dry wt. W _s + glass	124.3	170.5	127.2	125.3	128.7	123.6
Wt. of water, W _w	4.3	4.5	5.7	4.3	4.9	4.3
Dry wt. W _s + glass	124.3	170.5	127.2	125.3	128.7	123.6
Tare wt. of glass	89.8	134.9	89.9	86.5	86.5	86.5
Dry wt. W _s	34.5	35.6	37.3	38.8	42.2	37.1
w = Ww	4.3	4.5	5.7	4.3	4.9	4.3
W - W _S	34.5	35.6	37.3	38.8	42.2	37.1
Water Content, w	12.5%	12.6%	15.3%	11.1%	11.6%	11.6%
Speedy	12.6%	12.9%	13.6%	12.2%	12.9%	12.5%
Comments: Comparison	Between Sp	eedy Moisture	Meter	Date:		-
Readings a	nd Actual M	oisture Readi	ngs	Technician:	PJD	

Boring(Pit) No.

Boring Nos.

L-83036 - N.F.S.S.

APPENDIX 2-B

Field and Laboratory Density Test Results



COMPACTION CONTROL REPORT

Job No.	L-83036
Report #	53
 Standard	Count

	Nuclear Method	Nepol C #
X	Sand Cone Method	Moisture Standard Count
	Ballon Method	Density Standard Count

Γest No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
1	9/15	\$-1345 E-424 Elev. 306.0'	118.3	126.7	11.7	113.4	95.9
2	9/15	S-1378 E-424 Elev. 307.01	118.3	126.3	10.7	114.1	96.4
3	9/15	S-1505 E-424 Elev. 302.0'	118.3	126.1	11.7	112.9	95.4
							-
		•					
·							
		,					
					,		
	-						
	1						

COMMENTS: Uncontaminated Material

Notes: Density shown:

lbs. per cubic foot

Water Content:

Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample

indicated by material mark.



COMPACTION CONTROL REPORT	JOB NO. L-83036				
	Report # 54				
Nuclear Method					
X Sand Cone Method	Moisture Standard Count				

Density Standard Count

lest No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
1	9/19	S-13+82 E-4+26 El. 306.0'	118.3	114.7	13.0	101.5	85.8*
2	9/19	S-13+82 E-4+26 E1. 305.0'	118.3	127.5	11.4	114.5	96.7
3	9/19	S-14+95 E-4+24 E1. 304.0'	118.3	112.4	18.5	94.9	80.2*
-					·		
		`					
		,					
· ———		_					
<u> </u>	-						
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· <u>. </u>							
	1						

Ballon Method

COMMENTS:	Uncontaminated	Material .	- Test	//2 ls	Retest	of #1	*Test Failure
				<u> </u>			

Notes: Density shown: Ibs. per cubic foot

Water Content: Percent of dry weight



COMPACTION CONTROL REPORT	Job No. L-83036
	Report # 55
Nuclear Method	
X Sand Cone Method	Moisture Standard Count
Ballon Method	Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
1	9/20	S-14+95 E-4+24 E1. 304.0'	118.3	128.7	12.0	114.9	97.1
2	9/20	N-19+40 W-0+95 El. 313.0'	127.4	139.9	- 13.1	123.7	97.1 ·
3	9/20	S-16+05 E-4+24 E1. 302.5'	118.3	130.0	11.8	116.3	98.3
4	9/20	S-530 - E-40 El. 319.5'	121.4	130.3	12.8	115.5	95.2
5	9/20	S-13+60 E-4+22 El. 310.0'	118.3	126.4	11.6	113.3	95.7
6	9/20	S-15+40 E-4+24 E1. 307.5'	118.3	126.5	11.4	113.6	96.0
		`					
							•
		,					
							-
				a -	-11	-	
				Bo	(7)	_	
	1					•	
	1						1
					İ		
	1						
-						1	

COMMENTS: Uncontaminated Material - Test #1 is retest of #3 9/19/83 Test #2 Approx. 10% of

Material >3/4"

Notes: Density shown: lbs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample indicated by material mark.

٨.



COMPACTION	CONTROL	DUDART
LUMPALITUN	CUNTRUL	REPURI

Job No. L-83036 Report # 56

<u>x</u>	Nuclear Method					
	Sand Cone Method					
	Ballon Method					

Moisture Standard Count Density Standard Count

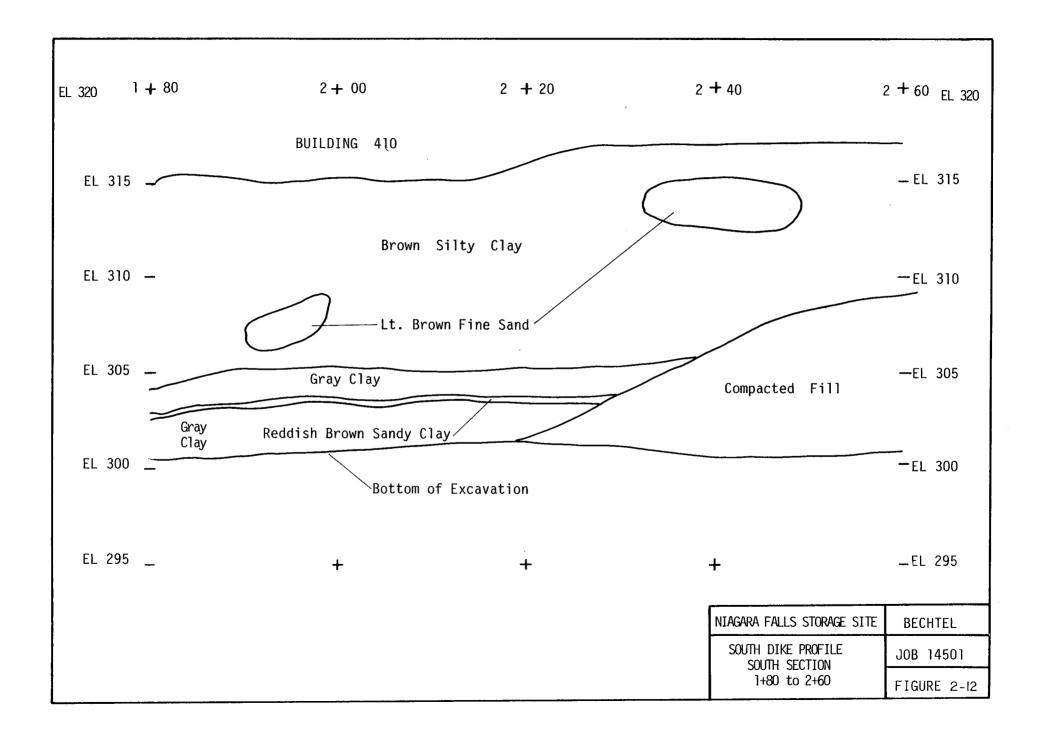
Γest No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
1	9/23	S-13+70 E-0+36 E1. 303.0'	118.3	119.1	12.9	105.5	89.2*
2	9/23	S-13+70 E-0+36 E1. 303.01	118.3	127.3	12.0	113.7	96.1
3	9/23	S-16+10 E-4+24 E1. 306.01	118.3	131.0	11.1	117.9	99.7
4	9/23	S-14+35 E-4+24 E1. 310.0'	118.3	127.7	12.6	113.4	95.9
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COMMENTS: Uncontaminated Material: Test #2 is Retest of #1-9/23 *Test Failure

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight Precent Compaction: Based on maximum dry density obtained on sample

indicated by material mark.





COMPACTION CONTROL REPORT	Job No. L-83036
	Report # 65
Nuclear Method	
X Sand Cone Method	Moisture Standard Count

Density Standard Count

Γest No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/1	S-13+80 E-0+42 E1. 318.5'	124.6	133.2	10.7	120.3	96.6
2U	10/1	S-15+30 E-0+42 El. 310.5'	124.6	139.8	12.9	123.8	99.4
3U	10/1	S-15+55 E-4+44 E1. 315.0'	124.6	134.6	13.1	119.0	95.5
4U	10/1	S-16+70 E-3+45 El. 310.5'	124.6	134.2	13.2	118.6	95.1
5U	10/1	S-14+60 E-0+40 El. 312.5'	124.6	133.5	12.0	119.2	95.7
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Ballon Method

COMMENTS: Uncontaminated Material

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum

dry density obtained on sample indicated by material mark.



COMPACTION	CONTROL	REPORT	Job	No.	<u>L-</u>	83036
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	Report #67
Nuclear Method	
X Sand Cone Method	Moisture Standard Count
Ballon Method	Density Standard Count

67

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
1 U	10/4	S-16+69 E-3+20 El. 312.5'	124.6	128.9	13.3	113.8	91.3*
2U	10/4	S-13+80 E-0+40 E1. 320.0'	124.6	132.8	13.7	116.8	93.7*
3U	10/4	S-13+80 E-0+40 E1. 320.01	124.6	133.6	12.7	118.5	95.1
4U	10/4	S-16+71 E-3+20 El. 312.5'	124.6	133.9	12.8	118.7	95.3
5U .	10/4	S-15+60 E-4+45 El. 317.5'	124.6	136.1	12.0	121.5	97.5
6u	10/4	S-14+93 E-0+43 E1. 314.0'	124.6	136.6	12.4	121.5	97.5
7U	10/4	S-13+80 E-0+42 E1. 318.0'	124.6	134.8	12.7	119.6	96.0
80	10/4	S-14+20 E-4+42 E1. 320.0'	124.6	134.7	12.8	119.4	95.8
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						*Test Fa	lure

COMMENTS: Uncontaminated Material: 3U Retest of #2U 10/4/83; 4U Retest of #1U 10/4

#1U Reworked and Dried; #2U Re-Rolled Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample

indicated by material mark.



COMPACTI	ON	CONTROL	REPORT

Job No. L-83036

Report # 68

	Nuclear Method
X	Sand Cone Method
	Ballon Method

Moisture Standard Count _____ Density Standard Count ___

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Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/5	\$-16+20 E-0+42 E1. 302.0'	124.6	133.9	12.6	118.9	95.4
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COMMENTS: Uncontaminated Material

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight



COMPACTION CONTROL REPORT	JOD 140. L-83036
	Report #69
Nuclear Method	
X Sand Cone Method	Moisture Standard Count
Ballon Method	Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/6	S-14+46 E-0+40 El. 320.0'	124.6	128.0	14.2	112.1	90.0*
2U	10/6	S-16+68 E-3+30 El. 313.0'	124.6	134.4	11.8	120.2	96.5
3U	10/6	S-16+20 E-4+35 E1. 314.01	124.6	134.9	12.1	120.3	96.6
4υ	10/6	S-14+46 E-0+40 E1. 320.0'	124.6	130.4	20.0	108.7	87.2*
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COMMENTS: Uncontaminated Material #10 Reworked & dried retest taken 10/6 #40 Then lift was

taken out

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight



COMPACTI	ON	CONTROL	REPURI

Job No. L-83036

Report #

Nuclear Method

x Sand Cone Method

Ballon Method

Moisture Standard Count Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/7	S-15+35 E-4+42 El. 319.01	124.5	137.3	12.3	122.3	98.2
2U	10/7	S-14+00 E-4+43 E1. 319.5'	124.5	133.9	12.1	119.4	95.9
3U	10/7	S-16+68 E-3+50 E1. 314.5'	124.5	121.6	14.3	106.4	85.5*
40	10/7	S-16+68 E-3+50 E1. 314.5'	124.5	135.3	12.4	120.4	96.7
5U	10/7	S-15+00 E-0+42 E1. 303.01	124.5	133.8	1.1.8	119.7	96.1
6U	10/7	S-13+85 E-0+46 El. 321.5'	124.5	136.7	13.0	121.0	97.2
7U	10/7	S-16+30 E-4+50 E1. 318.0'	124.5	135.2	12.3	120.4	96.7
80	10/7	S-15+30 E-0+41 E1. 303.5'	124.5	134.8	12.2	120.1	96.5
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COMMENTS: Uncontaminated Material: Test #3U Reworked & Rolled Retest #4U 10/7

Notes:

Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample

indicated by material mark.



COMPACTION CONTROL REPORT	Job No
	Report # 71
Nuclear Method	
X Sand Cone Method	Moisture Standard Count
Ballon Method	Density Standard Count

Γest No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/10	S-15+30 E-4+40 El. 320.0'	124.5	137.7	12.5	122.4	98.3
2U	10/10	S-13+65 E-0+40 E1. 324.01	124.5	136.5	13.2	120.6	96.9
3U	10/10	S-16+71 E-3+30 E1. 317.0'	124.5	134.2	12.4	119.4	95.9
40	10/10	S-14+45 E-0+44 E1. 319.01	124.5	133.9	11.9	119.7	96.1
5U	10/10	S-15+10 E-4+43 E1. 321.0'	124.5	135.6	13.1	119.9	96.3
6U	10/10	S-16+80 E-0+60 E1. 304.0'	124.5	130.6	11.1	117.6	94.4*
							
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COMMENTS: Uncontaminated Material: #6U re-rolled & no retest required *Test Failure

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight



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Job No. L-83036

Report # 72

	Nuclear Method				
X	Sand Cone Method				
	Ballon Method				

Moisture Standard Count _____ Density Standard Count ____

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/11	\$-16+55 E-0+55 E1. 305.5'	124.5	123.7	11.9	110.5	88.8*
2U	10/11	S-16+55 E-0+55 E1. 305.5	124.5	134.8	12.1	120.2	96.6
30	10/11	S-14+80 E-0+42 E1. 319.01	124.5	134.9	12.5	119.9	96.3
40	10/11	S-14+20 E-0+46 E1. 320.51	124.5	135.5	12.2	120.8	97.0
5U	10/11	S-16+70 E-3+05 E1. 304.5'	124.5	134.0	11.9	119.7	96.2
6U	10/11	S-16+70 E-0+58 E1. 306.01	124.5	134.6	11.9	120.3	96.6
7U	10/11	S-15+20 E-0+44 E1. 316.01	124.5	133.9	11.8	119.8	96.2
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	1	,				*Test Fai	ure

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COMMENTS:	Uncontaminated	Material;	#1U	Re-worked	and	Rolled	Retest	10/11	#2	

Notes: Density shown: lbs. per cubic foot Water Content: Percent of dry weight



COMPACTION CONTROL REPORT	Job No. L-83036
	Report # 73
Nuclear Method	
_x Sand Cone Method	Moisture Standard Count

Density Standard Count _

	Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
	1U	10/13	S-15+80 E-0+41 El. 313.0'	124.5	128.7	12.9	114.0	91.6*
A	2U -	10/13	N-39+96 E-4+40 E1. 297.94	124.4	136.8	14.4	119.6	98.5-
X	3⊍	10/13	N 40+22 E 4+45 E1. 298.1'	121.4	137.2	14.2	120.1	99.0-
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Ballon Method

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COMMENTS:	Uncontaminated	Material:	#1U Lift	Removed - No	Retest	*Test Failure

Notes: Density shown: ibs. per cubic foot

Water Content: Percent of dry weight



COMPACTION	CONTROL	DEDODE
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Job No. L-83036

Report # 74

	Nuclear Method	
X	Sand Cone Method	Moisture Standard Count
	Ballon Method	Density Standard Count
	Maximum In-Place	In-Place

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Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/17	S-16+70 E-2+05 E1. 302.0'	124.5	129.5	13.1	114.5	92.0*
2U	10/17	S-16+70 E-2+00 E1. 302.0'	124.5	133.6	12.4	118.9	95.5
3U	10/17	S-16+67 E-2+25 E1. 306.0'	124.5	134.8	12.5	119.8	96.2
40	10/17	S-16+72 E-2+00 El. 302.5'	124.5	134.6	12.6	119.5	96.0
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COMMENTS: Uncontaminated Material: Test #1U - Lift removed

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight



COMPACTION		

Nuclear Method χ Sand Cone Method Moisture Standard Count ____ Ballon Method Density Standard Count

Job No. L-83036

Report # 75

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	Test No.	Date	Location	Maximum Lab Dry Density	in-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
	10	10/18	S-13+58 E-4+42 E1. 324.0'	124.5	112.0	17.6	95.2	76.5*
	2U	10/18		124.5	134.6	12.2	120.0	96.4
A	3 U	10/18	N=40+17 E=4+42 E1. 307.1'	121.4	128.6	9.2	117.8	97.0-
	40	10/18	S-16+55 E-4+43 E1. 321.0'	124.5	128.4	17.7	109.1	87.6*
A	5 U-	10/18	S-15+75 E-3+20 E1. 320.0'	124.5	136.4	12.1	121.7	97 - 7-
N	€0	10/18	N-40+10 E-4+50 E1. 309.11	121.4	132.5	13.9	116.3	95.8
	7U	10/18	S-16+70 E-3+05 E1. 320.5'	124.5	128.0	15.2	111.1	89.2*
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COMMENTS: Uncontaminated Material: #10 Lift Reworked (Retest 10/19 #20); #40 Rerolled &

reworked (Retest 10/19 #4U); #7U Rerolled & reworked (Retest 10/19 #7U)
Notes: Density shown: lbs. per cubic foot Precent Compaction: Based on maximum

Water Content: Percent of dry weight

dry density obtained on sample indicated by material mark.



COMPACT	ON	CONTROL	REPORT

Job No. L-83036 Report # 76

	Nuclear Method
<u>X</u>	Sand Cone Method
	Ballon Method

Moisture Standard Count Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/19	S-15+20 E-0+40 El. 316.0'	124.5	132.7	14.4	116.0	93.2*
2U	10/19	S-13+58 E-4+42 El. 324.0'	124.5	134.2	13.4	118.3	95.1
3U	10/19	S-16+55 E-4+43 El. 321.0'	124.5	136.3	13.4	120.2	96.5
40	10/19	S-16+70 E-3+05 El. 320.5'	124.5	127.8	13.9	112.2	90.1*
50	10/19	S-14+75 E-4+46 El. 322.5'	124.5	134.9	13.2	119.2	95.7
 							
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						*Test Fai	ed

Uncontaminated Material: #3U retest of #4U 10/18; #4U retest of #7U 10/18; #2U retes COMMENTS: of #1U 10/18: #1U reworked & rolled (Retest #3U 10/20) #4U reworked and reolled

(Retest #7U 10/20) Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight



COMPACTIC'.	CONTROL	REPORT
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L-83036 Job No. 77 Report #

Nuclear Method	
X Sand Cone Method	Moisture Standard Count
Ballon Method	Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/20	S-13+90 E-0+38 E1. 324.5'	124.5	134.7	12.0	120.3	96.6
2U	10/20	S=16+10 E⊬4+43 E1. 323.0'	124.5	135.1	12.2	120.4	96.7
3U	10/20	S-15+20 E-0+40 E1. 316.0'	124.5	135.1	12.4	120.2	96.5
4υ	10/20	S-14+83 E-4+40 E1. 323.01	124.5	133.8	12.9	118.5	95.2
<u>-5U</u>	10/20	S-15+46-E-2+70-E1. 316.0'	117.01	124.1	13.6	109.2	93.4
6U	10/20	S-15+30 E-0+46 El. 317.5'	124.5	136.0	12.1	121.3	97.4
7U	10/20	S-16+70 E-3+05 E1. 320.5'	124.5	135.1	12.7	119.9	96.3
8υ	10/20	S-17+05 E-3+47 El. 323.0'	124.5	132.4	14.0	116.1	93.3*
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COMMENTS: Uncontaminated Material: #90% Compaction Required

Notes:

Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample

indicated by material mark.



COMPACTION CONTROL REP	COMPAC	711	ON.	CONTROL	REPORT
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Nuclear Method	
X Sand Cone Method	Moisture Standard Count
Ballon Method	Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10		S-15+20 E-0+46 El. 319.5'	124.5	142.1	12.6	126.2	101_4
-20	10/21	5-16+65 E 4+93 E1. 323.51	124.5	128.1	15.1	111.3	89.4 *
3U	10/21	S-15+33 E-4+42 El. 324.5'	124.5	139.2	12.7	123.5	99.2
4υ	10/21	S-16+75 E-3+15 El. 321.5'	124.5	134.9	11.9	120.6	96.8
5U	10/21	S-16+70 E-1+20 El. 299.0'	124.5	134.7	11.9	120.4	96.7
6U	10/21	S-14+70 E-4+35 El. 325.5'	124.5	135.6	11.3	121.8	97.9
7U	10/21	S-16+70 E-1+20 El. 300.0'	124.5	134.7	12.6	119.6	96.1
80	10/21	S-16+70 E-1+30 E1. 301.0'	124.5	135.6	11.6	121.5	97.6
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COMMENTS: Uncontaminated Material: *Denotes Test Failed: Test #2U Rerolled, no retest needs

#2U - 90% Compaction required Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample indicated by material mark.

4/4



COMPACTION	CONTROL	REPORT
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Job No. L-83036

Report # 79

	Nuclear Method				
X	Sand Cone Method				
	Ballon Method				

Moisture	: Standard	Count	
Density	Standard	Count	

						,	
Γest No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	10/22	S-16+73 E-1+02 E1. 306.51	124.5	134.1	11.3	120.5	96.8
20	10/22	S-16+75 E-3+00 E1. 321.51	124.5	139.7	11.4	125.4	100.7
30	10/22	S-15+20 E-0+40 E1. 322.5*	124.5	136.1	11.7	121.8	97.9
40	10/22	S-16+65 E-0+80 E1. 314.5	124.5	135.2	11.5	121.3	97.4
5U	10/22	S-16+75 E-2+10 E1. 315.0'	124.5	135.2	11.5	121.3	97.4
6U	10/22	S-16+68 E-1+50 E1. 309.0'	124.5	131.6	11.0	118.6	95.2
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MMENTS: Uncontaminated March

Pensity shown: 16s on 16% toot
Water Content Pensity Fide, weight



COMPACTION CONTROL REPORT	Job No. 1-83036
	Report # 81
X Nuclear Method	
Sand Cone Method	Moisture Standard Count

Density Standard Count

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
1U	10/31	S-16+72 E-1+52 E1. 315.0'	124.5	136.6	11.8	122.2	98.1
2U	10/31	N-24+50 E-4+25 E1. 311.2'	121.4	130.2	12.9	115.3	95.0
3U	10/31	S-16+65 E-2+75 E1. 321.5'	124.5	143.0	11.5	128.3	103.0
4U	10/31	S-16+69 E-1+23 E1. 315.5'	124.5	133.4	12.7	118.4	95.1
5U	10/31	S=16+70 E-0+92 E1. 318.5	124.5	137.1	11.9	122.5	98.4
6U	10/31	S-16+75 E-2+01 E1. 320.0'	124.5	135.2	12.0	120.7	97.0
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Ballon Method

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Notes: Density shown: lbs. per cubic foot

Water Content: Percent of dry weight



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Job No. L-83036

Report # 82

	Nuclear Method
X	Sand Cone Method
	Ballon Method

Moisture Standard Count ______

Density Standard Count _____

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	11/1	S-16+74 E-2+08 El. 318.0'	124.5	138.3	12.9	122.5	98.4
2U	11/1	S-16+65 E-3+55 El. 321.5'	124.5	134.0	12.4	119.2	95.8
3U	11/1	S-16+68 E-3+25 El. 319.5'	124.5	135.5	11.8	121.2	97 - 3
40	11/1	S-16+65 E-1+61 E1. 319.0'	124.5	133.8	12.2	119.3	95.8
5U	11/1	S-16+75 E-1+06 E1. 319.0'	124.5	134.8	12.3	120.0	96.4
6U	11/1	S-16+63 E-0+60 E1. 320.5'	124.5	137.3	12.8	121.7	97.8
7U	11/1	S-16+70 E-2+30 E1. 318.5'	124.5	135.2	12.5	120.2	96.5
80	11/1	S-16+75 E-2+83 E1. 318.5'	124.5	134.8	12.5	119.8	96.2
90	11/1	S-16+62 E-1+15 El. 318.5'	124.5	137.3	12.7	121.8	97.9
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COMMENTS: Uncontaminated Material

Notes: Density shown: lbs. per cubic foot

Water Content: Percent of dry weight



COMPACTION	CONTROL	REPORT
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Nuclear Method

X Sand Cone Method

Ballon Method

	Job No	L-63036
	Report #	83
Moisture	Standard	Count

Density Standard Count ____

Test No.	Date	Location	Maximum Lab Dry Density	In-Place Wet Density	Water Content	In-Place Dry Density	Percent Compaction
10	11/2	S-16+67 E-2+35 E1. 320.0'	124.5	141.5	12.8	125.4	100.8
2U·	11/2	S-16+10 E-4+40 E1. 325.0'	124.5	135.4	12.6	120.2	96.5
30	11/2	S-16+95 E-2+83 E1. 322.0'	124.5	129.9	13.8	114.1	91.7
40	11/2	S-16+66 E-1+20 E1. 320.5'	124.5	134.3	12.2	119.7	96.1
5U	11/2	S-16+30 E-4+43 E1. 325.5'	124.5	138.0	12.4	122.8	98.6
							
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COMMENTS: Uncontaminated Material: Test #3 90% Compaction Required

Notes: Density shown: 1bs. per cubic foot

Water Content: Percent of dry weight

Precent Compaction: Based on maximum dry density obtained on sample

indicated by material mark.

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MOLD WEIGHT	11.53	11.53	11.53	11.53
WET SAMPLE WT	4.27	4.49	4.56	4.58
WET DENSITY, PCF	128.1	134.7	136.8	137.4
MOISTURE CONTENT	5.9	8.7	12.2	14.1
DRY DENSITY, PCF	121.0	123.4	121.4	120.4
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MOLD WEIGHT	11.55	11.55	5 11.55	11.55			
WET SAMPLE WT	4.35	4.59	5 4.58	4.58			
WET DENSITY, P.C.F	130.5	136.	5 137.4	137.4			
MOISTURE CONTENT	6.6	9.7	12.6	13.6			
DRY DENSITY, P.C.F.	122.4	124.4	1 122.c	121.0			
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SAMPLE NO	1	2	3	4	<u> </u>]	,
MOLD + SAMPLE WT.	15.88	16.05	16.17	16.20			
MOLD WEIGHT	11.55	11.55	11.55	11.55			
WET SAMPLE WT	4.33	4.50	4.62	4.65			
WET DENSITY, P.C.F.	124.4	135.0	138.6	134.5			
MOISTURE CONTENT	6.8	9.2	11.4	14.4	·		
DRY DENSITY, P.C.F.	121.6	123.6	124.4	121.9			
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VOLUME 3

INTERIM CAP CONSTRUCTION

AND

PERMEABILITY TESTING

AUGUST-OCTOBER, 1984

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1.0 INTRODUCTION

Volume 3 of the Post-Construction Report contains the results of the remedial construction activities associated with the placement of the first sections of the interim cap at the Niagara Falls Storage Site (NFSS). The functional objectives of the interim cap are to exclude surface water from the contained waste and to provide a barrier to radiation and radon emanation. The interim cap design consists of a surficial layer covering an impervious clay blanket. The surficial layer, which is a 1.5 feet thick seeded topsoil layer, acts as a protective cover for the lower clay layer. The lower clay layer, which is the principal barrier against moisture infiltration and radiation emanation, consists of 3 feet of compacted clay soil. The interim containment system was designed to provide a minimum expected useful life of 25 years. Details of the functional and design concept of the interim cap are contained in the, "Waste Containment Design Report for the Niagara Falls Storage Site," (Reference 1).

The specific work performed for the interim cap between August and October, 1984 was the placement of the clay layer in the northern section of the waste containment area. The boundary limits of the work performed to date are shown on Figure 3-1. A general site and vicinity plan are shown on Figure 3-2.

Listed below are the entities involved with the placement of the clay cap.

Department of Energy: Owner

<u>Bechtel National, Inc.</u>: Project Management Contractor: Interim cap design, construction inspection and management.

<u>Cowper Construction Company, Inc.</u>: Construction (placement and compaction) of interim cap.

Empire Soils Investigation, Inc.: Laboratory and in-place testing of clay material.

<u>Eberline</u>, <u>Inc.</u>: On-site radiological survey and radiological safety for all site personnel.

In addition to the results of the construction activities, also contained in this volume of the Post Construction Report are the results of a laboratory testing program of the clay material. Tests were conducted on undisturbed samples taken from the dike and cutoff wall (see Volumes 1 and 2), and on disturbed samples of the clay cap material. The testing program included grain size analysis, Atterberg limits, specific gravity, permeability and consolidated undrained triaxial compression tests. The major emphasis of the testing program was to confirm permeability values that were assumed in the design of the interim cover. The results of the testing program are discussed in Section 6.0.

2.0 BACKGROUND

The construction of the waste containment cover is the final stage of the containment system planned for NFSS. Earlier work on the containment system consisted of constructing a series of cutoff walls and dikes surrounding the waste containment area. The earlier work, which is discussed in Volumes 1 and 2, was completed during 1982 and 1983. The dike and cutoff wall was designed to provide an effective barrier against migration of ground water into the containment area, and to prevent ground water from migrating from the enclosed area.

One of the major functions of the clay cap is to exclude surface water from entering the contained wastes. To accomplish this task the clay cover was specified to be a low permeability layer extending beyond the limits of the dike. A typical section of the interim cap is shown in Figure 3-3. The design permeability of the clay cap is 1×10^{-7} cm/sec (Reference 1).

3.0 AVAILABLE INFORMATION

The details regarding the design of the interim cap are contained in the, "Waste Containment Design Report for the Niagara Falls Storage Site," by Bechtel National, Inc. (Reference 1). Reference 1 also contains the design details of the cutoff wall and dike. A description of the construction activities associated with the cutoff wall and dike are contained in Volume 1 and 2 of the Post-Construction Report. Volume 1 deals with the R-10 dike and cutoff wall, which is the northern section, and Volume 2 deals with the South dike and cutoff wall.

4.0 CLAY CAP MATERIAL

The material specification requirements for the clay cap material were as follows:

- O The plasticity index shall be not less than 10 nor more than 20
- o The liquid limit shall be not less than 30 nor more than 50
- o Gradation: 3/4-inch-100% passing
 No. 200 Sieve-80% passing.

These specification requirements were selected to achieve a material, which when compacted, would have a permeability of less than 1×10^{-7} cm/sec. In addition, a material with a low plasticity was selected to minimize the shrink/swell potential due to any moisture content flucation of the clay soil. To further reduce the potential for shrink/swell, and to obtain the required permeability a compaction requirement of 95 percent of modified proctor maximum density (ASTM D 1557) was specified. A moisture criteria of 1 to 3 percent above optimum moisture was also established.

The material that was used for the clay cap was taken from local off-site borrow areas. The material used at the start of the work was taken from adjacent property owned by the Lew-Port School. The rest of the material, which was used to complete the work was taken from a borrow pit on Swann Road, approximately 1/2 mile from the site. The clay material from both borrow areas was transported to the site by truck and end dumped on top of the waste pile prior to spreading. The location of the two borrow areas are shown on Figure 3.

The clay cap material was a dark brown silty clay soil. The soil is very typical for this region for the upper unconsolidated deposits identified as the brown clay unit. The properties and geologic history of this brown clay unit are described in the Geologic Report - Niagara Falls Storage Site Lewiston, New York (Reference 2). The material used in the construction of the clay cap is from the same unit as the soil used for the construction of

both the cutoff walls and dikes. The clay material was tested during the construction period to verify compliance with the technical specification. The test results are discussed in Section 6 of this report. If any appreciable amounts of sand, gravel, or deleterious matter were found in the clay material that material was removed and wasted at the borrow areas.

5.0 CLAY CAP CONSTRUCTION

The construction of the clay cap was performed between August and October, 1984. All work was performed by Cowper Construction Company, Inc. under the continuous technical direction of Bechtel National, Inc. The work was also monitored on a periodic basis by a geotechnical engineer from Bechtel.

The work, in general, consisted of placing approved clay fill material and then compacting the material to a specified density within the specific moisture content range. Compaction requirements for the compacted material was a minimum of 95 percent of modified proctor maximum density in accordance with ASTM D 1557. The technical requirements for the placement of the clay cap are contained in Technical Specification for Earthwork Construction (Interim Cap), specification No. 14501-301-27-C-01.

The placement of the clay cap this year was accomplished in three phases as shown on Figure 3-1. The bottom lift of clay material, which was placed directly on the contaminated material, was placed by pushing the fill ahead of the spreading equipment (dozer) to prevent contamination of the equipment. doing so, it permitted the dozer and all other equipment to operate in the waste pile area without coming directly in contact with the contaminated soil. Contaminated soil under the clay cap had been previously compacted by other contractors to 90 percent of maximum density (ASTM D 1557). The initial lift of the clay cap had a maximum thickness of approximately eight inches. After spreading the clay soil in the eight inch lift the material was compacted to achieve the required density. At the start of the work in the Phase I area, the contractor elected to use a vibrating smooth steel drum roller for compacting the clay soil. However, due to problems in achieving the required degree of compaction the steel drum roller was replaced by the contractor with a vibratory tamping foot roller. The roller was an Ingersoll-Rand model SPF-56.

After the bottom lift was placed and compacted, succeeding lifts were placed until the final grade was obtained. All lifts were limited to a maximum loose thickness of eight inches. All lifts were compacted by three or more passes of the roller. The top lift at the end of each work day was also rolled with

the steel drum roller to seal the surface and maintain the moisture condition. Any lift that had been sealed or had dried on the surface was scarified and moisture conditioned prior to placing a new lift. It was also necessary during the construction period to moisture condition the fill material to obtain a moisture content within the specified range. The method of moisture conditioning varied during the construction period depending on the moisture level of the fill coming from the borrow area and on weather conditions. During the major portion of the work it was necessary to add water to the fill material. It was usually only after periods of rain that it became necessary to work the fill material to lower the moisture content.

The transitions between Phase I and Phase II, and Phase II and Phase III were accomplished by feathering the fill out into the new area and then placing the new fill in lifts upon the feathered edge. The surface of old fill was scarified and wetted, when necessary, prior to the placement of the new fill. This process was continued until the fill height in the new phase matched the existing adjacent fill height.

The last stage in the construction of the clay cap was the final grading and surface sealing of the upper layer. Final grading of the clay soil was accomplished using a motor grader and dozer until the fill height was within 0.1 feet of design grade. The 1.5 feet, thick topsoil layer of the interim cap was not placed during this construction season. The topsoil layer was not placed pending a DOE decision as to whether to proceed from the interim cap to the final cover (details of the final cover design are contained in Reference 1). Proceeding with the final cover would have required the topsoil layer to be removed, if it had been placed.

Attached at the end of this report are three photographs showing different stages of the construction of the clay cap. Shown in the first photograph is the spreading and compaction of the clay material; the second photograph shows a moisture test being performed, and the last photo shows the surface after being sealed with the steel drum roller.

6.0 QUALITY CONTROL AND LABORATORY TESTING

6.1 GENERAL

Laboratory and field testing of the clay material were performed to verify that the material met the specification soil classification requirements, that the required degree of compaction was being obtained and that the compacted material had a permeability of less than 1×10^{-7} cm/sec. All laboratory and field density testing was conducted by Empire Soils Investigations, Inc. under contract to Bechtel National, Inc. Additional field moisture testing was conducted by Bechtel.

6.2 COMPACTION CONTROL

Compaction control of the clay cap was maintained by performing a series of field density tests on the compacted soil. A specific area was tested after the contractor had indicated that the compaction in that area had been completed. The exact location of the test was selected either by Bechtel or by the field engineer from Empire Soils Investigations, Inc. The in-place wet density was determined using the sand cone test method in accordance with ASTM D 1556, except that the moisture content of the test sample was determined using the "Speedy Moisture Meter." A correlation between oven-dried moisture percentages and Speedy Moisture Meter readings was made prior to the start of work and repeated during the construction period. After completing a field test, the dry density of that material was calculated and then compared to the maximum dry density of that material to determine the percent compaction. The maximum density of the clay material was determined by performing a series of modified Proctor tests in accordance with ASTM D 1557. In order for any area to be accepted the in-place density had to equal or exceed 95 percent of the maximum density. Those areas that failed to obtain 95 percent were rejected. Those areas that were rejected were either recompacted by additional passes of the roller or reworked and then recompacted. After proper corrective action all areas that had failing tests were retested. An area was approved and the work allowed to proceed only after an acceptable test result was obtained.

Field density tests were conducted on every 400 cubic yards of material placed as a minimum. In total 81 density tests were run on the compacted material with an average percent of compaction of over 98.0 percent. This average compaction does not include any failing tests since those areas were reworked and retested. The field compaction tests results are contained in Appendix 3-A. The data sheets show the test number, date of test, location, in-place density and moisture content, and the maximum density that was used to determine the percent compaction. Compaction tests were run on the borrow material prior to initial placement and then periodically during the construction period. This procedure was required to verify that the compaction test best represented the material being placed at a given time. The maximum dry density ranged from 121 to 128 pounds per cubic foot with an average value of 126 pounds per cubic foot. The results of the compaction tests are contained in Appendix 3-B.

6.3 MOISTURE CONTROL

The technical specification required the moisture content of the clay material to be 1 to 3 percent above the optimum moisture at the time of placement. In order to check the moisture content, daily tests were run on the material prior to compaction. When the test results indicated the moisture content was outside the required range corrective actions were taken. Typically during construction it was necessary to add moisture to the fill material until the desired moisture level was obtained. The moisture content tests performed in conjunction with the field density tests typically showed lower moisture levels than those measured prior to placement. This would indicate some drying due to sun and wind action was occuring during spreading and compaction. The degree of drying depended on the weather conditions and time between compaction and testing, but was typically around 1 to 2 percent. The percent moisture test results from the field density test are shown on Table 3-1.

6.4 CLASSIFICATION TESTING

The required material properties of the clay soil were stated in Section 4.0. To verify that the soil met these requirements classification tests (grain

size distribution and Atterberg limits) were run on each compaction test sample. The test results are plotted on Figure 3-5. Shown on this figure are the specification limits and the individual test results. As is shown on this figure, all the test results were either within or very close to the specification limits.

6.5 PERMEABILITY TESTING

6.5.1 Background

The specification for the construction of the clay cap requires the material when compacted to have an in-place permeability equal to or less than 1×10^{-7} cm/sec. In order to verify the permeability of the compacted material, laboratory tests were conducted on both undisturbed Shelby tube samples and laboratory compacted samples. No field permeability testing was conducted because the anticipated range of permeability values is lower than the range that can be effectively tested by normal field test. As an example, Reference 3 indicates the lower end of measurable values from field tests are between 1×10^{-6} and 1×10^{-7} cm/sec.

The permeability testing of the compacted clay also included the dikes and cutoff wall surrounding the waste pile. The dikes and cutoff wall were also designed for an in-place permeability equal to or less than 1×10^{-7} cm/sec.

6.5.2 <u>Undisturbed Sample Testing</u>

The undisturbed Shelby tube samples were taken between July 3 and July 9, 1984. All the samples were taken from either the dike or cutoff wall. The drill holes were advanced to the selected sampling depth by rotary drilling using hollow stem augers. The samples were obtained by pushing a 3-inch diameter Shelby tube into the soil. No water was used in the drilling process. The six sampling locations are shown on Figure 3-1. As can be seen in this figure the sampling locations were spaced on all sides of the enclosure. The boring logs showing the depth and number of samples taken from each boring are contained in Appendix 3-C. All borings were grouted upon completion with a mixture of cement, sand, and bentonite.

Eight samples were selected for permeability testing from those collected. Of the eight samples tested two were from the dike section with the remaining six coming from the cutoff wall. An equal number of samples were taken from the R-10 dike area and the South dike area. It was important to test both areas because the fill material was from different borrow areas and was placed by different contractors over a two-year period.

The test procedure that was used to determine the permeability, in general, was performed as follows. The sample after being extruded and cut from the Shelby tube was sealed in a rubber membrane and placed in a triaxial chamber. In this method, the rubber membrane acts as the outer boundary of the permeameter. The triaxial chamber is used inorder to allow a confining pressure to be applied to the membrane and sample, in an effort to stop any leakage along the interface between the sample and the permeameter. In soil samples of low permeability it is extremely important to eliminate all leakage to ensure meaningful test results. After the sample was sealed in the chamber, it was saturated by applying a back pressure at both ends of the sample. The average degree of saturation of the test samples was over 99 percent. Upon completion of the saturation, the sample was placed under a differential head to initiate flow through the sample. The flow quantity was measured until a steady state condition was obtained over a 24 to 48-hour period. Once the steady state condition was obtained the sample permeability was calculated. Each sample was tested at both 5 and 10 pounds per square inch differential head. The test results of the permeability are contained in Appendix 3-D with a summary shown in Table 3-2. Also included in Appendix 3-D is the test procedure used by Empire Soils Investigations, Inc. for permeability testing.

6.5.3 Laboratory Compacted Sample Testing

Permeability testing was conducted on laboratory compacted samples of the fill material used for the clay cap. Three sets of tests were performed, two samples were from the Lew-Port material with the third coming from the Swann Road soil. The material used for the permeability testing was taken from samples that were collected for Proctor testing. For each set of tests two individual samples were compacted, one at approximately 90 percent of maximum

density and one at approximately 95 percent of maximum density. This method of testing was selected in order to determine the effect on the measured permeability due to a variation in the degree of compaction. Both samples were compacted at 1 to 3 percent above optimum moisture.

The test procedure after the samples were molded was identical to that previously described for the undisturbed samples. Again, each sample was tested under two different differential heads, 5 and 10 pounds per square inch. The average degree of saturation for the compacted samples was also over 99 percent. After the completion of each test the results were evaluated and the sample permeability was calculated. The test results are also contained in Appendix 3-D and summarized in Table 3-3. Figure 3-6 shows the permeability test results plotted as a function of degree of compaction.

6.5.4 Summary of Test Results

All the test results indicate the measured permeability is less than 1×10^{-7} cm/sec. The average permeability of all the undisturbed samples was calculated to be 2.80×10^{-8} cm/sec. and for the laboratory samples the average value was 1.35×10^{-8} cm/sec. The average for the laboratory samples was taken from Figure 3-6 at 95 percent compaction. Therefore, it can be concluded that the in-place permeability of the clay material in both the dikes and cutoff walls, and the clay cap is less than 1×10^{-7} cm/sec.

It was also noted that the range of permeability values was fairly consistent between the undisturbed samples from the R-10 dike area and the South dike area. This factor is significant for several reasons. Firstly, it tends to indicate that slight variations in the material and material sources had little effect on the permeability of the compacted clay material. Secondly, there was no significant difference in the measured permeability between the material placed two years prior to sampling (R-10 dike) and the material placed one year prior to sampling.

6.6 STRENGTH TESTING

Strength tests were performed on laboratory compacted samples of the clay material. The tests were performed to verify the design parameters used in the stability analysis of the interim and final covers. Those values were ϕ' (effective angle of internal friction) of 25 degrees and c' (effective shear strength) of 200 pounds per square foot. The test procedure, which was used to determine the strength parameters, was a three-stage consolidated undrained triaxial test with pore pressure meassurements. In total three sets of samples were tested, two from the Lew-Port material and one from the Swann Road material. The samples were taken from the same three samples used for the permeability testing. Each sample was compacted to a density equal to 95 percent of optimum density for that particular sample. The moisture level was maintained at 1 to 3 percent above optimum moisture.

The test results from the triaxial testing are contained in Appendix 3-E and summarized in Table 3-4. As can be seen from the test results the average c' value is nearly equal to the design parameter of 200 pounds per square foot and the ϕ ' value exceeds the design value of 25 degrees. Therefore, it can be concluded the slope stability factors of safety are acutally higher than those reported in Section 4.3.2 of the Waste Containment Design Report (Reference 1).

7.0 INSPECTION OF INTERIM CAP

The inspection requirements of for the interim cap are discussed in detail in Section 3.3.1 of the Waste Containment Design Report (Reference 1). A commitment is made in the Design Report to inspect the cap every Spring following the last frost and also in the Fall. The inspection would include a visual check for surface erosion, shrinkage cracks, animial borrows, and deep-rooted vegetation. In addition, the elevation of the top of the interim cover would be checked for depressions due to possible settlement. The interim cover will be recompacted or reworked if any damage or deterioration was noted during the inspection. It will be very important during the first inspection (Spring 1985) to check for possible deterioration due to freeze-thaw since the topsoil layer has not been placed.

8.0 SUMMARY

The initial construction of the interim cap was conducted between August and October 1984. The work was performed by Cowper Construction Company, Inc. under the technical direction of Bechtel National, Inc. All work was done in accordance with the appropriate specifications and design drawings. Field density tests showed that the average degree of compaction of 98 percent was achieved thus exceeding the required 95 percent. Laboratory tests results indicated all required material properties were maintained throughout the construction period and the permeability of the compacted soil was less than 1×10^{-7} cm/sec.

9.0 REFERENCES

- 1. "Waste Containment Design Report for the Niagara Falls Storage Site," by Bechtel National, Inc., Advanced Technology Division, prepared for US DOE, DOE/OR/20722-21, Draft, June 1984.
- 2. "Geologic Report Niagara Falls Storage Site Lewiston, New York," by Bechtel National, Inc., Advanced Technology Division, prepared for US DOE, DOE/OR/20722-8, June 1984.
- 3. <u>Earth Manual</u>, A Water Resources Technical Publication, 2nd Edition, U.S. Department of the Interior, 1974.

TABLE 3-1

PERCENT MOISTURE TEST RESULTS FIELD DENSITY TESTS

PROCTOR CODE	OPTIMUM MOISTURE	RANGE	AVERAGE
L-12	11.9	10.5 - 15.7	12.2
L-14	13.9	11.0 - 11.4	11.3
L-15	12.6	9.2 - 13.3	11.7
L-16	10.5	10.8 - 14.3	12.4
Average	11.9		12.0

PERMEABILITY TEST RESULTS UNDISTURBED SAMPLES

TABLE 3-2

SAMPLE	SAMPLE DEPTH	DRY UNIT WEIGHT	MOISTURE CONTENT	PERMEAE @ 5psi @	
	(FT)	(PCF)	(%)	х 10 ⁻⁷ ст	ı/sec)
BP-SW	18-19.5	117.3	14.7	0.664	0.599
BP-S	5-6.8	110.9	18.4	0.136	0.131
BP-S	15-16.4	117.0	16.5	0.140	0.145
BP-SE	18.5-19.7	119.6	14.9	0.0974	0.0978
BP-NE	9.5-11.4	108.0	20.4	0.252	0.230
BP-NE	3.0-4.5	111.3	17.4	0.409	0.368
BP-N	15.0-17.0	103.6	22.4	0.498	0.436
BP-NW	5.0-6.5	101.6	24.1	0.137	0.132

STRENGTH TEST RESULTS
LABORATORY COMPACTED SAMPLES

TABLE 3-4

SAMPLE	SOURCE OF MATERIAL	DRY UNIT	MOISTURE CONTENT	PERCENT COMPACTION	φ'	c'
		(PCF)	(%)	(%)	(DEGREES)	(PSF)
1	LEW-PORT #1 SAMPLE 10-Au	116.5	15.5	96	29.5	170
2	LEW-PORT #2 SAMPLE 11-Au	125.1	12.4	99	31.0	300
3	SWANN ROAD SAMPLE 12-Au	122.8	11.6	96	31.8	115
			AVERAGE		30.8	195

APPENDIX 3-A

FIELD DENSITY TESTS

- o General Notes
- o Test Results

NOTES:

- 1. Field density tests marked "Contaminated Pile" refers to contaminated soil in the R-10 waste pile below the clay cap.
- 2. Field density tests marked "Clay Cap" refers to uncontaminated soil used to construct the clay cap.
- 3. Test reports prior to Report No. DT-37 do not include any test results on the clay cap. The first field density test conducted on the clay cap was Test No. 35u. The last field density test was Test No. 147U.

FIELD 'N-PLACE DENSITY TEST REPORT

AP INVESTIGA	TRI ATIONS IN	
		≣

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202

☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

					635 JAMES S	THEET,	SYRACUSE, NY 13203 315-472-8333
Proje	ct: _Ni	agara	Falls S	torage	Site	<u></u>	Report No
Clien	t Be	chtel					Date:8-20-84
Conti	ractor:	Seve	nson/Co	wper			Job No. <u>BT-84-53</u>
Test No.	Date of Text	Depth or Elevation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
				35.0			Contaminated Pile - S1025,E370 - 90% Requested
89 C ~	8.20	330.7	111.2	15.0	91.8%	C-1	Bechtel accepted high moisture - (see remarks)
900	8-20	328,5	115.9	12.8	95.7%	C-1	Contaminated Pile - S1065, £395 - 90% Requested
91C	8-20	3324	112.4	12.2	92.8	C-1	Contaminated Pile - S825,E280 - 90% Requested
35U	8-20	333.5	123.6	10.5	98.9	Ļ-12 ★	Clay Cap - Phase #1 - S1100,E130 - 90% Requested
	<u> </u>						
Proctor Code	Maximi Density () plimum sisture (%)		1		Material Type and Source
C-1	121.1		.0%	Clay	- Conta	minat	ed Pile - Sample # 1C
L-12	125.0	11	.9%	l	- Lewpo		
	<u> </u>			<u> </u>			
			•				Respectfully submitted,
Remai	~	Sand C					EMPIRE SOILS INVESTIGATIONS, INC.
Te	est 890	- Ret	est of	test 8	37C - af	ter f	urther drying
Techni	cian Tim	ne: <u>8</u>					_
Techni	cian:	Ε	arl E.	Dubin			Earl E. Dubin

FIELD IN-PLACE DENSITY TEST REPORT

/P	RE

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881

□ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 06837

☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14821 716-342-5320 ☐ 835 JAMES STREET, SYRACUSE, NY 13203 315-472-8333

Project:	Niagara Falls Storage Site	Report No.	DT-38 Revised

8-21-84

Client _____ Bechtel Date: ___

Cont	ractor:		J. W. C	owper			Job NoBT -84-53
Test No.	Date of Test	Depth o		In-place Moisture (%)	% Cempaction	Proctor Code	Location and Remarks
92C	8-21	336.3	115.0	16.0	95.0	C-1	Contaminated pile - \$1030, E280 - 90% required accepted by Bechtel, after further drying
36U	11		109.5	13.6		L-12	Clay Cap - Phase #1 - S1130, E60 - 95% Reg'd
							(see test 37C)
Proctor Code	Maximu Denzity (j		Optimum oisture (%)		Material Type and Source		
C-1	121.1	1	2.0	Cont	aminate	d pil	e - Sample #1C
L-12	125.0	1	1.9	Clay	- Lewp	ort -	Sample #6U

Remarks: Sand	Cone Method Used	Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
Technician Time:	2:00 - 6:00	_ _ _
Technician:	Earl E. Dubin	Earl E. Dubin

SUBSURFACE EXPLORATION & CONSTRUCTION QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES

FIELD IN-PLACE DENSITY TEST REPORT

roje	ct:	Niag	gara Fa	lls St	orage S	ite	Report No. DT-39 Revised
lien	t	Bech	itel				Date: 8-22-84
ont	ractor:	J. k	I. Cowp	er	·		Job NoBT-84-53
Test No.	Date of Test	Bepth or Elevation	in-place Density (pcf)	in-place Moisture (%)	% Campaction	Practer Cade	Location and Remarks
7U	8-22	328.0	111.6	13.4	89.3	L-12	cap - phase #1 - S1125,E70 - 95% reg'd retested after further compaction (see
<u>8U</u>	11	334.0	119.5	12.4	95.6	<u>L-12</u>	remar cap - Phase #1 ~ S955, EllO 95% req'd
							
·							
octor Code	Maximu Density (j		ptimum sture (%)				Material Type and Source
-12	125.0	11.	9	Clay	le #6U		
		٠					Respectfully submitted,

Earl E. Dubin

Technician Time:

Technician:

Earl E. Dubin

FIELD IN-PLACE DENSITY TEST REPORT



	585	TROY	Y-SCHE	NECTA	DY RD.,	LATHA	M, NY	12110	518-78	3-1555		
	S-36	358 SI	HELDO	N RD., F	O. BOX	C 229, C	RCHAP	RD PARK	, NY 14	127	716-649-8110)
	105	COR	ONA A	VENUE,	GROTO	N, NY	13073	607-89	8-5881			
	RAF	RITAN	CENT	ER, 300	McGAV	DRIVE	E, EDISC	ON, NJ Q	8837	201-2	25-0202	
	116	4 RID	GE RD	EAST,	ROCHE	STER, F	NY 1462	1 710	342-53	20		
_	***											

Proje	ect:	Niag	ara Fa	lls St	orage S	ite	Report No. DT-40
Clien	it	Bect	itel				Date: 8-23-84
Cont	ractor:	J. k	I. Cowp	er			Job No. BT-84-53 -
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	In-place Moisture {%}	% Compaction	Prector Code	Location and Remarks
39U_	8-23-8	328.0	134.5	11.0	100+	L-12	Clay cap - Phase I (95% reg'd) S1125 E75 (re-test of 37U A.F.C.)
4 OU	31		124.9	11.8	99.9	L-12	Clay cap. Phase I (95% req'd) \$925 - E130
							·
						·	
Proctor Code	Maximu Density (s		ptimum isture (%)				Material Type and Source
L-12	125.0	11	.9	Cla	y - Lew	port ·	- Sample #6U
							
			•		-		Respectfully submitted,
Remar	ks: Sa	and Con	e Meth	od Use	d		EMPIRE SOILS INVESTIGATIONS, INC.
Techni	cian Time	12	:00 -	5:00			-
Techni			o Wiea	nd			Otto Wieand
•							

EMPIRE SOILS INVESTIGATIONS INC.	☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 /16-649-8110 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
	☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333
Nicesus Esli	le Ctomago Cito

						· •				
Proje	ct:	N	iagara	Falls	Storage	Site		Report No.	DT-41	Revised
Clien		В	echtel					Date:	8-24-84	
	actor:	J	. W. Co	wper				Job No	BT-84-53	<u> </u>
Test No.	Date of Test	Depth or Elevation		in-place Moisture (%)	% Campaction	Proctor Code		cation and Rem		
410	8-24-8	334.	8 124.2	13.2	99.4	L-12	Clay cap - Phase S 990 - E 110	I (95%	req'd) 	
									·	
			1							
										<i>;</i>
							•			
		<u> </u>								
Proctor Code	Maximu Bensity (Optimum foisture (%)		<u> </u>	<u> </u>	Material Type a	and Source		
	125.0		11.9	Cl	ay - Sar	mnle :	#6U			
	123.0		11.5	1	:					
								·		
L	1			J			Respectfully su	hmitted		
_		and Co	na Math	nd llen	d		, .		ONS INC	
Rema	rks: _ 3	and CO	ne neth	ou ose	d		_ EMPIRE SOILS	SINVESTIGATI	ONS, INC.	
		<u>-</u>	0:30AM	- 4:30	PM		_			
	ician Tim	ne:	to Wiea			,	-	Otto Wieand		
Techn	ician:							DING CRECIAL TY SERVI	***	



ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-549-8110

Proja	ect. N	iagara	Falls S	torage	Site		Report No. DT-41A Revised
Clier	nt:B	echtel					Date:8/24/84
Cont	ractor	. (errone				Job No. BT-84-53
Tes! 140.	Date of	Depth or Elevation	In Place Density	In-Place Moisture (%)	Relative Density (%)	Proctor	Location and Remarks
4 2u	8/24	293.3	136.4	2.8	100+		Lutz Road Culvert Centerline 74' West of Lutz Road Culvert Inlet
		 			100+	L-12	10' South of Lutz Road Culvert Centeline
43u	8/24	293.8	127.8	2.8	76.1	L-12	70' West of Culvert Inlet (Must Retest)
		ł		İ			See test 44U for retest
			:				
							·
							·
				<u> </u>		-	"
							·
			 		<u> </u>		
						-	
						<u> </u>	-
rictor Cose	Moximu Density (m Min	.Densit	ý I	}		Material Type and Source
L-12	325		06.6	R.O.	C. Ston	e - P	roctor Value provided by Bechtel
				·			
							•
R	EMARKS:	San	d Concr	ete Me	thod Us	ed	Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
I	NSPECTI	MIT NO	E: 1	:45 pm	- 3:30) pm	Otto Wieand
	NSPECT(.	O. Wiea	nd			THIS . MEMBER . AMERICAN SOCIETY FOR TESTING & MATERIALS



ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proj.	ac1:	Niagar	a Falls	Stora	age Site	<u> </u>	Report No. DT-42
-	nt:	Bechte	1				Date:8/27/84
- Cont	ractor	:Cer	rone				Job No. BT-84-53
7001	Dote of Test	Depth or Elevation	In Place Density	In-Place Moisture (%)	Relative Density (%)	Proctor Code	Location and Remarks
4 4u	8-27	293.8	142.9	2.0	100+%	*	10 5 N of Lutts Road Culvert Centerline 70'W of Culvert Inlet - 95% Required (See Remarks
45u		294.0	144.0	1.8	100+	*	10.5 S of Lutz Road Gulvert Centerline 75' W of Culvert Inlet - 95% Required
4 7u		297.3	134.3	1.8	96.2	*-	10.5 S of Lutz Road Culvert Centerline 45' W of Culvert inlet - 95% Required
			:				
							·
							-
							. •
							·
							_
Proctor Cote	Mozimus Density (s	m Min.	Density PCF)	,	*	<u> </u>	Material Type and Source
*	135.7	\neg	06.6	2" R	OC - Ni	agara	Stone
					· · · · · · · · · · · · · · · · · · ·		
R -	EMARKS:	Test	Cone Me 14U - R 8/24/8	etest	of Test	43U	Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
	NSPECTI				5:30		Earl Dubin
I	NSPECTO	R:	Earl Du	bin	SOIL AND CONG	AETE TES	TING & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS

ntractor: J. W. Cowper In-place in-place Meisture % Prector Test Elevation (pcf) (%) Compaction Code	RT-84-53
in-place in-	Job No. <u>BT-84-53</u>
	Location and Remarks
U 8-27 333.2 104.7 14.0 83.8 L-12 Clay Cap - required.	Phase #1 - \$885.E85 - 95% compaction
	sted after further compaction.
For retest	- see tests 50U, 51U
ctor Maximum Optimum Materia de Density (pcf) Moisture (%)	I Type and Source
12 125.0 11.9 Clay - Lewport - Sample #6U	

Earl E. Dubin

TOW & CONSTRUCTION QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES

Technician Time: 8:00 -5:30

Technician: Earl E. Dubin

	SINVE	शा(ट	ATI	ONS IN		S-3858 SHEL 105 CORONA RARITAN CE 1164 RIDGE 635 JAMES S	DON RE A AVENE NTER, S RD. EAS STREET,	300 McGAW DRIVE, EDISON, N. ST, ROCHESTER, NY 14821 SYRACUSE, NY 13203 315-	RK, NY 14127 898-5881 1 08837 201-: 716-342-5320 472-9333	716-649- 8110 225- 0202
Proje	ct:				115 St	orage S	ite_			o. <u>DT-44</u>
Clien	it		Bech	ntel		· · · · · · · · · · · · · · · · · · ·				8-27-84
Cont	ractor:		Seve	enson	·				Job No.	BT-84-53
Test No.	Date of Test	Depth Eleval		in-place Density (pcf)	in-place Moisture (%)	% Compaction	Proctor Code	Loc	ation and F	Remarks
9 3C	8-27	336.	2	126.5	9.1	100+	C-1	Contaminated Pile	- \$995.	E164 - 90% reo'd
			1							
			\dashv							
		-	+							·····
		-	+							
			\dashv							
			-+							
			\dashv							
			-							
	ļ		-							
			+							
		-	_							
										
Proctor Code	Maximu Density (limum lure (%)				Material Type an	d Source	
C-1	121.1		12.	0	Contar	minated	pile	- Sample #1C	•	
	1									
		-								
										

Respectfully submitted,

Remarks: Sand Cone Method used EMPIRE SOILS INVESTIGATIONS, INC.

Technician Time: 8:00 - 5:30

Technician: Earl E. Dubin Earl E. Dubin

EMPIRE SOILS INVESTIGATIONS INC.	☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-811 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
Némana 5.13 co	☐ 1164 RIDGE RD. EAST, ROCHESTER: 1:Y 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niagar	a Falls	Store	ge Site	<u></u>	Report No. DT-45 Revised
Clien		Bechte	1				Date: 8-28-84
_	ractor:	J. 1	W. Cowp	er		<u>-</u> -	Job No. BT-84-53
Test No.	Date of Test	Depth or Elevation	in-place Density (pci)	in-place Moisture (%)	% Compaction	Proctor Code	
500	8-28	333.0	113.0	11.6%	90.4%	L-12	Clay Cap - Phase #1 - S885, E80 - 95% compaction req'd. To be retested after further compaction. See test 51U (see remarks)
5) บ	8-28	333.0	118.0	12.2%	94.4%	L-12	Clay Cap - Phase #1 - S880,E80 - 95% compaction req'd. Accepted by Bechtel after further compaction. (see remarks)
530	"	334.4	108.1	13.4	86.5	L-12	Clay Cap - Phase #1 - \$1070, El00 - 95% compaction req'd. To be retested after further compaction. (see tests 540,560,600,630)
-			·				
Proctor Code	Maxim Density		ptimum isture (%)				Material Type and Source
L-12	12 125.0 11.		1.9	C1	ay - le	wport	Sample #6U
	· · · · · · · · · · · · · · · · · · ·	\dashv					
		```					Respectfully submitted,
Remar		Sand Co					EMPIRE SOILS INVESTIGATIONS, INC.
Techni	cian Tim	, lest ne:		- 5:00		t 500	(see also test 460) after further compaction.
Techni	cían:	Earl E	E. Dubi				Earl E. Dubin



ORCHARC PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG. P.

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proj	ect:	Niaga	ra Fall	ls Sto	rage Sit	te	Report No. DT-46
Clie	nt:	Becht	:e1		<del></del>		Date: <u>8/28/84</u>
Conf	ractor	Cer	rone				Job No. BT-84-53
Test No.	Date of Test	Depth or Elevation	In Place Density	In-Place Moisture	Relative Density (%)	Proctor Code	Eucation and Remarks
48u	8/28	298.9	138.5	1.8	100+	*-	Centerline of Lutz Road Culvert 40' W of Inlet - 95% Required
49u	8/28	298.9	130.4	4.0	85.1	*	10.5' N of Lutz Road Culvert Centerline 45' W of Culvert Inlet - 95% Required
							To be retested after further compaction.
<del>52u</del>	8/28	298.9	141.4	3.9	100+	*	10.5' N of Lutz Road Culvert Centerline 45' W of Culvert Inlet - 95% Required
							Retest of Test 49u - after further compaction
							· ·
							<i>;</i>
							=
roctor Code	Moximus Density (s		Density PCF)				Material Type and Source
*	135.7	10	06.6	2"	R.O.C.	- Nia	gara Stone
			-		<del></del>		
					<del></del>		
Ŕ	EMARKS:	Sand	Cone M	ethod	Used		_ Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
- 1	NSPECTI	ON TIMF	: 10	:00 -	5:00	<del>_</del>	Earl Dubin
	NSPECTO	R: É	arl Dub			·····,	
		SUBS	SURFACE EXPLI	ORATION . S	OIL AND CONC	RETE TEST	ING . MEMBER . AMERICAN SOCIETY FOR TESTING & MATERIALS

EMPIRE SOILS INVESTIGATIONS INC.	D 58 D 54 D 10 D 84 D 11 D 63
Nianara Falle	Sto

Technician: _

0	585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1	555
	S-3856 SHELDON RD., P.O. BOX 229, OPCHARD PARK, NY 1412	7 71 <del>6-649-</del> 8110
	105 CORONA AVENUE, GROTON, NY 13073 607-896-5881	
	RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837	01-225-0202

							T, ROCHESTER, NY 14621 716-342-5320 SYRACUSE, NY 13203 315-472- <b>6</b> 333
Proje	ct:	Nia	gara Fa	alls S	torage	Site	Report NoDT-47 Revised
Clien	t	Bed	htel		·		Date: 8-31-84
Conti	ractor:	<u>J.</u>	W. Cow	per			Job No. <u>BT-84-53</u> -
Test No.	Date of Test	Dapth or Elevation	In-place Density (pcf)	in-place Moisture [%]	% Compaction	Proctor Code	Location and Remarks
600	8-31	334.4	116.5	13.0	93.2	L-12	Clay Cap - Phase I 95% required S1070 E 105 ( retest of 530)
610		333.8	127.0	12.4	100+	L-12	Clay Cap - Phase I 95% req'd S865 E85 - restest of 55U
<b>63</b> U	. #	334.8	123.4			L-12	Clay Cap - Phase I 95% required \$1070 - E110 (retest of 53U)
64U	u	335.3	121.2			L-12	\$1070 - E110 (retest of 53U) Clay Cap - Phase I 95% required \$1000 - E120
		7					·
							•
							·
Proctor Code	Maximu Density (		Optimum Disture (%)				Material Type and Source
L-12	125.0	1	1.8	Cla	ay from	Lewpo	ort stockpile.
						,	
							Respectfully submitted,
Remar	ks:	Sand (	one Met	thod Us	sed		EMPIRE SOILS INVESTIGATIONS, INC.
Technic	cian Time	e:	9:15/	AM -4:	ВОРМ		
Technic	nian:	. Ot	to Wie	and			Otto Wieand



B/T Form C

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	N	lagara	Fails	Storage	Site	Report No1-48
Clien			echtel				Date: <u>8-31-84</u>
	ractor:	C	errone	<del>- ,</del>	<u>-</u> -		Job NoBT-84-53
Test No.	Date of Test	Depth or Elevation	in-place Density (pcf)	in-placa Moisture (%)	% Compaction	Proctor Code	Location and Remarks
6 <del>2U</del>	8-31	300.3	125.5	14.1	100+	N.A.	Lutz road - 50' West of culvert inlet 20' North of culvert inlet
65U		301.8	117.2	14.2	93.5	N.A.	Lutz road - 50' West of culvert inlet 15' South of culvert inlet
	_						
							· .
					,		
Proctor	Maximu	<u> </u>	lotimum				
Code	Bensity (		isture (%)				Material Type and Source
N.A.	125.4	11	.8	Lutz	road cu	lvert	fill - Clay (Proctor supplied by Bechtel)
			· · · · · · · · · · · · · · · · · · ·			<del>-</del>	
<u>-</u>							
			•				Respectfully submitted,
Remar	ks:	Sai	nd Cone	Metho	d Used		EMPIRE SOILS INVESTIGATIONS, INC.
	··········						- -
	cian Tim					· · · · · · · · · · · · · · · · · · ·	-
Techni	cian:						Otto Wieand

SOILS	INVEST	GATIC	RE

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

635 .	IAMES	STREET,	SYRACUSE,	NY 13203	315-472-9333

Proje	ect:		Niaga	ra Fal	1s Stor	age :	Site	Report No.	DT-49
Clier	nt		Becht	.e1		····		Date:	
Cont	ractor:		Sevens	on				Job No	BT-84-53
Test No.	Date of Test	Dapth or Elevation	in-place Density (pcf)	in-placa Moistura (%)	% Cempaction	Proctor Cade	L	ocation and Re	
94C	8-31	337.3	127.0	10.2	100+	C-1	Phase II - S1135	5 E 185 (fir	ish grade)
95C	1	İ	115.5		ŀ	l	Phase II \$815 E		
		<u> </u>						<del></del>	
Proctor Code	Maximu Density (;		isture (%)				Material Type	and Source	
C-1	121.1	12.	. 0	cont	<u>aminate</u>	d_fil	1.	<u> </u>	
					·	<del></del>			
			•				Respectfully s	ubmitted,	
Remai	rks:	Sand Co	ne Met	hod Us	ed		_ EMPIRE SOIL	S INVESTIGAT	IONS, INC.
Techni	ician Time	9:00	)AM - 4	:30PM			<u>-</u>		
Techni	ician:	Ott	o Wiean	d			Otto	Wieand	
							,	DING SPECIALTY SERVI	CFS

				= 0		RD. EAST	ROCHESTER, NY 14621 YRACUSE, NY 13203 31	716-342-5320 5-472- <del>9</del> 333	
Proje	ot:	Nia	agara f	alls :	Storage	Site	<del></del>	Report No.	DT-50 Revised
Client		Be	chtel	<del></del> .				Date:	8-29-84
Contr	actor:	Ce	rrone					Job No	BT-84-53 -
Test No.	Date of Test	Depth or Elevation	in-place Bensity (pcl)	In-place Moisture (%)	% Compaction	Proctor Code	Lo	ocation and Rema	
5.711	8-29	- <del>3</del> 00-0	110.3	12 7	88.0	1 12		ert centerline	
370	0-29	300.8	110.3	14.7	88.0	L-13		lvert inlet	n requirements.
									Trequirements:
.									
-									
				·					
					·				
Proctor Code	Maximus Density (p		plimum sture (%)		اـــــــــــــــــــــــــــــــــــــ		Material Type a	nd Source	
L-13			.8	CI	ay - Lu	tts r	ad - culvert fi		
						:			
								· .	
1						<del></del>	Respectfully su	bmitted	

Technician Time: 1:00 - 6:30

Technician: Ear E. Dubin

CONTROL . ENGINEERING SPECIALTY SERVICES

Earl E. Dubin

EMPTR SOILS INVESTIGATIONS	E

D 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555

S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 807-898-5881

201-225-0202

☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 20 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-242-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	· · · · · · · · · · · · · · · · · · ·	Niagar	a Fall	s Stora	ge S	ite R	leport No.	DT-51 Revised
Clien	t		Bechte	1			D	ate:	8-29-84
Cont	ractor:		J. W.	Cowper	·		J	ob No	BT-84-53 -
Test No.	Date of Test	Dapth or Elevation	in-place Density (pcf)	in-place Moisture (%)	% Compaction	Practer Cade	Loca	tion and Rem	parks
54U	8-29	B34.4	113.7	13.4	91.0	L-12	Clay Cap - Phase #1 to be retested - af	- S1070,f	100 95% req'd
							See test 56U (see	remarks)	
55U	11	333.8	116.8	12.8	93.4	L-12	Clay Cap Phase #1 - to be retested afte	r further	compaction.
56บ	"	334.4	114.8	14.1	91.8	L-12	Clay Cap - Phase #1 Material to be rewo	- S1075,E rked and r	100 - 95% required ecompacted.
		<del>                                     </del>							· · · · · · · · · · · · · · · · · · ·
					-		;		
							<u></u>		
Proctor Code	Maximu Density (		pilmum isture (%)				Material Type and	Source	
	125.0		.9	Louis	ant Clas				
	123.0	<del>-   ''</del>	• 5	LEWD	71. F - F 1 G 3	·	ample #6u		
								٠.	
	<u> </u>						Respectfully submi	tted .	· · · · · · · · · · · · · · · · · · ·
<b>.</b>	ks:	Sand Co	ne Meth	nod llee	ad				NIC INC
Test	54U -			t 53U	- taken	8-2	EMPIRE SOILS IN after further comp	vestion	7N3, INC.
					- Isee	also.	test 53U)		
		e: <u>1:0</u>					•		
Technic	cian:		Earl	E. Dub	חות			Earl E. I	Dubin

SOILS	/P	IR ATIONS	INC

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. 80X 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

=					835 JAMES S	TREET,	SYRACUSE, NY 13203 315-472-9333
Proie	ect:	N.	iagara	Falls	Storage	Site	Report No. <u>DT-52</u>
Clien			echtel				Date:9-4-84
	ractor:	Ċ	errone				Job NoBT-84-53
Test No.	Date of Test	Depth or Elevation	In-place Density (pcf)	in-place Maisture (%)	% Compaction	Prector Cade	Location and Remarks
		301 8	115.0	35.7		_	Lutts road culvert - 50' West of culvert inlet
66U 7	9.4	301.0	113.0	15.7	91.7		15' South of culvert centerline - 95% required. Retest of test 65U taken 8-31-84 after
							further compaction.
							Area to be windrowed and recompacted and then retested (see test 67U)
67 <del>U</del>	9-4	301.8	125.4	13.6	100	*-	Lutts road culver - 50' West of culvert inlet 15' South of culvert center line 95% req'd
-					.00		Retest of test 66U - after windrowing and recompaction.
cou	0.4	202.0	101 0				Lutts Road culvert - 40' West of culvert inlet
69U	9-4	303.0	121.9	11.2	9/.2	<del>-</del>	along center line of culvert - 95% req'd.
			* .				
Proctor Code	Maximu Density (		plimum sture (%)				Material Type and Source
*	125.4	11.	8%	Clay	- Lutts	road	- culvert fill
							Respectfully submitted,
	ς	and Con	a Math	ad Den	4		•
Remai	rks: <u>_</u>	and CON	e rieth(	ou use	<u>u</u>		EMPIRE SOILS INVESTIGATIONS, INC.
<b>-</b>		9	:00 AM	_ 5.31	) PM		<b>-</b> .
	cian Tim						- Earl E. Dubin
Techni	cian:	<u>Ea</u>	<u>r1 E. [</u>	Dubin			Ed. I E. DUDIN

Projec	et:	Niag	ara Fa	lls St	orage S	ite	Report No.	υT-53			
Client		Bech	itel				Date:	0.4.04			
	actor:	Cowp	er				Job No	BT-84-53			
Test No.	Date of Test	Dapth or Elevation	In-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Rem				
6 <b>B</b> U	9-4	336.3	120.1	15.7	96.1	L-12	Clay cap - phase #1 S1150,E Bechtel accepted high moist	165 - 95% req'd ure			
Proctor Code	Maxim Density		Optimum pisture (%)				Material Type and Source				
*	125.0	11	.9%	Lew	Lewport clay - sample #6U						

THE TWO OBSTICES TO CONSTRUCTION QUALITY CONTROL ENGINEERING SPECIALTY SERVICES

Earl E. Dubin

Technician Time: 9:00 AM - 5:30 PM

Technician: __

Earl E. Dubin



Chumand Fark & ROCHESTER & GRUTUN & ALBERT & STRAUDSE & NEW YORK GITT

WASHINGTON D.C. & WOODBRIDGE N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-449-8110

'roi	ect:	Niag	ara Fal	1s Sto	rage Si	te	Report No. DT-54
	nt:	Bech	tel				Date:9-5-84
	tractor	:Ce	· rrone_			<del></del> -	Job No. <u>BT-84-53</u>
• • • • • • • • • • • • • • • • • • • •	Б	Depth or Elevation		In-Place Moisture (%)	Relative Density (%)	Proctor Code	Location and Remarks
<del></del>	9-5-84	304 0			100%+	N.A.	Lutts road culvert 50' west of culvert inlet 10' North of culvert center line - 95% req'd
<del>700</del> .	5-3-04		1,10.2		100%		TO HOTER OF CUITCLE CENTER THE SON TEST
<u> </u>							
			<u> </u>				
					Ì		-
rector Code	Mozimus Density (s	m Min.	Density PCF)	<u></u>	<u> </u>		Moterial Type and Source
	135.7	106.		2" R.	.o.c. ·	- Niag	gara stone
			•				
<b>R</b>	EMARKS:	Sand	l Cone N	lethod	Used		_ Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
	NSPECTI NSPECTO	D.	Earl	. Dub	AM - 4:		Earl E. Dubin

É	M	P	R	NC.

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ \$-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881

☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 20
☐ 1164 RIDGE RD. EAST, RCUHESTER, NY 14621 716-342-5320
☐ 636 JAMES STREET, SYRACUSE, NY 13203 315-472-9333 201-225-0202

Proje	ct:	Niagar	a Falls	Store	age Site	Report No. DT-55	
		Bechte	1		<del></del>		Date: 9-5-84
			W. Cov	per			Job NoBT-84-53
Test No.	Date of Test	Dapth or Elevation		in-place Moisture (%)	% Compaction	Prector Cede	Location and Remarks
710	9.6	336.9	120.9	11.7	96.7%	L-12	Clay Cap - phase #1 - S1030,E175 - 95% req'd
	·····						
		<u> </u>					
	·	<u> </u>					
Proctor Code	Maxim Density		Optimum pisture (%)				Material Type and Source
4-12	125.0	)  11	.9%	Lewpo	ort clay	<u>- sa</u>	ample #6U
					···	· · · ·	
LJ	· · · · · · · · · · · · · · · · · · ·			I			
Remar	La:	Sand	Cone Me	thod U	Ised		Respectfully submitted,  EMPIRE SOILS INVESTIGATIONS, INC.
neillaf	ns						EMITINE SOILS HAVES HOAT TONS, INC.
Technic	cian Tim	ne:	8:00 A	M - 4:	30 PM		<u> </u>
Technic	cian:		Larl E	. Dubii	n		Earl E. Dubin

SOI	VAIIS	P ssile	RATIONS	INC

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-644-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14821 716-342-5320
☐ 835 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Miay	ara ra	115 500	orage S	ite	Report No
Clien	t	Bech	te1		·		Date:9-5-84
Conti	ractor:	Cerr	one				Job No
Test No.	Date of Test	Dapth or Elevation	In-place Bensity (pc()	In-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
<del>72U</del>	9-5-84	305.0	114.5	11.8	91.6	-	Lutts road culver - 40' West of inlet 25' North of centerline 95% compaction req'd
							(see remarks)
730		305.0	119.2	12.3	95.4	-	Lutts road culvert - 75' West of inlet 10' North of center line - 95% compaction req'd
74U	#	305.0	117.9	11 5	94.3		Lutts road culvert - 40' West of inlet
1.40		303.0	117.3	11.5	54.5	-	25' North of centerline - 95% compaction reg'd (see remarks)
							•
Proctor Code	Maximur Density (p		ptimum sture (%)				Material Type and Source
-	125.0	11.	9	Lewpo	rt Clay	- sa	mple #6u
	· ·						
		•					Respectfully submitted,
Regrafi	20 <del>- t</del> o	be re	ne Met	- afti	er furth	ner ci	EMPIRE SOILS INVESTIGATIONS, INC.
	70 - 10	LESL U	1 657	#/20 6	aiter fi	ITIDE	r compaction compaction.
Technic	ian Time	8	:00 AM	- 4:30	) PM	ther	- compaction.
	ian:		arl E.				Earl E. Dubin

SOII	SINVE	STIGAT	R IONS II		S-3858 SHEL 105 CORONI RARITAN CE 1164 RIDGE	DON RD A AVENU ENTER, 3 RD. EAS	00 McGAW DRIVE, EDISON, 1 T, ROCHESTER, NY 14621	ARK, NY 14127 - 1 7-898-5881	7 <b>16-649-8</b> 110 5-0202
Proje	ct:	Niaga	ra Fal	ls Sto	rage Si	te		Report No.	DT-57
Clien	t	Becht	tel					Date:	8-30-84
Cont	ractor:	J. V	V. Cowp	er	·			Job No	
Test No.	Date of Test	Depth or Elevation	in-place Density (pcf)	in-place Meisturs (%)	% Compaction	Practor Code	Lo	ocation and Re	marks
58U	8-30	337.7	126.3	10.6	100+%	r.12	Clay Cap - phas	e #1 - \$112	5,E90 - 95% req'd
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		<u> </u>	<u></u>	ļ			<del></del>	·	
Proctor Code	Maximi Density (		Optimum pisture (%)	ļ		<del></del> _	Material Type a	nd Source	
*	125.0	1	1.9%	Lewpo	rt Clay	- Sa	mple #6U	<del> </del>	<u> </u>
								· · ·	
<b></b>		Sand C	ono Met	hod lle	· Ad		Respectfully su		
Remai	rks:		one Met 8:00 AM				EMPIRE SOILS	S INVESTIGAT	IONS, INC.

Earl E. Dubin

Technician: Earl E. Dubin

		Ninga	ma Fall	<b>=</b> 0	635 JAMES	STREET,		ESTER, N ISE, NY 13		315-472-9333	
Proje	ct:	- 2		s Stor	age Sit	<u>e</u>				Report N	lo. <u>DT-58</u>
Clien	t	Becht	el					<u> </u>		Date:	8-30-84
Conti	ractor:	Cerro	ne			· · · · · ·		Job No. <u>BT-84-53</u>			
Test No.	Date of Test	Depth or Elevation	in-place Density (pcf)	in-place Moisture [%]	% Cempaction	J				Location and	
<del></del>	8-30	300.0	119.9	14.6	95-6-					culvert cent	er line - 95% required
טפנ	0-30	•••••			33.0					ndrowed and r	
									·		
								<u> </u>			
		l									<del></del>
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										· · · · · · · · · · · · · · · · · · ·	
			<u> </u>								
roctor Code	Maximu Density (s		otimum istura (%)					Materia	al Ty	pe and Source	······································
•	125.4	11	.8%	Clay	- Lutt	s roa	d cul	vert f	111	<u> </u>	<del> </del>
								•			

SUBSURFACE EXPLORATION & CONSTRUCTION QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES

Earl E. Jubin

8:00 AM - 1:00 PM

Earl E. Dubin

Technician Time: _

Technician: __



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ \$-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 2 ☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 201-225-0202

☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niaga	ra Fall	s Stor	age Sit	<u>e</u>	Report No. DT-59
Clien	t	Becht	<u>el Nati</u>	onal		·	Date: <u>9-6-84</u>
Conti	ractor:		Cowpe	r	· ·		Job No. <u>BT-84-53</u>
Test No.	Date of Test	Depth or Elevation	In-place Density (pcf)	m-place Moisture (%)	% Cempaction	Proctor Code	Location and Remarks
<b>75</b> U	9-6	338.3	116.3	11.4	96.1	L-14	Clay cap phase # 2 - S1082,E185 - 95% required
76U	9-6	338.3	115.2	11.0	95,2	L-14	Clay cap - phase #2 - \$1082,E185 - 95% require
·					-		
Proctor Code	Maximu Density (		ptimum isture (%)				Material Type and Source
L-14	121.0	13	.9	Clay	- sampl	e #10	U
			•				Respectfully submitted,
Remari	ks:S	and Con	e Metho	od Used	i		EMPIRE SOILS INVESTIGATIONS, INC.
		rected 100 be		roctor	value 1	for	•
				8:00 /	<u>M - 5:3</u>	30 PM	
echnic	ian:	Ea	r1 E. 1	Dubin			Earl E. Dubin

EMPIRE SOILS INVESTIGATIONS INC.	3 S S S S S S S S S S S S S S S S S S S
	<b>5</b> 1

- 85 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 3358 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 PARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837
- 716-342-5320 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 □ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

			DT_60
	Niagara Falls Storage Site	Report No.	
Project:	Magara	Data	9-6-84
	a 14.3 Nessanal	Date:	

Client <u>Bechtel National</u> BT-84-53 Job No. ____ Sevenson Contractor.

est lo.	Date of Test	Dapth or Elevation	In-place Density (pc!)	In-place Moisture (%)	% Cempaction		Location and Remarks  Contaminated pile - \$1320,E80 - 90% required
SC	9-6	328.0	109.6	<del>- 13.3</del>	89.1	<del>C-2</del>	test at finished grade. Area to be retested.  After further compaction.
							(See test #97C for retest).
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				<u> </u>	<u> </u>	-	, and the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of
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			1		<del> </del>	-	
						-	·
				<del></del>	-		
					<u> </u>	<u></u> _	Top and Source
Procto Code		imum ly {pcf}	Optimum Moizture (%	1			Material Type and Source
C-2	123.	0	11.6	Co	<u>ntamina</u>	ted p	oile - sample #2C

Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC. Remarks: Sand Cone Method Used 8:00 AM - 5:30 PM Technician Time: ___ Earl E. Dubin Earl E. Dubin PRINCIPAL OF ALL ITY CONTROL . ENGINEERING SPECIALTY SERVICES



CRCHARD PARK & ROCHESTER & GROTON & ALBANY & STRACUSE & NEW YORK CITY

MASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Pro.	jact:		Niagara	a Fall:	s Stora	ge Si	te Report No. DT-61						
Clia	nt:		Bechte	Natio	onal		Date:9-7-84						
Con	tractor	:	Cerrone	2			Job No. <u>BT-84-53</u>						
7017	Date of Test	Depth or Elevation	In Place Density	In-Place Moisture	Relative Density (%)	Prector Code	Location and Remarks						
	9-7	307.0	147.9	2.4	100%+		Lutts road culvert - 40' West of inlet - test of final grade - 25' S of center line (95% required)						
77II -78U	1		147.0		100%+		Lutts road culvert - 50' West of inlet - 95' North of center line. (95% required)						
			l:										
	-												
							_						
<del>-</del>	· .												
=													
rocter Cote	Maximum Density (o	er) Rin.	Density PCF)		<del> </del>		Moterial Type and Source						
-	- 135.7 106.6 2" ROC						Niagara Stone						
			`										
Ŕ	EMARKS:	Sand	Cone Me	thod U	sed		Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.						
	NSPECTIO					PM	Earl E. Dubin						
1	NSPELTOR	۲:	Earl	E. DUD	111	(7) TEST	NG & MEMBER & AMERICAN SOCIETY FOR TESTING & MATERIALS						

			FII	EL' II	N-PLA	CE D	PENSITY TEST PTORT
SOIL	SINVE	STIGAT	IONS IN		S-3858 SHELI 105 CORONA RAPITAN CE 1164 RIDGE I	DON RD AVENU NTER, 3 RD. EAS TREET,	TADY RD., LATHAM, NY 12110 518-783-1555 ., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 E, GROTON, NY 13073 607-898-5881 00 McGAW DRIVE, EDISON, NJ 08837 201-225-0202 T, ROCHESTER, NY 14621 716-342-5320 SYRACUSE, NY 13203 315-472-9333  Report No. DT-62
Clien	t	Bechte	1 Nati	onal			Date: 9-7-84
Cont	ractor:	Sevens	on/Cow	per			Job No. <u>BT-84-53</u>
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
9 <del>7</del> 6_	9-7	327.8	120,8	11.8	98.2	<del>C-1</del>	Contaminated pile - \$1320,E75 - 90% compaction req'd.
							Retest of test 96C - taken 9-6 - after further compaction.
79U	4	333.0	117.4	11.4	97.0		Clay cap - phase #1 - S1070,E90 - 95% compaction required.
800	н	339.0	121.9	11.3	100%+	L-14	CTay cap - Phase #2 - S1090,E180 - 95% compaction required.
<u> </u>							

roctor Code	Maximum Density (pcf)	Optimum Moisture (%)	Material Type and Source
C-1	123.0	11.6%	Clay - contaminated pile - sample #IC
L-14	121.0	13.9%	Clay - In-place material from clay cap - sample #10U

•	Respectfully submitted,
Remarks: Sand Cone Method Used	EMPIRE SOILS INVESTIGATIONS, INC.
Technician Time: 8:30 Am - 4:30 PM	
Technician: Earl E. Dubin	Earl 2. Dubin
· • - · · · · · · · · · · · · · · · · ·	ITY CONTROL & ENGINEERING SPECIALTY SERVICES

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☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110

☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881

201-225-0202

☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 20 ☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct: <u>Ni</u>	agara	Falls S	torage	Site		Report No		
Clien	it <u>Be</u>	chtel	<u>Nationa</u>	11			Date:9-17-84		
Cont	ractor:		Sevens	on			Job No		
Test No.	Sate of Test	Depth or Elevation	In-place Density (pcl)	In-place Moisture (%)	% Compaction	Precter Cede	Location and Remarks		
-81U	9-17	Finish <del>Grade</del>		10.0	89.5		Anna 101 Laurichan Taur Causan		
810	3-17	2/10"		13.3	65.5	L-0	Area "Q" Lewiston Town Garage S7008,E1953 - 90% compaction required. Bechtel Accepted Test Results		
980	- 11	323.3	119.0	10.0	98.3	C-1"	Contaminated pile - S830,E296 - 90% compaction required. Test at finished grade.		
99C	11	337.3	119.2	13.5	98,4	<del>C-</del> 1	Contaminated pile - S1049,E285 - 90% compaction required. Test at finished grade.		
	-								
Proctor Code	Maximus Density (p		ptimum  sture (%)				Material Type and Source		
L-8	125.0	12	.0	On/si	te fill	- pi	le #3		
C-1	121.1	12	.0	Clay - contaminated pile - sample #1C					
							Respectfully submitted,		
Remar	ks:S	and Co	ne Meth	od Use	ed		EMPIRE SOILS INVESTIGATIONS, INC.		
Toobali			11:00	AM - 5	:30 PM		-		
	cian Time					<del> <u>-</u></del>	Dani F. Dubin		
Technic	cian:	E	arl E.	חומטע			Earl E. Dubin		

C	585	TROY	-SCHE	NECTA	DY RD.	LATHAM	, NY 1:	2110	518-783	1555	
C	S-34	858 SH	HELDO	N RD., P	.O. BO	X 229, OF	CHAR	D PARK,	NY 141	27	716-649-8110
	105	COR	A ANC	ENUE.	GROTO	N, NY 13	073	607-898	-5881		
	RAI	RITAN	CENTI	ER. 300	McGAV	V DRIVE.	<b>EDISO</b>	N. NJ 08	837	201-22	25-0202

☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ect:	Niagara	Falls	Stora	ge Site		Report No
Clien	it	Bechte ¹	Natio	na l	·		Date:9-17-84
	ractor:	C	•				Job No. BT-84-53
Test No.	Date of Test	Depth or Elevation	In-place Density (pcf)	In-place Meisture (%)	% Compaction	Proctor Code	
82U_	9-17	330.5	119.7	11.8	95.0	L-15	Clay cap - phase #2 - S825,E175 - 95% compaction required.
			·				•
! !		ļ					
		<u> </u>		1			
Proctor Code	Maximu Gensity (		ptimum isture (%)				Material Type and Source
L-15	126.0	) 12	2.6	Lewp	ort cla	y <b>-</b> s	sample #11U
					· · · · · · · · · · · · · · · · · · ·	<u></u>	
						<u> </u>	
			•*				Respectfully submitted,
Remar	ks: Sa	nd Cone	<u>Metho</u>	d Used	<u> </u>	<u> </u>	_ EMPIRE SOILS INVESTIGATIONS, INC.
		31	•00 AM	F. 7	0 04		_
		e: <u> </u>	Dubi		U PM		- Earl E. Dubin
echni	cian:	rail [	ו משע	(1			



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☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-8333

Proje	ct:	Niagar	a Falls	Store	age Site		Report NoDT-65
Clien	t	Bechte	1 Natio	onal	· · · · · · · · · · · · · · · · · · ·	<del> </del>	Date:9-18-84
Cont	ractor:	Se	venson		<u>.</u>		Job NoBT-84-53
Test No.	Date of Test	Depth or Elevation	In-place	in-place Moisture [%]	% Compaction	Proctor Code	Location and Remarks
1000	9-18	329.0	122 7	10-3	100+	C-1	Contaminated pile - \$965,E385 - 90% required test at finished grade.
1000	3-10			10.0	100	<u> </u>	test at 1111311EU grade.
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	-	<u> </u>					
				·			
Proctor	Maxim		ptimum				
Code	Density (		isture (%)		<del></del> .		Material Type and Source
C-1	121.1	12	2.0	Clay	- cont	amina	ted pile - sample #1C
					· <u>-</u>		
					······	· 	
		•	-				Respectfully submitted,
Remar	ks: Sa	nd Cone	e Metho	d Used			EMPIRE SOILS INVESTIGATIONS, INC.
rechni	cian Tim	e:1	11:30 A	M - 5:	00 AM		<u>-</u> -
[echni	cian:	Earl	E. Du	bin			Earl E. Dubin
		s	UBSURFACE	EXPLORAT	ON E CONSTR	RUCTION	QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES

FMPIRE	☐ 585 TROY
SOILS INVESTIGATIONS INC.	☐ S-3858 SH
	☐ RARITAN

SCHENECTADY RD., LATHAM, NY 12110 518-783-1555. HELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 ONA AVENUE, GROTON, NY 13073 607-898-5881

☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5230
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct: <u>N</u>	iagara	Falls	Storag	<u>e Site</u>		Report NoT-66			
Clien	<u> B</u>	echtel					Date:9-18-84			
Contr	actor:		J. W. C	owper			Job No. <u>BT-84-53</u>			
Test No.	Date of Test	Depth or Elevation	In-place Density (pcf)	In-place Moisture (%)	% Cempaction	Proctor Code	Location and Remarks			
83U	9-18	338.3	113.8	10.6	90.3	L-15	Clay cap - S1095,E158 - 95% compaction required. To be retested after further compaction. (see remarks)			
							Clay cap - S825,E135 - 95% compaction required.			
84U	н	335.0	129.8	11.3	100+	나-15	51ay cap 5525,2155 55% csp. 1542.155			
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	·									
Proctor Code	Maximu Density (		Optimum pisture (%)		! <u> </u>	<u> </u>	Material Type and Source			
L-15	126.0		12.6	1	Lewport Clay - Sample #11U					
L-13	120.0	<u>'                                    </u>	12.0		троге (	, ay	Sample #110			
<u></u>	,			<u> </u>			Respectfully submitted,			
	Ç.			4 114						
			Method			•	_ EMPIRE SOILS INVESTIGATIONS, INC.			
Test (	33U - F	or ret	est se	e test	850	····	_			
Techni	cian Tim	e:	11:30	- MA C	5:00 PM	1	_			
Techni	cian:		Earl E				Earl E. Dubin			
			SUBSURFAC	E EXPLORA	TION E CONST	FRUCTION	QUALITY CONTROL E ENGINEERING SPECIALTY SERVICES			

SOI	VISINV	P ESTIGA	R	, NC

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☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Projec	:t:	Niaga	ara Fal	ls Sto	rage Si	te	Report NoT-67
Client		Bechi	tel				Date:9-19-84
_	actor:	Co	owper			_	Job NoBT-84-53
Test No.	Date of Test	Dapth or Elevation	in-place Bensity (pci)	in-place Moisture (%)	% Compaction	Proctor Cade	
85U	9-19		120.6	12.0			Clay cap - S1095,E158 - 95% compaction req'd Retest of test 83U taken 9-18
830	9-19	330.3	120.0	12.0	75.7	<u> </u>	after further compaction.
87 บ_	ll	340 4	121.1	12.0	96 1	L-15	Clay Cap S1105,E190 - 95% compaction req'd.
880	11		123.4				Clay Cap - S955,E185 - 95% compaction req'd.
_660_		340.4	123.4	13.3	37.3	1.513	
							·
				<u> </u>			
	· · · · · · · · · · · · · · · · · · ·						
		<del>                                     </del>	<u> </u>				
Proctor	Maxim		Optimum		<u>l</u>	1	Material Type and Source
Code L-15	Density		oisture (%)		+ 67		
L-13	126.	0	12.6	rew	port CI	ay -	Sample #9U
			<del>_</del>		<del> </del>	<del></del>	
	!			1			Respectfully submitted,
_		Sand Co	` one Met	had Us	ed.		, ,
Remar	'ks:		Me net	1104 03			EMPIRE SOILS INVESTIGATIONS, INC.
	<del></del>	<del></del> .	1.20 0	W _ S.	30 PM	<del></del>	<u>·</u>
Techni	cian Tin		1:30 P				
Techni	cian:	·	Earl E.			TRUCTION	Earl E. Dubin  N QUALITY CONTROL & ENGINEERING SPECIALTY SERVICES



UNCHAND FANK & HOCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

ac1:	Niagar	a Falls	Store	age Site	2	Report No. DT-68
nt:	Bechte	1 Natio	onal			Date: 9-19-84
ractor	. Seven	son				Job No. BT-84-53
Dote of Test	Depth or Elevation		In-Place Moisture	Relative Density (%)	Proctor Code	Location and Remarks
9-19			1			Lewiston Town Garage - S6954,E1921 - 95% compaction required.
		:				
						•
						<del>-</del>
						•
Mozimum Pensity (5:	Min.[	Density CF)			١	laterial Type and Source
135.7	106	.6	2" R.	0.C	Niaga	ra Stone
	-		·			•
		Cone M				Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC. Earl E. Dubin
	Mozimum Pensity (c:	Mosimum Min. () 135.7 106	Mosicum Min. Density (PCF)  135.7  Bechtel Nation Sevenson  Sevenson  Top of  9-19  Win. Density (PCF)  135.7  106.6	Mozimum Mozimum (2:1)  Mozimum Mensity (2:1)  Mozimum Mensity (2:1)  135.7  106.6  2" R.	Bechtel National  roctor: Sevenson  Top of 9-19 Subbase 141.8 3.2 100+%  Meximum Min. Density Pensity (act) (PCF)  135.7 106.6 2" R.O.C	Rechtel National  Proctor: Sevenson  Top of United Building State Subbase 141.8 3.2 100+% -  Mosifrem Pensity (PCF)  135.7 106.6 2" R.O.C Niagan



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 ☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-22 ☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333 716-649-8110 201-225-0202

Proje	ct: Nia	gara F	alls Si	torage	Site	Report No					
Clien	t Bec	ntel N	ational	<del> </del>			Date: 9-19-84				
Conti	ractor:	Se	venson				Job No. <u>BT-84-53</u>				
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Prector Code	Location and Remarks				
101C	9-19	334.2	117.9	15.4	97.4	<del>C-1</del>	Contaminated pile - S1135,E325 - 90% required Bechtel accepted high moisture.				
÷	-										
					-						
Proctor Code	Maximus Density (p		ptimum stura (%)				Material Type and Source				
C-1	121.1 12.0			Clay - contaminated pile - Sample #1C							
						<u>.</u>					
	r			. با د			Respectfully submitted,				
Remari	ks: <del>S</del>	and Cor	e meth	oa Use	<u>a</u>		EMPIRE SOILS INVESTIGATIONS, INC.				
<b>Fe</b> chnic	ian Time	: 1:30	PM -	6:30 P	M	<u> </u>	-				
Technic	ian:	Earl	E. Du	bin			Earl E. Dubin				



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☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	iagara	Falls S	torage	Site		Report No. DT-70
Clien	tBe	echtel					Date:9-20-84
Contr	actor:		J. W. (	Cowper			Job No. <u>BT-84-53</u>
Test No.	Date of Test	Dapth or Elevation	In-place Density {pcf}	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
890	9-20	340.6	106.5	12.4	84.5	L-15	Clay Cap - S1050,E252 - 95% compaction req'd. to be retested after further compaction. (see test No. 90 U.)
					,		
Proctor Code	Maximu Density (		ptimum Isture (%)				Material Type and Source
L-15	15 126.0 12.6 Lewport Clay - sa				ort Cla	<u>y - s</u>	ample No.,8
							Respectfully submitted,
Remar	ks:S	and Cor	ne Meth	od Use	d		EMPIRE SOILS INVESTIGATIONS, INC.
		e:10			O PM		
Technic	cian:	Earl					Earl E. Dubin



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☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

ct:!	Viagara	<u>Falls</u>	Storag	ge Site		Report No <u>DT-71</u>			
·	Bechtel			<del></del>		Date:9-21-84			
actor:		J. W.	Cowpe	r		Job No. <u>BT-84-53</u>			
Date of Test	Depth or Elevation	in-place Bensity (pcf)	In-place Moisture (%)	% Compaction	Procter Cede	Location and Remarks			
9-21	340.7	123.4	11.2	97.9	L-15 furt	Clay Cap - S1040,E252 - 95% compaction req'd Retest of test 89U - taken 9-20 - after her compaction.			
11	333.3	127.2	12.5	100%+	L-15	Clay Cap - S980,E350 - 95% Compaction reg'd			
11	334.5	122.2	12.0	97%	L-15	Clay Cap - S850,E320 - 95% Compaction reg'd			
- 11	334.5	125.0	11.4	99,2	L-15	Clay Cap - S1095,E330 - 95% Compaction req'd			
u	336.2	124.8	12.0	99.0	L-15	Clay Cap - S995,E300 - 95% Compaction reg'd			
	337.9	123.9	11.8	98.3	L-15	Clay Cap - S900,E285 - 95% Compaction reg'd			
<u>-</u>									
	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	•		===:-==	-1=	Material Type and Source			
				ewport (	Clav				
123.0									
						·			
	•					Respectfully submitted,			
ks:S	and Con	e Metho	od Use	đ	<del></del>	EMPIRE SOILS INVESTIGATIONS, INC.			
cian Tim		:00 AM	- 4:30	D PM	<u>.</u>	_			
						Earl E. Dubin			
	Maximum Density (	Bechtel actor:    Bate of Test   Bepth or Elevation     9-21   340.7     333.3     334.5     336.2     337.9     Maximum   0     Density (pcl)   Mol	Bechte	Bechte	Bechtel  actor: J. W. Cowper    Date of Test   Depth or Elevation   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (pcf)   Density (p	Bechte			

SOII	SINVE	SII	TIR EATIONS		S-3858 SHEL 105 CORONI RARITAN CE 1164 RIDGE	DON RD A AVENU ENTER, 3 RD. EAS	TADY RD., LATHAM, NY 12110 518-783-1555 D., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 JE. GROTON, NY 13073 607-898-5881 IOO McGAW DRIVE, EDISON, NJ 08837 201-225-0202 IT, ROCHESTER, NY 14621 716-342-5320 SYRACUSE, NY 13203 315-472-9333				
Proje	ct:	liag	ara Fal	s Stora	ge Site		Report No. DT-72				
Clien	t	lech	tel				Date: <u>9-22-84</u>				
Cont	ractor:		J. 1	1. Cowpe	r		Job No. <u>BT-84-53</u>				
Test No.	Date of Test		th or Dena	ty Moisture	1	Proctor Code	Location and Remarks				
96U_	9-22	332	5 122	6 11.7	95.5	L-16	Clay Cap S1110,E360 - 95% Compaction reg'd				
	-										
		_									
				+							
Proctor Code							Material Type and Source				
L-16	128.4		10.5	Clay	Clay - Swann Road - Borrow Pit - Sample No. 10U						
Remark	ks:	San	d Cone M	ethod Us	sed		Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.				
							•				

Earl E. Dubin

Technician Time: 2:00 PM - 3:30 PM

Technician: Earl E. Dubin



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☐ 1164 RIDGE IAD, EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ect:	Niagar	a Falls	Store	ige Site	<u> </u>	Report No. DT-73
Clien	it	Bechte	1				Date:9-25-84
Cont	ractor:	<u>J.</u>	W. Cov	vper	<del></del>		Job No. <u>BT-84-53</u>
Test No.	Date of Test	Depth or Elevation	In-place Density (pcl)	in-place Moisture (%)		Proctor Cade	Location and Remarks
97U	9-25	330.5	125.9	12.0	99.0	L-15	Clay Cap S790,F325 - 95% Compaction reg'd
980		335.0	119.4	14.1	93.0		Clay Cap S995,E325 - 95% Compaction req'd Area to be retested, after further compaction
					30.10		(see test 100U)
990	н	335.0	119.9	12.0	93.4	L-16	Clay Cap S900,E330 - 95% Compaction req'd Area to be retested, after further compaction
							(see test 101U)
						·	. *.
			-				
Proctor Code	Maximi Density (		ptimum isture (%)				Material Type and Source
L-16	128.4	10	.5	Clay	- Swann	Road	- Borrow Pit - Sample No. 10U
L-15					rt Clay	- Sa	mple No. 9U
							•
		•					Respectfully submitted,
Remar	ks:	and Co	ne Meth	od Use	d	<del></del>	EMPIRE SOILS INVESTIGATIONS, INC.
		1/	1.20 Au		0.04	<del></del> -	· .
		e:1(			U PM	<u> </u>	
Techni	cian:	Ear	<u>r1 E. D</u>	ubin			Earl E. Dubin

<b>EMPIRE</b>	☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ 5-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
SOILS INVESTIGATIONS INC.	☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
	☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
	☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
	☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Project: Niagara Falls Storage Site							Report No. DT-74			
Client	t <u></u>	Bechte	1	<del> </del>		<del></del>	Date: 9-27-84			
Contr	actor:		. W. Co	wper			Job No8T-84-53			
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Practor Code	Location and Remarks			
1030	9-27	340.2	122.7	14.3	95.6	L-16	Clay Cap - S1110,E270 - 95% Compaction req'd			
104U	11	334.9	116.6	15.5	90.8	L-16	Clay Cap S850,E315 - 95% Compaction req'd material to be windrowed and recompacted			
				-			after further drying. Retest of test 102.(for retest see test 105U)			
							·			
			_							
	·									
		·								
					·					
Proctor Code	Maximu Density (j		ptimum sture (%)				Material Type and Source			
L-16	128.4	10	.5	Clay - Swann Road - Borrow Pit - Sample No. 10U.						
			· ·							
			•			•	Respectfully submitted,			
Remark	(s:	Sand Co	ne Meti	nod Use	ed		. EMPIRE SOILS INVESTIGATIONS, INC.			
<del></del>										
Technic	ian Time	e:	7:00 A	1 - 9:0	00/2:00	PM				
Technic	ian:	Ear	1 E. Du	<u>ıbin</u>			Earl E. Dubin			



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☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niaga	ira Fal	ls Sto	rage Si	te	Report No 75			
Clien	t	Becht	el				Date:9/26/84			
Contr	actor:		Cowper				Job NoBT-84-53			
Test No.	Date of Test	Depth or Elevation	in-place Density (pci)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks			
1000	9/26	335.0	123.5	13.0	96.2	L-16	Clay cap S1000, E325 - 95% compaction required. Retest of test 980 taken 9/25 after further compaction			
1010	9/26	335.0	123.2	12.1	96.0	L-16				
1020	9/26	334.7	117.6	14.5	91.6	L-16	Clay cap S850, E320 - 95% compaction required to be retested - after further compaction (See test 104U and 105U)			
	<u> </u>						·			
Proctor Code	Maximu Density (j		ptimum isture (%)			<u> </u>	Material Type and Source			
L-16 128.4				Clay - Swann Road, Borrow Pit - sample #10U						
					-					
Remar	ks: San	d Cone	Method	l Used			Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.			
<b>Fechnic</b>	cian Time	7:00	AM - 9:	:00 AM,	′ 2:00 F	PM - 4	:30 PM			
Technic	cian:	Earl	E. Dut				Earl E. Dubin			
		-				TICLIUM U	CALLITY CONTROL E ENGINEERING SPECIALTY SERVICES			

#### FIELD IN-PLACE DENSITY TEST REPORT

INVES	PI	R	H NC.
			===

. 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555

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1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niagar	a Falls	Stora	ge Site		Report NoDT-76		
Clien	t	В	echtel_				Date:10/1/84		
Conti	ractor:	-	Cowper/	Seven	son		Job No. <u>BT-84-53</u>		
Test No.	Date of Test	Dapth or Elevation		In-place Moisture % Proctor [%] Compaction Code			Location and Remarks		
105U	10/1	334.9	127.6	12.8	99.4	L-16	Clay cap S860, E314 - 95% compaction required.  Retest of test 1040 (See also test 1020)  after further compaction.		
106U	10/1	331.8	127.4	13.2	99.2	L-16	Clay cap S1100, E380 - 95% compaction required		
107U	10/1	331.5	120.4	13.8	93.8	L-16	Clay cap S940, E380 - 95% compaction required. to be retested - after further compaction (see test 1090)		
1 <del>08U</del>	10/1	315.3	111.5	20.0	88.5	L-7	Oak St. area H' N2039, E1330- 90% compaction required. Bechtel directed that proctor from pile #2 be used.  Area to be retested after further drying		
							and compaction.		
		-							
Proctor Code	Maximu Density (	1	Optimum oistura (%)		<del></del>		Material Type and Source		
<b>L-</b> 16	128.		10.5	Cla	v - Swa	nn Roa	ad Borrow Pit - Sample #10U		
L-7	126.		12.1		<del> </del>		sample #4U		
Remar	ks: Sa	nd Con	e Metho	d Used		·	Respectfully submitted,  EMPIRE SOILS INVESTIGATIONS, INC.		
Techni	cian Tim	e:	00 AM -	1:00	PM		- -		
Techni	cian:	Earl	E. Dub	in			Earl E. Dubin		

#### FIELD IN-PLACE DENSITY TEST REPORT



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☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 . JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proied	:t:	Ni	iagara 1	1115	Stiorage	Site	Report No
Client			Bechte	·		<del></del>	Date:10/2/84
	actor:		Cowpe	<u> </u>			Job No
Test No.	Date of Test	Depth or Elevation	In-place Density (pcl)		s., Cosmpaction	Proctor Code	Location and Remarks
1090	10/2	331.6	117.2	12.0	<b>≆1.3</b>	L-16	Clay Cap- \$940, E376 - 95% compaction required retest of test 1070, to be retested A.F.C. See test #1120.
1100	10/2	343.2	117.8	13.8	£1.7	L-16	Clay Cap- S1125, E233- 95% compaction required to be retested A.F.C. (see test #1150)
1,110	10/2	337.5	123.4	12.0	96.1	L-16	Clay cap S960, E305 - 95% compaction required.
			-	<u>!</u>			
			<u> </u>		ļ		
			-				
Proctor Code	Maxim Bensity	•	Optimum loisture (%)		<u></u>	<u>11</u>	Material Type and Source
L-16	128	*	10.5	Clay	- Swann	Road	, Borrow Pit - Sample #10U
		•					Respectfully submitted,
Rema	rks:	San	d Cone	Method	ปรed		EMPIRE SOILS INVESTIGATIONS, INC.
Techn	ician Tir	ne:	12:30 -	4:30			-
Techn	ician: _	Earl	E. Dubi	n	<del></del>		Earl E. Dubin
							Train = ENGINEERING SPECIAL 1 SERVICES

#### FIELD IN-PLACE DENSITY TEST PORT



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☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct: Ni	agara 1	Falls S	torage	Site		Report No. <u>DT- 78</u>		
Clien	t	Bech	ntel				Date: 10/3/84		
Cont	ractor:		Cow	per		····	Job NoBT-84-53		
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	In-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks		
1120	10/3	331.6	121.5	13.4	94.6	L-16	Clay Cap S935, E376 -95% compaction required. retest of test 109U to be retested A.F.Csee test 118U		
<u>113U</u>	10/3	337.6	119.2	16.1	92.8	L-16	Clay cap S1040, E314 - 95% compaction required material to be reworked - see test 1190		
11411	10/3	333.0	121.0	13.8	94.2	L-16	Clay cap S1120, E365 95% compaction required. to be retested A.F.C. see test 1170		
1150	10/3	343.4	122.2	15.8	95.2	L-16	Clay cap S1110, E225 - 95% compaction required Area to be windrowed and recompacted -see test 121U		
1160	U 10/3 343.5 123.6		123.6	14.2	96.3	L-16	Clay cap S960, E235 - 95% compaction required. area to be windrowed and recompacted - see test 1200		
1170	10/3	333.2	124.6	13.9	97.0	L-16	Clay cap S1125, E360, 95% compaction required. retest of test 114U A.F.C. Bechtel Ok'd high moist.		
1180	10/3	331.4	126.5	13.2	98.5	L-16	Clay cap S940, E380, 95% compaction required. retest of test 1120 A.F.C.		
Proctor Code	Maximu Density (s	1 -	ptimum  sture (%)			<del></del>	Material Type and Source		
L-16	128.4	4 1	0.5	C	lay - S	vann f	Road, borrow pit - Sample #10U		
		•					Respectfully submitted,		
Remari Test			Cone Mo				EMPIRE SOILS INVESTIGATIONS, INC.		
rechnic	cian Time	7:00	AM -	4:00 PI	4				
[echnic	ian:	Earl E	. Dubii	1			Earl E. Dubin		

## FIELD IN-PLACE DENSITY TEST PEPORT



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niaga	ra Fal	<u>1s Sto</u>	rage Si	te	Report No <u>DT-</u> 7 <u>9</u>
Clien	t	Bechte	e1				Date: <u>10/4/84</u>
Conti	ractor:		Cowp	er			Job No. <u>BT-84-53</u>
Tesi No.	Date of Test	Depth or Elevation	in-place Density (pc1)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1190	10/4	339.7	116.3	15.8	90.6	L-16	Clay cap - S1035, E300- 95% Compaction required. retest of test 113U -after further compaction Material to be removed and reworked -see test
1200	10/4	343.5	126.7	13.0	98.7	L-16	122U Clay Cap - S965, E235, 95% compaction required. retest of test 116U.
		343.5	121.3	14.2	94.5	L-16	Clay cap - S1110, E230 - 95% compaction required. retest of test 115U - see test 123U  Clay cap - S1035, E295, 95% compaction required.
122U 123U	10/4	339.7 343.5	125.7 127.8				retest of test 119U.  Clay cap - S1110, E235- 95% compaction required. retest of test 121U
124U	10/4	338.5	118.3	13.8	92.1	L-16	Clay cap - S865, E295, 95% Compaction required.  to be retested after drying and further compaction  See test 126U
1250	10/4	335.5	115.4	16.3	89.9	L-16	Clay cap - S960, E345 - 95% compaction required. to be retested after drying and further compaction
Proctor Code	Maximu Density (	- 1	plimum sture (%)				Material Type and Source
L-16	128,	4 10	).5	Clay	- Swan	n Road	d, Borrow Pit - Sample #10U
Remari	ks:	Sand Co	ne Met	hod Us	ed.		Respectfully submitted,  EMPIRE SOILS INVESTIGATIONS, INC.
				-			
Technic	dan Time	·	30 AM		PM		
Technic	cian:	Earl	E. Dub	in	· · · · · · · · · · · · · · · · · · ·		Earl E. Dubin



THE HAPO PARK & ROCHESTER & GROTON & ALBANY & SYRACUSE & NEW YORK CITY WASHINGTON OLD & MCODBRIDGE IN J. & HARRISBURG PA

ORCHARD PARK DISTRICT OFFICE: S-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proj	act:	Niagar	a Falls	Stora	Report No. DT. 80		
Clie	nt:	Bec	htel	<u>-</u> -		·	Date: <u>10/9/84</u>
Cont	ractor	·:	Cer	rone			Job No. <u>BT-84-53</u>
100.	8	Depth or Elevation			Relative Density (%)	Proctor Code	
1360	10/9	finish grade	€d	2.0		•	"O" St. culvert at Western ditch- 95% compaction required.
			:				
							· -
	·						
		-			}		·
			·				
Tuctor Code (	Mozimur Density (c	m Min.	Density PCF)			!	Moterial Type and Source
*	135.7	106	. 6	2" F	R.O.C	Niac	gara Stone
RE	MARKS:	Sand C	one Met	hod Us	ed.		Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.
	ISPECTI(	R: E	arl E.	Dubin			Earl E. Dubin

## FIELD IN--PLACE DENSITY TEST PEPORT

SOILS	VIP INVESTIGA	ATIONS INC

☐ 585 1 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555 ☐ S-CASSES SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110 ☐ 105 : CORONA AVENUE, GROTON, NY 13073 607-898-5881 ☐ RARR TAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202 ☐ 1154 = P DGE RD. EAST, ROCHESTER, NY 14621 716-342-5320 ☐ 635 , JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niagar	a Fall	s Stor	Report No				
Clien	t	Bech	itel				Date: 10/9/84		
Contr	ractor:	Cow	per				Job No. <u>BT-84-53</u>		
Test No.	Date of Test	Depth or Elevation	in-place Density (pcf)	in-place Moisture (%)	compaction	Proctor Code	Location and Remarks		
137U	10/9	332.8	118.4	12.2	٠.٥ نتي	L-15	Clay cap S785, E105 - 95% compaction requested to be retested A.F.C See test #142U		
							•		
			<u> </u>						
Proctor Code	Maximu Denzity (		lptimum listure (%)				Material Type and Source		
-15	126.	.0 1	2.6		Lewport	ewport Clay - Sample #9U			
			<del>.</del>						
		•					Respectfully submitted,		
Remar	ks:S	and Con	e Meth	od Use	<u> </u>		EMPIRE SOILS INVESTIGATIONS, INC.		
	<del></del> .					<del></del>			
			3:00 - ` E. Dubi				Earl E. Dubin		
Technic	cian:		5001	···			CONTROL - ENGINFFRING SPECIALTY SERVICES		

#### FIELD IN-PLACE DENSITY TEST PEPORT



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229. ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niagar	a Fall	s Stor	age Sit	Report NoDT - 82	
Clien	t	Bech	ntel		·		Date: 10/12/84
Conti	ractor:	J. k	. Cowp	er			Job No. <u>BT-84-53</u>
Test No.	Date of Test	Depth or Elevation	in-place Density (pcf)	in-place Moisture [%]	% Compaction	Proctor Code	Location and Remarks
138U	10/12	331.8	128.7	12.0	100%+	L-15	Clay cap S1030, E75 - 95% compaction required. test at finished grade
1390	10/12	336.8	125.2	9.2	99.4	L-15	Clay Cap S1100, E200, 95% compaction required. test at finished grade
,							
							<u> </u>
Proctor Code	Maximu Density (s		ptimum isture (%)				Material Type and Source
L-15	126.0	) 1	2.6	Lew	port Cla	ay - S	ample #9U
		. •					Respectfully submitted,
Remar	ks:	Sand Co	ne Met	hod Us	ed -	<u>.</u>	EMPIRE SOILS INVESTIGATIONS, INC.
Technic	ian Time	9:0	0 - 12	:00			
Technic	-	arl E.					Earl [. Dubin

#### FIEL " IN-PLACE DENSITY TEST [ "PORT



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niag	gara Fa	lls St	orage S	ite	Report No 83
Clien	t	Becht	2]				Date: 10/13/84
Contr	actor:	_J_W_	Cowper		·	<del></del>	Job No. <u>BT-84-53</u>
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks
1400	10/13	335.6	111.2	14.0	86.6	L-16	Clay cap S960, E340 - 95% compaction required.
							and compaction.  Area to be retested after recompaction
							See test 141U
				,			
	·						
Proctor Code	Maximu Density (s		)ptimum listure (°°°)			<u></u>	Material Type and Source
L-16	128.4		10.5	Clay	/ - Swar	n Roa	d, Borrow Pit - Sample #10U
	······································						
					·		
			•				Respectfully submitted,
Remar	ks: <u>Co</u>	ne Met	hod Use	ed			EMPIRE SOILS INVESTIGATIONS, INC.
			0.20	20-01			
			8:30 -			<del></del> .	
Technic	cian:	tari E	. Dubir	1			Earl E. Dubin



## FIELD RELATIVE DENSITY TEST REPORT ORCHARD PARK & ROCHESTER & GROTON & ALBANY & SYR/ SED NEW YORK CITY WASHINGTON D.C. & WOODBRIDGE, N.J. & HARRISBURG, PA

ORCHARD PARK DISTRICT OFFICE: 5-3858 SHELDON ROAD ORCHARD PARK, NEW YORK 14127 AREA CODE 716-649-8110

Proj	ect:	Niagara	<u>Falls</u>	Stora	ge Site	,	Report NoNI-84		
Clier	nt:	Bechte	٠١				Date: <u>10/5/84</u>		
Cont	ractor	':	Cerrone	<u> </u>			Job No8T-84-53		
Test	Dote of Test	Depth or Elevation	In Place Density	In-Place Moisture	Relative Density (%)	Proctor Code	Location and Remarks		
1-28∪	10/5	finishe grade			100+	*	Culvert - Town of Lewiston @ W. Ditch,95% compaction req'd.		
1290	10/5	finishe grade	d 130.0	2.0	83.9	*	Culvert- "M" St. 0 W. Ditch, 95% compaction reg'd.		
1 <del>30U</del>	- 	finishe grade		3.6	100+	*	Test fails - to be retested  Culvert - "L" St. @ Central ditch, 95% compaction req'd.		
13 <del>1</del> U	10/5	finishe grade	d 151.5	3.4	100+	*	Culvert - Pine St. @ Central Ditch. 95% compaction Req'd.		
Proctor Code	Mozimi Density	m Min.	Density (PCF)	,	<u> </u>	1	Material Type and Source		
*	135.7		06.6	2" F	1.0.C. N	liagar	ra Stone		
R	REMARKS	: San	d Cone	Methoc	l Used		Respectfully submitted, EMPIRE SOILS INVESTIGATIONS, INC.		
	NSPECT	ION TIME	: <u>9:0</u> arl E.	<del></del>	:00		Earl E. Cibin		

#### FIELD IN-PLACE DENSITY TEST PEPORT

SOILS	M INVE	P	TIONS	INC

□ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
□ S-3858 SHELDON RD., P.O. BOX 229. ORCHARD PARK, NY 14127 716-649-8110
□ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
□ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
□ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
□ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct:	Niagaı	ra Fall	s Stor	age Sit	е	Report NoT-85
Clien	t	Beck	ntel				Date:10/5/84
Conti	ractor:	Se	evenson				Job No. <u>BT-84-53</u>
Test No.	Date of Test	Depth or Elevation	la-place Density (pcl)	In-place Meisters (%)	% Campaction	Precter Code	Location and Remarks
<del>1020</del>	10/5	321.0	117.7	11.6	95.7	C-2	Contaminated pile S1625, E320 90% req¹d.
,							
						·	
			·				
							**************************************
							· · · · · · · · · · · · · · · · · · ·
Proctor Code	Maximu Density (		plimum Istura (%)				Material Type and Source
C-2	123.	0 1	1.6	Clay	contam	inate	d pile - sample #2C
							· · · · · · · · · · · · · · · · · · ·
		•					Respectfully submitted,
Remar	ks: <u>S</u>	and Con	e Meth	od Use	d	· · · · · · · · · · · · · · · · · · ·	EMPIRE SOILS INVESTIGATIONS, INC.
Technic	cian Time	e:9:0	0 5:	00_		<u>_</u>	-
Technic		Earl E					Earl E. Dubin

## FIEL " IN-PLACE DENSITY TEST P"PORT



☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

					OOD DAMES .	OINELI,	31100001,111 10000 310-412-4000
Proje	ct: Nia	agara F	alls St	torage	Site		Report No
Clien		Bech	itel				Date:Date:
Conti	ractor:		Cowpe	er			Job NoBT-84-53
Test No.	Date of Test	Dapth or Elevation	In-place Density (pcf)	in-place Meisture (%)		Proctor Code	Location and Remarks
1260	10/5	338.3	124.0	11.0	96.6	L-16	Clay Cap-S855,E290, 95% compaction reg'd.
							Retest of test #124U
1270	10/5	335.0	118.8	11.8	94.3	L-15	Clay cap-S825,E175, 95% compaction reg'd.  Bechtel accepted after further compaction
							beciter accepted after farther compaction
	-	<u> </u>	<del> </del>	ļ			
		<u> </u>					
			ļ				
		ļ					
		ļ					
Prector Code	Maxim Density		Optimum oisture (%)				Material Type and Source
L-15	126.0	12	.6	Clay	- Lewpo	rt -	sample #9U
L-16	128.4	1 10	.5	Clay	- Swann	Rd.,	Borrow Pit - sample #10U
				•			
		•					Respectfully submitted,
Remai	rks: Sā	and Con	e Metho	d Used	i.		EMPIRE SOILS INVESTIGATIONS, INC.
Techni	ician Tirr	9:	00 - 5:	:00			<b>-</b>
Techni			E. Dub	oin			Earl E. Dubin
	~·~·· —						

## FIELD 'N-PLACE DENSITY TEST REPORT

1P	TIQLE

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-849
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14821 716-342-5320
☐ 835 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

715-649-8110

Proiect:	Niagara Falls Storage Si	te Report NoT-87
•	Bechtel	Date:10/15/84
Contractor:	Cowpor	Job No. BT-84-53

Clay Cap, S790, E105-95% compared to 10/15 333.0 128.2 10.8 100% L-15 test at finished grade - see recommendations.	
141U 10/15   335.6   122.2   11.8%   95.2   L-16 test at finished grade - see recompanies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies of the companies o	ks
142U 10/15   333.0 128.2 10.8   100% L-15 test at finished grade - see re	emarks
	ction req'd.
143U 10/15 343.7 117.9 10.8 93.6 L-15 test at finished grade - to be	action req'd. retested after
further compaction see tests #146 and #147	
144U 10/15 338.6 122.3 11.0 97.1 L-15 Clay Cap-S875, E160, 95% compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the compared to the	ction req'd/
Clay Cap -S785, E310, 95% comp.	action req'd.
Clay Cap - S950, E233, 95% com	
Clay cap - S950, E233, 95% com	paction req'd.
Practer Maximum Optimum Material Type and Source Material Type and Source	
L-15 126.0 12.6 Lewport Clay - sample #9U	
L-16 128.4 10.5 Clay - Swann Road, Borrow Pit - sample #10U	

Sand Cone Method Used.	Respectfully submitted,					
Remarks: Test 141U - retest of test #140U (see also 132U)	EMPIRE SOILS INVESTIGATIONS, INC.					
Test 142U-retest of test #137U	Test 147U- retest of test #146U(See test 143U)					
Test #146U- retest of test #143U  Technician Time: 8:00 - 4:30						
Technician: Earl E. Dubin	Earl E. Dubin					
	ALITY CONTROL & ENGINEERING SPECIALTY SERVICES					

## FIELD IN-PLACE DENSITY TEST PEPORT

Clien	_	Book	+-1				Report No. <u>DT-88</u>
Conti			Sever				Date:10/15/84 Job NoBT-84-53
Test No.	Date of Test	Bepth or Elevation	in-place Density	In-place Moisters	% Cempaction	Practer Cade	Location and Remarks
103C	10/15	319.3	92.2	24.0	76.1	C-1	Contaminated pile S.625, E290 - 90% compaction req'd. Fails to meet compaction requirements.
				·			
		<b>.</b>					
							·
Prector Code	Maximu Density (j		Optimum eisture (%)				Material Type and Source
C-1	121.		2.0	Clay	- conta	minat	ed pile - sample #1C

Earl E. Dubin

Technician Time: 8:00 AM - 4:30 PM

Technician: __

Earl E. Dubin

## FIELD IN-PLACE DENSITY TEST RFPORT

EM SOILS INVES	PIRE

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-849-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881

RARITAN CENTER, 300 McGAW DRIVE. EDISON, NJ 08837 201-225-0202

☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320

☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	ct: _N	iagara	Falls	Storag	e Site		Report NoDT-89
Clien	t	Be	chtel		· · · · · ·		Date:10/16/84
Cont	ractor:	<u></u>	Kimmir	S			Job NoBT-84-53
Test No.	Date of Test	Depth or Elevation	in-place Density (pcf)	In-place Meisture (%)	% Compaction	Prector Code	Location and Remarks
1480	10/16	325.2	121.1	10.4%	96.1	L=2	West Dike - S1672, E135 95% compaction req'd. retest of test #135U (see also test #12U)
	·						
							·
							<u> </u>
							·
Prector Code	Maximu Density (		ptimum isture (%)				Material Type and Source
L-2	126.		12.2	Clay	- Mode	rn La	nd fill #3
			•	<u> </u>		<del></del>	Respectfully submitted,
Remar	ks:S	and Co	ne Meth	od Use	d.		EMPIRE SOILS INVESTIGATIONS, INC.
Techni	cian Time	<del></del>	1:00 F	M - 5:	00 PM	<del></del>	<u>.</u>
	cian:						Earl E. Dubin

## FIELD IN-PLACE DENSITY TEST REPORT

E soi	LS INVE	P	RE	

☐ 585 TROY-SCHENECTADY RD., LATHAM, NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-5320
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Project: <u>Niagara Falls Storage Site</u>						Site	Report NoT-90	
Clien	lient Bechtel National Inc.						Date: <u>10/8/84</u>	
Conti	ractor:		Cow	per/Se	evenson		Job No. <u>BT-84-53</u>	
Test No.	Bate of Test	Depth or Elevation	in-place Density (pci)	in-place Moisture (%)	% Compaction	Prector Code	Location and Remarks	
1320	10/8	335.6	119.7	16.0	98.2	L-16	Clay Cap S955, E340- 95% Compaction Req'd. Retest of test 125U after dring and further compa	ac.
133U	10/8	315.3	118.6	14.0	94.1	L-7	tion.  Oak St. Area H'-N2045, E1330-90% compaction  req'd. Retest of test 133U	•
134U	10/8	331.4	125.0	12.0	99.2	L-15	Clay Cap S1810, E800- 95% compaction req'd	
135U	10/8	325.2	112.5	10.7	89.3	<del>L-</del> 2	S. Dike S1672, E135 - 95% compaction req'd retest of test #12U taken 6/14/84 To be retested after further compaction	
·	_							
Proctor	Mazimu		ptimum		<u> </u>		Material Type and Source	
L-2 L-7	126.0 126.0	1	1sture (%) 2.2 2.1	Clay Clay	- Moder - Pile	n Lar #1 -	Sample #3U	
L-15	126.0	1	2.6	Clay	- Lewpo	rt -	Sample #9U	
L-16	128.4	1	0.5	Clay	- Swann	Rd.,	Borrow Pit Sample #10U	
		•					Respectfully submitted,	
Remar	ks: <u>\$</u>	and Con	e Metho	d Used	i	<del></del>	EMPIRE SOILS INVESTIGATIONS, INC.	
Technic	cian Tim	e: <u>10:</u>	00 - 4:	:30			- -	
Techni	cian:	Earl	E. Dub	in		<del></del>	Earl E. Dubin	

#### FIELD 'N-PLACE DENSITY TEST RE ORT

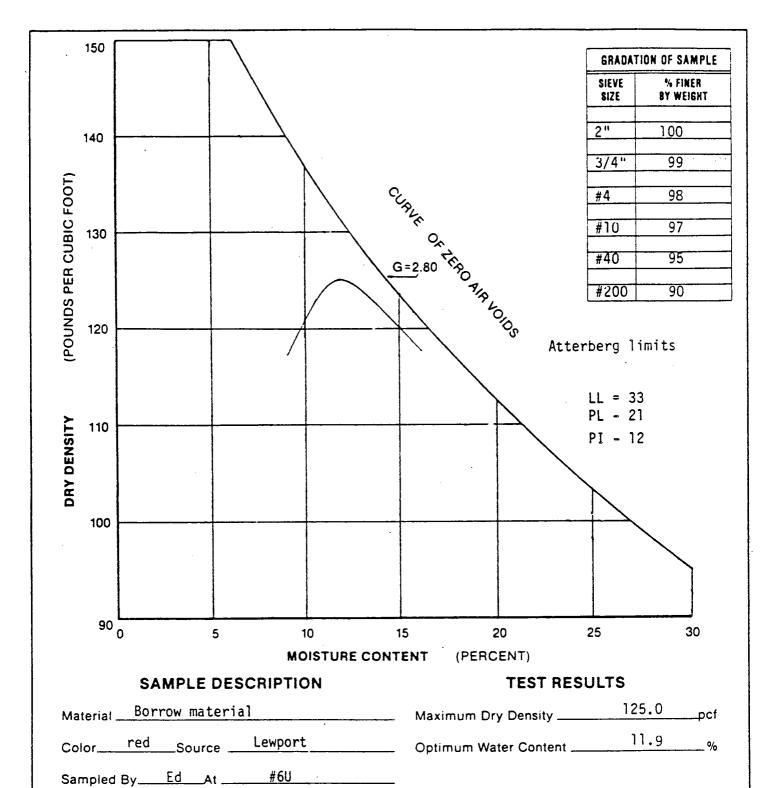


☐ 585 TROY-SCHENECTADY RD., LATHAM. NY 12110 518-783-1555
☐ S-3858 SHELDON RD., P.O. BOX 229, ORCHARD PARK, NY 14127 716-649-8110
☐ 105 CORONA AVENUE, GROTON, NY 13073 607-898-5881
☐ RARITAN CENTER, 300 McGAW DRIVE, EDISON, NJ 08837 201-225-0202
☐ 1164 RIDGE RD. EAST, ROCHESTER, NY 14621 716-342-53∠0
☐ 635 JAMES STREET, SYRACUSE, NY 13203 315-472-9333

Proje	roject: Niagara Falls Storage Site					Site	Report No. DT-90	
Clien	Bechtel National Inc.						Date:10/8/84	
Cont	ontractor:Cow			per/Se	evenson	<del></del>	Job NoBT-84-53	
Test No.	Date of Test	Depth or Elevation	in-place Density (pcl)	in-place Moisture (%)	% Compaction	Proctor Code	Location and Remarks	
1320	10/8	335.6	119.7	16.0	98.2	L-16	Clay Cap S955, E340- 95% Compaction Req'd. Retest of test 125U after dring and further com	
1330	10/8	315.3	118.6	14.0	94.1	L=7	Oak St. Area H'-N2O45, El330-90% compaction req'd. Retest of test 133U	11.
1340	10/8	331.4	125.0	12.0	99.2	L-15	Clay Cap S1810, E800- 95% compaction req'd	
135 <del>U</del>	10/8	325.2	112.5	10.7	89.3	L-2	S. Dike S1672, E135 - 95% compaction req'd retest of test #12U taken 6/14/84 To be retested after further compaction	-
·								
Proctor	Maximu	ım 0	ptimum				Material Time and Source	
Code L-2 L-7	126.0 126.0	(pcf) Moisture (%)			Material Type and Source idfill #3 - Sample #2U Sample #3U			
	126.0 128.4		2.6 0.5	Clay - Lewport - S			Sample #9U  Borrow Pit Sample #10U	
<u> </u>	120.4	<u></u>		Ciay	- Swalli	<u> </u>	Respectfully submitted,	
Remar	ks: <u>S</u>	and Con	e Metho	d Used	i,	······································	EMPIRE SOILS INVESTIGATIONS, INC.	
Techni	cian Tim	e: <u>10:</u>	00 - 4:	30			- -	
Techni	cian:	Earl	E. Dubi	n			Earl E. Dubin	

## APPENDIX 3-B

PROCTOR TEST RESULTS



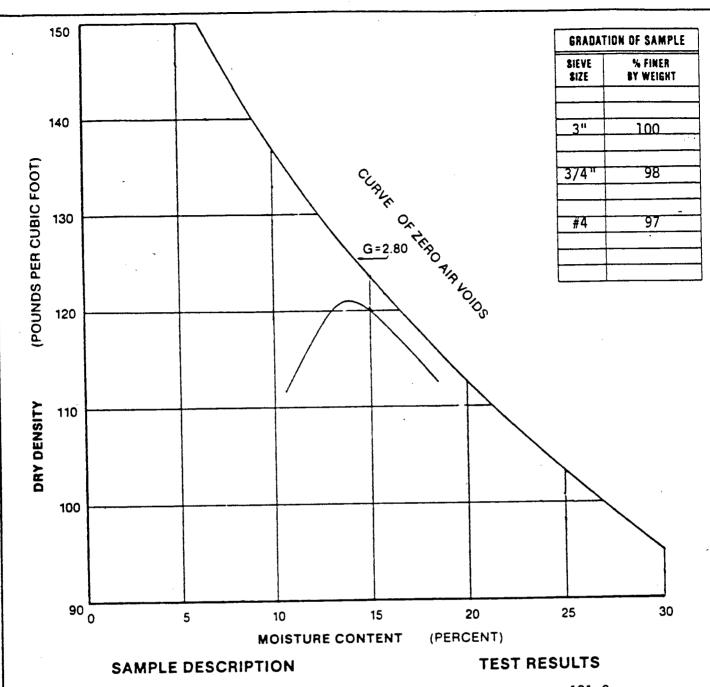
METHOD OF	TEST
STANDARD	METHOD
ASTM_D1557	_A
AASHTO	
MILITARY	
OTHER	

EMPIRE SOILS INVESTIGATIONS INC

#### OPTIMUM MOISTURE—MAXIMUM DENSITY

NIAGARA FALLS STORAGE SITE

DR. BY: WL	DATE SAMPLED: 8-10	
CK'D. BY: CCK	TESTED BY: JS & JH	CURVE NO. L-12



Material	Clay Cap Mat	terial	Maximum Dry Density	121.0	pcf
Color	red Source _	on site	Optimum Water Content	13.9	%
Sampled	By Ed At _	\$1075, F100, F1	evation 334.4		
	SAMPLE #10	OU			

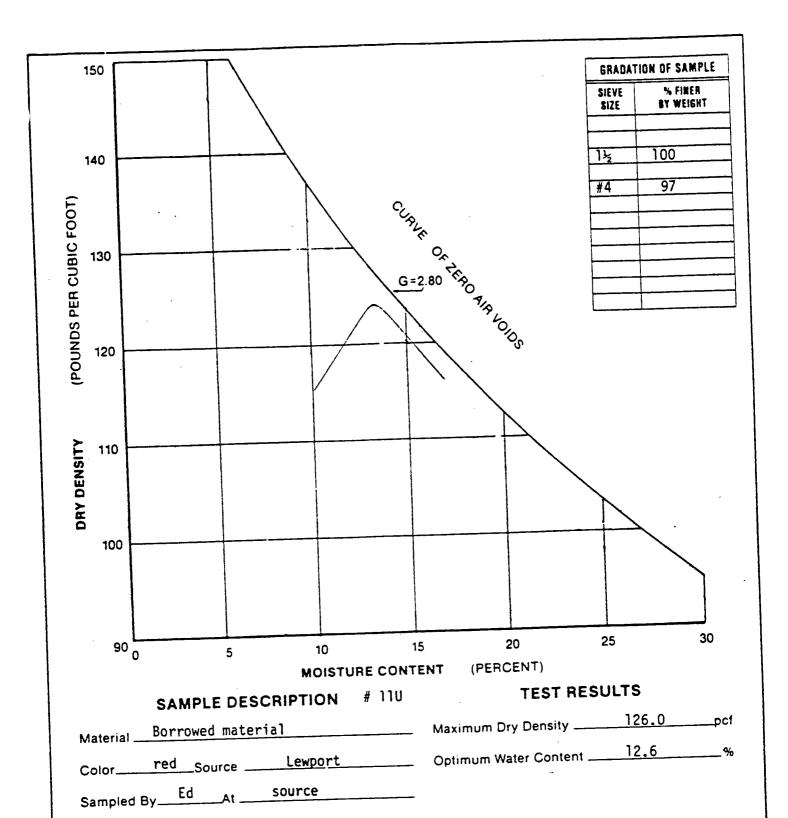
METHOD OF	TEST
STANDARD	METHOD
ASTM_01557	A
AASHTO	
MILITARY	
OTHER	



## OPTIMUM MOISTURE—MAXIMUM DENSITY

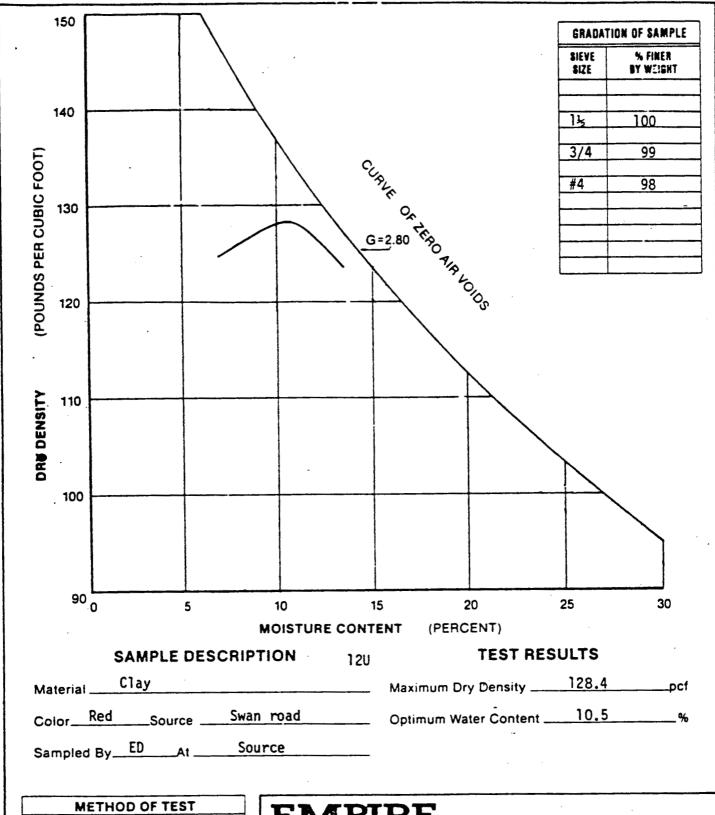
NIAGARA FALLS STORAGE SITE

ì			
DR. BY:	WL	DATE SAMPLED: 8-30	PROJ. NO.BT-84-53
CK'D. BY:	CCK	TESTED BY. DW & JJ	CURVE NO. L-14



METHOD OF	TEST
STANDARD	METHOD
ASTM_D 1557_	A
AASHTO	
MILITARY	
OTHER	

EN	/PI	RE DISTINC	
.(	OPTIMU	M MOISTURE-MAXIM	MUM DENSITY
		NFSS	
DR. BY:	WL	DATE SAMPLED: 8:30	PROJ. NO. BT-84-53
CK'D BY:		TESTED BY: EE & GJ	CURVE NO. L-15
			Pevised



METHOD OF	TEST
STANDARD	METHOD
ASTM_D1557	A
AASHTO	
MILITARY	
OTHER	

EMPI SOILS INVESTIGAT	RE IONS INC
OPTIMU	IM MOISTURE—MAXIMUM DENSITY
NFSS	
DR. BY: WL	DATE SAMPLED: 9-10 PROJ. NO. BT-84-53
CK'D. BY: CCK	TES ED BY: JH & RK   CURVE NO. L-16

## APPENDIX 3-C

BORING LOGS
BP-NE, BP-N, BP-NW, BP-SW, BP-S, BP-SE

Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil Overburden  Soil O	STARTEI FINISHE SHEET PROJECT	7-6-8 1_of_	1 SO	Storage Site LOCATION Niaga	LOC SURF ELEV. N.A.  G. W. DEPTH See Not
Soil Overburden  Soil Overburden  3" Shelby tube adva ced from 5.0'-6.5' with 1.1' recovery  3" Shelby tube adva ced from 15.0'-17.0 with 1.3' recovery  Bag (auger) samples were obtained at 0.0'-5.0' 5.0'-10.0' 10.0'-15.0'  Boring complete at 17.0 feet  Boring was grout sealed at boring completion	SAMPLES	SAMPLE 0 6 1	IR ONE		NOTES
were obtained at 0.0'-5.0' 5.0'-10.0' 10.0'-15.0'  Boring complete at 17.0 feet  Boring was grout sealed at boring completion	5			Soil Overburden	with 1.1' recovery  3" Shelby tube advanced from 15.0'-17.0'
sealed at boring completion	15				0.0'-5.0' 5.0'-10.0'
25	20			Boring complete at 17.0 feet	sealed at boring
	25				
					1

DATE STARTE FINISHE SHEET	D	7-6			OIISIN	APTRE  AVESTIGATIONS INC.  SUBSURFAC	HOLE NO. BP-NW SURF ELEV. N.A. G. W. DEPTH See Note
PROJECT	N	iagar	ra F	alls	Stora	ige Site LOCATION	Niagara Falls, New York
ODEPTH-FTT SAMPLES		BLOWS ( SAMPLI 6 1	ER	2	CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
5						Soil Overburden	3" Shelby Tube obtained from 5.0'-6.5' with 1.5' recovery
10	1					· .	Bag (auger) samples obtained from 0.0'-5.0' 5.0'-10.0' 10.0'-15.0'
15 🔻					F	Soring terminated at 15.0 feet	Driller notes drilli
-20-							through the dike side wall and therefore the boring was terminated
							/
N = No blo	ws to dri	ve	2	spoon	12	with 140lb, pin wt. falling 30 per blow	CLASSIFICATION Visual by

	7-5-84 7-5-84 ? OF 1	EMPIRE SOILS INVESTIGATIONS INC.	SUBSURFACE LOC	HOLE NO. BP-S SURF. ELEV. N.A. G. W. DEPTH See No
PROJECT _	Niagara Falls	Storage Site	LOCATION Niagara	Falls, New York
SAMPLE NO	8LOWS ON SAMPLER 0 6 12 18 N	. 1 5 4 1	OR ROCK ICATION	NOTES
2 2 5 3		Soil Overburden	•	3" Shelby tube obtained from 3.0'-4.2' with 1.1' recovery 18.0'-19.5 with 0.95' recovery
10				Bag (auger) samples obtained from 0.0'-3.0' 5.0'-10.0'
15 5				10.0'-15.0'
20		Boring complete	at 19.5 feet	Borehole grouted at boring completion
				-
i = No blows	to drive 2 "so	oon 12 " with 140   lb. pin wt. fa	alling 30 merhlow CLASS	SIFICATION Visual by

STARTED FINISHED SHEET	7-5-84 _Of_1	OLISINUSSIGATIONSING SUBSURFAC	G. W DEPTH See Not
PROJECT	irragara ra	LOCATION	Niagara Falls, New York
SAMPLE NO	BLOWS ON SAMPLER 5 12 18 N	SOIL OR ROCK CLASSIFICATION	NOTES
5 1 2 3		Soil Overburden	3" Shelby Tube obtained from 7.0'-8.4' with 1.4' Recovery 18.0'-18.2' with 0.0 Recovery 18.5'-19.7' with 0.8 Recovery
10 5 5			Bag (auger) samples were obtained from 0.0'-5.0' 5.0'-10.0' 10.0'-15.0' 15.0'-18.0'
20 8		Boring complete with Refusal 19.7 feet	at  Borehole grouted at  boring completion
			_
		12 "with 140 lb. pin wt. falling 30 "per blo" "with lb. weight falling "per blo	_

PROJECT Niagara Falls Storage Site LOCATION Niagara Falls, New York							
О обртилт	SAMPLES SAMPLE NO	5A	OWS ON MPLER	2	CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
5 - 1 - 1 - 1 - 1 - 1 - 1 - 1	4					Soil Overburden	3" Shelby tubes advanced from: 5.0' to 6.8' with 1.6' recovery, 18.0'-19.8' with 0.0 recovery  Bag (auger) samples obtained from; 0.0'-5.0' 5.0'-10.0' 10.0'-15.0' 15.0'-18.0'
20						Boring complete with Refusa 19.8 feet	Borehole grouted at boring completi

STARTED FINISHED SHEET	7-9-84	SOILS	APIRE  NVESTIGATIONS INC  SUBSURFACE	LOG SURF ELEV N.A.  G. W. DEPTH See Note
PROJECT _	Niagara	Falls Sto	orage Site LOCATION Niagan	ra Falls, New York
SAMPLE NO	BLOWS ON SAMPLER 0 6 12 18	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
2 2 3 4			Soil Overburden	3" Shelby Tubes advanced from 3.0'-4.5' with 1.5' recovery 8.0'-9.0' with 0.4' recovery 9.5'-11.4' with 1.2 recovery
10 5			Boring complete at 11.4 feet	1 block sample obtained Bag (auger) samples were obtained from
				0.0'-3.0' and 5.0'- 8.0'  Borehole grounted a boring completion
				·
			-	
i = No blows	to drive	spoon_12	with 140 lb. pin wt. falling 30 "per blow."	CLASSIFICATIONVisual by

## APPENDIX 3-D

PERMEABILITY TEST RESULTS

- o Test Procedure
- o Test Results



# CONSTANT HEAD PERMEABILITY TESTING WITH BACKPRESSURE SATURATION DESCRIPTION OF TEST PROCEDURE

#### I. DESCRIPTION OF TEST APPARATUS

The permeability test is performed in a triaxial cell, where the test specimen is enclosed in a latex rubber membrane, sealed at base and cap with rubber O-rings. Filter paper, porous stones, and drainage leads facilitate the application of hydrostatic pressure to both ends of the specimen.

Pressure is generated by self-compensating mercury columns capable of delivering pressures up to about 140 pounds per square inch. Three mercury columns are used. One provides a backpressure to ensure saturation of the test specimen. The second column is set at a higher pressure to produce a hydrostatic gradient across the length of the specimen. The third column provides the cell confining pressure, which acts on the rubber membrane to prevent passage of water up along the sides of the specimen.

Water flow to and from the specimen is measured by means of volume change units with graduated burettes containing contrasting colored fluid to facilitate reading of the interface meniscus. Burettes of various sizes are on hand with graduations ranging from 0.05 to 0.2 cubic centimeter.

#### II. SPECIMEN PREPARATION

#### A. Undisturbed Specimens

Undisturbed specimens usually are prepared from 3 inch outside diameter thin wall tube samples. A section of tube sample approximately 5 to 6 inches long is extruded from the tube. The specimen ends are carefully trimmed in a miter box so that they are plane and square with the longitudinal axis of the specimen. Length and diameter is measured by calipers. Two sets of measurements are made at 90° spacing. The diameter is measured near each end of the specimen. The average of the measured dimensions are computed and recorded on the test form.

#### B. Compacted Specimens

Compacted specimens are generally remolded in a 4 inch diameter compaction mold. Unless otherwise specified the specimen is compacted to about 95 percent of maximum dry density, as determined by the Standard Moisture-Density test (ASTM Designation D 698-70, Methods A or C), at a moisture content corresponding to 95 percent compaction on the wet side of the optimum moisture content. Maximum particle size permitted for this specimen size is three-quarter inch.

The specimen is weighed to verify that its density is reasonably close to the intended value, is carefully extruded from the compaction mold and the surface is examined for excessive pitting or other signs of poor compaction before placement in the triaxial cell.

#### III. TEST PROCEDURE

After the apparatus is assembled, and the triaxial cell is filled with deaired water, cell pressure and backpressure is gradually applied until the preset pressure levels on the self-compensating mercury columns are reached.

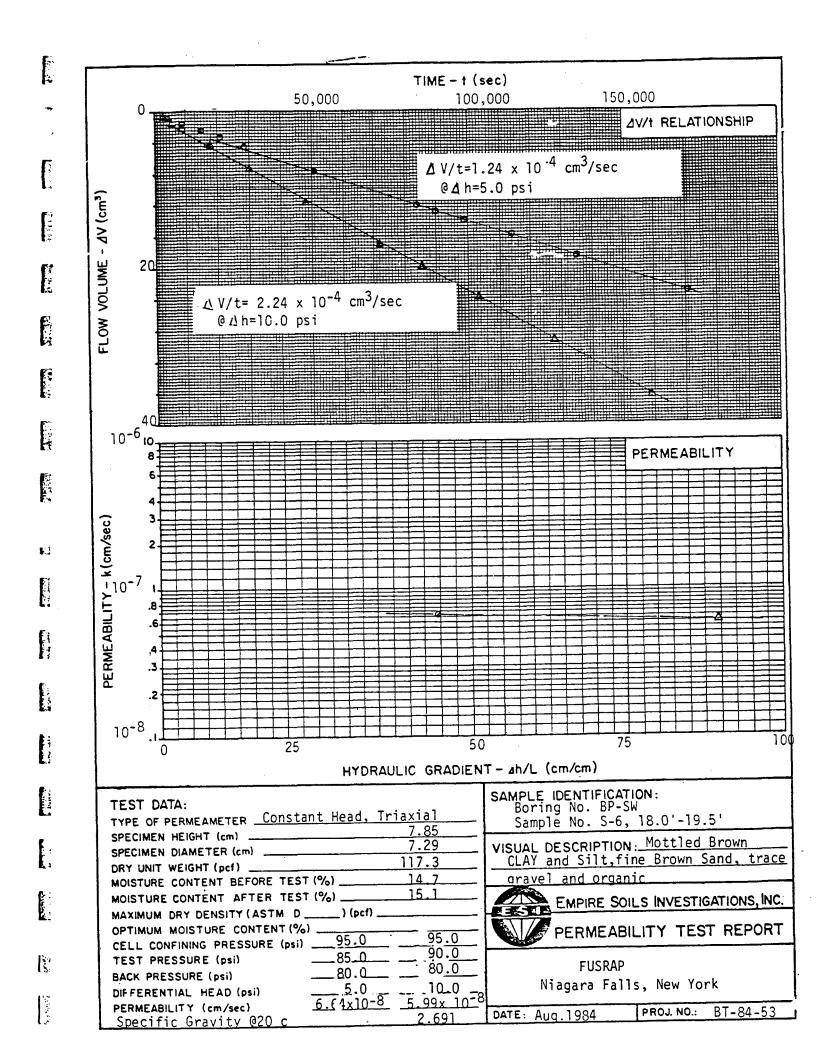
The test is conducted in two separate stages. the first stage a uniform backpressure is applied to both ends while the specimen is saturating and adjusting to the net confining pressure (the difference between the total cell pressure and the backpressure). Routinely, on specimens initially close to saturation, a backpressure of 50 pounds per square inch is used. Compacted specimens generally require a backpressure of 80 pounds per square inch for complete saturation. For undisturbed specimens the cell pressure generally is selected to duplicate the existing overburden pressure at the sample location, thus minimizing consolidation effects. Unless other considerations govern, the net confining pressure is selected so that it is at least 5 pounds per square inch greater than the highest gradient pressure to be used during the permeability test stage. It must be ascertained that all flow due to saturation and consolidation has ceased before the permeability test stage is initiated. With the range of pressures utilized this usually is accomplished within a 16 to 24 hour pressurization period.

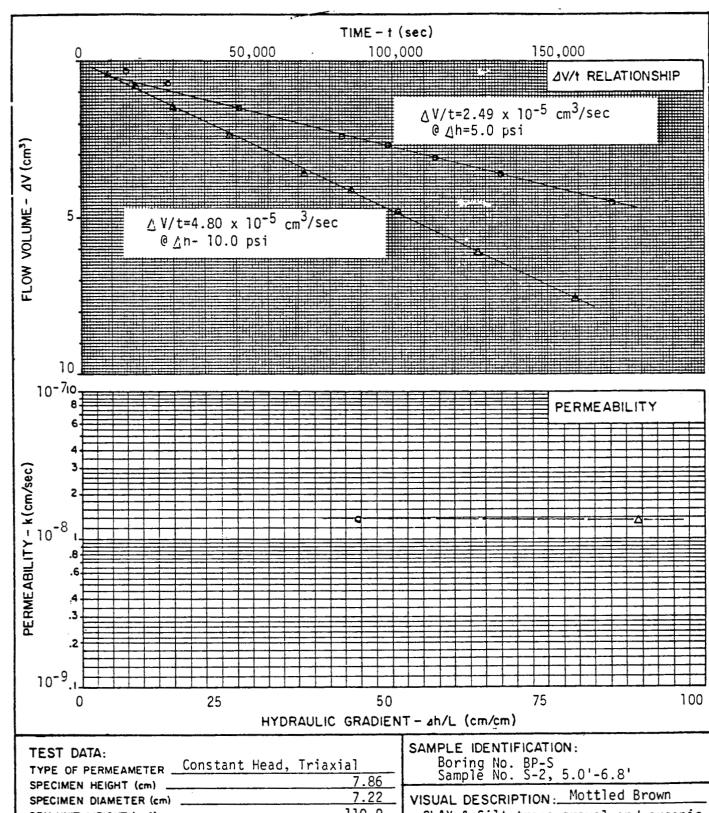
In the second stage of the test a hydrostatic gradient is established across the length of the sample by increasing the pressure at the base of the specimen while maintaining the backpressure at the top. The rate of flow

through the specimen is determined by burette readings, at timed intervals, on a volume change unit inserted in the gradient pressure line. The flow rate is routinely determined for two different gradient pressures. For fairly impervious soils gradient pressures 5 and 10 pounds per square inch higher than the backpressure generally are applied. Gradient pressures on the order of 1 to 2 pounds per square inch are used for more pervious materials. At each gradient pressure the permeability test stage is conducted for a sufficient period of time to accurately determine the flow rate.

The Permeability Test Report form contains all pertinent sample identification and specimen data. Graphical presentations are given of the data upon which the flow rate determination was made at the respective gradient pressures, as well as the permeability at the respective hydraulic gradients applied during the test.

Aside from the self-compensating mercury column pressure system and the twin burette triaxial volume change unit used for flow measurement the procedure described above is similar to "Permeability Tests with Backpressure" in U.S. Army Corps of Engineers EM 1110-2-1906, Appendix VII (7), pp. VII-17 to VII-22.





110.9 DRY UNIT WEIGHT (pcf) 18.4 MOISTURE CONTENT BEFORE TEST (%) 19.0 MOISTURE CONTENT AFTER TEST (%). MAXIMUM DRY DENSITY (ASTM D_ _) (pcf) OPTIMUM MOISTURE CONTENT (%) 95.0 95.0 CELL CONFINING PRESSURE (psi) . 85.0 90.0 TEST PRESSURE (psi) 0.08 0.08 BACK PRESSURE (psi) 5 0 10.0 DIFFERENTIAL HEAD (psi) 36x10-8 31x10-8 PERMEABILITY (cm/sec) Specific Gravity @20 c 2.686

. .

12.00

CLAY & Silt trace gravel and organic



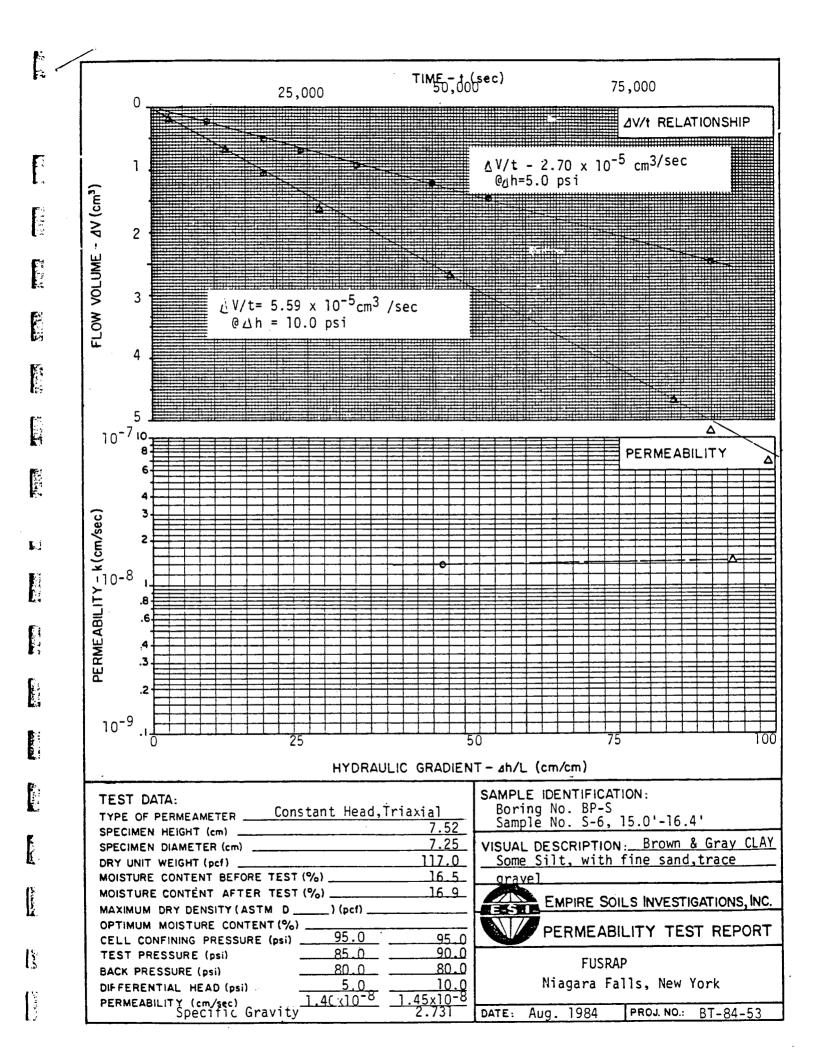
EMPIRE SOILS INVESTIGATIONS, INC.

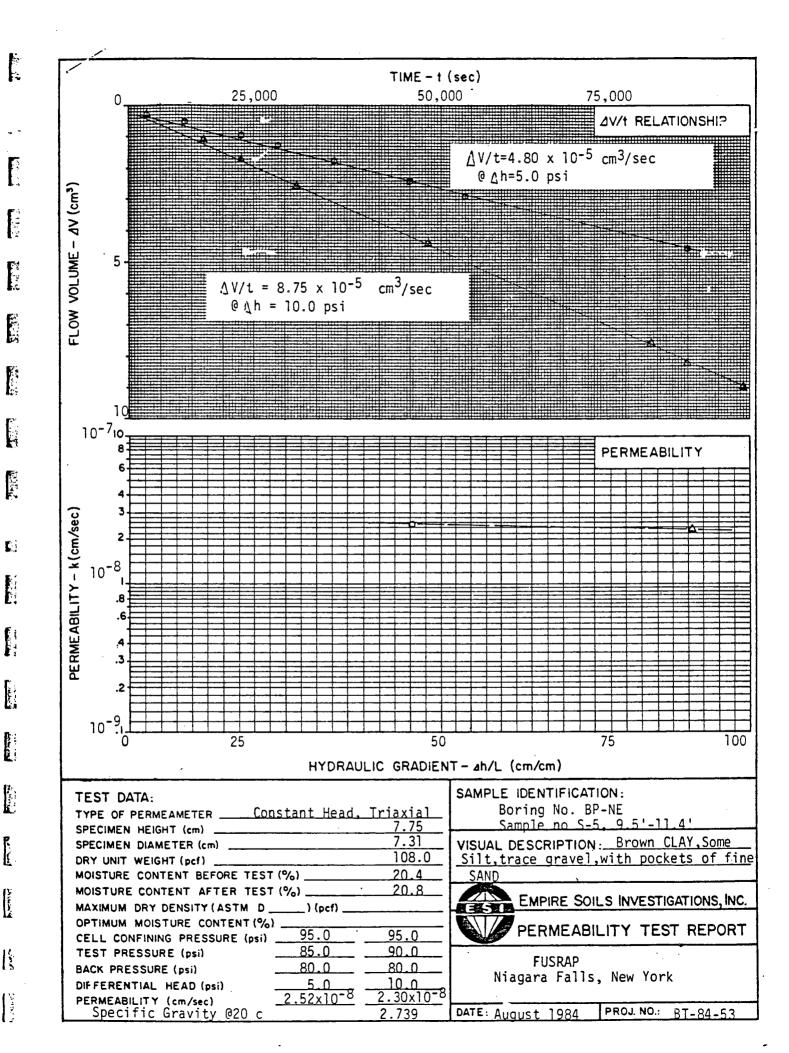
PERMEABILITY TEST REPORT

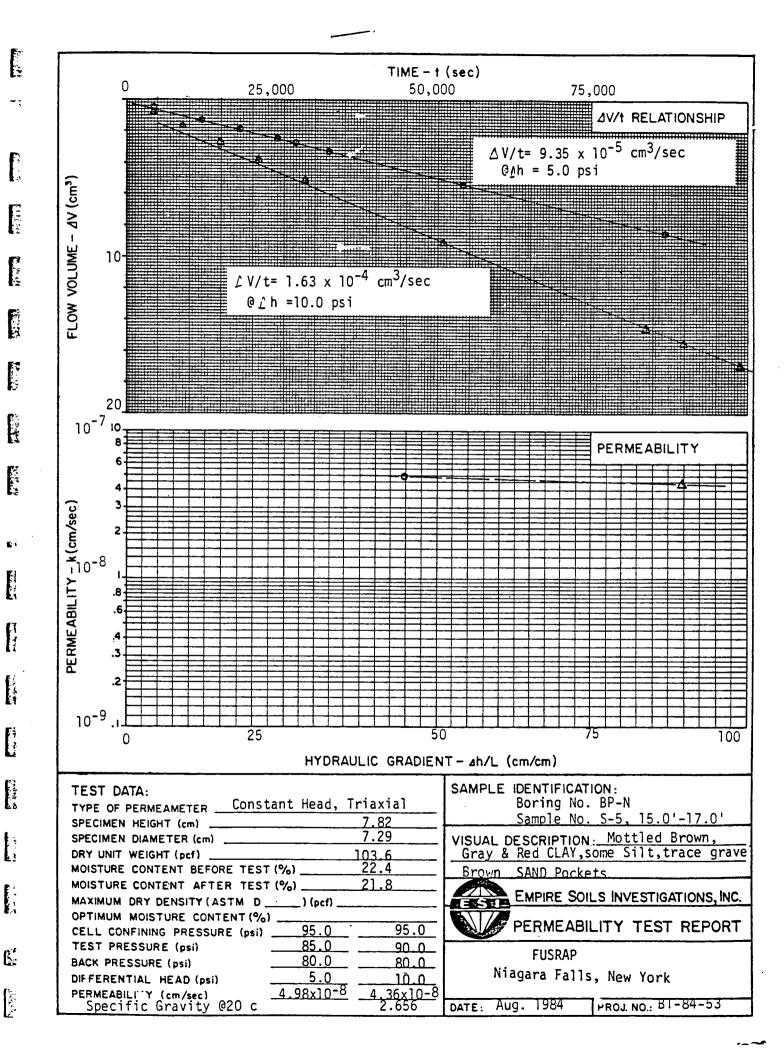
**FUSRAP** 

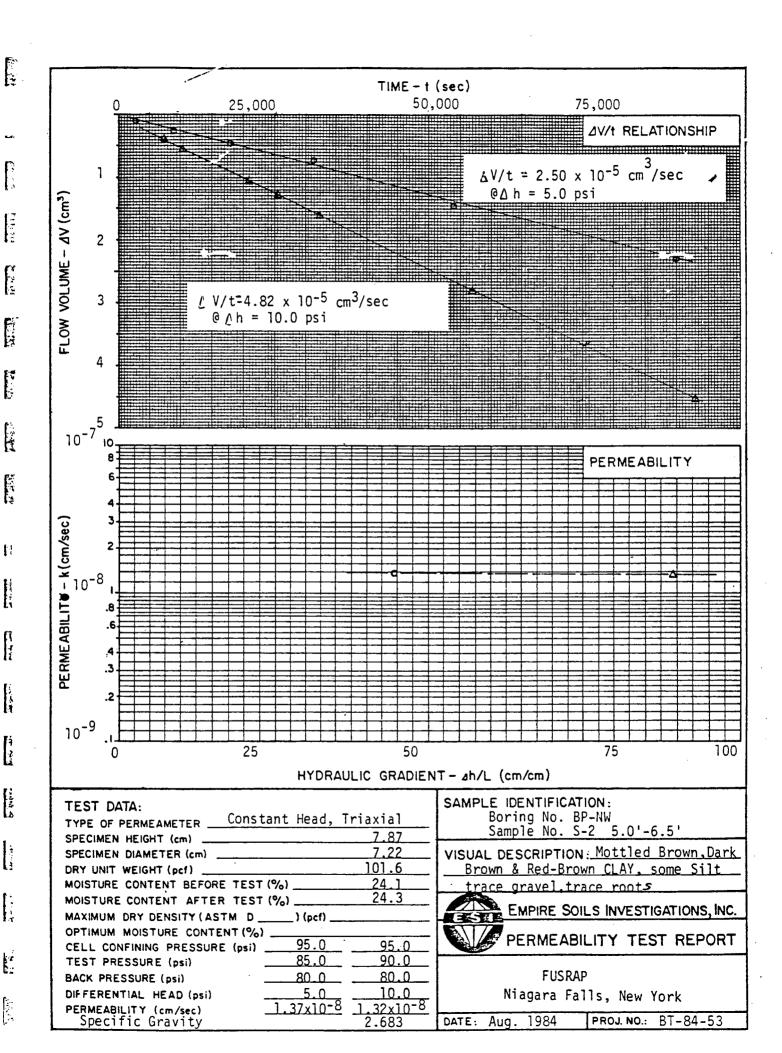
Niagara Falls, New York

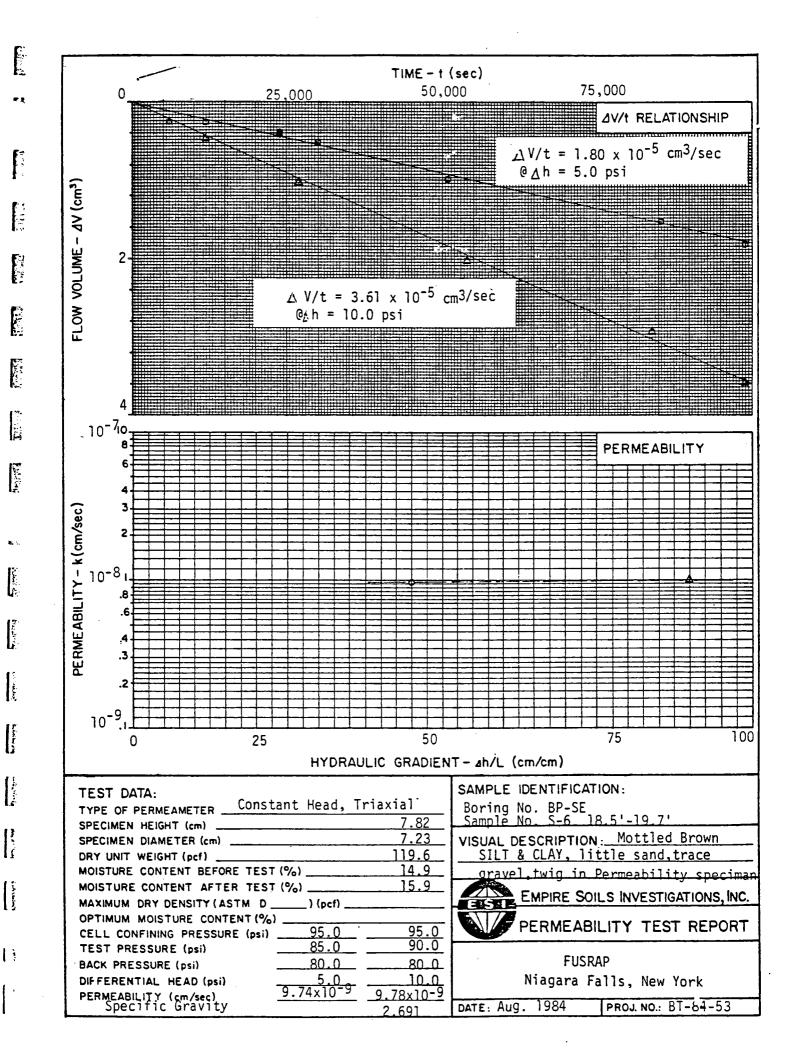
PROJ. NO.: BT-84-53 DATE: Aug. 1984

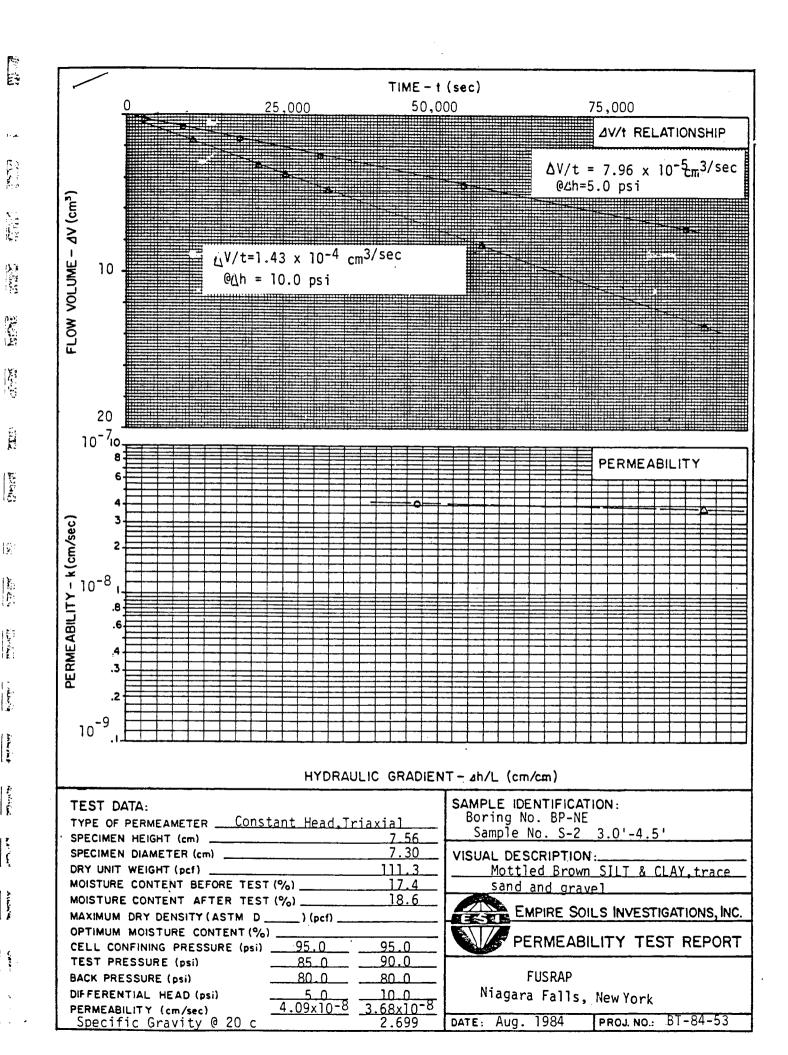


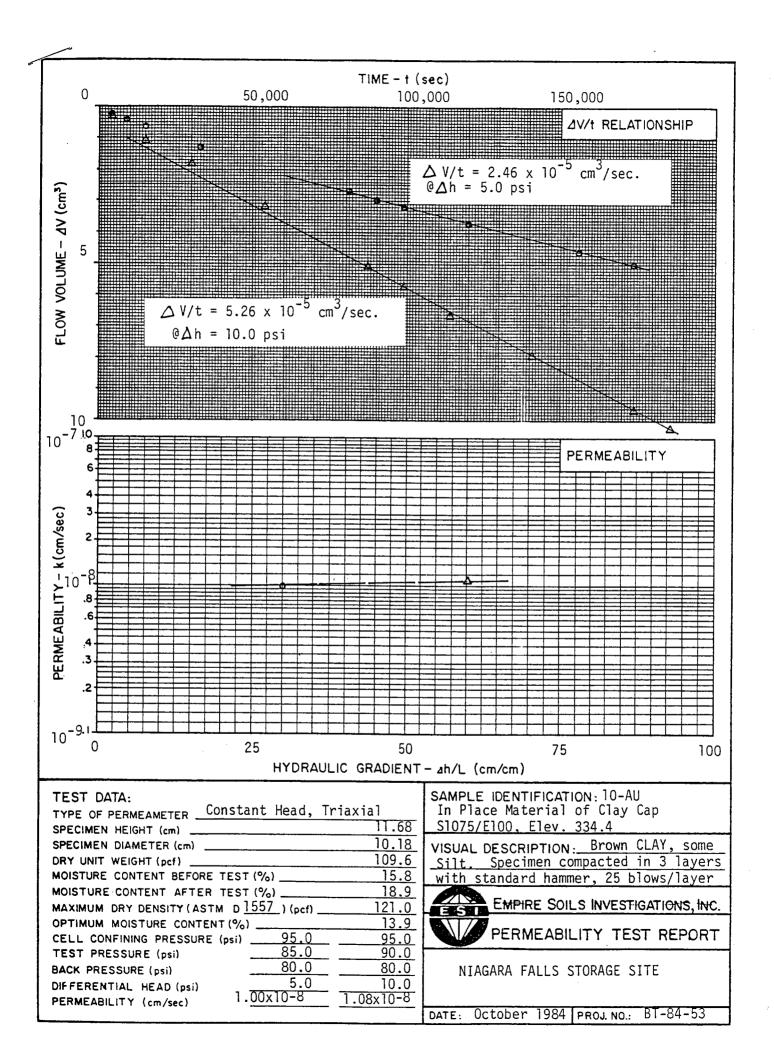


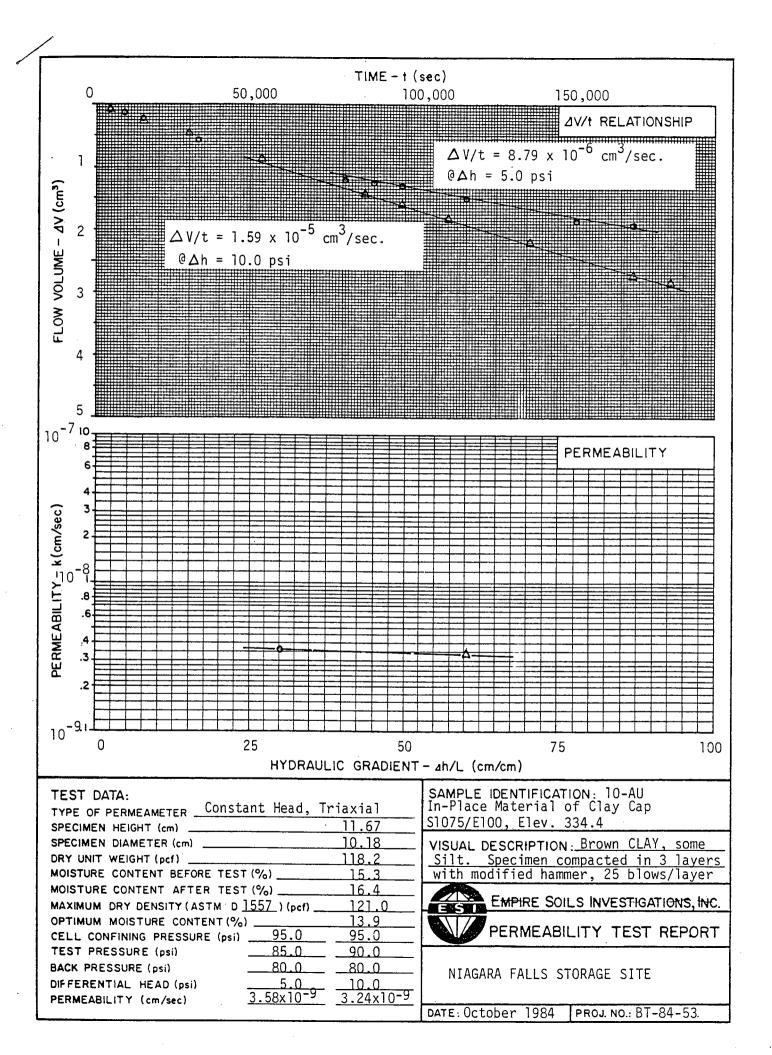


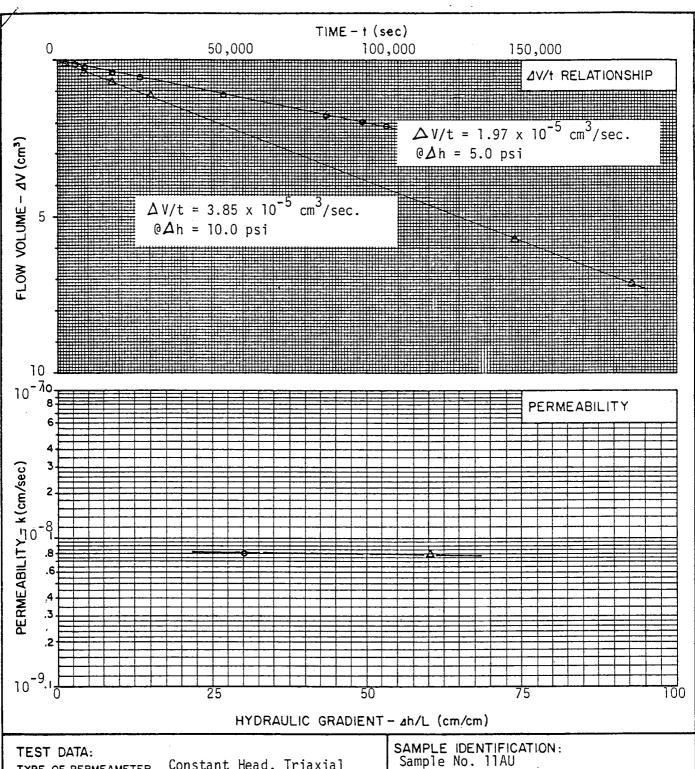












TEST DATA: TYPE OF PERMEAMETERConstant Head, Tr	iaxial
SPECIMEN HEIGHT (cm)	11.67
SPECIMEN DIAMETER (cm)	10.19
DRY UNIT WEIGHT (pcf)	123.0
MOISTURE CONTENT BEFORE TEST (%)	12.4
MOISTURE CONTENT AFTER TEST (%)	12.5
MAXIMUM DRY DENSITY (ASTM D 1557 ) (pcf)	130.6
OPTIMUM MOISTURE CONTENT (%)	10.4
CELL CONFINING PRESSURE (psi) 95.0	95.0
TEST PRESSURE (psi) 85.0	90.0
BACK PRESSURE (psi) 80.0	80.0
DIFFERENTIAL HEAD (psi) 5.0	10.0
PERMEABILITY (cm/sec) 8.04x10-9	7.84x10

SAMPLE IDENTIFICATION: Sample No. 11AU S1060/E225, Elev. 343.5

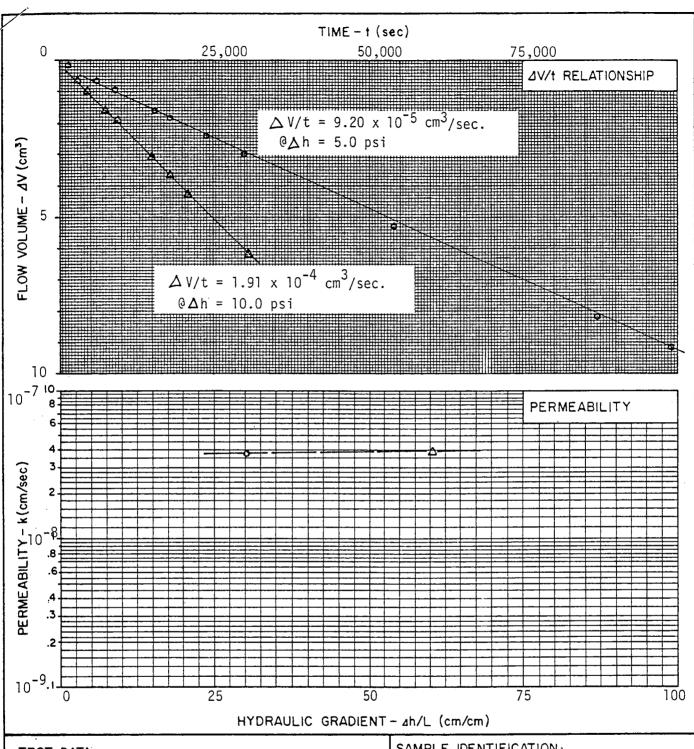
VISUAL DESCRIPTION: Brown SILT, some Clay, little Sand & Gravel. Specimen

compacted in 3 layers with Modified
Hammer, 25 blows/layer
EMPIRE SOILS INVESTIGATIONS, INC.

PERMEABILITY TEST REPORT

NIAGARA FALLS STORAGE SITE

DATE: October 1984 PROJ. NO.: BT-84-53



TEST DATA: TYPE OF PERMEAMETER Constant Head	, Triaxial
SPECIMEN HEIGHT (cm)	11.64
SPECIMEN DIAMETER (cm)	10.17
DRY UNIT WEIGHT (pcf)	119.3
MOISTURE CONTENT BEFORE TEST (%)	12.4
MOISTURE CONTENT AFTER TEST (%)	14.0
MAXIMUM DRY DENSITY (ASTM D 1557) (pcf)	130.6
OPTIMUM MOISTURE CONTENT (%)	10.4
CELL CONFINING PRESSURE (psi) 95.0	95.0
TEST PRESSURE (psi) 85.0	90.0
BACK PRESSURE (psi) 80.0	80.0
DIFFERENTIAL HEAD (psi) 5.0	0 10.0
PERMEABILITY (cm/sec) 3.75x10	3.89x10

SAMPLE IDENTIFICATION: Sample No. 11AU

S1060/E225, Elev. 343.5

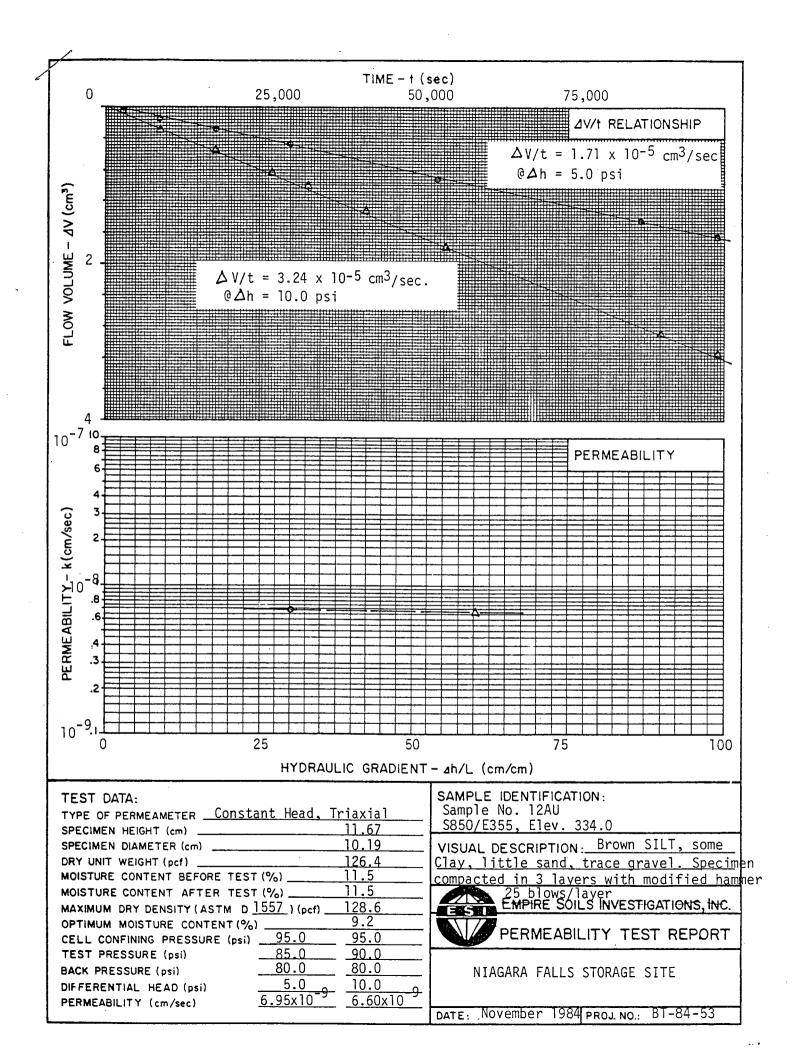
VISUAL DESCRIPTION: Brown SILT, some Clay, little Sand & Gravel. Specimen

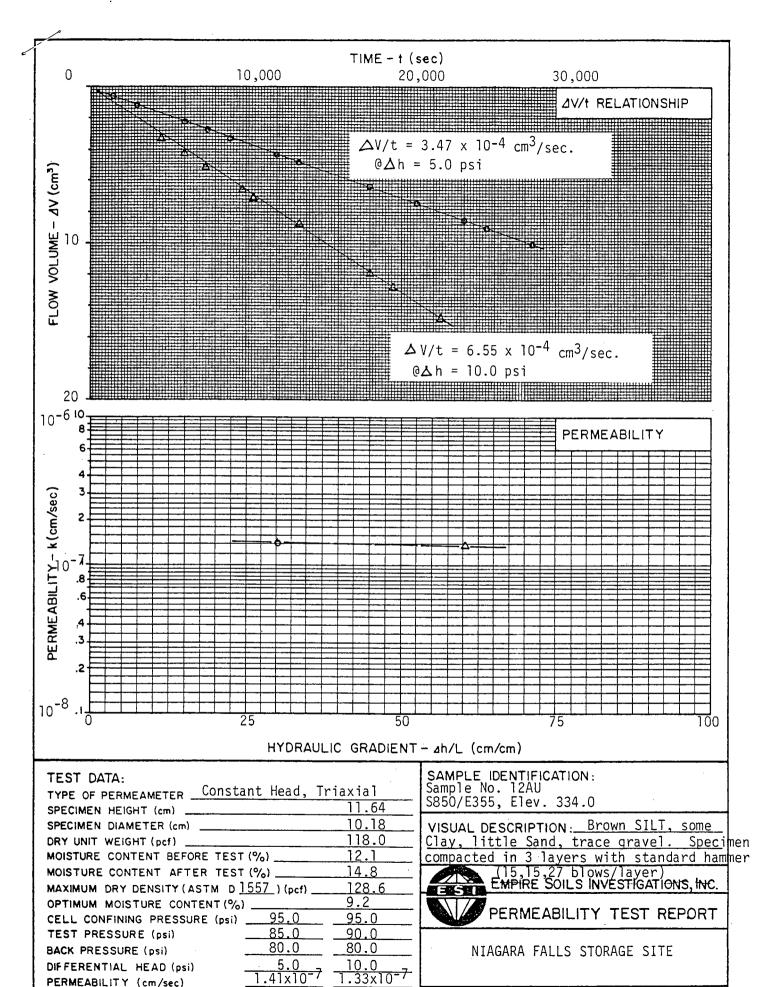
compacted in 3 layers with standard hammer (15,15,27 blows/layer) EMPIRE SOILS INVESTIGATIONS, INC.

PERMEABILITY TEST REPORT

NIAGARA FALLS STORAGE SITE

DATE: October 1984 PROJ. NO.: BT-84-53

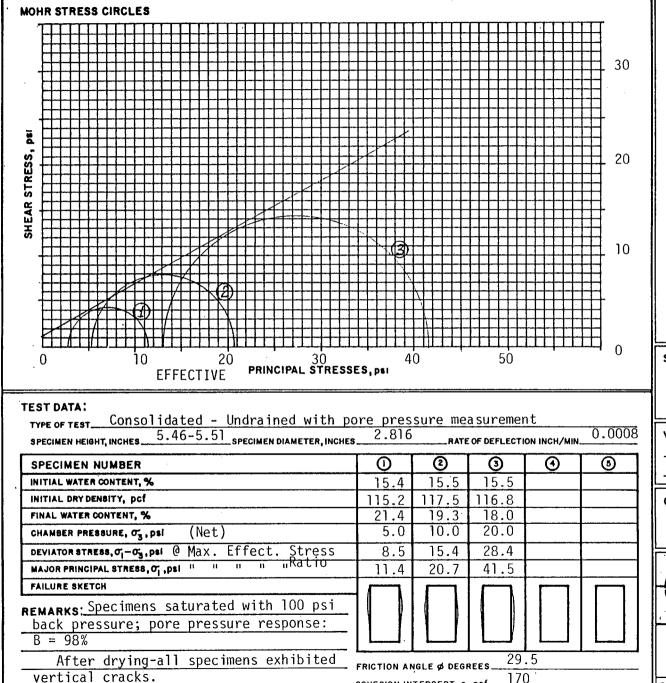




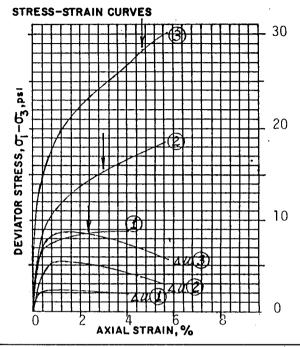
DATE: November 1984 | PROJ. NO.: BI-84-53

## APPENDIX 3-E

STRENGTH TEST RESULTS



COHESION INTERCEPT, c, psf.



BORING NO. S1075/E100	SURF. ELEV. 334.4
SAMPLE NO. 10-AU SAMPLE TYPE COMPACTED	DEPTH, FT.
SAMPLE TYPE Compacted Opt. Plus	to 95%
	CL AV

VISUAL DESCRIPTION: Brown CLAY, some Silt, trace gravel

CLASSIFICATION TESTS: SPECIFIC GRAVITY 2.73 ORGANIC CONTENT% LIQUID LIMIT, % _____PLASTIC LIMIT, % .

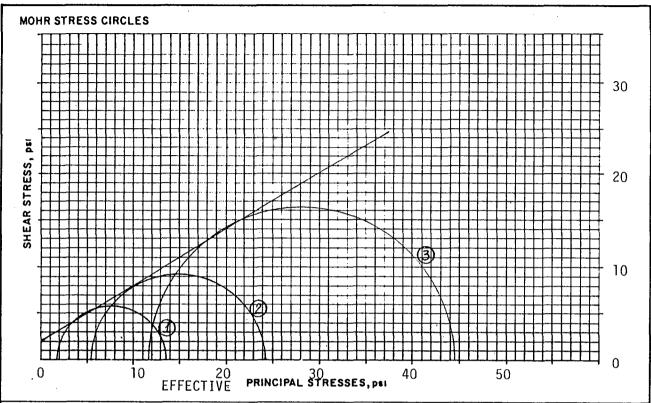


EMPIRE SOILS INVESTIGATIONS, INC.

TRIAXIAL COMPRESSION TEST

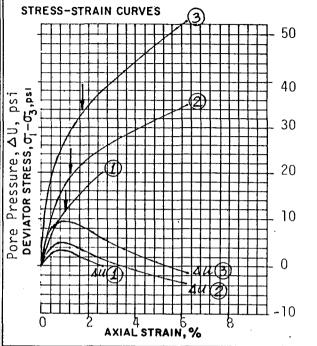
NIAGARA FALLS STORAGE SITE

DR BY:JFC CK'D. AJK DATE: 11/84 PROJ.NOB 1 -84 - 5



## Consolidated - Undrained with pore pressure measurement _RATE OF DEFLECTION INCH/MIN___0.0012 SPECIMEN HEIGHT, INCHES 5.48-5.57 SPECIMEN DIAMETER, INCHES 2.815 $\odot$ (6) SPECIMEN NUMBER 12.4 12.4 12.2 INITIAL WATER CONTENT. % INITIAL DRY DENSITY, pcf 125.0 124.9 125.5 FINAL WATER CONTENT. % 14.2 14.0 13.6 20.0 CHAMBER PRESSURE, OZ , psi (net) 5.0 10.0 DEVIATOR STRESS, 0, -0, psi @ Max. Effect. Stress 11.8 18.9 32.8 MAJOR PRINCIPAL STRESS, OT, PSI " " " " " " Ratio 13.6 24.4 44.5 FAILURE SKETCH REMARKS: Specimens saturated with 100 psi back pressure. Pore pressure response B ranging from 97% to 99%. All specimens exhibited vertical 31.0 cracking after drying.

COHESION INTERCEPT, C, psf.



SAMPLE DAT	<b>0</b> 60/E225	SURF. ELEV.	343.5
SAMPLE NO.	11AU	DEPTH.FT	
SAMPLE TYPE.	Compacted Opt. Plus	to 95%	
	UDI. PIUS.	1-3%	

VISUAL DESCRIPTION: Brown SILT, some Clay little sand and gravel

CLASSIFICATION TESTS:

SPECIFIC GRAVITY 2.74 ORGANIC CONTENT%

LIQUID LIMIT, % 24.3 PLASTIC LIMIT, % 14.4



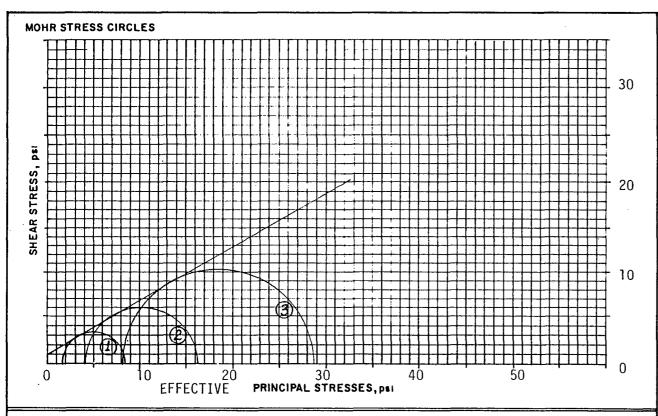
EMPIRE SOILS INVESTIGATIONS, INC.

TRIAXIAL COMPRESSION TEST

NIAGARA FALLS STORAGE SITE

DR BY: JFC CK'D. AJK DATE: 11/84 PROJ. NO. BT-84

TEST DATA:



## TEST DATA:

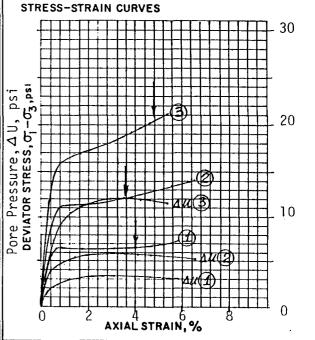
Consolidated - Undrained with pore pressure measurement SPECIMEN HEIGHT, INCHES 5.39-5.44 SPECIMEN DIAMETER, INCHES 2.814-2.816 RATE OF DEFLECTION INCH/MIN. 0.0012

SPECIMEN NUMBER	0	②	3	•	<b>③</b>
INITIAL WATER CONTENT, %	11.4	11.7	11.7		
INITIAL DRY DENSITY, pcf	122.0	123.2	123.2		
FINAL WATER CONTENT, %	15.4	14.4	13.8	,	
CHAMBER PRESSURE, 03, psi (Net)	5.0	10.0	20.0		
DEVIATOR STRESS, σ ₁ -σ ₃ , psi @ Max. Effect. Stress	6.6	12.2	20.8		
MAJOR PRINCIPAL STRESS, σ, psi п п п п п н пRat10	8.3	16.3	28.7		
FAILURE SKETCH					

REMARKS: Specimens saturated with 100 psi back pressure. Pore pressure response B ranging from 98% to 99%

All specimens exhibited slight vertical FRICTION ANGLE & DEGREES 31.8 cracking after drying.

_____ COHESION INTERCEPT, c, psf.



SAMPLE DATA: BORING NO. \$850/E355	SURF. ELEV	334.0
SAMPLE NO. 12AU	DEPTH.FT.	
SAMPLE TYPE Compacted Opt Plus	to 95%	
Opt_Plus_	-3%	

VISUAL DESCRIPTION: Brown SILT, some Clay <u>little_Sand</u>, trace gravel

CLASSIFICATION	TESTS:

SPECIFIC GRAVITY 2.72 ORGANIC CONTENT% LIQUID LIMIT, % _____PLASTIC LIMIT, % _

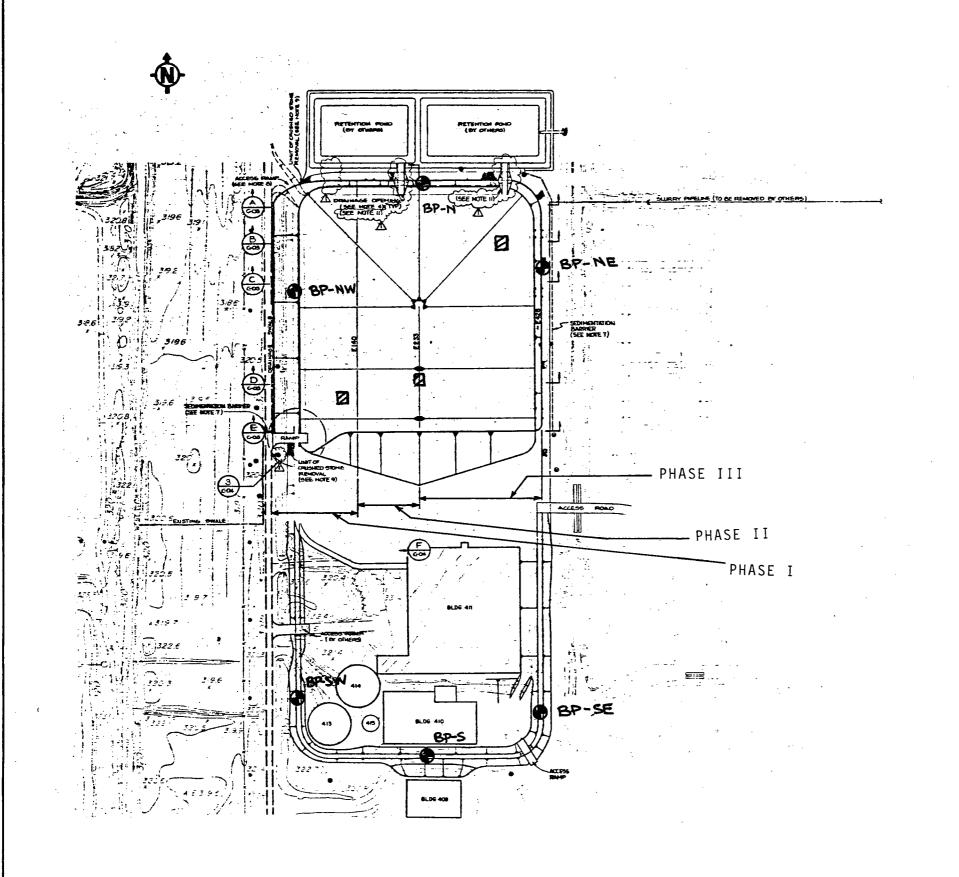


EMPIRE SOILS INVESTIGATIONS, INC.

TRIAXIAL COMPRESSION TEST

NIAGARA FALLS STORAGE SITE

DRBY: JF (CK'D. AJK DATE: 12/84 PROJ.NO. BT-84-

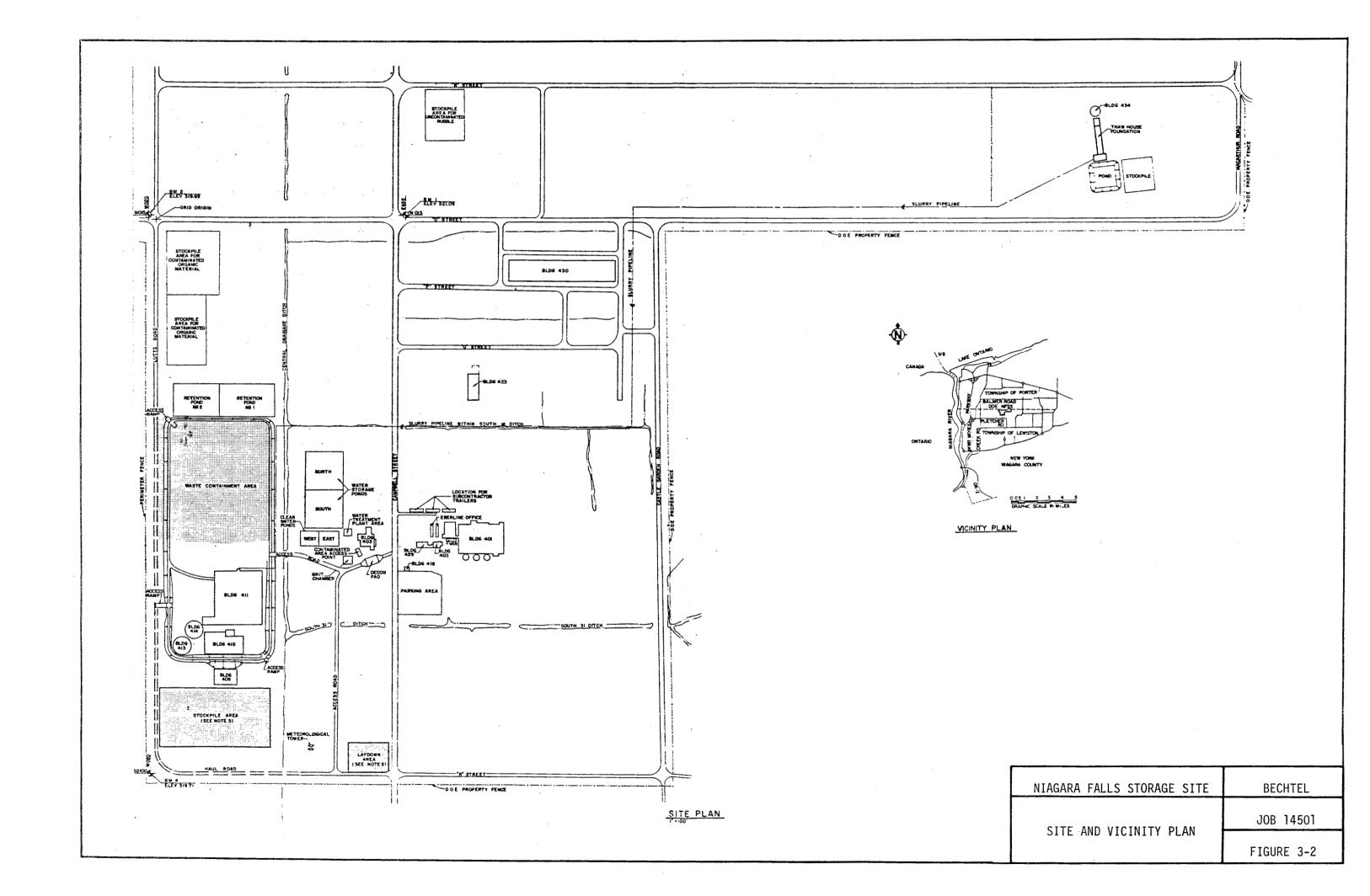


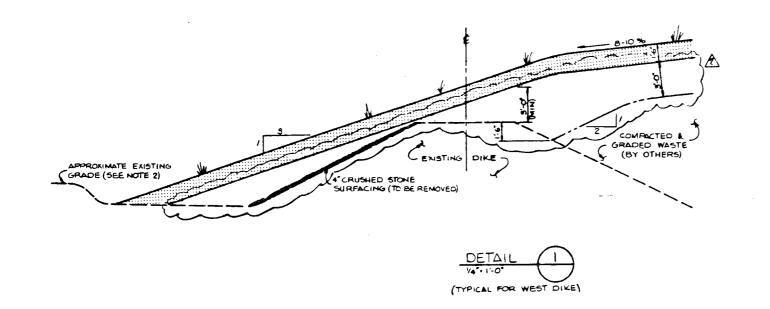
## LEGEND

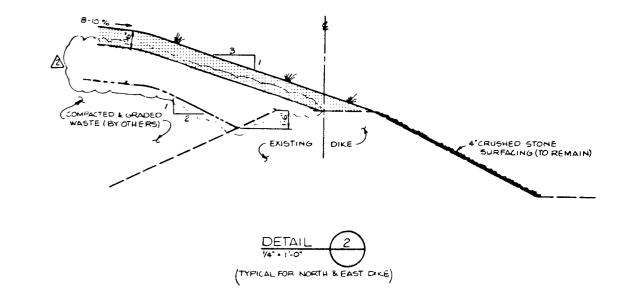
DENOTES BORING LOCATION FOR UNDISTURBED PERMEABILITY SAMPLES

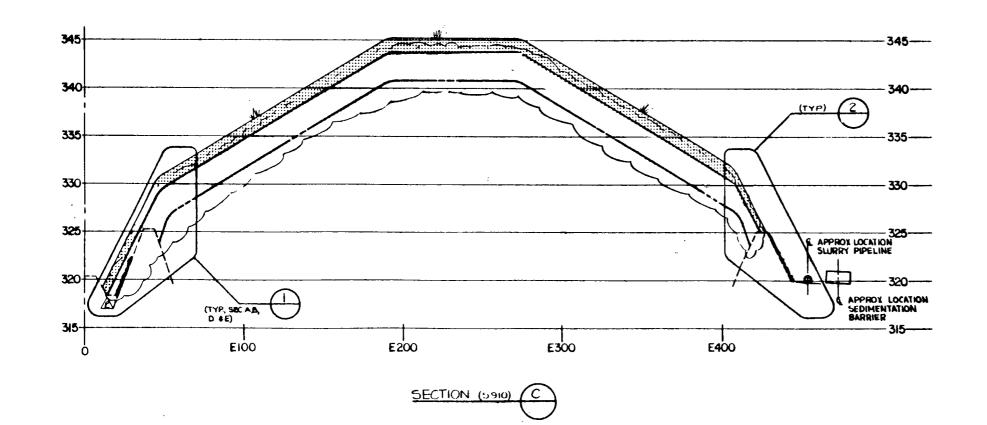
DENOTES LOCATION OF SAMPLES
TAKEN FOR LABORATORY COMPACTED
PERMEABILITY AND STRENGTH TEST

NIAGARA FALLS STORAGE SITE	BECHTEL
INTERIM COVER	JOB 14501
	FIGURE 3-1







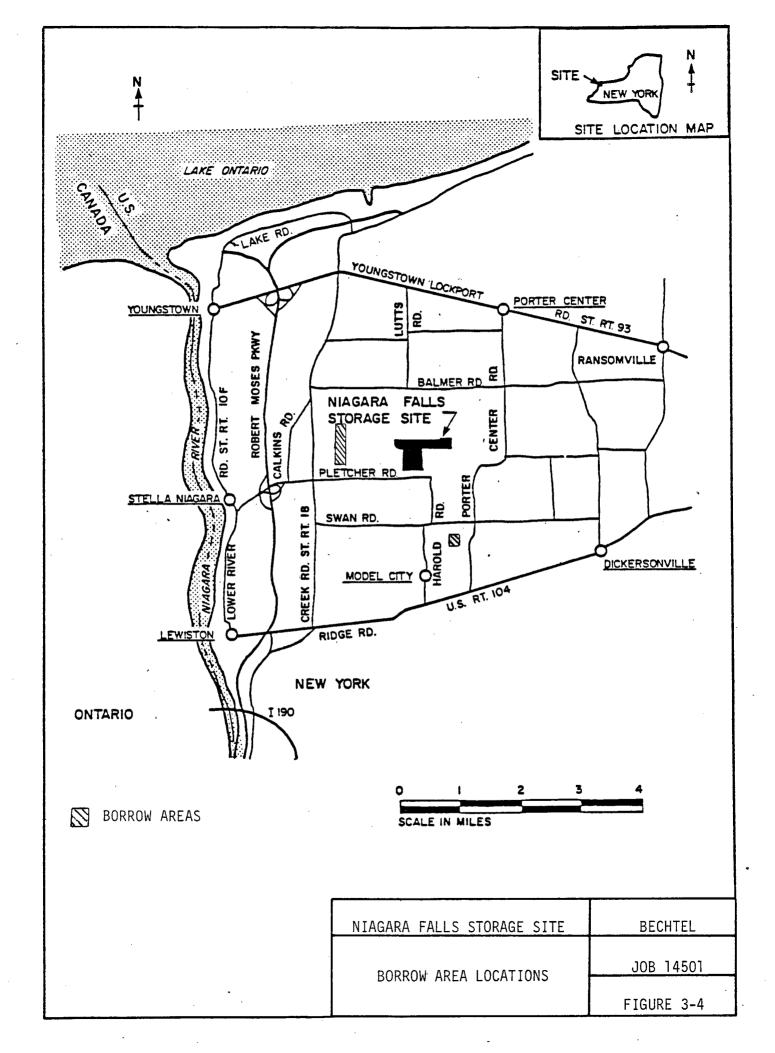


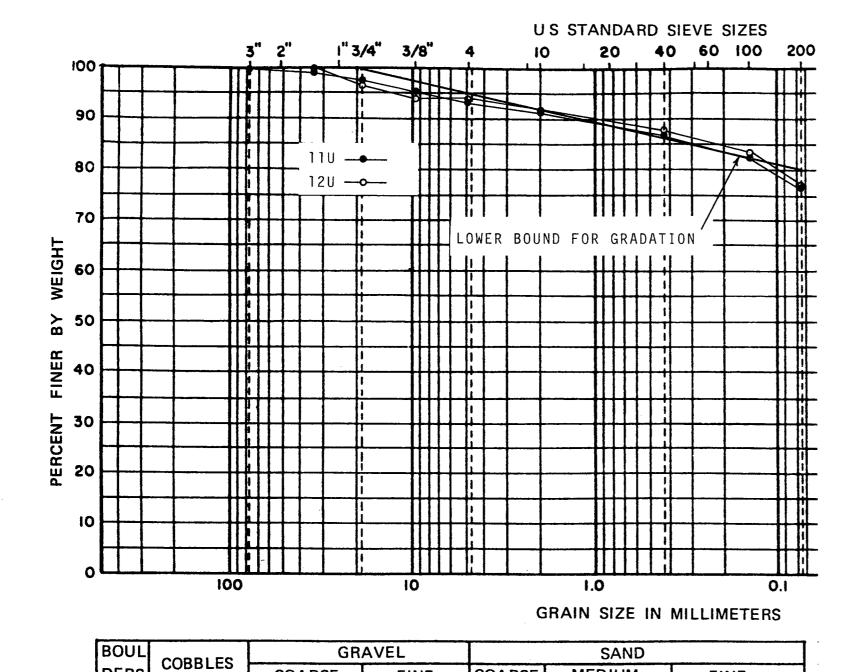
TOPSOIL

CLAY CAP

TOP OF WASTE

NIAGARA FALLS STORAGE SITE	BECHTEL
INTERIM COVER SECTIONS	JOB 14501
	FIGURE 3-3





FINE

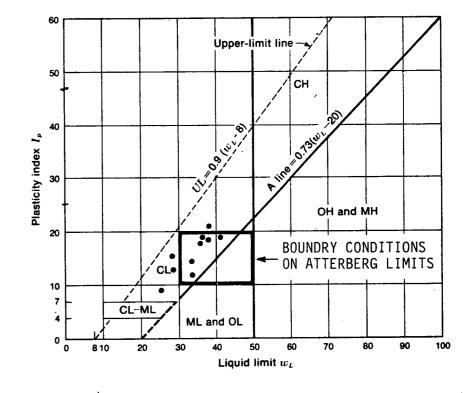
COARSE

MEDIUM

FINE

DERS

COARSE



NIAGARA FALLS STORAGE SITE	BECHTEL
CLASSIFICATION TEST RESULTS	JOB 14501
TEST RESELTS	FIGURF 3-5

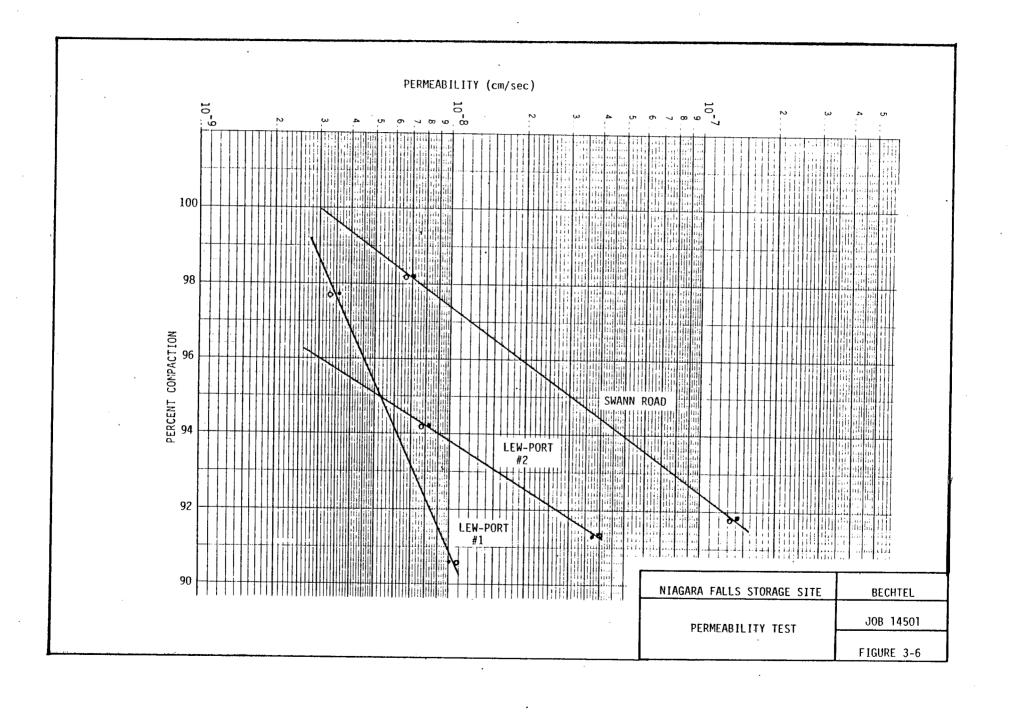






PLATE 2: MOISTURE CONTENT TESTING OF CLAY SOIL



PLATE 3: CLAY CAP SURFACE AFTER SEALING WITH STEEL DRUM ROLLER